

# SCOR's Internal Model and its application to Solvency II

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**SCOR**

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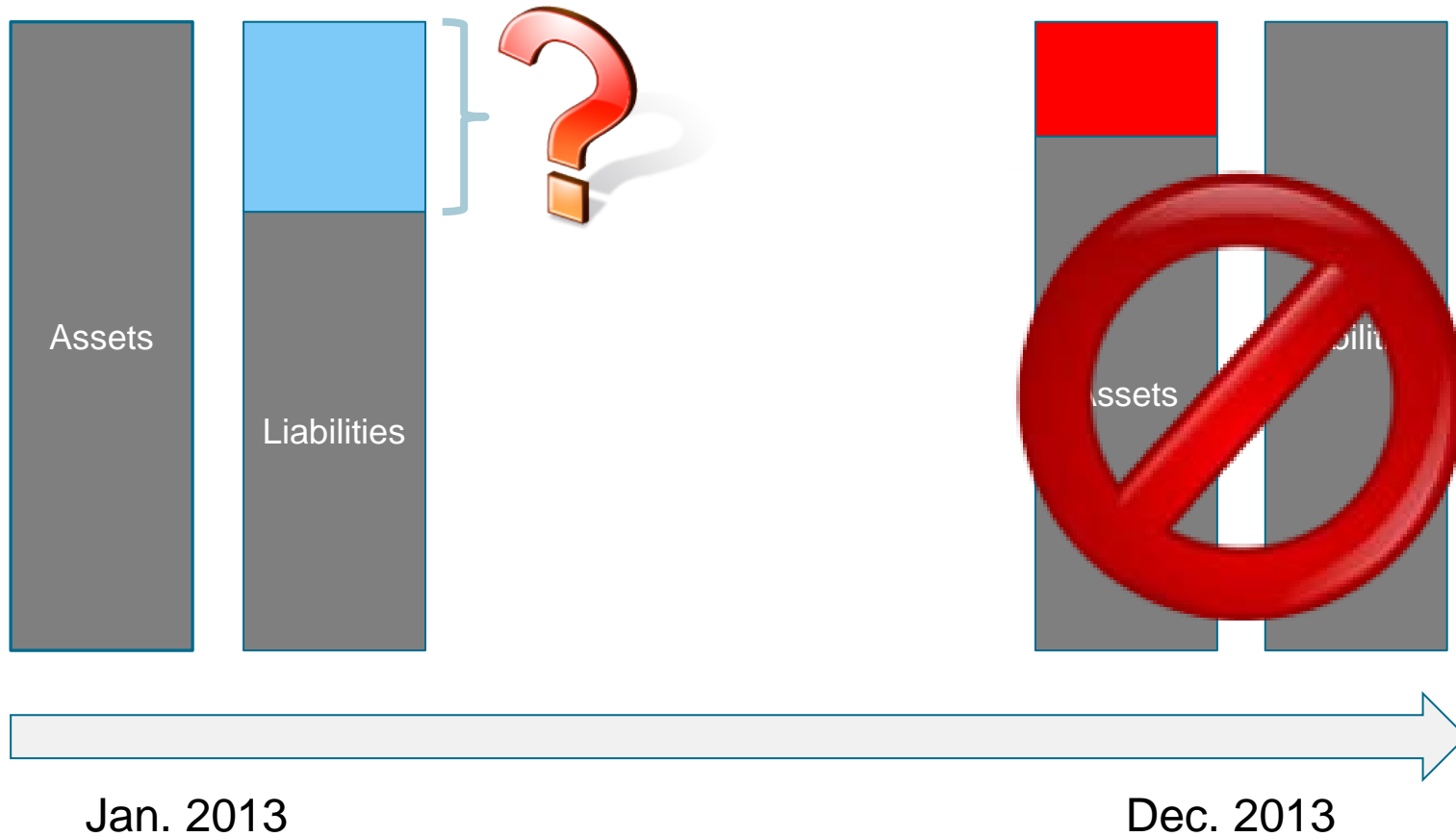
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# SCOR's Internal Model and its application to Solvency II

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1	High level overview of SCOR's internal model
2	Architecture and main model principles
3	More detailed aspects
4	Application to Solvency II

# Group Internal Model: major question



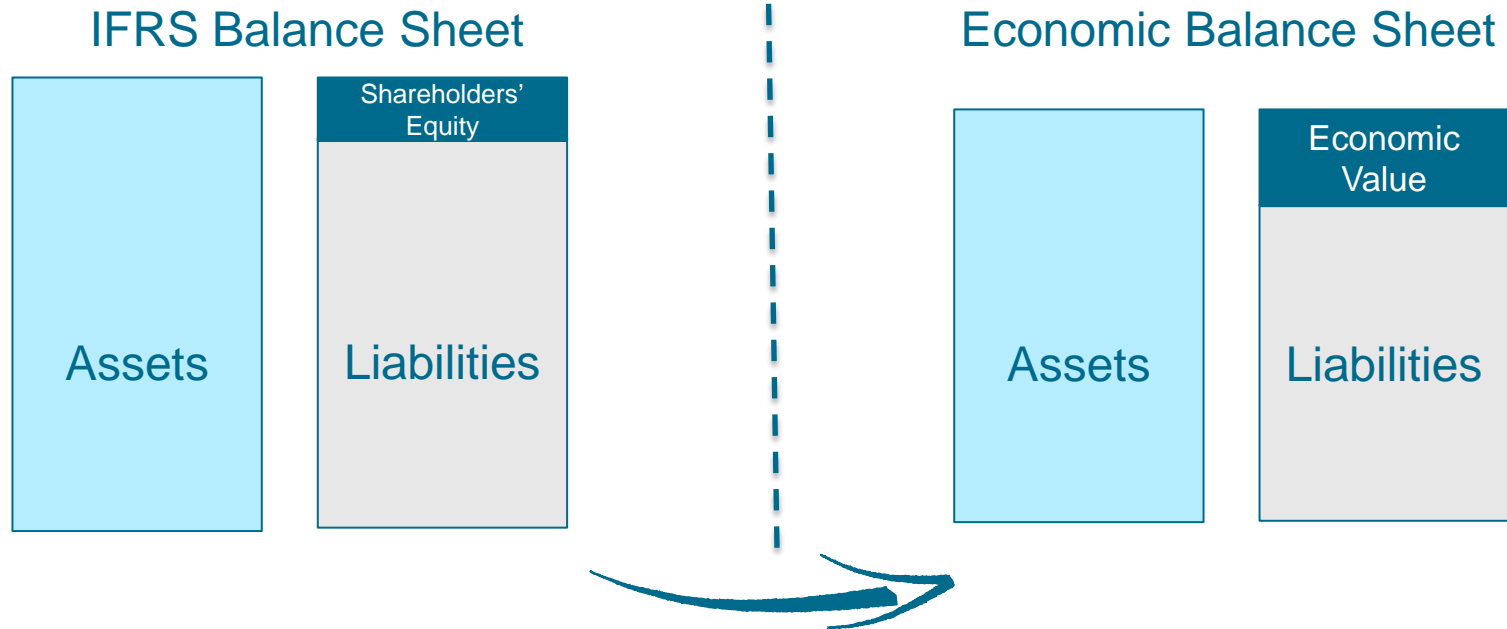
# Introduction

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How does our model produce a risk profile and the Solvency Capital Requirement (SCR):

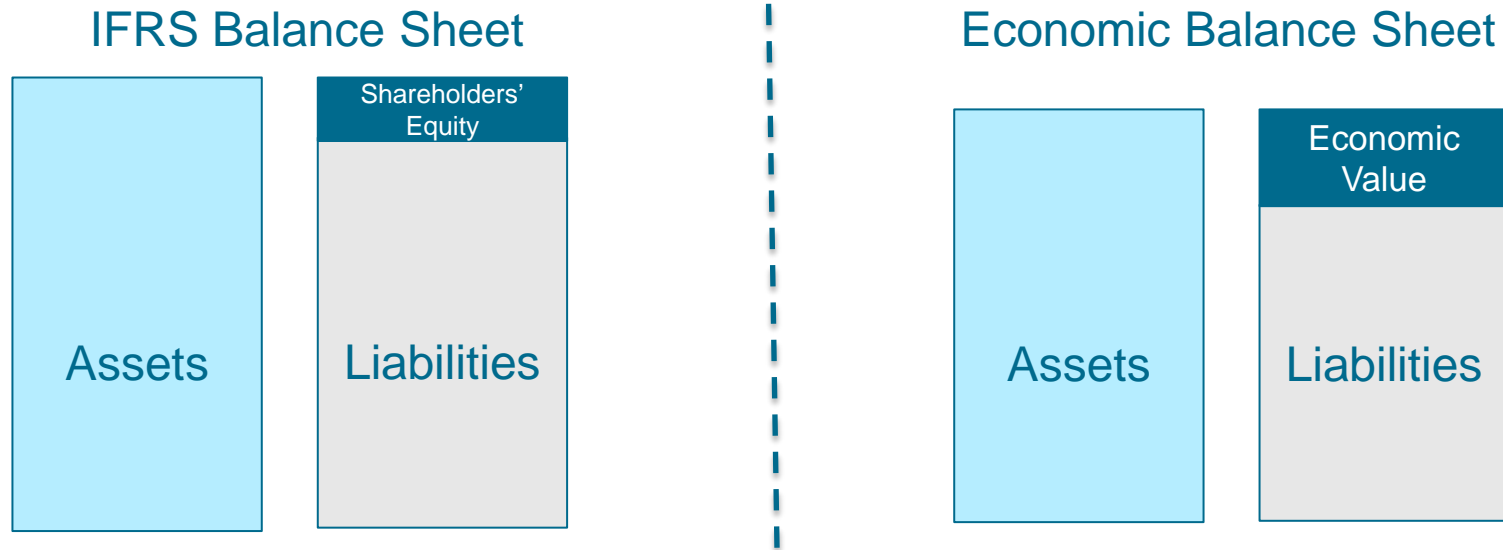
- ❑ The risk of SCOR is the change in its value
- ❑ The valuation principles used in the internal model are *economic*. This means that the values of assets and the liabilities are determined by the same underlying principles
- ❑ As a consequence, for assessing the risk of the company we have to start by modeling the economic balance sheet

# IFRS versus modeled Economic Balance Sheet (1/2)



- Discounting of future cash flows
- Removal of goodwill
- Removal of the future dividend foreseen at year-end
- Tax on economic adjustments

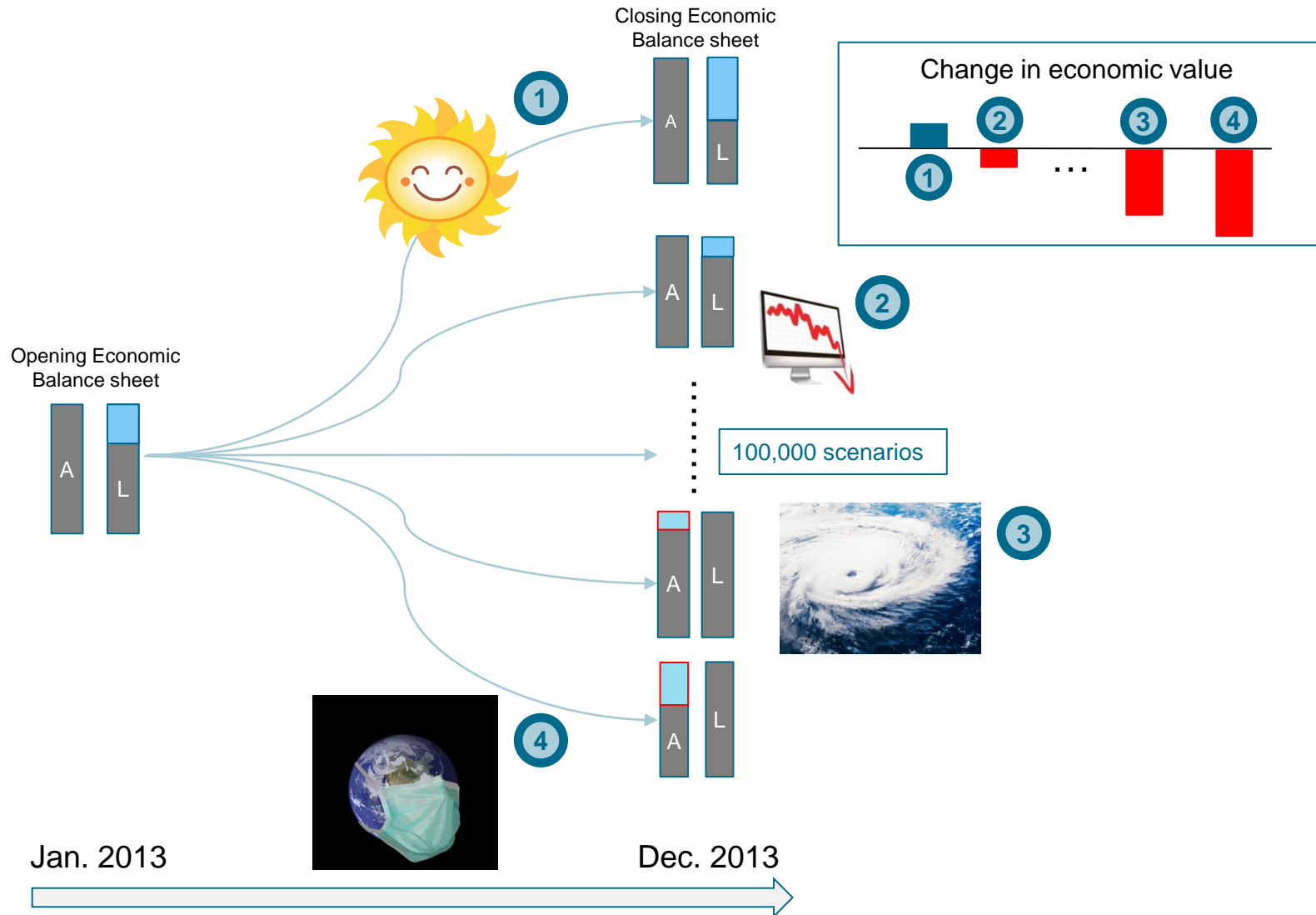
## IFRS versus modeled Economic Balance Sheet (2/2)



### Main valuation principles of the modeled Economic Balance Sheet

- Positions are valued as
  - mark-to-market (if a liquid market exists), otherwise
  - mark-to-model
- Please note that some of the assets are already valued at market value in IFRS

# Time evolution in the internal model: Examples

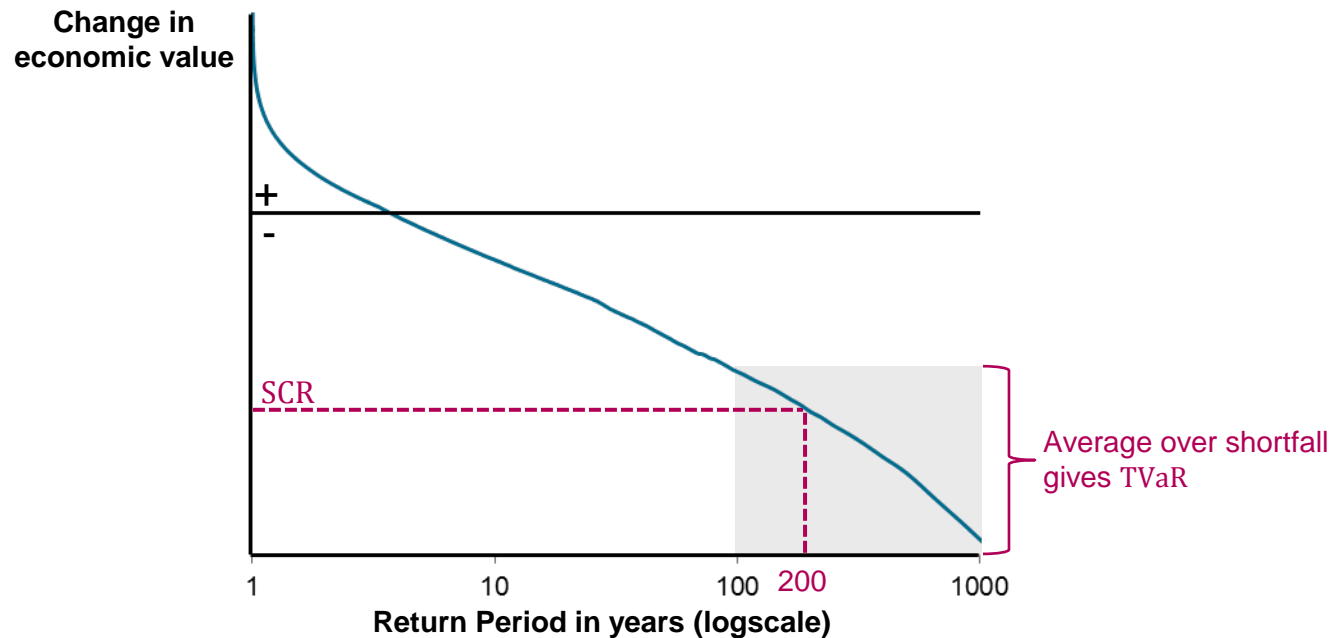


\*) Note that these are examples for illustration purposes only, and do not necessarily represent actual GIM scenarios



# Change in economic value distribution

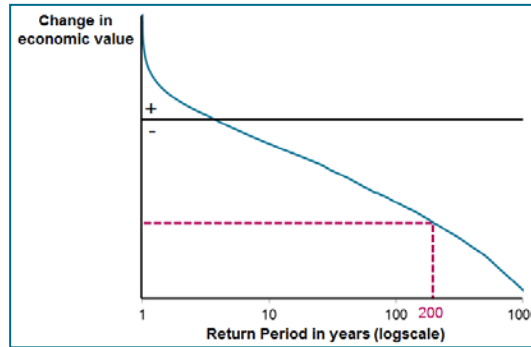
## SCOR's risk profile 2012



- ❑ SCR is the worst 1-in-200-year (VaR 0.5%) event of the annual change in economic value
- ❑ The 1% shortfall is defined as the region beyond the worst 100-year event
- ❑ tVaR 1% is the change in economic value averaged over the shortfall

# Major areas of application

Focus on risk



Focus on return

## Enterprise Risk Management (ERM)

- ❑ Describes the entirety of all organisational measures that enable us to identify, assess and control risks, and either decide to mitigate risks outside of our appetite or manage risks we wish to retain
- ❑ The internal model is fully embedded in our ERM Framework
- ❑ One aspect is the reduction of risks in the tail, which can be monitored using the IM

## Economic Value Based Management (EVBM)

- ❑ Focus on the relation between return and risks from enterprise-wide perspective with the goal of a holistic risk and return view
- ❑ One aspect is the reduction of capital costs through diversification, which can be monitored with the IM
- ❑ Through a capital allocation on all lines of business, performance can be consistently measured and compared
- ❑ This allows for portfolio and performance optimization

Protection

SCOR's Economic Value

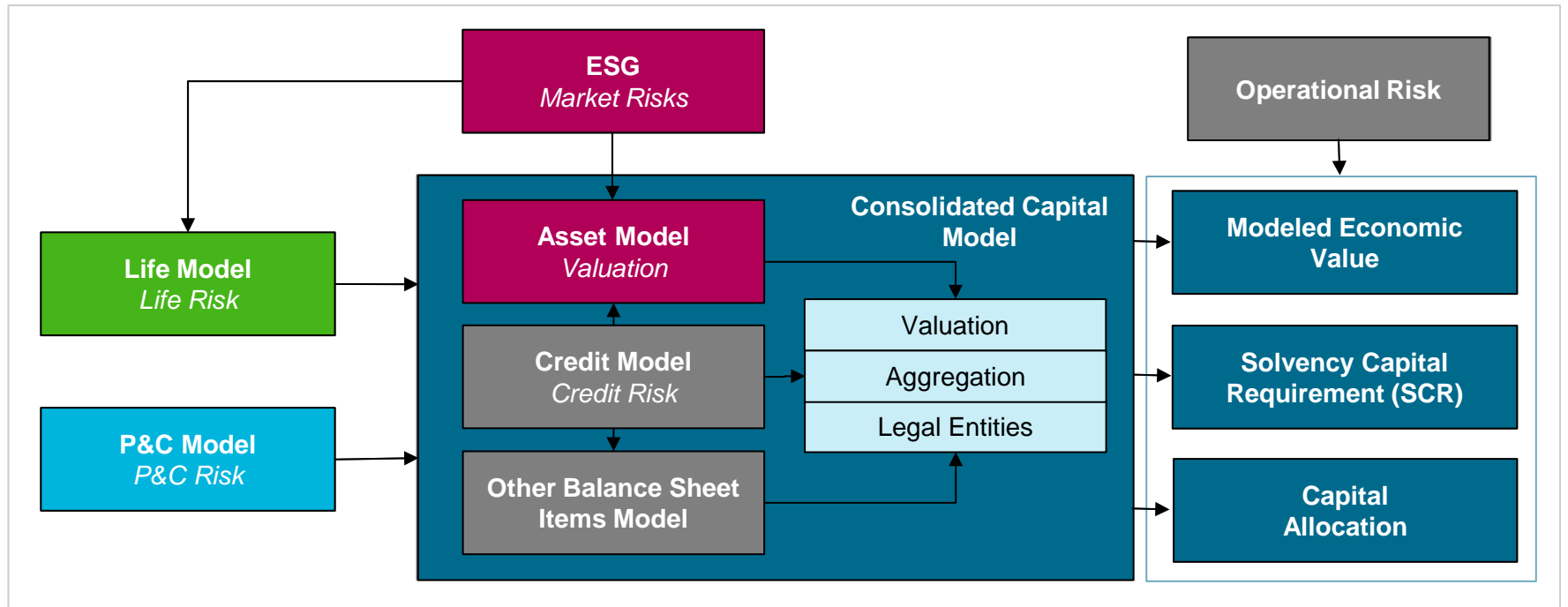
Optimization

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# Architecture of the internal model



# SCOR's main model principles

## Risk is modelled at the origin

- ❑ Data is entered and signed-off by the people who are in charge of the corresponding business
- ❑ Models are developed in their related divisions in close cooperation with the Financial Modeling team who is the ultimate responsible for the GIM and the integration of all risk models
- ❑ The responsibility of the parameterization and the life cycles of the partial models lies in the divisions

## Strong focus on dependency modelling

- ❑ Non-linear treatment by mirrored-clayton copulas to ensure strong dependence in the tails
- ❑ The Economic Scenario Generator (ESG) uses bootstrapping to conserve historical dependencies between economic variables and to produce consistent scenarios
- ❑ Dependencies are calibrated using also expert judgments within the PrObEx framework, which is scientifically sound<sup>1), 2)</sup>

## Full balance sheet approach

- ❑ From the current balance sheet a stochastic one-year projection of future balance sheets is calculated
- ❑ All risks are considered, such as underwriting, market, yield, credit, foreign and exchange risks
- ❑ All valuation is done on a market consistent basis

## Capital allocation via Euler principle

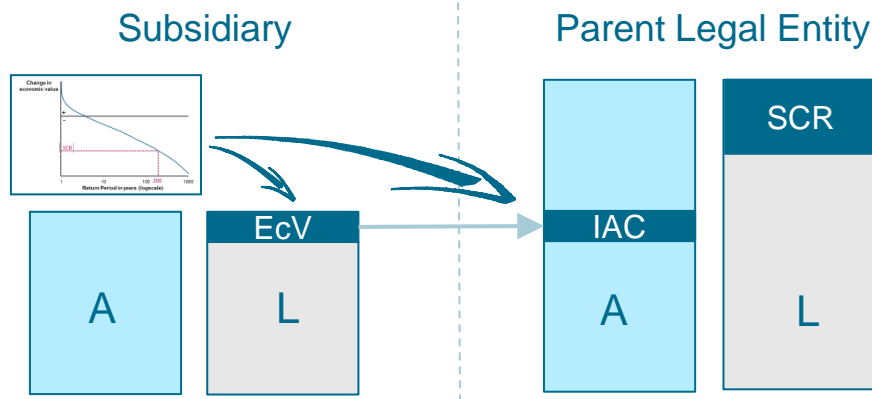
- ❑ Fully change in economic value distribution is produced
- ❑ Expected profit and capital requirements at the different thresholds and for different risk measures are computed
- ❑ Capital allocation is calculated by the marginal contribution to the TVaR (Euler principle) and preserve RoRaC compatibility

1) ARBENZ, P. and CANESTRARO, D. (2012). *Estimating Copulas for Insurance from Scarce Observations, Expert Opinion and Prior Information: a Bayesian Approach*. *ASTIN Bulletin*, 42 (1): 271-290.

2) ARBENZ, P. and CANESTRARO, D. (2010). *PrObEx: A New Method for the Calibration of Copula Parameters from Prior Information, Observations and Expert Opinions*. *SCOR Papers*, 10.

# How are Legal Entities modeled, in the Group Internal Model

## Treatment of participations



## Explanation

- ❑ The Economic Value (EcV) of the subsidiary is an asset position on the Economic Balance Sheet of the parent. This position is called “Investment in Associated Companies” (IAC)
- ❑ In SCOR’s model, the change of economic value of the subsidiary is a component of the change in economic value of the parent LE

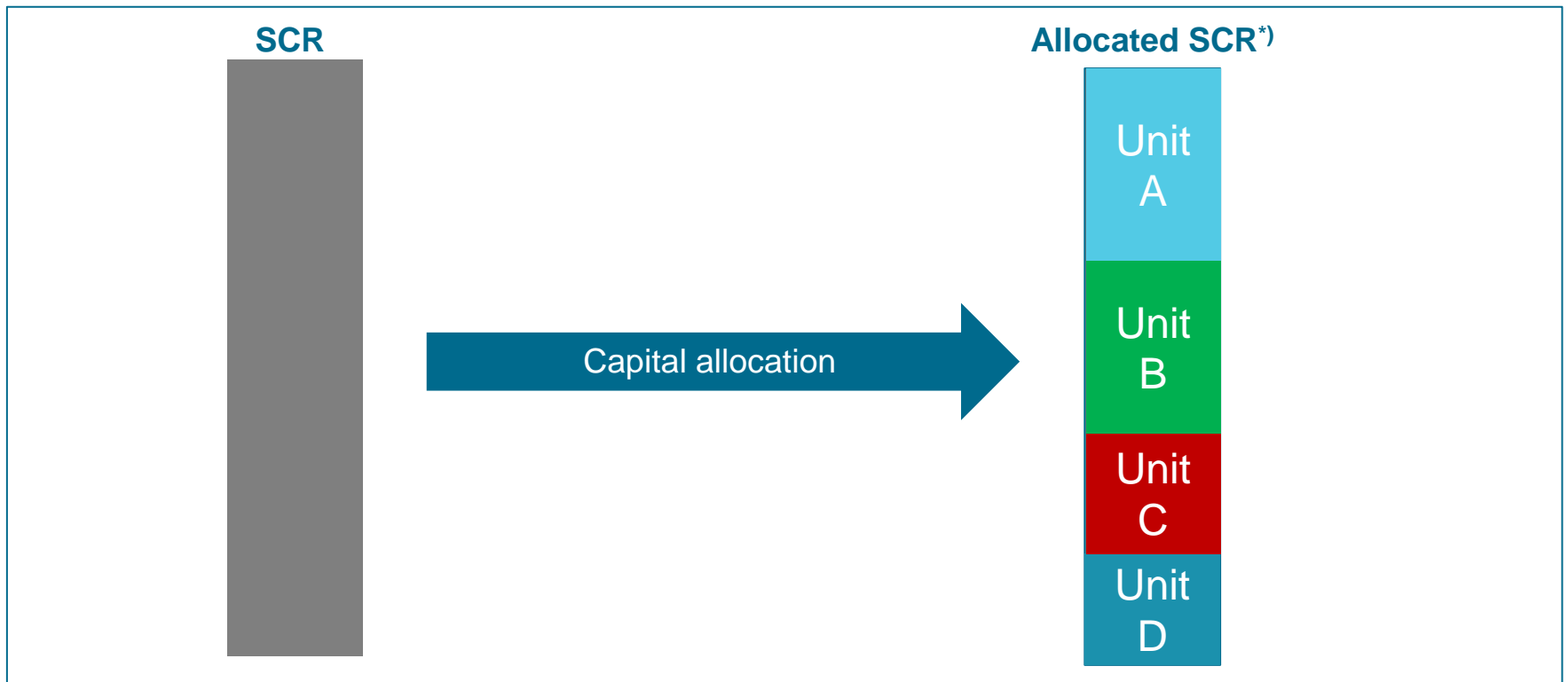
# SCOR's Internal Model and its application to Solvency II

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3	Capital Allocation
4	Application to Solvency II

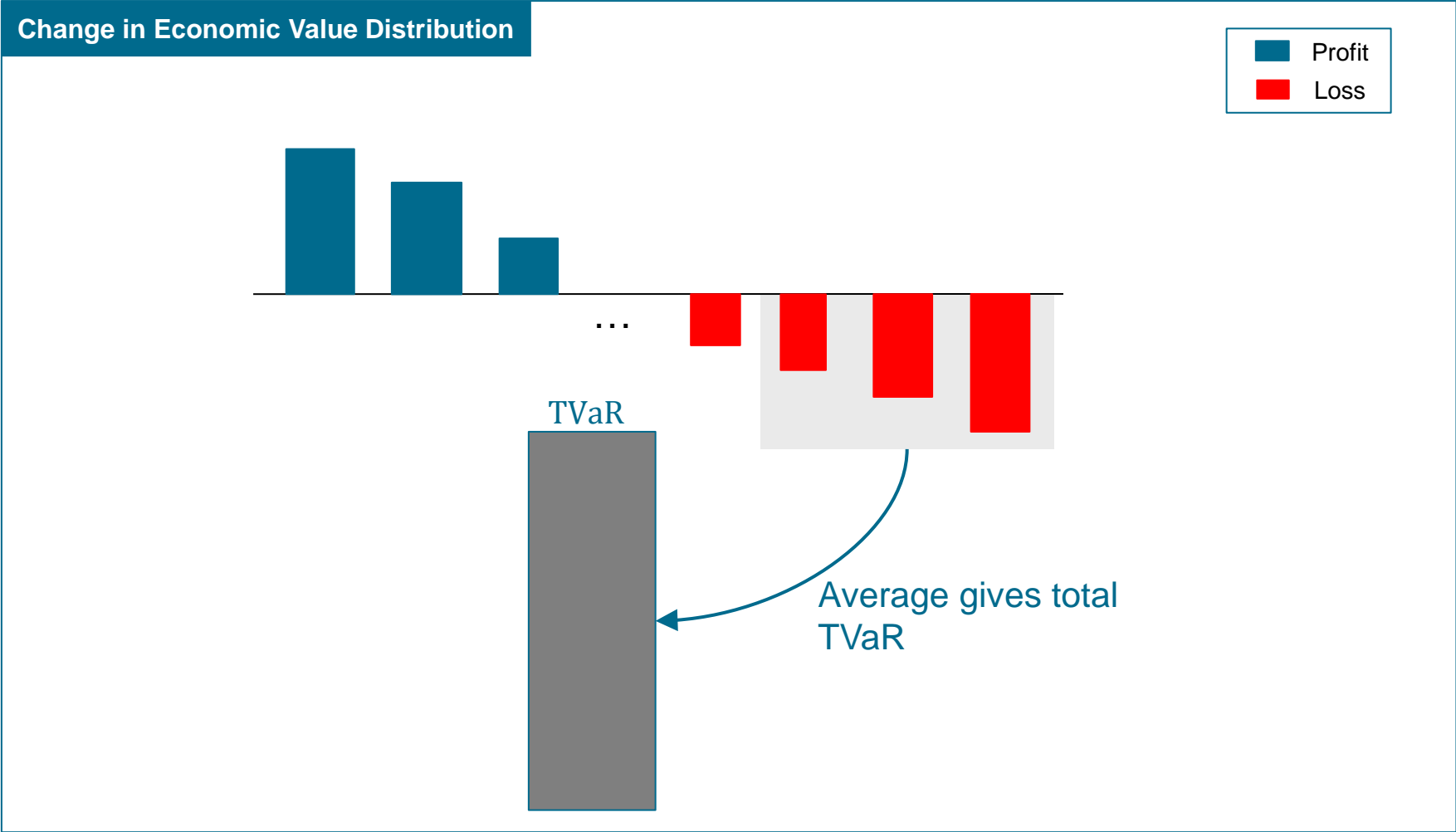
# Capital allocation: Overview

- ❑ In the internal model, the total SCR is allocated to different risk categories
- ❑ This allocation allows one to assess the contribution and cost of capital of individual lines or divisions



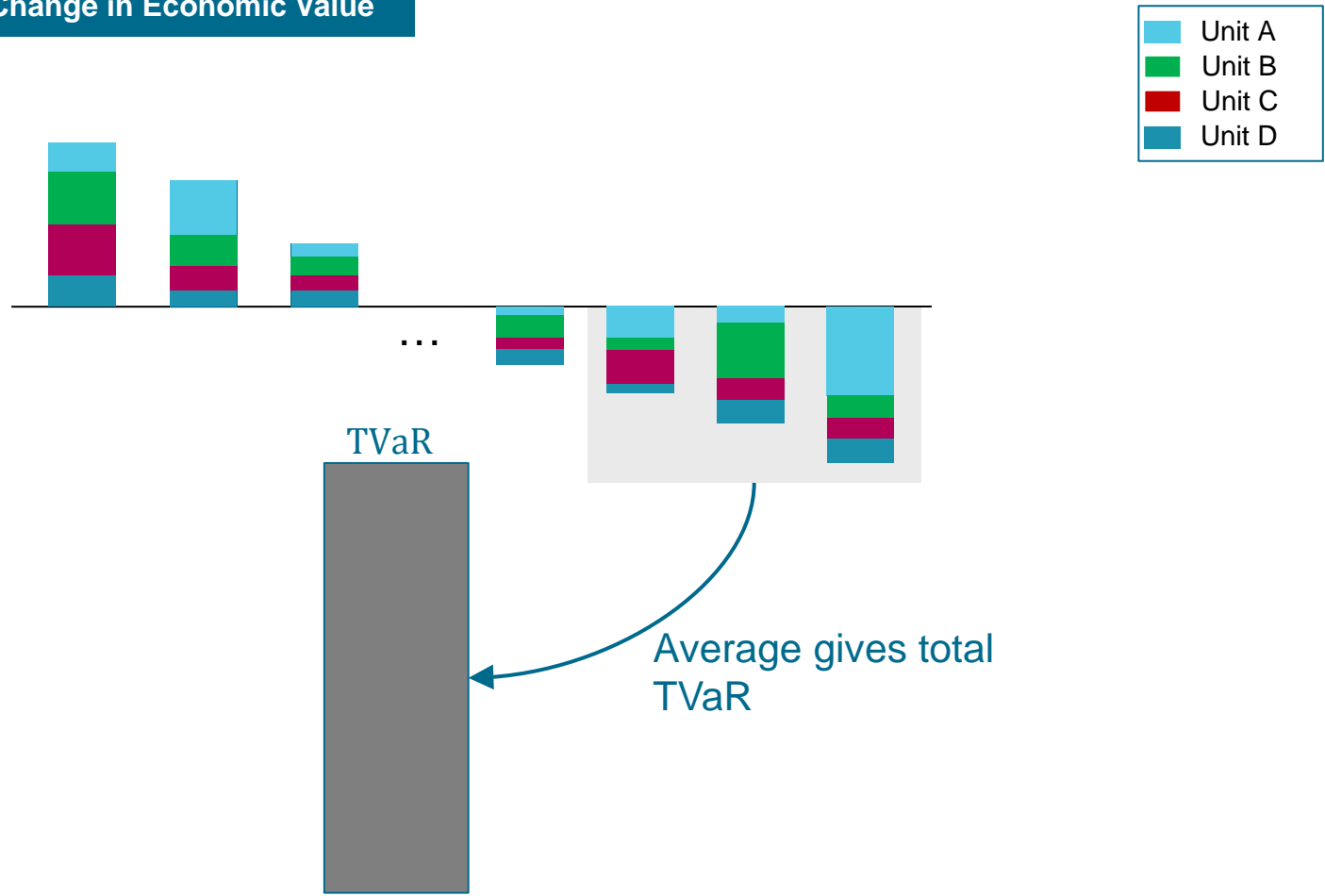


# Capital allocation using TVaR



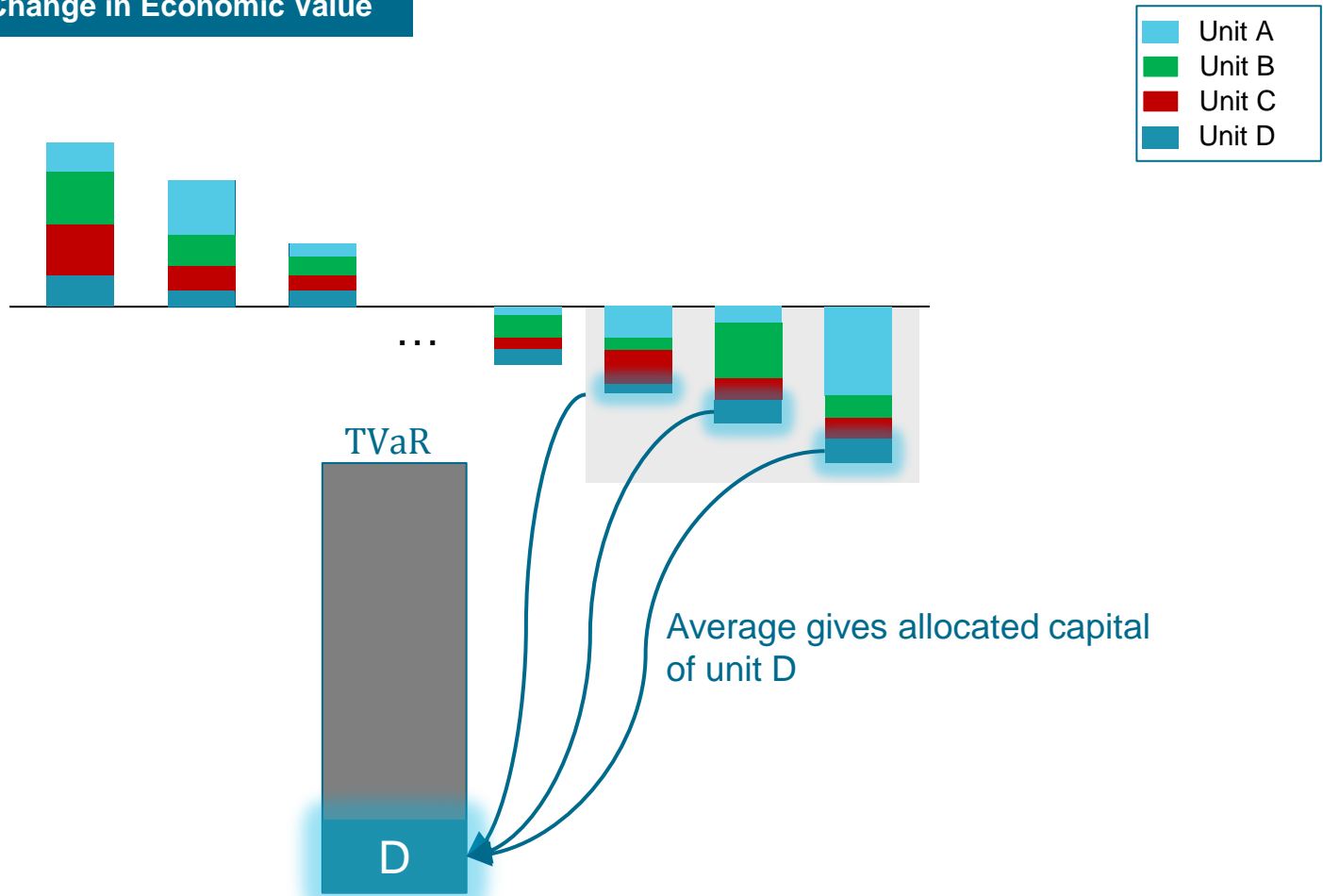
# Capital allocation using TVaR

## Contributions to Change in Economic Value



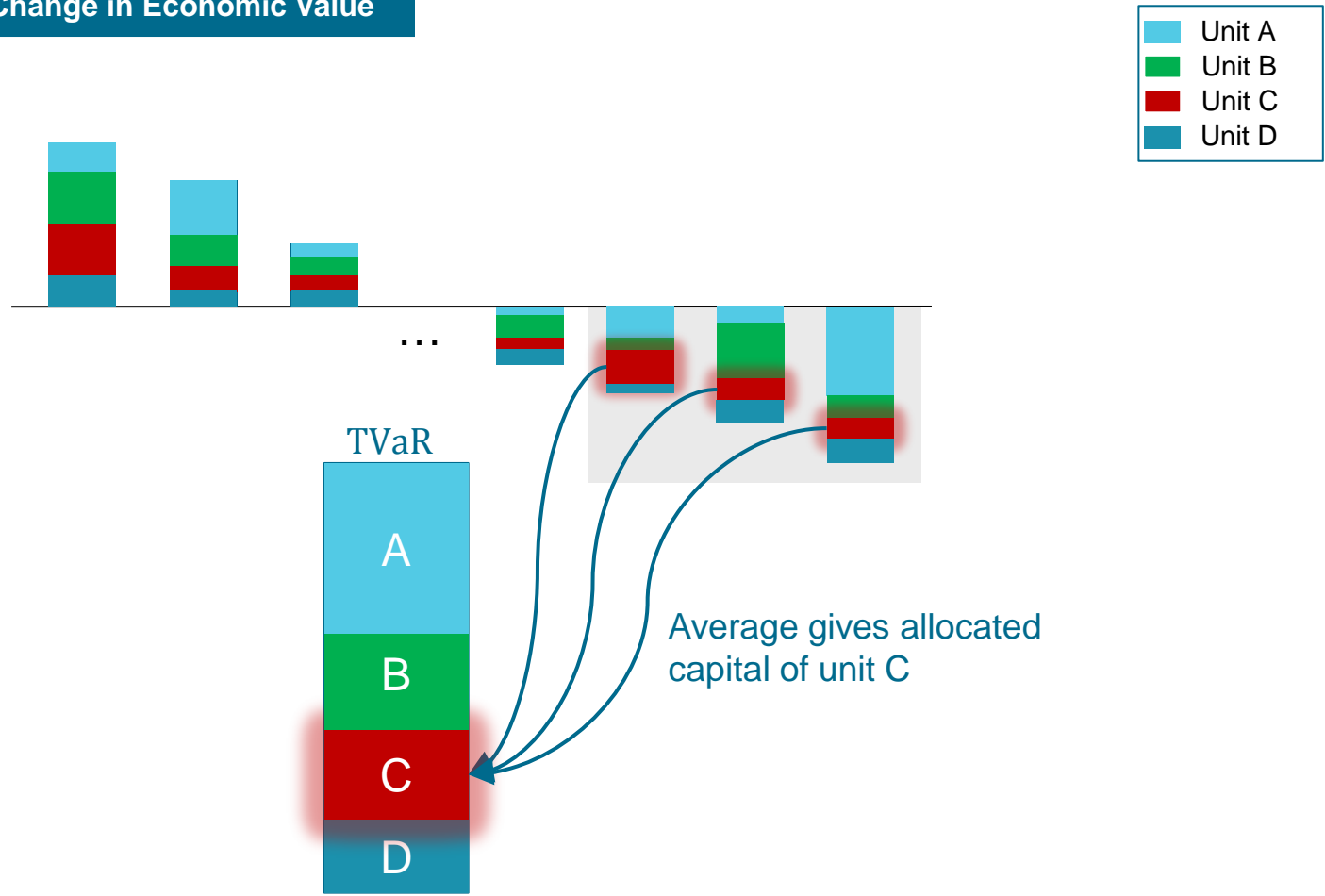
# Capital allocation using TVaR

## Contributions to Change in Economic Value



# Capital allocation using TVaR

## Contributions to Change in Economic Value



# Using capital allocation to optimize the portfolio

## Goal

**Maximize:** 
$$\text{RORAC} = \frac{\text{Expected Change in Economic Value}}{\text{SCR}}$$

## Recipe

- ❑ Allocate capital:  $\text{SCR} = \sum_i C_i$
- ❑ Compute RORAC for each business unit  $\text{RORAC}_i$
- ❑ If  $\text{RORAC}_i > \text{RORAC}$  then increase exposure to  $i$

 RORAC of portfolio will increase

## Mathematical justification: RORAC Compatibility

*Euler allocation used at SCOR has the property:*

$\text{RORAC}_i > \text{RORAC}$



Exposure to unit  $i \uparrow$



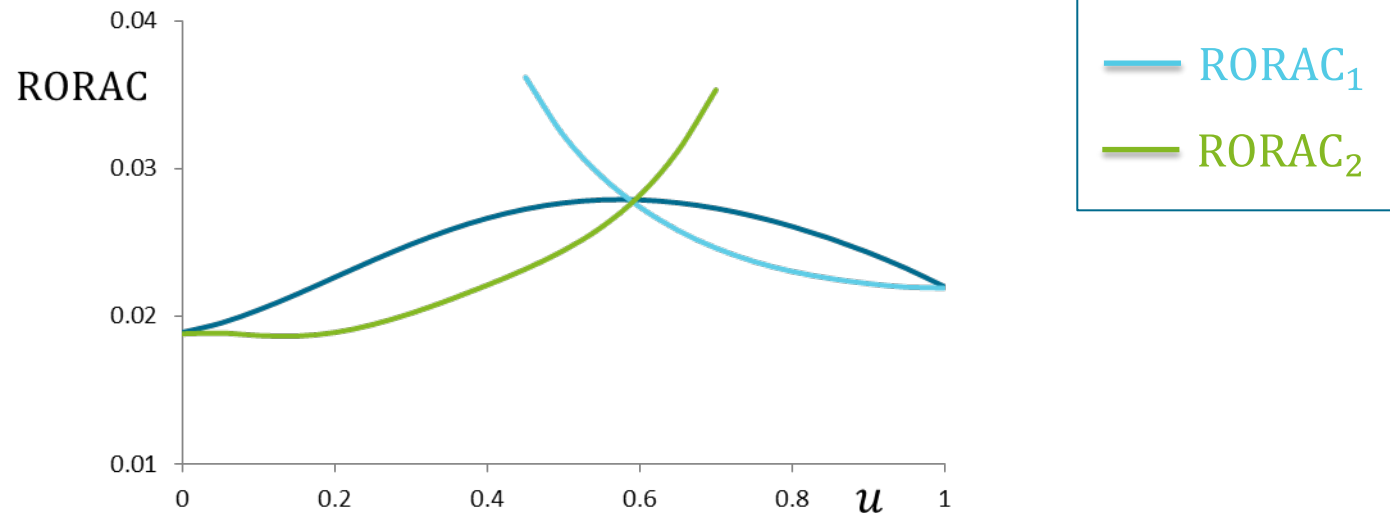
$\text{RORAC} \uparrow$

# Example of portfolio optimization and RORAC compatibility

## Example Model

- ❑  $X = u * X_1 + (1 - u) * X_2$
- ❑  $X_i$  Pareto distributed

## Result of RORAC simulation

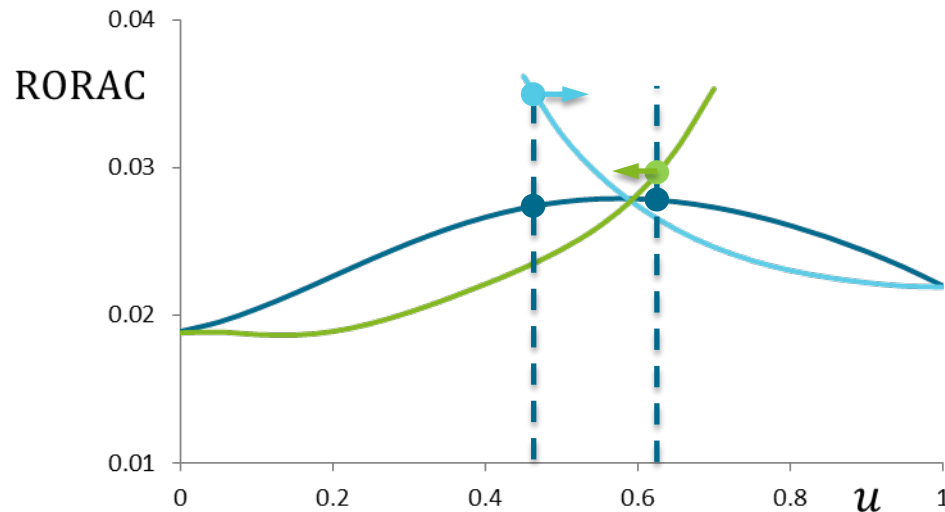


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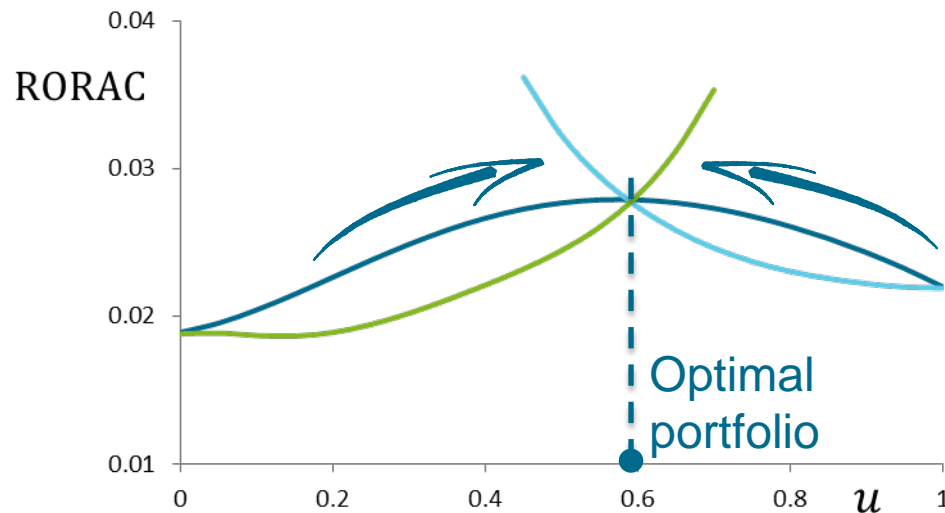


# Example of portfolio optimization and RORAC compatibility

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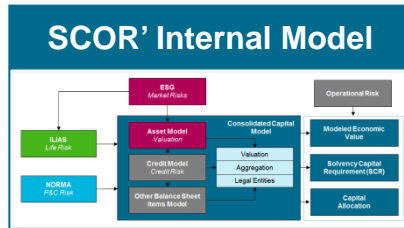


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# Applications to Solvency II



## Solvency II

### Pillar I Quantitative Requirements

- ❑ Solvency Capital Requirement (SCR)
- ❑ Minimal Capital Requirement (MCR)
- ❑ Report on GIM Results including detailed information on Internal Model outputs

### Pillar II Solvency Review

- ❑ Input for Own Risk and Solvency Assessment (ORSA)
- ❑ The ORSA requires the company to determine its solvency requirement (no SCR duplication)
- ❑ Input include the risk profile, projections of SCR to future years and ESG projections

### Pillar III Disclosure

- ❑ Input for Quantitative Reporting Templates (QRT)
- ❑ QRT are Excel templates that provide detailed information for the regulator
- ❑ The input includes for instance information on the risk margin and the SCR

*Article 120*

**Use test**

Insurance and reinsurance undertakings shall demonstrate that the internal model is widely used in and plays an important role in their system of governance, referred to in Articles 41 to 50, in particular:

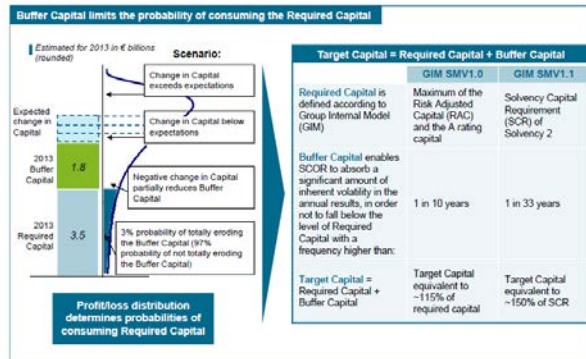
- (a) their risk-management system as laid down in Article 44 and their decision-making processes;
- (b) their economic and solvency capital assessment and allocation processes, including the assessment referred to in Article 45.



The use test requires of the internal model in the organization

# Application to risk strategy – examples from Strong Momentum v.1.1

## GIM: Capital management

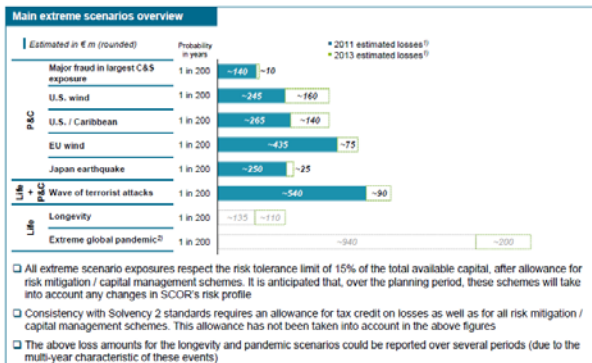


## GIM: Portfolio and scenario analysis

**Solvency Capital Requirement, SCOR Group**

€ billion (rounded)	SCOR 2010	SCOR + Transamerica Re pro-forma, 2011		Diversification Benefit
	Diversification Benefit	SCR Standalone	SCR Diversified	
SCOR Global P&C	15%	2.1	1.4	33%
SCOR Global Life	46%	2.4	1.6	31%
<b>Total</b>	<b>28%</b>	<b>4.5</b>	<b>3.0</b>	<b>32%</b>

## GIM: Risk tolerances monitoring



## GIM: Optimal deployment of shareholder capital

