EIOPA

FINANCIAL STABILITY REPORT

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European Insurance and
Occupational Pensions Authority

CONTENTS

FOREWORD BY THE CHAIRPERSON

The war in Ukraine is a human tragedy and a watershed moment in history. The EU responded resolutely and Member States welcomed millions of Ukrainian refugees. The Russian invasion triggered a supply shock with skyrocketing gas and oil prices, but due to considerable efforts of governments, citizens and companies it seems that the worst case scenarios for this winter can be avoided. The Covid-Pandemic continued to take a considerable human toll with premature deaths and long COVID. At least for the moment the situation seems stable.

The European regulatory framework has proven to be robust and insurers and pension funds have weathered so far the numerous shocks well, but we don't know what the future will bring. Among the many challenges are claims inflation, a potential widening of corporate and sovereign spreads and the gloomy macroeconomic outlook. Another concern is the impact of quickly rising interest rates on liquidity positions and market resilience. But at least capital positions remain at comfortable levels.

Over the last years the European economy has faced exceptional and unforeseen economic shocks with only short "calmer periods" between them. Not long ago interest rates reached historically unprecedented low levels. Then, a global pandemic broke out, which was fought with lockdowns that put a severe strain on the economy. In February Russia invaded Ukraine resulting in an energy shock in Europe, inflation levels not observed for decades and a looming recession. All these events also affect insurers which have to adapt to the fast changing risk landscape. One trend has been the shift in the life product mix from traditional profit participation products with guarantees to hybrid and unit-linked products. Some insurers have offloaded liabilities related to their legacy business altogether through a portfolio transfer. These measures make insurers less vulnerable to interest rate risk. From a supervisory perspective, it is a positive when insurers adapt and reduce their vulnerabilities. But the broader financial stability perspective needs to take into account also the effects on the risks for policyholders and other financial intermediaries.

One instance for an economic shock was the recent turmoil in the UK with pension funds at its center. The announcement of unfunded expansionary fiscal policies caused a sudden and material increase in the risk premium for UK government debt. Highly exposed sectors responded to margin calls with the pro-cyclical liquidation of investments such as long-term Gilts which proved to be illiquid. The EU insurance and pensions sectors seem less vulnerable to such risks as the investment portfolios of derivatives users tend to be well diversified in terms of asset classes, countries and

maturities. This allows to liquidate different types of assets with a potential lower impact on liquidity in specific segments of the market.

The European Systemic Risk Board issued the first general warning of its kind a few weeks back in which it warned that the likelihood of tail risk scenarios materializing has significantly increased over the past months. It called for a heightened awareness of the risks to financial stability in the EU.

EIOPA will continue to monitor financial market developments and all the mentioned risks. At the same time it will keep a strong focus on climate risks and risks related to digitalisation.

One key element for 2023 is the contribution to the first ever EU wide climate change stress test for the financial sector. As part of its Strategy for Financing the Transition to a Sustainable Economy the European Commission has mandated the ESAs to conduct this exercise in cooperation with the ECB and the ESRB. Its scope covers banks, insurers, IORPs and funds. The aim is to test the resilience of the EU financial system in case of a disorderly transition to the Fit for 55 objectives by 2030 and to assess how stress in the financial system could affect the transition to the 2030 goals. Work on the definition of the mandate and its operationalization has already started.

EIOPA is also constantly enhancing its bottom-up stress test framework to cover emerging risks related to digitalisation. The recently published discussion paper in the stress test methodological paper series lays the groundwork for an assessment of insurers' financial resilience under severe but plausible cyber incident scenarios. One major element covered in the paper is cyber resilience, i.e. the capability of an insurance undertaking to bear the losses resulting from an adverse cyber event; the other one is cyber underwriting risk. This means the capability of an insurance undertaking to sustain underwriting losses resulting from an extreme but plausible adverse cyber scenario.

All the above-mentioned topics are very high on the EIOPA agenda and we will continue to follow our mission: to preserve a robust insurance and pension industry for the benefit of all European citizens.

Petra Hielkema

KEY DEVELOPMENTS AND RISKS

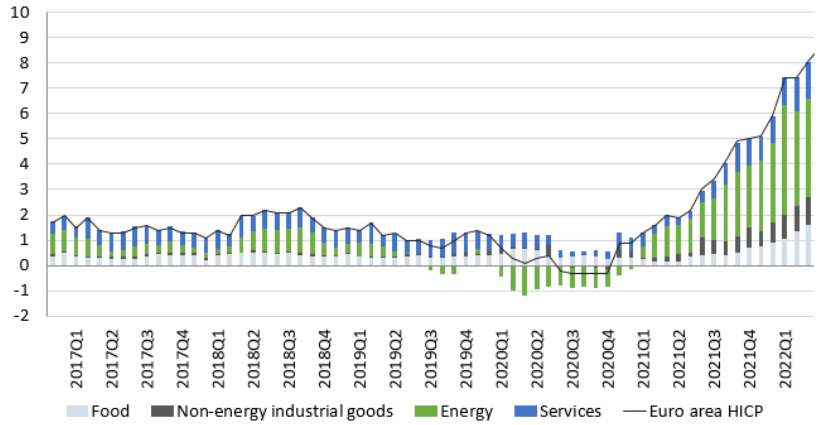
Continued war in Europe. The Russian invasion of Ukraine on February 24 triggered the largest armed conflict in Europe since 1945. It continues unabated with tragic human consequences. In stark contrast there have been **so far only limited direct effects on insurers and pension funds**. As outlined in the last semi-annual EIOPA Financial Stability Report the exposure of European insurers and pension funds to Belarus, Ukraine and Russia is not significant. There are of course indirect and second round effects triggered by higher prices and concerns about the future availability of fossil fuels on the economy and on financial markets.

Inflation is persisting globally, with energy the most significant driver for Europe. As of end September consumer price inflation was estimated at 10 % for 2022. Industrial producer prices, typically leading the consumer prices, were up by 43.3 % in the 12 months to August 2022.

So far **inflation expectations in financial markets have remained relatively stable**. The break-even rates for inflation-linked Bunds with a remaining maturity of 3.5 (7.5) years as of end September were at 2.35% (2.10 %). But continued high inflation and the strong labour market, with 6% unemployment rate in August for Europe, raise the **possibility of de-anchored inflation expectations and a wage-price spiral.**

Broad-based inflation could eventually result in the contraction of real disposable incomes for households and businesses and a decline in saving ratios and investments. This in turn can produce **lower growth**, leaving less room for further tightening without risking recession.

Figure 1: HICP main components (annual % changes).



Source Eurostat. Last observation August 2022.

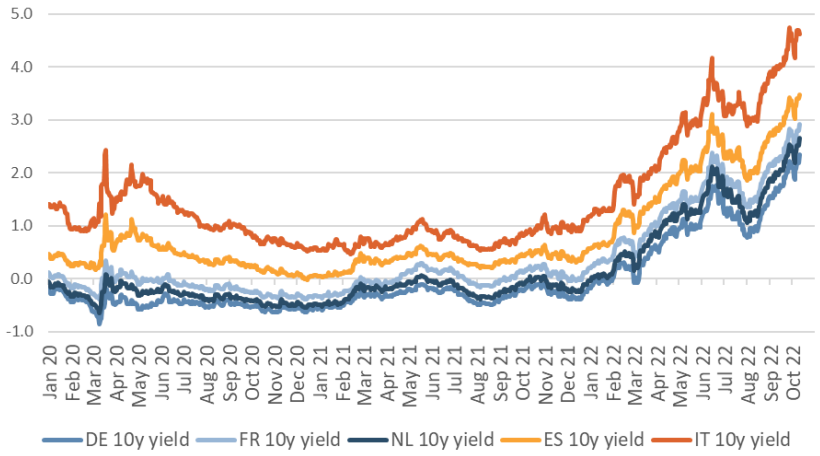
The prospects for economic growth in the EU have deteriorated significantly. Despite all the headwinds the European economy continued to grow in the second quarter supported by the reopening of the economies and seasonal effects like the tourism season. But the IMF revised its growth forecast for the Eurozone of 3.9 % for 2022 (2.5 % in 2023) from January down to 3.1 %

(0.5 %) in October. The economies of key European countries such as Germany and Italy are expected to shrink in 2023.

Over decades bond prices benefitted from ever lower interest rates, but some of these gains are now reversed. The narrative of the low interest rate environment seems to be, at least for the moment, out of date.

The 10-year German government bond **yield rose from -0.18 % to 2.11 % between January and September** (Figure 2). This is also reflected in the EIOPA Risk Free Rates which have a significant impact on technical provisions and own funds of insurers. The 20-year Risk Free Rate for the EUR increased from 0.46 % on December 31 to 2.25 % at the end of August and the **discount rates for all maturities are now solidly in positive territory**.

Figure 2: Yields of bonds, in %.



Source: Refinitiv, 10/10/2022.

However, it is **not clear whether this is a cyclical development linked to the hiking cycle or rather a more structural one**. Unless the trends in demographics and productivity reverse at least to some extent, it remains uncertain how sustainable the higher interest rates will prove. With the still deeply negative real interest rates nominal rates may have to increase further to dampen inflationary pressures. A normalisation seems generally desirable, but the transition could be painful and the resulting risks should be thoroughly monitored.

The current (and expected) inflationary and higher interest rate environment can be transmitted to insurers through five main channels. Claims and expenses inflation is the insurance specific aspect, leading to potentially higher reserves, to account for upward adjustments in expected inflation. While the largest impact is on the non-life segment and health, expense inflation can affect the whole sector. Without higher premiums underwriting results will also decrease. However, even in mandatory lines of business, the **lower purchasing power** of policyholders combined with the intense competition could restrict the room for such increases. At the same time the **volume of new business might decrease** and policyholders might surrender existing contracts, with the higher interest rates providing an additional incentive for life policies.

Higher interest rates can have positive and negative effects on insurers: Where the duration of liabilities exceeds those of the assets (in particular life insurers) the **higher discount rates increase the excess of assets over liabilities**. But this might be counterbalanced by the possibly accompanying **repricing of risk premia** and the negative impact on growth. Finally, higher liquidity needs resulting from surrenders and possible margin calls, driven by the increase of the risk-free rate, combined with lower premiums create **elevated liquidity risks**. The study described in Topical Focus 1 explores the possible impact of inflation on the excess of assets over liabilities of insurers and determines the increase in bond spreads that would just offset the positive effects.

The recent turmoil in the UK after the announcement of plans to cut taxes illustrates how volatile even markets in developed countries can be. The British Pound dropped more than 6% in a single week while yields on 30-year Gilts increased almost 150bps and the domestic FTSE 250 equity index dropped by more than 7%. The events were also a reminder of the risks associated with derivatives – even if they are used for risk mitigation. The rising yields triggered margin calls to pension funds on interest rate derivatives. In order to raise cash they sold treasuries at distressed prices incurring losses and putting further upward pressure on yields. The attempt to mitigate solvency risk created liquidity risk.

As the EU has entered into a period of heightened macro uncertainty with possibly increased volatility in bond prices the situation with EEA insurers and pension funds has to be carefully monitored. They also use interest rate derivatives and may have to post cash variation margins. Due to the upward trend in interest rates EEA insurers hedging interest rate risk were already faced with margin calls over the past quarters. The UK events make the study in Topical Focus 2, which analyses how they addressed the resulting liquidity needs, all the more pertinent.

Spreads on EU sovereign bonds remained roughly stable in the third quarter but are **still considerably higher than at the beginning of the year.**

A bright spot in all the uncertainty is the solvency position of insurers, offering room and buffers to absorb losses given the macro headwinds ahead. Life undertakings improved their SCR ratio in the second quarter of 2022, with the median increasing from 216% in Q2 2021 to 237% in Q2 2022, driven by the rise of the risk-free rate since the beginning of the year. Composites undertakings experienced a more moderate increase in their solvency positions from 220 to 221%, while there was a slight decrease for non-life companies from 218% to 215% (Figure 3).

Figure 3: SCR ratio by type of undertaking

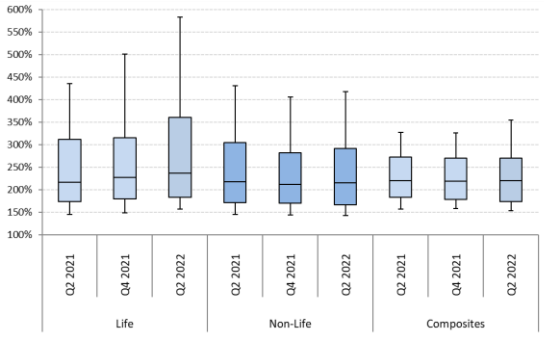
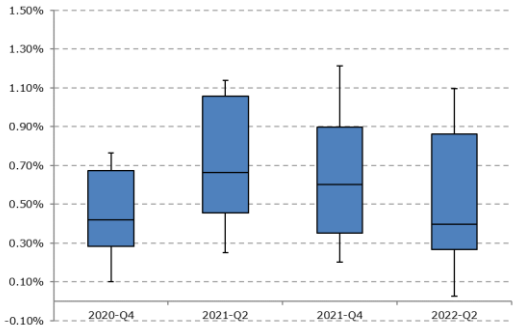


Figure 4: Return on assets (in %; median, interquartile range and 10th and 90th percentile).

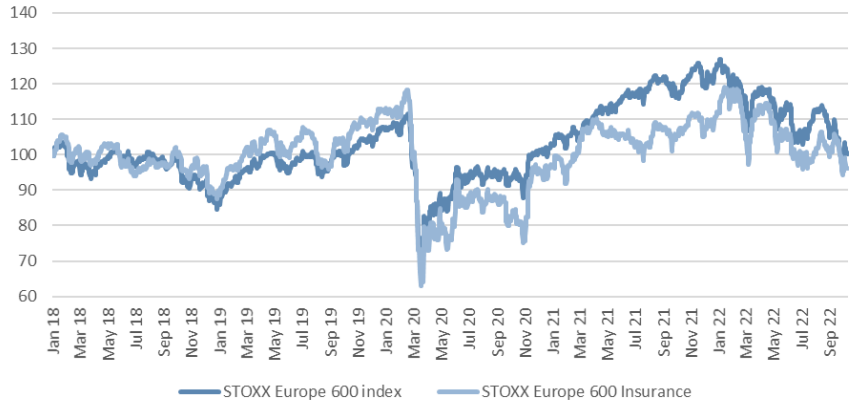


Source: SII Quarterly Reporting Solo.

The investment performance of insurers deteriorated slightly in the second half of 2022, with the return on assets dropping to a median of 0.4%. Life gross written premiums remained nearly constant with a drop of -1% on a year-on-year basis, while non-life written premiums increased by 11% (Chart A.2.1 in Statistical annex).

The **stocks of European insurers suffered less than the broad European market**. From January to September the Stoxx 600 Insurance lost 12 % of its value compared with 18 % for the broad Stoxx 600 (Figure 5). In terms of valuation, the price-to-earnings ratio as of end September was slightly above the January level (12.8x vs. 12.1 x).

Figure 5: Insurers' equity performance vs market.



Source: Refinitive, 10/10/2022.

A key priority of the EIOPA work is the **impact of climate change on insurers and pension funds**. While no further proof for the urgency of the topic was needed, the latest summer which brought again record temperatures, droughts and fires across Europe was another reminder of the need for action. In Q3 EIOPA collected data to **assess** for the second time **the resilience of pension funds**

in a climate change scenario devised together with the European Systemic Risk Board and the European Central Bank. The results will be published in December. Another area of work has been the **development of risk indicators** to assess the **potential impact of physical climate change risk on different non-life Lines of Business in several countries** capturing both acute and chronical climate change impacts. The results are presented in Topical Focus 4.

Insurers and pension funds have increased the **share of private equity in their portfolios** over the past years. But there is also a **growing interest by private equity firms to invest in insurers**. The topic is consequently widely discussed in international fora. EIOPA has looked at the **possible risks the increasing interlinkage can produce**, for example a potential change in the risk taking behaviour of acquired insurers. The results are set out in Topical Focus 3.

Supervisors continue to assess the materiality of digitalisation and cyber risks to have increased over the last quarter, especially in the current geopolitical context. The results of the EIOPA Autumn 2022 insurance bottom-up survey (BUS) among supervisors show digitalisation and cyber risks ranking in the fourth place in terms of materiality, after macro, market and profitability and solvency risks, but above e.g. credit and underwriting risks. This represents a relative decrease in materiality when compared to the EIOPA Spring 2022 BUS, which ranked digitalisation and cyber risks in the third place, mainly due to the increase in macro risks and their potential impact on profitability and solvency risks. When considering the expected developments in terms of risk materiality over the next year, digitalisation and cyber risks remain ranked second, behind macro risks as in the previous quarter.

Cyber security risks are still seen as the main driver of the developments in digitalisation and cyber risks (81% of supervisors vs. 92% in the last quarter), followed by cyber underwriting risks (11% vs. 4% in the last quarter).

This trend was also reflected in the October 2022 version of EIOPA's Risk Dashboard[1], which assessed digitalisation and cyber risks at medium level. Indeed, in addition to the high materiality of these risks for insurance as assessed by supervisors due to the cyber security issues and concerns of a hybrid geopolitical conflict, the cyber negative sentiment increased significantly since the same quarter of last year.

Finally, in this context of increasing concerns among supervisors regarding digitalisation and cyber risks, EIOPA published in November a discussion paper on methodological principles of insurance stress testing with focus on cyber risks. This paper sets out methodological principles that can be used to support the design phase of future bottom-up stress test exercises that aim to assess the vulnerability of insurers to cyber risks.

[1] EIOPA's October 2022 Risk Dashboard available here: https://www.eiopa.europa.eu/tools-and-data/statistics-and-risk-dashboards/risk-dashboard_en

TOPICAL FOCUSES

1. IMPACT OF CHANGES IN INFLATION AND INTEREST RATES AND VULNERABILITY TO POTENTIAL HIGHER RISK PREMIA: EVIDENCE FROM A TOP DOWN APPROACH

Financial stability risks in the insurance sector have increased as a result of the sharp increase in inflation and interest rates in combination with concerns of a global economic recession, increased markets volatility, Russia's invasion in Ukraine, supply chain disruptions and high energy prices. This topical analysis estimates the impact of the upward moves in expected inflation and interest rates from January until September 2022 on the balance sheets, in particular the excess of assets over liabilities (eAoL), of European insurers as of end 2021. As the result is an aggregate increase in the eAoL this is complemented by a calculation how much risk premia could increase before the aggregate eAoL drops below the Q4 2021 level.

INTRODUCTION

During 2022, inflation has increased further compared to 2021 while the outlook for growth has deteriorated. The Euro Area inflation rate (HICP) reached a record level of 9.1% in August and of 10% in September and it seems likely to remain high in the near term.[2] Elevated inflation becomes increasingly a concern as it leads to an pressure on consumers purchasing power and a potential reduction in economic growth. Commodity prices, particularly energy, were so far one of the main drivers of the increase that pushed up prices further across many sectors. Their surge post the Russia's invasion in Ukraine added to the already existing inflation following the pandemic that led to some supply chain disruptions.

To control inflation, central banks are now switching from accommodative to restrictive monetary policies. The ECB has already increased interest rates by 75 basis points in September, on top of the 50 basis point increase already announced in July. Interest rates have been rising since 2021 while spreads for specific countries have been growing asymmetrically with higher increases for more indebted countries. Upon normalization of the monetary policies and evolution of the markets, yields materially increased from historically low levels, with European sovereign bonds displaying positive nominal yields for all tenors.

Given these recent macroeconomic developments, this topical analysis focuses from a financial stability perspective on the insurance sector's vulnerability to inflation and increase in interest rates. These are two important factors in assessing risk in the insurance sector in the current post pandemic economic environment. Regarding the first factor, unanticipated inflation is a significant

[2] Inflation is even more pronounced in some non-euro area countries reaching close to double digit numbers.

source of risk particularly for non-life insurers and especially for long-tail lines of business. This is because future claims payment could increase more than insurers have planned for when calculating their technical provisions. As for the second factor, the downward re-valuation of fixed income assets as a result of increased interest rates could have a negative impact on insurers, since this asset class represents a large share of their investments. On the liability side, insurers typically benefit from higher interest rates, as future payments to policyholders are discounted with higher rates which reduces the value of technical provisions.

OBJECTIVE AND NARRATIVE

High inflation and increased interest rates have already materialised. The assessment of their impact on the insurance sector is therefore a high priority from a financial stability perspective. There has also been an increase in risk premia since the beginning of the year. Given the uncertain economic outlook, it seems useful to include their possible further expansion in the analysis. Therefore, one key question for the capital position of the sector is how much risk premia increase can be sustained by the beneficial impact of the increased rates on the present value of insurers' liabilities. The goal seeking of this model is therefore to investigate and calibrate what could be the turning point for the risk premia that might lead to losses for the insurance sector at the level of excess of assets over liabilities.

In order to come up with an estimation for the threshold of the risk premia, but also to monitor the impact of inflation, a top-down approach is used to model the European insurance market. Starting from the baseline, a step by step approach is employed using the following economic narratives.[3]

Economic narratives in 3 steps:

1. The observed increase in the **inflation has a direct impact on insurance liabilities** (Step 1).
2. Central banks react in the remit of their mandates to control inflation through the ***normalization of their monetary policies*** (Step 2);
3. Economic growth deterioration, higher uncertainty and tightening of monetary policy leads to an **increase in risk premia** (Step 3).

The scenarios are well anchored in reality as the moves in inflation and interest rates are based on their actual observed behaviour in 2022.

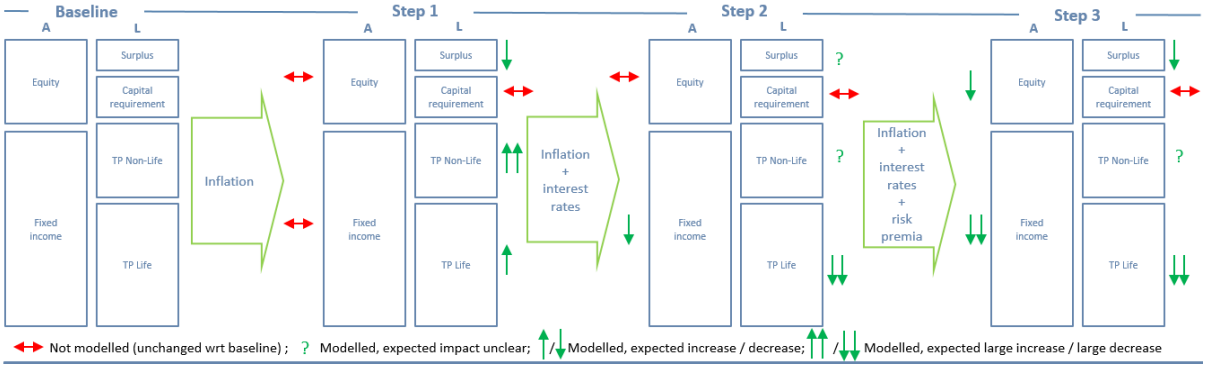
APPROACH

To simulate the impact of the economic narrative assumed, a step by step series of shocks are applied on a fixed balance sheet for each narrative, using year-end 2021 Solvency II QRTs. For each step, individual balance-sheet positions as well as the excess of assets over liabilities are

[3] The model, with its simplifications, is not designed to calculate the impact of the actual market and economic conditions on the insurance industry, it has the objective to identify potential vulnerabilities that might materialise in the future.

recalculated and compared to the baseline. Figure T1.1 unfolds the rationale and the intuition behind the impact of the economic narratives when translated into shocks that are modelled on a stylised balance sheet. The shocks are assumed to be one-off, instantaneous and simultaneous. Both market shocks and insurance-specific shocks are applied.

Figure T1.1: Modelled balance sheet items and expected effect of shocks.



In the first step, ***the increase in inflation expectations is assumed to impact only the liabilities***. The expected effect is on aggregate a decrease in the excess of assets over liabilities as technical provisions increase (particularly for non-life portfolios). The shocks are separately applied to life and non-life liabilities using the cash-flow approach. The calculation leaves the value of assets unchanged relative to the baseline, but assumes an increase in projected expenses for life technical provisions as well as in projected expenses and claims provisions for non-life technical provisions. The inflation shock is derived for different maturities based on the inflation SWAP changes observed during a 6-month rolling window from May 2021 to September 2022. These shocks are added to the existing best estimate assumptions (see annex)[4]. In summary, shocks are applied as follows:

- ***Assets:*** no shocks
- ***Liabilities:***
  - → Life BE liabilities: Future expenses and other cash out-flows are inflated based on the parameters
    - $CF_i^{Shock} = future\ expenses\ and\ other\ cash\ outflows_i \times (1+\beta_i)^i + other\ CF_i^{baseline}$
      where *i* is the year, β is the inflation shock, CF_i^{Shock} is the recalculated cash-flow and $CF_i^{baseline}$ is the baseline cash-flow
  - → Non-Life BE liabilities: Future expenses, future benefits and other cash out-flows are inflated based on the parameters
    - $CF_i^{Shock} = (future\ expenses\ and\ other\ cash\ outflows_i + future\ benefits_i) \times (1+\beta_i)^i + other\ CF_i^{baseline}$
      where *i* is the year, β is the inflation shock, CF_i^{Shock} is the recalculated cash-flow and $CF_i^{baseline}$ is the baseline cash-flow

In the second step, on top of the inflation shock from step 1, ***an increase in interest rates is applied to the baseline balance sheet as a consequence of the normalisation of monetary policy***. The

[4] The values of the inflation shocks are calculated for the different maturities. They are added on top of the rates of inflation implied in the assumptions used by undertakings to produce the cash flows, which form the base of the simulation. The latter makes the total inflation rates effectively applied in the proposed scenario higher than the ones presented. Please note that no information on the implied inflation is available, hence no details can be displayed.

increase in the interest rate is reflected on the assets side by an increase in the yields of the fixed income assets driven by their risk free component. On the liabilities side the increase in interest rate is reflected in a higher discount curve that results in a reduction of the technical provisions. Using the same cash-flow approach as in step 1 and a shock in discount rates calibrated based on the EUR SWAP rate (see annex), the following adjustments are made:

- ***Assets:*** parallel shock in the swap rates of +200 bps and revaluation of fixed income assets (government and corporate bonds) based on a duration approach at country level

$$Yield^{Bond}_{post\ stress} = Yield^{Bond}_{Baseline} + (Swap_{post\ stress} - Swap_{baseline})$$

- ***Liabilities:*** inflation shock (see Step 1) + recalculation of TP life and TP non-life using the change in the RFR curves based on a + 200 bps shock

How ***step 2*** affects the excess of assets over liabilities is difficult to predict ex ante and depends on the characteristics of the insurers. For life insurers, where the duration of liabilities exceeds those of the assets, the **higher discount rates increase the excess of assets over liabilities**. Non-life undertakings may suffer as their duration gap is smaller and the positive effect of higher interest rates does not compensate claims inflation.

Finally, in step 3, **the weakened economic growth and the tightened monetary policy result in a drop in equity markets and an increase in risk premia** on top of the effects of steps 1 and 2. The value of assets is further reduced by the fall of equity prices and additional losses on fixed income assets resulting from higher spreads. The value of liabilities is impacted by an increase in the volatility adjustment. For the equity shock, a loss of 20% is assumed based on the actual market movements from January to September. In the calibration of the volatility adjustment (VA), a prudent approach[5] is employed by assuming an increase of +46 bps. Finally, the **key is the calibration of the risk premia shock**. It corresponds to the value for which based on the aggregated assets and liabilities of all insurers the ratio between excess of assets over liabilities and technical provisions after all the shocks remains unchanged compared to the baseline level[6]. ***This results in an increase of +190 bps in the risk premia of fixed income assets***.[7] In summary, the following shocks are applied:

- **Assets:**
  - → **Equities:** Price shock: -20% with new values computed as

$$Price^{Country}_{post\ stress} = Price^{Country}_{Baseline} * (1 + \text{shock})$$

  - → **Fixed income:** A swap shock of +200 bps is applied to fixed income assets (government and corporate bonds) based on the duration approach at country level and a risk premia shock of +190 bps

[5] The calibration of the volatility adjustment (VA) is based on the aim that the selected shocks should reflect an evolving situation rather than instantaneous shocks. Furthermore, the prescribed shocks for the risk premia seem not too dissimilar from what was observed on the markets in Q1 2020 during the pandemic outburst (more similar for corporate bonds and less for government bonds). On this basis the analysis assumes the same VA as in Q1 2020 for the EURO. In addition, the actual calculation of VA using the assumption that the uniform shocks of the analysis are instantaneous, would have resulted in a higher VA. Thus, the selection of the VA of Q1 2020 is regarded as a more prudent approach for this analysis.

[6] The equation used is eAoL/TPs (baseline)= eAoL/TPs (step 3)

[7] When splitting the analysis by type of undertakings and using the same assumptions, the "neutral" increase in risk premia for life undertakings is +240 bps, for non-life undertakings +80 bps and for composite undertakings +145 bps.

$$Yield^{Bond}_{post\ stress} = Yield^{Bond}_{Baseline} + (Swap_{post\ stress} - Swap_{baseline}) + (RiskPremia_{post\ stress} - RiskPremia_{baseline})$$

- **Liabilities:** inflation shock (see Step 1) + recalculation of the TP life and TP non-life using the change in the RFR curve based on + 200 bps shock + VA (+46 bps)

Collective investment undertakings (CIUs) are considered in the analysis, but no look-through approach is applied. The applied shocks are based on an average composition of equity and fixed income by country and by average duration for the fixed income assets.

$$shock_{CIU} = \alpha_{equity,region} \times shock_{equity,region} + (1 - \alpha_{equity}) \times shock_{fixed\ income,\ country,\ duration}$$

where $\alpha_{equity,\ country}$ is the average proportion of equity in the country of issuance.

All calculations are based on the following ***assumptions***:

- → Only modelling of investments and liability portfolios (i.e. no Unit- and Index-linked business);
- → No consideration of the loss absorbing capacity of profit sharing
- → Use of duration approach for fixed income assets;
- → Uniform application of claims/expenses inflation shocks across all lines of business;
- → Exclusions of reinsurance business

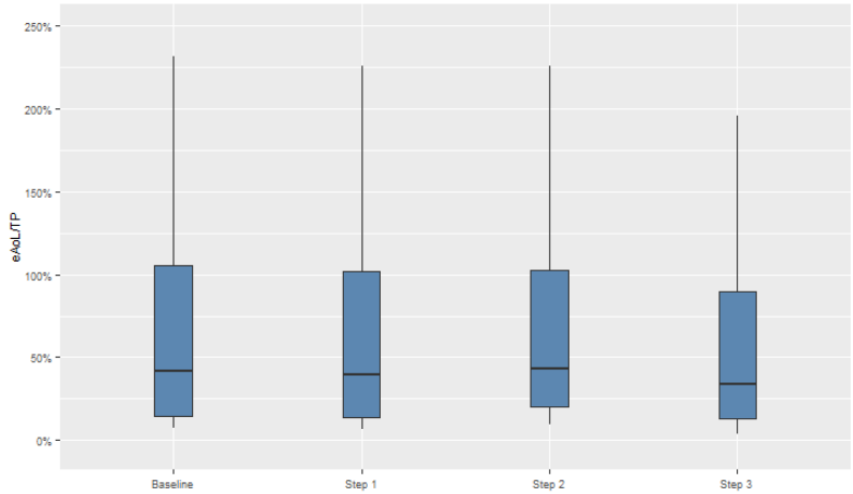
Regarding the **metrics**, the model computes the impact of the prescribed shocks on the balance sheet items, up to the excess of assets over liabilities (eAoL) and its constituents (i.e. investments, technical provisions, etc.). As the shocks impact both assets and liabilities to different extent and the relevance of absolute changes depends on the respective size of insurers, the analysis employs the ratio between eAoL and TPs as the main indicator for the level of the surplus the insurers hold throughout the different steps.

To what concerns the ***scope*****,** the analysis targets solo undertakings and is performed using a combination of QRTs and market data with the reference date end 2021. The sample includes 1346 insurers (364 composite undertakings, 359 life undertakings and 623 non-life undertakings). Consistency checks between the discounted cash-flows and the best estimates reported in the balance sheet (confidence interval applied) and completeness checks of the reporting (i.e. no gaps in cash-flow templates) were performed. Additional information on the scope and data sources can be found in the annex.

RESULTS

The evolution at aggregated level (life, non-life and composite undertakings) of the main indicator starting from the baseline and moving to each of the economic narratives is shown in Figure T1.2. Each boxplot shows the distribution of eAoL/TP in the baseline and after the application of the shocks in each of the narratives considered. As already mentioned in the methodological approach, the risk premia in the third economic narrative is calibrated assuming that the aggregate level of eAoL/TP in step 3 should return to the baseline level of the same indicator.

Figure T1.2: Evolution of the aggregated results of eAoL/TP for each narrative.



Note: Distribution of eAoL between 10th and 90th percentile.

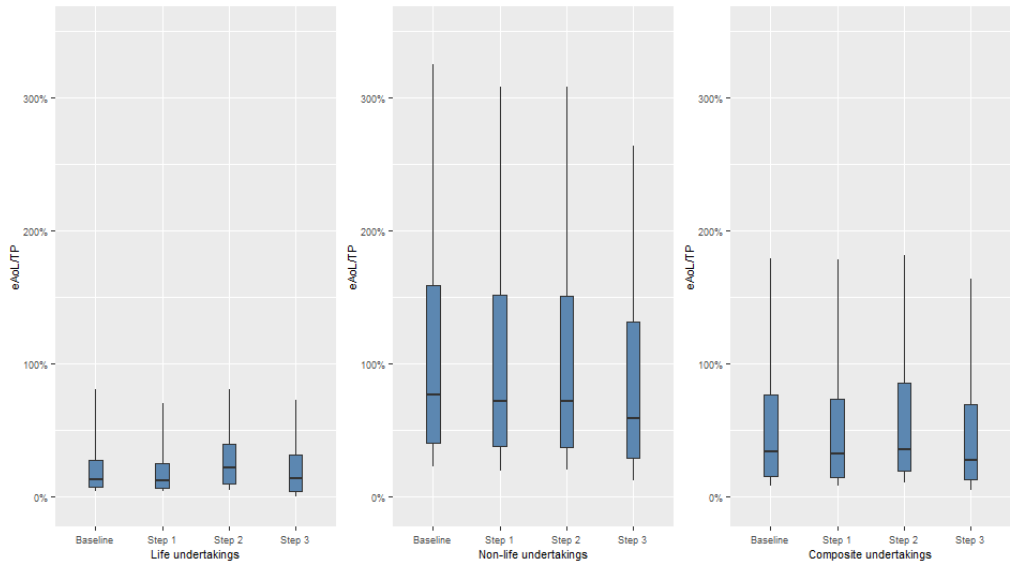
As expected, the application of the inflation shock in **step 1** to life and non-life best estimates causes a drop in the median eAoL/TP (from 41.4% to 39.4%). Based on the aggregated assets and liabilities of all insurers the eAoL/TP falls from 14.3% in the baseline to 13.7% in step 1 and the absolute excess of assets over liabilities is reduced by 44.9 bn. EUR. In **step 2**, losses are compensated by the increase in interest rates (+200 bps). The median eAoL/TP increases from 39.4% to 42.8%. In other words, for the median insurer the negative impact of inflation is more than compensated by the beneficial effect of higher interest rates. Based on aggregate figures the eAoL/TP moves up from 13.7% in step 1 to 22.1% in step 2 while the eAoL rises by 375.6 bn. EUR compared to the baseline. Finally, in ***step 3***, the risk premia of fixed income assets can increase by 190 bps combined with a drop of 20% in equity prices before the positive impact of the higher discount rates is neutralised and the eAoL/TP based on the aggregated assets and liabilities of all insurers reverts back to its baseline value of 14.3 %. The median of the individual eAoL/TP drops from 42.8% to 33.6% while the excess of assets over liabilities compared to the baseline drops by 188.8 bn. EUR. It should be noted that the threshold of +190 bps results from the set of other shocks applied, i.e. -20% on the equity process and +200 bps on the interest rates. Provided the negative duration gaps between assets and liabilities of insurance undertakings, a further increase in in the risk free rate results in a proportional increase in the level of risk premia that can be tolerated before observing negative effects on the balance sheets.

As the sensitivities to changes in inflation and interest rates vary considerably by type of undertaking, splitting the sample allows for a better understanding of the results. Figure T1.3 shows the distribution of eAoL/TP through the three steps for life, non-life and composite undertakings when disentangling the aggregate results for the risk premia calibrated at +190 bps.

For life undertakings, the negative impact of inflation (step 1) on the liabilities is less severe than for non-life undertakings. The median eAoL/TP drops from 12.4% (baseline) to 11.7% (step 1) and then rises to 21.2% (step 2). In step 3, the median eAoL/TP stays above the baseline level at 13.8%

when the risk premia is calibrated at +190 bps.[8] The results show that the direct effect of inflation on technical provisions is limited as obligations to policyholders are mostly in nominal terms. However, the erosion in the real value of payments and higher interest rates might lead to higher lapse rates and a decrease in new business. As the liabilities of life undertakings have typically a longer duration than their assets (negative duration gap), the drop in asset values is more than compensated by the lower value of liabilities resulting from the higher discount rates. The results for composite undertakings in the sample follow the same pattern as for life undertakings.

Figure T1.3 Evolution of eAoL/TP by steps and type of undertakings for risk premia calibration +190 bps



Non-life undertakings are most affected by the scenarios. In step 1, the increase in expenses and claims inflation reduces the median eAoL/TP from 76.1% in the baseline to 71.6%. The impact depends on the types of risk underwritten. Long tail business such as workers compensation, medical professional liability and other liability coverage entails a higher risk of underestimating future inflation. The increase in interest rates in step 2 reduces the median eAoL/TP slightly to 71.5% when keeping the +190 bps calibration for the risk premia. This is the opposite effect to what is observed for life and composite undertakings. When analysing only non-life undertakings, an increase in risk premia of +80bps is enough to return to the baseline level of aggregated eAoL/TP. The results confirm the expectation that interest rates changes have a less significant impact on non-life companies due to the on average shorter duration of their liabilities and the lower duration mismatch between assets and liabilities.

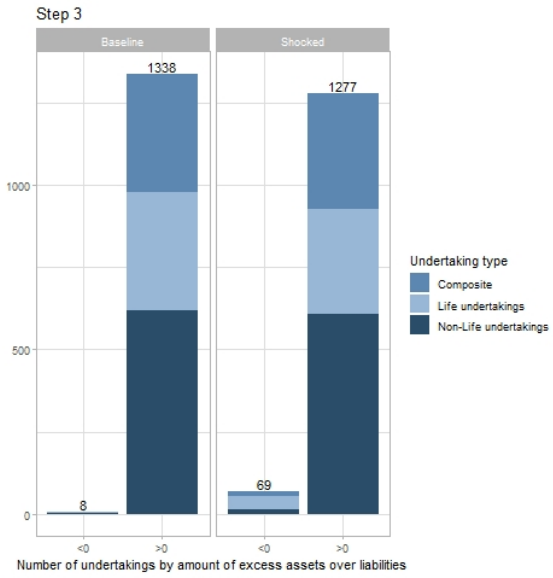
One important qualification of the above results is that the higher sensitivity of non-life undertakings to the shocks does not automatically translate into a higher risk of default: Even though **in aggregate, the life undertakings are less affected** by the applied shocks than non-life and composite undertakings, **their level of excess assets over liabilities in the baseline (i.e. their starting point) is lower than for the non-life** undertakings. This explains why the proportion of life

[8] The trashold of the risk premia increase for which life undertakings would suffer losses in aggregate eAoL/TP is calibrated at +240 bps when performing the same analysis only for life undertakings.

undertakings with less assets than liabilities after the shocks is higher than their share in the sample.

Figure T1.4 depicts the number of undertakings by type of business that have a negative/positive excess of assets over liabilities in the baseline and after the application of all shocks (i.e. including the increase in risk premia of +190 bps). The results show that out of the 8 insurers in the baseline with liabilities exceeding their assets, 5 are non-life undertakings, 1 life and 2 composites. After applying all the shocks 40 life, 16 non-life and 13 composite undertakings have liabilities exceeding their assets. This **significant heterogeneity in the results makes it – despite the apparently manageable effects on an aggregate level** - advisable to remain vigilant about the consequences of inflation for individual companies. In addition, **higher leveraged undertakings**, which are usually the life undertakings, seem to be more vulnerable to market movements.

Figure T1.4: Number of undertakings with positive/negative eAoL after the shocks by type



CONCLUSION

From a financial stability perspective, sudden changes and high volatility in the term structure of interest rates as well as high inflationary pressures are significant sources of risk for the insurance sector. The three steps economic narrative allows a better understanding how inflation and interest rate shocks affect different types of insurers. The third step with the estimation how much risk premia could increase before the combined shocks result in a deterioration relative to the base line could be an important tool in monitoring the financial stability of the sector.

Despite all the previously discussed limitations of the model and of the data, the results confirm that isolated **inflation shocks have a negative effect** especially on non-life undertakings due to the nature of their business. The increased **interest rates have a beneficial effect** on undertakings

with long term liabilities and material negative duration gap (life and composite undertakings). In their case, the increase in interest rates overcompensates the negative effect of inflation on the liabilities. In contrast, non-life undertakings with their short duration liabilities do not benefit enough from higher interest rates to compensate the inflation effects. Moreover, non-life undertakings with long tail business are more exposed to inflation due to the higher risk of underestimating future claims.

The calibration of the third economic narrative shows how much risk premia can increase before the excess of assets over liabilities of insurers after all shocks drops below the level in Q4 2021. Risk premia could rise by ***190 bps before fully offsetting the on balance positive effect of inflation and higher interest rates.*** The critical level of risk premia expansion varies considerably across types of business. The model results in a **+240 bps increase in risk premia for life undertakings** that could be underestimated as the loss absorbing capacity is not captured by the model, ***+80 bps for non-life undertakings*** that are even more exposed without further absorbing capacity buffers and +**145 bps for composite undertakings.** The thresholds identified qualify for the specific level of risk free rate set in the analysis. It is worth noting that, **due to the general negative duration gap between assets and liabilities, the higher the level of the risk free rate, the higher the level of the risk premia that can be absorbed** by an insurance undertaking before registering negative effects on its balance sheet.

The large differences in the impact on individual insurers require a cautious monitoring of the effects of inflation and higher interest rates by supervisors and undertakings. **Non-life undertakings appear more vulnerable to shocks, but also the long-tail business of life insurers could be affected.**

ANNEX

1. DATA SOURCE

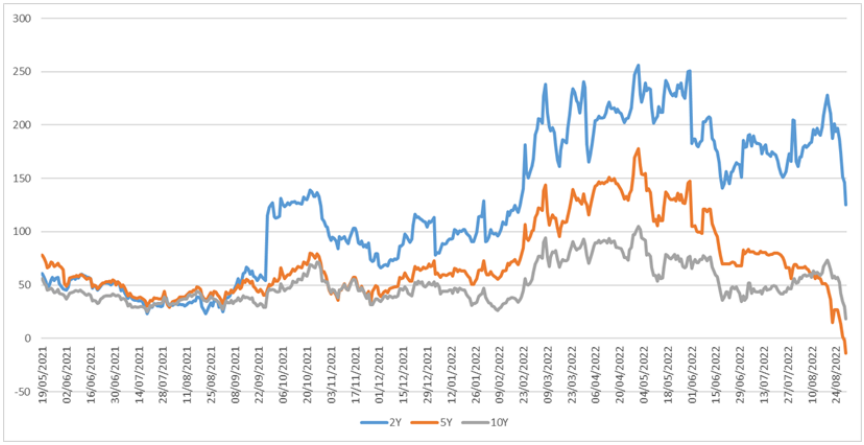
	Source	Notes
General information	S.01.02.01	Company identifier, type, country, currency, calculation specificities
Assets	S.02.01.01 S.06.02.01	Assets (relevant investments, totals), Liabilities (technical provisions, totals), Excess of Assets over Liabilities
Liabilities	S.13.01.01 S.18.01.01	Cash flow data life Cash flow data non-life
Market data	Bloomberg EIOPA	Indexes for equities macro-area of issuance , yields by country/ratings RFR curves

2. SAMPLE SIZE AND SPLIT BY TYPE OF BUSINESS

Undertaking type	No.	Total assets baseline (EUR)
Composite	364	3,629,576,793,627.15
Life undertakings	359	4,582,231,999,031.29
Non-Life undertakings	623	993,290,548,178.37

3. CALIBRATION – INFLATION SHOCK

Figure T1.6: Inflation SWAP.



Shocks applied

1Y: +4.5%

2Y: +2.5%

3Y: +2.0%

4Y: +1.5%

5Y: +1.5%

6Y: +1.5%

7Y: +1.3%

8Y: +1.2%

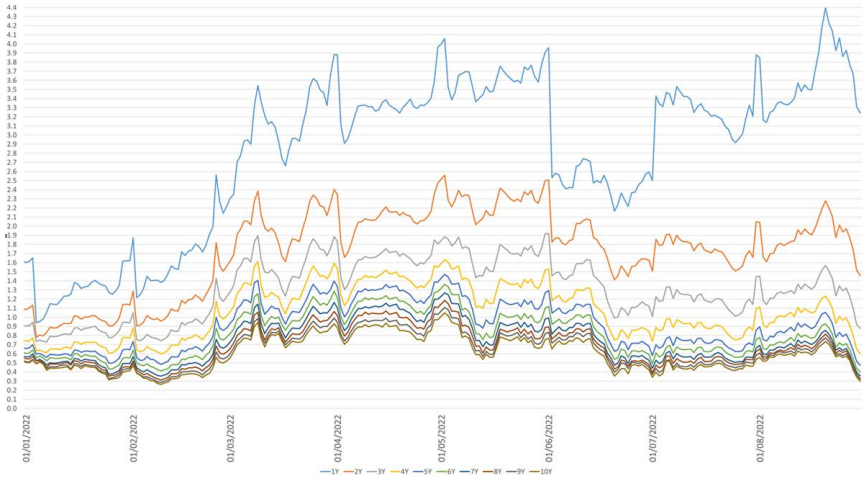
9Y: +1.1%

10Y: +1.0%

Source: Bloomberg.

4. CALIBRATION – INTEREST RATES SHOCK

Figure 1.7: Interest rate SWAP.



Shocks applied

$IR_{Step2,3}$ = +200 bps

Source: Bloomberg.

Explanations

- The interest rate shocks in the analysis were calibrated reflecting an upward shock;
- Although the recent market developments re-confirm that the past cannot simply be extrapolated into the future, the **maximum shocks observed since year-end 2021 for all maturities were selected**. In order to reflect evolving shocks and not instantaneous a **6-month rolling window was used**, resulting in a +200 bps shocks for all maturities.

5. CALIBRATION – VOLATILITY ADJUSTMENT SHOCK

Explanations

- Step 3 of the analysis includes a shock to risk premia for the fixed income assets which implies an **adjustment in the VA**
- Based on the fact that:
  - the selected shocks are intended to reflect a **evolving situation rather than an instantaneous shocks**; and
  - the shocks selected for the risk premia seem not too dissimilar from the evolution of spreads for benchmark indices in Q1 2020 (more similar for corporate bonds but less for government bonds), the analysis assumes the same VA as in 2020 q1 for the EURO.
- Given that the proper calculation of VA based on the assumption of instantaneous uniform shocks, would result in a higher **VA, the use of the VA of 2020 q1 seems more prudent**
- **From this considerations follows that VA_{Step3} = 46 bps**

2. EU INSURERS DERIVATIVES POSITIONS: HEDGING INTEREST RATE RISK AND LIQUIDITY NEEDS

EU insurers use derivatives primarily to hedge interest rate risk resulting from the long maturities of their liabilities. For this purpose they enter into Interest Rate Swap contracts (IRSs) that need to be cleared via Central Counterparties. Under these contracts insurers predominantly pay the floating rate and get the fixed rate. This exposes them to cash margin payments when risk-free rates increase. In Q1 and Q2 2022 the risk-free rate, as approximated by the EIOPA 10Y Risk-Free Rate, increased by nearly 200 bps, which represents the most dramatic shift since the introduction of SII. This topical focus discusses the amounts of cash margins insurers had to pay, whether they faced strains to meet their obligations and whether insurers had to liquidate investments to address their liquidity needs. The recent market turmoil in the UK which also forced UK pension funds to sell gilts into a falling market illustrate the relevance of the topic.

INTRODUCTION

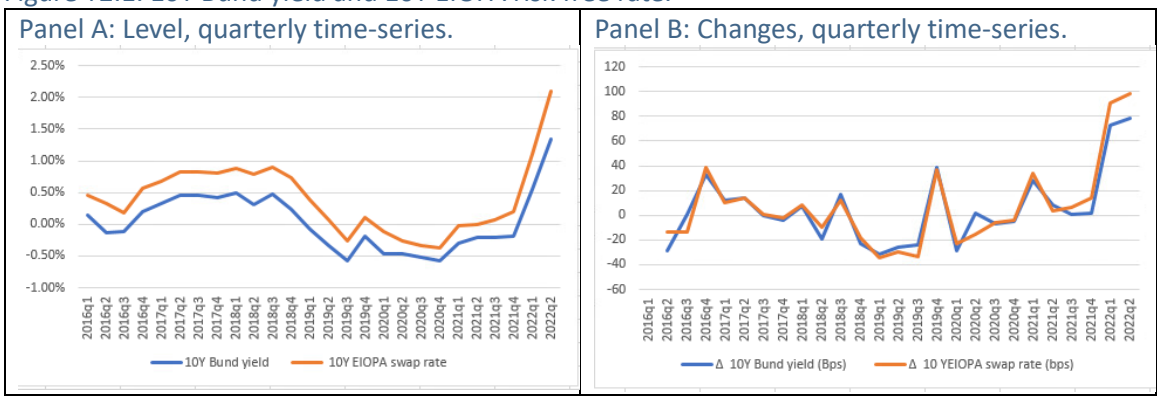
Several large EEA insurers use derivatives mostly to hedge interest rate risk. Especially, life insurers are exposed to interest rate risk because their liabilities tend to have longer durations than their investments; this is generally described as "negative asset minus liabilities duration gap" (for brevity "duration gap"). In such a situation, when the risk-free rate declines, the resulting increase in the market value of fixed income portfolios does not fully offset the increased value of technical provisions and capital positions deteriorate. Duration matching can be achieved by buying long-term bonds or entering into derivatives contracts. The instrument most frequently used by EU insurers are Interest Rate Swaps (IRSs). In these transactions they pay the floating-rate and receive the fixed-rate, thus hedging the risk of interest rate declines and, effectively, reducing or closing their duration gap. At the same time insurers may occur market losses and have to pay additional variation margin when the risk-free rate increases. IRSs are subject to clearing by Central Counterparties (CCPs). Insurers need to pay to the CCP initial margins to enter these contracts and variation margins (VMs) on a daily basis in the form of cash to reflect changes in the market value of their position[9]. Therefore any increase of the risk-free interest rate will generate liquidity needs.

[9] Interest rate swaps contracts (IRS) are bilateral over-the-counter (OTC). And since June 2019 it is mandatory that these contracts are cleared in regulated central counterparties, where variation margins need to be settled in cash. There are cases of financial institutions that are exempted from clearing because of very low derivatives positions/transactions. Other types of interest rate derivatives such as swaptions or bond options used by insurers do not need to be centrally cleared and in these case margins can be covered by posting liquid assets, but these are not in the scope of this study.

Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories (European Market Infrastructure Regulation – EMIR) reports under Article 46(1) that a CCP shall only accepts highly liquid collateral with minimal credit and market risks to cover its exposures to its clearing members, in order to avoid that the value of the margin declines or that the ability to rapidly liquidate margin

This topical focus provides evidence of how the use of derivatives helps insurers to reduce the volatility of their capital and examines the liquidity needs generated by cash margin requirements. In Q1 and Q2 2022 the risk-free interest rate, approximated by the 10Y EIOPA Risk-Free Rate[10], increased by 188 bps from 20 bps to 208 bps, which represents the most dramatic shift since the introduction of SII. Insurers had to make large variation margin payments on their interest rate derivatives positions. The question is whether they faced strains and whether they had to liquidate assets to meet their liquidity needs.

Figure T2.1. 10Y Bund yield and 10Y EIOPA risk-free rate.



Note. Source of the bund yield is Refinitiv and for the EIOPA swap rate is EIOPA.

The possible risks resulting from cash margin calls to long-term investors hedging interest rate risk has come recently into the spotlight in the UK. At the end of September the announcement of tax cuts and borrowing plans with limited details on accompanying spending cuts by the UK government sparked turmoil in the gilts market. The Bank of England had to take emergency action launching a £65bn bond-buying programme to prevent a crisis in government debt markets and also to protect pension funds in the UK. This stopped a vicious circle in which pension funds had to sell gilts on short notice to meet cash margin calls triggered by increased yields thus suffering substantial losses and putting further upward pressure on yields. The 30Y UK government bond price dropped by 24% in one day but recovered quickly after the BOE announced the intervention to -6%.

The further analysis is divided into the following parts: First, the use of derivatives by EU insurers. Second, the hedging effect of derivatives. Third, interest rate risk and insurers' positions. Fourth,

collateral is impaired. Finally, EMIR mandates ESMA – after consulting the EBA, the ESRB and the ESCB – to specify, via regulatory technical standards, "(a) the type of collateral that could be considered highly liquid, such as cash, gold, government and high-quality corporate bonds and covered bonds; (b) the haircuts; and (c) the conditions under which commercial bank guarantees may be accepted as collateral". The Delegated Regulation 153/2013 does not provide a detailed and closed list of types of eligible collateral but outlines a number of criteria for financial instruments, gold and bank guarantees to be accepted in principle by CCPs. However, the technical standards are enforced by CCPs in a strict way, accepting only cash as settlement conditions for Interest Rate Swaps. Public register for clearing obligation can be retrieved at: public_register_for_the_clearing_obligation_under_emir.pdf (europa.eu).

[10] In the observed period, the spread of the 10Y EIOPA risk-free rate over the German bund yield was on average 36 bps, but quarterly changes co-moved almost perfectly with the exceptions of Q1 and Q2 2022 where the increase of the EIOPA swap rate has been slightly larger. The EIOPA RFR is produced monthly while the Bund rate has the advantage it can be observed at a higher frequency.

the impact of risk-free rate changes on the market value of IRSs. Fifth, the effect of variation margins on the cash positions of insurers and finally the liquidity sources for the large cash margins that insurers had to pay in the first two quarters of 2022.

THE USE OF DERIVATIVES BY EEA INSURERS

Derivatives differ from other assets such as bonds, stock or real estate. They are financial instruments whose value changes in response to changes in the underlying asset or index that are settled at a future date. The required initial net investment is zero or at least smaller (often significantly so) than for other types of financial contracts with a similar risk exposure.

The use of derivatives by insurers is addressed by the Prudent Person Principle (PPP). According to Article 132 of the Solvency II Directive (2009/138/EC) insurance and reinsurance undertakings shall invest all their assets in accordance with the PPP. One element is that undertakings are allowed to use derivative instruments insofar as they contribute to a reduction of risks or facilitate efficient portfolio management. Risk reduction (i.e. hedging) means taking positions that offset existing or anticipated risk exposures (e.g. interest rate, currency, and equity or credit risk). When using derivatives for efficient portfolio management insurers get the desired risk exposures without the need to purchase assets[11]. According to the PPP this should be achieved without taking any material additional risks due to an increase of the leverage.

The use of derivatives can have side effects. While exchange traded derivatives are mainly subject to market risk, over-the-counter (OTC) derivatives give also rise to counterparty risk, which is the risk that the counterparty to a transaction defaults before contracts are settled at a future date. This risk, for most types of derivatives (see EMIR), is mitigated by the existence of clearing houses which act as central counterparties to guarantee that the other side of each transaction honours its obligation. Insurers like any other investor collateralise these positions, to make sure the counterparty is solvent at maturity. The two parties are therefore required to deposit some initial and variation margins based on the volatility of the value of the asset underlying the derivative. When the market value of a derivative contract declines (i.e. mkt-to-mkt losses) insurers would owe money to the counterparty and vice-versa. Margin requirements can be a source of liquidity risk. In the light of all this, market participants and supervisors need to monitor the use of derivatives because although used for hedging some type of risks, they might be potentially generate others[12].

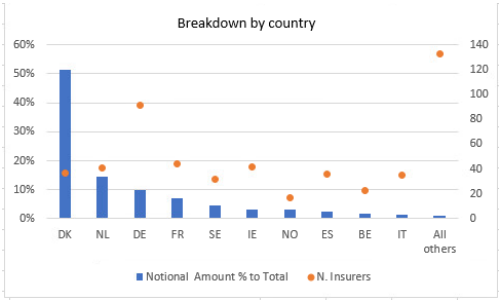
The use of derivatives is concentrated in few EEA countries. 531 insurers in the EEA used derivatives as of Q4 2021. Of these 186 used IRSs and 292 currency derivatives ("FXs").

[11] This might be either motivated by a specific need, e.g. an institutional investor wants to hold equity to exercise control rights but want to neutralise the risk exposure, or by the fact that it is more cost effective to get a risk exposure via derivative.

[12] Also operational risk may be relevant derivatives.

Figure T2.2. Insurers' derivative notional amount as of 2021 Q4: Total EUR 2.9 Trillion.

Panel A: Notional amount and number of insurers using derivatives by country.



Panel B: Number of insurers using derivatives by risks and by type of derivatives.

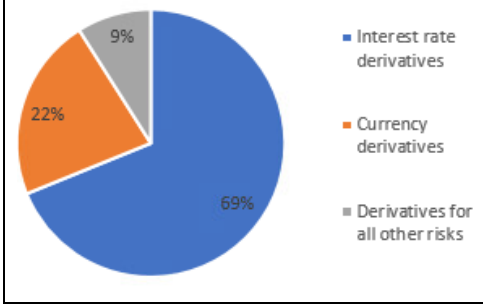
	Nr. Of insurers using derivatives
All derivatives	531
Interest Rate derivatives	**286**
IRS	186
Swaptions	60
Forwards	53
Bond options	15
Others	59
Currency derivatives	**344**
FX	292
All other derivatives	**308**

Note. Insurance SII Solo quarterly reporting from S.08.01.

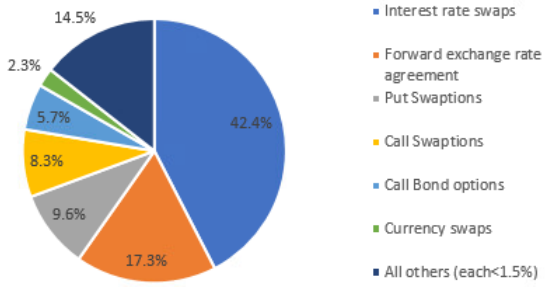
The main exposures are to interest rate and currency derivatives[13]. These two represented respectively 69% and 22% of the EUR 2.9 tr. total notional amount (as of 2021 Q4).

Figure T2.3. Insurers' derivative notional amount as of 2021 Q4: Total EUR 2.9 Trillion.

Panel A: Breakdown by risks



Panel B: Breakdown by contract



Note. Insurance SII Solo quarterly reporting from S.08.01.

Insurers use primarily Interest Rate Swaps (IRSs) to manage interest rate risk. IRSs are by far the most frequently used derivative type to manage interest rate risk (42.4% of the total). Put and Call Swaptions (17.9 %) and Call bond options (5.7%) are used to a lesser extent.

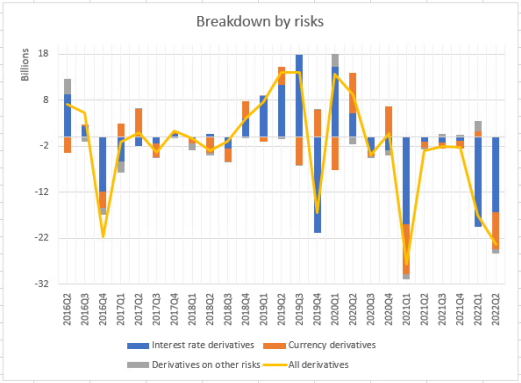
This topical focus studies variation margins to be paid and these correspond to changes in market values of derivative positions. **When changes in "market values of total derivatives" are broken down by type or risks, interest rate derivatives play by far the dominant role**. But in some

[13] Currency risk is the exposure to fluctuations in exchange rates. Consistently with sound risk management and the principle of matching, insurers should hold assets to cover anticipated costs (i.e. liabilities) in the same currency these are expected to occur. In fact, if exchange rates movements would affect assets and liabilities equally the impact on an insurer's financial risk would be neutralised. To manage by reducing or eliminating exchange rate risk insurers have also the possibility to hedge unmatched currency positions by using derivatives. Currency derivatives represent 22% of the total notional amount of derivatives. To hedge interest rate risk insurers use primarily Forward exchange rate agreements (FX) which represent 17.3 % of the total notional amount.

quarters, for example in 2021 Q1, other derivatives such as currency derivatives exhibited also material changes in market values.

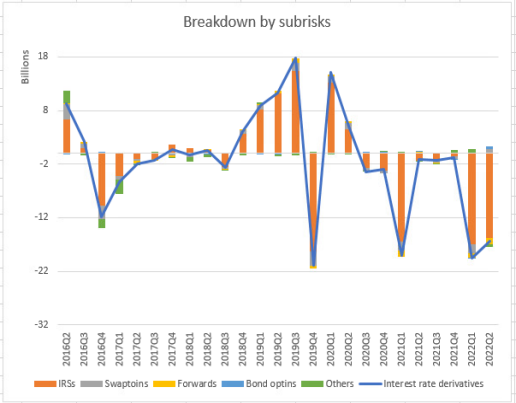
Figure T2.4. Quarter on quarter changes of SII (market) values of derivatives.

Panel A. All derivatives: Breakdown by risks.



Note. Insurance SII Solo quarterly reporting from S.08.01.

Panel B. Only interest rate derivatives.



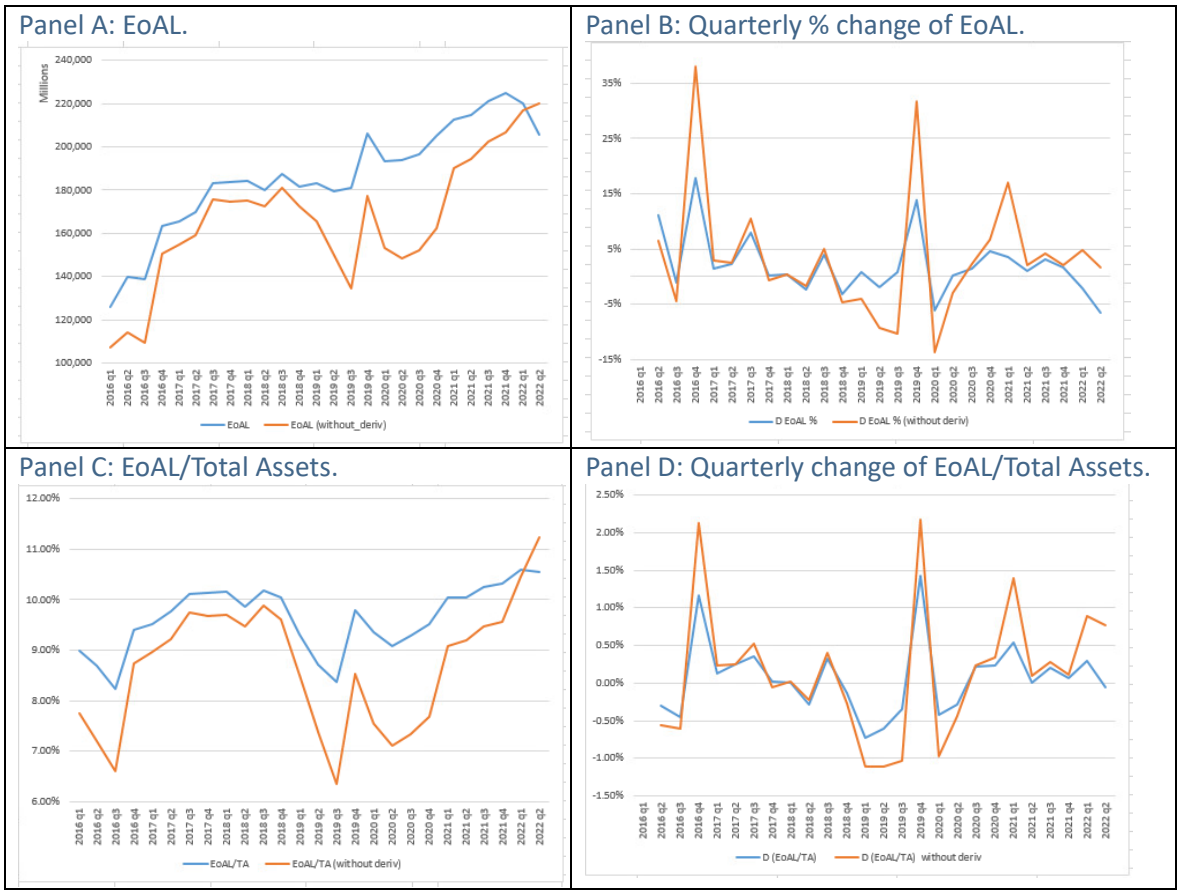
Note. Insurance SII Solo quarterly reporting from S.08.01.

When changes in "SII market values of interest rate derivatives" are broken down by type or risks, IRSs play a dominant role. Swaptions and bond options play a minor role. A regression analysis of the changes in the total value of derivatives for individual insurers shows that changes in the value of interest rate derivatives explain 83% of the total variation (IRSs alone 76 %) while currency derivatives explain 7 %.

HEDGING CAPITAL POSITIONS

There are several factors that may drive changes in insurers' capital positions, one of the main ones being the level of interest rates. When the risk-free interest rate increases the capital increases and vice versa, as liabilities tend to have longer durations than investments. When looking at insurers using derivatives and the evolution of their capital positions, as approximated by the Excess of Assets over Liabilities (EoAL), it can be seen that derivatives have consistently reduced the volatility of capital over the last six and a half years since the introduction of SII reporting.

Figure T2.5. The hedging effect of derivatives: Dynamics of Excess of Assets over Liabilities for derivative users with and without the effect of derivatives.



Note. Insurance SII Solo quarterly reporting from S.02.01. The sample consist of 98 solo insurers using derivatives. The sample is subject to data cleaning and check of materiality of SII values of derivatives with respect to an insurer total asset (i.e. >+0.4% if asset and <-0.4% if liability). These insurers cover 18% of EEA insurers' total assets. These insurers cover almost 70% of EEA insurers' total notional amount of derivatives.

Figure T.2.5: Panels A and B show the absolute levels and percentage changes for the EoAL, while Panels C and D set out the absolute levels and changes for the EoAL over total assets. Panel B shows that the risk-free rate (10Y EIOPA RFR) decreased by 98 bps (Q1: 35, Q2: 30, and Q3: 33 bps) in Q1-Q3 2019 while capital fell by -0.2% (0.9, -1.9% and 0.8%). Without offsetting gains on derivatives the drop would have been -23.7% (-4%, -9.3% and -10.4%). The hedging effect is symmetric, i.e. when the risk free-rate increases, the losses on derivatives dampen the improvement in the capital position. This symmetry might be less pronounced for insurers using bond options or swaptions which would result in comparatively lower losses in case of rising interest rates.

INTEREST RATE RISK AND INSURERS' POSITIONS ON IRS CONTRACTS

Insurer have often both long and short exposures towards the risk-free rate via IRSs because they target a desired net exposure to interest rate risk and adjust dynamically their positions accordingly. Basically, when a pay FL and get FX IRS derivative position is opened, where the contract has a maturity of for example 10 year, and subsequently there is the need to reduce or

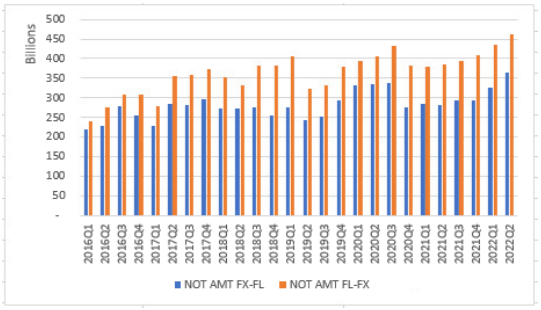
eliminate the initial exposure, then a partially or completely offsetting position on a pay FX and get FL IRS is opened matching the residual maturity of the first contract. In fact, when looking at the net exposure at the individual level and therefore also at the aggregated level no switch from long to short from one quarter to another is observed in the SII reporting data.

The most extensively used IRS type is the one in which the insurer is the floating-rate payer and fixed-rate receiver (FL-FX). FL-FX IRSs extend synthetically the duration of assets augmenting their sensitivity to interest rate changes so to match the sensitivity of the liabilities which tend to have relatively longer durations. With a net exposure towards IRS FL-FX, when the risk-free interest rate declines, the value of the derivative position increases in parallel with the value of the fixed income portfolio. When the sum of these two changes matches the changes in technical provisions, the capital position is immune to interest rate fluctuations.

In the period between 2016 and 2022 the "remaining time to maturity" at the aggregate level weighted by the notional amounts was approximately 9.2 years for FL-FX- IRS and slightly lower, i.e. 7.7 years, for FX-FL IRSs. This figure provides information on the IRS positions in relation to interest rate changes. There is very little variability from quarter to quarter, but a slightly and persistent upward trend can be observed in the sample period for both contracts.

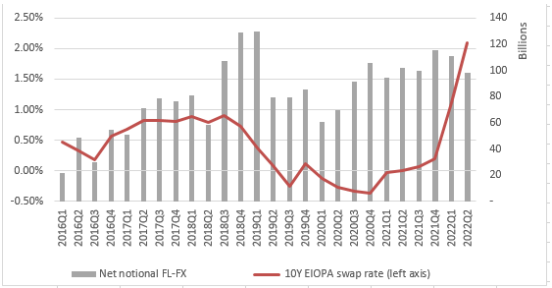
Figure T2.6 –IRSs notional amount in EUR.

Panel A: Notional amount of FX-FL and FL-FX.



Note. Insurance SII Solo quarterly reporting from S.08.01.

Panel B: Notional amount of net FL-FX.

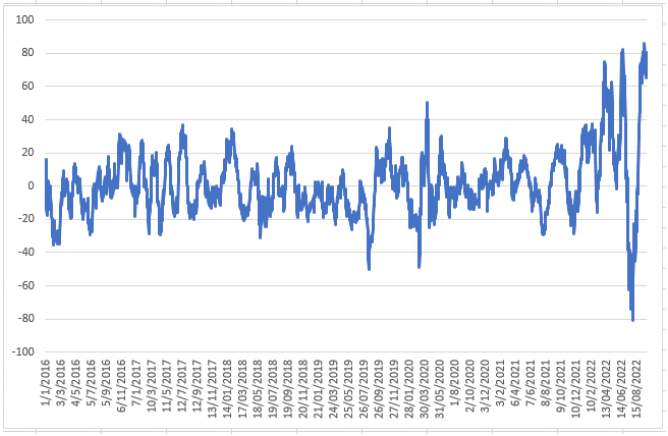


Note. Insurance SII Solo quarterly reporting from S.08.01.

It is noteworthy that given the negative duration gap the typical life insurer needs to hedge against sharp interests rate declines, even if it may prove to be short-lived. For this reason even in a situation when the risk-free rate is on an upward path because of high inflation and the normalisation of monetary policy, insurers need to remain hedged against potential rate declines. This is the likely explanation why insurers maintained a net short interest rate exposure at the end of the sample period when the risk-free rate was expected to increase (which it subsequently did), as it can be seen in Panel B of Figure T2.6.

The risk-free rate (see 10Y EIOPA RFR in Figure T2.6: Panel B) has been on an increasing trend since the end of 2021, but the volatility (see 10Y Bund rate in Figure T2.7, which can be observed at a higher frequency) is elevated and the summer 2022 saw a very large monthly drop.

Figure T2.7 –Bund yield 10Y: Monthly changes in bps.



Data: Monthly 10Y Bund yield from Refinitiv.

THE RISK-FREE RATE AND MARGINS ON IRS CONTRACTS

IRSs are subject to clearing in Central Counterparties (CCPs) and insurers need to pay an initial margin to enter the contract and variation margins (VMs) in the form of cash during its lifetime. This study focuses on variation margins on Interest Rate Swaps because these are settled via CCPs and hence margins have to be paied or are received in cash. As previously discussed, among all derivatives used by insurers IRS play by far the dominant role. Variation margins (VMs) have to be provided and are received on a daily basis[14] in case the value of the position from the perspective of the insurer declines or increases. The cash provided to CCPs remains temporarily, till the position is closed and the loss is realised, on the balance sheet of the insurer and is flagged as pledged as collateral, meaning that it is not available to be used for other purposes.

Derivatives SII value changes correlate negatively[15] with interest rate changes. The variation margin to be paid or received corresponds to the change (i.e. mkt-to-mkt profit or loss) of the derivative market value (i.e. SII value)[16]. What can be observed in SII reporting data are only the positions at reporting dates. When the risk-free interest rate increases throughout a quarter,

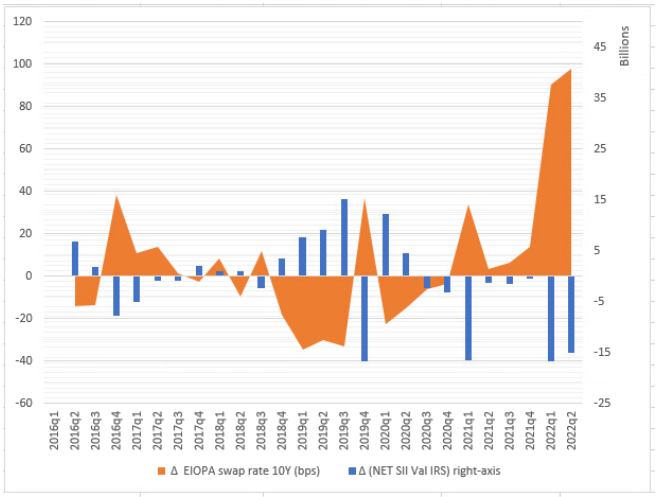
[14] An analysis on the liquidity aspects due to variation margins of IRS positions has already been published in the EIOPA Financial Stability Report of December 2019 with data for Q4 2018. Key elements of the analysis are then replicated in FSR July 2020 to reflect the evolution of IRS positions in Q4 2019 and the shock in March 2020 right after the outbreak of the Covid-19 pandemic.

[15] There is exceptionally a positive correlation in 2018 Q1 and 2020 Q3 because in this quarters the risk-free rate was very volatile and insurers rebalanced net exposures on IRS intra-period.

[16] When an IRS contract is originated its value is zero. Then if the market value subsequently becomes negative (i.e. mkt-to-mkt loss on the IRS) it means the insurer would owe to its counterparty. The contract will be settleed at maturity, but on a daily basis the clearing house that centrally clears the OTC derivative transaction collects the variation margin corresponding to the change of the market value. In SII data we observe the evolution of positions only quarter-on-quarter but margin paid daily cumulate and make up the total quarterly variations.

derivatives positions of insurers decline in value and they have to pay variation margins. This happened on an cumulative basis, within a quarter, in 2016 Q4, 2019 Q4, 2021 Q1, 2022 Q1 and Q2. When the risk-free interest rate decreases insurers receive margins (on an cumulative basis in 2019 Q1, Q2 and Q3). In case of a continued decrease (increase) in the risk-free interest rate, insurers accumulate margins in cash (have persistent cash outlays). During the quarters the sensitivity of the market value of IRSs to the risk-free rate fluctuates in line with the IRS FX-FL net exposures.

Figure T2.8. Quarterly changes of the risk-free interest rate and of SII derivatives values (=Variation Margin).



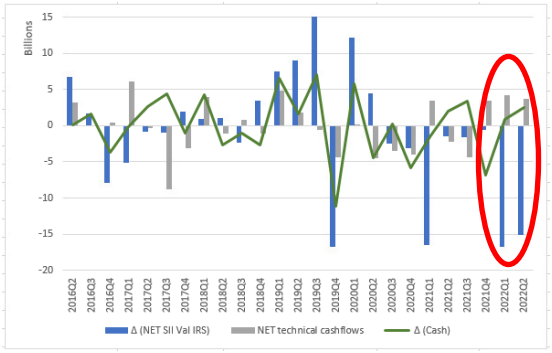
Note. Insurance SII Solo quarterly reporting from S.06.02. The sample consist of 98 solo insurers using derivatives. The sample is subject to data cleaning and check of materiality of SII values of derivatives with respect to an insurer total asset ((i.e. >+0.4% if asset and <-0.4% if liability). These insurers cover 18% of EEA insurers' total assets and almost 70% of EEA insurers' total notional amount of derivatives.

MARGINS, OTHER CASHFLOWS AND CASH POSITIONS

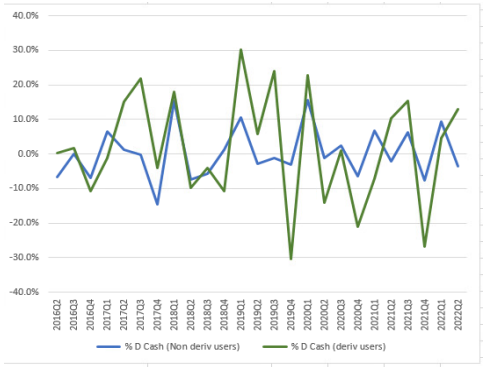
Cash positions on balance sheets of insurers tend to correlate positively with variation margins, when margins are large, with the exception of the first two quarters of 2022 (this specific period will be discussed later in the text and is the main focus of the analysis). Figure T2.9 Panel A shows q-o-q changes of cash positions in Bn. EUR, while Panel B sets out the share of cash to total assets. When margins are received or paied, cash positions increase or decrease. This correlation does not exist for non-derivative users, and the volatility of their cash positions is much lower.

Figure T2.9. Quarterly changes SII derivatives value (=Variation Margin), cash positions and other cash-flows (i.e. GWP minus claims and expenses), derivative versus non-derivative users.

Panel A. Margins on IRSs, cash positions and technical cash-flows.



Panel B. Cash positions % changes q-o-q. Derivatives users versus non-users.



Note. Insurance SII Solo quarterly reporting from S.06.02 and S.05.01. The sample consist of 98 solo insurers using derivatives.

Across quarters, technical cash-flows, defined as gross written premiums minus claims and expenses, were smaller than cash in- or out-flows for margins on IRSs. Therefore the cash needed to pay margins had to come from other sources than the current cash positions and the quarterly technical cash-flows. This shows how important it is for insurers that use derivatives to be able to manage continuously the liquidity needs associated with margin calls arising from market value fluctuations of derivatives. These calls can happen at every time and might have a severe impact also between quarterly reporting dates.

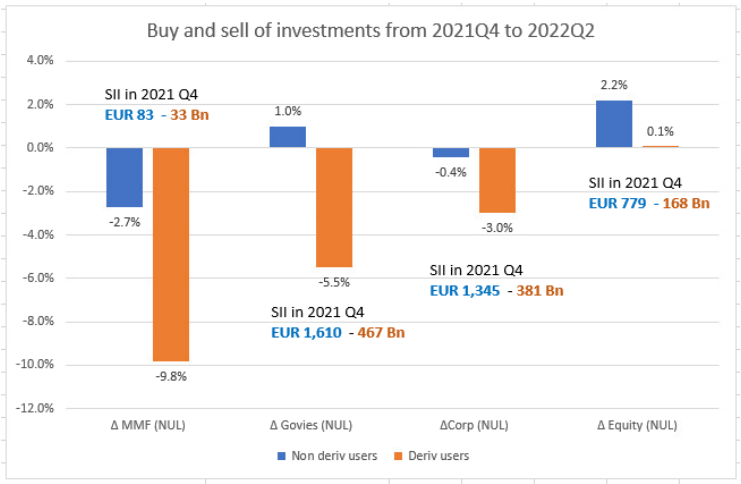
In 2022 Q1 and Q2, the risk-free rate increased by nearly 200 bps and insurers had to pay large amounts of margin to CCPs for two quarters in a row, but cash positions were not affected while technical cash-flows were positive but not large enough to cover the margin payments.

VARIATION MARGINS IN Q1 AND Q2 2022 AND LIQUIDITY SOURCES

This paragraph discusses how insurers raised the liquidity needed for paying variation margins on derivatives when the risk-free interest rate increased sharply in the first two quarters of 2022.

Derivative users increased redemptions of money market instruments (MMFs) and were net sellers of both government and corporate bonds. Similar magnitudes were never observed since the introduction of SII reporting requirements. Figure T2.10 shows that net sales were larger for derivative users in 2022 Q1 and Q2 for MMFs, government bonds and corporate bonds. This supports the hypothesis that insurers which had to pay margins liquidated investments to address their liquidity needs. Government bonds are particularly relevant because they are more material in term of total amounts; net sales of government bonds in the two quarters amounted to 5.5% relative to 2021 Q4 positions. Taken together the cash generated by net sales of the three asset classes plus technical cash-flows matched the liquidity needs generated by margins.

Figure T2.10. Buy and sell activity cumulated over 2022Q1 and Q2 relative to the Solvency II values of each investment type position in the beginning of each quarter. Only non-unit-linked investments (NUL) are considered here.



Note. Insurance SII Solo quarterly reporting from S.06.02 and EIOPA calculations.

Since the end of 2021 when inflation started to become relevant and the low yield environment was no more the main narrative, the risk-free rate has persistently increased. In Q1 and Q2 2022 insurers using derivatives faced liquidity strains and became (as opposed to the non-derivative users) net seller of bonds to generate cash to pay variation margins at a time when bond prices were declining.

Insurer are rich of liquid assets and can flexibly sell these but they could also raise cash via Repurchase agreements (repos); this means acting as sellers in repos to borrow cash lending liquid assets such as government bonds. Interestingly, derivative users make use of repos to a larger extent. An inspection of the list-of-assets shows that, for these, the average share of investments (in nominal amounts) which are pledged as collateral in repos is 3.6% as opposed to only 1.6% for the non-users. Also, it is noteworthy that derivative users exhibited a peak of 4.6 and 4.3% of assets pledged as collateral respectively in Q1 and Q2 2022, which was the period when liquidity for margin payment was mostly needed. The use of repos will be investigated in more detail when the dedicated annual reporting templates for 2022 will be available.

FINAL REMARKS

This topical focus shows that insurers are successful in hedging interest rate risk with derivatives but, more importantly, that the rising risk-free rate created a situation where they had to pay large variation margins which mirrored their mkt-to-mkt losses on IRSs.

Since end 2021 the market was expecting an increase in the risk-free rate because of high inflation and the anticipated response by central banks. But insurers need to be constantly hedged against potential interest-rate declines, which can happen at any time. The analysis of reporting data shows that when the risk-free rate increased as anticipated and the volatility remained high throughout the year insurers using derivatives, as opposed to the non-derivative users, sold bonds when prices were declining acting in a pro-cyclical manner. This topical focus discusses evidence

at the aggregated level, by showing how users and non users behaved differently when interest rates increased and, given the derivatives positions reported, margins had to be paid. An additional analysis conducted at a granular level and not reported in this topical focus, shows two additional things. First, that the individual insurers' cash positions at the beginning of the period were not sufficient to cover the margins to be paid during the period. Second that insurers with larger margin calls sold more investments and also that for each individual insurer investments liquidations (sum of net sales of MMFs, government bonds and corporate bonds) correspond approximately to the size of the margin calls. Taken together these results support the hypothesis that investments were liquididated also to pay margins on derivatives positions.

The hedging of interest rate risks using derivatives reduces the risk to the solvency of insurers making them safer on the individual level. At the same time liquidity needs resulting from variation margin calls should pose no problems for insurers as they have large holdings liquid assets which they can quickly convert to cash via a sale or a repurchase agreements (repos). But the recent events in the UK illustrate the potential risks:

First, insurers might not be always able to liquidate investments when many others are forced to do so as well, possibly creating a situation in which one or more insurers cannot meet a margin call. The consequence would be a loss of the hedge and a sudden increase of capital requirements or the need to re-establish the hedge with possibly much less favourable conditions. Second and most importantly, insurers that use derivatives might need to sell bonds when their prices are falling creating a negative feed-back mechanism. This could pose a threat to financial stability at the broad market level. Insurers, which are typically long term investors and could function as shock absorbers by holding or even expanding their bond positions in a crisis, would instead contribute to fuelling the selling pressure.

The intervention by the Bank of England stopped a vicious circle in which pension funds had to sell gilts on short notice to meet cash margin calls triggered by increased yields thus suffering substantial losses and putting further upward pressure on yields.

This is not to suggest that what happened in the UK may happen in the EU. But the events serve as a useful reminder of the impossibility to eliminate risk altogether.

Against this background it is noteworthy that insurers that are derivative users are most likely increasing their presence in repo and security lending markets to borrow cash collateralised with liquid bonds which can be used to post cash collateral. As a next step it seems therefore useful to learn more about the liquidity management by insurers and potential risks and vulnerabilities in the repo market. One element could be the analysis of data on Repos in SII QRTs and in the Securities Financing Transaction Regulation Requirements (SFTR).

3. LIFE PORTFOLIO TRANSFERS AND THE ROLE OF PRIVATE EQUITY IN THE EU INSURANCE SECTOR

In the last years, EU life insurers saw portfolio sales as an opportunity to shift strategy or transfer parts of their life portfolios in response to the profitability challenges created by the low interest rate environment and the more recent disruptions created by the pandemic and the Russian war. How the potentially low profitability of the transferred business can be reconciled with the return expectations of the portfolio buyers calls for a better understanding of business models of the latter. Based on an ad-hoc data collection, this topical focus documents the increased relevance of insurance liability portfolio transfers at the European level. It provides information on the materiality of the transactions, the characteristics of the transferred policies, and the business model that the acquirers follow.

INTRODUCTION

The European insurance market has seen an increasing trend to consolidation, especially in the life segment, over the past five years. European life merger and acquisition deals since 2016 have reached €636bn in terms of insurance liabilities transferred. The UK was the dominant market for such deals from 2016 to 2019, with around 77% of life liabilities transacted in European consolidation deals. This percentage dropped to 25% after 2020, while transactions involving European liabilities rose to 30%[17].

The willingness of insurers to sell parts of their business or entire business lines is linked to the low interest rate environment of the last years.[18] Combined with the more recent disruptions created by the pandemic it challenged the profitability of insurers. Returns on fixed income portfolios, which represent around 60% of the investments of insurers, dropped significantly. Given these headwinds some insurers saw portfolio sales as an opportunity to shift their strategy or transfer parts of their life portfolios characterized by high guarantees and consequently high capital absorption.

Parallel to the emergence of these transactions, some private equity firms (PE) have increased their exposure to life insurance portfolios through purchases of insurers or support for the acquisition of portfolios by insurers. As private markets have expanded over the last decade, private equity firms have increased their involvement in the funding of the insurance sector. In Europe, private equity played a significant role in the life and health insurance mergers and acquisitions space in 2020 and 2021. PE might be interested in investing in life and annuities

[17] European life M&A transaction value reaches $639bn | Insurance ERM, Fitch

[18] Ultra-low yields and COVID-19 crisis significantly affecting the European insurance sector | Eiopa (europa.eu)

business as they present an opportunity to add assets under management and to generate a steady stream of fee income from investment management expertise.

One of the key questions in this context is how the potentially low profitability of the transferred business can be reconciled with the return expectations of (PE) portfolio buyers. This calls for a better understanding of their business models.

Box. PE- controlled insurance – global perspective and supervisory risk assessment

The involvement of PE in the insurance business is not limited to the European market, but it is part of a global trend. In the US, the involvement of private equity in the business of life insurance dates back to the financial crisis, when several PE firms bought for the first time significantly discounted blocks of businesses from legacy carriers reeling from the sharp economic downturn. The U.S. has seen an increase of PE involvement in the insurance industry via ownership, asset management and structured deal origination.

The IAIS, through the Global Monitoring Exercise and member observations, explored the emerging risk associated with PE-owned insurers as part of the 2021 collective discussion's low interest rate environment macro prudential theme.[19] PE ownership in the life insurance sector may pose potential risks. Capturing the role of PE in insurance is challenging due to the lack of a consistent definition, the complexity and opaque nature of some of the strategies with which PE engages in insurance, and the lack of consistent and comparable data across jurisdictions. The business model and supervisory risk assessment for PE-controlled insurers revolves around the extensive use of reinsurance including of cross-border reinsurance, non-traditional investment allocation and potential herding behaviour of other insurers to retain competitiveness.

OBJECTIVE AND ACTIVITIES IN SCOPE

This topical focus discusses the increased relevance of insurance liability portfolio transfers at the European level. It provides information on the materiality of the transactions, the characteristics of the transferred policies and the business model that acquirers follow.

This is complemented by an analysis of the role that private equity funds play in such transactions and the risks that their involvement could create.

The term liability portfolio transfer refers to the practice of selling a portion of insurance business by transferring not only liabilities but also related assets and risks (e.g. market, underwriting, counterparty risks), from one insurer to another. These transactions can take various forms.

The key players in the transactions are the "portfolio sellers" and the "portfolio buyers". Their operating models are set out in stylised form in Figure T3.1. The insurers acting as portfolio

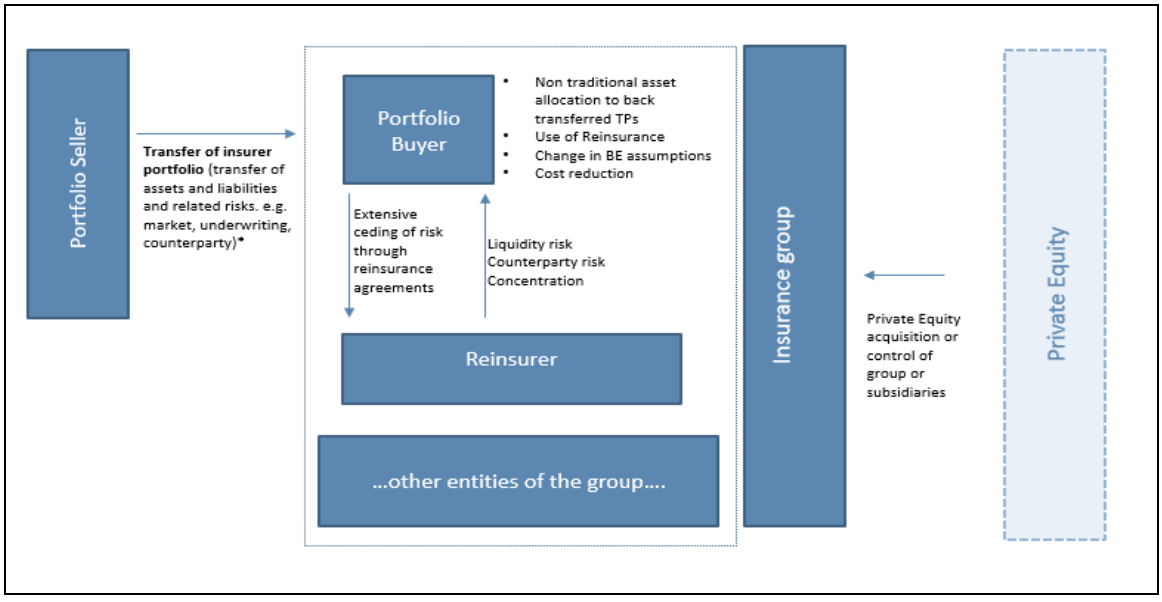
[19] GIMAR - International Association of Insurance Supervisors (iaisweb.org)

buyers can rely on liability consolidation platforms to buy the entire undertaking (i.e. change of ownership) or just the portfolio. The economic substance of these various forms remains broadly the same as the buyer focuses on the acquisition and management of pieces of insurance businesses, coming from insurers offloading their legacy liabilities. It is a business-to-business approach as opposed to liability origination platforms, which create liabilities by underwriting and selling new business.

The portfolio buyers can use specific strategies to optimize their financial position. The acquisition of multiple businesses with similar characteristics allows portfolio buyers to benefit from cost reductions through economies of scale. The portfolio buyers could make increased use of reinsurance to optimise capital. Moreover, they could increase the allocation to alternative assets with higher credit and liquidity risks.

Portfolio buyers can be backed by PE interested in investing in life businesses. The regulation allows only insurers to acquire portfolios from other insurers and the acquisition needs to be notified to the relevant National Competent Authority. Private equity firms can use different strategies to gain exposure to insurance activity, based on the level of ownership. One can distinguish between "balance sheet intensive", "balance sheet light", and partnerships/outsourcing agreements. In the "balance-sheet intensive" approach, PE uses its own balance sheet to invest directly into an insurer. This results in the highest exposure to regulatory risk. In the "balance-sheet light" approach PE limits its direct exposure by acquiring only a minority stake in an insurer. The third approach consists in a partnership (non-ownership structure), in which the PE firm takes the role of a third-party investment manager as part of outsourcing services.

Figure T3.1. Insurers' liability portfolio transfers: stylised identification of risks



EVIDENCE FROM EUROPEAN DATA COLLECTION ON INSURANCE PORTFOLIO TRANSFERS

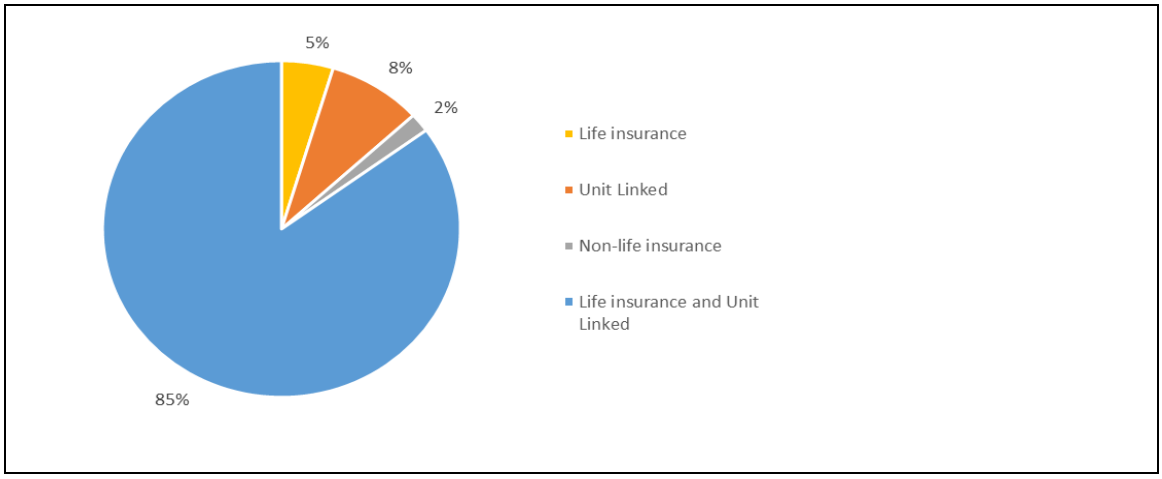
DATA SOURCES

EIOPA launched an ad-hoc data collection focused on the European insurance portfolio transactions. As the Solvency II reporting does not include information on portfolio transfers, EIOPA launched a data collection with National Competent Authorities (NCAs). The objective was to gather information on the relevance of these transactions at the European level, the specificities of the business model and potential risk implications. The evidence was collected on a best effort basis. 16 NCAs which represent the majority of the sector responded. The information provided focused on the years 2019-2021 and was complemented with data from Solvency II reporting for the analysis.

VOLUMES AND TYPE OF BUSINESS

The reports confirm an increased interest of European insurers in offloading life business in the past three years, with transactions involving a total of EUR 70 billion of transferred technical provisions (figure T3.2). 98% of transactions involved mixed portfolios, composed of life products together with unit-linked, profit-participation or annuities (see Figure 2). The transactions represented 2% of all life and unit-linked business in the EU.

Figure T3.2 Split of business lines involved in the transaction.



Source: NCAs survey. Note: Life and Unit-linked include mainly life, annuities and partly linked products that have been reported together.

The transactions were concentrated in few players and countries. While NCAs reported a total of 49 transactions involving insurers from 9 countries, two countries represented 81% of all transferred technical provisions. In terms of geographical areas, the transactions involving DE undertakings corresponded to 2.5% of registered total technical provisions, those in HU to 2.5% and those in IE to 1.5%. In 8 of the 9 countries portfolio buyers acquired only domestic portfolios, i.e. cross-country transactions played a very limited role.

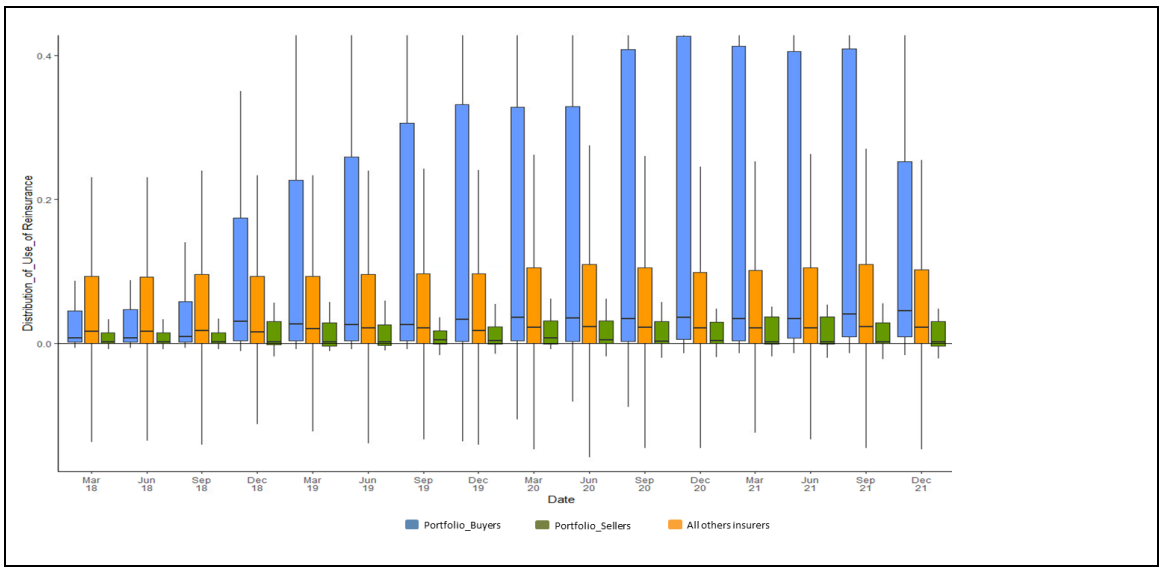
The policies transferred have an average guaranteed rate of 3% which is 2 percentage points above the average for all policies. They have long maturities of 10 or more years. The majority of liability transfers involve portfolios in run-off, i.e. they are part of business that the insurer tries to exit as profitably as possible. These characteristics suggest that insurers saw transfers as a possibility to free capital and improve their operational results after the persistent low interest rate environment made it more and more difficult to meet the high guarantees.

BUSINESS MODEL AND POTENTIAL RISK CHANNELS

According to the data reported, the portfolio buyers utilize different methods to manage the portfolio. Several jurisdictions mentioned an extensive use of reinsurance, a higher allocation to non-traditional (e.g. illiquid) assets, a stricter focus on Asset-Liability Management and the use of fixed service-fees per contract. They also reported changes in the assumptions used to determine technical provisions or changes in the method of calculating regulatory capital.

The data shows that portfolio buyers rely to a much larger degree on reinsurance than traditional insurers (Figure T3.3). Reinsurance can be used for capital optimisation, as it leads to reduced capital requirements for insurance and market risk which are only partially compensated by a higher capital requirement for counterparty default risk. While the buyer may benefit from the use of reinsurance, extensive reliance on it makes the safety of policyholder claims wholly depend on the ability of the reinsurer to meet its obligations. A higher cession rate results also in a higher counterparty and potentially liquidity risk. Moreover, the data shows that the vast majority of outward reinsurance volume is contracted with reinsurance vehicles concentrated in a specific jurisdiction. The resulting potential risks from concentration, capital arbitrage and potentially complex/less transparent governance structures are still under scrutiny.

Figure T3.3. Distribution of usage of reinsurance



Source: S02, NCAs' Survey responses. Note: Portfolio Buyer = Undertakings acquiring liability portfolio transfers, Run-off Seller: Undertakings selling liability portfolios, Others= Remaining Solo Undertakings.

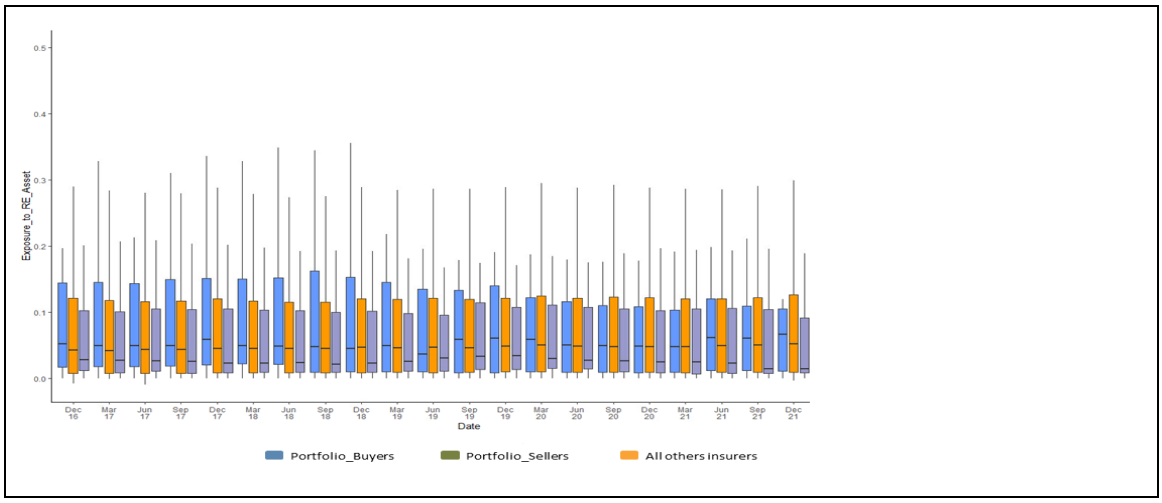
In terms of portfolio allocation, portfolio buyers need to generate sufficient returns to back the acquired portfolio with their high guaranteed rates. This could incentivise a search for yield behaviour. While no analysis of risk-adjusted returns was performed, the investment portfolios of the buyers were compared with those of other insurers to detect significant differences in exposures to asset classes potentially more profitable but at the same time inherently more illiquid or associated with higher credit risk.

In particular, portfolio buyers have increased their direct investments in real estate assets and manage substantial part of their portfolio via collective asset undertakings. We found evidence of consistently higher and increasing exposure into real estate assets, which are inherently less liquid. No evidence was found of significant differences in relative exposures to other asset classes: portfolio buyers exposures to collateralised loans obligation are very small and in line with the rest of the sector; exposures to bond with a CQS below 3 were higher than average, with level of 30% of investments in 2020, but have been declining and are currently in line with the rest of the sector.

Portfolio buyers exposures to:	Results from comparison to rest of the insurers
Real Estate Assets	Consistently higher then the median
Collateralised Loan Obligations	Currently in line with the median, but higher during 2019-2020
Investments in funds	Higher than median
Average credit quality of their direct investments	Currently in line with the median, but lower than others during 2019-2020
Investments into below investment grade assets (CQS>3)	Currently in line with the median, but lower than others during 2019-2020

These results cover only the direct investments of insurers. Portfolio buyers make however ample use of collective investment funds with the level exceeding the median for the rest of the sector. The assessment of the credit and the liquidity risks for the underlying asset in the funds is more challenging.

Figure T3.4. Distribution of Exposure to Real Estate Assets



Source: S06, S02, NCAs' Survey responses. Note: Run-off Buyer = Undertakings acquiring liability portfolio transfers, Run-off Seller: Undertakings selling liability portfolios, Others= Remaining Solo Undertakings. Real Estate Exposure= CIC9 (property), CIC32 (equity related to real estate), CIC45(real estate funds), CIC84 (Debt mortgages), CIC65 (Collateralised securities with real estate), risk , CIC55(structured note with real estate risk)

In the EU, portfolio buyers are not necessarily part of a PE-controlled group. The business model of these groups shows similarities in the use of reinsurance, investment allocation and concentrations. Given the trend to higher involvement of private equity funds in the insurance

sector, their role in the reported liability portfolio transfers was an obvious field for further analysis.[20] The results indicate that PE-controlled entities were involved in a minority of the portfolios transactions in the past 3 years, however there are limitations with respect to the available data on the ownership structure of portfolio buyers which would lead to an underestimation. In addition to the PE-controlled insurers involved in liability portfolio transfers, a group of 30 insurers with some form of PE control (ownership, control via subsidiaries) were identified. The analysis of their asset allocation and business model shows similarities to the PE-controlled portfolio buyers.

In addition to the already mentioned risks, a potential misalignment may exist for PE-controlled insurers between the shorter-term objectives/strategy of the alternative asset manager investment model and the long-term commitment necessary for fulfilling annuity/life insurance policyholder claims. Moreover, with increasing inflation and interest rate, this non-traditional business model structure may become less sustainable. On the one hand, inflation could present opportunities for private equity investors moving away from low investments returns, amid challenges to manage effectively after a period of persistently rising prices and volatility. On the other hand, private equity funds may face challenges from rising rates and costs. Dealmakers who have benefited from the run-up in multiples over the past two decades may face headwinds if valuations flatten out or even drop.

CONCLUSION

The data collected showed that life insurers offloaded liability portfolios with higher guaranteed rates to improve capital efficiency, as profitability was challenged during the persistent low interest rate environment. Portfolio buyers, sometimes backed by private equity funds, benefitted from low funding costs and saw the opportunity for generating returns by acquiring life liability portfolios. In order to achieve this goal they optimized the use of capital by adopting a non-traditional business model with high reliance on reinsurance, especially cross-border, and to some extent a non-traditional asset allocation.

The business model adopted by the portfolio buyers with the very high cession of risks to reinsurers has inherent risks resulting from concentration, capital arbitrage and complex/less transparent governance structures. The high inflation and increase in interest rates could shift private equity away from insurance sector. This raises concerns related to the sustainability of their business model and the misalignment between the interests of policyholders with long maturity contracts and private equity investors with a much shorter investment horizon.

The low volume of transactions, which are concentrated in a few countries and actors, suggests that consumer protection rather than financial stability is the more important concern at the moment. In this area, EIOPA has already issued a supervisory statement on run-off portfolios to ensure that a high-quality and convergent supervision is applied to run-off undertakings and

[20] The lack of centralized reporting is likely to underestimate the involvement of PE and doesn't allow for a complete analysis on the significance and the trend of the private equity involvement into the insurance sector, which is instead under the scope of national supervision.

portfolios while taking into account their specific nature and risks, the principle of proportionality and the prudent person principle.

While the direct relevance of portfolios transfers for financial stability seems at the moment limited, the perceived success of the strategies adopted, like the use of cross-border reinsurance and non-conventional asset allocation, could motivate other insurers to adopt them as well to retain competitiveness. Such behavior could result in concentration risk with consequence for financial stability, depending upon the level of interconnectedness and scale.

4. RISK INDICATORS FOR PHYSICAL CLIMATE CHANGE RISK FOR THE EUROPEAN NON-LIFE UNDERWRITING BUSINESS

The increase in intensity and frequency of excessive weather events caused by a warming climate is expected to remain a key source of risk and uncertainty for the European insurers. Therefore, insurers need to ensure a proper forward-looking risk management of physical climate change risk in their underwriting portfolios. This chapter presents an analysis on the potential direct effect of changes in solid mass-, wind-, water- and temperature-related hazard under a 2˚C warming scenario by mid-century on the European non-life solo insurance undertakings. Results show that European insurers' exposures are mainly concentrated in countries for which the current risk level remains relatively contained. However, even under a relatively mild warming scenario and a short-term climate-horizon, changes in weather-related patterns are expected to have a cascading effect on the non-life insurance business highlighting the need for the insurance sector to prepare for these changes.

INTRODUCTION

Extreme weather events continue to put significant pressure on non-life insurers and are expected to become more frequent and severe due to climate change. In the first half of 2022, total natural catastrophes and weather related losses amounted to approximately USD 65 bn globally.[21] As in the previous year, climate-related catastrophes in the USA dominated the statistics, where extreme tornados alone caused billions in damages. In Europe, the main threats stem from temperature-related hazards as heatwaves, droughts and wildfires. The 2022 European summer was characterized by extreme heat and arid conditions which led to water scarcity and wildfires, especially in Italy, Spain and Portugal. In August, according to data from the European Forest Fire Information System (EFFIS)[22], wildfires had burned more than 600,000 hectares in EU countries since January, burning the second-largest area since 2006.[23] Spain has been the most affected European country, followed by Romania and Portugal. Moreover, as warned by the IPCC in its latest summary for policymakers, dryland, water scarcity and wildfire damages are expected to increase in large parts of the world due to global warming.[24]

Changes to the frequency, severity and correlation of chronic and acute weather events are expected to impact the liability side of the non-life insurance portfolio in several ways. For example, changes in climate trends may introduce further uncertainty in the underlying

[21] Source: Munich Re NatCatSERVICE available at Natural disaster review for first half of 2022 | Munich Re
[22] EFFIS - Statistics Portal (europa.eu)
[23] In 2017, 987,844 hectares were burned and about 420,000 hectares had been burnt by mid-August.
[24] Source: Summary for Policymakers — Special Report on Climate Change and Land (ipcc.ch)

assumptions used to determine the technical provisions. In fact, historical data for weather related claims may no longer be appropriate due to change in climate as well changes in seasonality or increasing interconnectivity of risks (i.e. a flood after a hurricane). This could lead to higher than expected claims exacerbating the underwriting risk, which could have financial stability implications as discussed in the recent ESRB report[25]. It is therefore key for insurance undertakings to increase their understanding of the physical effects of climate change and further develop analytical capacity and modelling techniques to assess adequately the underlying risks.

This analysis combines scientific climate data, an IPCC climate scenario and undertaking-level data to define a set of risk indicators. The purpose of these indicators is to identify and highlight important effects of climate change on different non-life lines of business and geographical areas. The analysis explores how European insurance undertakings' worldwide exposures through their cross-border business written via foreign branches, may also be affected by increasing physical climate change risk.[26]

While these indicators should be interpreted as part of a broader effort to increase our ability to analyse climate change, and not a final proposal for a fixed methodology, the results presented in this article clearly illustrate how a structured analysis can improve the understanding of how non-life underwriting can be affected by the long-term effects of climate change. The analysis focuses on the impact of solid mass-, wind-, water- and temperature-related[27] changes under a 2˚C warming scenario by mid-century on nine non-life lines of business (LoBs).[28] The sample includes European non-life and composite solo undertakings.

MODELLING PHYSICAL CLIMATE-CHANGE RISKS – KEY BUILDING BLOCKS

Three key factors need to be considered for modelling physical climate change risk:

1. The *level of exposure* estimating the policyholders' insured assets at risk and their value[29],
2. the *hazard* describing the physical characteristics, such as frequency and intensity, of weather-related events, and
3. the *vulnerability* of the exposures to weather-related damages.[30]

[25] ECB/ESRB 2022, The macroprudential challenge of climate change.

[26] Gachon et al. 2022: Intersectoral Research and Multi-Risk Approaches in Québec: Systemic Risk Management and its Psychosocial Consequences. GAR2022 Contributing Paper. Geneva: United Nations Office for Disaster Risk Reduction. http://www.undrr.org/GAR2022

[27] For example, temperature-related hazard refers to extreme heat, aridity and fire weather, solid-mass to solid-mass, landslide and coastal erosion, water-related to river flood, heavy precipitation and flood, agricultural and ecological drought and coastal flood, and wind-related to severe wind storm, tropical cyclone, sand and dust storm. For further information, please see the classification available here: Annex A of the EU Taxonomy Climate Delegated Act supplementing Regulation (EU) 2020/852.

[28] The lines of business included in the analysis are: *Motor vehicle liability insurance*, *Other motor insurance*, *Marine, aviation and transport insurance*, *Fire and other damage to property insurance*, *General liability insurance*, *Credit and suretyship insurance*, *Legal expenses insurance*, *Assistance*, *Miscellaneous financial loss*. Meanwhile, Medical expense insurance, Income protection insurance, Workers' compensation insurance LoBs have been excluded.

[29] With regard to non-life insurance business, insurers' exposure is driven by the overall value of buildings, assets and properties at risk (as determined by their location and replacement value, among other factors).

[30] The vulnerability can be defined as the propensity of exposed population or physical assets to suffer adverse effects from the impact of natural events. For the non-life insurance business, the vulnerability usually refers to destruction rates or damage ratio of the insured properties and their contents.

Correspondingly, the methodology used in this analysis combines scientific and insurance reported data as input for each of the three risk components.

First, the estimation of the *level of exposure* is based on the technical provisions (TP) data related to direct business and reported under Solvency II S.17 annual reporting template. The TP data, reported by LoB and country of exposure[31], provides an estimate of the insurers' potential exposure to the four identified hazard-types.[32] To overcome some of the data limitations, the exposure indicators have been enriched with LoB-specific scores describing the likelihood for each LoB of being negatively affected by an increase in frequency and severity of natural catastrophes caused by physical climate change risk. The scores have been derived from insurers' expectations collected via the EIOPA's Pilot Exercise on Climate Change Adaptation. *Table T4.1* below summarises the different LoB-scores used in the analysis.

Table T4.1: LoB-weights based on insurers' expectations

LoB	Score
Fire & other damages to property	4.2
Miscellaneous fin. loss	2.9
Other motor	2.8
Marine, Aviation and Transport	2.4
Assistance Insurance	2.2
Credit & suretyship	1.6
General liability	1.5
Legal expenses	1.3
Motor	1.3

Source: EIOPA, EIOPA's Pilot Exercise on Climate Change Adaptation. LoB-weights range between 0 (no impact expected) and 5 (very high impact expected).

Second, the EM-DAT database, the World Bank ThinkHazard data and other sources[33] are combined to estimate the *current level of hazard* for 252 countries. In addition, 12 climate impact drivers (CIDs) [34], based on the IPCC interactive atlas, are used to define scores for 51 macro-regions

[31] The non-life technical provisions (TP) data reported by solo insurance undertakings in the S.17 annual reporting template refers to the undertakings' direct business only (excluding accepted reinsurance) and it is broken down by LoB and country of exposure. Solo undertakings and third party branches report TP data for the business written in their home countries as well as for material EEA and non-EEA exposures. Given the lack of geo-localised contract level data needed for a more detailed measurement, the Solvency II TP data is used as proxy for the "worst-case" exposure neglecting diversification benefits (i.e. assuming that all policyholders in a certain LoB are affected by climate change). Finally, the TP data is reported by risk's location only for Fire and other damage to property and Credit and suretyship LoBs. For other LoBs, the methodology assumes that the risk location coincides with country where the risk has been insured.

[32] In fact, the undertaking's underwriting business may not be entirely exposed to a specific hazard as weather-related risks may not be covered by its insurance contracts or the insured properties may not be located in hazard-prone areas.

[33] The average annual losses (AAL) for flood risk estimated by United Nations Global Assessment Report on Disaster Risk Reduction (GAR 2015) available through the WESR: RISK mapx: https://app.mapx.org/?project=MX-XVK-HPH-OGN-HVE-GGN&language=en. The share of the country land area that is a low elevation coastal zone (i.e. it is near the coast and below 5m above sea level). Source: Center for International Earth Science Information Network - CIESIN - Columbia University. 2013. Low Elevation Coastal Zone (LECZ) Urban-Rural Population and Land Area Estimates, Version 2. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/H4MW2F2J. Accessed 28 07 2022. The number of extreme windstorms (with wind speed exceeding 25.0m/s and expected to cause at least light damages) modelled for a subset of European countries as share of the total extreme European windstorms simulated by the Copernicus Climate Change Service since 1979. Source: Winter windstorm indicators for Europe from 1979 to 2021 derived from reanalysis (copernicus.eu).

[34] The 12 IPCC climate impact drivers considered in the analysis are: Landslide, Coastal erosion, Extreme heat, Aridity, Fire weather, River flood, Heavy precipitation and pluvial flood, Agricultural and ecological drought, Coastal flood, Severe wind storm, Tropical cyclone, Sand and dust storm. The CIDs do not indicate the expected future hazard levels,

describing the *expected change* in the frequency and severity under a 2˚C warming scenario by mid-century for four hazard drivers (solid mass-, wind-, water- and temperature-related). The IPCC scenario assumes intermediate GHG emissions and CO_2 emissions remaining around current levels until mid-century[35], and is considered a relatively mild physical risk scenario (see Box 1).

BOX 1: THE IPCC SHARED SOCIOECONOMIC PATHWAY SSP2-4.5 SCENARIO

The analysis aims at understanding the impact of physical climate change risk on different non-life LoBs and country of exposures under a relatively mild physical risk scenario. The IPCC Shared Socioeconomic pathway *SSP2-4.5 scenario* considered assumes intermediate GHG emissions and CO_2 emissions remaining around current levels until mid-century.

Table T4.2: Changes in global surface temperature for five IPCC emissions scenarios (best estimate)

Scenario	Near term (2021–2040)	Mid-term (2041–2060)	Long term (2081–2100)
SSP1-1.9	1.5	1.6	1.4
SSP1-2.6	1.5	1.7	1.8
SSP2-4.5	1.5	2.0	2.7
SSP3-7.0	1.5	2.1	3.6
SSP5-8.5	1.6	2.4	4.4

Source: IPCC, Climate Change 2021: The Physical Science Basis, Summary for Policymakers, Table SPM.1. SSP1.-1.9 and SSP1-2.6 scenarios assumes varying levels of net negative CO_2 emissions (i.e. when anthropogenic removals of CO_2 exceed anthropogenic emissions).

For reference, *Table T4.2* compares the *SSP2-4.5 scenario* with four alternative IPCC emissions scenarios and socio-economic assumptions, and it describes the five scenarios in terms of expected degrees of global warming.

- Under the *SSP1-1.9 scenario*, emissions would rapidly decline to net zero by about 2050, and become negative after that. This is the only scenario compatible with the Paris Agreement.
- The *scenario SSP1-2.6* assumes low GHG emissions and CO_2 emissions declining to net zero after 2050.

but rather the expected change in hazard under a 2˚ C warming scenario by mid-century reflecting increasing projected trends at either high, medium or low confidence. 1. Only down-side consequences for the non-life business are considered and mapped to a positive score (from 0 = no change in hazard to 5 very high change in hazard). Using the regional hazard scores as starting point, individual country scores are derived mapping each country to an IPCC region.

[35] The five IPCC illustrative scenarios are referred to as SSPx-y, where 'SSPx' refers to the Shared Socio-economic Pathway or 'SSP' describing the socio-economic trends underlying the scenario, and 'y' refers to the approximate level of radiative forcing (in W m–2) resulting from the scenario in the year 2100. The Interactive Atlas regional synthesis, used for the climate projections, summarises changes in the regional synthesis related to a 20–30 year period centred on 2050 and/or consistent with 2°C global warming.

- The *scenario SSP2-4.5* expects intermediate level of GHG emissions and CO_2 emissions remaining around current levels until the middle of the century.
- The *scenarios SSP3-7.0 and SSP5-8.5* assume high and very high GHG emissions and CO_2 emissions that roughly double from current levels by 2100 and 2050.

While the five scenarios lead to minor differences in the near term, the gap widens in the mid-term becoming significant towards the end of the century.

Third, the *vulnerability* component[36] is defined, at country and consequently at regional level, using the infrastructure and human habitat subcomponents of the vulnerability ND-GAIN Country Index[37] and complemented with Unbreakable Resilience Indicators[38] developed by the Global Facility for Disaster Reduction and Recovery (GFDRR)[39], a trust fund administered by the World Bank.

Defining risk scores

The risk is expressed in the scientific literature as the interaction of hazard, exposure and vulnerability[40]:

$$(1) \quad Risk = Hazard * Exposure * Vulnerability$$

The existing INFORM methodology[41], published by the European Commission and already partially used in the EIOPA pilot dashboard on insurance protection gap for natural catastrophes[42], has been adapted to derive the formula used to estimate the current risk level and the expected change in light of physical climate change.[43] In particular, hazard, exposure, vulnerability are combined using a multiplicative equation for each $insurer_i$, $country_j$, LoB_z and $hazard\ type_h$ to calculate the risk score $Risk_{i,j,z,h}$[44]:

[36] The vulnerability component is generally hazard-specific (e.g. infrastructure may for instance be vulnerable to windstorm, but not to floods or wildfire depending on the construction materials employed). However, although the vulnerability score is an average score that takes into account several hazards (e.g. heatwaves, river and coastal flood), due to the lack of granular data for all hazards considered in this analysis, the vulnerability is considered as a hazard-independent component.

[37] Notre Dame Global Adaptation Initiative // University of Notre Dame (nd.edu)

[38] 1) Estimates of asset vulnerability as weighted average of vulnerable assets of poor and non-poor people (defined as the share of value lost when an exposed assets of poor/non-poor is affected by a hazard). 2) Post-disaster support such as contingent financial instruments and delivery mechanisms for social protection.

[39] Unbreakable Web Platform | GFDRR

[40] The main concept behind the formula was inspired by the existing methodology of the dashboard INFORM published by the European Commission and readapted for the EIOPA pilot dashboard on insurance protection gap for natural catastrophes. For further information, please see: https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Risk/Methodology and The pilot dashboard on insurance protection gap for natural catastrophes | Eiopa (europa.eu)

[41] INFORM > INFORM Risk > Methodology (europa.eu)

[42] The pilot dashboard on insurance protection gap for natural catastrophes | Eiopa (europa.eu)

[43] The forward-looking element of the analysis is mainly incorporated in the hazard component through the twelve IPCC CIDs, while no specific assumption on the future evolution of the insurance sector exposures and of the country vulnerability levels is taken into account at this stage.

[44] The hazard component reflects the probability of occurrence of events of $hazard\ type_h$. The exposure component measures the level of policyholders' assets insured by $insurer_i$ in $country_j$ under LoB_z against event of $hazard\ type_h$. It is calculated as the TP of $insurer_i$ reported for LoBz and $country_j$ as share of the total TP reported by all solo undertakings writing business under LoB_z and $country_j$. The vulnerability component considers both the fragility of the socio-economic system and the lack of economic capacity (i.e. disaster management systems or other institutional and

$$(2)\quad Risk_{i,j,z,h} = Hazard_{j,h}^{1.25/3} * Exposure_{i,j,z}^{1.25/3} * Vulnerability_{j}^{0.5/3}$$

The weight for the vulnerability component is set in line with the methodology developed for the EIOPA pilot dashboard on natural catastrophes. Moreover, as the vulnerability is hazard independent it seems reasonable to assign a lower weight to this component, while equal weights have been assigned to the hazard and exposure dimensions.

For the purposes of this analysis, all scores are defined to vary between 0 and 5.

Table T4.3: Scores mapping

Score	Description
0	No hazard/exposure or vulnerability
1	**Low level** of hazard/exposure or vulnerability
2	**Medium level** of hazard/exposure or vulnerability
3	**Medium-high level** of hazard/exposure or vulnerability
4	**High level** of hazard/exposure or vulnerability
5	**Very high** level of hazard/exposure or vulnerability

Source: EIOPA.

MAIN FINDINGS – KEY RISK COMPONENTS

The sections below analyse each of the three risk components separately to better understand the drivers of the risk score.

Insurers' exposure

The sample includes 573 solo non-life and composite European insurance undertakings reporting the S.17 QRT template. The reference year for the TP data is annual 2021 data.

Figure T4.1: Evolution over time of TP by region of exposure

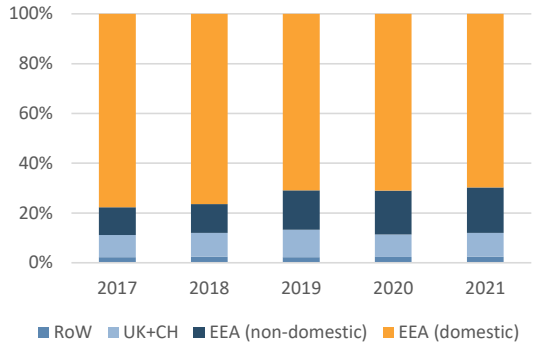
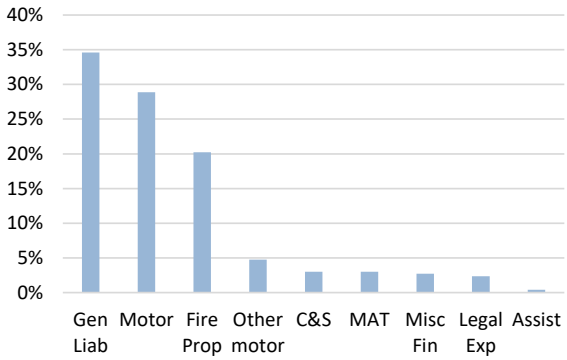


Figure T4.2: TP by non-life LoB in 2021



Source: EIOPA, SII data from Quantitative Reporting Templates annual Solo. Legend: MAT corresponds to Marine, Aviation and Transport insurance, Fire Prop to fire and other damages to property, Gen Liab to General liability

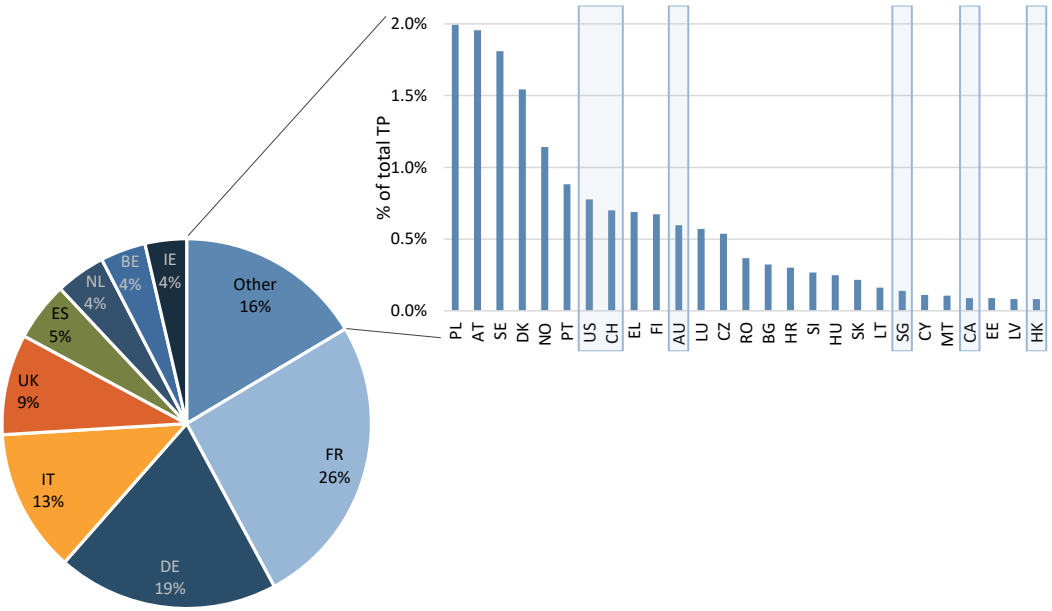
infrastructure resources) of *country*$_j$. The higher the exposure, the hazard or the vulnerability, the higher is the risk. Finally, the risk equals zero if one of the three dimensions is zero. The company-, LoB-, country- level scores are then aggregated as weighted averages according to the relevant TP shares.

insurance, C&S to Credit suretyship insurance, Legal Exp to Legal expenses and Misc Fin to Miscellaneous financial loss.

The sample covers close to 70% of the EEA non-life insurance market in terms of technical provisions accounting for more than EUR 276 bn[45].

The large majority (about 88%) of the TP used in the analysis to build the exposure indicator are related to EEA business (see *Figure T4.1*). Among the non-EEA countries of exposure, UK is by far the most relevant market, followed by the US, CH and AU. Since 2017, the share of non-EEA TP has remained largely stable at about 11%, while the share of cross-border EEA business (non-domestic EEA exposures) has increased to 18% (see *Figure T4.3*). General liability, motor, as well as fire and other damage to property LoBs are the three most significant LoBs in terms of TP and account for about 84% of total TP in scope (see *Figure T4.2*).

Figure T4.3: TP by country of exposure



Source: EIOPA, SII data from Quantitative Reporting Templates annual Solo 2021. For visualisation purposes only the most significant countries of exposure have been displayed, which account for 99% of total TP.

Hazard by type and region

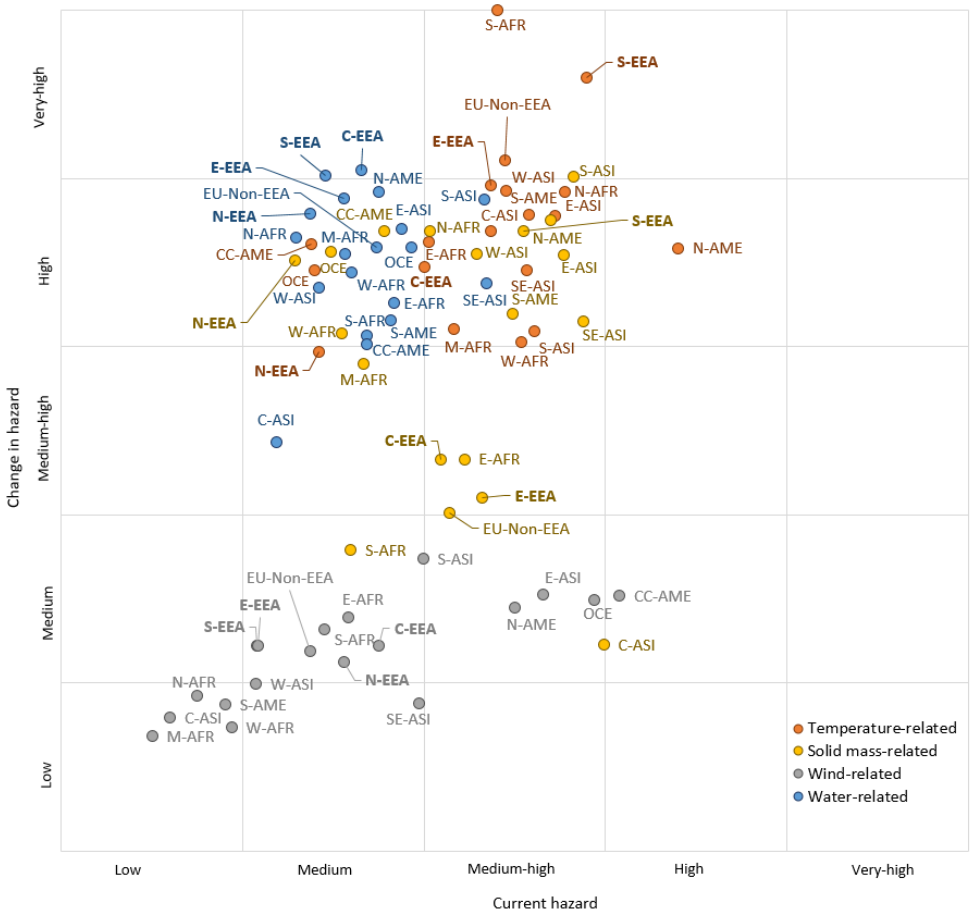
Figure T4.4 shows a graphical representation of the current hazard scores and the expected changes in hazard for each hazard driver and region. Looking at the current hazard levels, the highest temperature-related scores are observed in North America and Southern EEA countries and they are mainly driven by wildfire events in California and in Spain respectively. Although not visible from the chart, wildfire is also determining a high temperature-related score in Australia.

45 The analysis focus on the following non-life LoB: Fire & other damages to property, Miscellaneous fin. Loss, Other motor, MAT, Assistance Insurance, Credit & suretyship and General liability. The health-related LoB are out of scope of this analysis.

In Southern African and EEA countries the temperature-related hazard levels are expected to increase substantially.

Across all EEA sub-regions, the current level of water-related hazard is assessed to be at medium level, but the impact of climate change on water-related drivers is expected to be significant. The current wind-related score levels have the largest variability across regions, with Oceania, Central American and Caribbean countries reaching the highest scores. However, at the contrary of what is observed for other hazards, only low or medium changes are expected for wind-related hazard. This could be explained by the large level of uncertainty associated with the expected impact of climate change on wind speed in extra-tropical regions.

Figure T4.4: Current hazard levels and expected change in CIDs by hazard type and region



Sources: IPCC, EM-DAT, ThinkHazard, UN GAR on DRR, NASA SEDAC, C3S and EIOPA calculations. The figure shows 76 datapoints illustrating the current and expected change in hazard for 19 macro-regions and 4 hazard types (temperature-related in orange, solid-mass related in yellow, wind-related in grey and water-related in blue). EEA sub-regions are marked in bold. Legend: E-EEA refers to Eastern EEA countries, N-EEA to Northern EEA countries, S-EEA to Southern EEA countries, C-EEA to Central EEA countries, EU-Non-EEA to European non-EEA countries, AFR to African countries, AME to Americas, OCE to Oceania. Please note that the categorisation is based on the UN geographical sub-regions, more information can be found in the Annex. For visualisation purposes, the numeric scores have been assigned to qualitative categories.

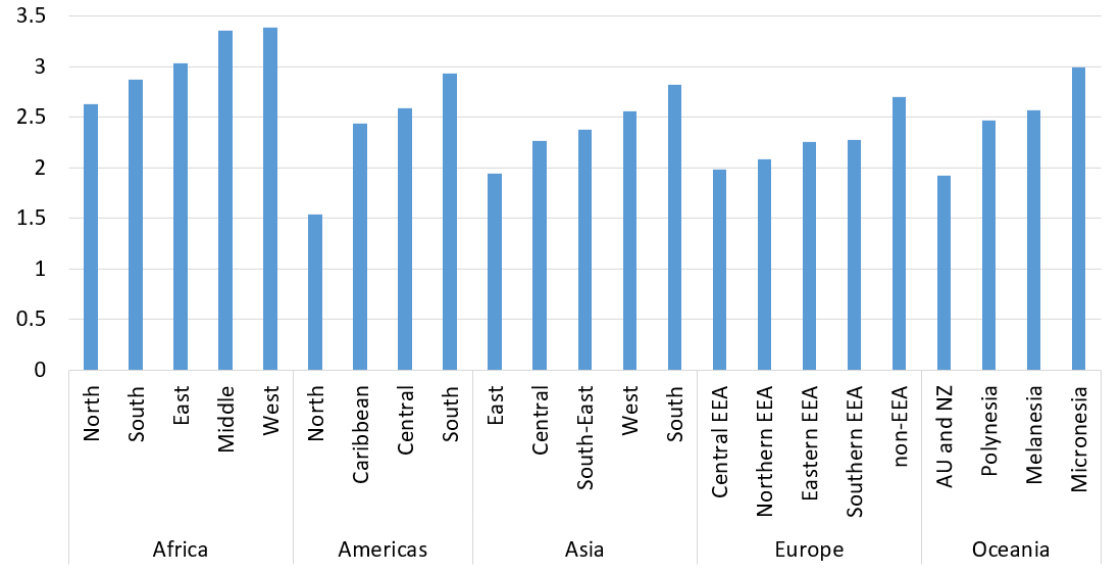
Vulnerability by region

Weather-related risk can be amplified or reduced thanks to human intervention. Globally, the exposure of population and infrastructure to hazards has increased significantly over the last

decades, mainly due to continuous urbanisation, also of hazard-prone areas. At the same time, risk reduction and protection measures can decrease the overall vulnerability of communities to disasters, in terms of limiting their physical exposure to natural hazards.

The low income and most vulnerable part of the population is the most likely to be exposed to disaster losses being more likely to depend on fragile infrastructure and housing. At the same time, they are likely to suffer higher consequences as they generally lose a much greater proportion of their income and assets than the high income part of the population when disasters strike.[46] Western and Middle African countries are characterised by the highest vulnerability scores, while the lowest scores are observed in North America sub-region (see *Figure T4.5*).[47]

Figure T4.5: Average vulnerability scores by sub-regions



Sources: ND-GAIN, Global Facility for Disaster Reduction and Recovery (GFDRR) and EIOPA calculations. Vulnerability scores range between 0 (not vulnerable) and 5 (very high). Please note that the categorisation is based on the UN geographical sub-regions, more information can be found in the Annex.

RISK ASSESSMENT OF THE EUROPEAN INSURANCE SECTOR

The current risk scores and the risk scores for the expected change in climate impact drivers are calculated considering all methodological aspects and assumptions described above. Following *formula (2)*, risk scores are obtained at the lowest level of granularity on company-, LoB- and country of exposure-level. These sub-scores are then aggregated as weighted averages according to TP shares[48]. When looking at the results by region of exposure and type of hazard in *Figure T4.6*, a positive correlation between the current risk level and the risk score for the expected change

[46] UN Global assessment report on disaster risk reduction 2022, (GAR 2022): GAR2022: Our World at Risk | UNDRR

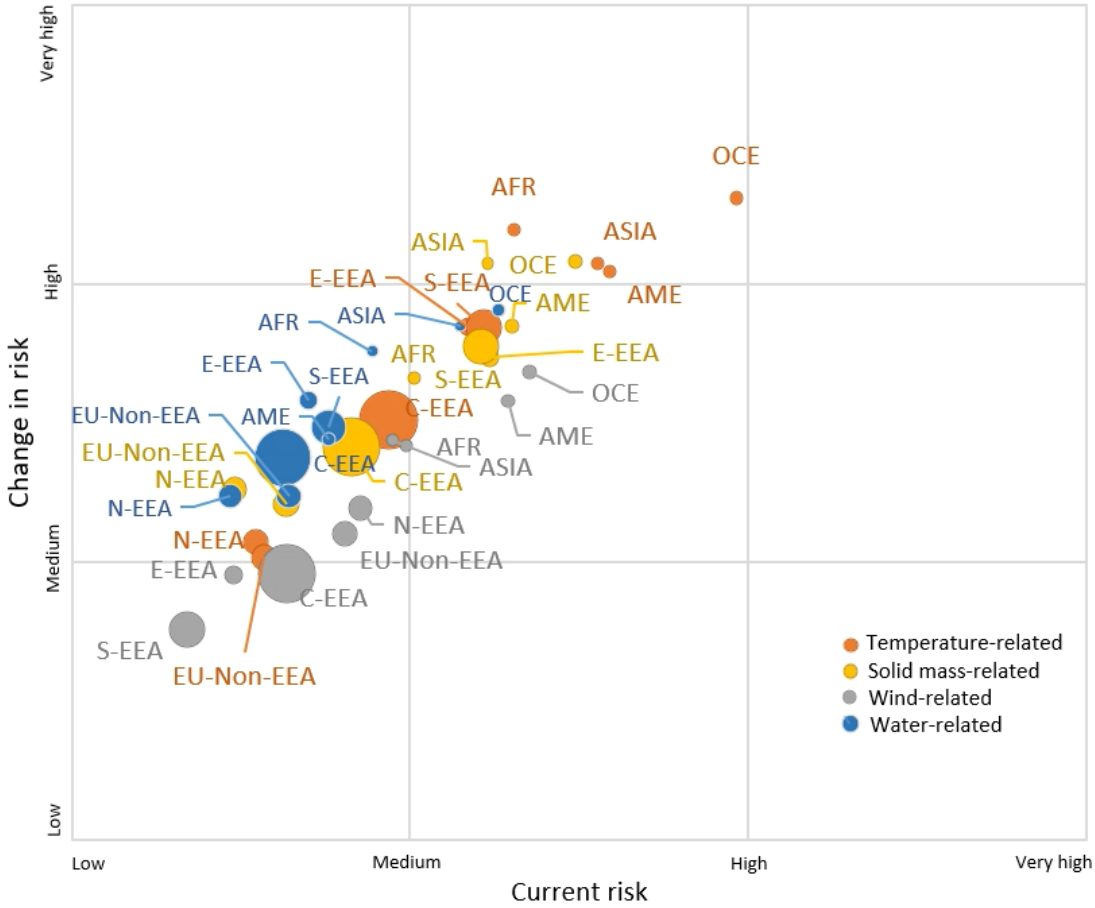
[47] While the spatial scope of analysis is global, the scale is national and for visualisation purposes the results are presented at regional level.

[48] For example, the calculation of weighted average risk scores for LoB_z and $hazard\ type_h$ over all $insurers_i$ and all countries of $exposures_j$ follows: $Risk_{z,h} = \frac{\sum_{i,j} Risk_{i,j,z,h} * TP_{i,j}}{\sum_{i,j} TP_{i,j}}$.

can be observed. The correlation coefficients vary between 0.97 for solid-mass to 1 for temperature-related hazard.

The large majority of the European insurance sector exposures is located in regions at low or medium risk. Looking at EEA sub-regions, temperature- and solid mass-related risk scores for Southern and Eastern EEA exposures are the highest among the EEA sub-regions. This can be explained by a combination of higher hazard and vulnerability levels compared to other regions. In line with what was observed for the wind-related hazard scores, the risk scores for the expected change in CIDs are the lowest. Moreover, for this hazard-type, exposures located in Northern and Central EEA are considered at higher risk compared to other EEA exposures. Finally, it is noteworthy that water-related risk scores are generally less disperse than those for other hazard-types.

Figure T4.6: Current risk scores and risk scores for the expected change in CIDs under 2℃ IPCC scenario by 2050 by hazard type and region of exposure for all non-life LoBs in scope



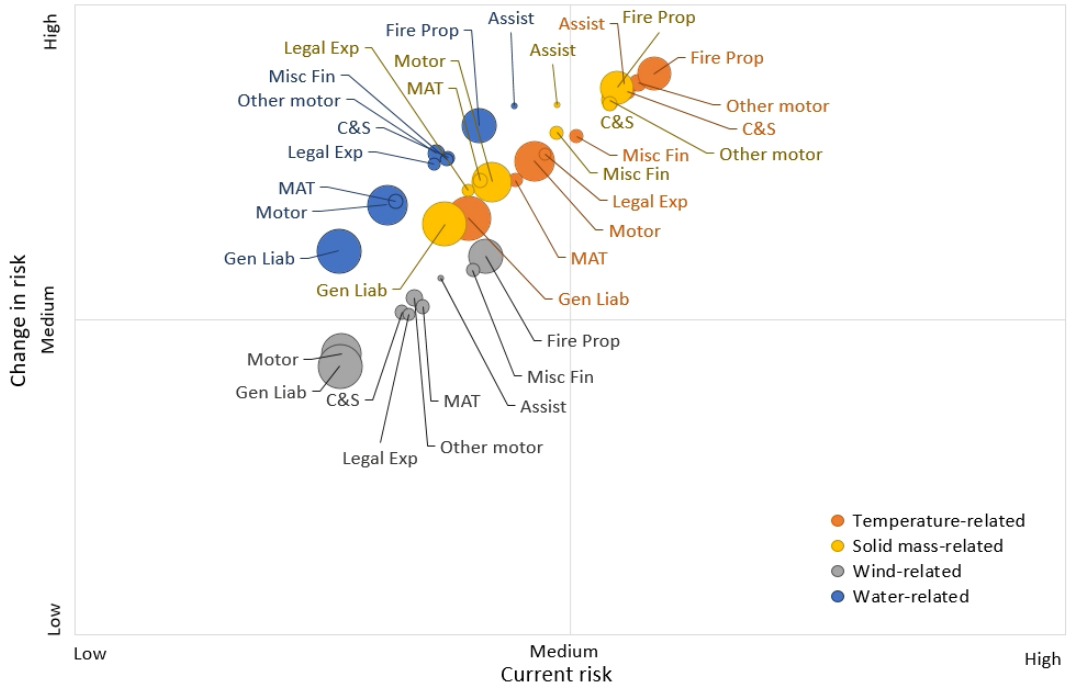
Sources: IPCC, EM-DAT, ThinkHazard, UN GAR on DRR, NASA SEDAC, C3S, ND-GAIN, GFDRR, EIOPA's Pilot Exercise on Climate Change Adaptation and EIOPA calculations. The figure shows 36 datapoints illustrating the current and expected change in risk scores for 9 macro-regions and 4 hazard types (temperature-related in orange, solid-mass related in yellow, wind-related in grey and water-related in blue). The bubble size refers to the relevance of the TP in a specific region (TP in a region as share of total TP) based on SII data from Quantitative Reporting Templates annual Solo 2021. Legend: E-EEA refers to Eastern EEA countries, N-EEA to Northern EEA countries, S-EEA to Southern EEA countries, C-EEA to Central EEA countries, EU-Non-EEA to European non-EEA countries, AFR to African countries, AME to Americas, OCE to Oceania. Please note that the categorisation is based on the UN geographical sub-regions, more information can be found in the Annex. For visualisation purposes, the numeric scores varying between less than 2

and 5 have been assigned to qualitative categories. Finally, non-EEA macro-regions (less relevant in terms of TP) have been grouped to improve the readability of the chart.

On aggregate, the line of business currently considered at highest weather-related disaster risk is fire and other damages to property LoB, which corresponds to a substantial share (20%) of European insurers' portfolio. Other relevant non-life LoBs, such as Motor (29%) and General liabilities (35%), are characterised by low-medium current risk score levels (see *Figure T4.7*).

Climate-related catastrophes may impact each non-life LoB differently. In fact, weather-related disasters do not only devastate physical assets, but they also have disruptive effect on business in the disaster zone which can propagate through supply chain disruptions. Although less relevant in terms of TP at European level, assistance insurance, other motor, credit and suretyship insurance as well as miscellaneous financial loss LoBs are expected to be significantly impacted by weather-related losses. For instance, based on the insurers' views collected via the EIOPA's Pilot Exercise on Climate Change Adaptation, higher claims rates for evacuation and repatriation services after a disaster may increase losses related to travel assistance insurance. Other motor LoB is mainly expected to be impacted by hail events, convective storms or other wind-related events, while an increase in loss of profit related claims may negatively impact miscellaneous financial loss LoB. Finally, natural disasters may affect the ability of businesses to pay their creditors and therefore expose C&S LoB to higher losses.

Figure T4.7: Current risk scores and risk scores for the expected change in CIDs by hazard type and non-life LoBs in scope



Sources: IPCC, EM-DAT, ThinkHazard, UN GAR on DRR, NASA SEDAC, C3S, ND-GAIN, GFDRR, EIOPA's Pilot Exercise on Climate Change Adaptation and EIOPA calculations. The figure shows 36 datapoints illustrating the current and expected change in risk scores for 9 LoBs and 4 hazard types (temperature-related in orange, solid-mass related in yellow, wind-related in grey and water-related in blue). The bubble size refers to the relevance of the TP in a specific LoB (TP in a LoB as share of total TP) based on SII data from Quantitative Reporting Templates annual Solo 2021. Legend: MAT corresponds to Marine, Aviation and Transport insurance, Fire Prop to fire and other damages to property LoB, Gen Liab to General liability insurance, C&S to Credit suretyship insurance, Legal Exp to Legal expenses insurance and Misc Fin to

Miscellaneous financial loss. For visualisation purposes, the numeric scores varying between less than 2 and 4 have been assigned to qualitative categories.

BOX 2: AN ALTERNATIVE APPLICATION OF RISK SCORES ON COMPANY-LEVEL

Turning to the distribution across insurers in the sample, aggregated risk scores on company-level range from low to medium-high. Typically, larger insurers, i.e. with high TP are concentrated in the higher end of the risk score distribution, which is due to the relative weight of their exposure (see *Figure T4.8*). This effect stems from the construction of the exposure indicator in *formula (2)*, which is partially defined as market share for a given LoB and country of exposure-combination. The underlying assumption is that insurers with significant market share may need to bear a significant part of the losses should a natural disaster occur in this country of exposure.

Both for current risk scores and the expected change in risk, partial internal model (PIM) users exhibit the highest median scores, followed closely by full internal model (FIM) users (see *Figure T4.9*). Considering that these are typically large companies and market leaders in their respective jurisdictions, higher scores could be expected by the relative weight of their exposures.

Figure T4.8: Distribution of expected change in risk score and share of total TP

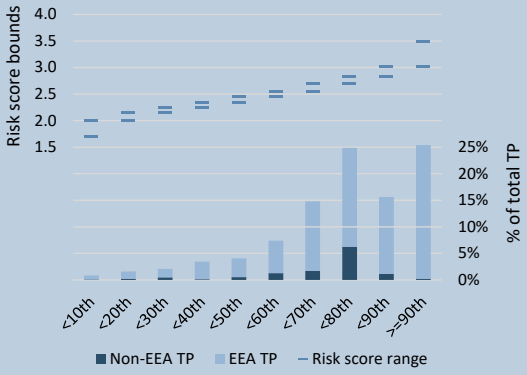
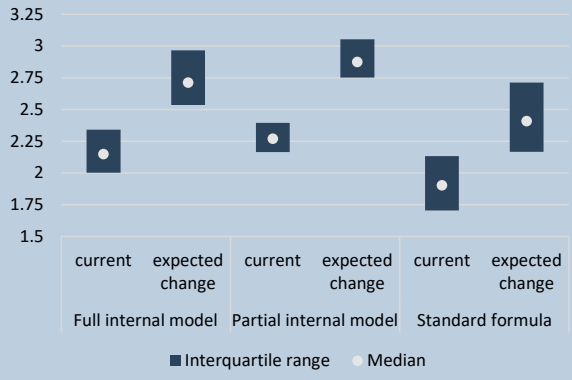


Figure T4.9: Distribution of current and expected change risk scores by type of SCR calculation



Sources: IPCC, EM-DAT, ThinkHazard, UN GAR on DRR, NASA SEDAC, C3S, ND-GAIN, GFDRR, EIOPA's Pilot Exercise on Climate Change Adaptation, SII Quantitative Reporting Templates annual Solo 2021 and EIOPA calculations. The TP data is based on SII QRT annual Solo 2021. Expected change in risk scores range between 0 (no change in risk expected) and 5 (very high change).

In terms of portfolio composition, FIM users have the majority of their TP in general liability and motor insurance, followed by fire and other damage to property LoB (see *Figure T4.10*). PIM users stand out with a relatively large share of TP in C&S LoB. Geographical exposures for PIM users are almost exclusively within the EEA, while FIM users hold the majority of non-EEA and especially TP in UK and CH (see *Figure T4.11*).

Figure T4.10: TP by LoB and type of SCR calculation

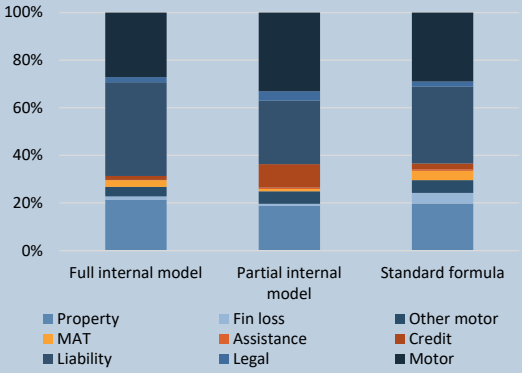
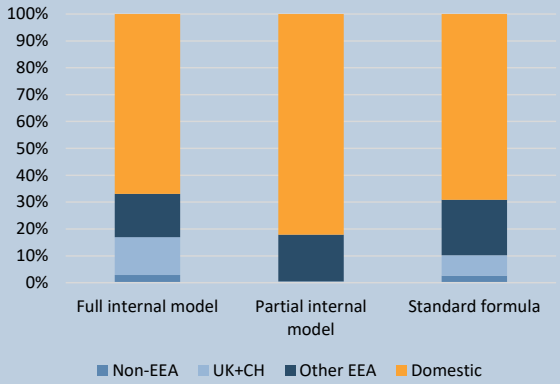


Figure T4.11: TP by region and type of SCR calculation



Source: EIOPA, SII data from Quantitative Reporting Templates annual Solo 2021.

CONCLUSIONS

This chapter uses an alternative quantitative approach to assess the current and the potential change in risk for non-life and composite undertakings in light of physical climate change risk. In particular, the methodology uses several scientific sources to estimate the impact of solid mass-, wind-, water- and temperature-related changes under a 2˚C warming scenario by mid-century on nine non-life lines of business through their worldwide exposures.

This study highlights that even under a relatively mild warming scenario and short-term climate-horizon, changes in weather-related patterns are expected to have a cascading effect on the non-life insurance business. On aggregate, the results confirm that the line of business "Fire and other damages to property", accounting for 20% of the European insurers' portfolio, is among the LoBs at highest weather-related disaster risk. Furthermore, the large majority of the European insurance sector's exposures are located in regions of low or medium risk.[49] In particular, when looking at European sub-regions, the highest scores for temperature- and solid mass-related risks are observed for Southern and Eastern countries.

[49] *Country of exposure* refers to the risk's location of non-life direct business written by solo insurance undertakings in their home country as well as in other material EEA and non-EEA countries. For Fire and other damage to property and Credit and suretyship LoBs the technical provision data is already reported by risk's location under Solvency II reporting requirement. For other LoBs, the methodology assumes that the risk location coincides with country where the risk/contract has been insured/issued.

These trends may further exacerbate the protection gap and insurability issues of weather related-risks, which could negatively impact overall economic growth by limiting the availability of investment for reconstruction or slowing down the economic recovery following extreme climate-related events.[50] On the one hand, the insurance sector can play a crucial role in closing the protection gap developing new insurance solutions and services as well as incentivising mitigating measures. On the other hand, insurers need to ensure a proper forward-looking risk management of physical climate change risk in their underwriting portfolios.

These initial results represent a first attempt of defining a methodology for physical climate change risk assessment. While the results signal possible material effects of climate change on different hazard type levels, the final risk assessment also depends on the insurance sector's actual exposure. Therefore, the evolution of insurance penetration for weather-risks going forward is an important source of uncertainty as changes to the underwriting insurance exposure composition may lead to changes in the underlying risk profile. Future and more granular data may be used to enhance this methodology and provide more solid ground for interpretations and further developments.

[50] EIOPA 2021, Climate change, catastrophes and the macroeconomic benefit of insurance

Annex T4.A – List of abbreviations

Geographical mapping

Region	Sub-region	Countries
Africa	Eastern Africa	Burundi; Djibouti; Eritrea; Ethiopia; Kenya; Comoros; Madagascar; Mauritius; Malawi; Mozambique; Rwanda; Seychelles; Somalia; South Sudan; Tanzania, united republic of; Uganda; Mayotte; Zambia; Zimbabwe
	Middle Africa	Angola; Central African Republic; Congo; Cameroon; Gabon; Equatorial Guinea; Sao Tome and Principe; Chad
	Northern Africa	Algeria; Egypt; Libya; Morocco; Sudan; Tunisia
	Southern Africa	Botswana; Lesotho; Namibia; Eswatini; South Africa
	Western Africa	Burkina Faso; Benin; Côte d'Ivoire; Cape Verde; Ghana; Gambia; Guinea; Guinea-Bissau; Liberia; Mali; Mauritania; Niger; Nigeria; Sierra Leone; Senegal; Togo
Americas	Central America	Antigua and Barbuda; Anguilla; Aruba; Barbados; Saint Barthélemy; Bermuda; Bonaire, Sint Eustatius and Saba; Bahamas; Belize; Costa Rica; Cuba; Curaçao; Dominica; Dominican Republic; Grenada; Guadeloupe; Guatemala; Honduras; Haiti; Jamaica; Saint Kitts and Nevis; Cayman Islands; Saint Lucia; Saint Martin (French part); Martinique; Montserrat; Mexico; Nicaragua; Panama; Puerto Rico; El Salvador; Sint Maarten (Dutch part); Turks and Caicos islands; Trinidad and Tobago; Saint Vincent and the Grenadines; Virgin Islands, British; Virgin Islands, u.s.
	Northern America	Canada; USA
	South America	Argentina; Bolivia; Brazil; Congo, Dem. Rep.; Chile; Colombia; Ecuador; Falkland Islands (Malvinas); French Guiana; Guyana; Peru; Paraguay; Suriname; Uruguay; Venezuela, Bolivarian Rep.
Asia	Central Asia	Kyrgyzstan; Kazakhstan; Tajikistan; Turkmenistan; Uzbekistan
	Eastern Asia	China; Hong Kong; Japan; Korea, Dem. People's Rep.; Korea, Rep.; Mongolia; Macao; Taiwan, province of china
	South-Eastern Asia	Brunei Darussalam; Indonesia; Cambodia; Lao PDR; Myanmar; Malaysia; Philippines; Singapore; Thailand; Timor-Leste; Vietnam
	Southern Asia	Afghanistan; Bangladesh; Bhutan; India; Iran, Islamic republic of; Sri Lanka; Maldives; Nepal; Pakistan
	Western Asia	United Arab Emirates; Armenia; Azerbaijan; Bahrain; Georgia; Israel; Iraq; Jordan; Kuwait; Lebanon; Oman; Palestine, state of; Palestinian territory, occupied; Qatar; Saudi Arabia; Syria; Syrian Arab Republic; Turkey; Yemen
EEA	Eastern Europe	Bulgaria; Czechia; Hungary; Poland; Romania; Slovakia
	Northern Europe	Denmark; Estonia; Finland; Ireland; Iceland; Lithuania; Latvia; Norway; Sweden
	Southern Europe	Cyprus; Greece; Spain; Croatia; Italy; Malta; Portugal; Slovenia
	Central Europe	Austria; Belgium; Germany; France; Liechtenstein; Luxembourg; Netherlands
EU-non EEA	EU-non EEA	Albania; Bosnia and Herzegovina; Belarus; Switzerland; Moldova; Montenegro; North Macedonia; Serbia; Russian Federation; San Marino; Ukraine; United Kingdom; Åland islands; Faroe Islands; Gibraltar; Monaco; Holy See (Vatican city state)
Oceania	Oceania	Australia; New Zealand; Fiji; Papua New Guinea; Solomon Islands; Vanuatu; Micronesia, Fe. Sts; Kiribati; Marshall Islands; Nauru; Palau

General

Bn	Billion
CID	Climate Impact Drivers
C3S	Copernicus Climate Change Service
DRR	Disaster Risk Reduction
EFFIS	European Forest Fire Information System
EM-DAT	Emergency Events Database
FIM	Full Internal Model
GAR	Global Assessment Report
GHG	Greenhouse gas
GFDRR	Global Facility for Disaster Reduction and Recovery
IPCC	Intergovernmental Panel on Climate Change
LoB	Line of Business
NASA	National Aeronautics and Space Administration
ND-GAIN	Notre Dame Global Adaptation Initiative
PIM	Partial Internal Model
QRT	Quantitative Reporting Templates
SEDAC	Socioeconomic Data and Application Center
SSP	Shared Socioeconomic pathway
TP	Technical provisions
UN	United Nations

ANNEX T4.B – ADDITIONAL MATERIAL AND FINDINGS

Table T4.B.1: Hazard-related and LoB specific weights

LoBs	Temperature-related	Wind-related	Water-related	Solid mass-related
Fire & other damages to property	22%	27%	32%	20%
Miscellaneous fin. loss	25%	25%	33%	18%
Other motor	13%	31%	41%	15%
MAT	16%	42%	36%	5%
Assistance Insurance	22%	27%	36%	15%
Credit & suretyship	23%	31%	31%	15%
General liability	19%	36%	36%	10%
Legal expenses	20%	36%	24%	20%
Motor	16%	19%	53%	13%

Source: EIOPA, EIOPA's Pilot Exercise on Climate Change Adaptation.

Table T4.B.2: Country-specific coverages based on TP for non-life LoB by undertaking type

	N. of undertakings	TP in scope in bn EUR	TP in scope/EEA non- life TP	TP in EEA countries	TP in UK	TP in rest of the world
Non-Life undertakings	498	218.93	67.9%	85.9%	10.9%	3.2%
Composite undertakings	75	57.88	72.9%	98.7%	0.9%	0.4%
Total	**573**	**276.81**	**68.9%**	**88.6%**	**8.8%**	**2.6%**

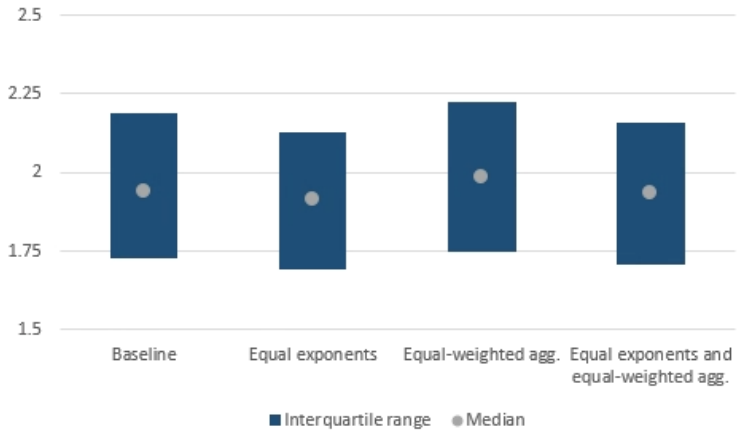
Source: EIOPA, SII data from Quantitative Reporting Templates annual Solo 2021.

ANNEX T4.C – ALTERNATIVE ASSUMPTIONS

Aside from the baseline approach, as described in *formula (2)* and based on which the main findings presented in the previous section were derived, three alternative assumptions were tested to estimate their impact on the final results. *Figure T4.C.1* provides an overview of the distribution of risk scores on company-level obtained under different assumptions:

1. An alternative version with equal exponents for the hazard, vulnerability and exposure component in *formula (2)* was calculated, which results in on average slightly lower scores.
2. When aggregating across climate drivers, i.e. over wind-, water-, temperature- and solid mass-related drivers, the baseline indicator uses weights derived from insurers' expectations collected via the EIOPA's Pilot Exercise on Climate Change Adaptation (see *Table T4.B.1* in Annex). The alternative assumption of assigning equal weights for all drivers leads to slightly higher scores on average.
3. Finally, the third option combines the two alternative versions described above assuming equal exponents to derive the risk score instead of those specified in *formula (2)*, as well as equal weights in the aggregation process across hazard types.

Figure T4.C.1: Distribution of company-level aggregated risk scores using the IPCC change in hazard under different assumptions



Sources: IPCC WGI Interactive Atlas, EM-DAT database, World Bank (WB) ThinkHazard, United Nations Global Assessment Report on Disaster Risk Reduction (UN GAR on DRR), NASA Socioeconomic Data and Application Center (SEDAC), Copernicus Climate Change Service (C3S), ND-GAIN, GFDRR, EIOPA's Pilot Exercise on Climate Change Adaptation, SII Quantitative Reporting Templates annual Solo 2021 and EIOPA calculations. Expected change in risk scores range between 0 (no change expected) and 5 (very high change). Note: The "baseline" indicator follows formula (2) and employs LoB-specific hazard-related weights (see Table B.1 in Annex B) to aggregate the scores across hazard type. The weights are derived from EIOPA's Pilot Exercise on Climate Change Adaptation and represent the industry's expectations on the relevance of each hazard type in driving the increase in physical underwriting risk exposure for different non-life LoBs. The "equal weighted aggregation" option instead uses equal weights in the aggregation process across hazard types. The "equal exponents" option assumes equal exponents to derive the risk score instead of those specified in formula (2), i.e.it follows the formula: $Risk_{i,j,z,h} = Hazard_{j,h}^{1/3} * Exposure_{i,j,z}^{1/3} * Vulnerability_{j}^{1/3}$ *and the LoB-specific hazard-related weights. The "equal exponents and equal weighted aggregation" option assumes equal exponents to derive the risk score instead of those specified in formula (2), as well as equal weights in the aggregation process across hazard types.*

APPENDIX

A.1. RESULTS OF QUESTIONNAIRE TO NATIONAL COMPETENT AUTHORITIES

In order to assess the risks and key vulnerabilities for the insurance sector, EIOPA conducted a survey based on a qualitative questionnaire among national competent authorities (NCAs).

Figure A.1.1: Risk assessment in terms of materiality for the insurance sector

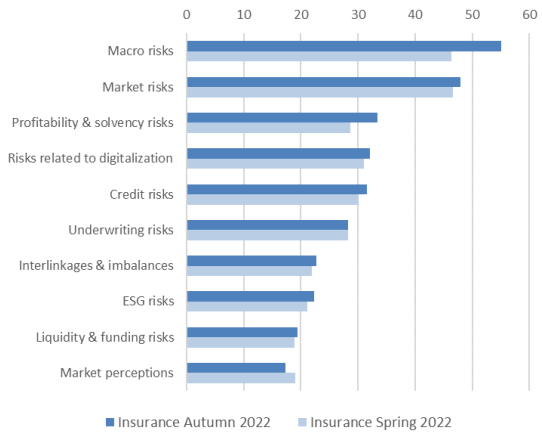
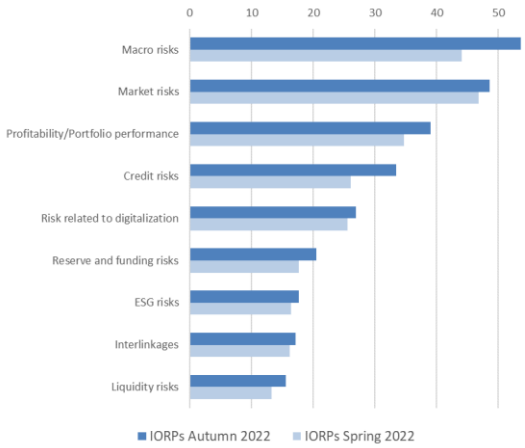


Figure A.1.2: Risk assessment in terms of materiality for the IORP sector



Source: EIOPA Insurance and pension Bottom-Up Surveys Autumn 2022

Note: Based on the responses received risks are ranked based on probability of materialisation (from 1 indicating low probability to 4 indicating high probability) and impact (1 indicating low impact and 4 indicating high impact). The figure shows the aggregation (i.e. probability times impact) of the average scores assigned to each risk. The results were subsequently normalised on a scale from 0 to 100.

Since spring the risk assessment for insurers and IORPs by NCAs had worsened with macro risks becoming the main concern as of end 2022 (Figures A.1.1 and A.1.2). The high inflation and economic slowdown already experienced in some EEA Member States will have a negative impact on the broader economic conditions in the next quarters. Moreover, a persistent high inflation could lead to a deterioration in the economic situation of households and lower their demand for insurance products. Second-round effects such as a drop in aggregate demand and a rise in unemployment could further amplify the economic downturn. Furthermore, geopolitical instability, which NCA identified as the current main driver for macro risks for insurers (Figure A.1.3) and IORPs, introduces greater uncertainty around the outlook for inflation and growth.

The macroeconomic situation can also create risks for investment portfolios. The expected deterioration in macroeconomic conditions and high interest rates, could increase market and credit risks for insurers and IORPs in the next year. Possible channels are credit rating downgrades

and drops in asset prices. For insurers interest rate risk was identified in the survey as the main driver for market risks reflecting their high exposure to fixed-income assets and interest rate guarantees in several EEA Member States. This was followed by equity risk (Figure A.1.4).

The survey finds that the exposures to non-financial companies remain the main driver for credit risks, followed by exposure to sovereigns and financials (Figure A.1.5). The potential credit downgrades or insolvencies driven by the deteriorating macroeconomic conditions, along with the large exposure to non-financial companies and sovereigns in some EEA countries could have a severe impact on insurers and IORPs highly exposed to these borrowers. With respect to sovereign debt sustainability there are some concerns due to the significant debt which some EEA countries incurred to mitigate the damage caused by the pandemic and the possible support to citizens and corporates affected by the high energy prices.

While it exacerbates the macro situation the Russian invasion of Ukraine has only very limited direct impact on insurers and pension funds as their exposures to Russia, Belarus and Ukraine are on aggregate small.

Figure A.1.3: Main drivers for macro risks[51]

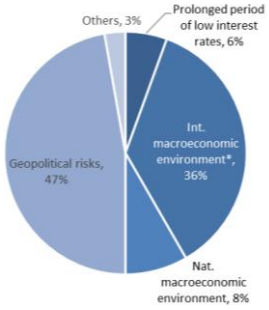


Figure A.1.4: Main drivers for market risks

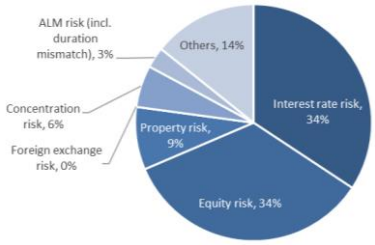
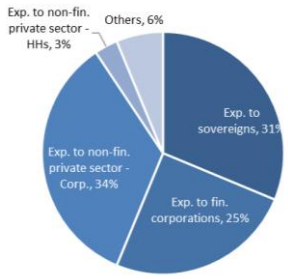


Figure A.1.5: Main drivers for credit risks



Source: EIOPA Insurance Bottom-Up Survey Autumn 2022
Note: Based on the responses received.

Profitability and solvency risks remain among the top risks for insurers (Figure A.1.1). Profitability deteriorated slightly throughout 2022 (Figure 4 in key developments and risks). According to the survey the profitability of investments portfolio remains the main driver for profitably and solvency risks (Figures A.1.6). The lower returns that insurers earned in the first half of 2022 have already lowered their profitability. Underwriting profitability remains also a concern for insurers. In terms of new business life insurers stagnated with gross written premiums dropping by 1% on a year-on-year basis. Non-life written premiums increased by 11% (Chart A.2.1 in Statistical annex). One good news is that the solvency positions for insurers as one of the main drivers for profitability and solvency risk remain robust. It actually improved throughout the

second half of 2022, in particular for life undertakings, driven by the increase of interest rates (Figure 3 in key developments and risks).

A prolonged high inflation environment could put additional pressure on the profitability of insurers, particularly for non-life business, through reduced underwriting margins (i.e. higher claim costs and higher operational costs). Moreover, profitability may suffer from the higher prices in reinsurance due to the large natural catastrophes experienced throughout 2021.

Figure A.1.6: Main drivers for profitability & solvency risks

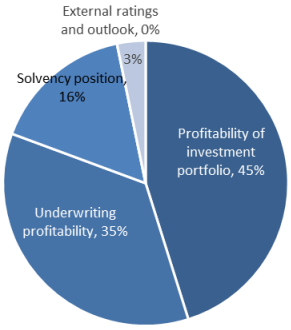
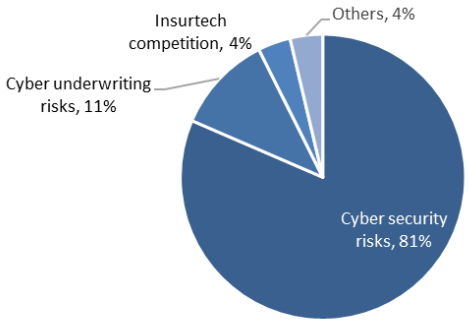


Figure A.1.7: Main drivers for risks related to digitalization



Source: EIOPA Insurance Bottom-Up Survey Autumn 2022
Note: Based on the responses received.

Portfolio performance remains according to the survey a key concern for IORPs, ranked third among the top risks (Figure A.1.2). Their returns could be negatively impacted by the potential worsening of economic conditions. Pension funds which provide guarantees in real rather than nominal terms could be particularly affected by a further escalation of inflation and put upward pressure on contributions by sponsors and members.

Risks related to digitalization are ranked in 4th place for insurers and 5th place for IORPs (Figures A.1.1 and A.1.2), with cyber security the predominant concern, in particular for insurers (Figure A.1.7). One concern related to cyber security are possible attacks on IT infrastructure in Europe as response to the economic sanctions that the EU has imposed on Russia.

The results of the survey indicate that there is an increase in cyber attacks in general as well as on European insurers. Insurers are not only potential victims but also offer protection in the growing cyber insurance market.

Risk related to digitalization are expected to further increase over the next 12 months (Figures A.1.8 and A.1.9). The geopolitical instability and uncertainty, along with the increased use of digitalization is increasing the vulnerability of the insurance and IORP sectors to risks related to digitalization. Furthermore, there is a growing awareness that the new technologies used by insurers to enhance underwriting, claims and operational management make insurers increasingly

dependent on a functioning IT. Insurers that are unable to keep up with the digital transformation might lose premium income and market share.

Going forward, macro risks are anticipated to remain the top risk with the highest expected increase in materiality over the next 12 months for the insurance and IORP sectors (Figures A.1.8 and A.1.9). The continuation of the Russian invasion in Ukraine and high inflation rates could cripple economic growth and adversely impact the investment prospects of insurers and IORPs.

Figure A.1.8: Risk assessment in terms of expected increase in materiality over the next 12 months for the insurance sector

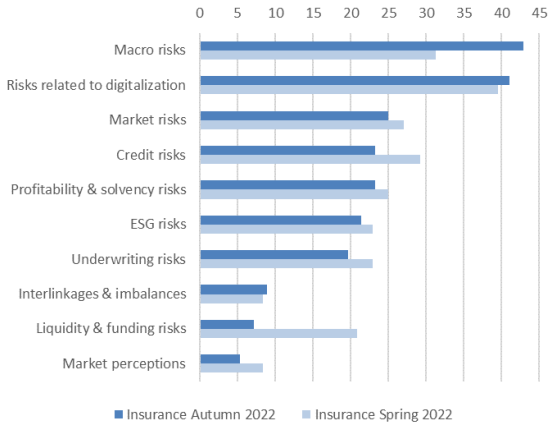
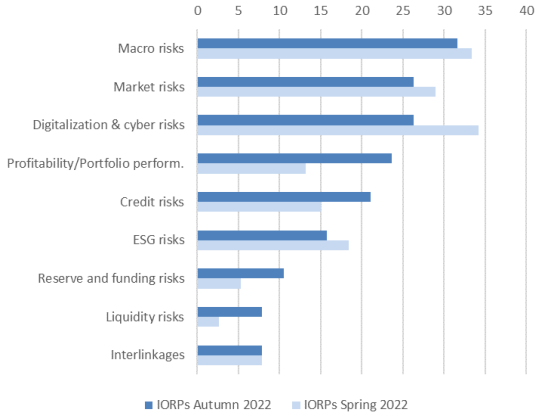


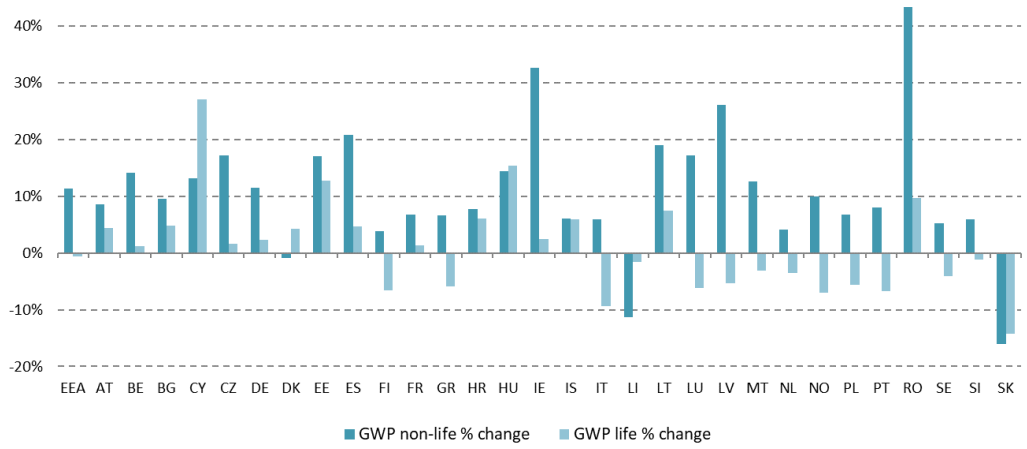
Figure A.1.9: Risk assessment in terms of expected increase in materiality over the next 12 months for the IORP sector



A.2. STATISTICAL ANNEX

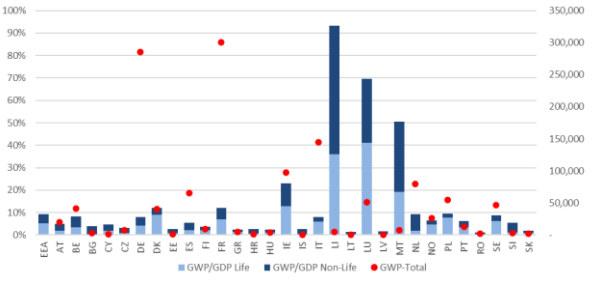
Insurance sector

Figure A.2.1: GWP growth in Q2 2022 (in %, year-on-year).



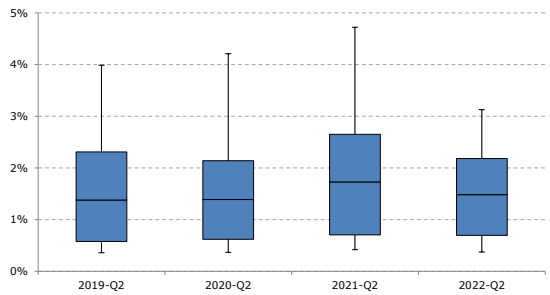
Source: EIOPA Quarterly solo.
Note: EEA weighted average. The decline observed for Slovakia for life and non-life business is driven by a structural change in the market due to the transformation of two insurance undertakings into foreign Undertakings.

Figure A.2.2: GWP as a Share of GDP (in %) (LHS) and total GWP (in EUR million) (RHS) by country in Q4 2021.



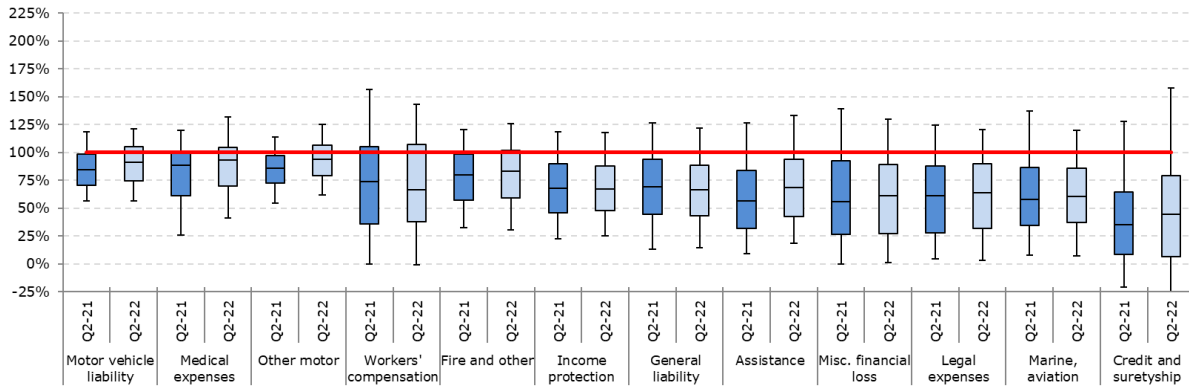
Source: EIOPA Quarterly Solo and Eurostat
Date: Q4-2021 and 2021.

Figure A.2.3: Lapse rates (in %; median, interquartile range and 10th and 90th percentile).



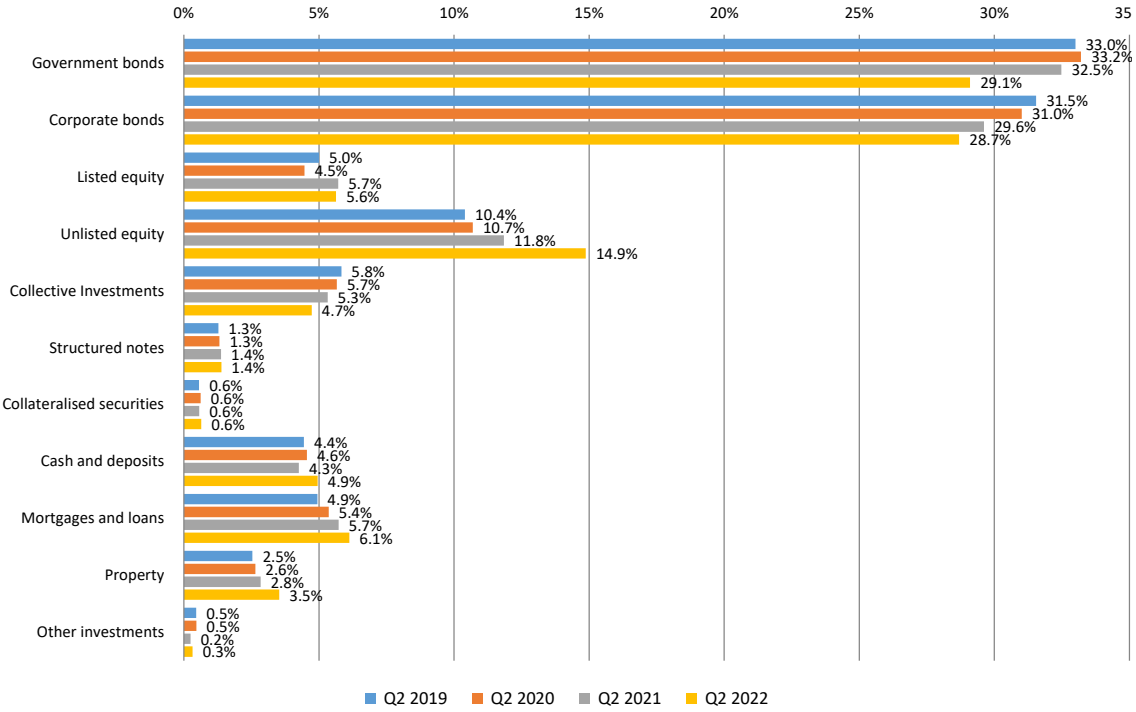
Source: EIOPA Quarterly Solo and Eurostat.

Figure A.2.4: Gross Combined Ratio across lines of business (in %; median, interquartile range and 10th and 90th percentile).



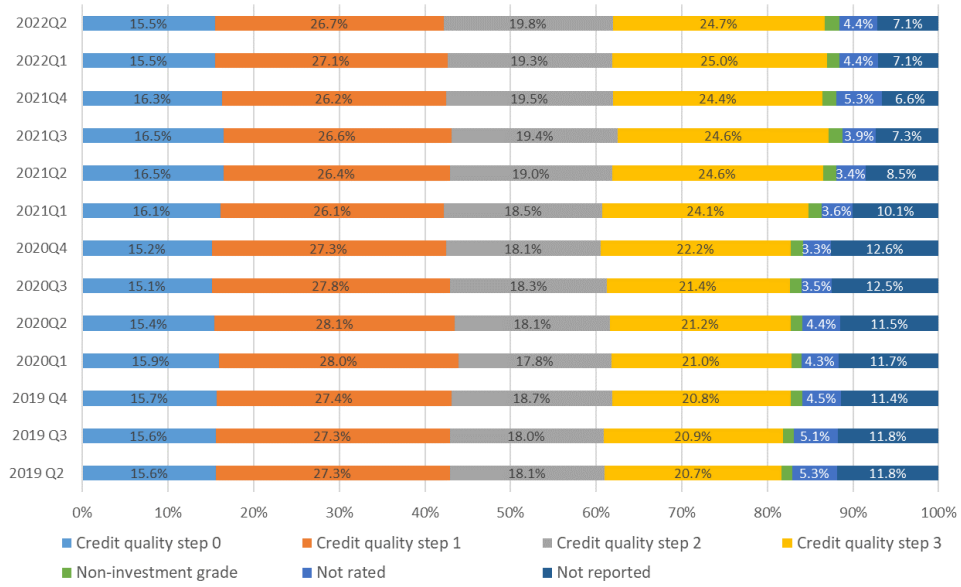
Source: EIOPA Quarterly solo

Figure A.2.5: Investment split in Q2 2022 compared to Q2 2021, Q2 2020 and Q2 2019.



Source: EIOPA Quarterly solo.

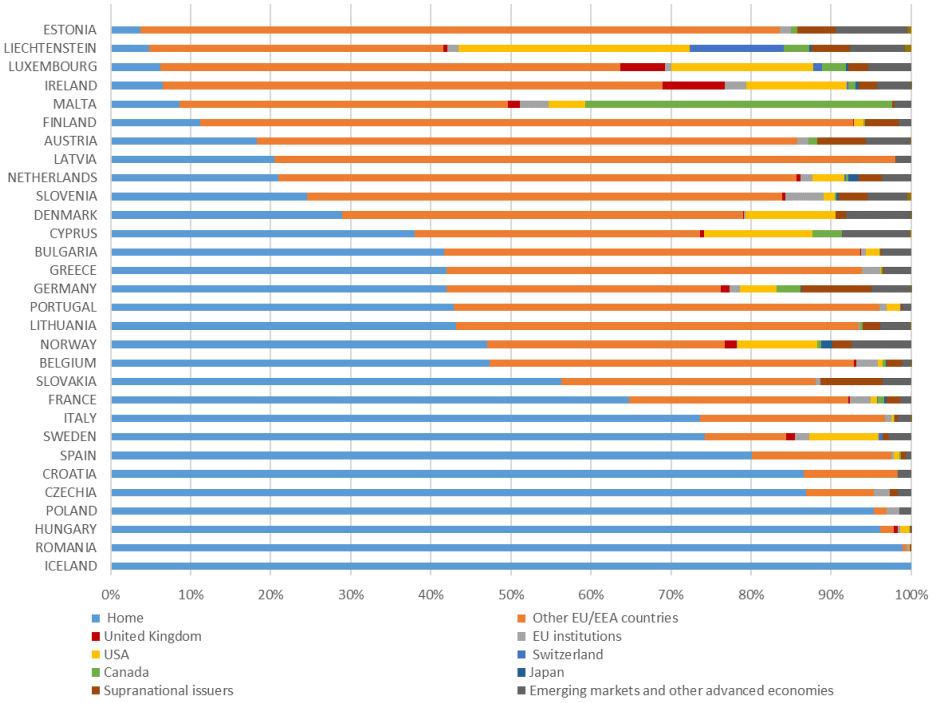
Figure A.2.6: Credit quality of bonds portfolio across countries.



Source: EIOPA Quarterly solo.

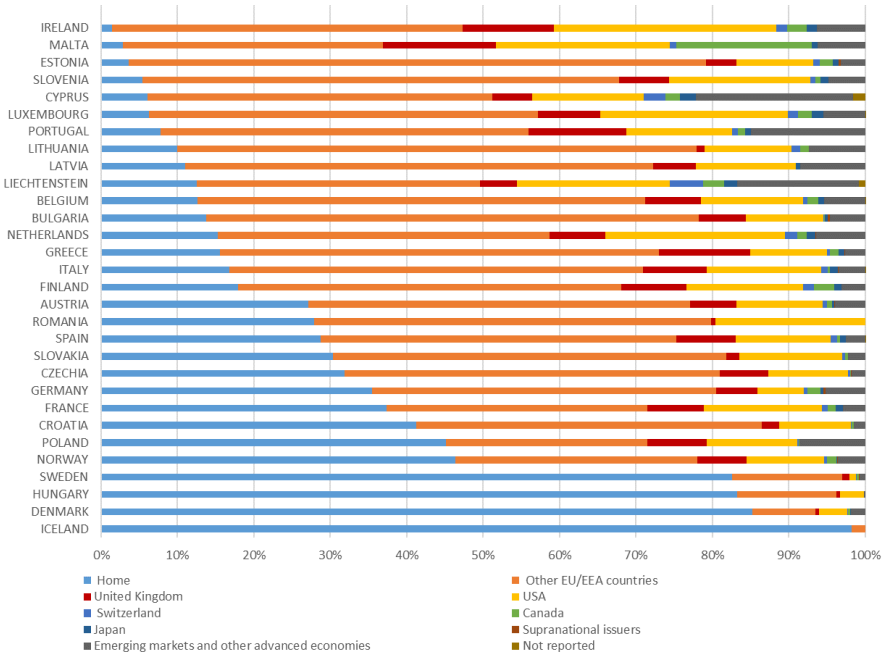
Note: Government and corporate bond portfolios combined. Assets held for unit-linked are included.

Figure A.2.7: Investment breakdown by issuer country for insurers' holdings of government bonds in Q2 2022.



Source: EIOPA Quarterly solo.

Figure A.2.8: Investment breakdown issuer country for insurers' holdings of corporate bonds in Q2 2022.



Source: EIOPA Quarterly solo.

Reinsurance sector

Figure A.2.9: Gross Written Premiums in the EEA (in EUR billion and %) in 2022-Q2.

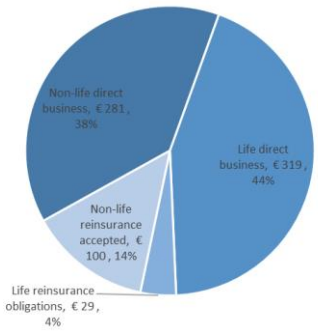
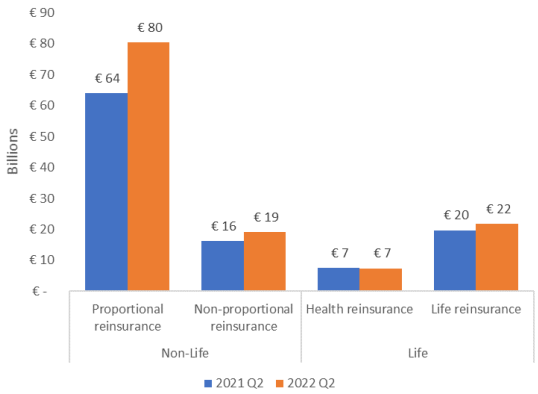


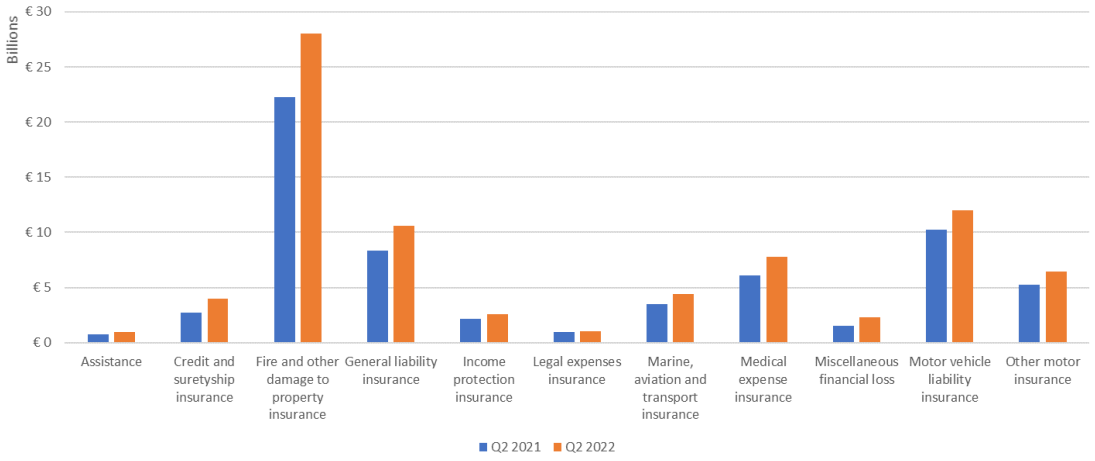
Figure A.2.10: Reinsurance Gross Written Premiums in the EEA (in EUR billion) in 2022-Q2.



Source: EIOPA Quarterly Solo.

Note for figure 2.10: Year-to-date amounts. Non-life reinsurance accepted includes proportional and non-proportional reinsurance. Life reinsurance obligations include life reinsurance and health reinsurance.

Figure A.2.11: Gross Written Premiums for non-life proportional reinsurance by Line of Business (in EUR billion).



Source: EIOPA Quarterly Solo.

Figure A.2.12: Gross Written Premiums for non-life non-proportional reinsurance by Line of Business (in EUR billion).

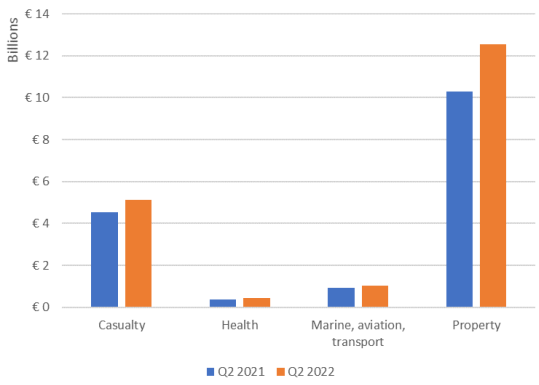
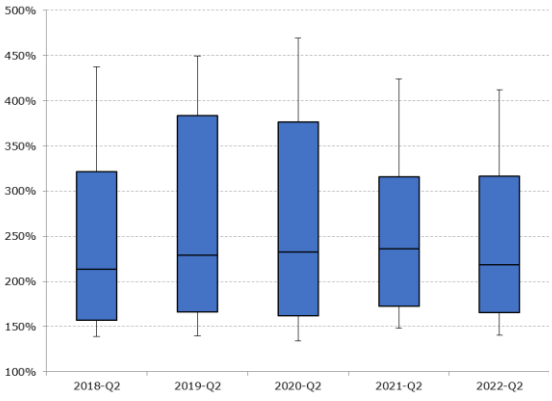


Figure A.2.13: Solvency ratio of EEA reinsurance undertakings (in %; median, interquartile range and 10th and 90th percentile).



Source: EIOPA Quarterly Solo

IORP sector[52]

Figure A.2.14: Total Assets (in EUR bn).

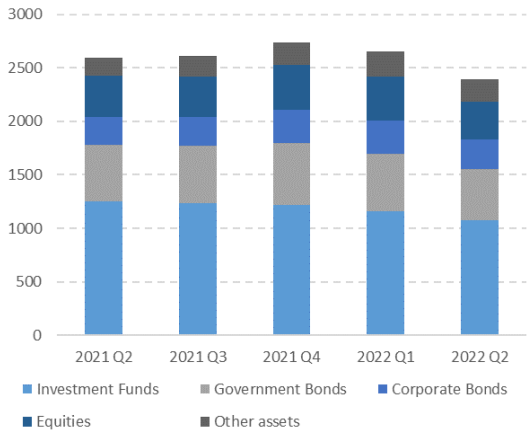
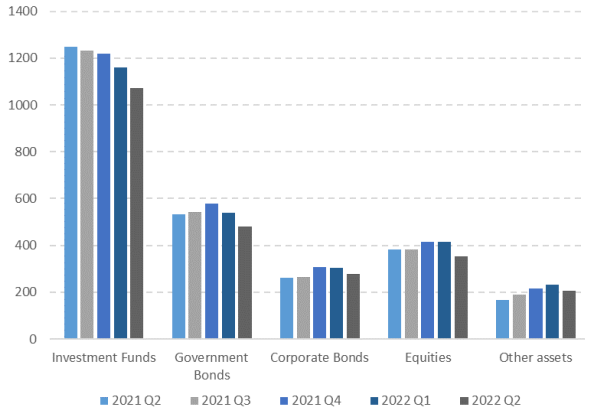


Figure A.2.15: Assets by category (in EUR bn).



Source: EIOPA IORPs statistics.

Figure A.2.16: Excess of Assets over Liabilities (in EUR bn).

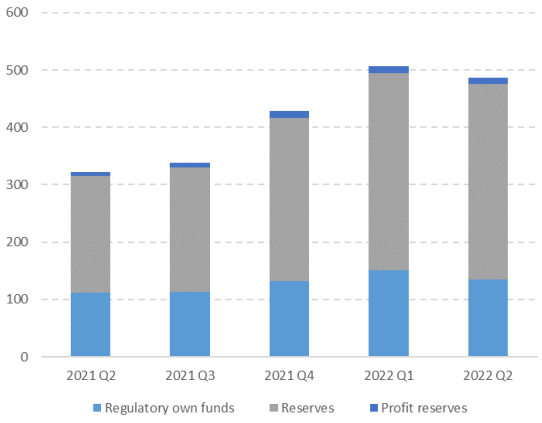
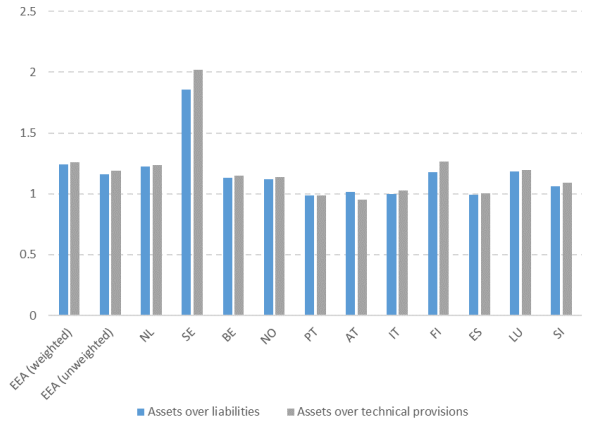


Figure A.2.17: Cover Ratios (DB schemes) by EEA Member State.

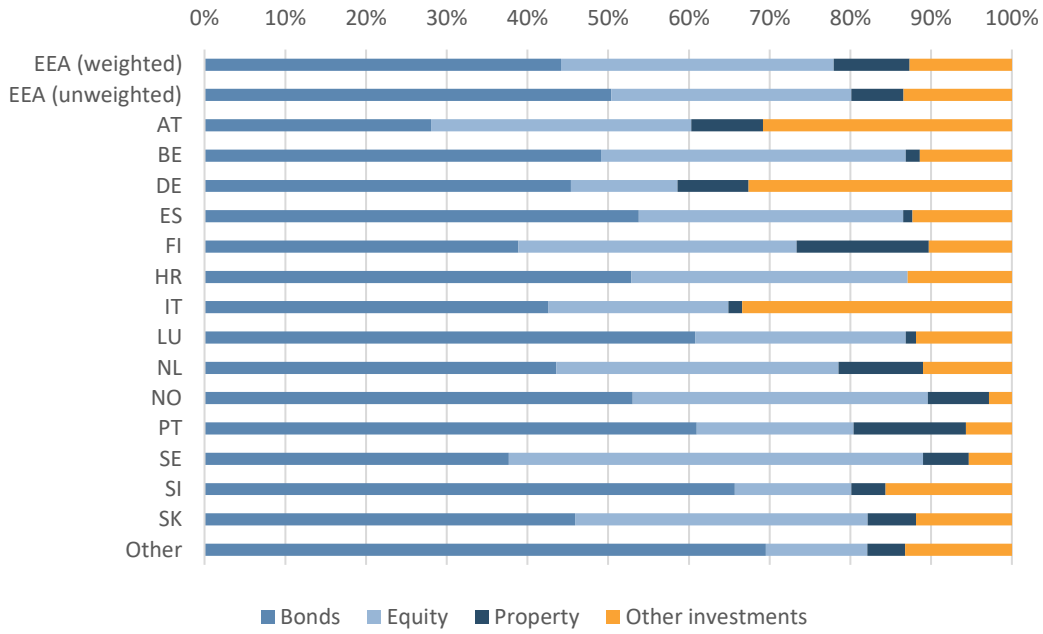


Source: EIOPA IORPs statistics.

Note for figure A.2.17: In the case of Italy, due to the discontinuation of many DB schemes, the data on technical provisions that are reported to EIOPA are set as equal to the assets held. Notice that the overall share of DB schemes in Italy is only around 2.6%. of total assets.

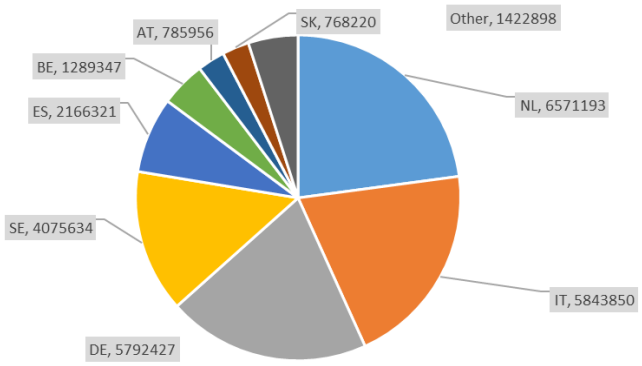
[52] Figures may be subject to revisions, as they could not cover all Member States due to missing submissions. Information on small IORPs, which are exempted from the full reporting requirements, are excluded, so that for some Member States 2019 data may not represent 100% of the total national IORPs sector.

Figure A.2.18: Asset allocation including full look through (in %).



Source: EIOPA IORPs statistics.
Date: Q2-2022.
Note: Bonds consist of government bonds, corporate bonds, mortgages and loans, debt funds and money market funds. Equity consists of direct equity, equity funds and private equity funds. Property consists of direct property, real estate funds and infrastructure funds and 'other' investments consists of direct other investments, asset allocation funds, alternative funds and other funds.

Figure A.2.19: Number of Active Members by Country (per 2021)



Note: an active member is an individual who contributes to a pension scheme that's often set up by their employer.
Source: EIOPA IORPs statistics.

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