Principles and models for the Embedded Value calculation (second wave)

Solvency 2: Principles and model for Risk evaluation

AGENDA

1. Risk free definition

2. The MCEV calculation: a simple and “practical” example

3. Solvency2 overview

4. S2 Standard Formula and alternative approaches

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1. Risk free definition

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Level 2 Draft Implementing Measures

The rates of the relevant risk-free interest rate term structure to calculate the best estimate with respect to insurance or reinsurance obligations, as referred to in Article 77(2) of Directive 2009/138/EC, shall be calculated **as the sum of**:

- the rates of a **basic risk-free interest rate term structure**;
- where applicable, a **counter-cyclical premium**
- where applicable, a **matching premium**

For each relevant currency, **EIOPA shall derive and publish**:

- the **basic risk-free interest rate term structure** referred to in point (a) of paragraph 1;
- the **counter-cyclical premium** referred to in paragraph 1 of Article IR6;
- the **ultimate forward rate** referred to in paragraph 2 of Article IR4.

DIRECTIVE 2009/138/EC

Art. 76 General provision
…the calculation of technical provisions shall make use of and **be consistent with information provided by the financial markets** and generally available data on underwriting risks (market consistency)…..

Art. 77 Calculation of technical provision (TP)
The best estimate shall correspond to the probability-weighted average of future cash-flows, taking account of the time value of money (expected present value of future cash-flows), using **the relevant risk-free interest rate term structure**.

General Solvency2 Principle: «same risk, same rules, same value»

The Present Value of the same net cashflows in different countries with the same currency has the same value:

Example:

- ❑ The value doesn't depend on the asset backing TP
- ❑ The Risk free is the same for German and Italian policies
- ❑ The TP of a pure risk contract, sold in Germany and Italy, with the same net cashflows, is the same in both Countries.

Level 2 Draft Implementing Measure

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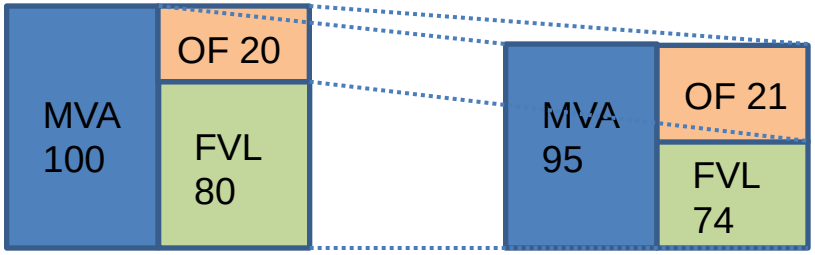
- the **ultimate forward rate** referred to in paragraph 2 of Article IR4.

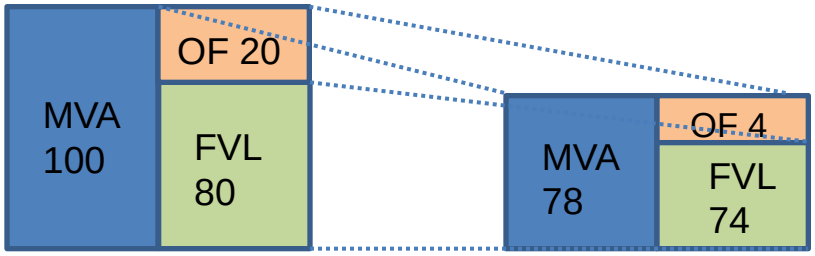
EXAMPLE *(first part)*

Market Value Asset YE10: 100 (100% Government Bond, *duration 5*)
Fair Value of Liabilities YE10: 80 (*duration 7*)
Risk Free (swap) YE10 = 2%
Spread between Government Bond and Swap = 0 bps
Risk Free (swap) YE11 = 3%



CASE A: German Company invested in BUND
At YE11 no additional spread between BUND and SWAP

The increase of OF is due to the duration gap



CASE B Italian Company invested in BTP
At YE11 the spread between BTP and SWAP increases by 400 bps

The Fair Value of Liabilities are the same for both Companies because the risk free rate is the same
The impact in the Own Fund is different due to the different asset backing liabilities.

Why does the Industry need an appropriate risk free rate?

The risk free rate term structure is one of the most critical areas of Solvency2 framework.

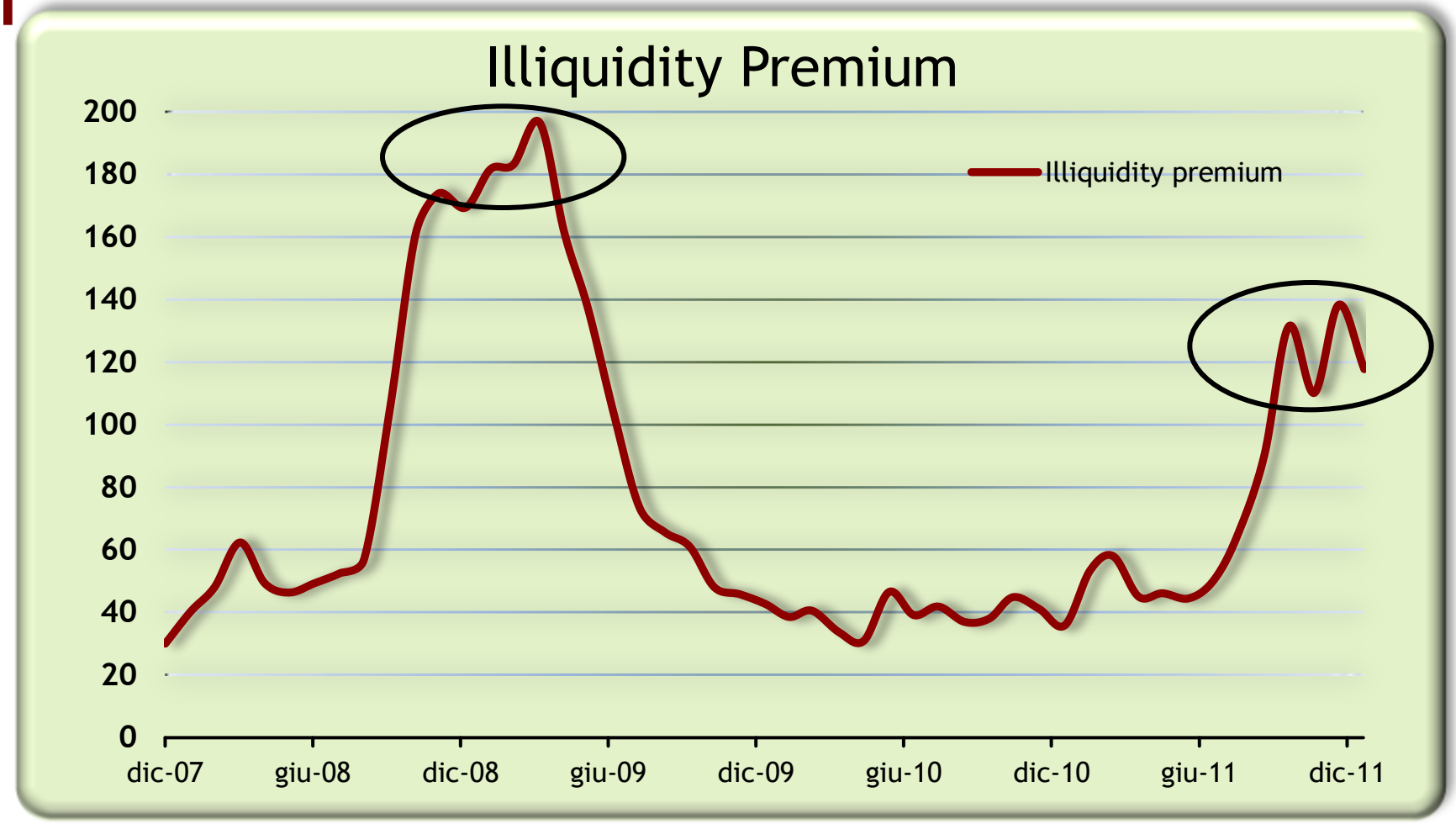
The European Commission has defined in the QIS5 TS the risk free rate as
«SWAP – 10 bps + ILLIQUIDITY PREMIUM * %bucket»

BUT

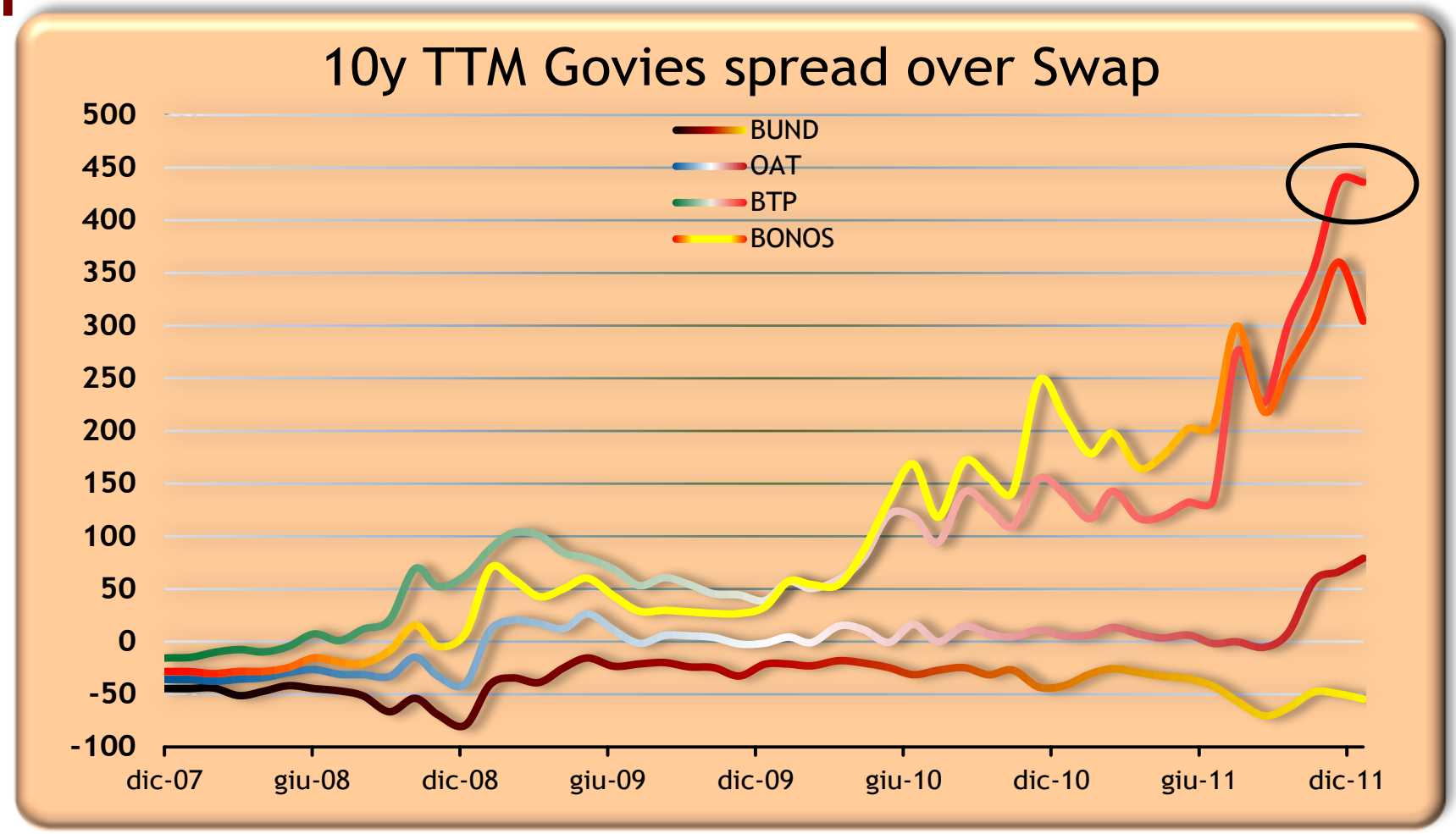
The recent volatility in the financial market requests a «**predictable counter-cyclical mechanism**» to reduce the volatility without producing other undesirable effects

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).

Illiquidity premium with QIS5 formula



Government spread over swap



When is the counter-cyclical premium (CCP) applicable?

In periods of stressed financial markets as determined by EIOPA, the risk-free rates should include a **CCP** to reflect temporary distortions in spreads caused by illiquidity of the market or extreme widening of credit spreads, in particular in relation to **government bonds**, in order to avoid pro-cyclical behaviour of insurance and reinsurance undertakings.

Industry proposal

Companies need a pre-defined trigger to correctly evaluate the Fair Value of Liabilities - Solvency Capital Requirement and to put in place Risk Management actions to manage/reduce the risk.

How should the CCP be evaluated?

For each currency, **the counter-cyclical premium** shall be calculated in a transparent, prudent, reliable and objective manner as a portion of the spread between the interest rate that could be earned from assets included in a representative portfolio of assets that insurance and reinsurance undertakings are invested in and the rates of the basic risk-free interest rate term structure. The portion shall not be attributable to a realistic assessment of expected losses or unexpected credit risk on the assets. The portion shall not be attributable to any other risk.

INDUSTRY PROPOSAL: The counter-cyclical premium is determined based on the following components:

1. an illiquidity premium
2. a government spread premium
3. an additional discretionary component.

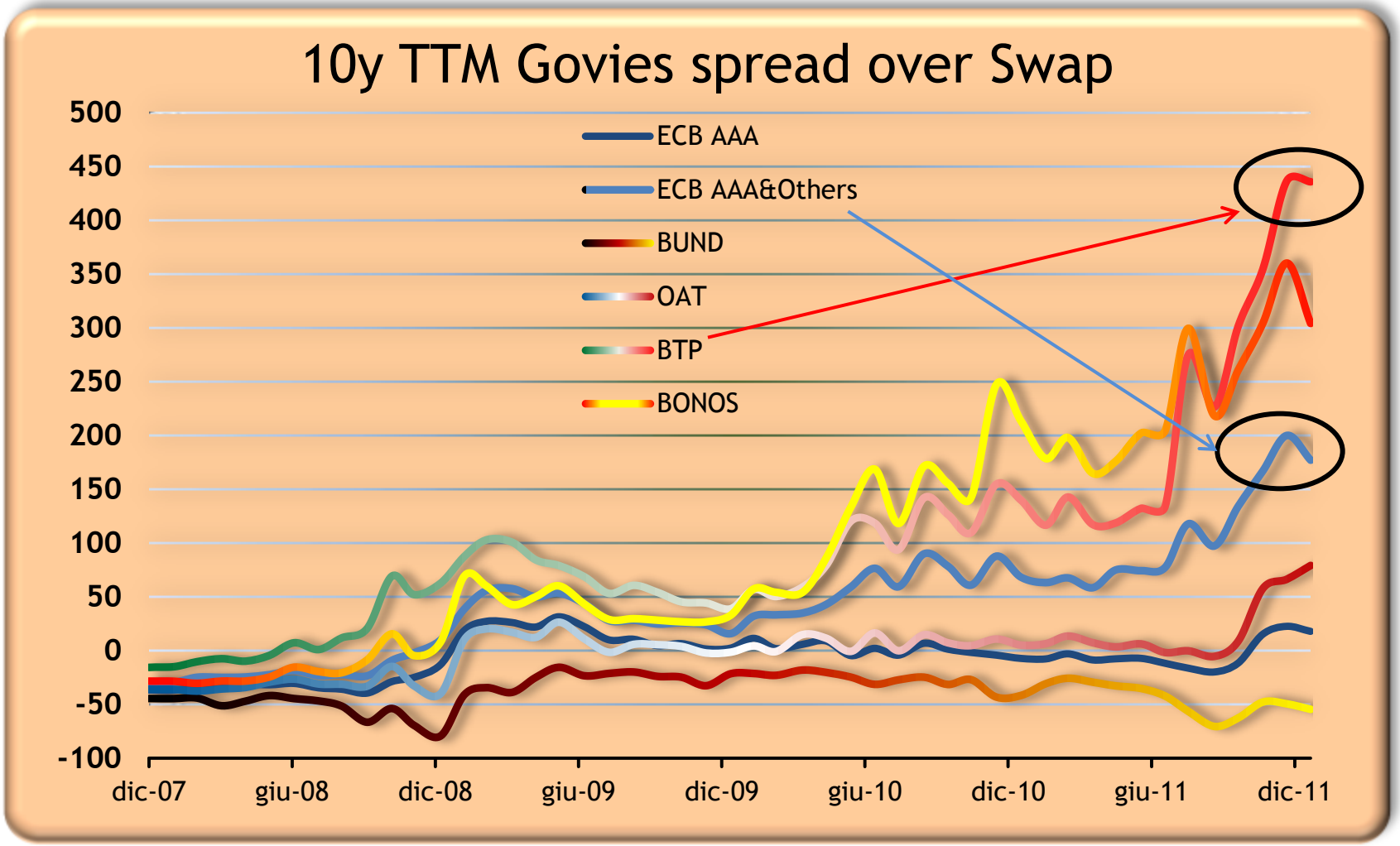
Under market conditions similar to those at the date of adoption of this Regulation the illiquidity premium and government spread premium components of the counter-cyclical premium could be:

Function of

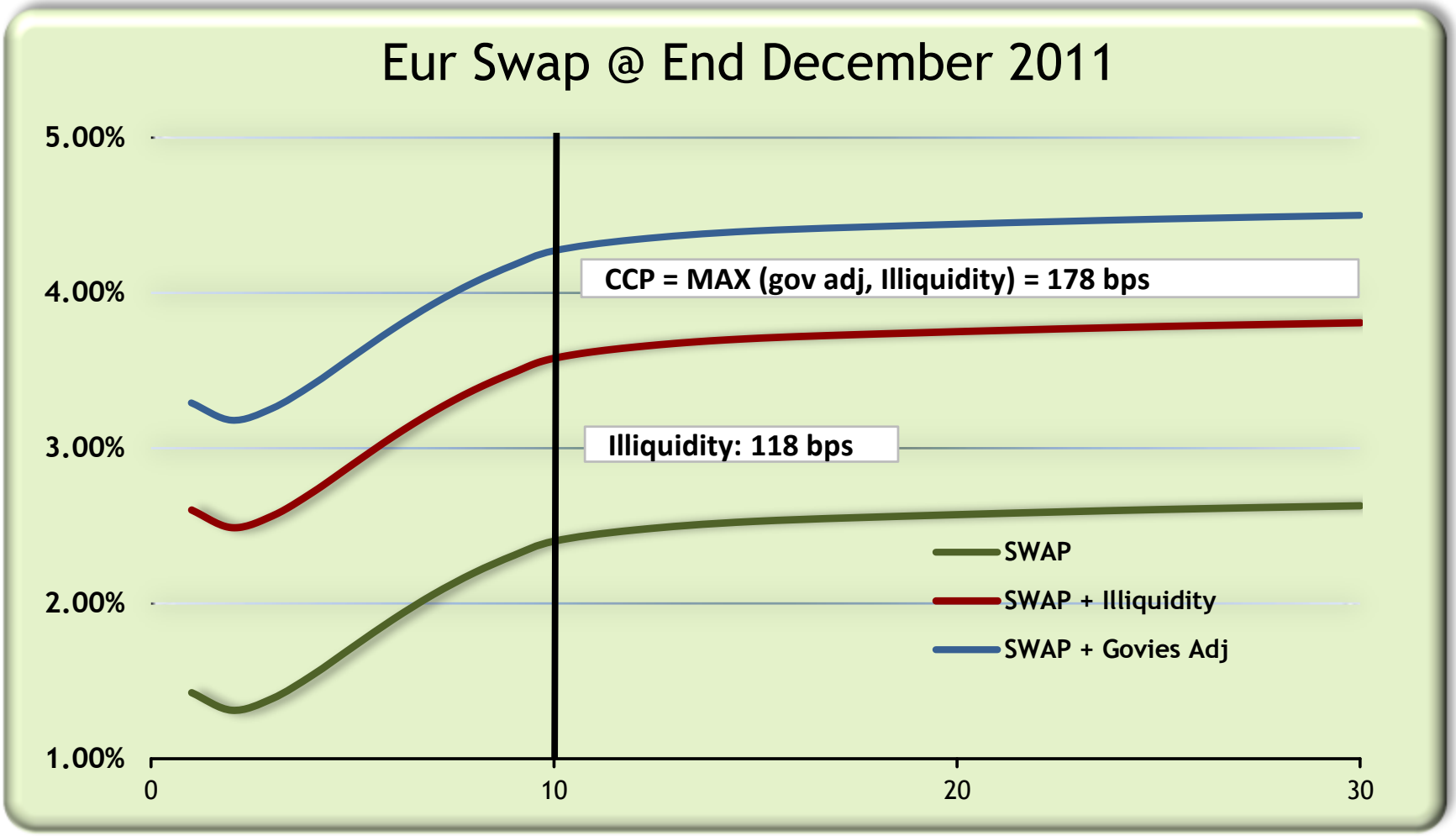
- MAX (0 ; 50% * (*spread over swaps* – 0.4%))
- MAX (0 ; "ECB AAA and other government curve" - swap)

THE ADJUSTMENT DOESN'T DEPEND ON ASSET BACKING LIABILITIES

ECB government curves



Which Risk Free Rate curves?



EXAMPLE *(second part)*

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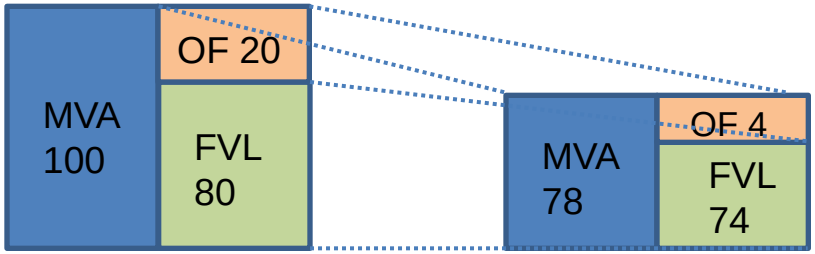
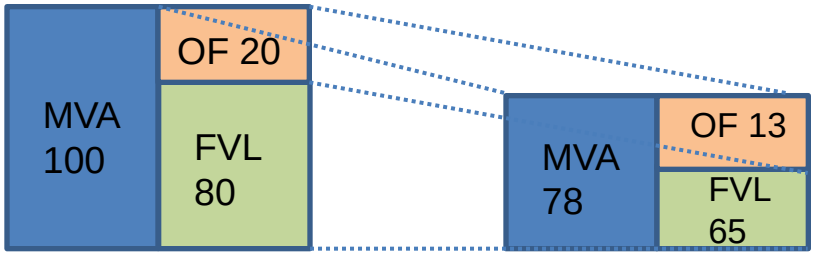


CASE B: Italian Company invested in BTP without CCP
At YE11 the spread between BTP and SWAP increases by 400 bps,



CASE C: Italian Company invested in BTP with 200 bps of CCP
The loss in OF is reduced from 16 to 7.

The CCP increases the risk free rate, modifies the FVL and limits the volatility of Own Funds.
An additional positive second order effect on SCR is expected.

Matching premium: when?

In case of assets and liabilities respect some specific requirements Company can use a MATCHING PREMIUM instead of CCP:
The most important requirements are:

- the insurance undertaking has assigned **a portfolio of assets**, consisting of bonds and other assets with **similar cash-flow characteristics and** replicate the expected future cash-flows of the liabilities portfolio
- the portfolios are **ring-fenced**, without any possibility of transfer;
- the MP is applicable insurance contracts do **not** give rise to **future premium** payments ;
- the only underwriting risks are **longevity and expense**; no options for the policy holder or only a **surrender option where the surrender value does not exceed the value of the assets**
- the cash-flows of the **assets** of the assigned portfolio of assets are **fixed**

For Italian Companies the matching premium, under this requirements, could be used for **"contratti con specifica provvista di attivi".**
The requirements are very burdensome and not applicable to Italian segregated fund **without changes in the L2 proposal**.

With Matching premium the risk free rate is fully related to asset backing liabilities

Matching premium: how in theory?

The matching premium shall be equal to the difference of the following:

1. the annual effective rate where applied to the cash-flows of the portfolio insurance obligations, results in a value that is equal to the value of the portfolio of assigned assets (netted of fundamental spread and probability of default);
2. the annual effective rate where applied to the cash-flows of the portfolio insurance obligations, results in a value that is equal to the value of the best estimate of the portfolio of insurance obligations where the time value is taken into account using the basic risk-free rate term structure.

The ***fundamental spread*** of a specific asset shall be equal to the sum of the following:

- ✓ the credit spread corresponding to the probability of default of the asset;
- ✓ a spread corresponding to the expected loss resulting from downgrading of the asset;

The probability of default should be based on long-term default statistics that are relevant for the asset in relation to its duration, credit quality step and asset class.

Matching premium: how in practise?

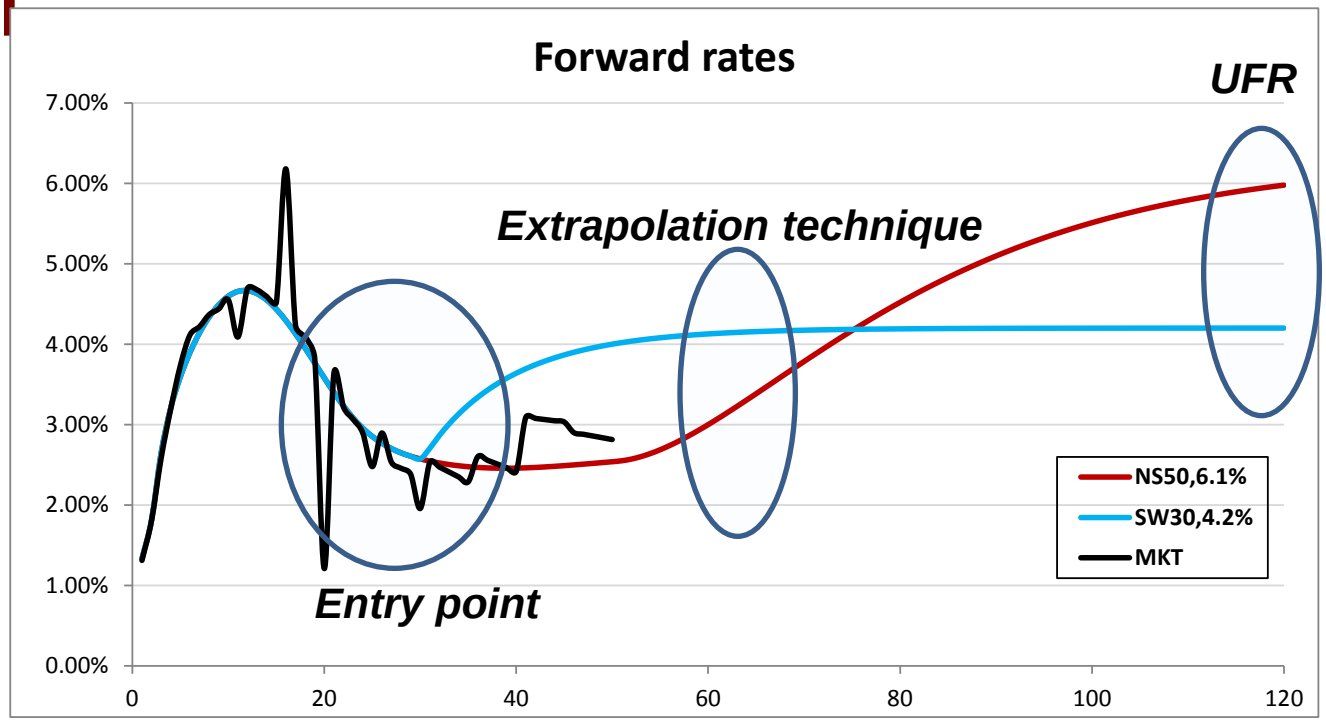
The process should be:

1. Company should define the net cash-flows of the portfolio;
2. Company should evaluate a fundamental spread and a default probability embedded in the own asset and recalculate the Internal Rate of Return netted by default probability only (de-risking)
3. Company should evaluate the Internal Rate of Return based on risk free rate curves
4. MP is the difference between the two IRR

Step	1	2	3
MVAsset	-33,00	-33,00	-35,53
t			
1	1,60	1,60	1,60
2	1,60	1,59	1,59
3	1,60	1,59	1,59
4	1,60	1,58	1,58
5	33,67	33,16	33,16
IRR	4,33%	4,02%	2,35%

Matching Premium = 4,02% - 2,35% = 1,68%

Extrapolation: some Directive highlights (1/2)



The **extrapolation technique** *(Nelson Siegel or Smith Wilson)*, the extrapolation **entry point** and the **ultimate forward rate** (UFR) are **key drivers** of the valuation, especially in case of long term business with guarantees

- How many years should I use market data for? (extrapolation entry-point)
- When I extrapolate, where do I go? (ultimate forward rate, UFR)
- When do I reach the UFR? (UFR-year)
- How do I get there? (extrapolation method)

Extrapolation: some Directive highlights (2/2)

For each currency, the **basic risk-free interest rate** term structure *(swap rate before any adjustments)* shall be determined on the basis of **all relevant observed market data**.

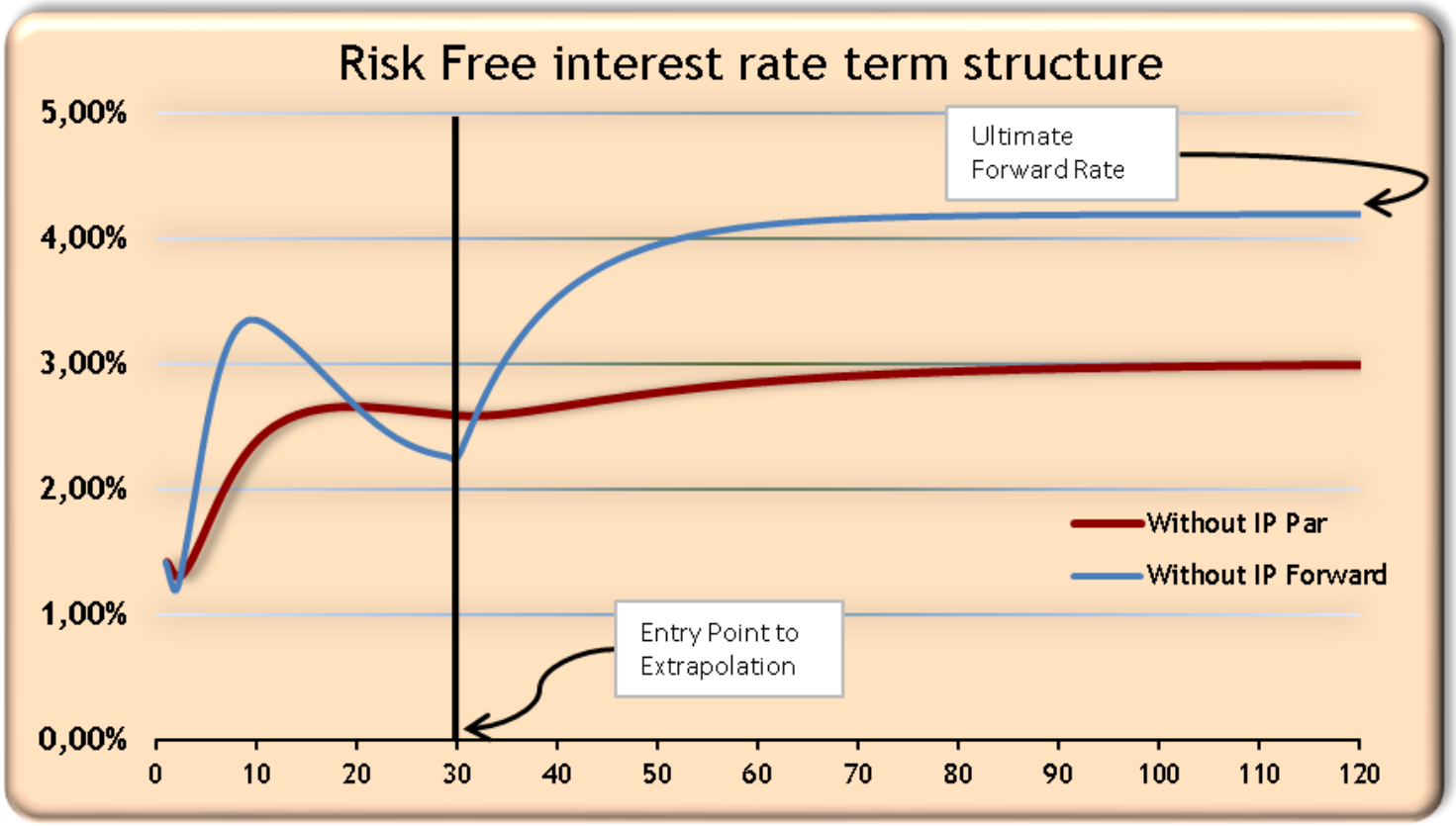
Some Countries propose to define at **20y the entry point for EURO**

The **ultimate forward rate** shall be **stable over time** and only change because of changes in long-term expectations.

The ultimate forward rate shall **take account of expectations of the long-term real interest rate and of expected inflation**.
The ultimate forward rate shall **not include a term premium** to reflect the additional risk of holding long-term investments.

In **40y** the swap rate should **reach the ultimate forward rate**

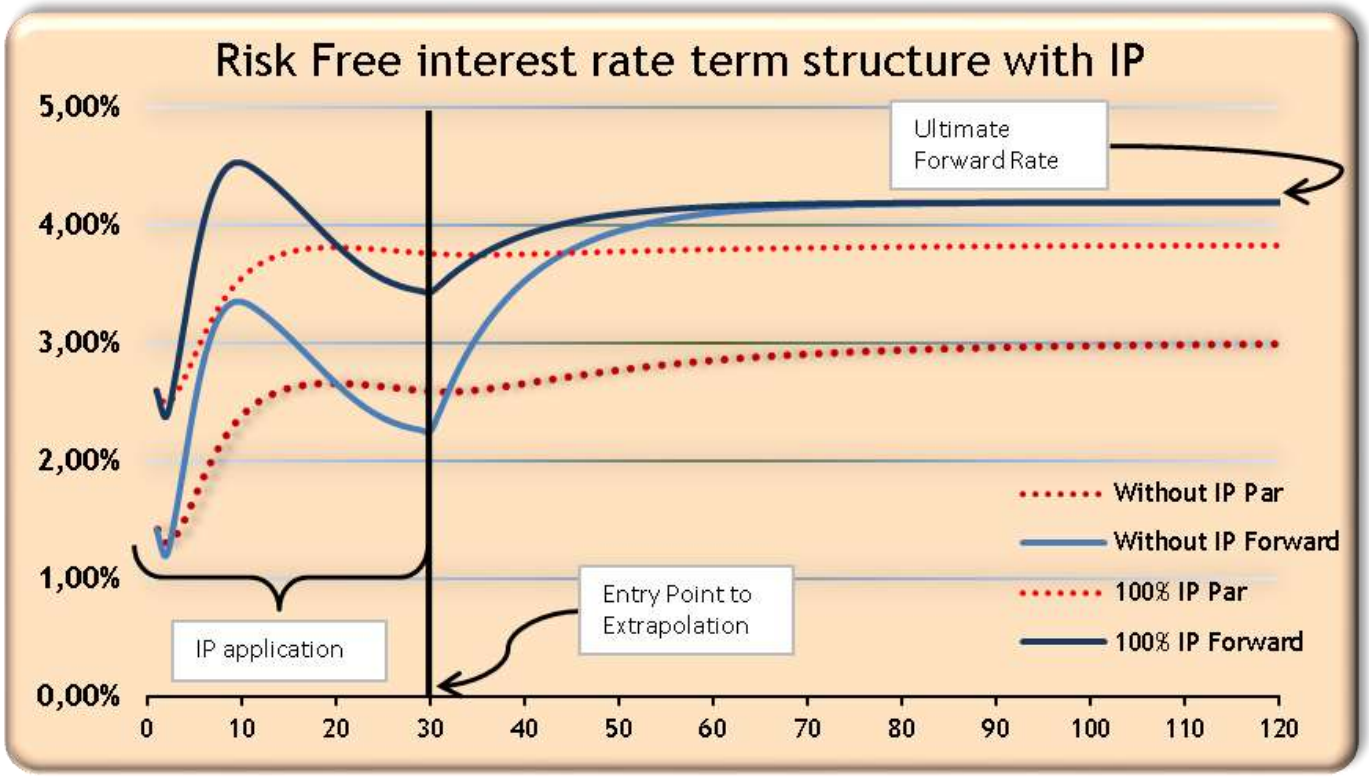
Basic Risk Free interest rate term structure



Generali is using, for EV/EBS exercise at YE2011 (EURO):

- Swap rates as basic risk-free interest rate term structure;
- 30y entry point for the extrapolation
- 4.2% as Ultimate Forward Rate
- Smith-Wilson as extrapolation technique

Counter – cyclical premium



Generali is supporting the Industrial proposal for CCP and, in line with last CFO Forum statement, will disclose to Financial Markets at YE2011:

- calculation using Illiquidity premium applied to forward rate
- impact assessment using a govies adjustment based on Industrial Proposal

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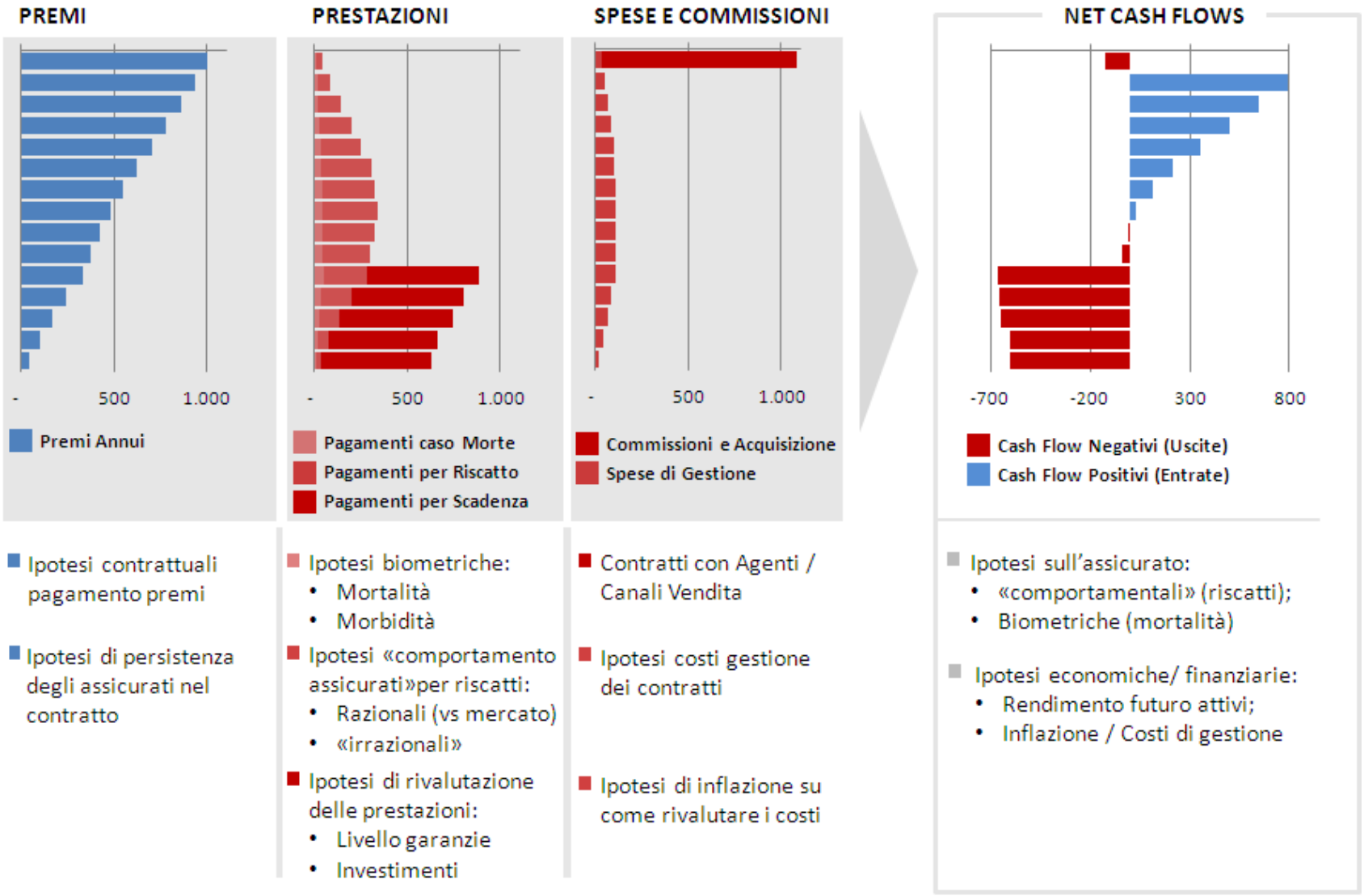
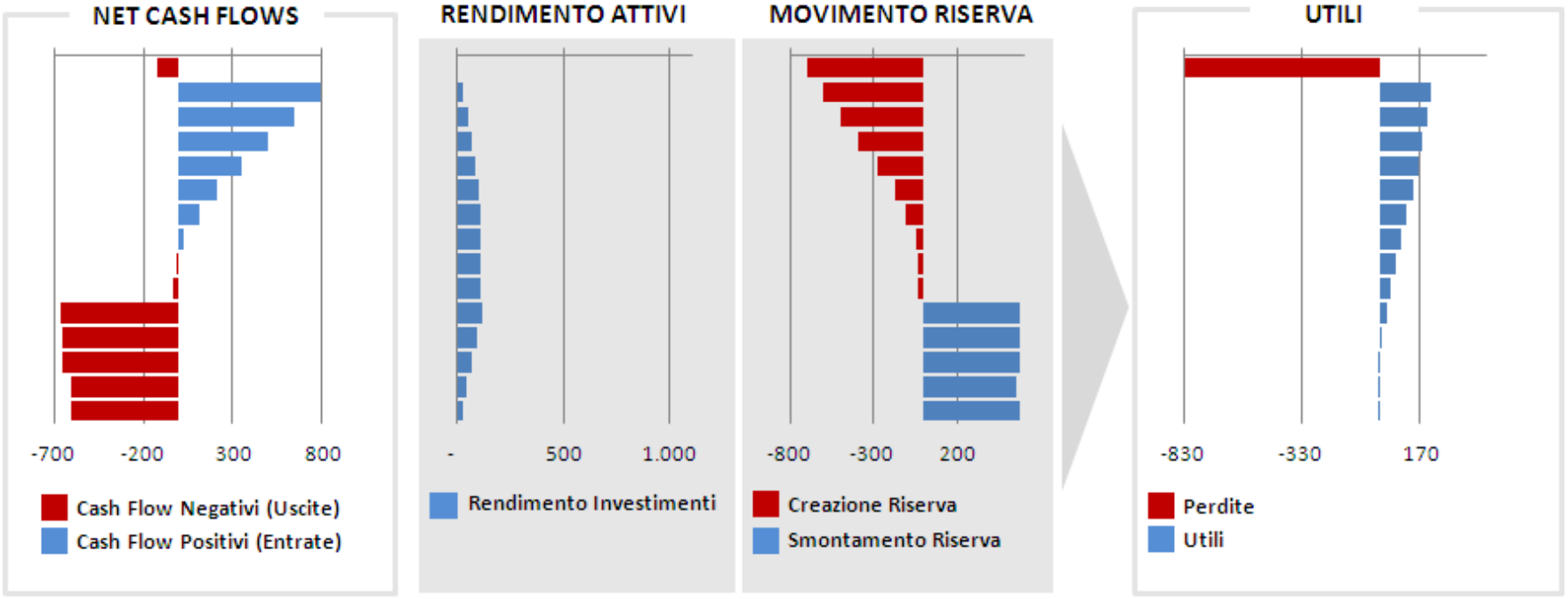
The MCEV calculation: a simple and “practical” example



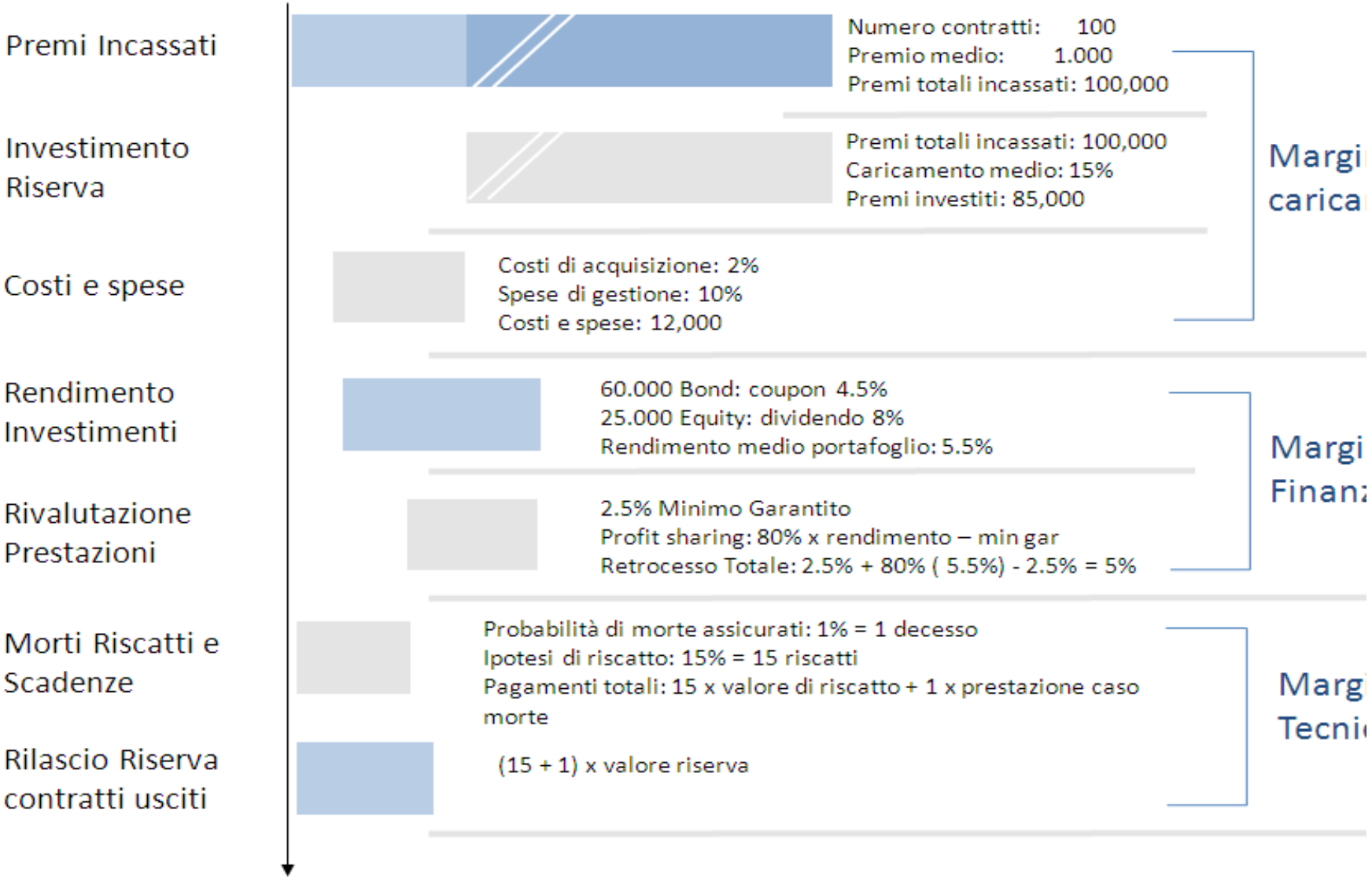
The MCEV calculation: a simple and “practical” example



Quali sono le principali caratteristiche del prodotto che impattano sulla valutazione del valore e della riserva?

- Livello, struttura delle garanzie finanziarie e regole di rivalutazione
- Corrispondenza tra costi associati al contratto e caricamenti
- Penalità di riscatto, in ammontare e anni di opzione
- Opzioni contrattuali aggiuntive, come l’opzione di conversione in rendita

The MCEV calculation: a simple and “practical” example



The MCEV calculation: a simple and "practical" example

Perché proiettare gli attivi?

Ottenere rendimenti per:

- Finanziare i minimi garantiti
- Finanziare la rivalutazione delle prestazioni
- Generare utile finanziario

Rendimenti provenienti da:

- Cedole fisse
- Dividendi, affitti, cedole variabili
- Trading (realizzo minus/plus)

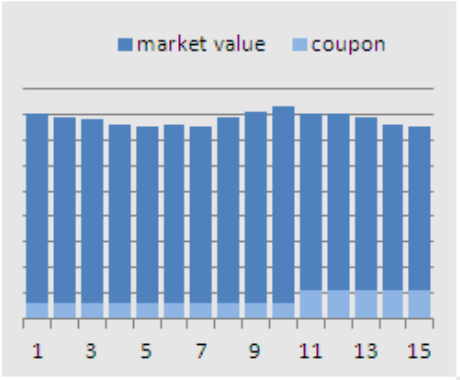
PUNTI DI ATTENZIONE

- Le valutazioni sono effettuate considerando il portafoglio chiuso, senza afflusso di premi di nuova produzione
- L'assenza di *matching* tra attivi e passivi può produrre costi di **disinvestimento** e/o di **reinvestimento**

Cosa fare nella proiezione?

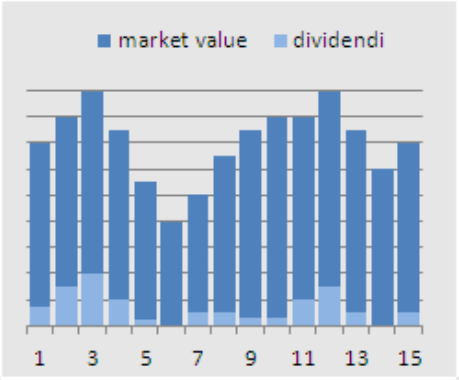
Per ogni titolo è necessario proiettare cedole/dividendi e valore di mercato:

PROIEZIONE BTP 10ANNI



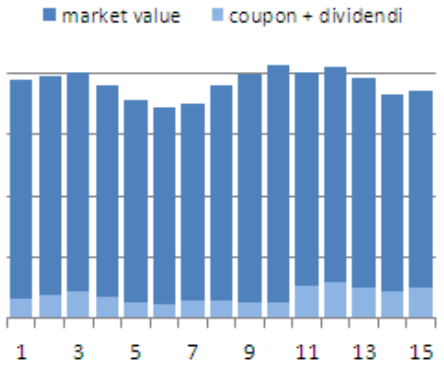
- Fino al 10 anni il coupon è certo, dalla scadenza cambia il coupon.
- Il valore di mkt cambia in funzione dei tassi di mercato.

PROIEZIONE AZIONI



- Il dividendo è incerto, sin dal primo anno di proiezione.
- Il valore di mkt è – in media – molto più volatile di quello dei Bond

PORTAFOGLIO ATTIVI



Definita l' asset allocation (% Bond, % Equity,..) è possibile derivare i rendimenti attesi del portafoglio di attivi a copertura

The MCEV calculation: a simple and “practical” example

Va definito uno scenario

con la proiezione per 40 anni di:

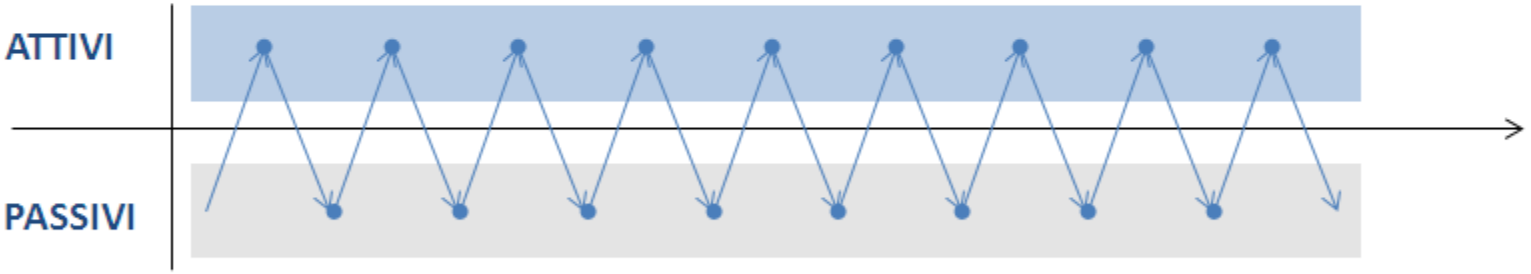
- Struttura a termine dei tassi risk-free
- Spread/migrazioni corporate bond
- Dividendi / indici azionari e real estate

Come va utilizzato?

Nella proiezione, in base ai net cash flow:

- Definisco asset allocation
- Determino i rendimenti e il valore di mercato dei titoli a copertura
- Trading (realizzo minus/plus)

Cosa succede nella proiezione?



I pagamenti nell’anno **T** dipendono dal rendimento degli attivi nel periodo precedente (**T-1**)

Il rendimento del fondo in **T-1** dipende dalle «**management action**» (per esempio quali titoli compro/vendo) definite e dall’andamento dei mercati nello scenario

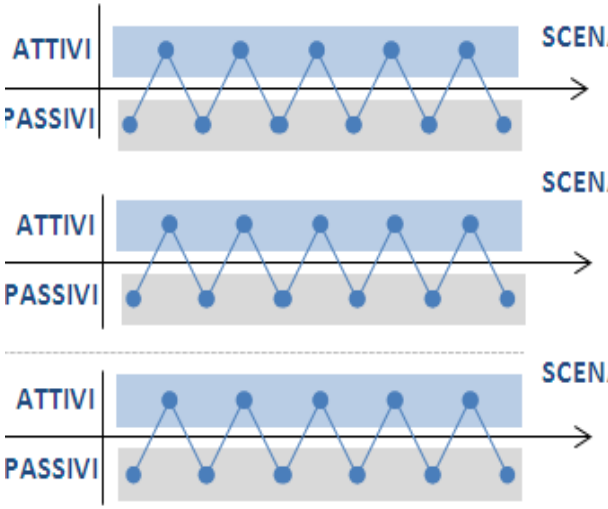
The MCEV calculation: a simple and "practical" example

'VFP certainty equivalent: è calcolato in un unico scenario:

$$\sum_{i=1}^{n} Utile_i^{CE} \text{x } d_i$$

E' il valore atteso degli utili futuri nello scenario centrale

PVFP market consistent: la valutazione va ripetuta nei 1.000 scenari



$$\sum_{i=1}^{n} Utile_i \text{x } d_i$$

$$\sum_{i=1}^{n} Utile_i \text{x } d_i$$

$$\sum_{i=1}^{n} Utile_i \text{x } d_i$$

Il PVFP è la media dei valori ottenuti nei 1.000 scenari con ipotesi :

$$\frac{\sum_{j=1}^{1000}(\sum_{i=1}^{n} Utile_i \text{x } d_i)}{1000}$$

PUNTI DI ATTENZIONE

Gli scenari stocastici devono catturare la diversa rischiosità degli attivi(bond governativi, corporate, azioni..)
Il rendimento medio nei 1.000 scenari è lo stesso per tutte gli attivi, ma più gli attivi sono rischiosi, maggiore è la volatilità del loro rendimento ***(SCENARI DI TIPO RISK NEUTRAL)***.

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Solvency II a 3 pillars system

The **Directive 2009/138/CE** on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II), has been released on the 17th of December 2009. The Directive defines a **new system of prudential supervision**.

Solvency I

According to the current regulation the financial stability of an insurance and reinsurance undertaking is evaluated on the basis of:

- adequacy of **technical provisions** to meet insurance obligations towards the policyholders;
- availability of **eligible and sufficient assets** to cover the technical provisions;
- respect of a minimum capital adequacy requirement, defined as **required solvency margin**, determined according to the undertaking's **premiums and reserves** volume.

MSM = 4% x Reserves + 0,3% x Sum at Risk

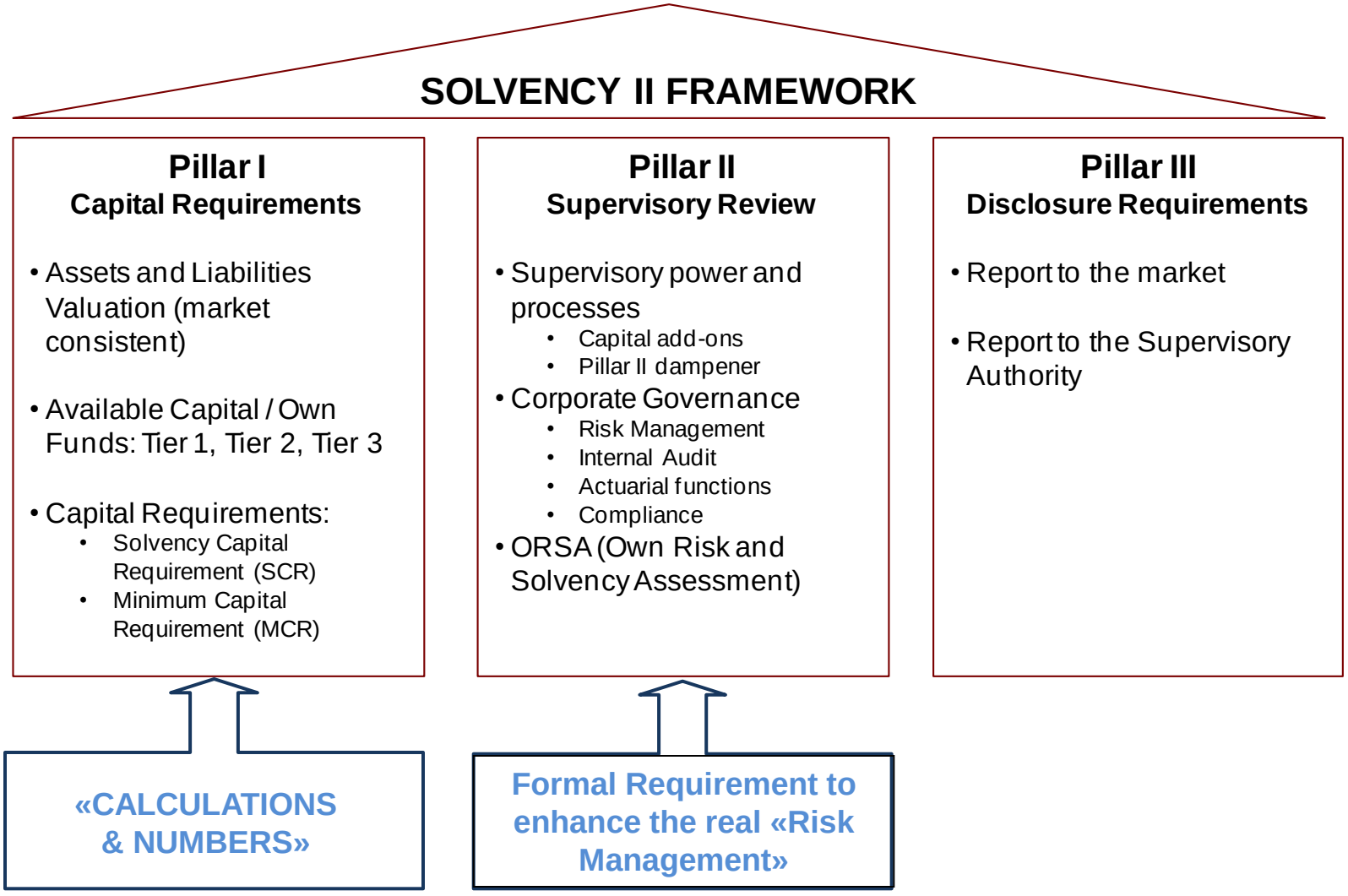
Solvency II

The new system introduces capital requirements based on the **market evaluation of assets and liabilities**, considering the **effective risks** which the undertakings are exposed to.

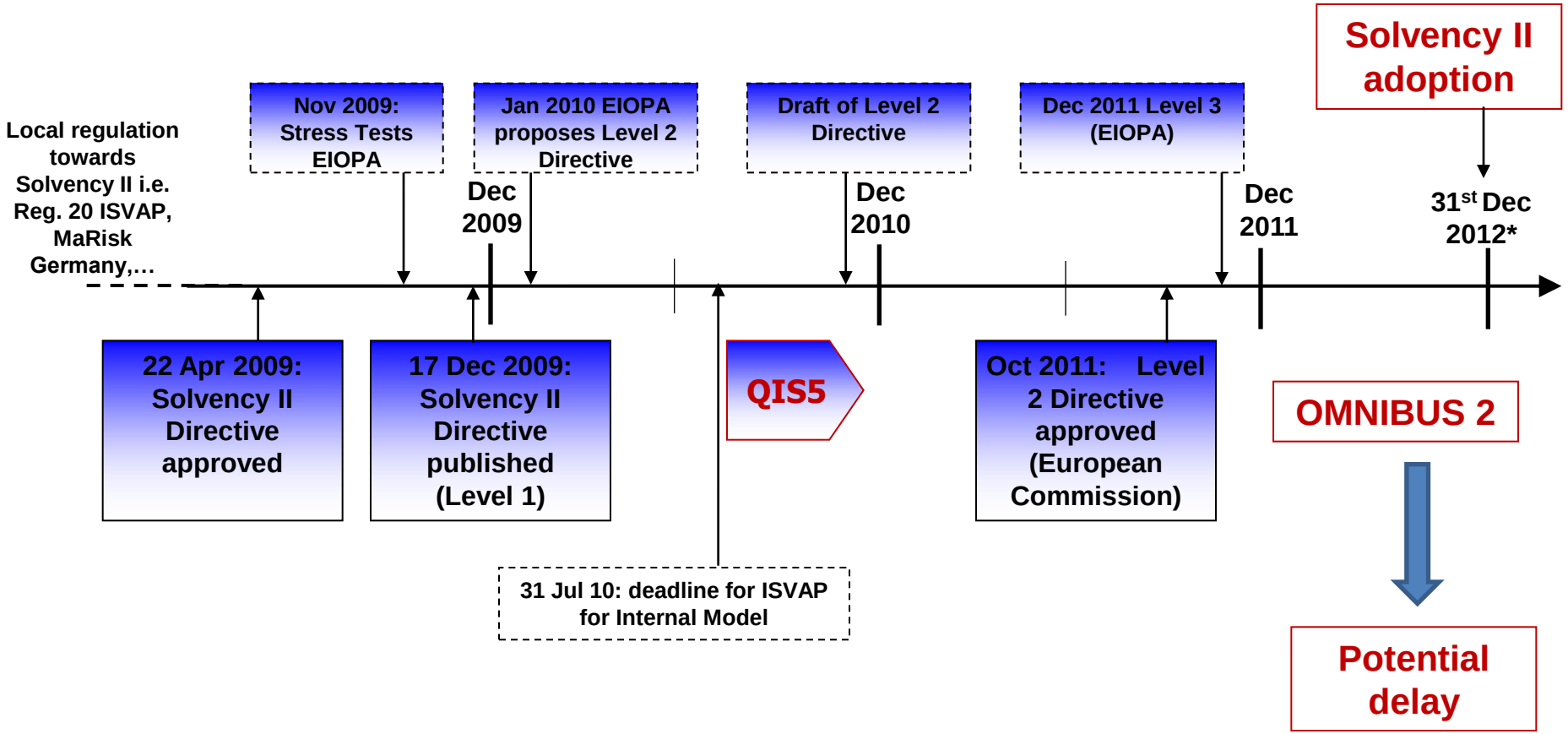
Defines a system of **governance** and **disclosure requirements** focused on the risk management.

The adoption of the Directive implementing measures is **currently still in progress**.

Solvency II a 3 pillars system



Solvency II a 3 pillars system



(*) 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.

Solvency II: Standard Formula or Internal Model? (1/4)

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

→ Solvency II framework allows Companies to adopt an Internal Model or a Partial Internal Model.

BUT

Internal Model (IM) and Partial Internal Model (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.

Solvency II: Standard Formula or Internal Model? (2/4)

«Tests and Standards for Internal Model Approval» are regulated by the following Articles of the Directive:

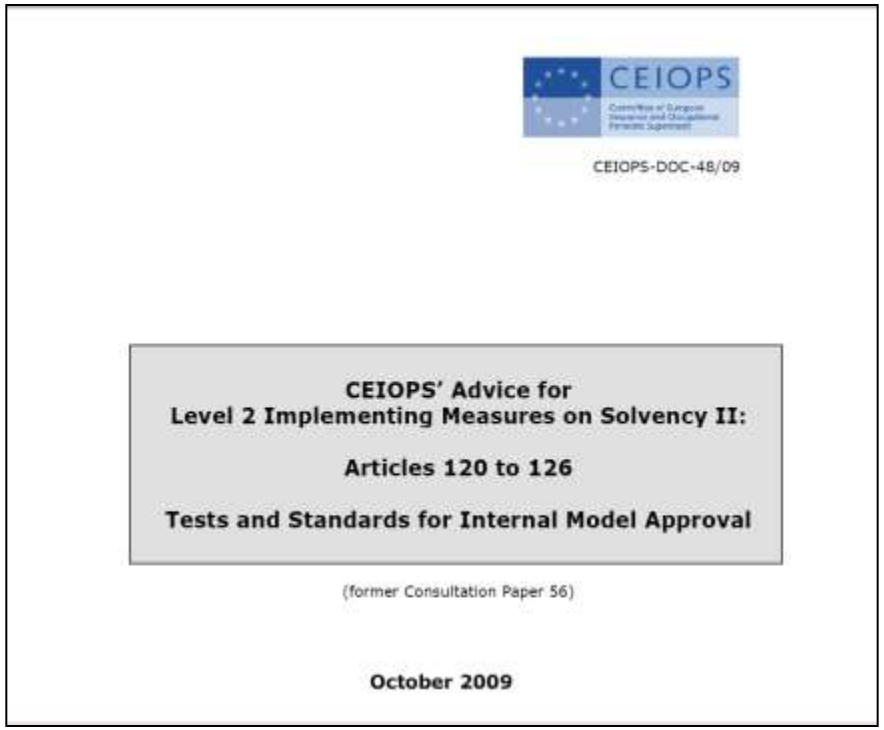
- **Art. 112 → Approval of full and partial internal models**
- **Art. 120 → Use Test**
- **Art. 121 → Statistical Quality Standard**
- **Art. 122 → Calibration Standard**
- **Art. 123 → Profit and Loss Attribution**
- **Art. 124 → Validation Standard**
- **Art. 125 → Documentation Standard**
- **Art. 126 → External Model and Data**

Solvency II: Standard Formula or Internal Model? (3/4)

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

Solvency II: Standard Formula or Internal Model? (4/4)

Former Consultation Paper 56 «Tests and Standards for Internal Model Approval» specifies all aspects related to the IM / PIM approval


CEIOPS

CEIOPS-DOC-48/09

CEIOPS' Advice for
Level 2 Implementing Measures on Solvency II:

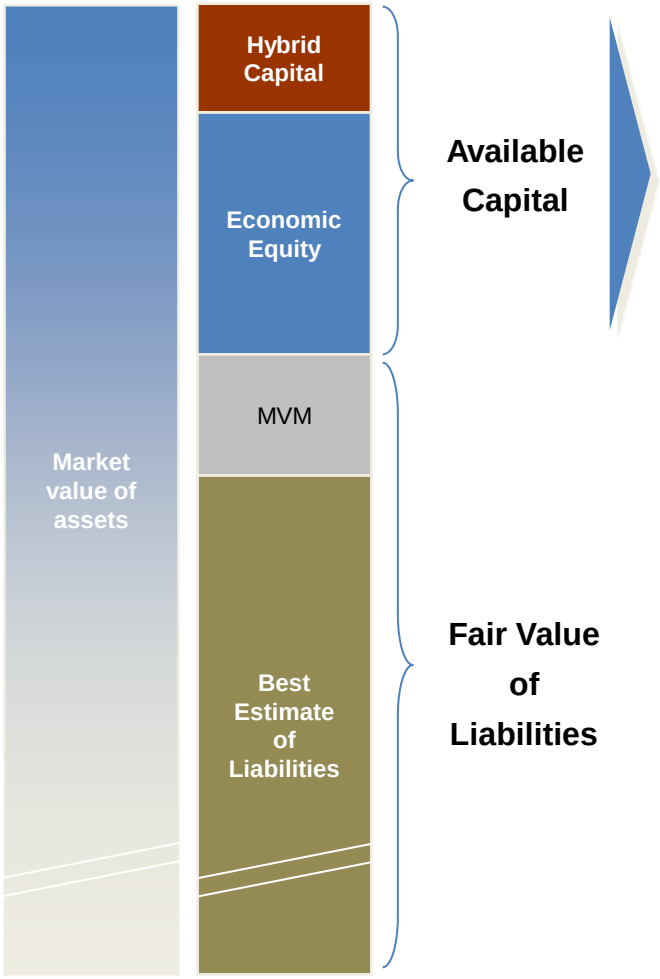
Articles 120 to 126

Tests and Standards for Internal Model Approval

(former Consultation Paper 56)

October 2009

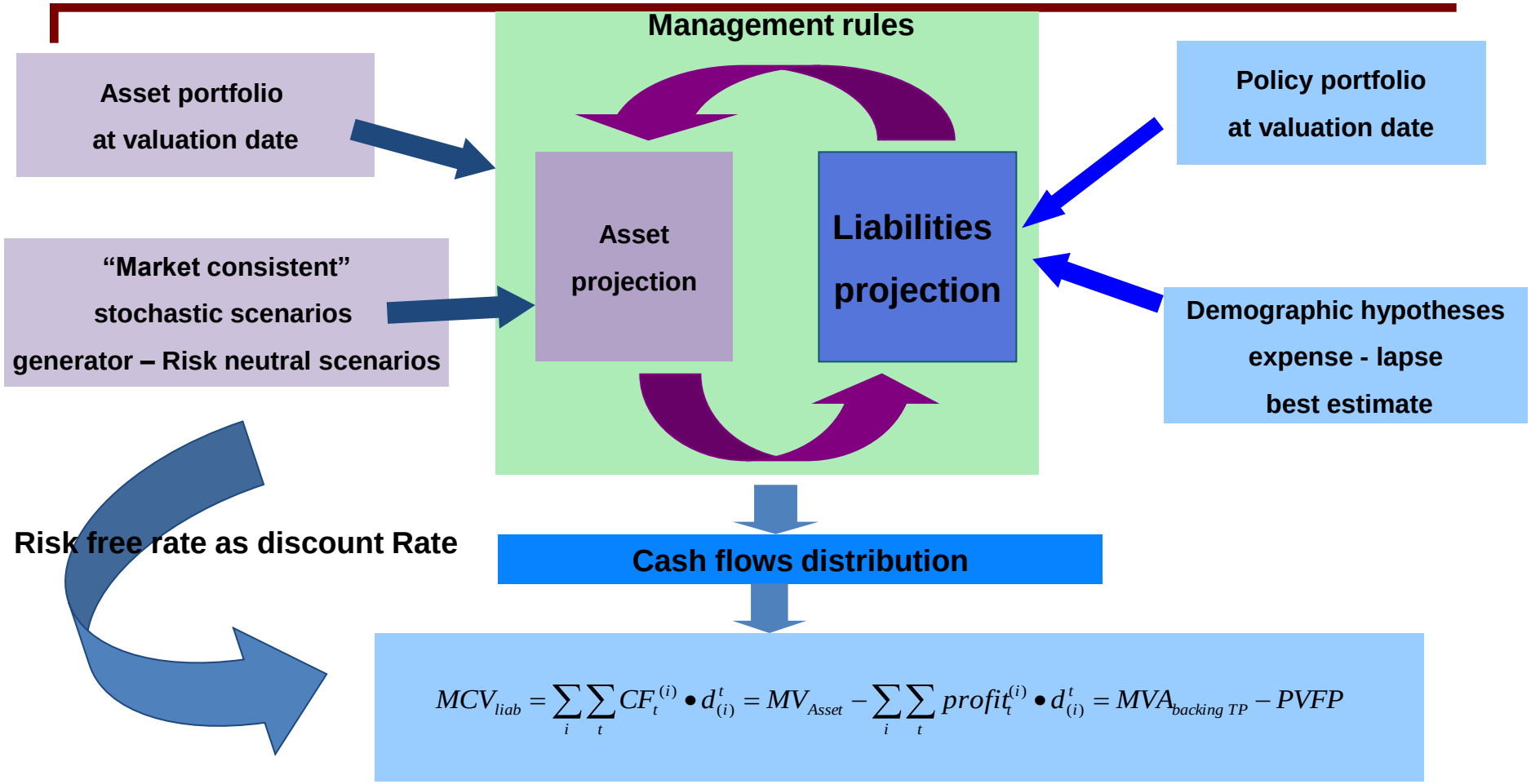
Methodology: Available Capital



Available Capital under Economic Balance Sheet

- **Available Capital** is defined as the sum of Economic Equity and Hybrid/Subordinated Debt.
- **Economic Equity** 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 Market Value Margin (MVM).
  - BEL is based on market values where they exist, and on estimates of market values where they do not exist (mark to model approach)
  - MVM 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.

Best estimate of liabilities: general framework



In this model there is consistency between BEL/RC and MCEV valuation

The same structure can be used to perform ALM analyses

Methodology: technical provisions

- **Definition of Best Estimate of Liabilities ?**

CEIOPS-SEC-52/10
9 April 2010

***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 tacking into consideration embedded options, if exist**

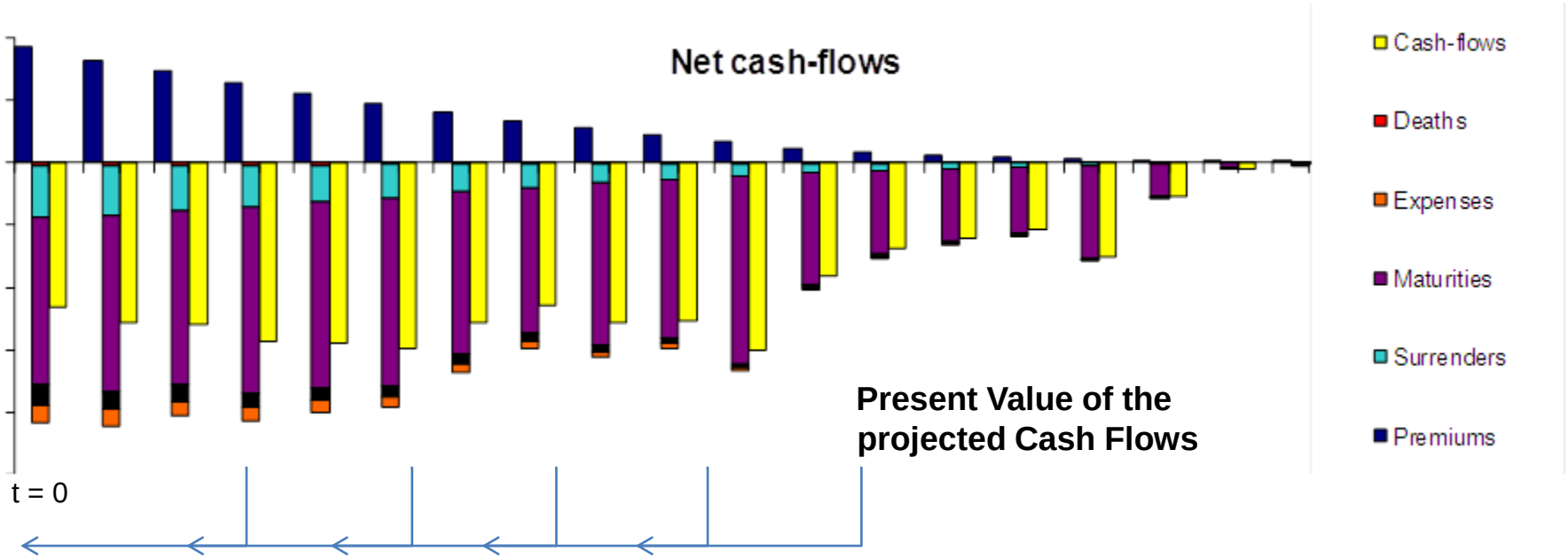
- **Decomposition of Best Estimate of Liabilities**

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. To distinguish between guaranteed and discretionary benefits the following distinction is proposed:*

→ **BEL = Minimum guaranteed provisions + Future Discretionary benefits**

Methodology: Minimum Guarantee Provisions

Minimum Guarantee provisions: present value of future guaranteed net cash flows



- **Key aspects**
  - **Actuarial tool** to project future cash flows
  - Definition of **best estimate assumptions** regarding technical aspects (mortality, lapses,…)
  - Definition of **discount rates**: certainty-equivalent scenario
  - **Timing of Cash-flows** and consistency with discount rates structure

Methodology: BEL & Future discretionary benefits (1/2)

Future discretionary benefits (FDB) = Best Estimate – Minimum guaranteed provisions

Best Estimate of Liabilities = Average(Present value of future net cash-flows)

Best Estimate of Liabilities can be calculated using three different methods, according to the characteristics of the portfolio:

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 **certainty equivalent scenario** to project assets and liabilities and to discount the cash flows
- ❑ **FDB component** is equal to zero

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.

- ❑ Certainty equivalent value 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.

Methodology: BEL & Future discretionary benefits (2/2)

Best Estimate of Liabilities = Average(Present value of future net cash-flows)

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 (MARKET CONSISTENT) for projections of asset prices and returns
- Test on **Market consistency** of stochastic scenarios and on **no arbitrage opportunities**, using martingale test (1=1);
- **Timing** of cash flows (e.g. **ANNUALY**)
- **Leakage Test**– value creation/distruction (caused by the model): test that 1 Euro MVA produces two components (Value and Liabilities) which sum is equal to 1 Euro

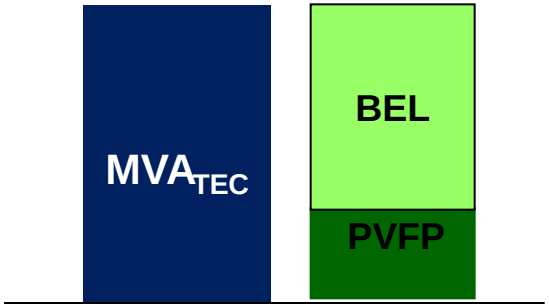
Embedded Value vs. Best Estimate of Liabilities

- **Standard approach: direct method**

  BEL = present value of future net cash-flows

- **Alternative approach: indirect method**

BEL = MVA_{TEC} – PVFP



where:

MVA_{TEC}:market value of assets backing technical provisions

PVFP: present value of future profits gross of taxes

ADVANTAGES of indirect model:

- **Timing**: in PVFP calculations profits emerges at the same time (end of year), while cash flows emerges continuously along each year
- **Consistency** with other valuations (e.g. Embedded Value)
- High level of **controls and checks**: increase/decrease of *available capital and tiering*
- Analysis of **P&L attribution and risk drivers**

Fair value of liabilities: Market Value Margin

Sources of uncertainty in the best estimate calculation:

FINANCIAL ASSUMPTIONS
(short medium term)
- 10 yr USD, EUR cash flow
- 10 yr interest rate option
- 10 yr equity option

MARK TO MARKET:
The model generating the financial scenarios is calibrated on the observed market prices

Best Estimate of Liabilities

FINANCIAL ASSUMPTIONS
(long term)
- 80 yr USD, EUR cash flow
- 80 yr interest rate option
- 80 yr equity option

MARK TO MODEL:
No financial instrument in the market, adjustments in the model generating the financial scenarios

Best Estimate of Liabilities*

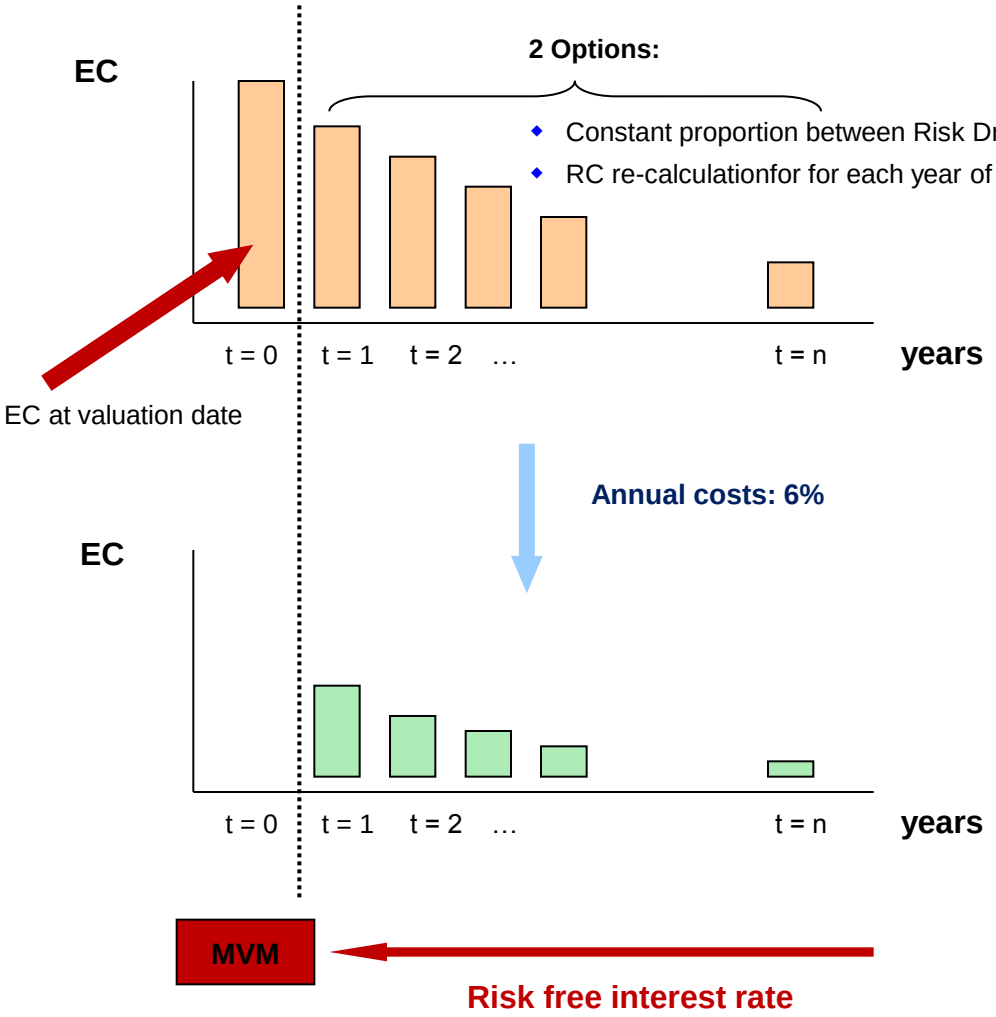
OPERATIVE ASSUMPTIONS
- Mortality
- Longevity
- Morbidity
- Expense
- Irrational lapse behaviour
- Operational

MARK TO MODEL:
No liquid market to look at in setting the assumptions. To be measured with an explicit "external" risk margin

Risk Margin / Market Value Margin

Fair value of liabilities: Market Value Margin

Run off RC for underwriting and operational risk



1° STEP:
Calculation of the RAC for each underwriting/operation risk (reserve, capital at risk, expenses)

2° STEP:
Definition of a Risk Driver for each underwriting/operation risk (reserve, capital at risk, expenses)

2° STEP:
RAC calculation for non hedgeable risk, for each year of projection of existing portfolio at valuation date

3° STEP:
Definition of cost of capital 6% over risk free

4°STEP:
Application of costs to annual RC

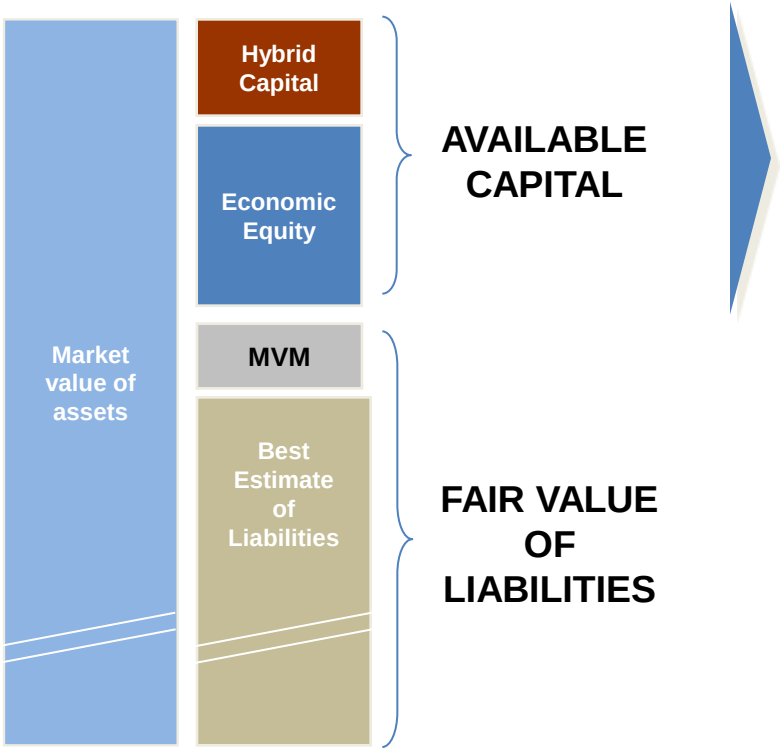
5° STEP:
Calculation of present value of annual costs

Solvency Capital Requirement

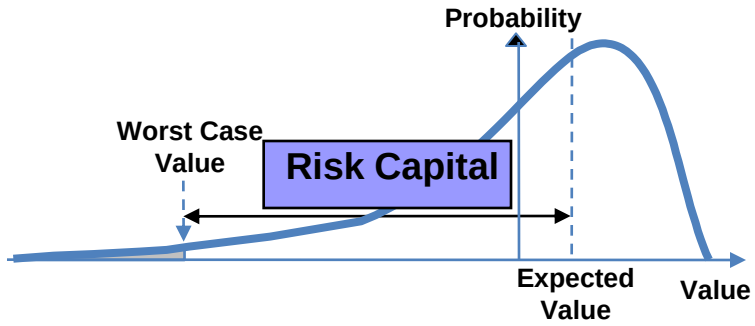
Solvency Capital Requirement

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



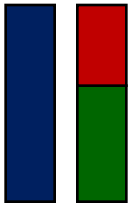
Distribution of Available Capital



- **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

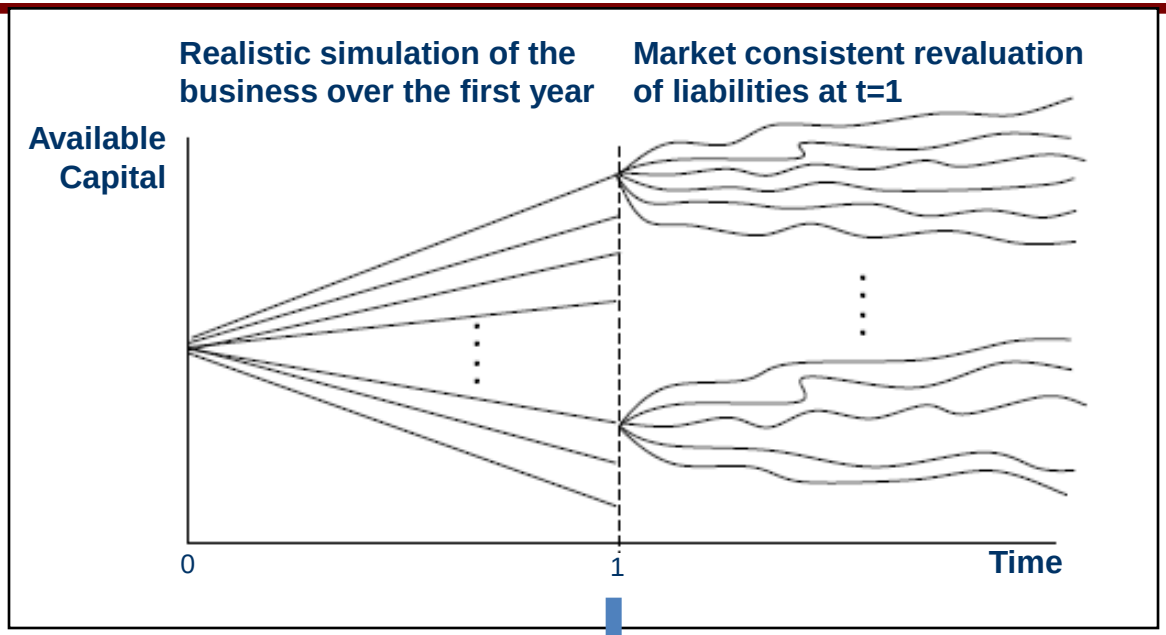
Methodology for SCR: Theoretical approach

Economic Balance Sheet at t=0

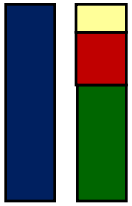


Realistic simulation of the business over the first year

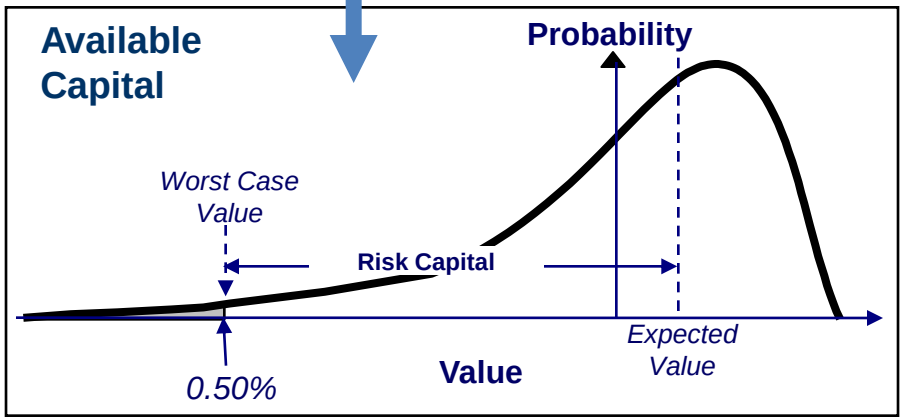
Market consistent revaluation of liabilities at t=1



Solvency Balance Sheet at t=0

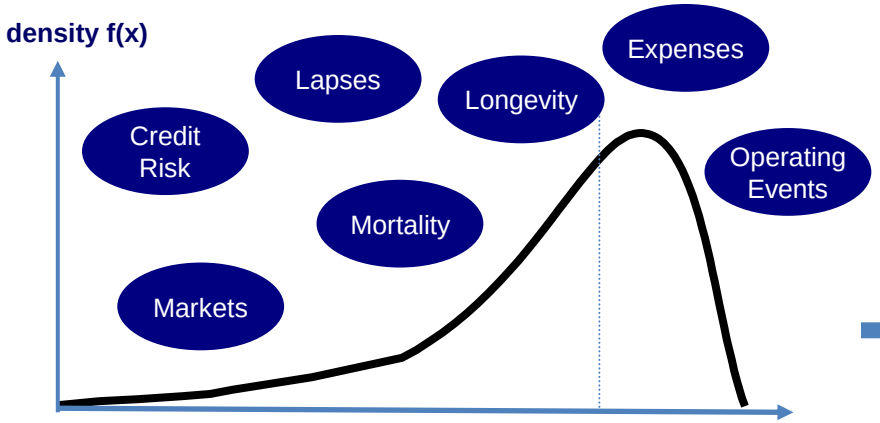


Discounting to t=0 at risk free rate



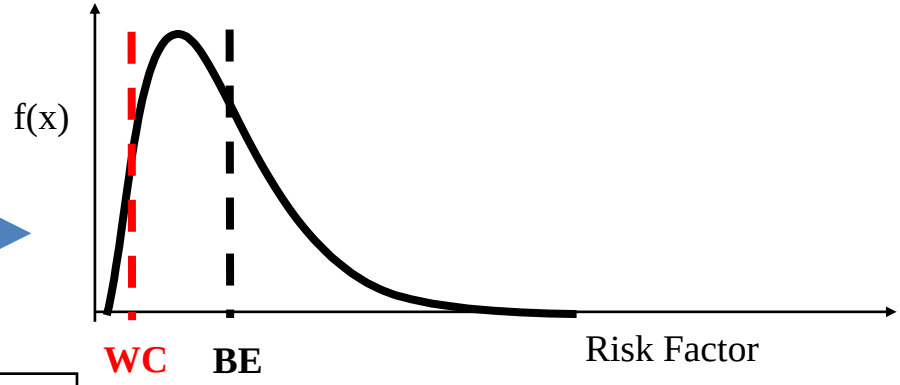
Alternative solution: Modular Approach

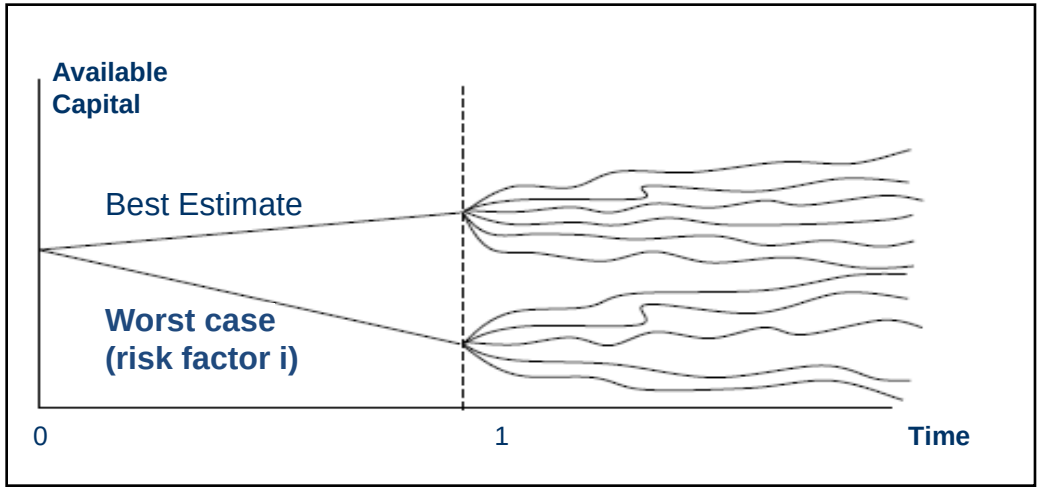
Identification of Risk Factors that affects the AC distribution

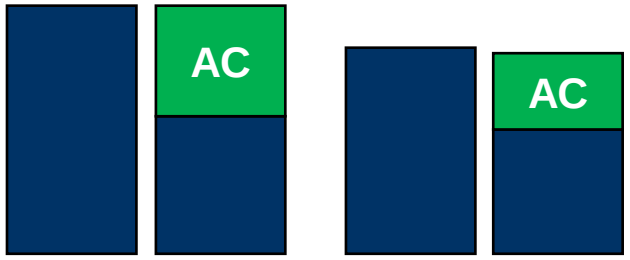


Focus on the single risk factors:

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

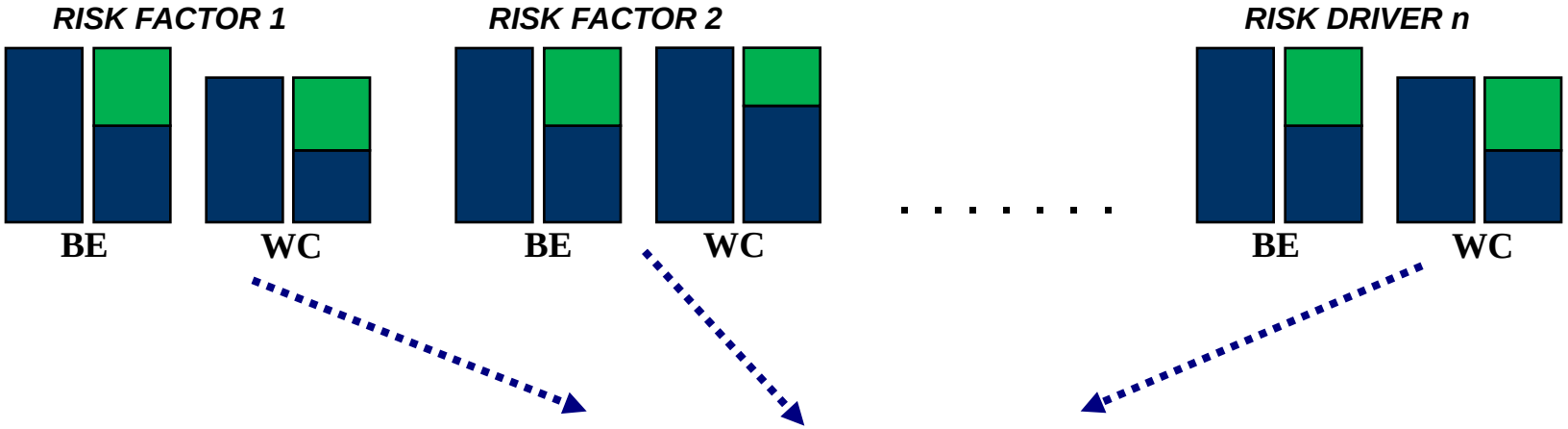






SCR = AC (BE) – AC(WCi)

Alternative solution: Modular Approach



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

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

AGENDA

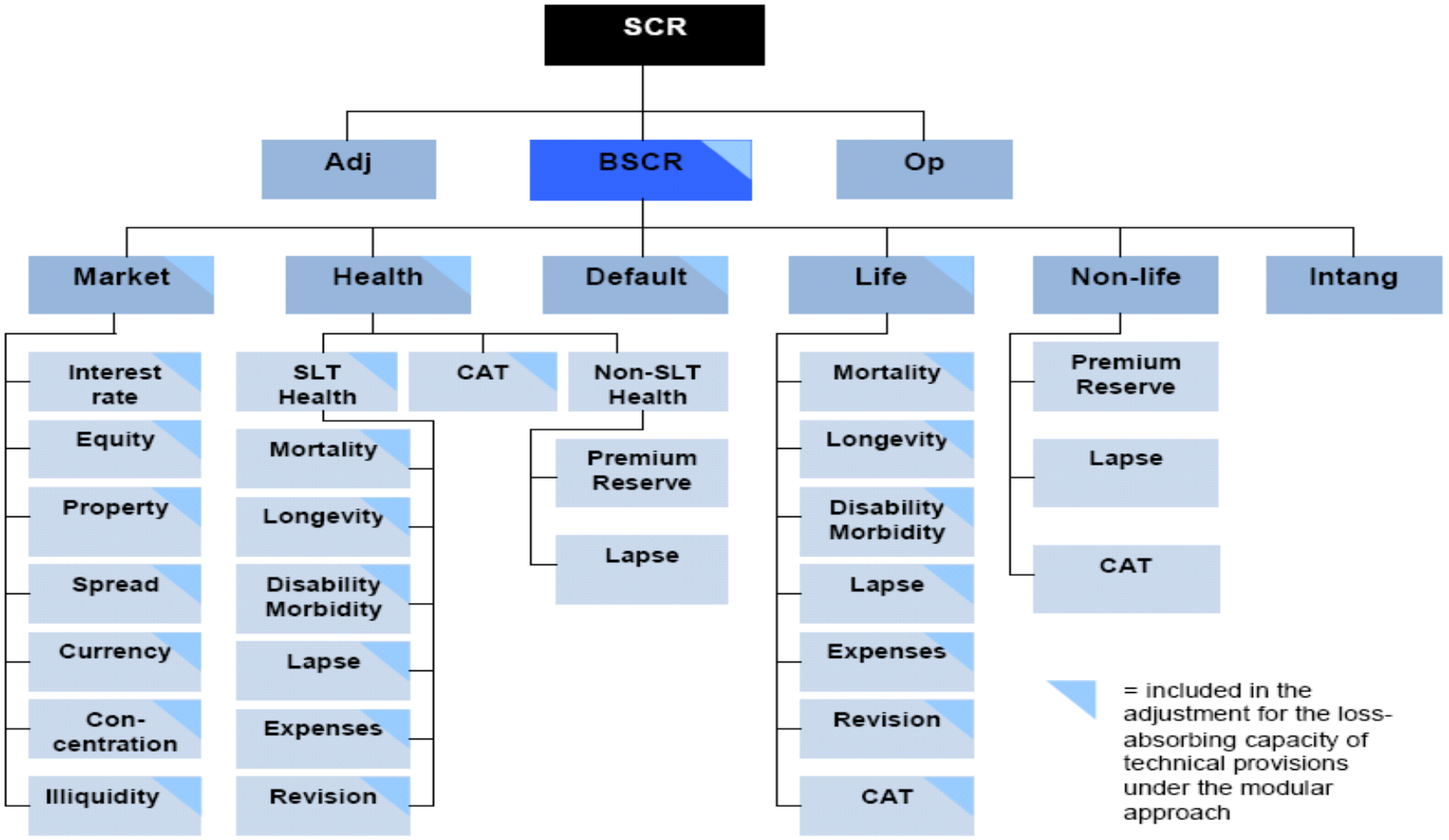
1. Risk free definition

2. The MCEV calculation: a simple and “practical” example

3. Solvency2 overview

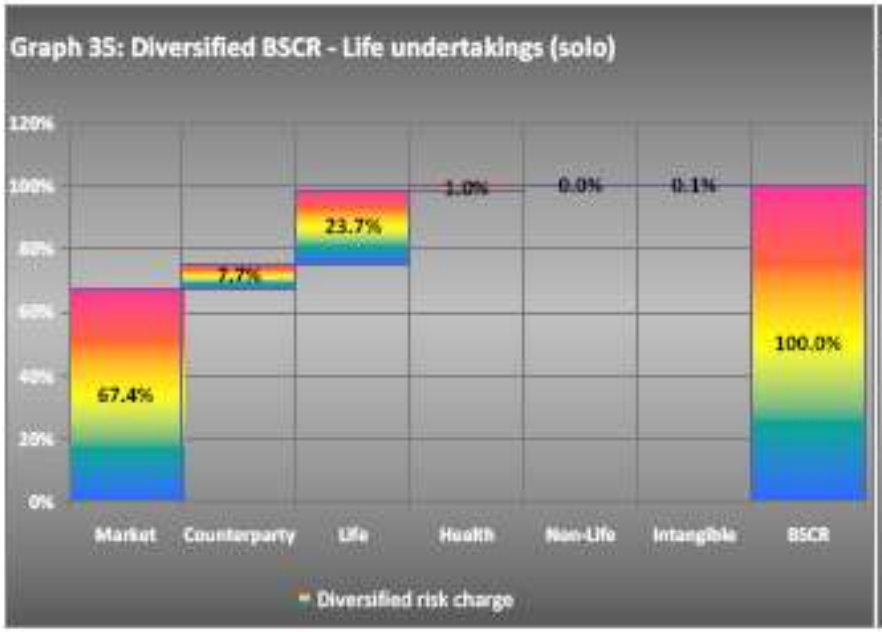
4. S2 Standard Formula and alternative approaches

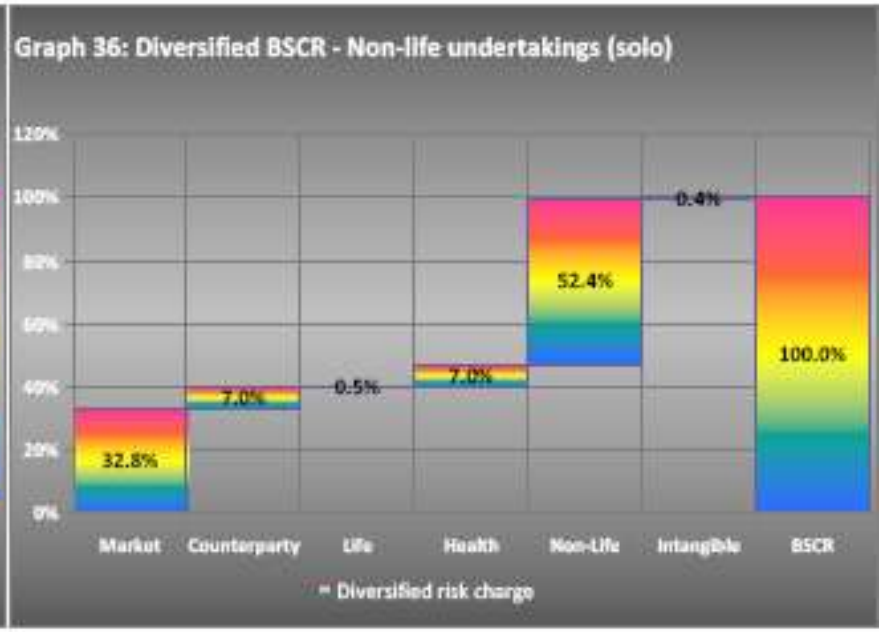
Solvency II Framework: risk overview



QIS5: final result

BSCR structure





Other «Risk Based» Models

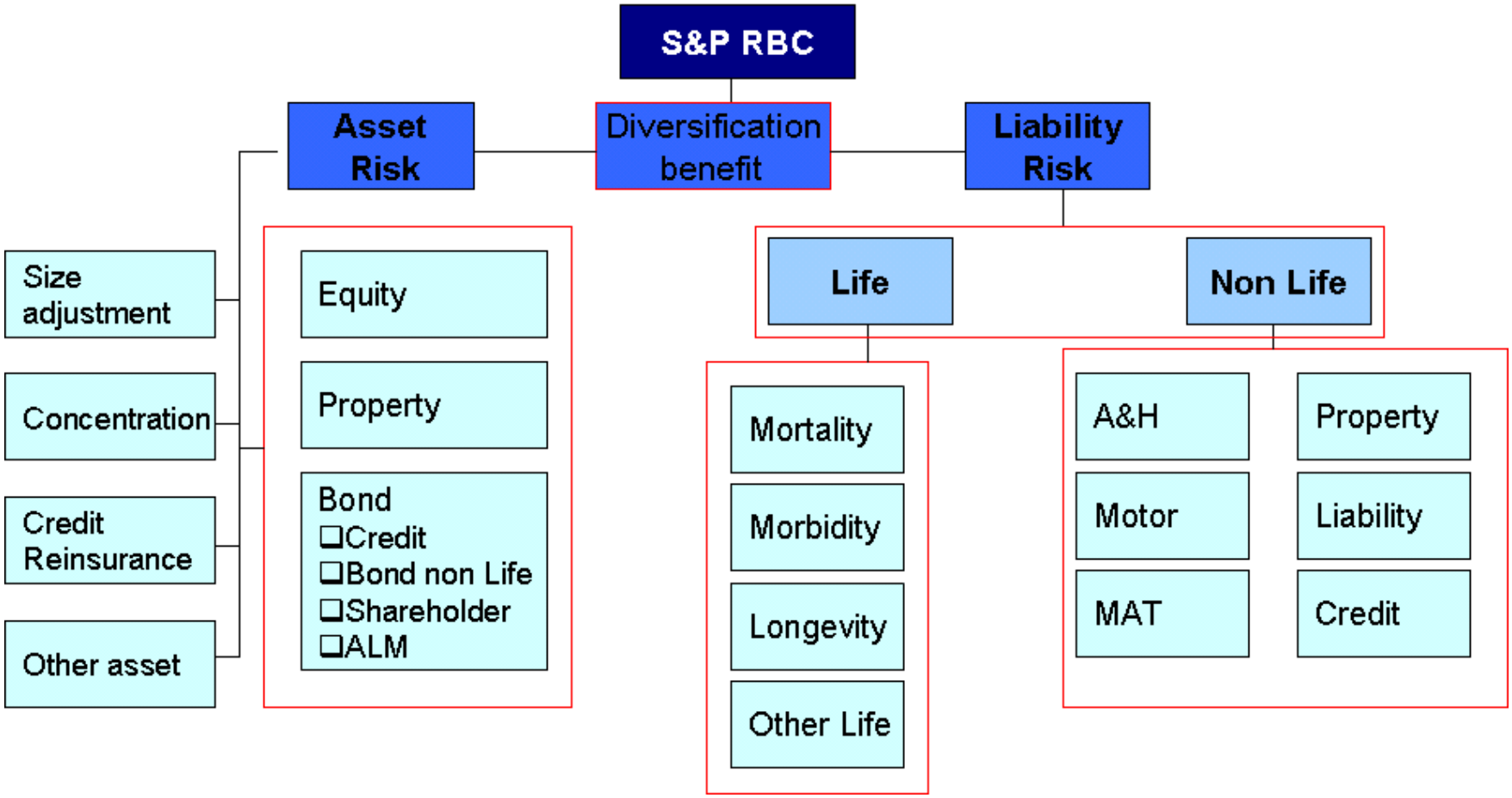
Models for Risk capital evaluation:

- VaR or Tail VaR?
- One year or multi-year?
- Bottom- up or top-down
- External or internal

- ***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.*

S&P Model Overview (1/2)



S&P Model Overview (2/2)

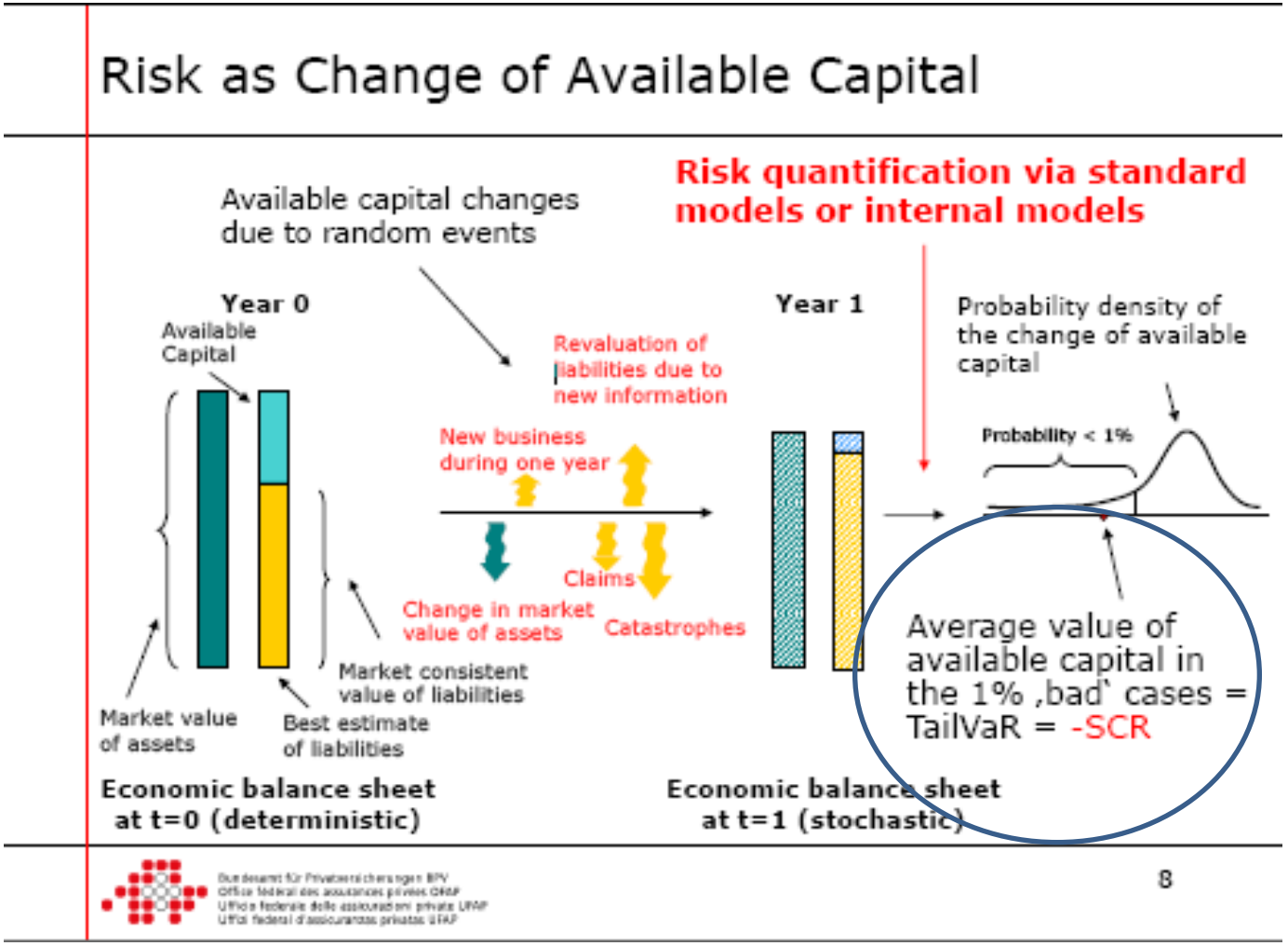
MODELLO S&P

- determinazione del *RBC* per ogni singolo rischio;
- calcolo di un *RBC* diversificato raggruppato in sottogruppi;
- calcolo di un *RBC* diversificato tra rischio vita e danni;
- calcolo del rischio complessivo senza e con diversificazione tra i sottogruppi;
- riduzione del 50%, come ulteriore prudenza, del beneficio di diversificazione ottenuto

MODELLO SOLVENCY2

- determinazione dell'SCR per ogni singolo rischio pre e post mitigazione;
- calcolo di un SCR diversificato raggruppato in sottogruppi;
- aggregazione in quattro blocchi dei rischi di investimento, assicurativo vita, danni e malattia;
- aggregazione di tutti i rischi
- aggiunta del rischio operativo e limitazione della capacità mitigativa alla riserva per utili futuri discrezionali disponibile a data di bilancio.

SST Model Overview (1/2)



SST Model Overview (2/2)

Future States of the World at t=1

- Risk factors need to be projected to possible future states in one year's time
- The projections should lead to consistent states of the world
  - Arbitrage-free
  - Dependencies between the risk factors need to be taken into account
  - Dependencies should also take future state of the world into account → in stressed situations, some risk factors might exhibit higher dependency
  - The states evolve according to physical probabilities, not risk-neutral → based on observed, historical data
- Risk Factors
  - Market Risk: Yield curves, spreads, equity indices, real estate prices, FX rates, embedded options…
  - Insurance Risk: Mortalities, morbidities, embedded options…
  - Credit Risk: Defaults, LGDs,…
- The functional dependence on risk factors need to be modeled, for instance lapse rates in function of interest rates, the economic state of the company,…

Links for additional publication

https://eiopa.europa.eu/activities/insurance/solvency-ii/index.html

http://www.ania.it/opencms/opencms/ECONOMIA_E_FINANZA/SOLVENCY_II/Home_Page.html

http://www.insuranceeurope.eu/key-issues/solvency-ii

http://www.gcactuaries.org/solvency.html

http://www.finma.ch/i/beaufsichtigte/versicherungen/schweizer-solvenztest/Pagine/default.aspx