



**UNIVERSITÀ
DI TRENTO**

Department of Mathematics
Laboratory of Mathematics for Biology and Medicine

INTRODUCTION TO SOLVENCY II and implications of a high interest-rate regime

May 7th, 2024

Who am I?



Roberto Bruni

Actuary (IOA)

Studio Attuariale Visintin & Associati

bruni@studio-visintin.it

www.studio-visintin.it

Specialization area

Life insurance business with a focus on

Solvency II Directive and IFRS accounting standards

CONTENT

1. Introduction to Solvency II
2. Risk classification and the Standard Formula
3. Understanding the interest rate
4. An Italian overview: Segregated Funds
5. The impact of the market rate
6. The lapse risk

THE STORYLINE

1. **Introduction to Solvency II** Presenting Solvency II and its requirement
2. **Risk classification and the Standard Formula** Understanding the Solvency Capital Requirement
3. **Understanding the interest rate** Introducing the interest rate effect on the Balance Sheet figures
4. **An Italian overview: Segregated Funds** Having a look at the Italian market
5. **The impact of the market rate** Combining all together: what are we observing in the insurance market?
6. **The lapse risk** A practical example



Introduction to Solvency II

What is Solvency II?



Solvency II is a *prudential regime* for insurance and reinsurance undertakings in the EU aimed at ensuring adequate protection of policyholders and beneficiaries



Solvency II has a risk-based approach that enables to assess the “*overall solvency*” of insurance and reinsurance undertakings through quantitative and qualitative criteria

Prudential regime

It focuses on ensuring the financial soundness and stability of insurance companies.

It establishes stringent requirements and standards aimed at safeguarding policyholders and beneficiaries by ensuring that insurers maintain adequate capital reserves to cover liabilities and unexpected losses

Overall solvency

As part of quantitative assessment, solvency measures the financial strength and stability of insurance companies.

It indicates the insurer's ability to meet its financial obligations, particularly its ability to pay claims to policyholders

In other words...



Solvency II is the **regulatory framework** introduced by the European Union to modernize and harmonize insurance regulation across member states.

It imposes **rigorous risk management and capital adequacy requirements**, shifting the focus from a rules-based approach (Solvency I) to a more risk-sensitive and forward-looking framework.



Insurers are required to assess and manage their risks taking into account various factors such as **market risk, credit risk, and underwriting risk**.



The framework also introduces sophisticated valuation methods, including **market-consistent and risk-neutral valuation principles**, to better reflect the true economic value of assets and liabilities

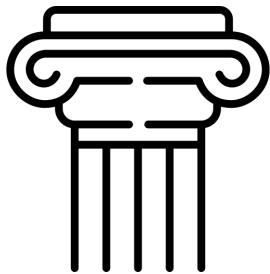
Solvency II structure



Solvency II is built upon a **three-pillar structure** collectively providing robust foundation for insurers to **assess and manage risks effectively**, **maintain adequate capital reserves**, and **enhance overall market confidence** and stability

Pillar I

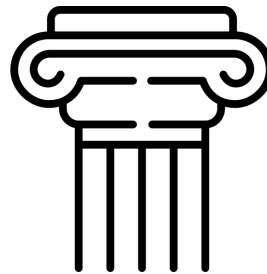
Quantitative Requirements



It focuses on the numbers, setting out specific rules for how much money insurance companies need to have to cover potential losses

Pillar II

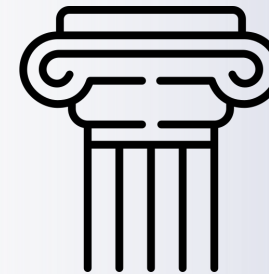
Qualitative Requirements



It focuses on how insurance companies assess and manage risks including the governance structures they have in place to oversee these processes effectively

Pillar III

Transparency and Reporting



It requires insurance companies to provide clear and comprehensive information about their financial health to regulators and the public

Solvency II structure: Pillar I



Pillar I provides the quantitative aspects of insurance regulation, focusing on the **mathematical calculations** and financial measurements that insurers need to adhere to.

Items to be valued



Fair value of assets

Market value assets



Fair value of liabilities

Technical provisions
The amount that companies would need to pay if they were to immediately transfer their obligations to another enterprise



Capital requirements

MCR, SCR

Solvency II structure: Pillar I



Pillar I provides the quantitative aspects of insurance regulation, focusing on the **mathematical calculations** and financial measurements that insurers need to adhere to.

Items to be valued



**Risks and how they
impacts on balance
sheet**



Risk classification and Standard Formula

The risk classification in Solvency II



Solvency II implements the risk classification to help insurance companies systematically **identify, analyze and manage** the diverse risks they may face and to better assess the **nature, severity, and correlations** of these risks.

Risk classification allows the assessments of the balance sheet in stressed scenarios

Repricing of assets and liabilities

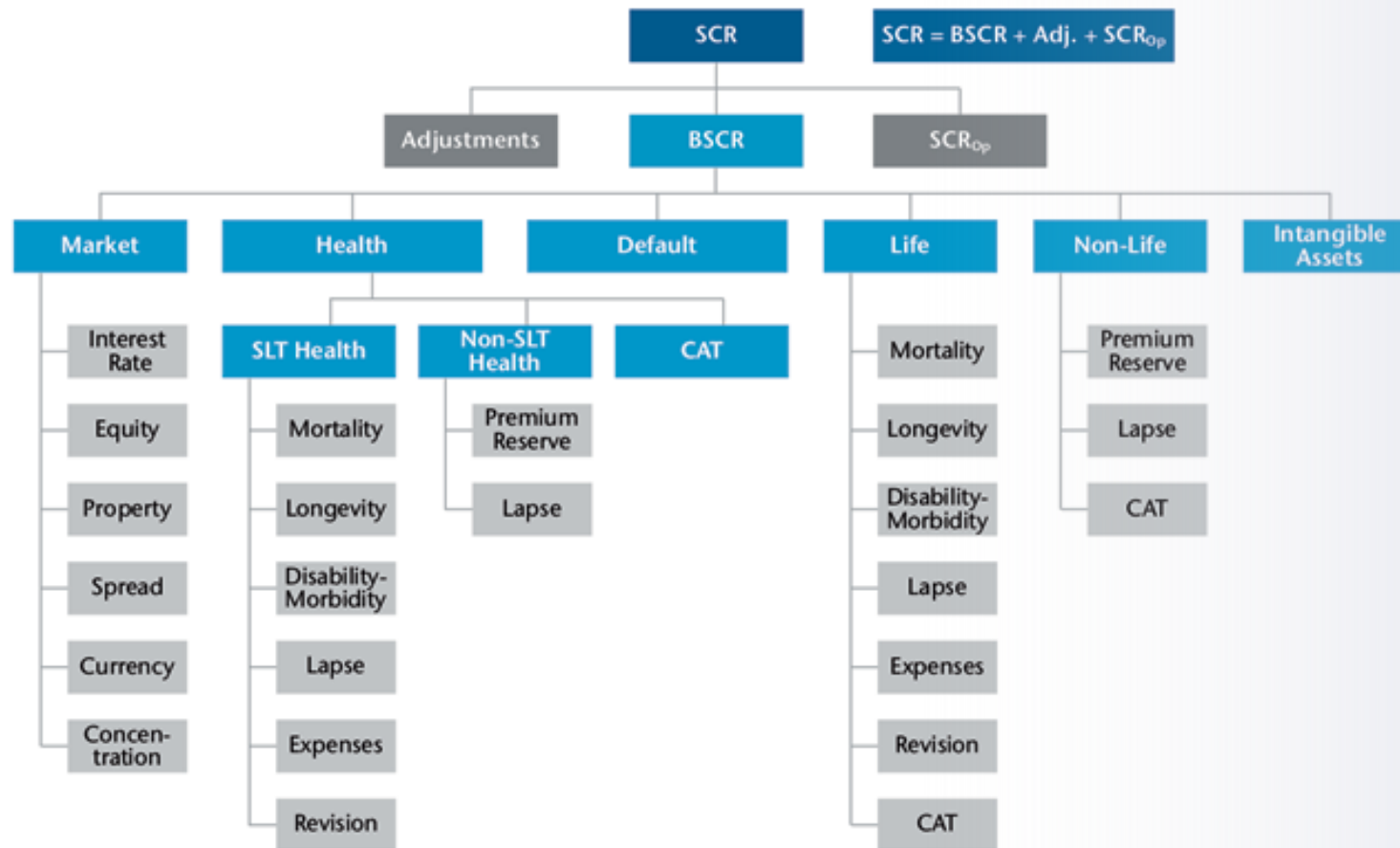
Insurers can quantify and assess the impact of each risk on their overall financial position, studying them individually before combining them in an aggregate effects.

Calculation of stressed own funds

Insurers can determine how their own funds would be affected under adverse conditions

and the Solvency Capital Requirement (**SCR**), which represents the minimum amount of capital that insurance companies must hold to ensure a **99.5% level of confidence** in their ability to withstand adverse events.

The Solvency II risk classification



The SCR and the Standard Formula



The SCR represents the minimum amount of capital that insurance companies must hold to cover potential losses **with a specified level of confidence**

Under Solvency II, the best option for computing the SCR would be to **build an internal model**, a customized risk assessment tool tailored on the specific risk profile of an insurance company that provide an accurate reflection of their risk exposures.



On the other hand, this option entails **high costs** in terms of **development** and **maintenance**.

The SCR and the Standard Formula

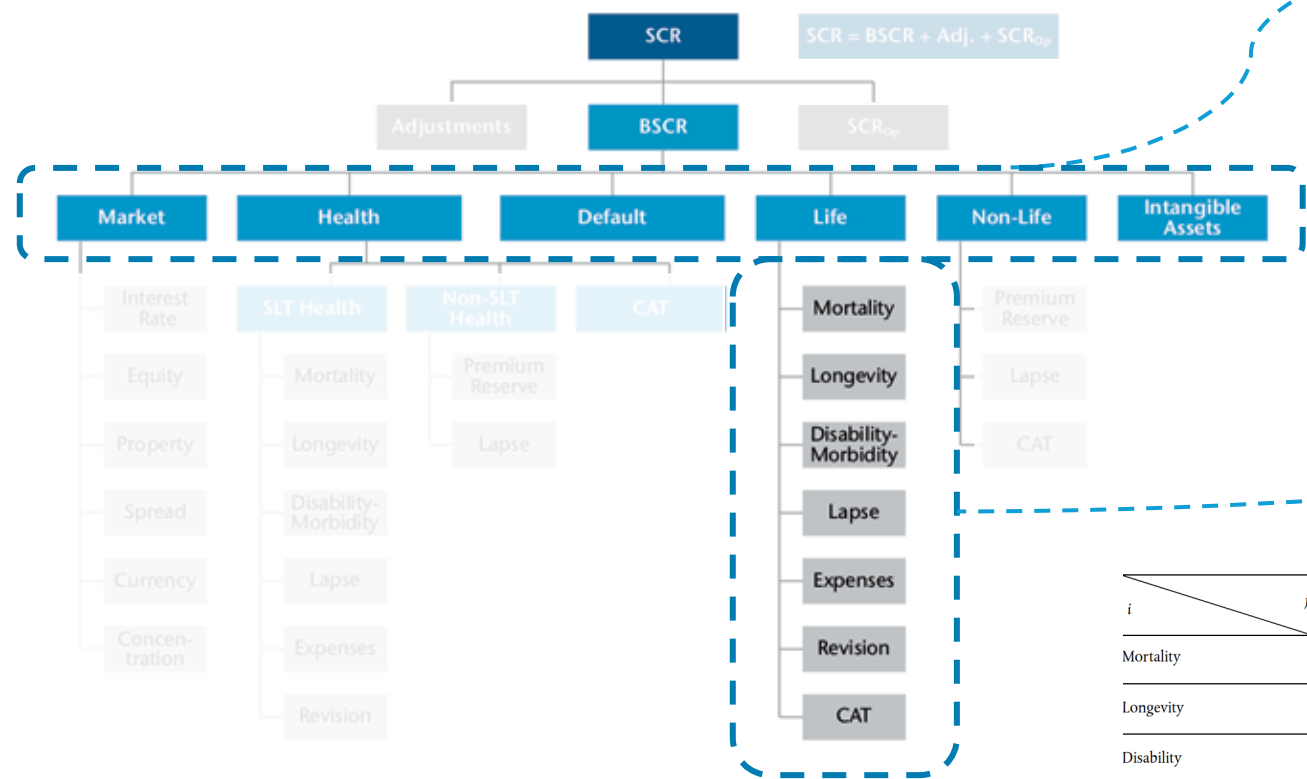
fx

To overcome those issues, Solvency II foresees a **Standard Formula** that offers a transparent and relatively straightforward method for **assessing capital requirements**, helping insurers to comply with regulatory obligations efficiently.

The Standard Formula provides a **simplified approach** that takes into account all the risk identified in the risk classification and its correlations to determine the **amount of capital that insurers need to hold**, making it easier for insurers to comply with Solvency II regulations.

$$BasicSCR = \sqrt{\sum_{i,j} Corr_{i,j} \cdot SCR_i \cdot SCR_j} + SCR_{intangibles}$$

The SCR and the Standard Formula



$$BasicSCR = \sqrt{\sum_{i,j} Corr_{i,j} \cdot SCR_i \cdot SCR_j} + SCR_{intangibles}$$

$$SCR_{life} = \sqrt{\sum_{h,k} Corr_{h,k} \cdot SCR_h \cdot SCR_k}$$

$i \backslash j$	Mortality	Longevity	Disability	Life expense	Revision	Lapse	Life catastrophe
Mortality	1	-0,25	0,25	0,25	0	0	0,25
Longevity	-0,25	1	0	0,25	0,25	0,25	0
Disability	0,25	0	1	0,5	0	0	0,25
Life expense	0,25	0,25	0,5	1	0,5	0,5	0,25
Revision	0	0,25	0	0,5	1	0	0
Lapse	0	0,25	0	0,5	0	1	0,25
Life catastrophe	0,25	0	0,25	0,25	0	0,25	1

$= Corr_{i,j}$

The SCR and the Standard Formula

$$BasicSCR = \sqrt{\sum_{i,j} Corr_{i,j} \cdot SCR_i \cdot SCR_j} + SCR_{intangibles}$$

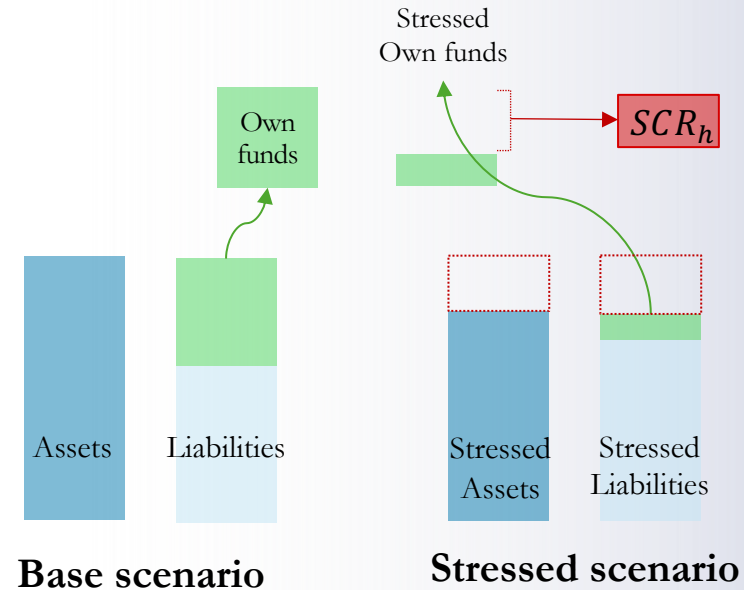
$$SCR_{life} = \sqrt{\sum_{h,k} Corr_{h,k} \cdot SCR_h \cdot SCR_k}$$

For each single risk factor, the capital requirement is equal to the **loss in basic own funds** that results from an **instantaneous shock** of some specific variables.



Own funds are computed as the difference between the market value of assets and liabilities

The loss in own funds can be determined by comparing the own funds **before and after a shock**



3

Understanding the interest rate

Why interest rates raised?



Central banks, like the European Central Bank (ECB) in the Eurozone or the Federal Reserve in the United States, **adjust interest rates to achieve macroeconomic objectives** such as price stability, full employment, and economic growth.

During the past two years, **to curb inflationary pressures** the ECB raised rates by 4.5%, from -0.5% to 4% (last on 20 Sep. 2023).

How can it help to reduce inflation pressure?



Reducing Consumer Spending

Borrowing becomes more expensive, which can lead to a decrease in consumer spending

Increasing savings

Higher interest rates also make saving more attractive. People might be more inclined to put their money in savings accounts or certificates of deposit that offer better returns. This takes money out of circulation, further reducing demand.

Interest rate in the insurer's Balance Sheet

Interest rates impact Solvency II evaluations in many ways, for example:



Asset valuation

Changes in interest rates impact directly the valuation of fixed-income securities (the main asset class in Italian insurers asset portfolio), such as bonds, since they are inversely correlated.

When interest rates rise, the **market value of existing bonds falls** and, conversely, when interest rates decline, the market value of existing bonds increases



Discount rate for Technical Provision

These risk-free rates used in discounting liabilities is **based on government bond yields**.

Changes in interest rates directly **impact the discount rates** used for valuing technical provisions, reducing the present value of future cashflows and liabilities if the interest rate rises.

The overall impact varies significantly depending on the nature of each insurance company's operations and the specific products they offer

4

An Italian overview: Segregated Funds

Products in life insurance business

Life insurance business is composed by many different kind of products:

Term Life Insurance	Whole Life Insurance	Annuities
It offers protection for a specific timeframe while, if the insured person passes away, the policy pays out a death benefit . Typically, term insurance are associated to protection goals	It provides lifelong protection . provides coverage for the entire lifetime and are typically associated also to saving goals , leveraging the fixed or participating rates	It provide a guaranteed income stream for a specified period or for life, typically purchased with a single payment
Endowment Policies	Universal Life	
Endowment policies combine life insurance coverage with a savings component , offering a lump-sum payout upon death or policy maturity, leveraging the financial returns generated by the invested premium, similarly to whole life insurance	Universal life policies, diffused in USA, provide flexibility in premium payments and death benefits, with a cash value component that accrues interest based on market performance.	

And many others...

Italian's Segregated Funds

In Italy, the **prevalent form** of life insurance product are **Endowment Policies** linked to “Gestioni Separate”, also known as Segregated Funds, a portfolio of assets underlying those contracts, with some specific guidelines regarding **profit sharing** and a low-risk profile.



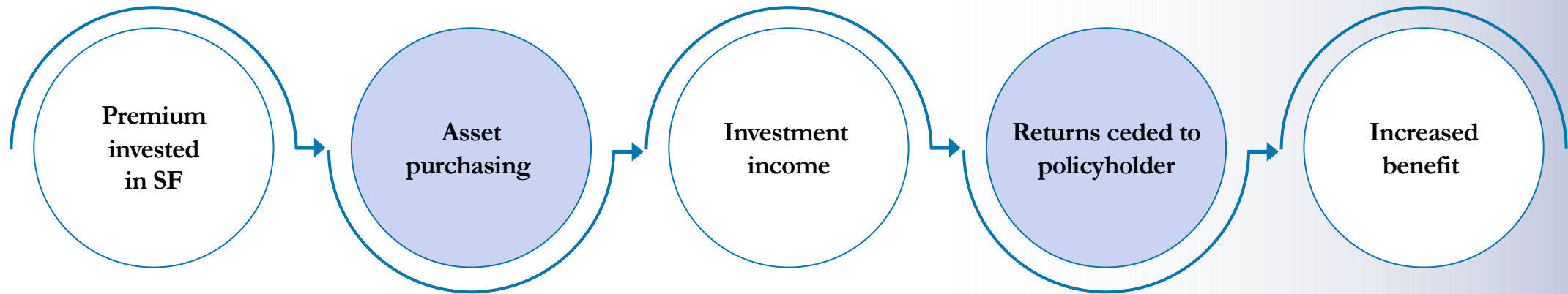
Segregated Funds are managed and maintained by insurance companies.

The term "segregated" highlights the distinct separation between these funds and the insurer's patrimony, which is crucial for safeguarding policyholders' interests by ensuring that the assets within the segregated funds are dedicated solely to fulfilling the obligations associated with the insurance policies.

Investing in segregated funds involves contributing a **single premium** or a series of **fixed premiums** utilized by the insurer to purchase various assets, with the goal of **generating financial returns**. These returns are then ceded to policyholder based on the product features (and subsequently paid to the policyholder, for example, upon **death or maturity**)

Segregated Funds' profit sharing

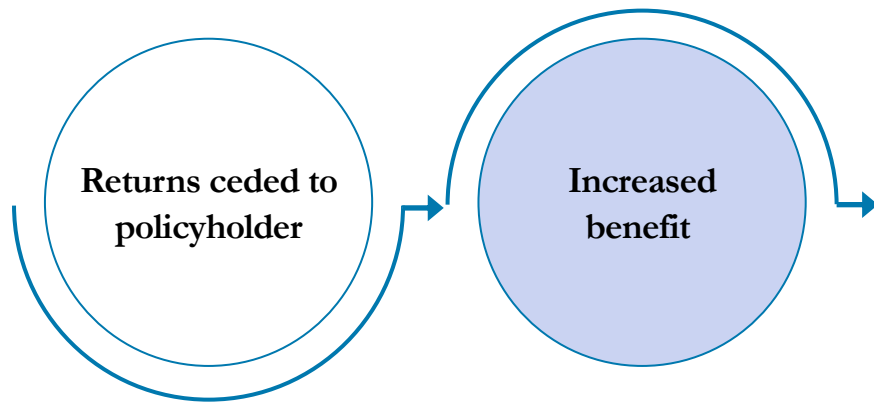
The assets within the portfolio generate income through coupon payments, dividends, and trading activities (in the SF, asset returns are valued at cost)



Considering the low-risk profile of the segregated funds, insurer tend to purchase low-risk assets, such as investment grade bonds

Some of the income is transferred to policyholder increasing its mathematical reserve

Segregated Funds' profit sharing



Asset portfolio composition

High-yield bonds and stocks purchased during **economic booms**, such as the period from 2008 to 2012

Low-yield bonds and stocks purchased during **economic downturns**, such as the period from 2016 to 2020.

The overall return of the portfolio will be an average of the returns experienced during both economic booms and downturns



As an average of different economic cycles, the return of segregated funds will tend to be **lower than market rates** during economic booms or high-interest rate periods, such as the actual one, and **higher** during economic downturns

3,8% - 4th May 2024 - Italy 10-Year Gov Bond

2,7% - Average SF's return in 2023 (Ania)

1,5% - 1st January 2016 - Italy 10-Year Gov Bond

Segregated Funds' options and guarantees

A variety of products are linked to Segregated Funds, providing policyholders with a range of **options and guarantees** to choose from

Options	Guarantees
Lapse Most of life insurance products give to the policyholder the option to unilaterally terminate the contract before its natural term	Principal protection guarantee It ensures that the policyholder will receive at least the original amount invested (the principal) upon maturity or death
Paid up It's the policyholder's option to unilaterally stop the payment of premiums	Minimum guaranteed return Insurers may guarantee a minimum rate of return on the investment, regardless of the performance of the underlying assets
Additional premiums It's the policyholder's option to pay additional premiums on a voluntary basis during policy's lifetime	Guaranteed lock-in or cliquet: lock in investment gains periodically or at specific intervals, protecting them from market downturns and ensuring that the accrued gains are preserved
Annuity conversion It's the policyholder's option to receive part or the total amount of the accrued capital through annuity installments at maturity	Guaranteed minimum death benefit It ensures that the policyholder's beneficiaries will receive a minimum death benefit
Automatic deferral at maturity It's the policyholder's option to extend the maturity of the contract beyond its natural duration	Surrender value guarantee This guarantees a minimum amount receivable if the policyholder surrenders the policy before maturity
Switch The policyholder has the option to switch between different funds (if any), such as those with higher risk aiming for higher returns	

5

The impact of the market rate

The policyholder behavior



The purpose of segregated funds is to safeguard policyholders' investments by delivering **consistent returns over time** and offering **sufficient coverage guarantees**



In periods of **significant market outperformance** compared to the segregated fund's performance, policyholders may be tempted to **lapse their contracts** in favor of more remunerative investment instruments with similar risk profiles



This behavior, also known as **dynamic policyholders' behavior**, is influenced by the fact that capital invested in segregated funds typically carries an annual minimum guaranteed rate of 0% or a surrender value guarantee.

This guarantees ensures that policyholders will receive a **refund of their invested capital**, mitigating their risk of incurring in significant losses and allowing them to reinvest in some **more lucrative forms of investment**.

The asset and the liability evaluation

But what occurs from the insurer's perspective?

Asset valuation



When **interest rates rise**, the **market value of existing bonds falls**

If policyholders lapse, insurers may be compelled to **sell assets** to fulfill benefit payments with a realization of capital losses. This affects the insurer's **profit and loss statement** and its solvency through a reduction in own funds



Liability valuation

Insurers are required to ensure that the liabilities owed to policyholders **do not fall below the guaranteed value**, notwithstanding of any declines in the market value of the funds

When using a **risk-neutral approach**, we assume the expected return on assets equals the discount rate. In this case, the overall effect on the liabilities is driven by different factors, such as the specific features of the contracts and the insurer's management actions

6

The lapse risk

Lapse risk sub-module

Solvency II defines the **lapse risk** as the **risk of loss**, or of adverse change in the value of insurance liabilities, **resulting from changes** in the level or volatility of the **rates of policy lapses**, terminations, renewals and surrenders

The capital requirement calculation approach for lapse risk (SCR_{lapse}) states that it shall be equal to the largest of the following capital requirement:



a capital requirement for the risk of a **permanent increase** in lapse rate



a capital requirement for the risk of a **permanent decrease** in lapse rate



the capital requirement for **mass lapse risk**

Mass lapse risk

The capital requirement for **mass lapse risk** shall be equal to the **loss in basic own funds** [...] that would result from [...] **the discontinuance of 40% of the insurance policies**

What does it mean for insurers?



High interest rate scenario ⇒ Low market value asset ⇒ Guaranteed liabilities



Mass lapse event ⇒ Utilization of own funds for benefit payments and realization of losses

Does the company possess adequate own funds to refund policyholders?



The lapse risk

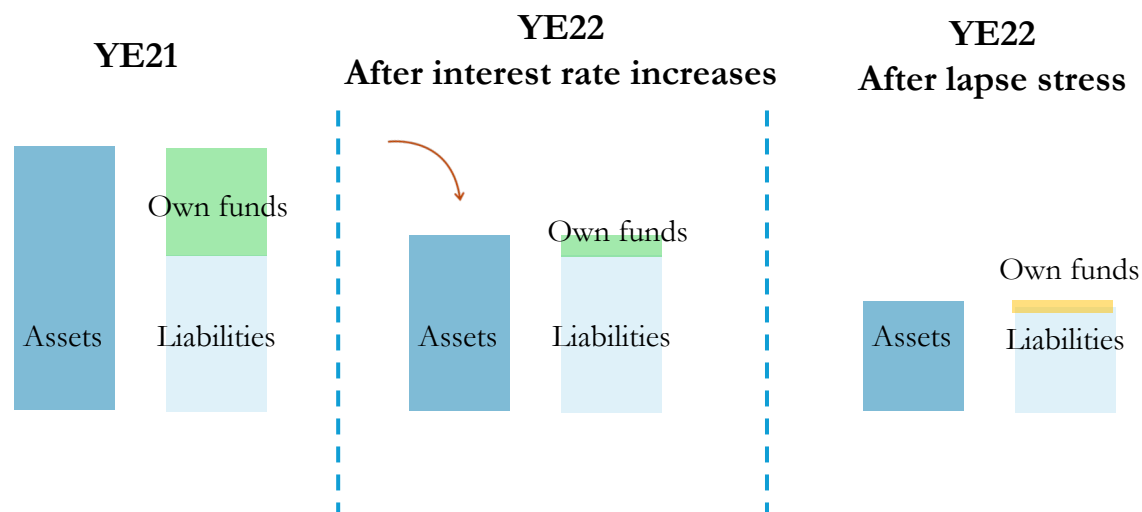
A practical example

Understanding Eurovita's case

In late 2022 and early 2023, central banks, due to various factors including the post-pandemic economic recovery and geopolitical tensions such as the war in Ukraine, **initiated interest rate increases**. This policy adjustment aimed to **address rising inflationary pressures** by making borrowing more costly, thereby moderating consumer spending.

The several interest rate hikes had a direct impact on the market valuation of government bonds (the principal investment asset class for insurance companies), significantly depreciating their worth.

On the other hand, due to options, guarantees and the participation features, the **liabilities remain relatively stable**, leading to a substantial decline in own funds.



Even in this challenging economic time, insurance companies had to **reevaluate their solvency capital requirement** stressing their balance sheet (in an “already stressed” scenario), worsening their financial situation which (in an exceptional situations) could cause the insurer to **fall below solvency requirements**, and, as stated in the Directive, leads to the Extraordinary Administration.

How could it have been prevented?

Despite the volatility of macro-economic factors, insurers have a variety of strategies at their disposal to mitigate the risk of crisis:



Strong risk management

Implementing robust risk management practices helps to identify and mitigate potential risks. Moreover, implementing an internal model may lead to comprehensively assess the company's most critical risks, achieving a more accurate determination of the solvency capital requirement



Strategic planning and stress testing

Developing and executing a clear strategic plan that aligns with market dynamics, regulatory changes, and customer needs, while also considering long-term sustainability

... and many others!



Thanks for your attention!