NEOMA BUSINESS SCHOOL

***Preliminary Work***

# How to overcome the challenge of volatile interest rates environment in the insurance industry?

**Msc Finance & Big Data**

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## - Why this subject?

Since 2008 European and American economies have been experiencing a sharp fall in interest rates. Central Banks decided to carry out quantitative easing to avoid a deflationary spiral. Due to the Covid-19 pandemic crisis rates are now close to zero, or even negative depending on the country and duration, the negative interest rates are one of the pure creations of central banks and monetary authorities. One of the main goals is to demonstrate that monetary policy has no limits, and its presence in the financial sector is important for savers and investors. Due to their invention governments can now borrow money at will without increasing budget deficits.

This crisis pushed Central Banks to unveil new huge asset purchasing programs. Such an environment worsens the mismatch between the asset side's duration and the liability side's duration which is not sustainable under Solvency II regulation. In addition, Life & Health contracts are specific contracts where the insurer promises to pay a pre-established amount of capital in exchange for the payment of a single or periodic premium from the client. In this unseen environment, insurances are struggling to pay guaranteed rates as they are much higher than the yields at which they could reinvest their coupons today.

Our objective is to explain the causes and consequences of the low/negative interest rates environment and to provide solutions for the insurance industry to face this context. We will highlight the main explanations of the current environment without considering Central Banks as the only cause.

## - Plan proposal

I) Introduction

II) Macroeconomic overview
   a. Why interest rates are low?
   b. Is low-interest-rate bad for the overall economy?
   c. The current outlook
   d. Regulatory framework

III) The insurance industry
   a. The impact on the insurance industry

# I) Introduction :

For several years, European and American economies have been experiencing a sharp fall in interest rates. This process began in 2008, with a reduction in the key interest rates of the Federal Reserve and the European Central Banks. Rates are now close to zero, or even negative depending on the country and duration. In the Euro area, this factor, combined with a lack of inflation, raises fears of liquidity and a deflationary trap scenario as observed in Japan in the 1990s. At the beginning of 2015, the ECB decided to carry out quantitative easing to avoid this type of deflationary spiral. It is an ambitious program of securities purchases to flood European financial institutions with liquidity and support economic growth. By acting downwards on rates, the ECB wants to boost investment and private demand and thus bring inflation back towards its historical target of 2%. Two years ago, the Covid-19 pandemic crisis has pushed Central Banks to unveil new huge asset purchasing programs. The huge amount of liquidity and the increasing demand for safe havens due to the uncertainty pushed rates even lower.

Such an environment worsens the mismatch between the asset side's duration and the liability side's duration which is not sustainable under Solvency II regulation. In addition, Life & Health contracts are specific contracts where the insurer promises to pay a pre-established amount of capital in exchange of the payment of a single or periodic premium from the client. In this environment, insurances are struggling to pay guaranteed rates as they are much higher than the yields at which they could reinvest their coupons.

Today Central Banks want to reduce the purchase program in order to control the inflation that exceeds their targets, through a new program under the name of "Tapering" which refers to policies that involve the slowing of asset purchases. The new environment makes also suffer the insurances because their P&L decreases day after day with this environment of rates increase.

Our paper is split into two main parts. In the first one we analyze the causes and consequences of the decrease and current increase of interest rates, investigate the constraints of the insurance industry and explain the consequences of the current

environment on it. In the second and last part, we provide solutions and use quantitative analysis to assess whether an insurance company should adopt one or another suggested strategy.

# II) Macroeconomic overview :

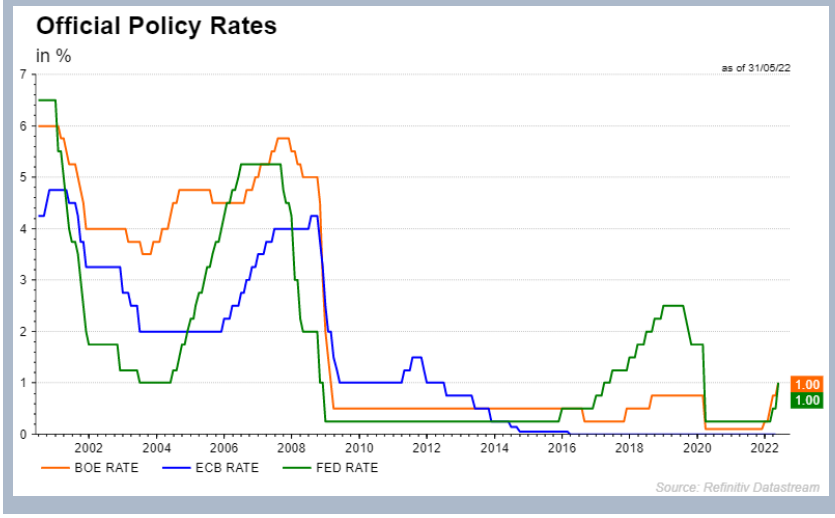
## a. Why interest rates are low?

### i. Monetary policy history:

A few months ago, our economy was characterized by an exceptionally low/negative interest rates environment (*Graphic 1*). The Covid-19 crisis has severely impacted the global economy leading Central Banks to cut interest rates further. As a reminder, the main role of Central Banks is to steer the monetary policy into an area or region. They also provide and issue money (fiat money) to the economy, supervise the functioning of financial markets and play the role of "lender of last resort" in case of systemic crisis as what happened during the last pandemic crisis. In this thesis, we focus on the European Central Banks.

Let us make a quick historic overview of what happened. In September 2008, the well-known investment bank, Lehman Brothers goes bankrupt during the "subprime crisis" from which the recovery has been slow. Later, the 8th of October, the Eurosystem takes the decision to finance banks as much as they want at a fixed rate. Central Banks reacted to the crisis by reducing the key interest rates at which commercial banks borrow and finance themselves.

*Graphic 1 : Official Policy Rates*




Main Central Banks around the world reacted to the 2008 financial crisis by firmly lowering their refinancing interest rate.

This is what we call, "conventional policy". For instance, the European Central Banks (ECB) controls the short-term interest rates so that it impacts the interbank rate and stimulates the economy through credit. The ECB intervenes through 3 key interest rates:

- The Main-Refinancing-Operation rate (MRO) – **0%**, at which financial institutions are refinancing themselves over one week.

- The Deposit-Facility rate – **-0.5%**, which banks may use to make overnight deposits with the Eurosystem.

- The Marginal-Lending-Facility rate (short term) – **0.25%**, the rate which offers overnight credit to banks from the Eurosystem.

The ECB lowered its Main-Refinancing-Operation rate so that commercial banks can borrow at (almost) no cost. By imposing negative interest rates for deposits, central banks are seeking to make savings unattractive and borrowings cheap. The objective is thus to relaunch the economy by providing cheap money into the economy.

In November 2008, the Federal Reserve started its first assets purchasing program. As interest rates were already low, Central Banks started to use other "unconventional policies" in order to improve the financing conditions of the economy. Unconventional measures can take different forms such as:

- Negative interest rate and "forward guidance". This last is a tool used to influence economic agents and market expectations.
- Long term financing. Notably, in 2012, the ECB started its very long-term refinancing operations (VLTROs) with a maturity of three years.
- Quantitative easing, especially the asset purchasing program on the secondary market. In 2012, we remember the well-known sentence of Mario Draghi "Whatever it takes" announcing an unlimited asset purchasing program in order to save the Euro amid the European debt crisis. The Quantitative Easing starts in 2014-2015 with the purchases of govies on the secondary market (APP).

## ii. Quantitative Easing

Quantitative easing (QE) is a form of massive intervention of Central Banks directly in financial markets by buying assets from banks.
Decided by the Governing Council in Europe and amended several times, the European QE consists, of the Central Banks of the countries of the eurozone, buying assets on the secondary market. The purchased assets are mainly government bonds (govies) issued in the Euro area. As the ECB agreed to not finance European states directly, the govies are only purchased on the secondary market and not on the primary market where governments issue their debt. This agreement of not using what we call the "helicopter money" must be reconsidered today, we will come back to this in the next lines. The ECB also buys other assets such as corporate bonds that can be bought directly on the primary market.

By buying securities from banks on a massive scale, Central Banks increase circulating liquidity and lower interest rates, thus indirectly acting against the risk of deflation and slower growth. Central authorities cannot by themselves ensure the recovery of the economy, but they participate in it through the transmission mechanisms of monetary policy such as:

- **Portfolio effects** for banks. As safe assets have low/negative yields, banks and other financial institutions go toward more profitable assets (for example corporate European bonds or other corporate bonds in local or hard currency) and finance directly the real economy.

- **Direct effects** of lower borrowing rates. Increasing demand for securities involves raising their prices and puts downward pressure on interest rates because of the opposite relation between bonds' prices and yields. This stimulates credit to businesses and households and lowers the risk of deflation. By deflation, we mean a situation where the general price level of goods and services decreased and is lower than 0% for some time.

- There are also **signal effects**, which allow monetary policy to have an impact even before it is actually implemented, through a simple announcement effect (this is the purpose of the forward guidance).

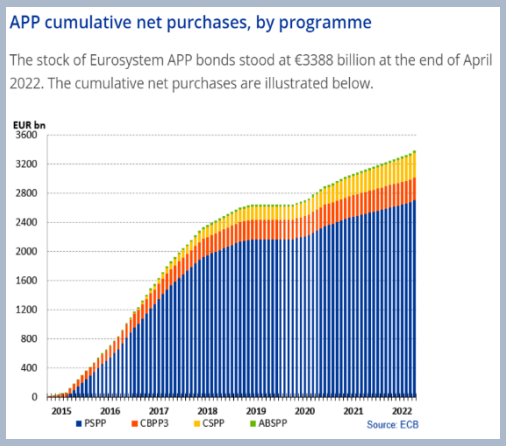
- Another important effect, even if this is not an initial objective, **the currency effects**. Lower interest rates make investors unwilling to invest their liquidity in a country as it is more profitable elsewhere, leading to a devaluation of the domestic currency (lower demand) and so an increase in exportations.

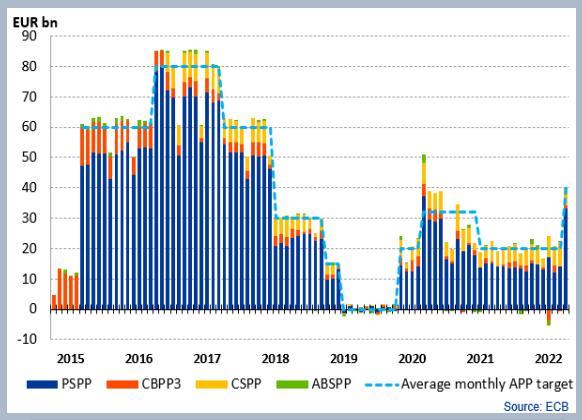
## iii. The first quantitative easing

In the Euro area, the first massive quantitative program implemented was the APP (Asset Purchasing Program) in 2014, which was initiated to support the current monetary policy transmission mechanism and ensure price stability. There are four programs within the APP: the corporate program (CSPP), the public sector program (PSPP), the asset-backed program (ABSPP), and the covered bond program (CBPP3). The public sector program remains the highest program with 2,558,848[1] EUR as of the end of April 2022 (see below Graphics).

[1]See more on:
https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html

*Graphic 2 : APP*




The APP has been restarted end of 2019 with a monthly pace of 20 EUR bn and more during

More recently, in March 2020, during the Covid-19 crisis, the ECB started a new program called the PEPP (pandemic emergency purchasing program). This is a so-called "unconventional" monetary measure. The program was firstly set at 750 EUR bn in March 2020. In June 2020, the Governing Council decided to increase the envelope to 1,350 EUR bn (an additional 600 EUR bn). Later in December, the envelope has been increased to 1,850 EUR bn (+500 EUR bn). The current pandemic program has been extended to March 2022 until "significant progress" were made. All the assets included APP is also eligible in the PEPP, plus the assets issued by the Greek government. The residual maturity allowed in the program ranges from 70 days to a maximum of 30 years and 364 days.

## b. Is low-interest-rate bad for the overall economy?

Borrowing money and being paid for borrowing it, is not a dream? Well, the question is not that easy to answer. Low, even negative, interest rates mean that money is cheap and so that economic agents can easily borrow money and invest. However, since economic agents are trapped in what Keynesians call a "liquidity trap", the current low/negative environment does not provide the desired effect. Because the current "conventional policies" do not work, Central Banks have to change their methods and use other "non-conventional methods" such as quantitative easing. With the Covid-19 crisis, governments have drastically increased their debt issuances to finance their budget deficit that has increased due to huge budgetary programs. As a consequence, Central Banks have launched massive purchase programs, such as the PEPP in Europe, to support the economy during the crisis.

Should we be concerned about the huge amount of debt held by the ECB? This is one of the most asked questions. Should we cancel the European debt? The question has been investigated by several economists and politicians. One of the main economists that have been working on this topic is Patrick Arthus from Natixis. According to him, the government is actually doing what we call "helicopter money" when doing quantitative easing. As a reminder, quantitative easing is a situation where the Central Banks buy public debt by creating money. Helicopter Money is simply the addition of a fiscal deficit and quantitative easing. When the government makes a public transfer to households or companies (for instance the $1.9bns stimulus package from Biden), finances it by issuing public debt, and this public debt is bought by the Central Banks against monetary creation. In this particular situation, everything happens as if the Central Banks gave the newly created money to economic agents who receive public transfers. In the Covid-19 crisis, there was therefore helicopter money. However, it is up to the government to decide the nature of public transfers, not the Central Banks.

We often worry about this very high level of public debt, especially after the Covid crisis. However, the only public debt that matters is the public debt not held by the Central Banks. Indeed, Central Banks belong to governments. Like shareholders, the Central Bank returns its profits to governments. Because the Central Banks hold the govies, governments have to pay interest on it. However, those interest rates are in-fine given back to governments as a form of a dividend. Therefore, we should not be worried about the increasing amount of debt held by Central Banks, we must look at the consolidated balance sheet of the government and the Central Banks.

So far, we have seen that the current massive quantitate easing should not be a major issue especially when the debt is held by the central bank. One point that we investigate now is the impact of low-interest rates and nonconventional policies on financial assets. What is the direct effect of the current low/negative interest rates environment on equity valuation?

Investors and economists see lower interest rates as a growth driver, which allows companies to finance their operations and expansions at a more attractive rate. This increases their future earnings growth potential, which leads to a rise in stock prices. Some sectors that offer high dividends such as real estate, telecommunications ... are considered more sensitive to interest rates, if interest rates fall the stocks in that sector will rise and vice versa.

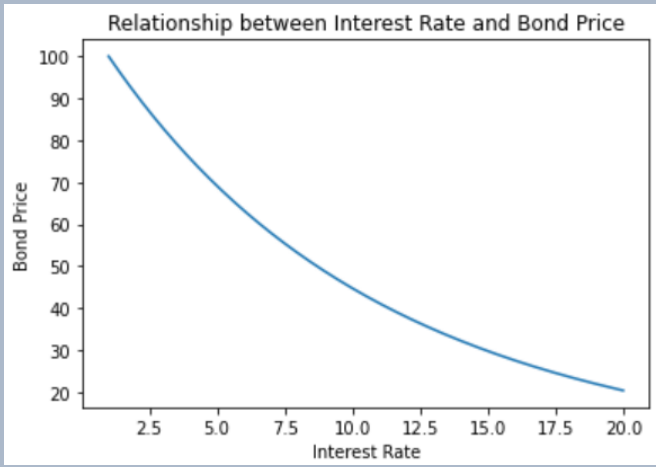
If we take a look at the value of a fixed income asset (bond), lower interest rates mean lower yields on markets and higher prices. This negative relationship can be explained by the formula of bond price:

$$P = \sum_{t=1}^{T} \frac{Ct}{(1+r)^t} + \frac{ParValue}{(1+r)^T}$$

Since the yield is in the denominator the relationship between yield and price is anticorrelated when the rate decreases the price increase

Let us confirm this relationship with our dear friend, Python, that will follow us through this paper. We simulate the price of bond with different annual returns and we generate the following graphic:

*Graphic 3 : Relation between Interest Rate and Bond Price*




We assumed a principal of 100 a coupon of 1% and 10 years to maturity, we then have varied the annual interest rate from 1% to 20% and we plotted the graphic in the left.
we can clearly see the negative relationship between the price of the bond and the rate.

We were able to understand in a simple way the relationship between interest rates and financial markets. Before going any further, we need to understand the challenges of insurers, one of the most important is regulation.

## c. The current outlook

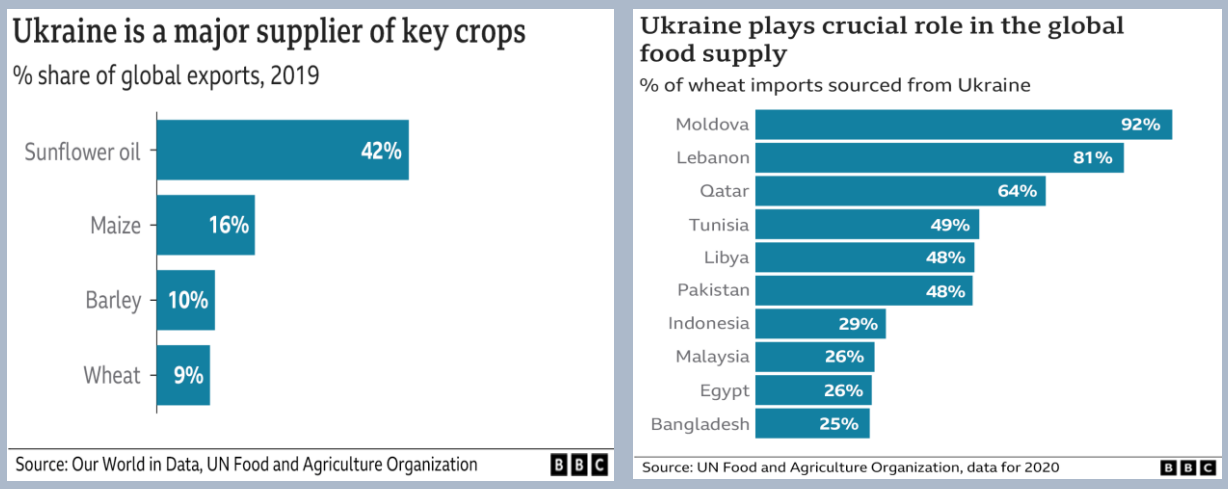
From the 2010s until 2022 the interest rates were very low, and this environment has been conducive to asset price bubbles (equities, real estate, corporate value, but also cryptocurrencies and metaverse assets, etc. ). Europe faced the pandemic of COVID-19 with the programs mentioned in the previous sections. Now it faces two challenges:

- controlling inflation
- reducing the budgetary support

The rise in inflation is largely due to factors that are likely to fade over time. One of them that we noticed at the end of 2020 and 2021 is supply chain disruptions and resulting bottlenecks are putting pressure on durable goods prices, especially as demand has quickly picked up, like the war against Covid-19, the war in Ukraine has only made things worse by generating both a demand shock and a supply shock.

- The demand shock comes mainly from consumer and investor responses to the sharp rise in uncertainty. Household consumption is in continuous decrease in favor of savings. Investment is also falling, and companies are taking a cautious, wait-and-see attitude, except in defense-related sectors. The European stock market reflects this since the beginning of the conflict. Net demand from abroad could also deteriorate. On the export side, the deterioration is driven by the same logic as the decline in domestic demand. On the import side, rising prices for energy, minerals, and certain agricultural products will greatly increase the bill.
- In the same logic the supply shock comes essentially from the rising in energy costs, oil has already risen by more than 20% since the beginning of the war, compared to a 40% rise in the price of natural gas. Brent crude jumped from $91 to $113. The same is true for a many other commodities, especially metals for which Russia is a major producer, such as Palladium, Platinum, and Gold, which are essential for the automotive, tech, and aerospace industries. On the other side Ukraine is a major agricultural exporter and 42% of its global exports are sunflower oil which passes through the Black Sea. The supply chains will undergo new disorganizations that generate higher production costs.

*Graphic 4 : Ukraine Agricultural Supply*




Since December 2021, the ECB has been impressed by the dynamics of inflation, which accelerated due to the war in Ukraine. In May, it reached 8.1% year-on-year, with 14 countries (out of the 19 in the eurozone) above this average. This is the first time that this has happened since the introduction of the single currency and is four times higher than the ECB's target of 2%.

The ECB significantly raised its inflation forecasts until 2024. The institution now expects inflation to reach 6.8% in 2022, which should then slow down to 3.5% in 2023, but remain, at 2.1%, above the 2% target, even in 2024. However, "if the medium-term inflation outlook persists or deteriorates," a larger rate increase, above 25 points, "will be appropriate at the September meeting," the ECB warns.

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For several weeks now, the institution's "hawks", advocates of greater monetary rigor, have been arguing for increases of 50 basis points.
Other central banks facing high inflation, such as the U.S. Federal Reserve and the Bank of England, have already begun a rate hike cycle.

The ECB has locked itself into a very gradual monetary tightening schedule and to deviate from it now would damage its credibility. Thus, the institution confirmed on that it would end its net asset purchases "on 1st of July 2022", a prerequisite before starting to raise rates.
Along with negative key interest rates, these programs spearheaded the ECB's efforts to fight deflation, allowing it to buy bonds on the market in droves to lower financing costs and get the economy moving again. The colossal amount of some €5 trillion in bonds has been bought by the ECB since 2015. In the face of runaway inflation, this support is no longer necessary.
The exit from the negative interest rate policy started in 2014, which has caused floods of criticism in Germany in particular, is tricky. This policy means that banks are taxed - by -0.5% to date - on their deposits entrusted to central banks for lack of distributing them via loans.

The ECB must be careful not to break European growth, which is already seriously shaken by the consequences of the war in Ukraine. The institution has thus lowered, Thursday, its annual growth forecasts: the increase in the gross domestic product (GDP) should be limited to 2.8% in 2022 in the euro area, before 2.1% in 2023, against respectively 3.7% and 2.8% in the last forecasts, in March.

The ECB must also be careful that a rate hike does not lead to fragmentation in the eurozone sovereign debt market, i.e. that European governments do not borrow at too different levels.

# d. The regulatory part

## i. What is insurance?

Insurance means life and health insurance (L&H) as well as property and casualty (P&C). In this paper, we focus on the first one, L&H, which represents the biggest asset under management in an insurance company. Life insurance is an agreement between the insurer and the policyholder. A life insurance policy guarantees that in the event of the death of the insured, the insurer will pay a sum to the named beneficiary in exchange for the premiums paid by the policyholder over their lifetime. In Europe, the offer of any insurance company is composed schematically of two main contracts: contracts in euros and unit-linked contracts. For contracts in euros, the investment risk is borne by the insurance companies.

The insurer chooses the asset allocation. However, the insurer must satisfy an annual remuneration that is sufficiently attractive compared to the returns offered by other insurance companies but also compared to the returns offered by other financial investments. Also, this asset allocation must provide a return that meet the guarantees offered by contracts in euros. Depending on the European countries, this can be a capital guarantee, for instance in France, or even a guaranteed annual return, as often in Germany and Switzerland.
When deciding its assets allocation an insurer has to comply with different rules and regulations such as IFRS rules (accounting rules) or Solvency II, which represents the main regulation in the insurance industry.

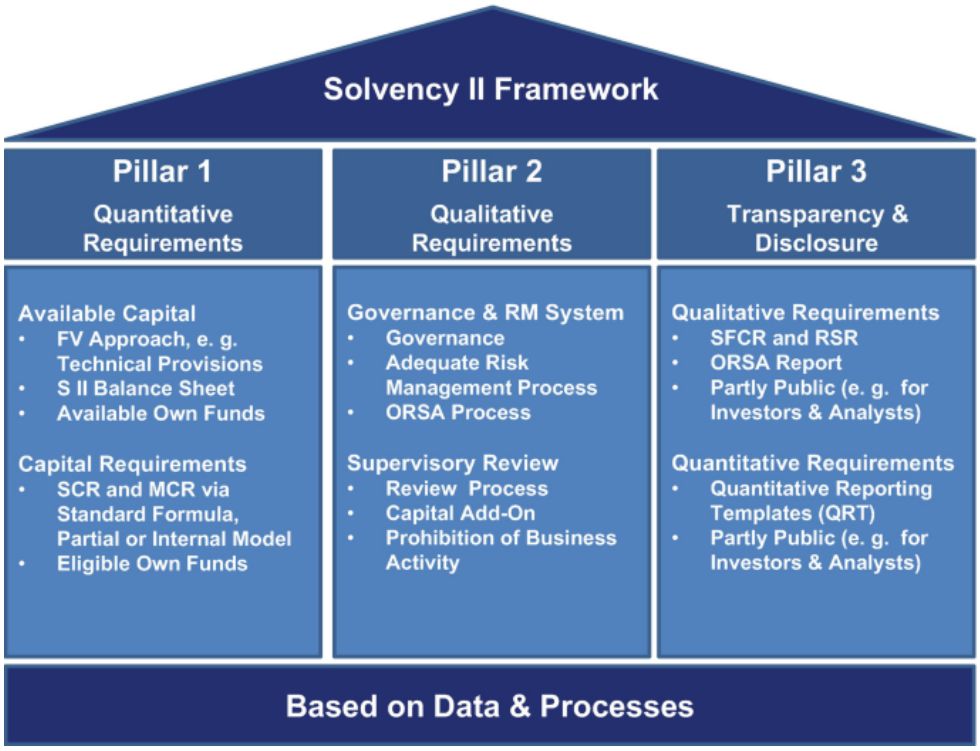
## ii. Solvency II

Solvency II is a European regulation, introduced in 2016, that is addressed to all European insurers and reinsurers, with the main objective of protecting policyholders through a better estimate of their solvency. The reform also aims to build a homogeneous European insurance market to:

- Promote the international competitiveness of European insurers,
- Harmonise and improve regulation,
- Ensure the transparency of the insurance market.

The directive is based on a radically different and much more complete view of an insurer's situation and commitments, through a comprehensive approach to risk factors. This directive
is based on three pillars:

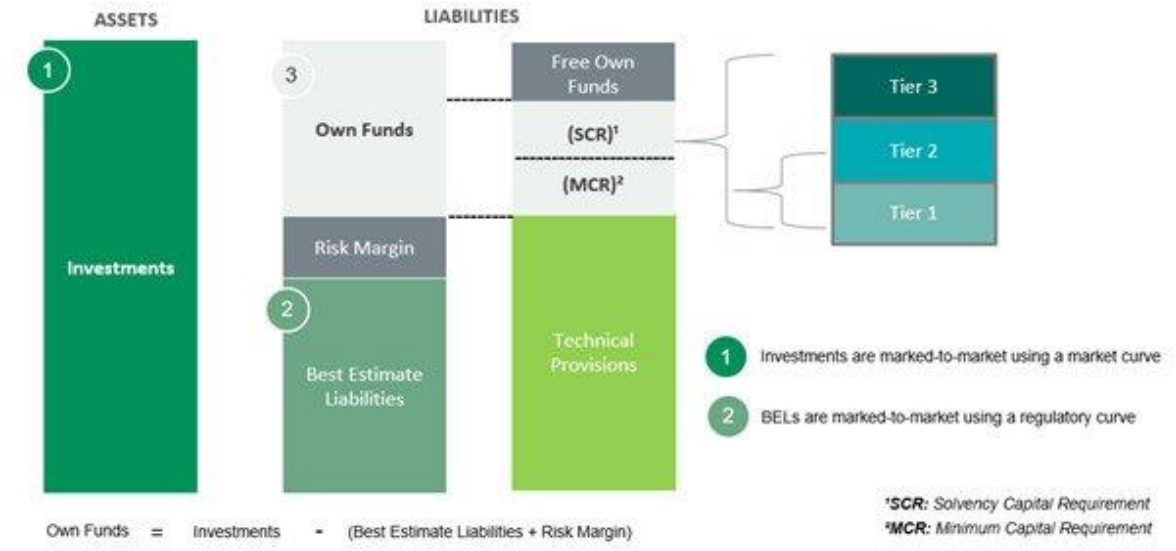
- The first pillar (The quantitative pillar) defines the principles and methods of calculation for the economic valuation of the balance sheet and for the determination of the capital requirement under Solvency II. The aim is to harmonize the calculation of these indicators for all European insurance companies.
- The second pillar (The qualitative pillar) describes the quality standards to be met by all market participants. It acts as a control for the authorities and as an internal control for companies. Indeed, one of the objectives of the reform is to allow companies to be autonomous in the assessment of their risks. It is a risk management tool specific to the company that should allow managers to continuously monitor the need for capital and manage their business plan.
- The third pillar is intended to ensure transparency in the company's communication to the supervisory authorities, the market and the public.




# 1. The quantitative pilar:

The main objective of the first pillar is the definition of the capital requirement under Solvency II. It is also a question of defining the methods of calculating the components of the Solvency II balance sheet for an insurance company. The asset side of the balance sheet is valued at market value (quoted prices) under normal conditions of competition. If such prices are not available, another approach called the "economic value" could be used, that is the amount at which the assets could be exchanged between two parties. Liabilities are valued at the amount for which they could be transferred or settled in a transaction concluded, under normal conditions of competition.

*Graphic 4 : Solvency II Balance sheet*




Source: BNP AM

The Solvency II balance sheet could be split into different segments as shown in the chart above.

# 2. Technical provision:

The technical provisions correspond to the amount that an insurer requires to fulfill its insurance obligations and settle all expected commitments to policyholders and other beneficiaries arising over the lifetime of the insurer's portfolio of insurance contracts. The valuation of assets is done simply by taking "the value at which they could be traded", in other words, the market value. The valuation of liabilities differs from that of assets in the sense that liabilities consist mainly of technical provisions and there is no "market" where these liabilities are traded. The main method used to evaluate liabilities is the sum of a "best estimate" and a "margin risk".
The "best estimate" is the weighted-average probability of future cash flows taking into account the time value of the money, estimated on the basis of the relevant risk-free yield curve provided by the EIOPA[2]. The "margin risk" is the cost that would require another insurer in order to take on the best estimate part. This is a sort of risk premium associated with the best estimate in case the initial insurer goes bankrupt.

[2]See https://www.eiopa.europa.eu/tools-and-data/risk-free-interest-rate-term-structures_en for more information about the risk-free yield curve used for liability valuation purpose.

# 3. Own funds:

Own funds correspond to the available financial resources that an insurer can use if the provisions are not sufficient to cover its liability. This brings us to the notion of solvency and a capital requirement under Solvency II. The first pillar introduces two regulatory quantitative threshold levels:

- The Minimum Capital Requirement (MCR) is the minimum capital requirement under which insurance is not considered solvent anymore.
- The Solvency Capital Requirement (SCR) is the main part of Solvency II.

# 4. SCR:

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