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EUROPEAN INSURANCE
AND OCCUPATIONAL PENSIONS AUTHORITY

Financial Stability Report December 2017



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December 2017

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Foreword by the Chairman

On the same occasion last year, I referred to the implementation of Solvency II as a milestone. Today, I can state that the European insurance industry is benefitting from this modern and robust regime. With Solvency II we have the basis for a more transparent industry with harmonised data templates for supervisory reporting and enhanced public disclosure. The data availability, also reflected in the improved EIOPA Risk Dashboard, allows us to conduct deeper analyses on solvency positions, investment allocations or cross-border businesses, among others. Looking forward, longer time series will further enable a gradual improvement of the EIOPA analytical framework.



The ongoing low interest rate environment, demographic and climate changes, new technologies and digitalisation ask for a continuous adaptation of business models. Indeed, our data has shown that unit-linked business has increased for the median insurance company over the last year. Although, no major shifts in insurers' investment portfolios were observed with the introduction of the Solvency II regime, a recent EIOPA survey revealed trends that could be associated with a search-for-yield investment behaviour as a response to the low interest rate environment. More investments into non-traditional asset classes, such as infrastructure, improve asset diversification on the one hand but demand new risk management capabilities from insurers and closer supervisory attention on the other hand.

Recent hurricanes and other events may add to rising claims towards the end of the year 2017 eventually impacting the profitability and solvency levels of insurers. Hence, the EU-wide insurance stress test to be performed in 2018 will include a wider range of business and scenarios compared to the previous exercise conducted in 2016.

On the occupational pensions side, the lack of granularity of the data available in Europe seriously limit the relevance and decisiveness of the regular risk assessment and financial stability analysis of the sector. For that reason, EIOPA published a consultation paper on information requests towards the national supervisory authorities regarding the provision of occupational pensions information. This will increase efficiency and further strengthen the monitoring and analysis of the European occupational pensions sector.

Looking forward, EIOPA will continue the build up of a robust methodological framework to monitor and assess all relevant risks and mitigate them proactively.

A handwritten signature in blue ink, appearing to read 'G. Ferrero', written over a thin yellow horizontal line.

Executive Summary

The global economic outlook continues to improve but many challenges remain for insurers. Even if insurance companies seem to align their business models in order to remain profitable, the low yield environment persists. So far, especially life insurers have reduced and continue to reduce the guaranteed rates on new products in many countries or do not offer guaranteed products at all anymore. Although their exposures are dominated by fixed income assets, insurers might progressively look for alternative investments which can provide higher returns whilst being more risky at the same time. The prolonged low interest rate environment gives an incentive to search for yield. Green bonds can be an alternative for sustainable investments for the insurance sector though their risks are not clearly assessed yet.

Insurance sectors differ substantially by country as the key figures of the European insurance industry suggest. In times of low yields, unit-linked business has increased over one year and amounts to 34% in Q2 2017 for the median company as opposed to 26% in Q2 2016. EIOPA will monitor the development of these products as the risk is shifted from insurers to policyholders. Traditional investments are affected by the low yield environment. A recent EIOPA survey¹ led to the identification of a number of trends that could be associated with a search for yield behaviour. The increased exposure to more illiquid investments, such as non-listed equity, and to non-traditional asset classes, such as infrastructure, improves asset diversification but also demands new risk management capabilities from insurers and closer supervisory attention. The first observations from the impact of Solvency II point to an increase in long-term investment and to a stable allocation to equity. EIOPA will continue to closely monitor the investment behaviour of insurers to ensure that it continues to remain in line with their risk bearing capacity.

In this context, geopolitical events, environmental challenges and evolutions of financial markets are also a source of uncertainty. In this challenging environment, profitability levels remain low but positive for the time being with an EIOPA projection revealing a slightly deteriorating return on assets for 2017. Moreover, due to market conditions increasing the value of long-term liabilities, some insurers' solvency ratios will eventually be impacted. The net basic Solvency Capital Requirement (SCR) reflecting insurers' risk profiles, exhibits indeed heterogeneity at country level as does the impact of long-term guarantees (LTG) and transitional measures on SCR, both across insurance companies and countries. From a financial stability perspective, the LTG measures seem to provide a financial stability cushion potentially acting in a counter cyclical manner.

In 2017 the reinsurance market still suffered from an oversupply of capacity owing to the absence of large losses in previous years and the continuing inflow of alternative capital into the reinsurance market, both traditional and alternative. The high losses resulting from the active hurricane season 2017 will undoubtedly lead to lower technical results of many reinsurers and in some cases hinder the achievement of the profit guidance for 2017. Even though, from a short-term perspective the losses could diminish temporarily the resilience and the solvency position of the reinsurers, the reinsurance industry in total will maintain its high resilience. Given the amount of cash on the sidelines waiting to be put to work, even after hurricane Katrina, the overall capacity is to be expected to remain where it is. Until mid-2017, no major decrease in

¹ See Investment behaviour report published on 16/11/2017, https://eiopa.europa.eu/Publications/Reports/Investment_behaviour_report.pdf.

the SCR ratios due to the recent natural catastrophes can be observed and the effect on the SCR ratios of reinsurers might be revealed only in the third quarter or even towards the end of the year 2017.

In the European occupational pension fund sector, total assets increased for the euro area in 2016 as did the average rate of return. The investment allocation as well as the average cover ratios for defined benefit schemes remained broadly unchanged in 2016, whilst the overall active membership increased in the course of 2016 towards defined contribution schemes.

The report consists of two parts – the standard part and the thematic article section. The standard part is structured as in previous versions of the EIOPA Financial Stability Report. The first chapter discusses the key risks identified for the insurance and occupational pension sector. The second, third and fourth chapter elaborates on these risks covering all sectors (insurance, reinsurance and pension). The fifth chapter provides the final qualitative and quantitative assessment of the risks identified. This assessment is done in terms of the likelihood as well as the impact of their materialization using also qualitative questionnaires. Finally, one thematic article elaborates on macroeconomic fundamentals and latent factors of the EU yield curve.

About EIOPA Financial Stability Reports

Under Article 8 of Regulation 1094/2010, EIOPA is, inter alia, mandated to monitor and assess market developments as well as to undertake economic analyses of markets. To fulfil its mandate under this regulation EIOPA performs market intelligence functions regarding its supervisory universe, develops a market surveillance framework to monitor, and reports on market trends and financial stability related issues. The findings of EIOPA's market development and economic analyses are published in the Financial Stability Report on a semi-annual basis.

(Re) insurance undertakings and occupational pension funds are important investors in the financial market and provide risk sharing services to private households and corporates. In the financial markets, they act as investors, mostly with a long-term focus. Their invested assets aim to cover liabilities towards policy holders or members of pension schemes to which long-term savings products are offered, for example in the form of life assurance or pension benefits. Aside from offering savings products, (re)insurance undertakings provide risk sharing facilities, covering biometric risks as well as risks of damage, costs, and liability.

Financial stability, in the field of insurance and pension funds, can be seen as the absence of major disruptions in the financial markets, which could negatively affect insurance undertakings or pension funds. Such disruptions could, for example, result in fire sales or malfunctioning markets for hedging instruments. In addition, market participants could be less resilient to external shocks, and this could also affect the proper supply of insurance products or long-term savings products at adequate, risk-sensitive prices.

However, the insurance and pension fund sectors can also influence the financial stability of markets in general. Procyclical pricing or reserving patterns, herding behaviour and potential contagion risk stemming from interlinkages with other financial sectors, are negative examples that could potentially make the financial system, as a whole, less capable of absorbing (financial) shocks. Contrary to this, the investment behaviour of both pension funds and (re)insurers could also contribute to an overall market stabilization. Finally, (re)insurance undertakings might engage in non-traditional/non-insurance business such as the provision of financial guarantees or alternative risk transfer, which needs to be duly reflected in any financial stability analysis.

The Financial Stability Report draws on both quantitative and qualitative information from EIOPA's member authorities. Supervisory risk assessments as well as market data are further core building blocks of the analysis.

Second half-year report 2017

EIOPA has updated its report on financial stability in relation to the insurance, reinsurance and occupational pension fund sectors in the EU/EEA (European Union and European Economic Area). The current report covers developments in financial markets, the macroeconomic environment, and the insurance, reinsurance and occupational pension fund sectors as of Q2 2017, if not stated otherwise. The cut-off date for Solvency II data is 24/10/2017 and for market data 17/11/2017.

PART I

1. Key developments

The global economic outlook continues to improve but many challenges remain. European countries are slowly converging towards a more stable path of recovery sustained by domestic demand and increasing investments. However, inflation remains below the ECB target.

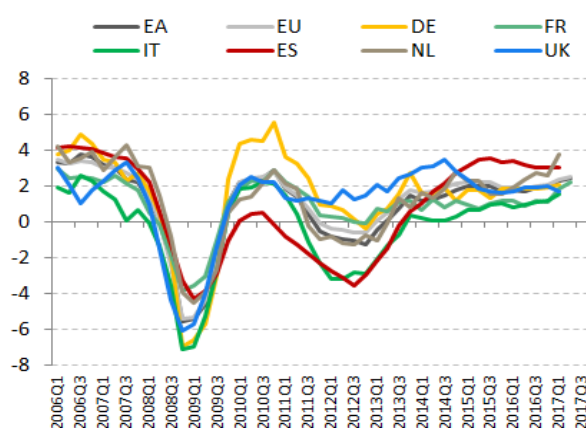
Amid a persistent low yield environment and high level of uncertainties, risks of a sudden spike scenario remain. The latest figures point to an overall low yield curve, narrowed bond spreads and high asset prices in a context of low market volatility. This outcome contrasts with a high level of political and economic policy uncertainty, such as forthcoming the conclusion of negotiations between the UK and the EU or terrorist attacks, indicating a potential mispricing of risks. Therefore, in the context of geopolitical risks, environmental challenges and financial markets vulnerabilities, new sources of investments might be needed. As technology advances, new investment options are available (see Box 1). Green bonds can be an alternative for sustainable investments for the insurance sector though their risks are not clearly assessed yet. The prolonged low interest rate environment gives incentives to search for yield. Some tendencies towards investments in new asset classes such as infrastructure, mortgages, loans, real estate could be already observed among insurance groups, although the exposure to these asset classes is small overall.

The Capital Markets Union (CMU) Action Plan provides further incentives for long-term and sustainable investments by facilitating the access of business to more diverse sources of capital and strengthening investments across borders. Additionally, new pieces of legislation and proposals are expected to address cyber threats that might have a major impact on the insurance sector. The demand for cyber insurance is expected to rise substantially and requires the insurance sector to be ready for the new upcoming opportunities and challenges.

1.1. Low yields and the risk of a sudden interest rate spike scenario

The euro area (EA) economy experiences positive economic growth despite global and domestic uncertainties but sustainability and robustness of the positive development is still uncertain. Countries are slowly converging towards a more stable path of recovery (Figure 1.1). Additionally, unemployment in the euro area continues to decrease, reaching 9% in August 2017. Investments reached pre-crisis level and are an important supportive factor for growth together with domestic demand (Figure 1.2). This might signalise positive effects of the current accommodative monetary policy, which will be extended until September 2018. However, it is still too early to evaluate whether investors' confidence is solid and robust enough to continue this trend without further monetary stimulus.

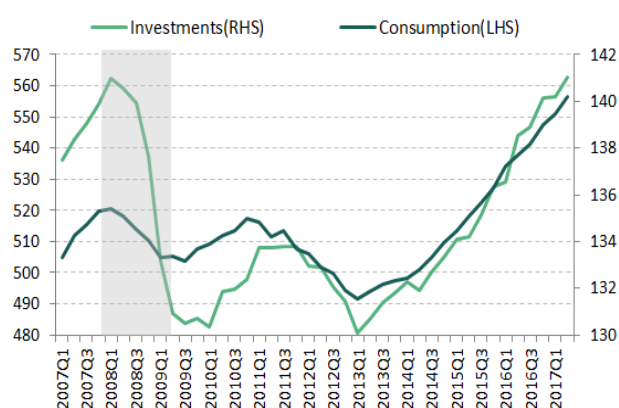
Figure 1.1: GDP growth (%)



Source: ECB

Last observation: 2017 Q3

Figure 1.2: Investments and consumption – euro area (2007 Q1=100)

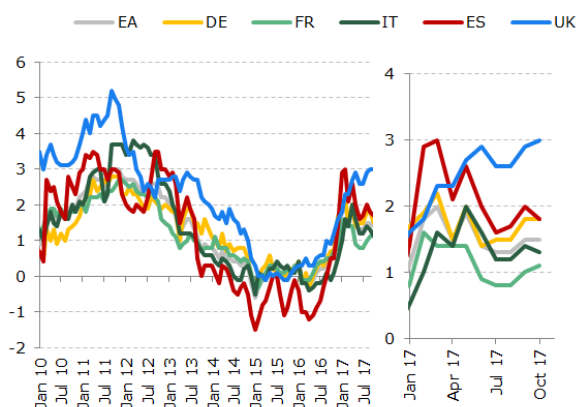


Source: ECB

Note: The shadow grey area denotes the period of crisis according to the Centre for Economic Policy Research
Last observation: 17/11/2017

Inflation has moved upwards in recent months but still remains below the ECB target of 2% (Figure 1.3). Core inflation, which excludes food prices and energy, has remained at low levels with high heterogeneity among countries (Figure 1.4). In October 2017, the Harmonised Index of Consumer Prices (HICP) year-on-year was 0.9%, remaining relatively stable when compared to the previous year. According to the European Commission, inflation is forecast to 1.6% at the end of 2017, but to decrease to 1.3% in 2018 assuming a drop in oil prices.²

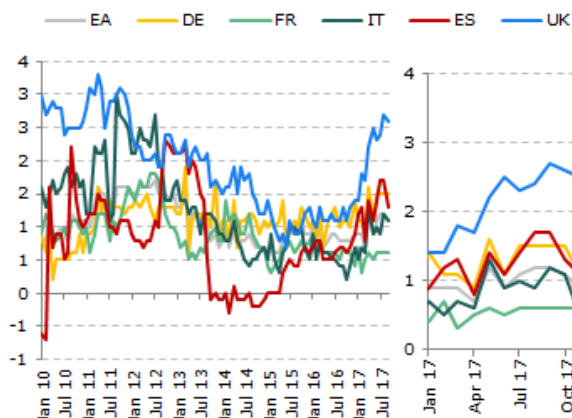
Figure 1.3: Inflation: HICP – All items (annual rate of change in %)



Source: ECB

Last observation: October 2017

Figure 1.4: Inflation: Core (annual rate of change in %)



Source: ECB

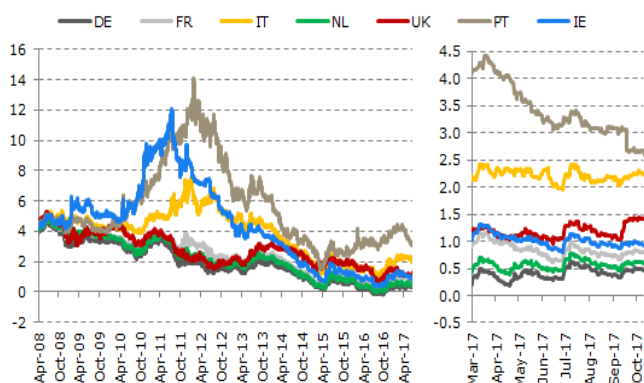
Last observation: October 2017

Given a persistent low yield environment and high level of uncertainties, risks of a sudden yield spike scenario may emerge. A slightly upward movement followed by a flattened pattern can be observed in some long-term European government bond yields as well as in short-term forward rates in the second half of the year (Figure 1.5 and Figure 1.6). Although changes towards a less vigorous

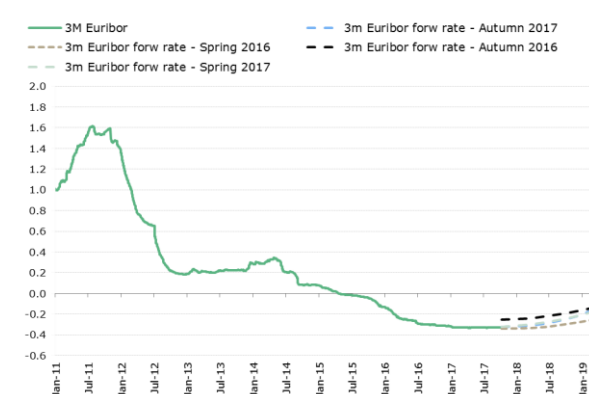
² https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-forecasts/spring-2017-economic-forecast_en

monetary stimulus or a normalisation of monetary policy should be gradually priced and incorporated by the market, the event of a shock could trigger a reassessment of risk premium and a sudden spike in yields. As sovereign bond yields are the benchmark for other assets' returns, the magnitude and the direction of their movements is essential for the market. An increase on yields would imply a decrease of asset prices (amid high current valuations), affecting all interest rate sensitive investments such as bonds.

Figure 1.5: 10-year government bond yields (in %) Figure 1.6: 3M Euribor (in %)



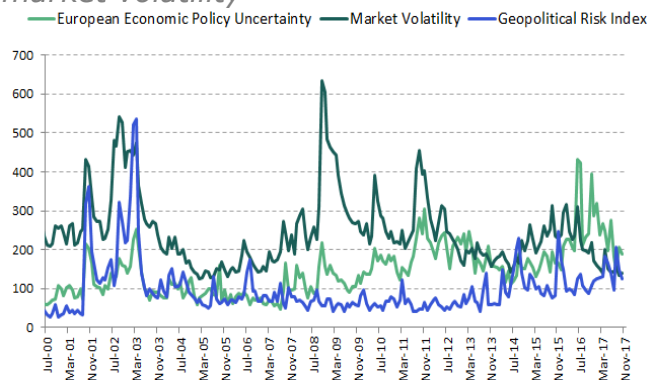
Source: Bloomberg
Last observation: 17/11/2017



Source: Bloomberg
Last observation: 17/11/2017

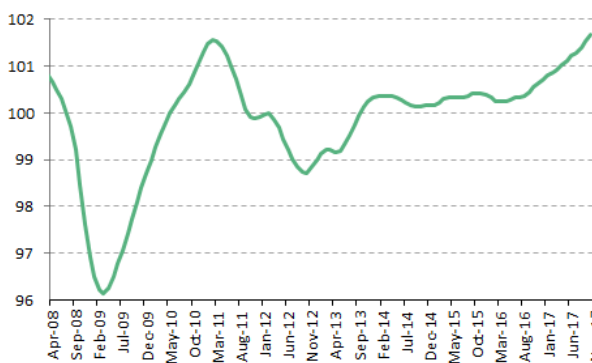
Market volatility is at historical low levels, despite the contrasting high level of economic policy and political uncertainty (Figure 1.7).³ The high provision of liquidity from the accommodative monetary policy and improvements in the economy leading to better confidence (Figure 1.8) as well as expectations are factors that can help to explain the low volatility in markets. Elections and uncertain outcomes of referendums also keep the uncertainty high with a potential risk premia reassessment.

Figure 1.7: Uncertainties indexes and market volatility



Source: Bloomberg, Economic Policy Uncertainty and Geopolitical Risk Index
Last observation: 17/11/2017

Figure 1.8: Business Confidence - euro area



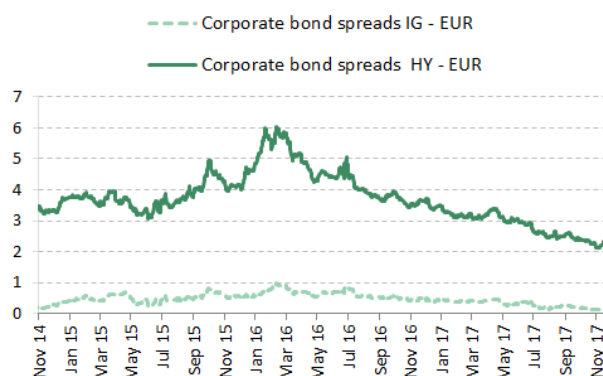
Source: ECB
Last observation: 17/11/2017

Corporate bonds spreads have narrowed substantially (Figure 1.9). Credit spreads for high yield corporate bonds compressed by approximately 4 percentage points since the beginning of 2016, when very low oil prices and uncertainties regarding the Chinese economy affected markets substantially. The credit spread for

³ The Geopolitical Risk Index and the Economic Policy Uncertainty Index are extracted from: <http://www.policyuncertainty.com/gpr.html> and <http://www.policyuncertainty.com/methodology.html>.

investment grade bonds is very close to zero, which might imply that the market is potentially mispricing credit risks. Sovereign credit default swaps also remain at low levels (Figure 1.10). Cheaper credit for companies and for households stimulates higher indebtedness making the real estate sector more vulnerable to potential asset price corrections. These risks could be transmitted to the insurance sector directly via balance sheets' exposures, by a potential drop in gross written premiums, or indirectly via contagion due to the high level of interconnectedness among insurance and banking sectors (see Chapter 5).

Figure 1.9: Corporate bond spreads (in %)

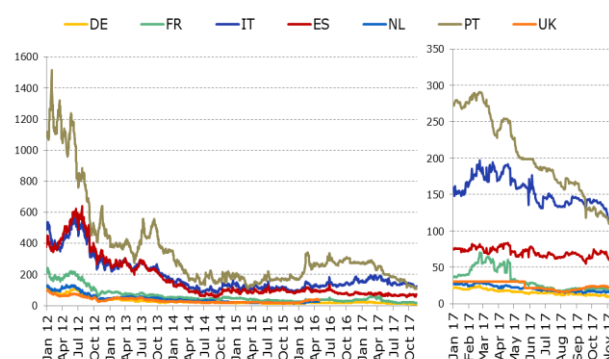


Source: Bloomberg.

Last observation: 17/11/2017

Note: IG (Investment grade) and HY (High yield)

Figure 1.10: Sovereign credit default swap (in %)



Source: Bloomberg

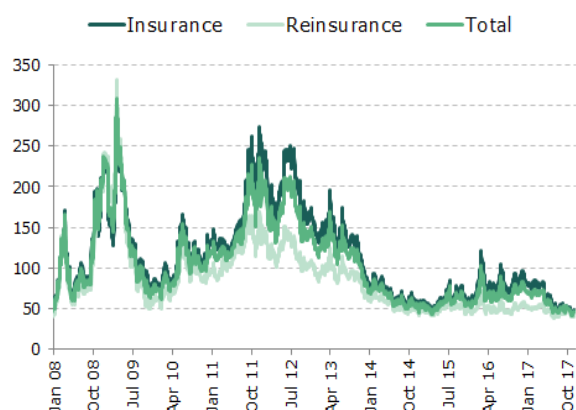
Last observation: 17/11/2017

A yield curve steepening would affect insurers as their investment portfolios are typically composed of fixed income securities (see Chapter 5). However, given the fact that the duration of the liabilities for traditional life insurance typically exceeds the duration of fixed income assets, an increase in yields could be considered to have a positive impact on Solvency II own funds. In this case, liabilities could drop more significantly in value than assets. This would allow a better perspective in meeting the obligations from the balance sheet point of view. Furthermore, in the medium to long run, an increase of the yields would also help to improve insurers' profitability as safe assets would become more profitable. Insurers would then have sufficient return on assets to satisfy consumers' expectations without adopting risky investment behaviours as search for yield.

However, as a consequence of the sharp increase in yields it might become rational for a large share of policyholders to surrender traditional life insurance contracts as the difference between their surrender value and the value of participating further in the life insurer's assets narrows. As a consequence, life insurers could face a massive increase in lapses in the short term and/or with lapse rates moving to level which is still considerably higher compared to the best estimate assumption in the medium and long term. This could present a threat for some European insurance companies that are already having financial difficulties, although companies typically have surrender penalties designed to limit sudden lapses. The legal and bureaucratic process behind lapses can often be time consuming (see also Figure 2.5).

The insurance sector is aligned with the general trends in the market. Credit default swaps (CDS) are low but stable (Figure 1.11) while the insurance equity market performance is high (Figure 1.12).

Figure 1.11: 5-year CDS insurance (bps)

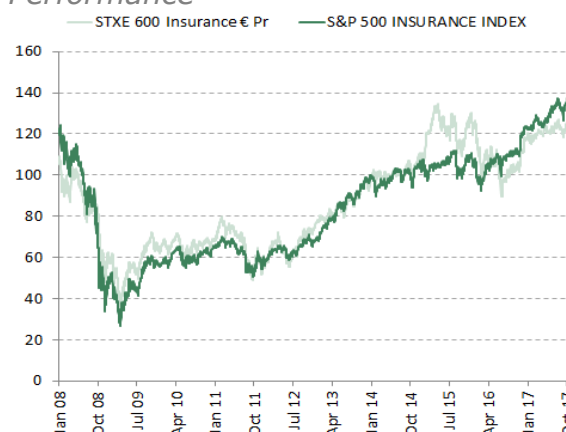


Source: Bloomberg

Last observation: 17/11/2017

Note: Average is based on 7 insurance companies and 4 reinsurance companies

Figure 1.12: Insurance Sector Performance



Source: Bloomberg

Last observation: 17/11/2017

1.2. Global changes and sustainable investments

The current environmental challenges, the recent adoption of the Paris Agreement⁴ and the UN 2030 Agenda for Sustainable Development may require changes in investment strategies. Against this background, sustainability is an important aspect to be considered both in short and long-term investment plans. In parallel, technology has been impacting industries with an unprecedented speed, being another key variable to be considered when structuring investment plans.

Some insurance companies have publicly announced clear targets and plans to increase the proportion of green bonds in their portfolio. This is often considered a credible way to signalise that climate change is also taken into consideration in the investment plans. Globally, green bond issuance had a record of USD 32.2bn in the second quarter of 2017, with an average transaction size of USD 278 mn.⁵ However, figures have to be interpreted with caution as an official recording of figures only started in 2007.⁶ Although there are still some bottlenecks that should be addressed, such as a lack of green bonds harmonised definitions and clear risk profiles of green investments, green bonds issuance is largely supported by the main European and international institutions as a promising alternative.⁷

Furthermore, a shift towards more sustainable investments also implies substantial changes in terms of energy sources, in particular regarding alternatives to carbon. In the short run, the potential repricing of carbon-related assets might imply risks to portfolios that hold such assets. However, it is estimated that approximately only 0.2% of the major insurance companies' assets are identified as low-carbon investments.⁸ Another increasing alternative are factor allocations. This investment strategy is based on designating securities according to attributes that are associated with higher returns. This might improve the portfolio diversification as it also incorporates in the strategy different reactions of securities to market conditions.

⁴ <https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>

⁵ https://www.moody's.com/research/Moodys-Global-green-bond-issuance-tops-new-record-of-322--PR_370377

⁶ Source: Bloomberg and SEB.

⁷ <http://ec.europa.eu/environment/enveco/pdf/potential-green-bond.pdf>

⁸ Estimative from Asset Owners Disclosure Project's (AODP), considering an initial sample of 116 insurers from different geographic regions. The estimation is performed based on a more restrict sample that have direct disclosures and publicly available information.

Factor allocations are often considered an efficient and relatively lower risk method compared to other strategies. According to the Invesco Global Factor Investing Study, the current and 5-year forecast allocations are driven by insurers and state pension funds in Europe and the US.⁹

Insurance and occupational pension funds are also expected to be primary growth drivers of investments in Exchanged Traded Fund (ETF) in years to come.¹⁰ ETF is a type of a marketable index fund that tracks different assets, commodities, other indexes and industries.

1.3. Capital Market Union and Insurance Investments

Incentives for long-term, infrastructure and sustainable investments as well as for innovative technological finance related activities are some of the new priority initiatives to strengthen the Capital Markets Union (CMU) Action Plan.¹¹ Other main priorities are strengthening the capacity of EU Capital markets, make it easier for companies to enter and raise capital on public markets, foster retail investments, strengthen banking capacity and facilitate cross-border investment.

CMU is an EU initiative with an ultimate objective of deepening and further integrating the capital markets in Europe. It aims at providing incentives and facilitates the access of business to more diverse sources of capital, while strengthening investments across borders. According to the European Commission, the aim is to improve disclosure and better integrate sustainability and Environmental, Social and Governance (ESG) in rating methodologies and supervisory processes, as well as in the investment mandates of institutional investors and asset managers but also to develop an approach for taking sustainability considerations into account in upcoming legislative reviews of financial legislation.¹² A High-Level Expert Group on Sustainable Finance to develop a European policy programme was established and the Commission will decide on concrete measures based on their recommendations.

Adjustments on Solvency II (SII) calibrations for insurers' investments are mentioned in original CMU Action Plan. These calibrations aim at targeting long-term investments, in particular infrastructure. The amendments to SII legislation regarding infrastructure projects and European Long Term Investment Funds (ELTIF) took effect in April 2016.¹³

Another priority action that can (indirectly) affect the insurance sector is the possibility of enabling an EU licensing and passporting framework for FinTech (Financial Tech) activities. Although this measure is more directly related to the financial sector, depending on the scope of the Commission's decision, this could certainly support start-ups that are also involved in insurance activities.¹⁴ In particular if these companies could engage on cross-border business without requiring further authorisations in each EU country.

⁹ https://www.invesco.com/pdf/factor-investing_global-study.pdf

¹⁰ <https://www.pwc.com/jg/en/publications/etf-2020-exchange-traded-funds-pwc.pdf>

¹¹ https://ec.europa.eu/info/sites/info/files/communication-cmu-mid-term-review-june2017_en.pdf

¹² https://ec.europa.eu/info/sites/info/files/communication-cmu-mid-term-review-june2017_en.pdf.

¹³ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32016R0467>

¹⁴ For more details on digitalisation and its implications for the insurance sector please see EIOPA Financial Stability Report from June 2016, section 1.3:

https://eiopa.europa.eu/Publications/Reports/Financial_Stability_Report_June_2016.pdf

Lastly, CMU also prioritises to foster retail investment. The legislative proposal on a pan-European personal pension product is one of the key actions as well as the follow-up research on distribution systems of retail investment products across the EU (see Chapter 4).

Box 1: Technological Developments, Cyber risks and Regulation

The Digital Single Market (DSM) strategy is an EU initiative that aims to boost the European digital industry, bringing digital opportunities to people, business, SMEs and non-tech industries. Addressing cybersecurity risk was one of the key challenges identified¹⁵ for fully implementing DSM.¹⁶ On September 2017, the European Commission adopted a cybersecurity package. This package is based on the 2013 EU cybersecurity strategy, which has the goal to ensure a strong and effective protection and promotion of citizens' rights so as to make the EU's online environment the safest.

Among crisis management mechanisms applied to the digital context, proposals to address cybercrimes and to establish institutional reforms to make products, services and processes safer and more harmonised across Europe, the implementation of the Directive on security of network and information systems¹⁷ (NIS Directive) is one of the key initiatives.

NIS took force in August 2016 and is considered the first piece of EU-wide legislation on cybersecurity. It requires companies in critical sectors (energy, transport, water, banking, financial market infrastructures, healthcare and digital infrastructure) to adopt risk management practices and report major incidents to the National Authorities.¹⁸ Although insurers are not in the scope of the NIS, the Directive might impact the insurance sector indirectly. Some decisions, including penalties and the scope of other entities to be considered in the Directive's criteria, are taken by the Member States. This could enlarge the scope of entities required to meet cyber securities requirements. Consequently, there is an expected generalised increase in the demand for cyber insurance, which may vary across countries depending on the difference of certain rules.

Another relevant measure is the Contractual Public-Private Partnership (cPPP) on cybersecurity, signed by the European Commission and the European Cyber Security Organisation (ECSO).¹⁹ It consists of market-oriented policy measures aimed to stimulate the cybersecurity industry, aligning the demand and supply sectors and boosting the cooperation between public and private actors at early stages of the research and innovation process. The expected improvements on the exchange of information will help to fulfil the existing gap of data on cyber related issues.

¹⁵ <https://ec.europa.eu/digital-single-market/en/news/digital-single-market-commission-calls-swift-adoption-key-proposals-and-maps-out-challenges>

¹⁶ DSM consists of 16 specific initiatives and is built in three pillars: (i) Access: better access to digital goods, (ii) Environment: create the right conditions for innovations and digital networks and (iii) Economy and Society: maximise the growth of the digital economy. For more information: <https://ec.europa.eu/digital-single-market/en/policies/shaping-digital-single-market>

¹⁷ <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L1148&from=EN>

¹⁸ Countries have 21 months to fully implement in the national laws plus 6 months to identify operators of essential services.

¹⁹ http://europa.eu/rapid/press-release_IP-16-2321_en.htm

Finally, the General Data Protection Regulation (GDPR)²⁰ law is the regulatory measure that might impact the insurance sector the most, but also the pension sector. However, this will also require an improvement on security procedures for insurance companies as they are also under the same rules. In particular, insurance companies are often a target for cyberattacks due to the amount of confidential data they have. Pension funds also treat confidential data which will require them to improve their data protection procedures.

GDPR is a regulation that intends to strengthen and unify data protection for individuals within the European Union (EU) and is to be applied by 2018 in all the EU member states. The Directive requires that the Data Controller will be under a legal obligation to notify the supervisory authority about a data breach within 72 hours. Individuals have to be notified if an adverse impact is determined. The scope of the EU data protection law is also extended to all foreign companies processing data of EU residents.

Insurers must get prepared for the next challenges and to the unique opportunities arising from the upcoming regulatory measures. It is also a chance to invest in digitalization and improve their cyber protection policies. Additionally, proper risk management techniques should be in place addressing also residual risks.

²⁰ <http://www.eugdpr.org/>

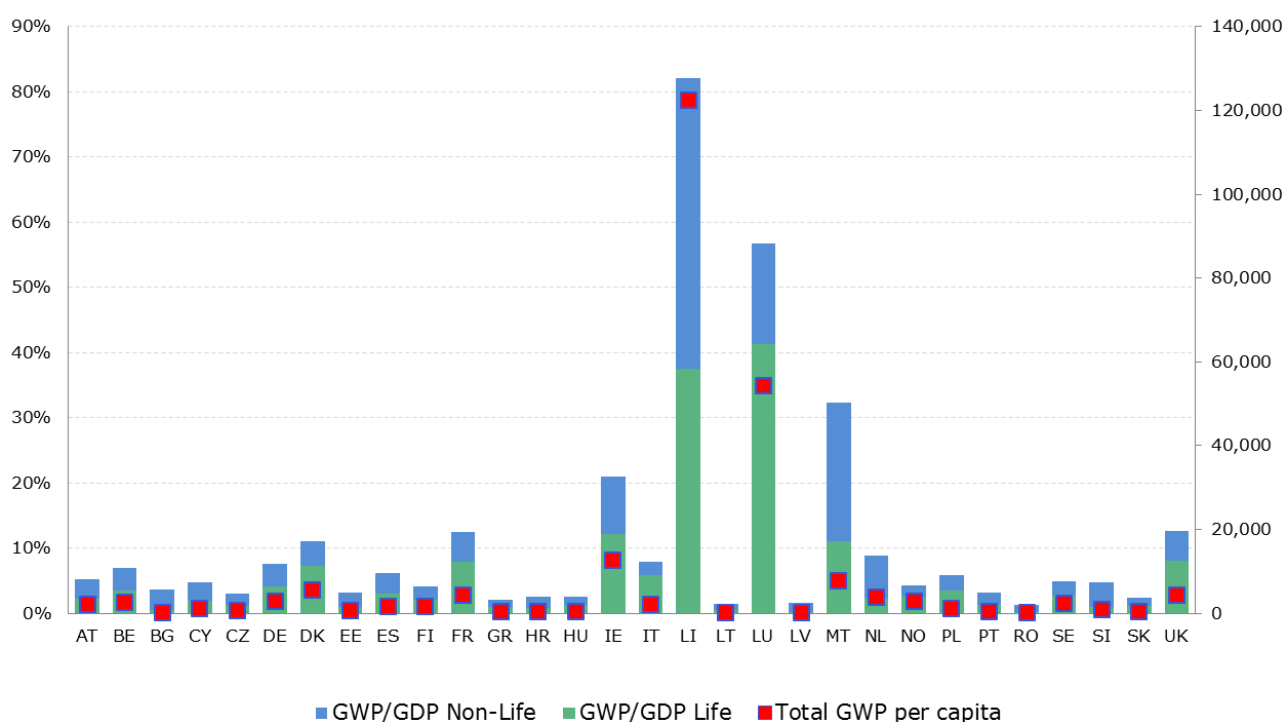
2. The European insurance sector

2.1. Market Share and Growth

The insurance sector substantially differs among European countries (Figure 2.1). The penetration rate indicates the level of development of the insurance sector in a country. Measuring the size of the sector by total Gross Written Premiums (GWP) as a percentage of Gross Domestic Product (GDP), it ranks highest for Luxembourg for life business (41%), followed by Liechtenstein (37%) and Ireland (12%). For non-life business, Liechtenstein ranks highest (45%), followed by Malta and Luxembourg with 21% and 15% respectively.

Liechtenstein and Luxembourg are also the countries where GWP per capita is highest by country. In these two countries also a substantial amount of cross-border business is written (see Box 2).

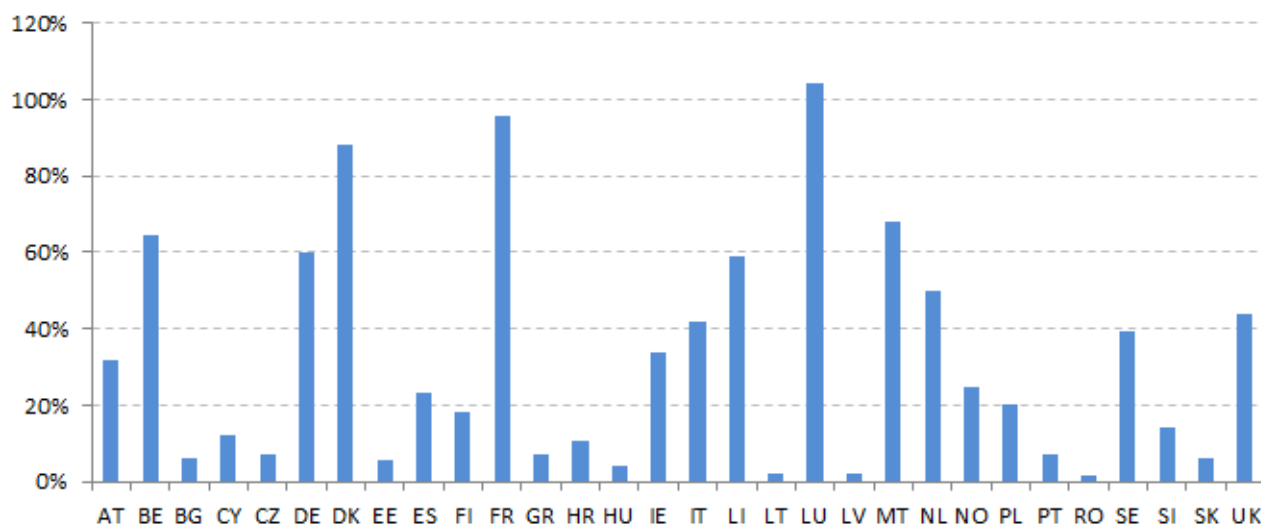
Figure 2.1: GWP as a Share of GDP in % (LHS) and Total GWP per capita by country in EUR bn (RHS)



Source: EIOPA Quarterly Solo
Reporting reference date: 30/06/2017

The level of insurers' investment portfolio to GDP also varies widely among countries (Figure 2.2). In Q2 2017, the total insurers' investment portfolio to GDP was highest in Luxembourg and lowest in Romania.

Figure 2.2: Insurers' investment portfolio to GDP in %

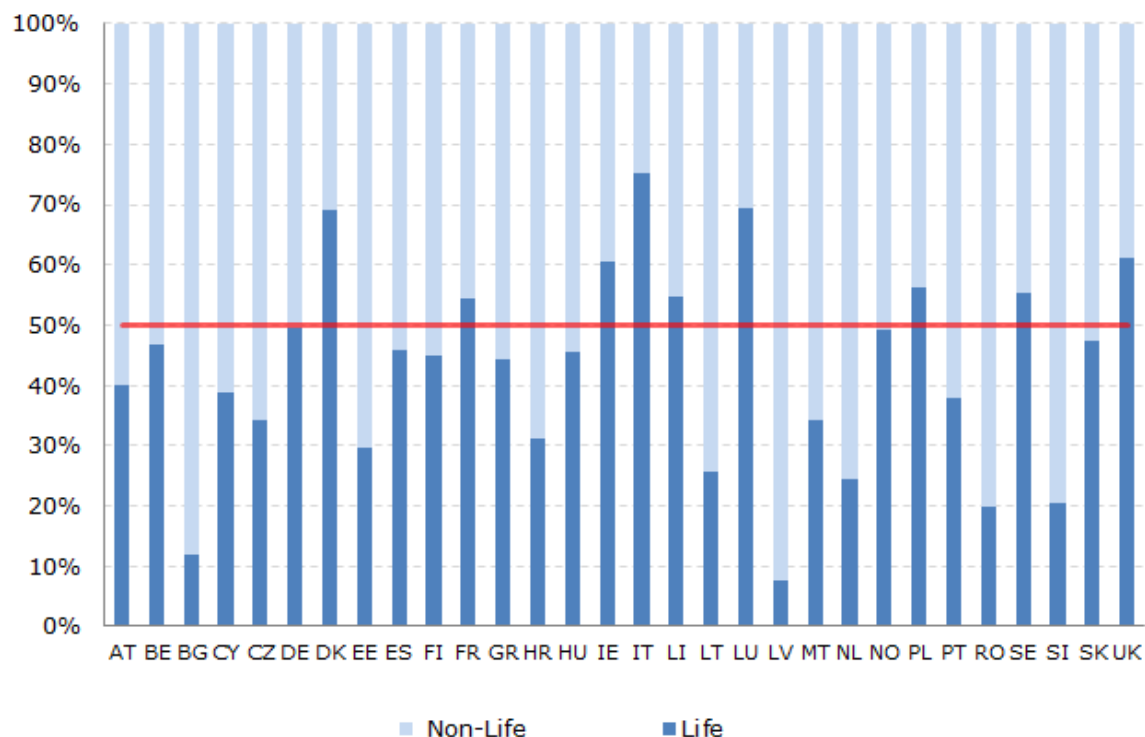


Source: EIOPA Quarterly Solo
Reporting reference date: 30/06/2017 (Q2 GDP annualised)

Similarly, the share of GWP non-life business to GWP life business is also heterogeneous among countries (Figure 2.3). Contrary to life premiums, non-life premiums improved in many countries, as insurance companies focus increasingly on non-life products in the low yield environment. However, it should be noted that especially the Motor Third Party Liability (MTPL) segment saw premiums simply increasing as a result of price increases in previous years.

EIOPA will monitor the development of GWP for both life and non-life companies in the years ahead. Due to the low interest rate environment, especially life insurance companies are expected to further align their business operations in the future which might have an impact on overall premium volumes. Indeed, in some countries tax changes and a drop in single paid premiums already contribute to decreasing life insurance premiums. Lately, for instance, in order to remain profitable, reduced guaranteed rates or at least the announcement of further reductions have also been observed. In addition, other life insurance companies have recently put their new business into run-off.

Figure 2.3: GWP Non-life as a Share of Total GWP (in %) and GWP Life as a Share of Total GWP (in %)

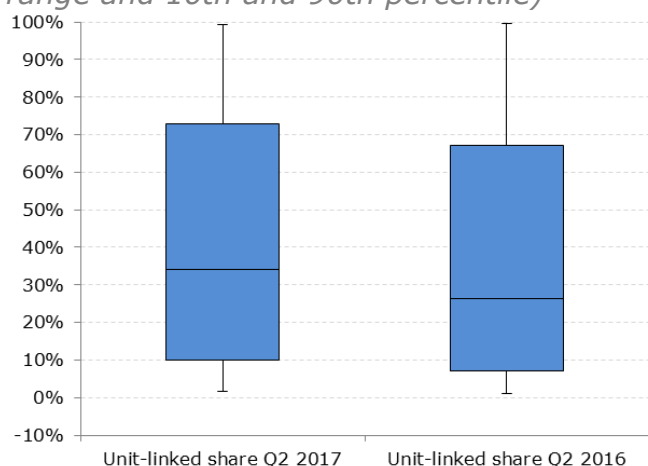


Source: EIOPA Quarterly Solo
Reporting reference date: 30/06/2017

However, significant changes in the business models and strategy will only evolve over time. Article 132 of the Solvency II Directive (Directive 2009/138/EC) introduces the "prudent person principle" which includes guidelines on how undertakings should invest their assets. The absence of regulatory limits on investments does not mean that undertakings can take investment decisions without any regard to prudence and to the interests of policyholders.

In times of low yields, however, the median value for unit-linked business at undertaking level has increased over one year (Figure 2.4). In Q2 2017 total unit-linked business as a percentage of GWP is 34% for the median company as opposed to 26% in Q2 2016. However, the dispersion has been relatively stable in Q2 2017. EIOPA will monitor the development of these products as the risk is shifted to policyholders which deserves further attention from a financial stability perspective.

Figure 2.4: GWP-Life business: Unit-linked share (in %; median, interquartile range and 10th and 90th percentile)



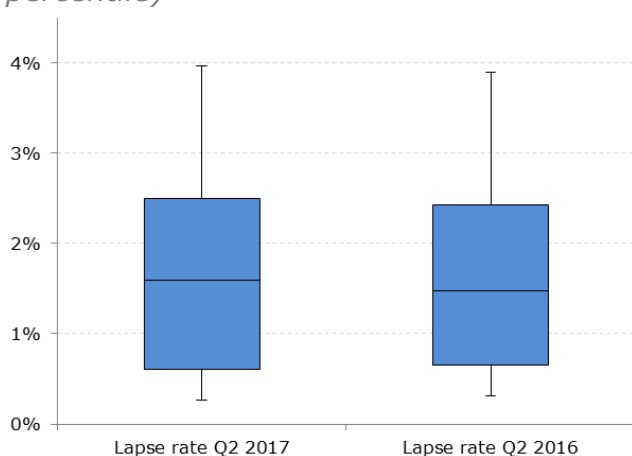
Source: EIOPA Quarterly Solo

Note: Sample sized on 557 insurance companies which have reported unit-linked business (life and life part of composite insurance companies)

Reporting reference date: 30/06/2017

Lapses for life insurance companies are relatively stable over the last year as products benefit from relatively high guaranteed rates (Figure 2.5). Insurance companies' profits remain high when compared with EU banks.²¹ However, EIOPA will monitor the future development, especially in case of a sudden increase in interest rates. Surrender penalties that are in place are highly heterogeneous across countries. In some countries surrender penalties are e.g. limited by law, others have annuities that cannot be surrendered at all, some recently blocked surrenders in case of emergency (at least temporarily), whilst others enable policyholders to surrender policies relatively easy. If this is the case, often the products also lack differentiation with banking and asset management products. Additionally, lapses lead to the termination of insurance protection which only might be retrieved under conditions due to biometric reasons which are unfavourable in comparison with the terminated contract.

Figure 2.5: Lapse rate (in %; median, interquartile range and 10th and 90th percentile)



Source: EIOPA Quarterly Solo and Group

Reporting reference date: 30/06/2017

²¹ [https://esas-joint-committee.europa.eu/Publications/Reports/Spring%20Joint%20Committee%20Risk%20Report%20\(JC%202017%2009\).pdf](https://esas-joint-committee.europa.eu/Publications/Reports/Spring%20Joint%20Committee%20Risk%20Report%20(JC%202017%2009).pdf)

Box 2: Cross-border business in the European Economic Area (EEA)

Insurance undertakings authorised in an EEA country may carry out insurance activities in another EEA country ("host country") via Freedom of Establishment (FoE) or via Freedom of Services (FoS). FoE requires the establishment of a branch, while FoS can be done without physical presence in the host country. Cross-border business is an established and material part of European insurance business. Business of insurance groups via a subsidiary established in another country is not classified as cross-border business.

In the EEA, EUR 59 bn gross written premiums (GWP) are reported via FoS and EUR 56 bn via FoE, accounting together for more than 8 % of all GWP in the EEA.²² The share of the cross-border business to the total EEA insurance market depends on the type of business. For direct business life, the share is 6 %. For direct business non-life and reinsurance the share is 9% and 12% respectively. Out of more than 2800 insurance and reinsurance undertakings under Solvency II, 750 reported cross-border business within the EEA in 2016.

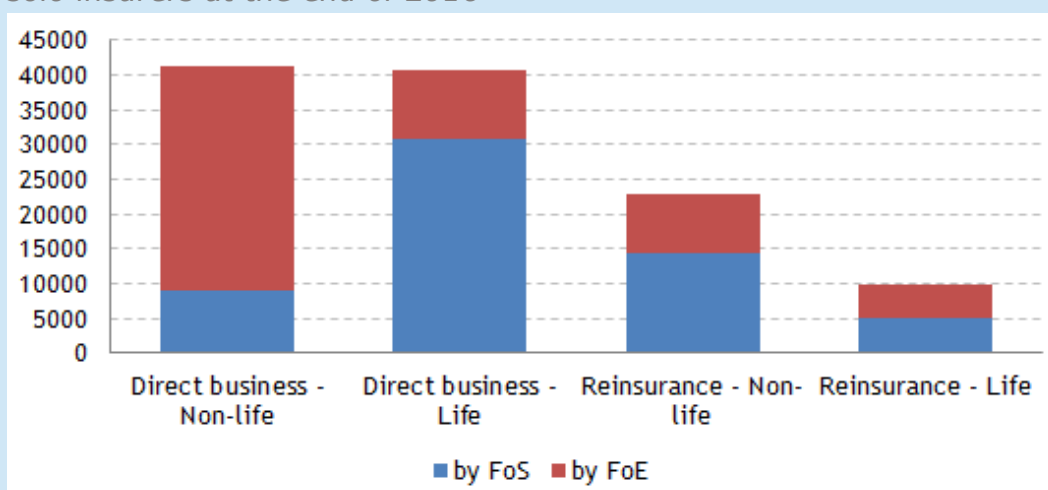
The amount of cross-border business and the interconnectedness between countries depend not only on the line of business, but also on regional specificities. These factors are discussed below.

Line of Business

For direct business, i.e. insurance sold directly to customers, a clear distinction between the life and non-life segments can be seen (Figure B2.1). While cross-border life business is mainly written via FoS, cross-border non-life business is mainly written via FoE. Customers of non-life business are likely to prefer to have a local branch through which damage claims can be sent and settled. For reinsurance, where both counterparts are professionals, the need for a local branch seems less important (indeed, non-life reinsurance relies more on FoS than FoE most likely due to the relatively higher share of Business-to-Business).

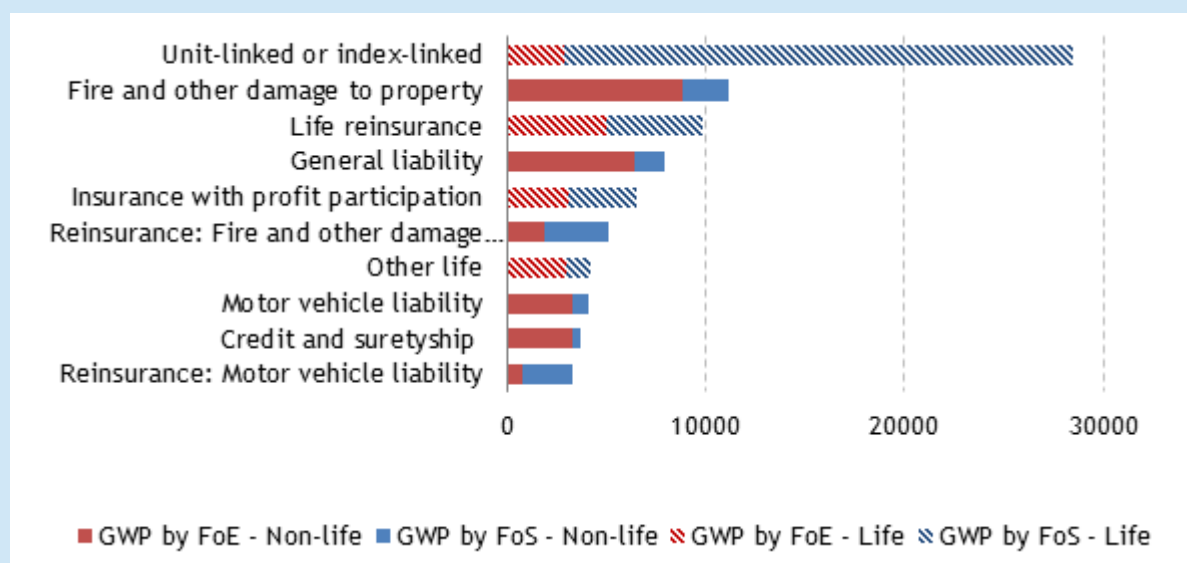
²² Note that the data used for this box is based on a reporting template that follows accounting recognition and valuation and that the data might not be fully comparable across companies or countries. In particular, in some countries following IFRS or local GAAP that recognise the difference between insurance and investment contracts, some insurance contracts may be recognised as investment contracts and be accounted as such, i.e. with no premiums reported in this box for those contracts. This issue has been addressed in Commission Implementing Regulation (EU) 2017/2189 of 24 November 2017 amending and correcting Implementing Regulation (EU) 2015/2450 laying down implementing technical standards with regard to the templates for the submission of information to the supervisory authorities according to Directive 2009/138/EC of the European Parliament and of the Council and for year end 2017 onwards both insurance and investment contracts will be reported.

Figure B2.1: Categories of cross-border insurance business (EUR mn) for 2800 solo insurers at the end of 2016



Unit-linked or index-linked business accounts for more than EUR 25 bn cross-border GWP in EEA, about 25% of the total (Figure B2. 2). In line with the observation above, the vast majority of this life business is written via FoS, while all non-life business is dominated by business written via FoE.

Figure B2.2: Top 10 line of business by GWP (EUR mn) cross-border in EEA for 2800 solo insurers at the end of 2016



Volume by country

The share of cross-border GWP within the top 5 countries (in terms of outgoing share), indicates the main host countries and the top line of business for each country. Off all written premiums issued by insurance undertakings authorised in Luxembourg, 59% reflect cross-border business in other EEA countries (Table B2.1). The top line of business that Luxembourg undertakings write in these countries is unit-linked or index-linked business. The main countries where Luxembourg undertakings write business to are France, Italy and the UK.

Table B2.1: Top 5 outgoing ²³ (in percent of GWP of domestic undertakings)

	Outgoing (%)	Top line of business	Top 3 host countries
Luxembourg	59%	Unit-linked or index-linked	France, Italy, United Kingdom
Ireland	54%	Unit-linked or index-linked	Italy, United Kingdom, Germany
Estonia	53%	Unit-linked or index-linked	Lithuania, Latvia
Malta	35%	Miscellaneous financial loss	United Kingdom, France, Spain
Lichtenstein	34%	Unit-linked or index-linked	Italy, Germany, Netherlands

While cross-border business is mainly driven by unit-linked or index-linked business at EEA level, other lines of business can dominate bilateral cross border activity (Table B2.2). The Baltic countries (Estonia, Lithuania, Latvia) have a relatively open insurance market with a high share of incoming business. Moreover, the markets have a high level of interconnectedness among themselves relative to their national insurance market, with Estonia in particular exporting to its neighbours (Table B2.2). While highly relevant for the national markets, the cross-border business between the three Baltic countries accounts for only 0.5% of the total EEA cross-border business.

Table B2.2: Top 5 incoming (in percent of GWP of domestic undertakings)

	Incoming (%)	Top line of business	Top 3 home countries
Latvia	52%	Medical expense insurance	Estonia, Lithuania, Germany
Lithuania	46%	Motor vehicle liability insurance	Estonia, Latvia, Malta
Estonia	28%	Other motor insurance	Lithuania, Latvia, Finland
Cyprus	20%	Medical expense insurance	United Kingdom, Ireland, Germany
Norway	18%	Fire and other damage to property insurance	Sweden, Denmark, United Kingdom

2.2. Profitability

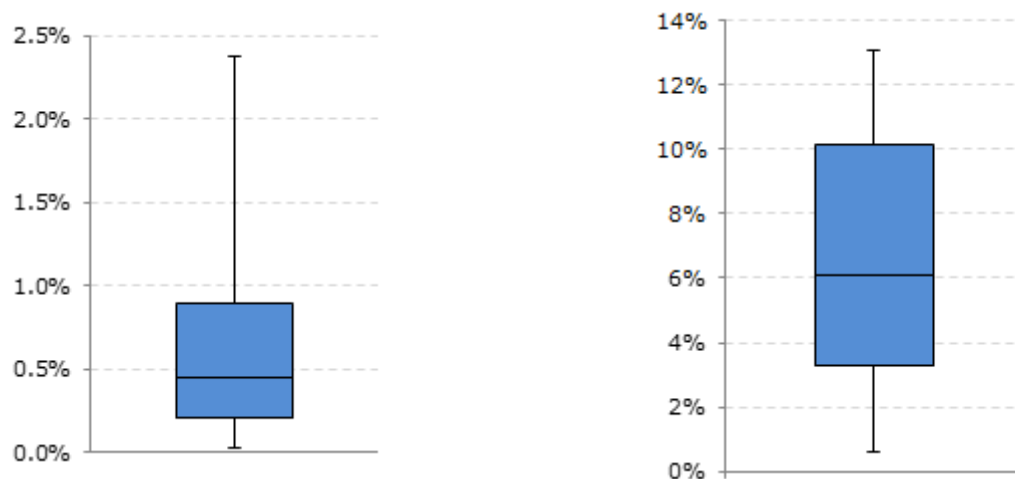
Insurance companies have to deal with a challenging macroeconomic environment characterised by low interest rates. New technologies and the growing pace of digitalisation require them to continuously adapt their business models to remain profitable. In addition, the ageing population will eventually have a corrosive effect on the profitability of life insurance portfolios potentially leading to portfolio shifts in different asset classes or markets where growth potential is stronger, e.g. emerging markets.

In the last couple of years, especially life insurers have reduced and continue to reduce the guaranteed rate on new products in many countries as a result of the low interest rate environment. Others have completely stopped selling new business with guarantees. However, a high percentage of long-term commitments still consist on existing policies where high returns are guaranteed. It is interesting to see that products offering a zero per cent guarantee are on the rise in some countries. This shows that markets somehow adapted to the low interest rate environment for new products.

²³ Percentage outgoing is defined as: EEA Cross-border GWP by domestic undertakings/Total GWP of domestic undertakings and percentage incoming is defined as: Cross-border GWP by EEA undertakings in the country/(Total GWP of domestic undertakings – EEA Cross- border GWP by domestic undertakings).

Profitability remains low but positive in 2016 (Figure 2.6). Based on annual data, return on assets (ROA) for the median insurance company is about 0.45%. For the 10th percentile and 90th percentile it amounts to 0.03% and 2.38% respectively. Return on excess of assets over liabilities is 6.1% in 2016.

Figure 2.6: Return on Assets (ROA) and Return on Excess of Assets over Liabilities; (in %; median, interquartile range and 10th and 90th percentile)



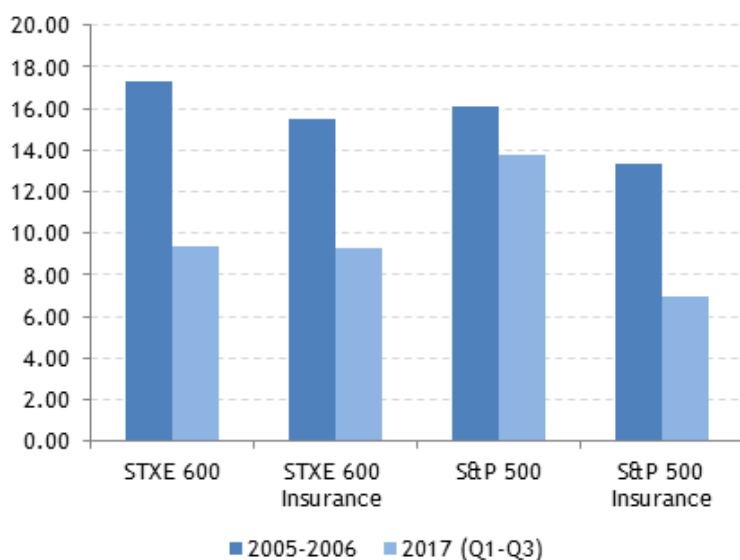
Source: EIOPA, Annual QRT data
Reporting reference date: 31/12/2016

Insurers, especially life-insurers that have issued long-term interest guarantees to their policyholders, are sensitive to interest rate changes. Results of the EIOPA stress tests in 2014 and 2016 already showed that a prolonged low interest rate environment will make it increasingly difficult for insurance companies to meet their commitments long-termish (see Chapter 5).²⁴

In the current low yield environment maintaining profitability is getting more and more difficult as already reflected by market returns (Figure 2.7 and Figure 2.8). The return on equity (ROE) has indeed substantially dropped compared to the pre-crisis period although is high overall.

²⁴ <https://eiopa.europa.eu/financial-stability-crisis-prevention/financial-stability/insurance-stress-test>

Figure 2.7: Return on Equity (ROE) in %



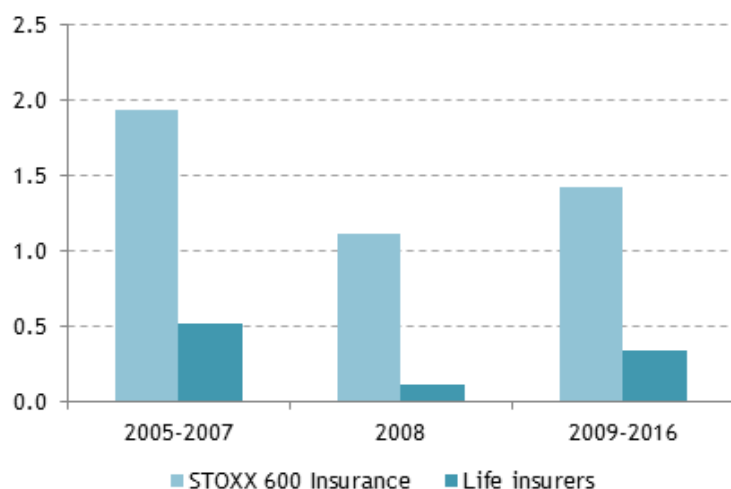
Source: Bloomberg

Note: Annual Data and annual average weighted of summed quarterly data for 2017

Reporting reference date: Q3 2017; data extracted on 29/09/2017

Based on market data, the return on assets on the other hand improved since the crisis. However, overall it remains low (Figure 2.8).

Figure 2.8: Return on Assets (ROA) in %



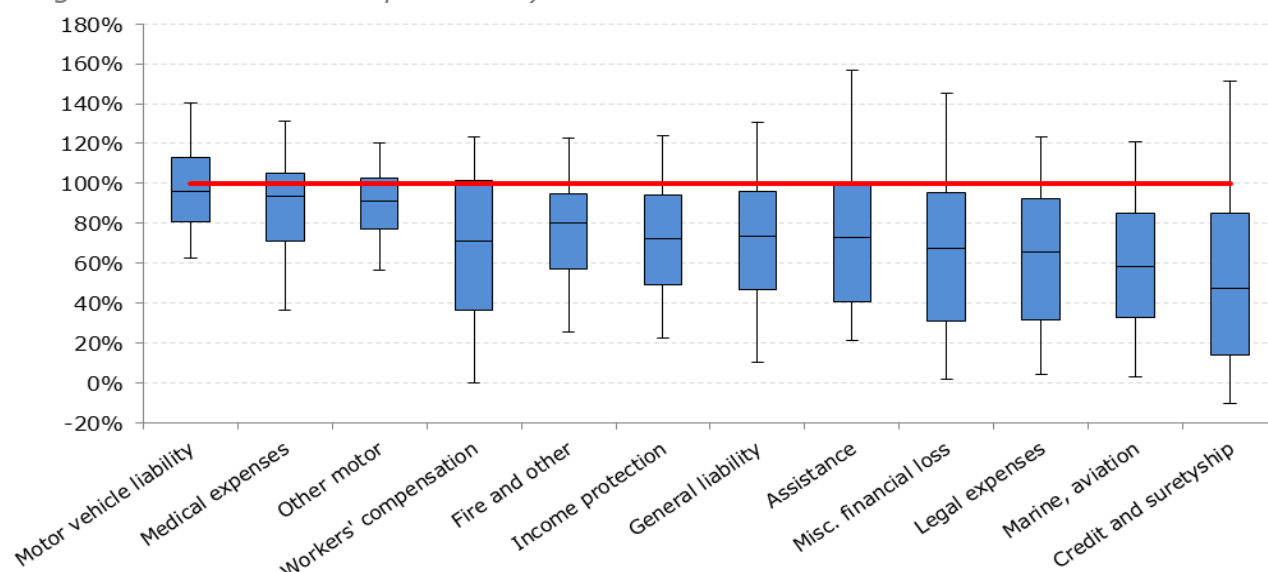
Source: Bloomberg, Annual data

On the non-life side strong market competition leads to intense price pressures. Especially those insurance companies that lack size, international relations or a niche might eventually have difficulties maintaining their profitability in the long-run.

Nevertheless, the gross Combined Ratio (CR) has been relatively stable across business lines (Figure 2.9).²⁵ In some countries, for example, negative price and volume effects can be seen for motor and credit insurance due to new quota share agreements where premiums earned are not sufficient to cover claims and costs. Also health costs are extremely high in some countries and disability covers are experiencing severe losses potentially increasing claims costs even more in the future. Claims to natural catastrophes might rise in Q3 following the Hurricanes and other events but the extent of the devastation is not fully clear yet (see Chapter 3).

²⁵ Below 100% implies an underwriting profit, above 100% implies an underwriting loss.

Figure 2.9: Gross Combined Ratio across business lines (in %; median, interquartile range and 10th and 90th percentile)



Source: EIOPA, Quarterly Solo

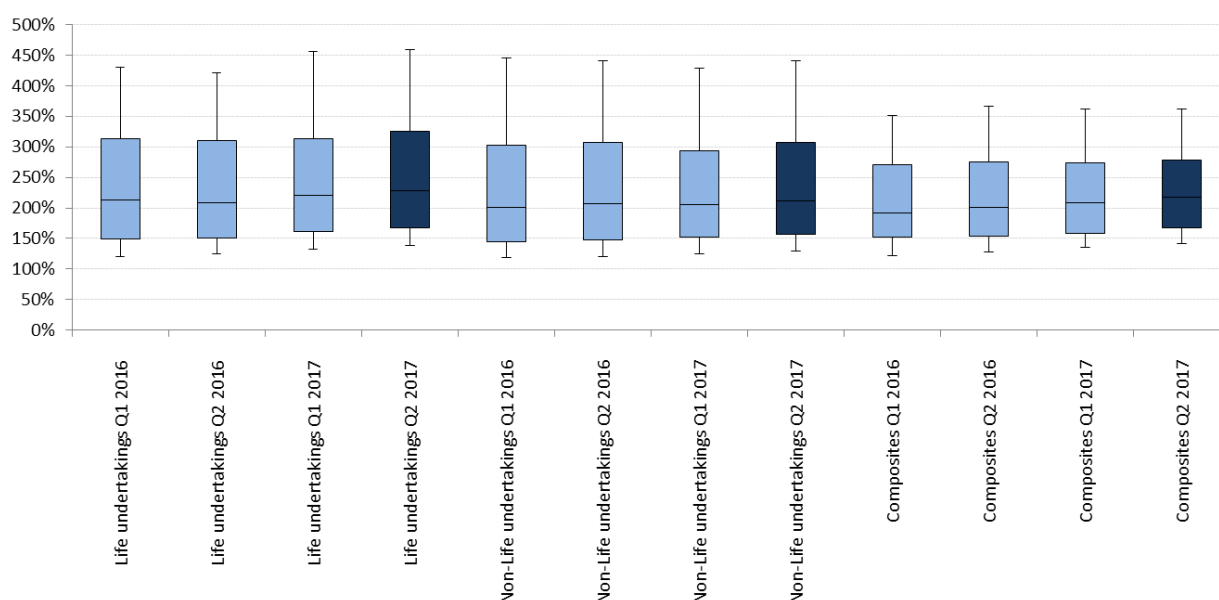
Note: Nominator S.05.01.02 ([R0310+ R0550, C0010-C0160]); Denominator S.05.01.02 [R0210, C0010-C0160]

Reporting reference date: 30/06/2017

2.3. Solvency

As of Q2 2017 the SCR ratio of the majority of solo insurance undertakings remains high (Figure 2.10). In fact, the SCR ratio for the median company is above 200% and hence twice as much as the regulatory requirement.

Figure 2.10: SCR ratio (in %; median, interquartile range and 10th and 90th percentile)^{26 27}



Source: EIOPA Quarterly Solo based on 2698 insurance companies

Reporting reference data: 30/06/2017

²⁶ SCR calculated using the Standard Formula.

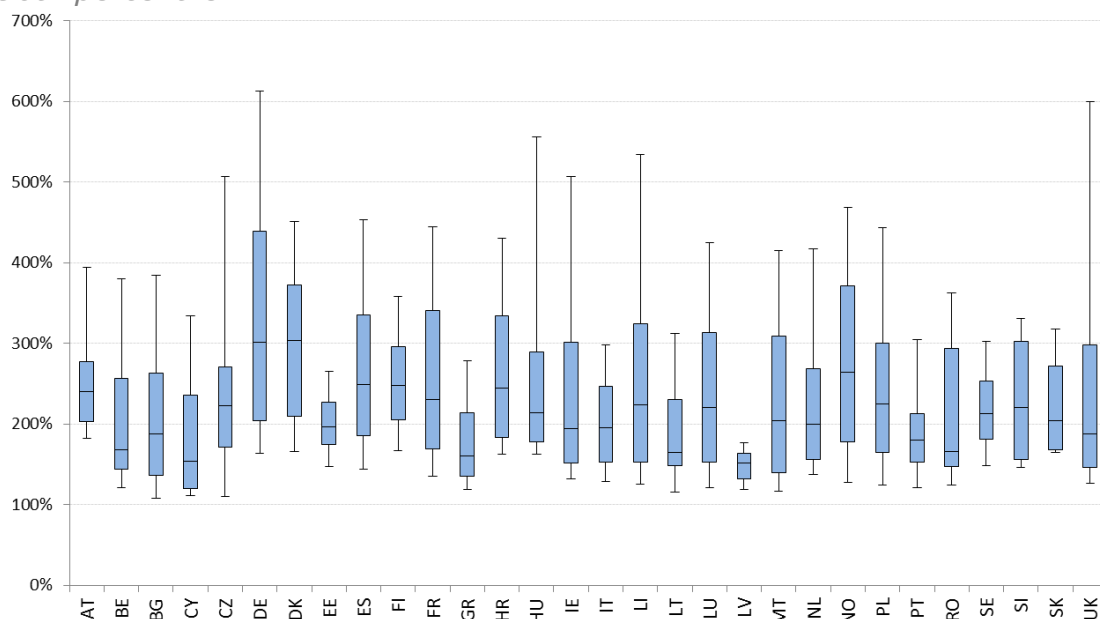
²⁷ Please note that the graph does not show any observation below the 10th percentile.

Transitional measures form an integral part of Solvency II and are intended to limit the procyclicality of the regulatory changes and to facilitate the entry into the new regime by giving companies the time needed to adapt to the new solvency requirements. Specific transition periods are used mostly by life insurance companies with long-term guarantees business (See also “Background information and Data description”). An analysis of the insurance companies illustrates the importance of these transitionals. Applying these measures has a major impact on the SCR ratio (see Chapter 5).

When comparing the SCR ratio among EEA countries, a high heterogeneity remains in Q2 2017 (Figure 2.11). However, the SCR ratios are well above the prudential requirement of 100% for the median company in all countries, ranging from 154% in Cyprus to 304% in Denmark.

Based on Q2 2017, a total of eighteen insurers from ten different EEA-countries reported SCR ratios below 100%. Fifteen of the undertakings operate solely in the non-life segment, two in the life segment and one is a composite insurer and these companies hold EUR 17.4 bn in assets (or 0.2 per cent) and EUR 17 billion (or 0.2 per cent) in technical provisions in their respectable country.²⁸ The gross combined ratio for these non-life entities exceeds 100% especially due to the low profitability in the motor insurance segment (Figure 2.9 in this report).

Figure 2.11: SCR ratio by country (in %; median, interquartile range and 10th and 90th percentile)



Source: EIOPA Quarterly Solo based on 2698 insurance companies
Reporting reference data: 30/06/2017

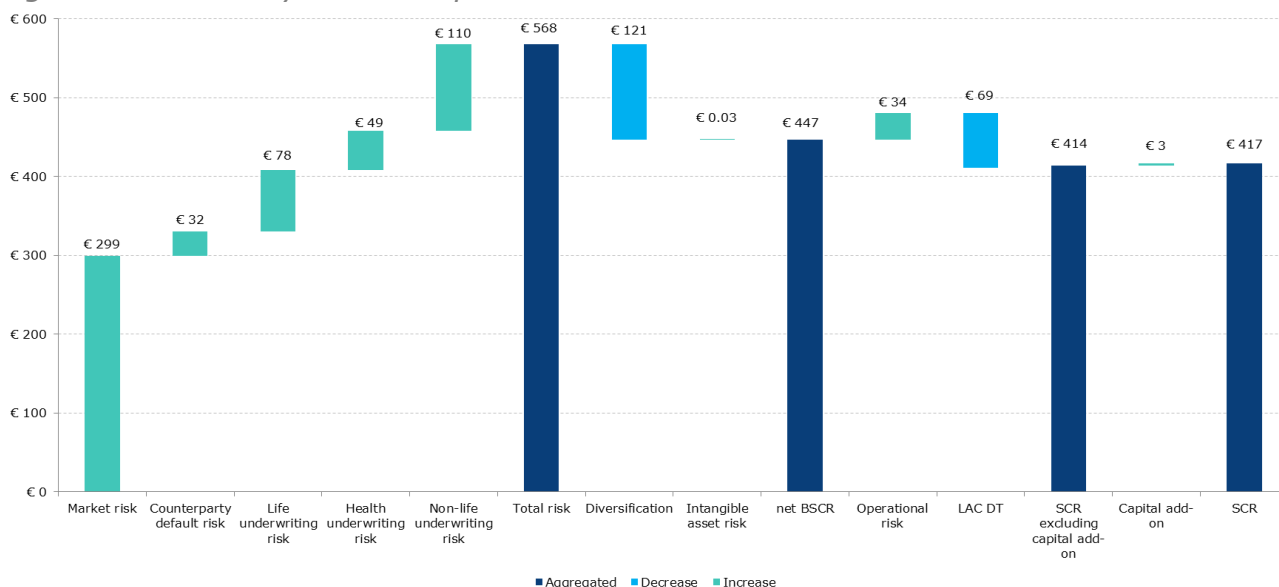
At the end of 2016 the SCR was EUR 417 bn, which is somewhat higher than last year (Figure 2.12).²⁹ The largest risk components for all insurers were market risk (53%), non-life underwriting risk (19%) and life underwriting risk (14%). Counterparty risk and health underwriting risk amounted for a relatively small proportion of the total risk, namely 6% and 9% respectively.

²⁸ Market share calculated as ratio of GWP, TA and TP (un-weighted).

²⁹ SCR calculated using the Standard Formula.

Diversification effects reduced the sum of the partial capital requirement by 21% on average. The effect of the loss absorbing capacity of deferred taxes (LAC DT) amounted to 17% of SCR (see Chapter 5).

Figure 2.12: SCR by main components in EUR bn



Source: EIOPA Annual Solo based on 2637 insurance companies; excluding insurers with internal model (Article 112 (7) of Directive 2009/138/EC), (S.25.01 and S.25.02)
Reporting reference date: 31/12/2016

2.4. Regulatory developments

On 5th of July 2017 EIOPA published an Opinion to institutions of the European Union on the harmonisation of recovery and resolution frameworks for (re)insurers across the Member States. The Opinion calls for a minimum harmonisation of national recovery and resolution frameworks for insurers and provides the main building blocks of a harmonised framework, including: preparation and planning; early intervention; resolution; and cross-border cooperation and coordination. The Opinion states that the scope of a harmonised recovery and resolution framework should in principle cover all (re)insurers within the scope of Solvency II. However, in accordance with the proportionality principle, Member States should be given the possibility to waive certain requirements of the framework for specific insurers; this applies, in particular, to the requirements to develop and maintain pre-emptive recovery and resolution plans. On 17th July 2017 EIOPA submitted to the European Commission draft amendments to the Implementing technical standards (ITS) on reporting and the ITS on public disclosure. The proposed amendments to specific templates are intended to facilitate consistent reporting and disclosure as well as to improve the quality of the information reported, including the correction of several minor drafting errors identified. After the adoption by the European Commission and publication in the Official Journal the amendments will enter into force and become applicable. It is expected that the ITS will be applicable for the submissions and disclosures at the end of 2017.

In light of the United Kingdom's decision to withdraw from the European Union and the relocation of UK-based undertakings in the EU27, EIOPA issued in July 2017 an opinion addressed to the national competent authorities of the EU Member States in order to foster convergence and consistency of authorisation processes across Member States by setting out guidance on the application of the existing legal framework considering arrangements between EU and non-EU entities. EIOPA's Opinion on supervisory convergence in light of the United Kingdom withdrawing from

the European Union emphasises the need for consistent supervisory approaches both on authorisation processes and on-going supervision of undertakings so as to avoid standards being lowered or prudential requirements disregarded. The Opinion also encourages communication between the UK and EU supervisors.

Following the proposal submitted by EIOPA in February 2017, the Commission Implementing Regulation laying down a standardised presentation format for the insurance product information document (IPID) was adopted on the 11th August 2017. The Regulation establishes the standardised presentation format to be completed by insurance providers that will be provided to customers prior to the sale of a non-life insurance product.

Following the Technical Advice provided by EIOPA in February 2017, two delegated regulations concerning the Insurance Distribution Directive (IDD) were adopted by the Commission and officially published on the 21st of September 2017. The Commission Delegated Regulation with regard to product oversight and governance (POG) requirements for insurance undertakings and insurance distributors specifies the criteria and practical details for the application of the POG rules in the IDD, which are intended to ensure that all insurance products for sale to customers meet the needs of their specific target market in order to avoid and reduce from an early stage risks of failure to comply with customer protection rules. The Commission Delegated Regulation with regard to information requirements and conduct of business rules applicable to the distribution of insurance-based investment products concerns information requirements and conduct of business rules applicable to the distribution of insurance-based investment products, specifying the criteria and practical details for the application of the rules on conflicts of interest, on inducements and on the assessment of suitability and appropriateness.

In April 2017 EIOPA published a methodology to derive the ultimate forward rate (UFR). By doing so EIOPA fulfilled its mandate according to Article 47 of the Delegated Regulation on Solvency II which requires that the methodology to derive the UFR shall be clearly specified (see Box 3).

In the context of the IDD, EIOPA published on the 11th of October 2017 Guidelines on Insurance based investment products that incorporate a structure which makes it difficult for the customer to understand the risks involved. The guidelines aim to facilitate the identification of types of products which are deemed complex and therefore not fit for distribution via execution-only (i.e. distribution without an assessment of the suitability or appropriateness of an insurance-based investment product for the customer by the insurance intermediary or insurance undertaking).

The Joint Committee of the three European Supervisory Authorities (EBA, EIOPA and ESMA - ESAs) approved on the 28th July 2017 its technical advice to assist the Commission on the possible content of the delegated acts on the procedures used to establish whether a Packaged Retail and Insurance-based Investment Product (PRIIP) targets specific environmental or social objectives. The Technical Advice addresses four areas of regulatory attention with regard to PRIIPs with environmental or social objectives: specific environmental or social objectives, disclosure of specific investment policy, governance procedures and controls and review of progress.

The Joint Committee of the three European Supervisory Authorities published on the 22nd September 2017 guidelines to prevent the abuse of funds transfers for terrorist financing and money laundering purposes. These guidelines are part of the ESAs' wider work on fostering a consistent approach to Anti-Money Laundering and Countering the Financing of Terrorism (AML/CFT) and promote a common understanding of payment service providers' obligations in this area. In particular, the

guidelines set clear, common regulatory expectations of payment service providers' policies and procedures to ensure the completeness of the information on payers and payees to be passed on along the payment chain.

The International Association of Insurance Supervisors (IAIS) announced in July 2017 the release of Insurance Capital Standard (ICS) Version 1.0 for extended field testing, which will be an important input into the future development of the ICS. The ICS is part of the Common Framework for the Supervision of Internationally Active Insurance Groups (IAIGs). Once finalised and agreed, the ICS will establish minimum standards for setting levels of capital for IAIGs, including methods of calculating the ICS capital requirement and ICS capital resources.

Box 3: The methodology to derive the UFR

Under Solvency II risk-free interest rates are used for the discounting of insurance and reinsurance liabilities. For that purpose, EIOPA is required to derive and publish risk-free interest rates. EIOPA is currently publishing risk-free interest rates for 33 currencies on a monthly basis.

The risk-free interest rates are derived from prices of financial instruments that are traded in deep, liquid and transparent markets. The financial instruments are interest rate swaps and, where swaps are not available, government bonds. For maturities where the markets for the relevant financial instruments or for government and corporate bonds are no longer deep, liquid and transparent the risk-free interest rates are derived by means of extrapolation towards an ultimate forward rate (UFR). For the euro the risk-free interest rates for maturities longer than 20 years are extrapolated. EIOPA is currently applying an UFR of 4.2% for most currencies, including for the euro.

In April 2017 EIOPA published a methodology to derive the UFR. By doing so EIOPA fulfilled its mandate according to Article 47 of the Delegated Regulation on Solvency II which requires that the methodology to derive the UFR shall be clearly specified.

In line with the relevant provisions of the Delegated Regulation the published methodology determines the UFR as the sum of an expected real rate and an expected inflation rate. The expected real rate is a long-term average of observed real rates since 1961. The expected inflation rate is based on the inflation targets of central banks. The annual changes to the UFR are limited to 15 basis points.

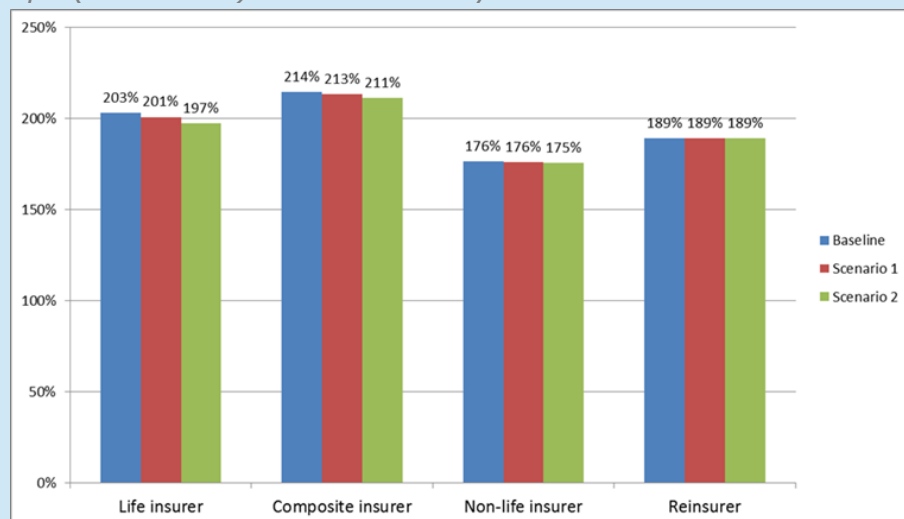
The methodology aims to strike the right balance between the legal requirements of stability of the UFR over time and reflecting changes in long term expectations.

The first application of the UFR methodology is set to the beginning of 2018. In line with the methodology, and reflecting the significant changes in the long-term expectations of interest rates in the recent years, the calculated value of the UFR for the euro is 3.65%. However, since annual changes will not be higher than 15 basis points, the current UFR of 4.2% will be lowered in January 2018 to 4.05%.

EIOPA has analysed the impact of changes to the UFR on the financial position of a representative sample of 336 insurance and reinsurance undertakings from 29

countries of the EEA (Figure B3.3). The impact varies across different markets and undertakings, but the results of the calculations show that at a European level the impact of the planned changes to the UFR is very small and manageable by insurance and reinsurance undertakings.

Figure B3.3: Average impact of reducing the UFR by 20 bps (scenario 1) and 50 bps (scenario 2) on the solvency ratio of insurance and reinsurance undertakings)



Source: EIOPA

Reporting Reference Date: 31/12/2015

3. The global reinsurance sector

In 2017 the reinsurance market still suffered from an oversupply of capacity owing to the absence of large losses in the last years and the continuing capital-inflow into the reinsurance market, both traditional and alternative. The rate of price declines reduced in 2017 further but due to the high losses in the third quarter of 2017 (hurricane Harvey, Irma and Maria) the future price development is largely uncertain. Up to now most analysts expect reinsurance rate increases to be limited to regions affected by the 2017 hurricanes and to one or two renewal seasons, after which slow and steady softening may return.³⁰

3.1. Market growth

Reinsurance demand is still subdued, whereas the reinsurance capacity continues to increase. As a long-term trend insurers tend to raise the retention as insurers have increased their risk management. Furthermore, the competitive markets as well as low investment returns force the insurers to be increasingly price sensitive, whereas the insurers' capital basis rose along with the reinsurers' one due to the relatively benign catastrophe activity in the last years.

In the first half year of 2017 the global insurance industry catastrophe losses were considerably lower than the corresponding figures for the previous year. The insured losses decreased by nearly 40% to USD 19.5bn from USD 32bn during this time.³¹ The overall economic losses fell by nearly two-thirds to USD 41bn from USD 111bn. However, the overall economic losses and the insured losses were considerably lower than the 10-year average of USD 102bn and USD 29bn respectively. But most positive is the further decrease of fatalities. 3,200 people lost their lives during the first two quarters of 2017 in comparison with 5,100 in 2016 for the same period. These figures are significant lower than the 10-year (47,000) and also the 30-year (28,000) averages.

Table 3.1: The five largest natural catastrophes in the first half year of 2017, ranked by insured losses (in USD bn)

Date	Event	Region	Overall losses USD bn	Insured losses USD bn
08/05/2017-11/05/2017	Hailstorm, severe storm	USA	2.2	1.8
06/03/2017-09/03/2017	Severe storm, tornado	USA	2.2	1.6
25/03/2017-28/03/2017	Hailstorm, severe storm	USA	2.0	1.5
27/03/2017-06/04/2017	Cyclone Debbie, flood	Australia	2.7	1.4
28/02/2017-02/03/2017	Tornado, severe storm	USA	1.9	1.4

Source: Munich Re, NatCatSERVICE

The three costliest natural disaster events for the insurance industry during the first half of the year were thunderstorms in the USA, each causing economic losses of more than USD 2bn. The total economic loss from these storms amounted to USD 18.5bn, of which USD 13.5bn was insured. In Europe, catastrophe events caused

³⁰ <http://www.artemis.bm/blog/2017/09/26/maria-how-big-is-it-really-are-reinsurance-rate-rises-likely/>

³¹ Munich Re: NatCatSERVICE.

overall losses of USD 5bn (EUR 4.4bn), of which USD 1.9bn (EUR 1.7bn) were insured.³²

In 2017 the hurricane season was very active. With Harvey, Irma and Maria at least three mayor hurricanes came over the Caribbean and Southern USA with devastating consequences. Hurricane Harvey was the first hurricane, which made landfall in the USA since hurricane Wilma in 2005. Air Worldwide expects that hurricane Maria, which hit mostly Puerto Rico, alone could cause insurance losses between USD 40bn and USD 85bn.³³ All insurance losses from the Q3 events could total up to USD 165bn.³⁴ This quarter could be the most costly on record for the reinsurance industry.

The loss estimations are preliminary, but there is no doubt, that the losses will burden the technical results of the reinsurers. Some reinsurers already warned that the hurricane losses reduce the profit guidance for 2017.

On the other hand against the background of the huge capital supply in the reinsurance market the hurricane losses have presumably not what it takes to change sustainably the trend of prices across all regions and lines of business. Thus, the further price development looks largely uncertain.³⁵

Against the background of the ongoing finance and debt crisis the diversifying nature of catastrophe-exposed business attracts investors who are searching for safe investments. Low corporate and sovereign debt yields are likely to continue to produce more capacity for catastrophe and other reinsured risks. While the non-traditional capital is mainly going into the non-proportional catastrophe business, this new capital seems to spill over also into other reinsurance lines.

3.2. Profitability

Altogether, the competitive pressure in the reinsurance sector remains high.

The combination of the continuing capital-inflow into the reinsurance market, lacking large catastrophe losses affecting the prices and increasingly low investment returns due to the sustained low interest rate environment increases the profitability pressure in the reinsurance business. Moreover, the ability to release reserve from previous years appears to have been diminished, whereas the long-term business is getting less profitable or even unprofitable as the high interest rates calculated in previous years are difficult to earn. Against this background getting risk-adequate prices at the upcoming renewals is crucial for the reinsurance companies.

3.3. Solvency

The global reinsurer capital totalled USD 605bn as of June 2017 and remained more or less unchanged when compared with the end of 2015 (USD 595bn). Over the last decade, however, overall reinsurer capital has increased by 78 percent.³⁶

The high losses resulting from the active hurricane season 2017 will undoubtable lead to lower technical results of many reinsurers and in some cases hinder the achievement of the profit guidance for 2017. Thus, from a short-term perspective the

³² Munich Re, NatCatSERVICE.

³³ Munich Re, NatCatSERVICE.

³⁴ Munich Re, NatCatSERVICE.

³⁵ <http://www.artemis.bm/blog/2017/09/26/maria-how-big-is-it-really-are-reinsurance-rate-rises-likely/>

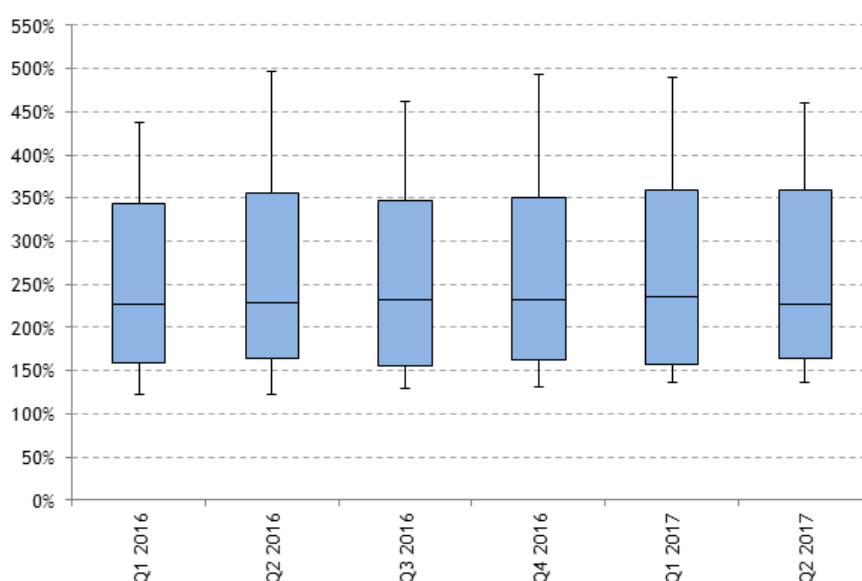
³⁶ AON Benfield: Reinsurance Market Outlook September 2017, page 2.

losses could diminish temporarily the resilience and the solvency position of the reinsurers. As the future price development is largely uncertain an increase of the profitability in return remains to be seen.

Nevertheless a sustained lower resilience of the reinsurers is not expected. According to most estimates reinsurance rate increases are expected in regions affected by the 2017 hurricanes. Most striking, the loss events occurred at a moment where the reinsurance market is characterised by an oversupply of capacity. Thus, the reinsurance industry in total will maintain its high resilience. Given the amount of cash on the sidelines waiting to be put to work, even after hurricane Katrina, the overall capacity is to be expected to remain where it is. The reinsurance industry has sufficient capital to absorb a 1/250 aggregate net loss.³⁷

So far, there has been no major decrease in the SCR ratios due to the recent natural catastrophes (Figure 3.1). The SCR ratio declined slightly for the median company in Q2 2017 but is well above the prudential requirement of 100%. However, for the 90th percentile the drop has been more substantial, albeit from an extremely high basis. Short-tail claims like property damage are normally reported a short time after the incident and are generally settled only within months after the damage has occurred. The effect on the SCR ratios of reinsurers might hence be even higher after the third quarter or towards the end of the year 2017.

Figure 3.1: Reinsurers' SCR ratio (in %; median, interquartile range and 10th and 90th percentile)³⁸



Source: EIOPA Quarterly Solo based on 121 reinsurance companies
 Note: Reinsurers included write more than 80% of GWP in reinsurance
 Reporting reference date: 30/06/2017

³⁷ ARTEMIS Website: <http://www.artemis.bm/blog/2017/09/26/maria-how-big-is-it-really-are-reinsurance-rate-rises-likely/>

³⁸ Please note that the graph does not show any observation below the 10th percentile.

3.4. Alternative sources of capital

Alternative capital rose by 10 percent to USD 89bn in the first half year of 2017, reflecting renewed investor appetite for insurance risk.³⁹ In the first half year more than USD 8.5bn of insurance-linked securities (ILS) were placed, an all-time high beating even any prior full-year total. The total outstanding ILS amounted to USD 29.9bn by the end of September, also an all-time high in comparison with the prior full-year totals.⁴⁰ Nevertheless, collateralised reinsurance transactions represent still the bulk of the alternative capital.

³⁹AON Benfield: Reinsurance Market Outlook September 2017, pages 2, 4-6.

⁴⁰<http://www.artemis.bm/dashboard/>

4. The European pension sector

The European pension sector is negatively affected by the challenging macroeconomic environment. Low interest rates keep pressure on pension funds. This was clearly revealed by the EIOPA EU-wide IORP stress test in 2015. Hence, the second EU-wide exercise was performed this year to follow up on the risks identified. Additionally, the new exercise is focused on the impact on the real economy and financial stability.

4.1. Developments in the quality of occupational pension fund data⁴¹

EIOPA collects aggregated occupational pension fund data from the national competent authorities (NCAs) on a 'best effort basis', where adjustments and simplifications are applied. Furthermore, the absence of a unified valuation framework makes comparisons across countries very difficult. Hence, an in-depth risk analysis and assessment of the sector based on granular knowledge of assets and liabilities cannot be regularly performed. The baseline scenario of the EU-wide IORP stress tests with the use of a common methodology, when the representativeness of the sample is achieved, could provide detailed insight into risks and vulnerabilities. However, it cannot be used frequently, given the resource intensiveness and the complexity of the exercise.

For this reason, EIOPA is planning to enhance the availability of occupational pensions data at European level and is developing one single framework where regular annual and quarterly information is requested from national supervisory authorities. In addition, EIOPA's proposal is broadly aligned with similar European and international reporting standards (e.g. European Central Bank (ECB), Eurostat, the Organisation for Economic Co-operation and Development OECD) to ensure an efficient use of information.

For this purpose a public consultation was launched on 26 July 2017 and ended on 27 October 2017. After consideration of the input received and potential amendments to the reporting templates it is planned that the final set of templates will be published most likely in Q1 2018. EIOPA has proposed that the reporting requirements should enter into force in 2018, with the first annual reporting of end 2018 data to be carried out in 2019. High quality data is decisive to take informed policy decisions, to effectively monitor and analyse the situation of the European occupational pensions sector, to highlight potential gaps and corresponding risks as well as to advise on required actions.

4.2. Market growth of the occupational pension fund sector

Total assets owned by occupational pension funds increased by 0.2 per cent for the EEA and 5 per cent for the euro area in 2016 (Figure 4.1). The euro area growth rate of total assets has been significant during the course of 2016. In the NL, the second largest IORP market, the value of total assets increased by 10%. The overall small increase in total assets is mainly attributed to the substantial exchange rate depreciation of the GBP over the EUR in 2016, which negatively affected the EUR value of total assets in the UK. Finally, when looking at all other countries in the sample (excluding UK and NL) total assets increased by 7% in value in 2016.

⁴¹ <https://eiopa.europa.eu/Pages/Consultations/EIOPA-CP-17-005-Consultation-paper-on-EIOPA's-regular-information-requests-towards-NCAs-regarding-provision-of-occupational.aspx>

The UK and the Netherlands account for about 81% of the European occupational pensions sector in terms of total assets under management (Table 4.1). Cross-country differences in the importance of the sector are mainly driven by the national set-up of pension systems and the relative share of private and public pension provision. Both the UK and NL are providing their citizens with relatively modest flat-rate state pensions, which are complemented by significant private pension provisions. Pension funds under Pillar I are not covered in this chapter.

Table 4.1: Total assets per country as a share of total assets reported for 2016

UK	NL	DE	IT	IE	ES	NO	BE	IS	AT	SE	PT	DK
45.53%	35.90%	6.24%	3.44%	2.94%	1.03%	0.97%	0.75%	0.67%	0.58%	0.52%	0.48%	0.22%
RO	LI	FI	SI	LU	SK	GR	PL	LV	HR	BG	MT	HU
0.20%	0.17%	0.12%	0.07%	0.05%	0.05%	0.03%	0.01%	0.011%	0.003%	0.0002%	0.00006%	0.00002%

Source: EIOPA

Note: Figure for UK contains DB and HY schemes only

The penetration rate, i.e. the size of the occupational pension fund sector with respect to the GDP, remained broadly unchanged in 2016, both for the EEA and the euro area (Figure 4.1). Overall, for the EEA it is approximately 24% and for the euro area it is 13% in 2016. This ratio gives an indication of the relative wealth accumulated by the sector. However, there is large heterogeneity across countries (Figure 4.2), which again is mainly driven by the different relative share of private and public pension provisions.

Figure 4.1: Total Assets (in EUR bn)

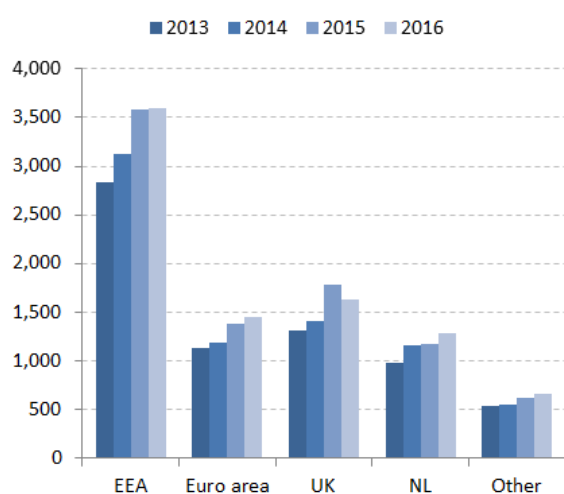
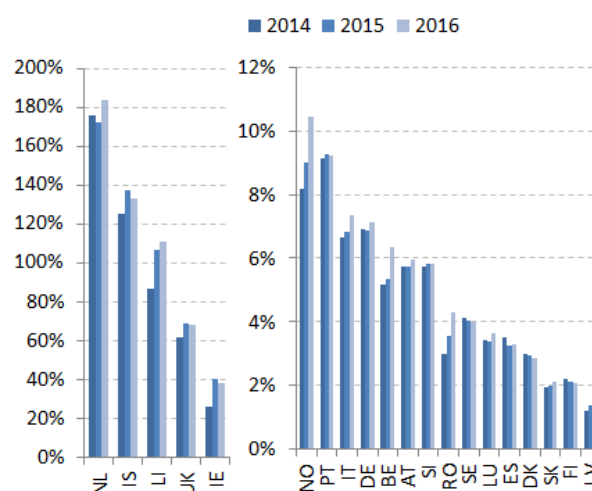


Figure 4.2: Penetration rates (total assets as per cent of GDP)



Source: EIOPA

Note: For the UK data refer only to DB and HY schemes.

Figure 4.1 is based on data received by 26 countries (EEA) and 15 countries (EA) which provided total assets for 2016. The category "Other" includes all countries except UK and NL.

Figure 4.2 Penetration rate for GR, HR, PL, MT, BG, and HU is lower than 1 per cent.

4.3. Performance, funding and membership developments

In aggregate terms, the investment allocation of pension funds for most of the countries remained almost unchanged in recent years (Figure 4.3 and Figure 4.4). Debt and equity investments account for the highest share in the portfolio investment allocation of pension funds. The total exposure to sovereign, financial and other bonds added up to 48 per cent in 2016 and the total exposure to equity to 30 per cent in 2016. Pension funds typically have a long-term horizon regarding investments; it was observed that equities generally have a higher weight in the investment share than in the insurance sector.

This investment mix of IORPs was relatively stable in the past three years. This is partly due to strict legal or contractual investment restrictions, which are put in place for prudential reasons, as well as due to the fact that pension funds generally have a long-term perspective when investing, so that investment portfolios are not reallocated frequently.

Figure 4.3: Investment Allocation for 2014 to 2016 (in per cent)

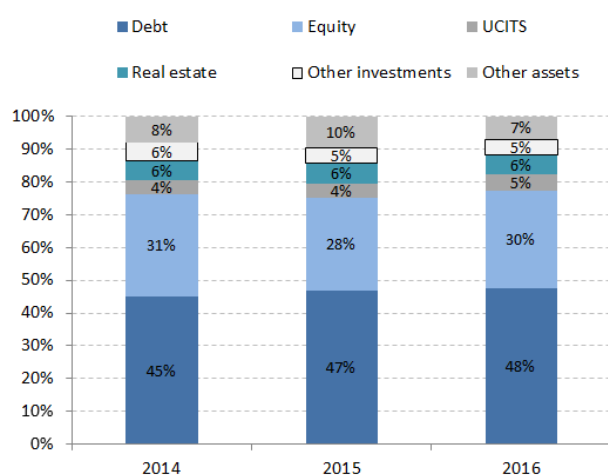
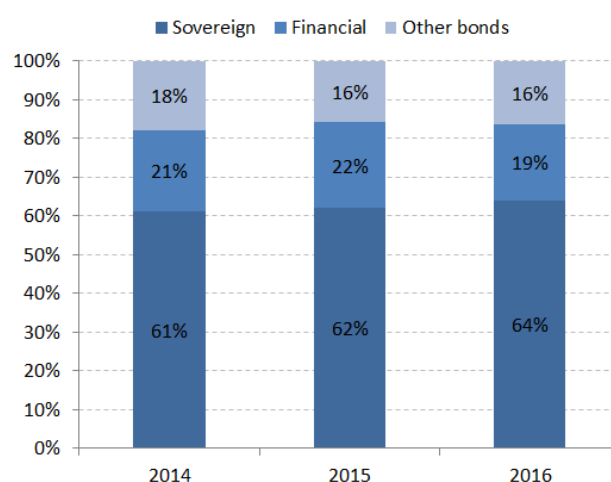


Figure 4.4: Bond investments breakdown for 2014 to 2016 (in per cent)

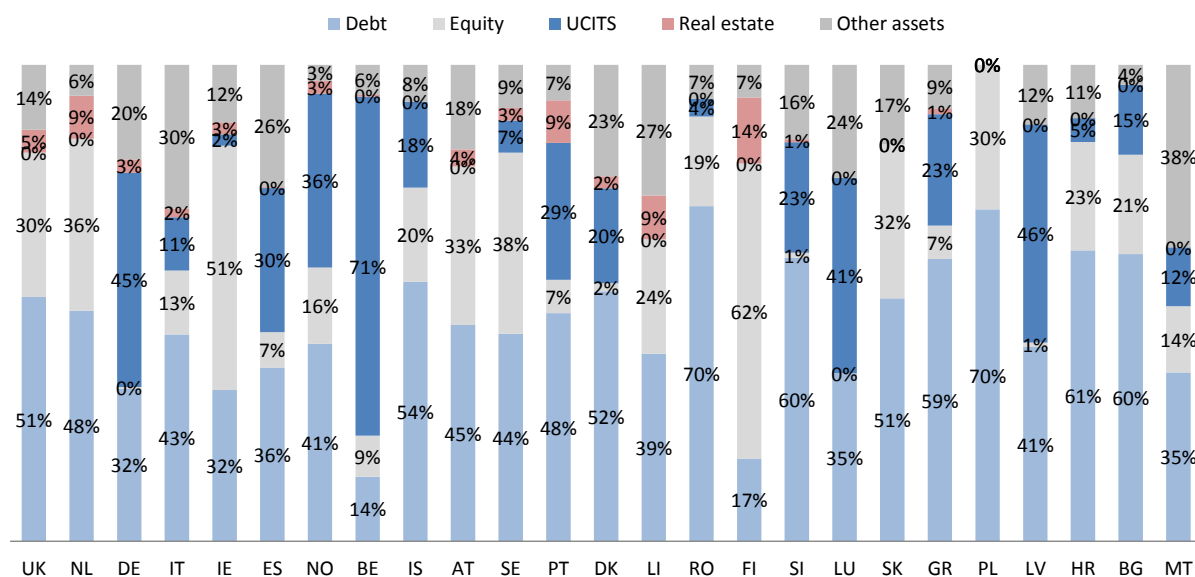


Source: EIOPA

Note: UCITS stands for Undertakings for Collective Investment in Transferable Securities. For all variable definitions please refer to the statistical annex published at: <https://eiopa.europa.eu/financial-stability-crisis-prevention/financial-stability/statistics>. In the figure, "Other investments" also Loans and Reinsured technical provisions are included.

Investment allocation for 2016 across countries is very heterogeneous (Figure 4.5). Direct investments in bonds and equity may vary substantially across the countries of the sample. However, countries with particularly low direct investments to debt and equity usually invest in these categories through UCITS.

Figure 4.5: Investment Allocation per country (in per cent) for 2016



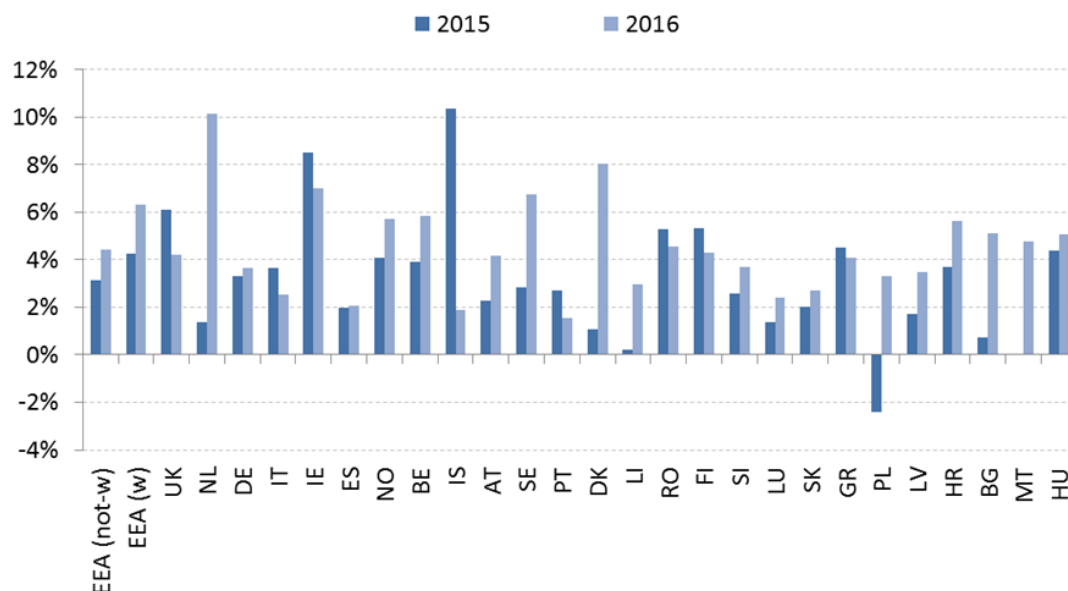
Source: EIOPA

Note: "Other" includes: Derivatives, loans, reinsured technical provisions, other investments and other assets.

For all variable definitions please refer to the statistical annex published at: <https://eiopa.europa.eu/financial-stability-crisis-prevention/financial-stability/statistics>. The UK figure used for the calculations of these figures relates to DB and HY schemes only. Finally, please note that the information on investments in UCITS is not available for all countries.

The average rate of return increased in 2016. The average ROA (Figure 4.6) in 2016 (un-weighted 4.4 per cent, weighted 6.3 per cent) increased compared to 2015 (un-weighted 3.1 per cent, weighted 4.2 per cent). This can be attributed to the relatively high performance of the equity and fixed income markets during 2016.

Figure 4.6: Rate of return on assets (ROA) in per cent



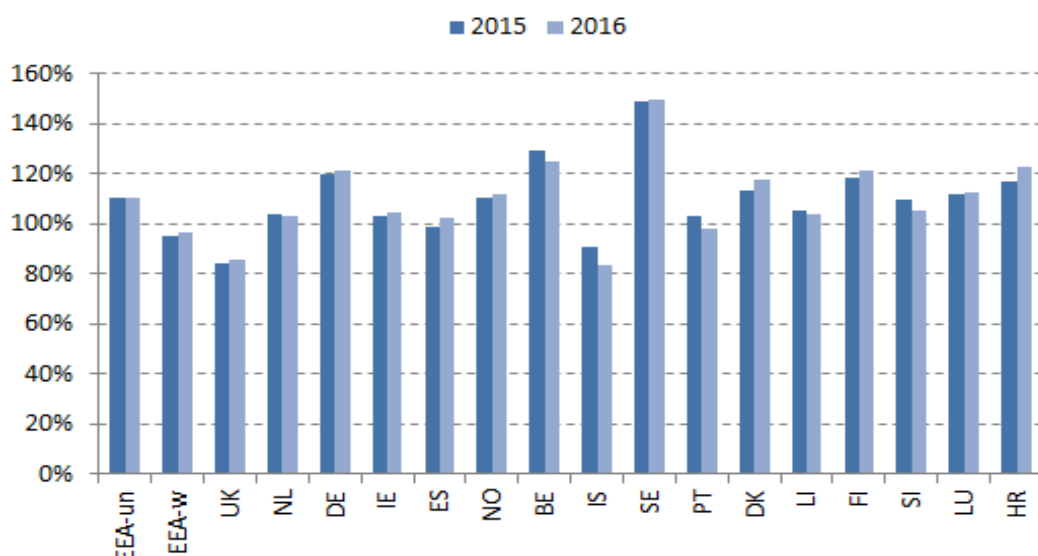
Source: EIOPA

Note: Both the weighted and un-weighted averages for ROA were calculated on the basis of the countries that are depicted in the chart. The weighting was based on total assets.

Cover ratios for DB schemes have remained broadly unchanged in 2016.⁴²

Overall, the weighted average cover ratio increased from 95% in 2015 to 96% in 2016 whereas the un-weighted average coverage ratio remained unchanged at 111%. Due to differences in national regulatory frameworks, IORPs across Europe are not subject to the same funding requirements. However, cover ratios close to or below 100 per cent remain a concern for the sector if low interest rates persist. In some countries there is full sponsor support and pension protection schemes exist to support schemes in the event of shortfalls. However, an extreme adverse scenario may strain the ability of the sponsors to deal with the potential increases in contributions. In some countries a (partial) suspension of benefit increases as well as benefit reductions are ways to tackle low cover ratios.

Figure 4.7: Cover ratios (in per cent)



Source: EIOPA

Note:

(1) Cover ratios refer to DB schemes. Countries with predominant pure DC schemes are not included in the chart and in the average calculations.

(2) Both the weighted and un-weighted averages for the cover ratio were calculated on the basis of the 16 countries depicted in the chart. The weighting was based on total assets.

(3) Due to different calculation methods and legislation, the reported cover ratios are not comparable across jurisdictions.

(4) For PT, the amount of liabilities reported corresponds to the one calculated under the financing scenario. At the end of 2016 this amount was higher than the amount calculated according to the applicable funding requirements. Therefore, the fact that assets are lower than liabilities does not necessarily mean that the market is in deficit in terms of applicable funding requirements.

The overall active membership increased in 2016 by 7 per cent in the EEA and 3 per cent in the euro area (Figure 4.8). The overall increase in active membership can be attributed to a large extent to the (gradual) introduction of auto-enrolment in the UK. Since October 2012 larger employers are required to automatically enroll workers in a workplace pension. This requirement will apply to all employers by 2018. Furthermore, new members in most of the countries automatically enroll into DC schemes as depicted in figure 4.9. This trend is likely to continue in the coming years since DB schemes are generally closed to new members. It also implies shift of the risks from pension funds to policyholders. From a financial stability and consumer protection point of view this trend requires close monitoring.

⁴² Cover ratio (%) is defined as net assets covering technical provisions divided by technical provisions.

Based on a recent survey published by the FSB, risks associated with both DB and DC schemes have financial stability implications.⁴³

Figure 4.8: Active members (in thousands)

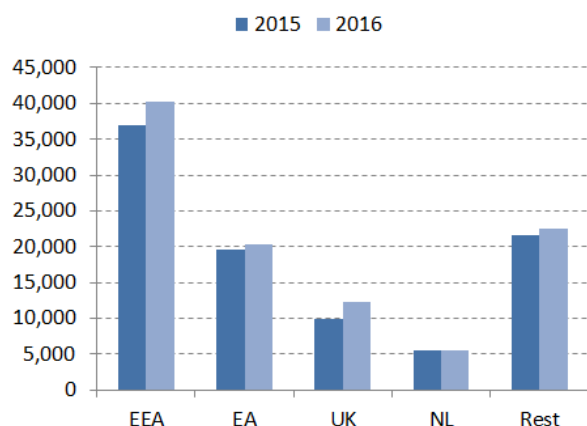
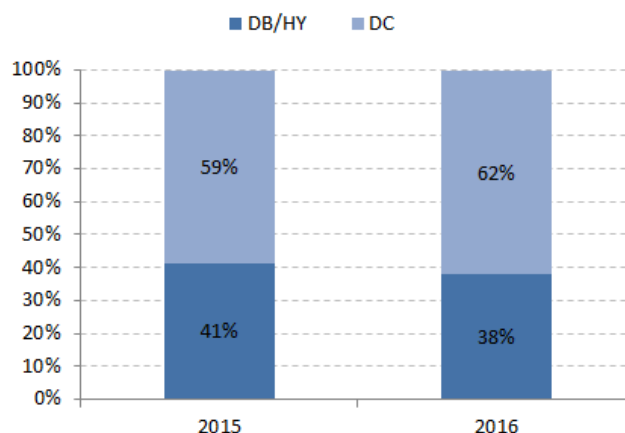


Figure 4.9: DB/HY and DC breakdown (in per cent)



Source: EIOPA

Note: Figure 4.8 does not include SE. Furthermore, BG, DK, FI, GR, HR, HU, LI, LU, MT and PL have below 100.000 members. Figure 4.9 does not include SE and AT.

4.4. European pension product developments⁴⁴

Additionally to the developments in the occupational pension sector, EIOPA submitted to the European Commission its Advice on the development of an EU Single Market for personal pension products (PPP) in 2016 recommending the development of a standardised Pan-European Personal Pension Product (PEPP) regulated by a 2nd regime for personal pensions. EIOPA proposed the PEPP as being the most attractive option to promote the Single Market and to strengthen the regulatory framework for the benefit of protection of consumers.

PEPP is designed to be a safe, transparent and cost-effective long-term retirement savings product that will offer pensions savers new savings opportunities for future retirement income within a European personal pension framework. It is expected to be a powerful tool to encourage personal pension savings for individuals and to enable important long-term investments. The design of this personal pension product framework, in particular through its standardised elements, can reap economies of scale and help to increase transparency and consumers' understanding. Furthermore, it will provide a level playing field for providers, encourage competition, increase trust among consumers and cater for the European labour market. The PEPP will not replace existing national personal schemes, but will be a complimentary regime alongside national regimes. Following the European Commission's proposals, issued in June 2017, EIOPA will have a key role in enabling consistent implementation and EU-wide consistent authorisation to ensure high-quality PEPPs throughout Europe.

⁴³ FSB (2017): Report on European Private Pension Schemes: functioning, vulnerabilities and future challenges, <http://www.fsb.org/wp-content/uploads/P171017.pdf> (pages 77-79).

⁴⁴ <https://eiopa.europa.eu/regulation-supervision/pensions/personal-pensions>

5. Risk assessment

5.1. Qualitative risk assessment

EIOPA conducts twice a year a bottom-up survey among national supervisors to determine the key risks and challenges classified as the most imminent in terms of their probability and potential impact. The Autumn survey reveals that low interest rates, credit and equity risks remain the main risks, although overall they decreased slightly for the insurance sector (Figure 5.1). For the pension sector, the risk for low interest rates increased (Figure 5.2). According to the survey, low interest rates and sovereign credit risk are expected to decrease further, whilst equity risk and property risk is expected to increase (Figure 5.3). ALM risks and lapse risks are also expected to increase, albeit to a smaller extent. However, the overall increase is lower than the one observed in the Spring Survey 2017.

The highest variations for the insurance sector when compared with the previous survey were ALM and lapse risks which increased by about 1%. All the other risks remain more or less unchanged.

Figure 5.1: Risk assessment for the insurance sector



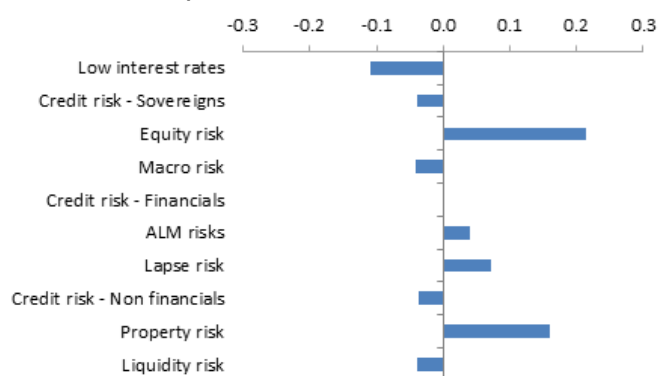
Figure 5.2: Risk assessment for the pension funds sector



Source: EIOPA Autumn Survey 2017

Note: Risks are ranked according to probability of materialisation (from 1 indicating low probability to 4 indicating high probability) and the 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.

Figure 5.3. Supervisory risk assessment for insurance and pension funds - expected future development



Source: EIOPA Autumn Survey 2017

Note: EIOPA members indicated their expectation for the future development of these risks. Scores were provided in the range -2 indicating considerable decrease and +2 indicating considerable increase.

5.2. Quantitative risk assessment

This chapter further assesses the key risks and vulnerabilities identified in this report. In detail, more comments on the solvency capital requirements are made. The asset allocation and the investment portfolios are further analysed. Equity investments for solo undertakings are also presented. Furthermore, the use of derivatives and insurers' exposure to the banking sector is shown. The profitability for insurers is evaluated, assessing the ROI (return on investments) for the first time and includes the ROA (return on assets) projection for 2017. Finally, cross-border exposures and interlinkages are discussed as well.

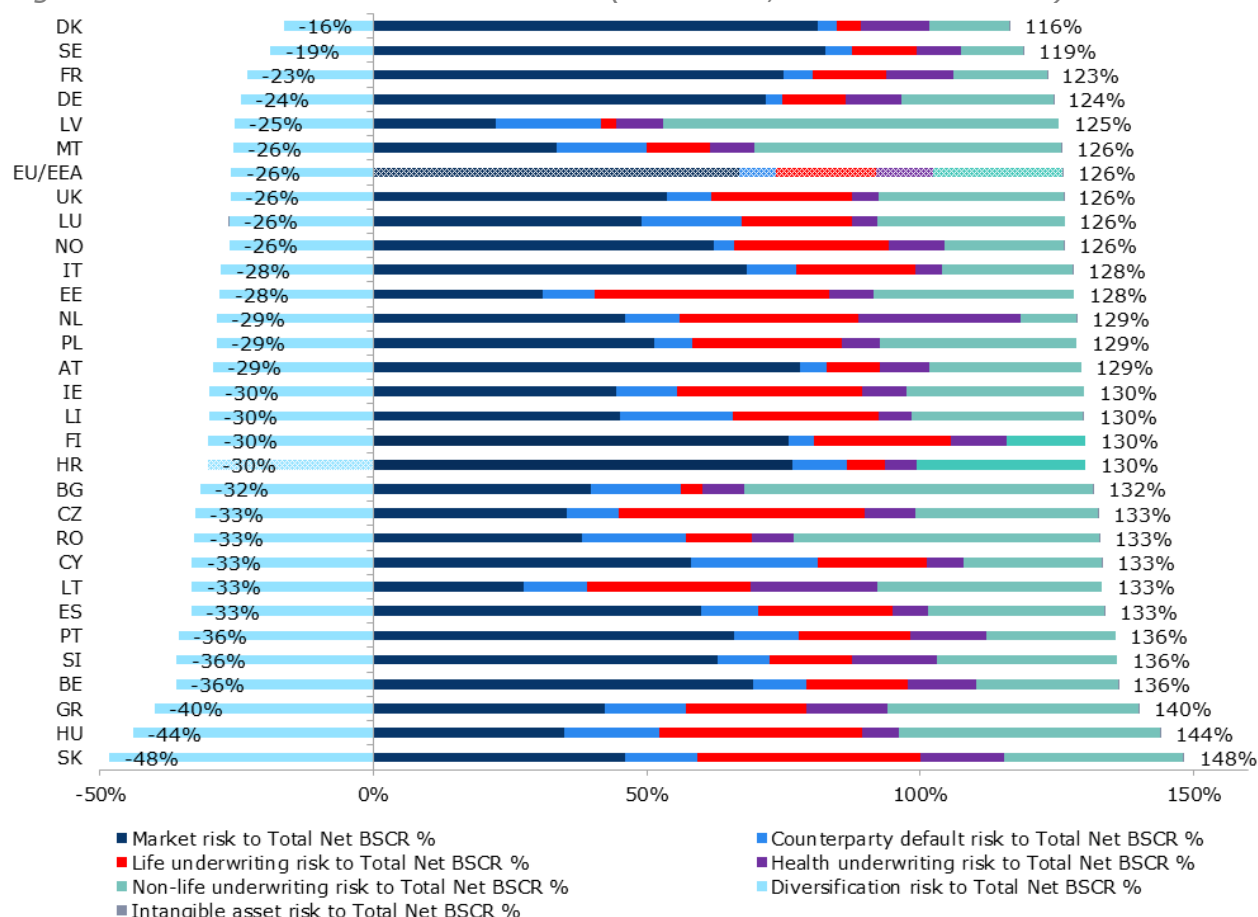
With a still low yield environment, the market conditions have affected some insurers' solvency ratios by increasing the value of long-term liabilities, eventually impacting the solvency position. The negative impact is higher for life insurers with more pronounced duration mismatch between assets and liabilities. In this context, the latest developments of solvency ratios are illustrated below.

The net basic SCR reflecting insurers' risk profiles exhibits heterogeneity at country level (Figure 5.4).⁴⁵ The market risk varies from 22% in Latvia to 83% in Sweden before diversification. Non-life underwriting risks ranks second highest. It varies from 10% in the Netherlands to 72% in Latvia. The diversification benefit has also a large impact on the Net Basic SCR. It ranges from -48% in Slovakia and -44% in Hungary to -19% in Sweden and -20% in Denmark.

The EU/EEA average also shows that more than half of the net basic SCR is composed of market risk while the diversification benefits reduce it by almost one third. Market risk is the main component that affects the SCR. Hence, there are several measures like long-term guarantees and transitional measures that can mitigate the effect (see Chapter 6).

⁴⁵ The diversification bar is calculated as the sum of diversification divided by the Total Net Basic SCR.

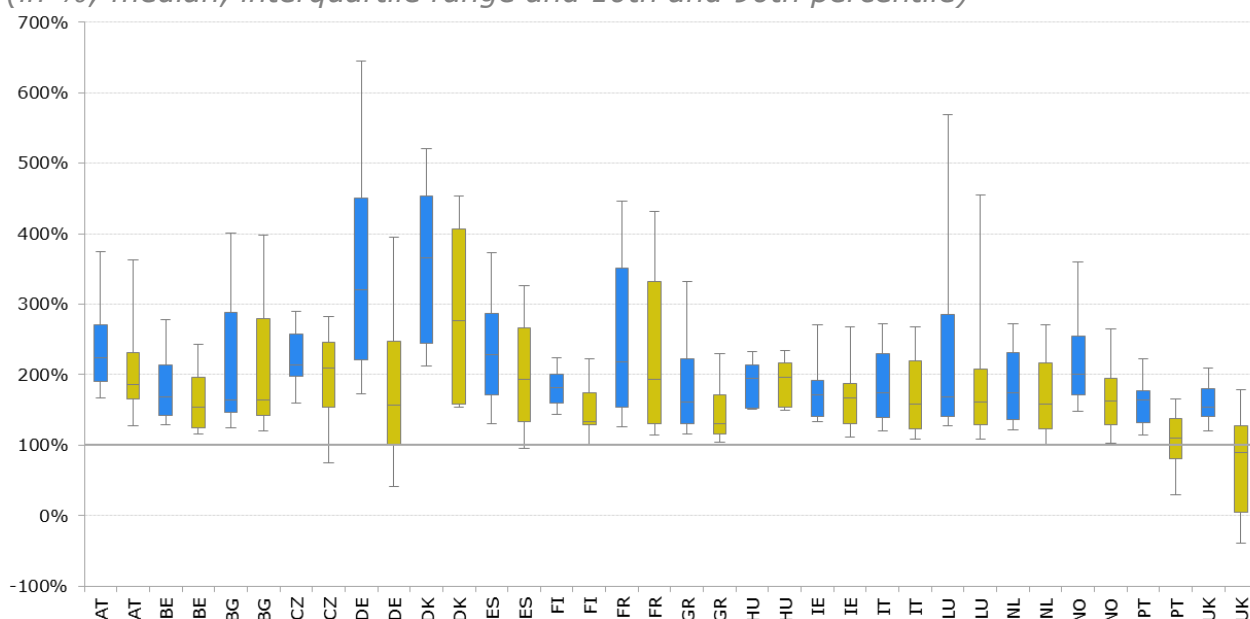
Figure 5.4: Breakdown of net basic SCR (basic SCR, Standard Formula)



Source: EIOPA Annual Solo (S.25.01 "Solvency Capital Requirement - for undertakings on Standard Formula").
Reporting Reference Date: 31/12/2016

The distribution of SCR ratios with and without the impact of LTG and transitional measures differs across undertakings and countries and in some countries the 100% critical threshold would be missed if these LTG measures were not applied (Figure 5.5). Given that transitional measures form an integral part of Solvency II and are intended to limit the procyclicality of the regulatory changes, especially insurers in Germany, Spain and the UK make use of the transitionals but also Greece and Portugal have various numbers of users.

Figure 5.5: Distribution of insurers' SCR ratios with LTG and transitional measures versus SCR ratios without LTG and transitional measures at country level (in %; median, interquartile range and 10th and 90th percentile)



Source: EIOPA (S.22.01.), sample based on 702 solo insurance undertakings in EEA

Reporting Reference Date: 31/12/2016

Note: blue boxplots show SCR ratios with LTG and transitional measures and yellow boxplots show SCR ratios without LTG and transitional measures. Countries that have less than 5 insurers in the sample at the date of analysis have been excluded.

The LTG measures seem to provide a financial stability cushion potentially acting in a counter cyclical manner.⁴⁶ The Report on long-term guarantees measures and measures on equity risk has shown that, in the absence of the easing effect of the LTG measures, insurers might be induced to force sales and de-risk in order to lower their SCR and MCR, possibly pushing further down asset prices, adding to the market volatility and potentially affecting financial stability.

The cumulative effect of LTG measures and transitionals on SCR is larger on life insurers while, as expected, the impact on non-life undertakings is for most countries negligible. Figure 5.6a shows the impact of the LTG measures and the transitionals on the aggregate SCR ratio for life insurers from a 2,701 sample with the full bar showing the aggregate SCR ratio with LTG measures and transitionals and each coloured block the impact of the corresponding measure or transitional while Figure 5.6b shows the impact of the LTG measures and the transitionals on the aggregate SCR ratio for composite insurers. Out of 2,701 undertakings, 557 are life, 1758 are non-life and 386 are composites.

⁴⁶ See EIOPA Insurance Stress Test Report 2016 and the Report on long-term guarantees measures and measures on equity risk 2016.

Figure 5.6a: Cumulative effect of LTG measures and transitionals on SCR ratios for life undertakings

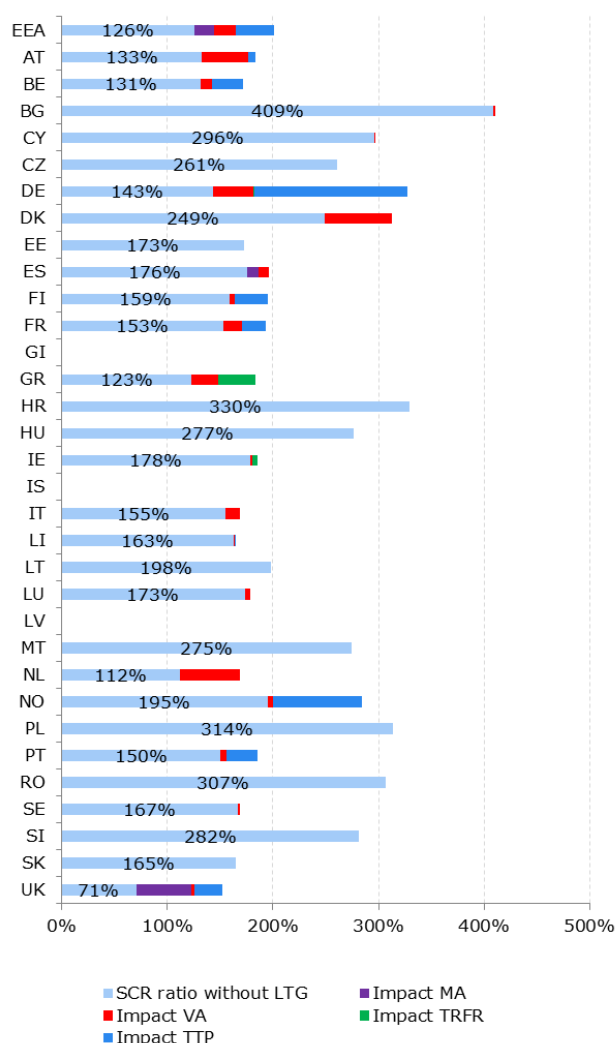
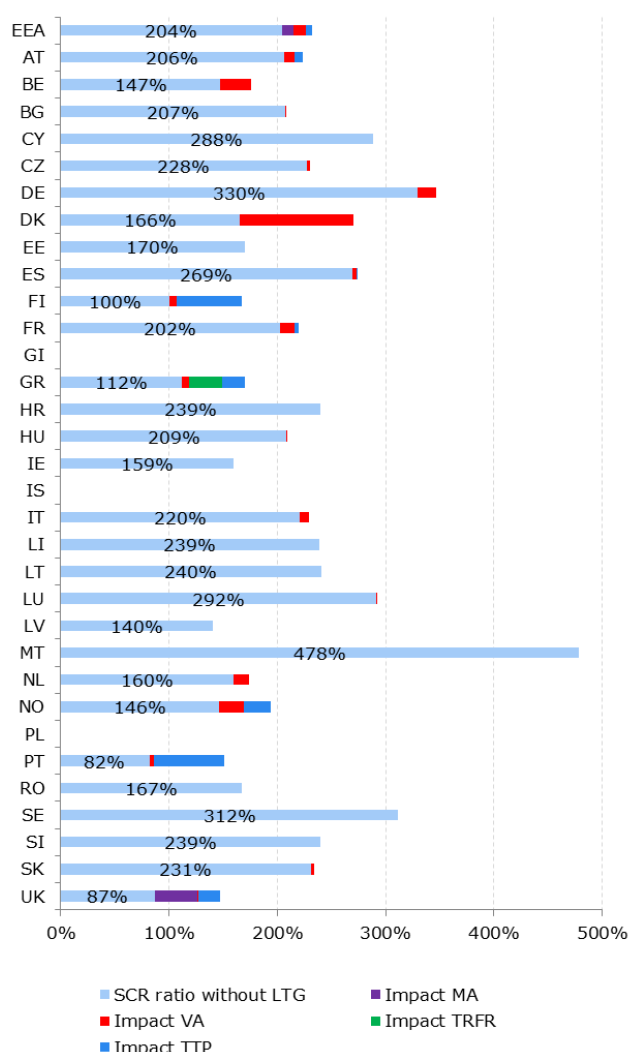


Figure 5.6b: Cumulative effect of LTG measures and transitionals on SCR ratios for composite undertakings

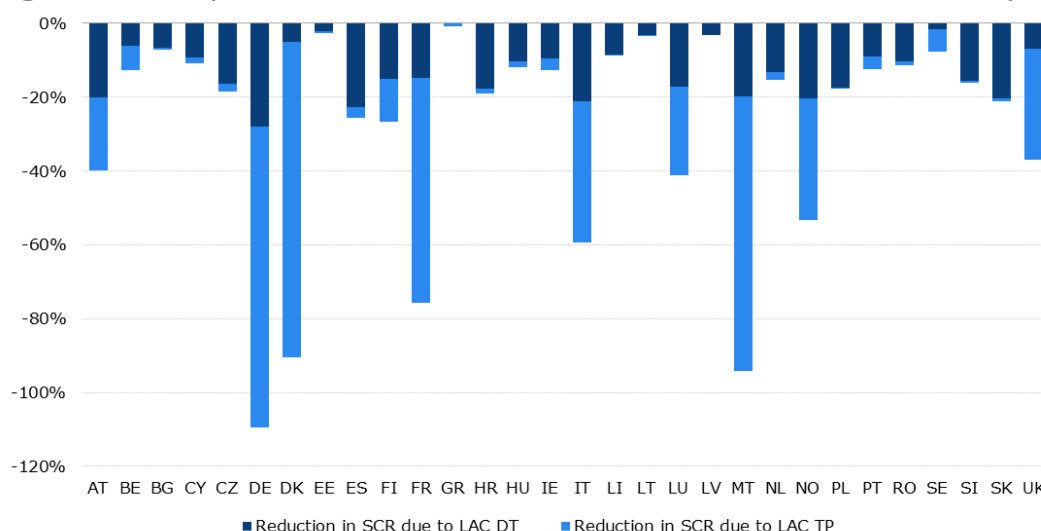


Source: EIOPA (S.22.01.), sample based on 2.701 solo insurance undertakings in EEA
Reporting Reference Date: 31/12/2016

The loss absorbing capacity of technical provisions (LAC TP) and deferred taxes (LAC DT) have also a significant impact on the SCR ratio (Figure 5.7).

These measures are related to the circumstances where the defined losses and shocks of the standard formula SCR can be compensated by a simultaneous decrease in the technical provisions for future discretionary benefits or an increase in net deferred taxes. The impact may be reduced if the undertaking can provide credible evidence that it can utilise the fiscal losses stemming from the impact of this pre-tax shock loss. The discretionary benefits components in technical provisions have an impact on both the solvency balance sheet of the insurer by increasing technical provisions and decreasing own funds and on the SCR by increasing the loss absorbency capacity of technical provisions, and hence decreasing the SCR (see Box 4).

Figure 5.7: Impact of LAC DT and LAC TP on the SCR ratio at country level

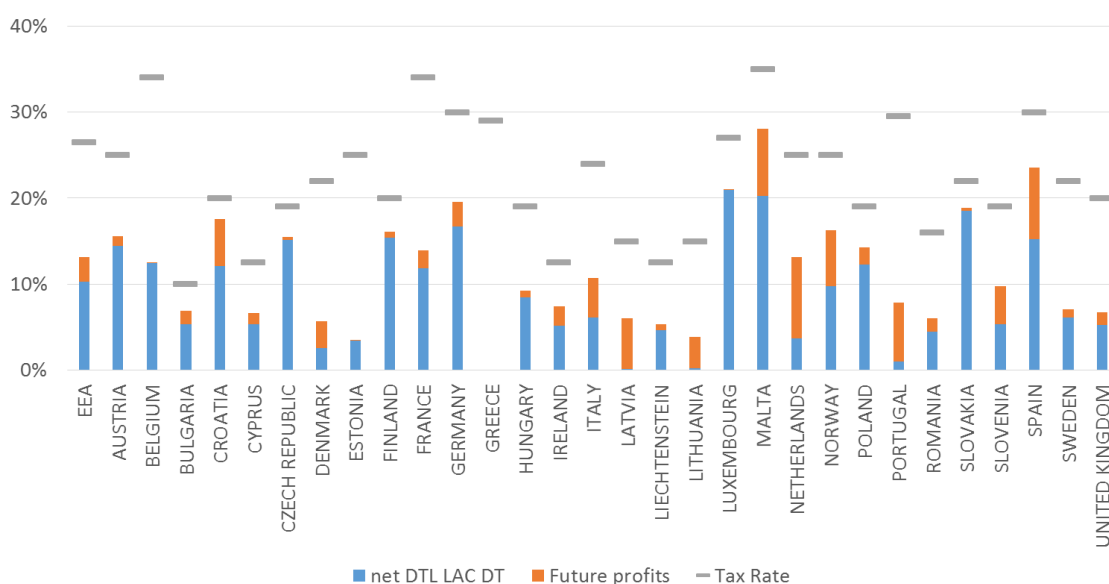


Source: EIOPA Annual Solo
Reporting Reference Date: 31/12/2016

Figure 5.8 shows as for each of the 30 jurisdictions, the total amount of LAC DT as percentage of the bSCR* (defined as the basic SCR plus operational risk and the loss absorbing capacity of technical provisions). The blue bars show the part of LAC DT for which a likely utilisation is being demonstrated by a net DT position on the balance sheet while the orange bars indicate the part of LAC DT that is being demonstrated by other means, including future profits.

At country level, in HR and LU the LAC DT is close to the tax rate whereas BE, AT, FR and DE insurers, among others, almost fully rely on net DTL for the likely utilisation of LAC DT. Insurers in NO, ES and the NL rely mainly on future profits, and carry-back if applicable (Figure 5.8).

Figure 5.8: Split of LAC DT over net Deferred Tax Liabilities (DTL) and other sources (future profits) versus the tax rate per jurisdiction in the EEA.*/**



Source: EIOPA Annual Solo
Reporting Reference Date: 31/12/2016

Note: * The total LAC DT per jurisdiction, both "net DTL LAC DT" and "Future Profits", are the sums of the LAC DT in a specific jurisdiction as a percentage of the sums of the bSCR*, the SCR excluding LAC DT, in that jurisdiction.

** The part of LAC DT that is being demonstrated by future profits for Ireland, the Netherlands and the United Kingdom also contain the part of LAC DT that is being demonstrated by carry-back.

Box 4: SCR post stress analysis

One of the June 2017 EIOPA Financial Stability Report thematic articles dealt with the re-estimation of Solvency Capital Requirement (SCR) after a shock.⁴⁷ The article elaborated on French Stress Test data to illustrate an unexpected phenomenon at the time⁴⁸: positive increase of the SCR value after a financial shock identifying the drivers of this evolution. A similar analysis has been conducted at EU level, using two financial scenarios, double hits, one originated from a shock in the EU stock market ("CA1") and the other in corporate debts ("CA2"). Aggregating and anonymising the figures⁴⁹, it is possible to fit the simple linear model utilised in the maiden article:

$$SCR = a \cdot gBSCR - b,$$

where, $gBSCR$ corresponds to the gross basic SCR, a represents the risk exposure (approximated as a fraction of the assets post over pre-stress) and b the different mitigation components: diversification, future discretionary benefits ("FDB") and Deferred Taxes ("DT"). Table B4.1 summarises the pre-stress position.

Table B4.1: Virtual insurance company calibrated for each scenario

in M€	CA1	CA2
Liabilities	100	100
gBSCR	7.78	8.39
b	4.51	2.99
Net SCR	3.26	5.39

Source: EIOPA

Using the linear mode T above, one infers the value of post-stress $gBSCR'$ and b' . The Net SCR averages reported SCR of groups with a positive increase of the capital charge. Results for each scenario are provided in table B4.2.

Table B4.2: Analysis of the two scenarios

in M€	CA1			CA2		
	Actual (a ≈ 0.93)	a = 0.9	a = 0.8	Actual (a ≈ 0.95)	a = 0.9	a = 0.8
Liabilities'	95.1	92	81.8	93.4	90.4	80.3
gBSCR'	7.39	6.65	5.91	7.83	7.05	6.26
b'	3.6	2.86	2.12	1.83	1.05	0.27
Net SCR'	3.79	3.79	3.79	6.00	6.00	6.00

Source: EIOPA

⁴⁷ See June 2017 Financial Stability Report thematic article "Re-evaluation of the capital charge in insurance after a large shock: empirical and theoretical views" by Fabrice Borel-Mathurin, Stéphane Loisel, and Johan Segers based on EIOPA ST 2014.

⁴⁸ The technical specifications and the analysis of the report of the 2014 EIOPA exercise are aligned with this view from the past.

⁴⁹ Each of them corresponds to one of the financial scenarios of the 2014 EIOPA stress test exercise (namely "CA1" and "CA2" in the reporting template).

Finally, one can estimate the respective evolution of all mitigation components for each scenario and evaluate their credibility. Assuming that b is the sum of the diversification module (assumed constant since it is an inherent characteristic of the group), FDB and DT, one can infer the surge of the DT's after stress (Table B4.3). Although an increase of the DT is expected after a shock, its size is questionable. Hence, the actual recoverability should be discussed.

Table B4.3: Analysis of the future discretionary benefits evolution

	CA1	CA2
b'/b	79.8%	61.2%
FDB'/FDB	8.5%	13.9%
DT'/DT	310%	286%

Source: EIOPA

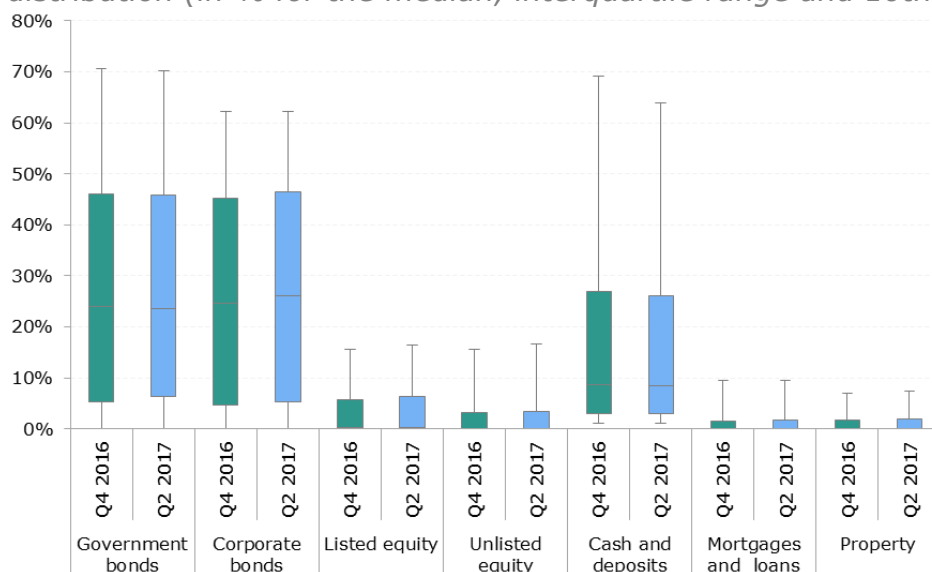
These results obtained with the very simple linear model shed lights on the prominence of the loss absorption capacities in the Solvency II framework. They also confirm and reinforce first country specific estimations for the overall European insurance sector.

Given the low yield environment and high level of uncertainties, combined with the risk of a sudden spike scenario, insurers' asset allocation might be adjusted in order to accommodate interest rate risk. With sovereign bond yields as the benchmark for other assets' returns, the magnitude and the direction of portfolio movements are essential to be analysed.

Insurance companies have high exposure to fixed income assets, in particular in government and corporate bonds which could be translated to higher interest rate sensitiveness and lower profitability in the current economic environment (Figure 5.9). However, holdings of government bonds, as a share of investment, vary widely and range from 0% to approximately 70% for the 10th and 90th percentile respectively. The median value for investments in government bonds has been relatively stable between Q2 2017 and Q4 2016, while the median for corporate bonds has increased by 2 percentage points, amounting to a total of 24% and 26.14% respectively. Also the median values for listed and unlisted equity increased in the same period.

Investments in unlisted equity as well as mortgages and loans have slightly increased in Q2 2017 compared to the end of 2016 suggesting that there might be a trend towards more illiquid investments. The distribution of the share of listed equities has also increased in Q2 2017.

Figure 5.9. Type of investment as a share of total investment. Cross-sectional distribution (in % for the median, interquartile range and 10th and 90th percentile)



Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA, asset by asset template, look through approach applied)
Reporting Reference Date: 30/06/2017

On an aggregated level, in Q2 2017 life insurers' portfolios remain to be focused on fixed-income assets with a heavy focus on corporate bonds (36%) and government bonds (32%) being the ones most exposed towards interest rate risk (Figure 5.10a and 5.10b). This is due to the fact that life insurers are more focused on asset-liability matching as opposed to non-life insurers.

The non-life insurers' share on government bonds and corporate bonds is hence less than for life insurers (Figure 5.10c and 5.10d). However, compared to Q4 2016, investment in fixed income assets recorded a slight increase for corporate bonds and a slight decrease for government bonds. Equities on the other hand are higher for non-life insurers than for life insurers and also grew from Q4 2016 to Q2 2017.

The investment portfolio of undertakings pursuing both life and non-life insurance comprises mostly fixed income securities (Figure 5.10e and 5.10f). In fact, about two thirds of assets make up this investment category.

Figure 5.10a: Investment split for life insurance companies in Q4 2016

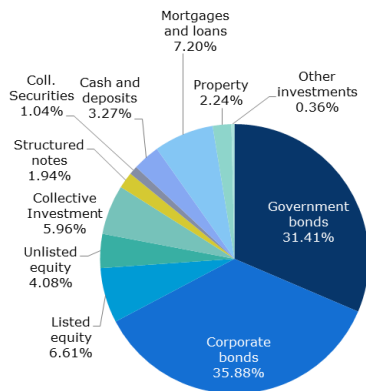


Figure 5.10b: Investment split for life insurance companies in Q2 2017

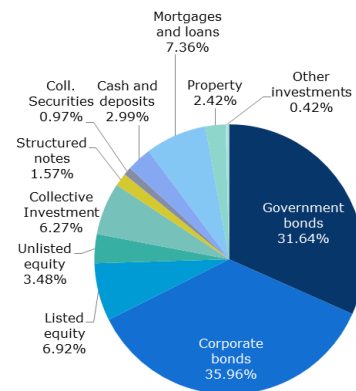


Figure 5.10c: Investment split for non-life insurance companies in Q4 2016

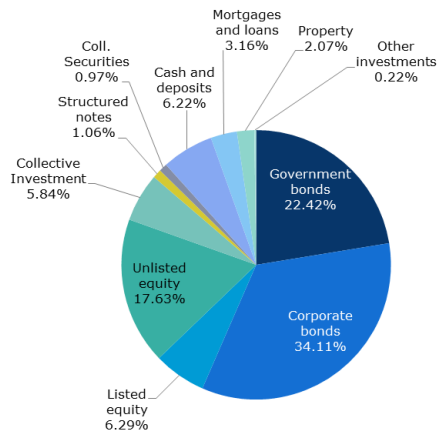


Figure 5.10d: Investment split for non-life insurance companies in Q2 2017

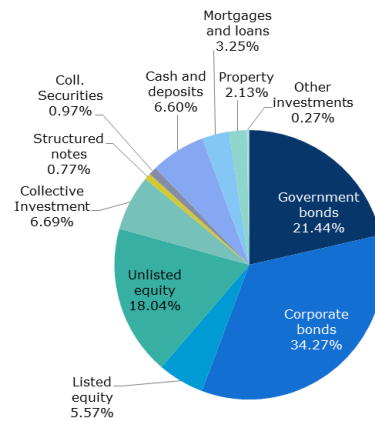


Figure 5.10e: Investment split for undertakings pursuing both life and non-life insurance business in Q4 2016

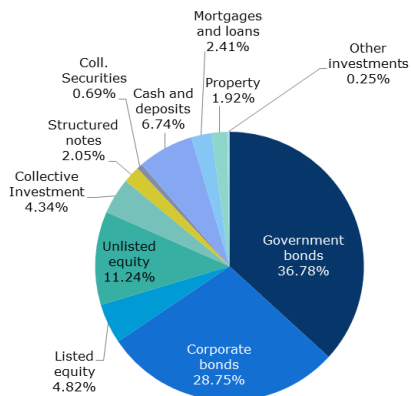
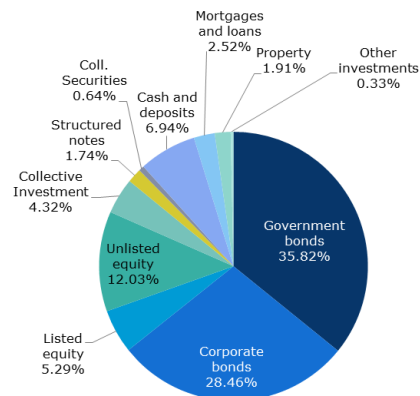


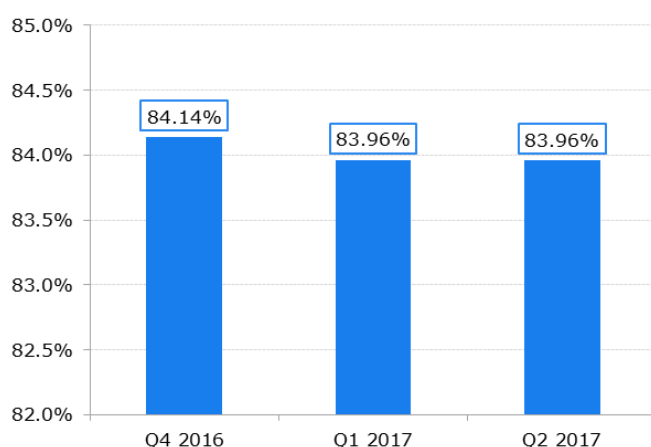
Figure 5.10f: Investment split for undertakings pursuing both life and non-life insurance business in Q2 2017



Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA, asset by asset template, look through approach applied)
Reporting Reference Date: 30/06/2017

Traditional investments are affected by the low yield environment and given the current situation, asset managers might look for alternative investments which can provide higher returns but could turn out to be more risky. The EIOPA Investment Behaviour Report⁵⁰ has revealed that there already exists a tendency to invest into new asset classes among insurance groups (see Box 5 for further details on insurers' exposures to real estate). The proportion of traditional investments of insurers seems to have slightly decreased in the last two quarters (Figure 5.11).

Figure 5.11: Proportion of traditional investments (including look-through information) as % total investments (bonds, equities, cash and deposits)



Source: EIOPA Quarterly Solo (S.06 and S.08 templates)

Note: the indicator is computed as a percentage of total investments, where bonds, equities, cash and deposits are considered as traditional investments.

Reporting Reference Date: 30/06/2017

Box 5: Insurers' exposures to real estate

The EIOPA Investment Behaviour Report identified a tendency of insurers to invest more in asset classes such as mortgages, loans and real estate. The report concluded that the share of these investments in the total portfolio is currently limited at European level, but that it could grow over time as a consequence of the persistent low interest rate environment. Such investments expose insurers to vulnerabilities in real estate markets, which in some European countries are assessed to be currently high.⁵¹ Thus, a further analysis on the topic based on Solvency II data is warranted given the need to monitor and evaluate potential risks originating in real estate markets for the financial stability of the European insurance sector.

To this aim, insurers' holdings of real estate-related assets were assessed based on solo data reported by insurance companies of the EEA Member States with reference date Q1 2017. Real estate-related assets comprise investments in equity

⁵⁰ Published on 16/11/2017

⁵¹ ESRB's warnings on medium-term vulnerabilities in the residential real estate sector, 28 November 2016 <https://www.esrb.europa.eu/mppa/warnings/html/index.en.html>

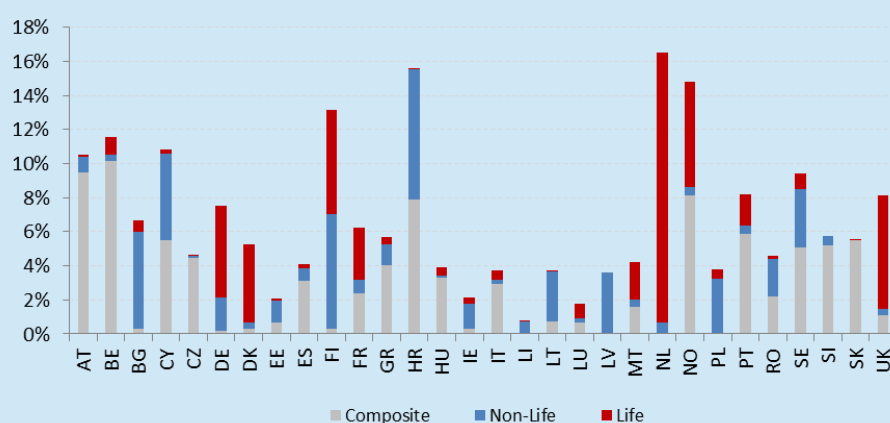
of real estate related corporations, real estate funds, mortgages, property and any other assets or investments related to the real estate sector.⁵²

Overview of exposures

Total real estate-related assets in Q1 2017 amounted to EUR 642 bn, accounting for around 7% of the total assets of the European insurance sector. Exposures across countries are very diverse (Figure B5.1), ranging from 1% in Liechtenstein to 17% in the Netherlands. Moreover, ten countries have exposures greater or equal than 8% of total assets (Austria, Belgium, Cyprus, Finland, United Kingdom, Croatia, Netherlands, Norway, Portugal and Sweden). Among these, six received a warning on residential real estate vulnerabilities from the ESRB in 2016 (Austria, Belgium, Finland, United Kingdom, Netherlands and Sweden). Depending on the country, the main vulnerabilities identified by the ESRB were the strong growth in residential real estate prices, high indebtedness levels and somewhat loose credit standards. Some of these countries have implemented macroprudential measures for the residential real estate market, although not all targeted exposures of the insurance sector.

On aggregate level, life insurers are those most exposed to real estate-related assets, which is probably justified by the need to match the long duration of their liabilities to long-term investments that yield stable returns. Additionally, for life insurers it should be taken into account that losses on the asset side (e.g. due to developments in property markets) could be mitigated by the loss-absorbing capacity of technical provisions.

Figure B5.1: Real estate-related assets in % of total assets and breakdown by type of undertaking

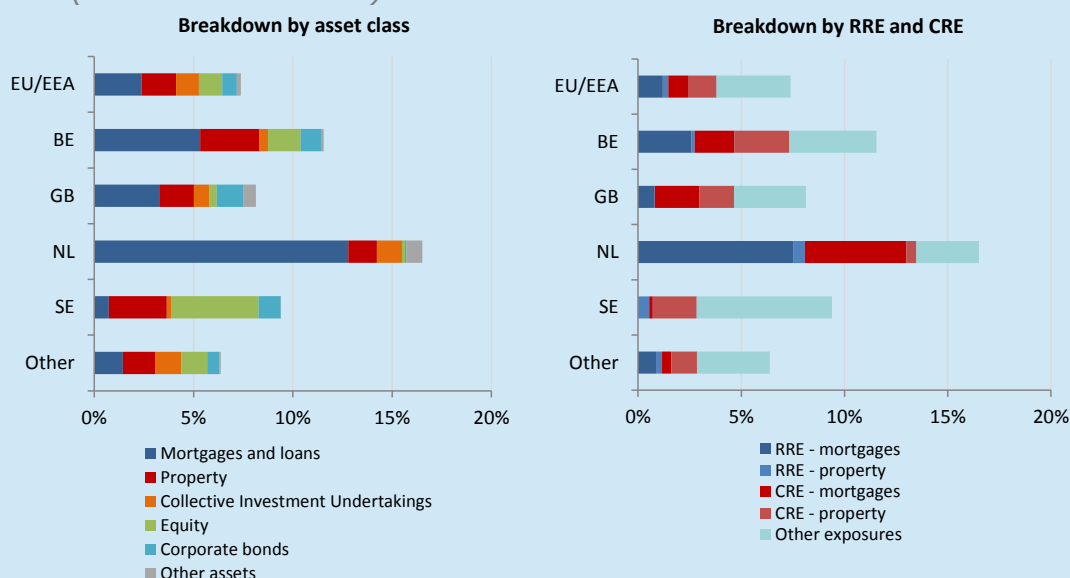


Source: EIOPA Quarterly Solo. All figures exclude assets held for index-linked and unit-linked contracts.
Reporting Reference Date: 31/03/2017

⁵² Real estate-related assets comprise those reported in the list of assets of the Solvency II Quantitative Reporting Templates: i) investments and other assets with CIC code clearly identifying them as real estate-related (CIC 32, 45, 55, 65, 84 and 9); and ii) any other investments/assets with counterparty sector either construction of buildings or real estate activities (NACE F41 and L). Property includes that held for own use as under the Solvency II market-consistent balance sheet, fluctuations in market values for property have an impact on the undertakings' own funds and solvency positions.

Figure B5.2 presents a breakdown of real estate exposures by asset class and by residential and commercial real estate (RRE and CRE, respectively) for the whole EU/EEA and for those countries with larger exposures and a larger share of the European market in terms of total assets.⁵³ EU/EEA exposures are mainly attributed to mortgages and loans and property, which together account for 4.1% of European insurers' total assets. Exposures to equity, bonds and through investment funds together comprise 3.1% of total assets. Exposures to CRE amount to 2.3% of insurers' total assets, while exposures to RRE sum up to 1.5%.⁵⁴ Other exposures through investments in securities issued by or loans granted to the real estate sector comprise 3.6% of total assets. A country breakdown reveals that exposures to mortgages and loans predominate among the countries with larger exposures and a larger share of the European market in terms of total assets, with the exception of Sweden, where equity investments prevail. In addition, most of these countries' exposures are to CRE or exposures through investments in securities issued by or loans granted to real estate counterparties, with the exception of the Netherlands, which is mainly exposed to RRE.

Figure B5.2: Breakdown of real estate-related assets by asset class and by RRE and CRE (in % of total assets)



Source: EIOPA Quarterly Solo. All figures exclude assets held for index-linked and unit-linked contracts. Look-through approach is not applied
Reporting Reference Date: 31/03/2017

Financial stability considerations

Through their holdings of real estate-related assets, insurers are exposed to market and credit risk. Negative developments in real estate markets have the potential to impact the asset side of insurers' balance sheets through several channels: i) decrease in the market value of property due to changes in residential

⁵³ Considering a minimum threshold of 2% of total EU/EEA assets excluding assets held for index-linked and unit-linked contracts.

⁵⁴ These figures are likely to be underestimated because they do not include exposures through securities issued by and loans granted to real estate-related counterparties, as for these, the breakdown by RRE and CRE is not available.

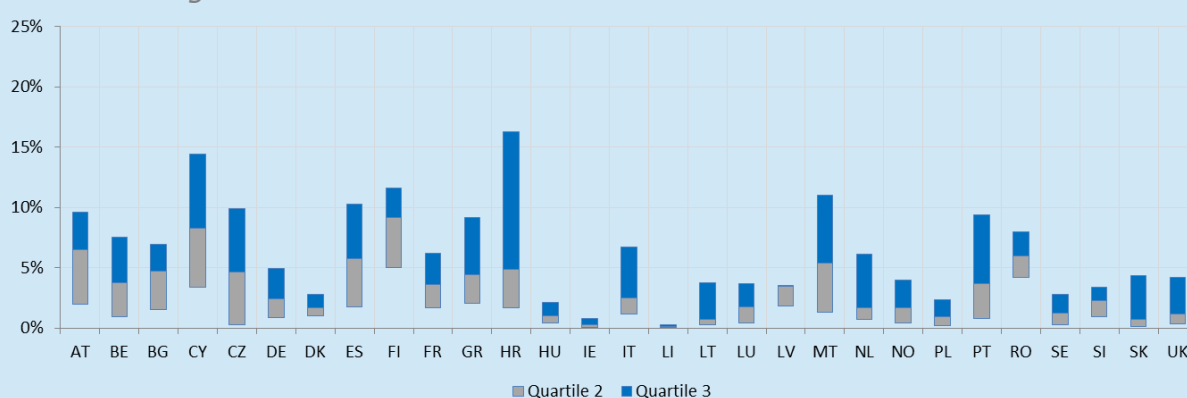
and commercial property prices; ii) higher risk of default on mortgages and loans if developments in real estate markets are accompanied by high indebtedness and reduced debt servicing capacity of borrowers; iii) reduction in the value of available collateral in mortgage loans (and consequently, a higher loss-given-default) due to decreases in property prices; iv) higher potential for negative developments in equity prices and for a deterioration of the credit quality of corporate bonds of real estate-related companies resulting from generalised stress in the real estate sector.

A materialisation of the risks mentioned above implies a decrease in asset values which ultimately leads to a reduction in own funds. This is likely to be lower for insurers offering life products with profit sharing features due to the loss-absorbing capacity of technical provisions. Solvency II capital requirements cover the risks stemming from these exposures and, for insurers using the standard formula, these are addressed in the market and counterparty default risk modules.

Illustration: Standard formula SCR for property risk

Article 174 of the Solvency II Delegated Regulation states that the capital requirement for property risk in the standard formula shall be equal to the loss in own funds that would result from a decrease of 25% in the value of property. Based on 2016 reporting by solo companies using the standard formula it is possible to assess the different sensitivity of insurers in each jurisdiction to a change in property values (Figure B5.3). For most countries, a decrease of 25% in property values seems to lead to a reduction in own funds of less than 10%, although there are some exceptions (Cyprus, Spain, Finland, Croatia and Malta).

Figure B5.3: Decrease in own funds after a 25% decline in property values for insurers using the standard formula



Source: EIOPA Annual Solo.

Reporting Reference Date: 31/12/2016.

Note: shows median and interquartile range for the decrease in own funds after a 25% decline in property values for insurers using the standard formula. Change in own funds is calculated by dividing the capital requirement for property risk, net of the loss-absorbing capacity of technical provisions, by basic own funds of each insurance undertaking. Countries that have less than 5 insurers in the sample at the date of analysis have been excluded.

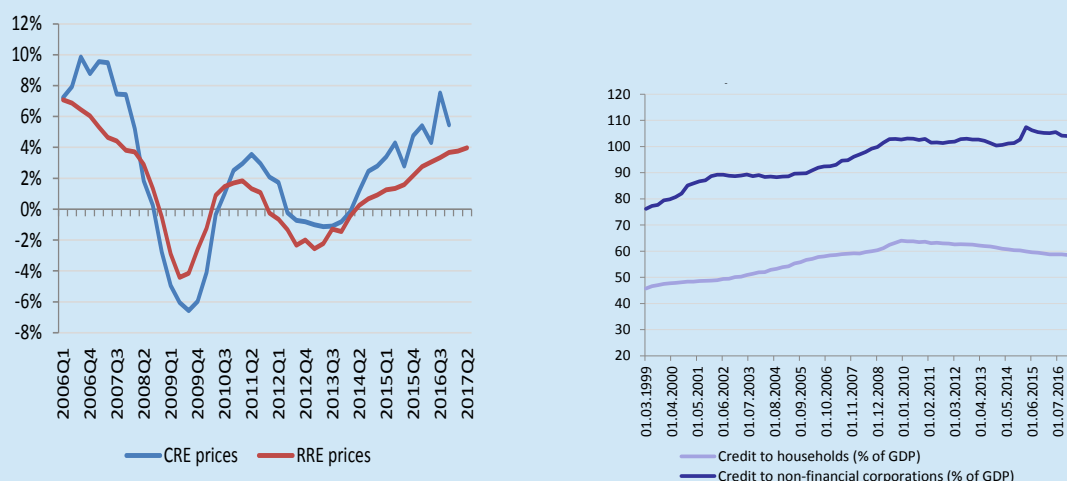
Recent developments in European real estate markets

Developments in European real estate markets are worth monitoring due to the possibly increasing exposures of the insurance sector over time and to the financial stability considerations discussed above.

Residential real estate prices in the euro area have been increasing since beginning of 2014, reaching a year-on-year growth rate of 4% in Q2 2017. In some of the euro area countries with the largest exposures there were high price increases, such as in Portugal (8%) and the Netherlands (7.3%). Strong house price increases were also registered in exposed countries outside the euro area, such as in Sweden (8.6%) and Norway (7.8%). Data on price-to-income and price-to-rent ratios shows that prices are close to their long-term average in the euro area, although in Belgium and in some other EU/EEA major countries (Norway, Sweden and the United Kingdom) they are clearly above.⁵⁵ Commercial property prices have also been increasing in the euro area since 2014, with the annual growth rate reaching 5.5% in Q4 2016 (Figure B5.4), which is still below the pre-crisis peak (9.8% in Q3 2006).

In the euro area, household indebtedness as a percentage of GDP was still below pre-crisis levels in Q1 2017, but the same does not hold for non-financial corporations (Figure B5.4). In some of the EU countries identified as having the largest exposures, household indebtedness is high as compared to the size of the economy, particularly in Netherlands (108%), United Kingdom (88%) and Sweden (86%). Indebtedness of non-financial corporations is predominantly high in Belgium (158%), Sweden (147%), Netherlands (123%) and Finland (109%).

Figure B5.4: RRE and CRE prices (year-on-year growth rate, in %) and credit to households and non-financial corporations (as a % of GDP), euro area



Source: ECB and BIS. Last figure refers to 2016Q4 for CRE prices, 2017Q2 for RRE prices and 2017Q1 for credit. Nominal RRE prices and transaction-based CRE prices.

⁵⁵ Based on OECD standardised price-to-income and price-to-rent ratios indicators with reference date 2017Q1 and 2017Q2 (not shown).

Analysing insurers' portfolios at country level, the heterogeneity across individual insurers is also high (Figure 5.12). Insurers from Hungary (79.21%), Romania (68.10%) and Lithuania (66.29%) invest more than two thirds of their portfolio in government bonds while insurers from Finland (10.65%), Sweden (15.26%) and Cyprus (15.61%) prefer other types of investments. Swedish insurers are the largest investors in equity (37.27%).

For insurers relying heavily on government bonds home biased investment behaviour can be observed. For example, insurers from Romania, Hungary and Poland have allocated more than 90% of their government bonds in their country issued bonds.

Figure 5.12: Investment split at country level

	Government bonds	Corporate bonds	Equity	Cash and deposits	Mortgages and loans	Property	Other
EU/EEA	31.41%	33.03%	15.06%	4.98%	4.97%	2.18%	8.37%
AUSTRIA	24.82%	30.36%	22.51%	4.50%	4.05%	6.59%	7.18%
BELGIUM	50.09%	23.27%	6.25%	2.78%	10.62%	2.89%	4.09%
BULGARIA	47.09%	21.00%	10.10%	12.33%	1.57%	3.33%	4.58%
CROATIA	58.98%	4.22%	8.08%	9.55%	7.17%	7.92%	4.10%
CYPRUS	15.61%	32.40%	11.86%	18.69%	3.38%	6.49%	11.56%
CZECH REPUBLIC	47.89%	29.35%	7.37%	7.91%	0.73%	0.31%	6.44%
DENMARK	17.31%	41.98%	26.34%	3.18%	2.94%	3.26%	4.99%
ESTONIA	27.53%	52.83%	1.98%	12.76%	0.52%	0.00%	4.38%
FINLAND	10.65%	44.73%	15.09%	7.33%	4.33%	5.37%	12.49%
FRANCE	32.39%	36.15%	12.27%	3.36%	1.71%	2.27%	11.85%
GERMANY	25.06%	38.33%	19.36%	3.86%	4.87%	1.88%	6.63%
GREECE	58.39%	21.36%	4.53%	7.43%	1.12%	2.32%	4.84%
HUNGARY	79.21%	4.01%	4.23%	4.67%	0.28%	0.09%	7.50%
IRELAND	30.69%	30.90%	4.37%	23.84%	3.95%	1.20%	5.06%
ITALY	51.57%	20.84%	12.72%	3.44%	0.87%	0.82%	9.74%
LATVIA	57.85%	12.03%	2.90%	24.11%	0.68%	1.22%	1.21%
LIECHTENSTEIN	19.28%	31.26%	7.89%	32.43%	4.39%	0.15%	4.58%
LITHUANIA	66.29%	13.67%	2.61%	11.65%	0.97%	0.79%	4.01%
LUXEMBOURG	40.71%	30.30%	7.75%	10.31%	5.57%	0.80%	4.55%
MALTA	29.96%	17.94%	6.40%	17.93%	12.05%	1.98%	13.74%
NETHERLANDS	36.71%	14.86%	8.03%	5.71%	25.58%	2.28%	6.82%
NORWAY	16.27%	45.74%	22.38%	2.89%	8.74%	0.14%	3.84%
POLAND	54.14%	3.84%	24.11%	4.99%	4.53%	0.30%	8.10%
PORTUGAL	45.46%	30.04%	9.40%	8.98%	0.55%	2.73%	2.83%
ROMANIA	68.10%	7.62%	7.07%	13.35%	1.34%	1.54%	0.99%
SLOVAKIA	48.02%	32.63%	4.40%	6.96%	3.23%	0.71%	4.05%
SLOVENIA	37.84%	33.24%	17.11%	4.33%	1.25%	1.72%	4.52%
SPAIN	55.47%	22.56%	5.90%	8.62%	0.80%	2.44%	4.21%
SWEDEN	15.26%	28.98%	37.27%	4.60%	2.81%	2.97%	8.11%
UNITED KINGDOM	21.74%	35.18%	14.97%	9.07%	8.03%	2.64%	8.37%

Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA, asset by asset template, look through approach applied)

Note: Red - above 90th percentile, Blue - below 10th percentile

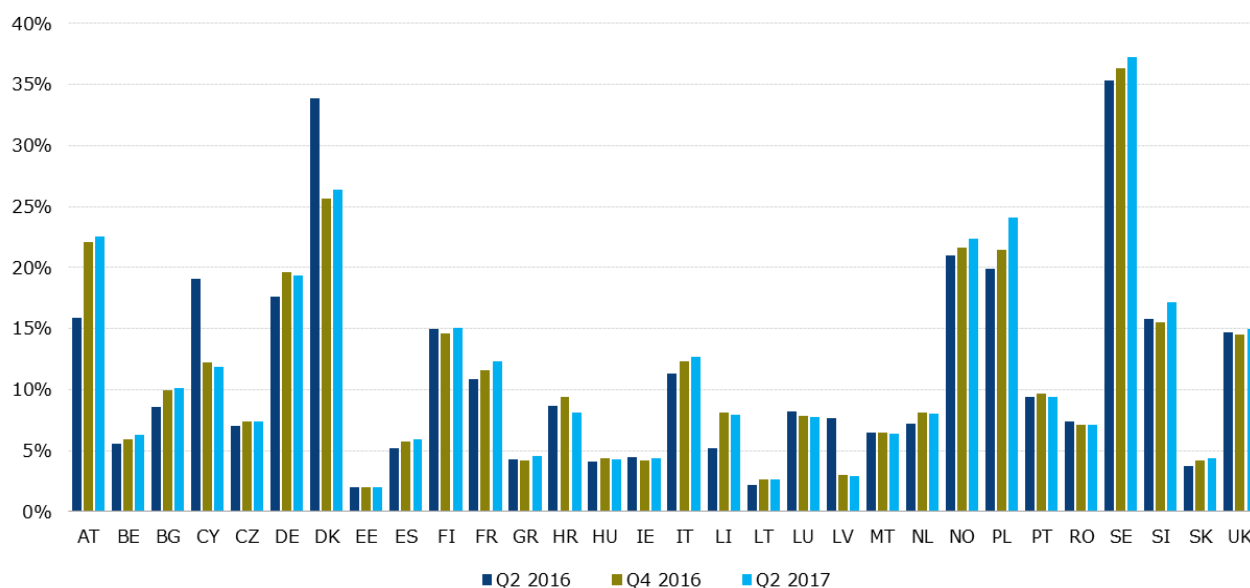
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A further analysis of equity investments of solo insurers at member state level suggests that there are significant differences among countries regarding their equity investments (Figure 5.13 and Box 6). According to Solvency II QRT data, equity investments seem to be high in countries like SE, DK, FR, FI, BG and AT but this can be related also to the specificities of each country.

Insurance companies that are well capitalised tend to invest more in equity than more vulnerable insurers. By splitting the SCR ratio into buckets and looking at the equity ratio in the portfolio, one can notice that in aggregate terms the share of equity investments seems to be higher in well capitalised undertakings. As equities bear a higher risk charge than e.g. bonds in the SCR coverage calculation, it is important to see the connection between equity investments and the SCR ratio.

Nonetheless, increased investments in equity could also be attributed to other reasons such as different business models.

Figure 5.13: Total equity as a % of Total Investment Assets, in %



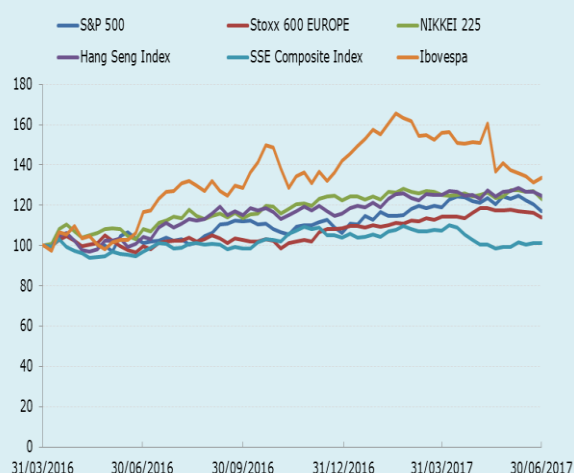
Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA, asset by asset template, look through approach applied)
Reporting Reference Date: 30/06/2017

Box 6: Stock prices and equity portfolio allocation

The market value of equity portfolios has increased by 15% in total for the EEA countries included in the sample from Q1 2016 until Q2 2017. Most global reference indices have registered a positive growth during this period (Figure B6.1). The total growth rate ranged from 1% for SEE to 38% for Ibovespa. The Hang Seng Index increased 23% over this period and about 16% increase were observed for both Nikkei 225 and S&P 500.

The impact of developments in stock prices on the market value of equity portfolios was also investigated in EIOPA Investment Behaviour Report. The report shows that from 2011 to 2016 the overall increase in the market value of equity portfolios corresponded only partially to the increase in stock prices. The same conclusion could be drawn by looking at the equity portfolios' developments during 2016 and first half of 2017 (Figure B6.2). The contribution of changes in equity prices to the observed growth rate of the market value of equity portfolios was estimated based on a weighted average of stock market indices. The estimated change in equity prices is referred to as cumulative returns. Estimated cumulative returns for the whole sample range from -2% to 8% while the observed changes in the market value of equity portfolios vary between -2% and 7%. The change in the market value of equity portfolios is generally lower than the estimated returns (except for the second quarter in 2016 and 2017). The overall equity portfolio developments might suggest that, insurers rebalance their investment portfolios to some degree, to maintain a relatively stable equity allocation over time.

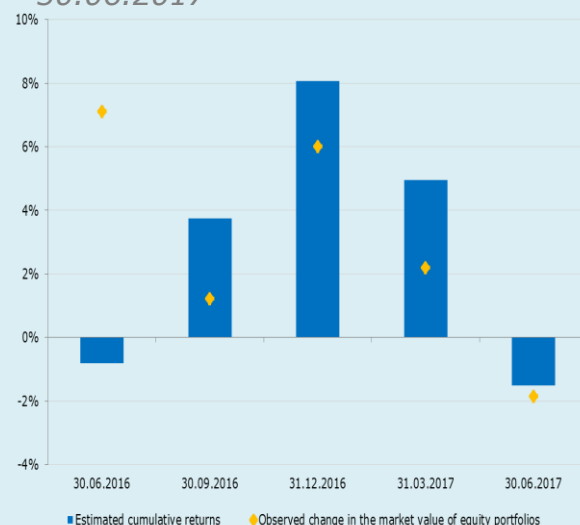
Figure B6.1: Developments in major world indices (31.03.2016 =100)



Source: Bloomberg.

Note: EIOPA's calculations. Indices are shown for US (S&P 500), Japan (NIKKEI 225), China (SSE Composite Index), Europe (Stoxx 600 Europe), Hong Kong (Hang Seng Index) and Brazil (Ibovespa).

Figure B6.2: Equity portfolios' developments in total during 30.06.2016 – 30.06.2017



Source: EIOPA and Bloomberg.

Note: EIOPA's calculations. Cumulative returns are estimated using a weighted average of stock market indices based on 2016 portfolio allocations per country. For exposures to EU/EEA countries, Switzerland, US, Japan, China, Hong Kong and Brazil, the reference stock market index was used. For exposures to other countries and exposures with missing counterparty, the US stock index was used.

Insurers can use derivatives in their portfolio for hedging purposes according to the Solvency II regulation (Figure 5.14a, 5.14b and 5.14c).

In Q2 2017, the market value of derivatives was less than 0.4% of the total investments. In total figures, the Solvency II (market) value of derivatives is approximately EUR 22.15 bn while the notional value of the contracts reached approximately EUR 4.36 trn in Q2 2017.⁵⁶

Compared to the volume of the derivatives contracts held at the end of 2016 by the European insurers, the value has significantly decreased in the first half of 2017. Put (call) options can be used to hedge (or leverage up i.e. increase the risk exposure) equity, whereas the purchase (selling) of credit default swaps can be used to hedge (leverage up) default risk. Swaps are used to hedge interest rate risk. Insurers may aggregate and hedge risks associated with certain blocks of invested assets or liabilities together (a portfolio hedge), or may hedge individual assets against one or more risks.

Among the three types of undertakings, life insurers are the ones that make use of derivatives to hedge their portfolio risks (Figure 5.14a). In Q2 2017, swap contracts (46.87%) are the most common type of derivatives followed by put options (22.47%) and call options (19.02%). At the end of the 2016, forward contracts were the second most used contracts while in Q2 2017 they only rank fourth with 10.33%. Non-life insurers are using more than two thirds forward contracts while the portfolio of composite undertakings is similar with the one of life insurers.

⁵⁶ The charts are computed using the absolute market values of the derivative contracts.

Figure 5.14a: Derivatives for life insurance companies

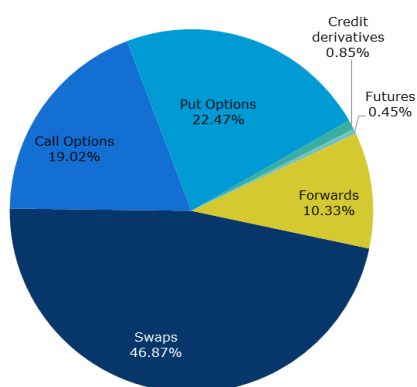


Figure 5.14b: Derivatives for non-life insurance companies

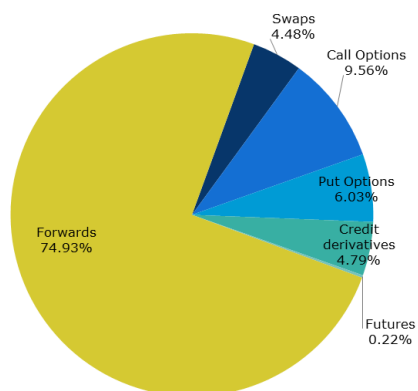
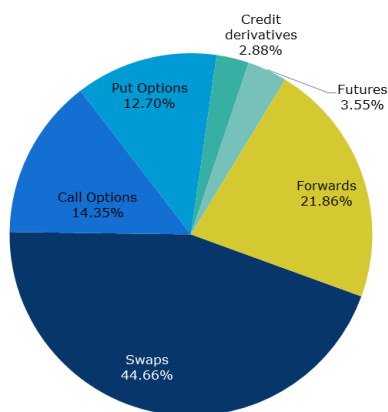


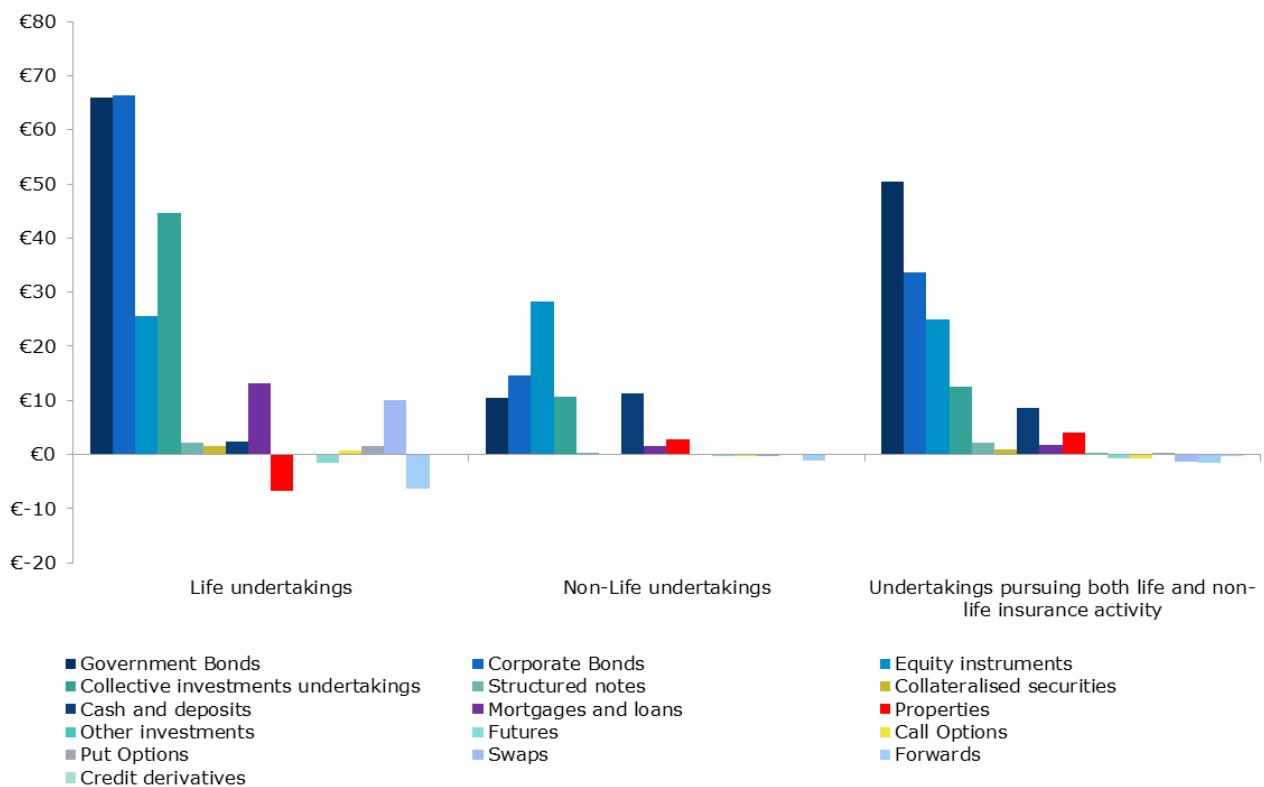
Figure 5.14c: Derivatives for undertakings pursuing both life and non-life insurance business



Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA)
Reporting reference date: 30/06/2017

Maintaining profitability is one of the main challenges for insurers in the current low yield environment (Figure 5.15). More than EUR 132 bn of profits is generated by fixed income assets, with a 60% contribution in the profits for life insurers at the end of 2016. On the other hand, equities made up an additional EUR 28 bn for non-life insurers, contributing 36% to the profit of non-life insurers. Derivatives are loss making for non-life and composite undertakings. Profit of investments by investments category has been calculated as the sum of dividends, interest, rents, gains and losses, unrealised gains and losses for each undertaking.

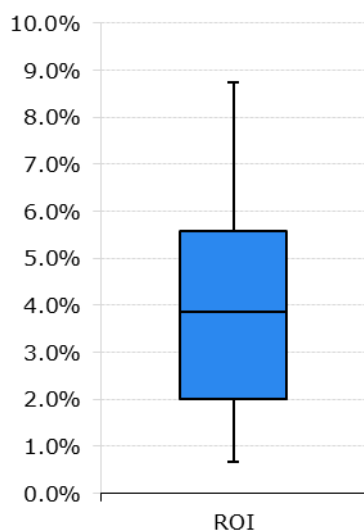
Figure 5.15: Profit of investments by investments category and by type of undertaking in EUR (bn)



Source: EIOPA, Annual data, template S.09.01
Reporting Reference Date: 31/12/2016

The distribution of Return on Investments (ROI) shows a median value of 3.87% at the end of 2016 (Figure 5.16). However, discrepancies are significant with the 10th percentile showing a 0.68% ROI, while the 90th percentile reaches a high 8.74%. Return on investments is computed as the ratio between the profit of investments (explained in the above figure) and total investments (derivatives are taken into consideration).

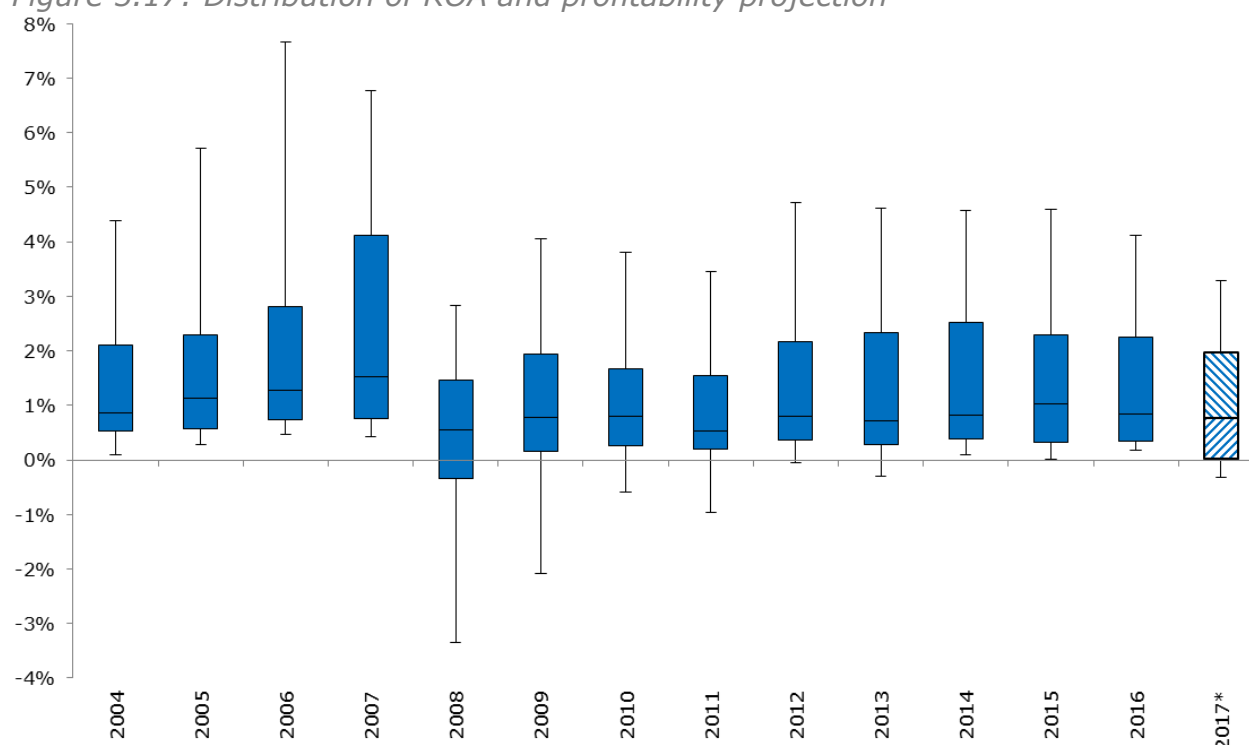
Figure 5.16: Distribution of ROI at company level



Source: EIOPA Annual Solo
Reporting Reference Date: 31/12/2016

The current data and projections reveal a slightly deteriorating ROA (Figure 5.17). In 2014 and 2015 the profitability increased and had a positive trend, but starting with 2016 the median ROA experienced a minor decrease. EIOPA's projection for 2017 has been updated with the latest available data for 2016 and indicates a median value of 0.75% for ROA for 2017, a slightly better ROA compared to the previous projection.⁵⁷ The reallocation of the investments might be triggered by the low profitability of insurers focused on asset-liability matching. Especially in the case of life insurers, the constant pressure on profitability affects both the assets and liabilities side which will eventually also lead to a deteriorating solvency position.

Figure 5.17: Distribution of ROA and profitability projection⁵⁸



Source: Bloomberg, Eurostat, EIOPA (sample based on 67 solo insurance undertakings in EEA)

Reference Date: 20/09/2016

Note: * EIOPA own forecast

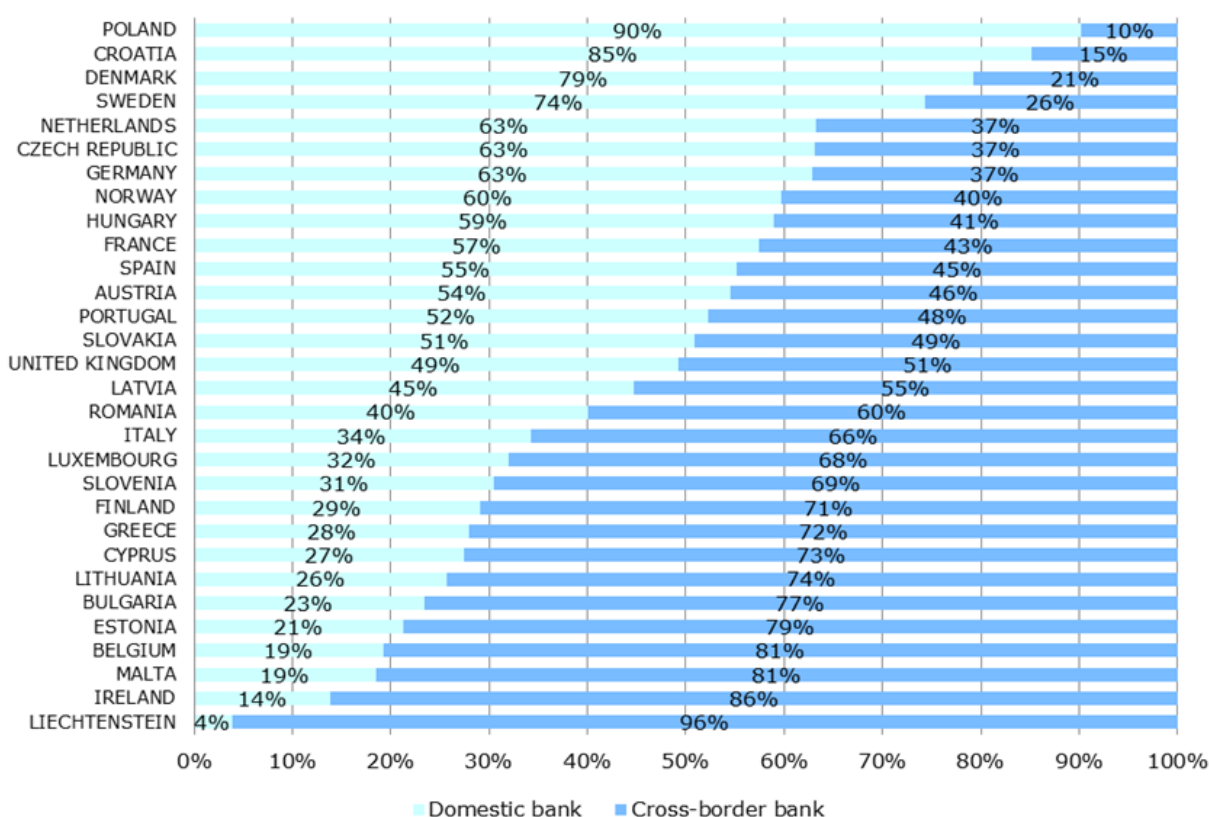
The interconnectedness between insurers and banks gives relevant implications for financial stability given that in the case of stress in the financial markets the banking system may potentially have spillover effects over the insurance market. Hence, it is vital to identify channels of transmissions, in order to monitor them and mitigate the risk.

The insurance sector is extensively exposed towards the banking sector: the total exposure amounts to approximately EUR 2.5 trillion which corresponds to 35.42% of insurers' total investments. Some insurers from countries such as Poland (90%), Croatia (85%) and Denmark (79%) tend to be more domestically exposed, while insurers from Lichtenstein (96%) and Ireland (86%) tend to be more cross-border exposed (Figure 5.18).

⁵⁷ This is in line with estimations from Bloomberg. Note that the EIOPA projection is slightly more conservative.

⁵⁸ For more information on the methodology of the forecast see Box on page 61 in the EIOPA Spring Financial Stability Report at <https://eiopa.europa.eu/Pages/Financial-stability-and-crisis-prevention/financial-stability-report---June-2017.aspx>

Figure 5.18: Insurance sector exposure towards the banking sector, domestic versus cross-border in %



Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA)
Reporting Reference Date: 30/06/2017

In the above mentioned context, a potential transmission channel is through investments (Figure 5.19). The map representation of EU insurers' exposures towards banks⁵⁹ as a percentage of their total investment assets shows that some insurers are heavily exposed to the banking sector.⁶⁰ Total exposures include corporate bonds, equity, cash and deposits, structured notes, collateralised securities, mortgages and loans, property and other investments.

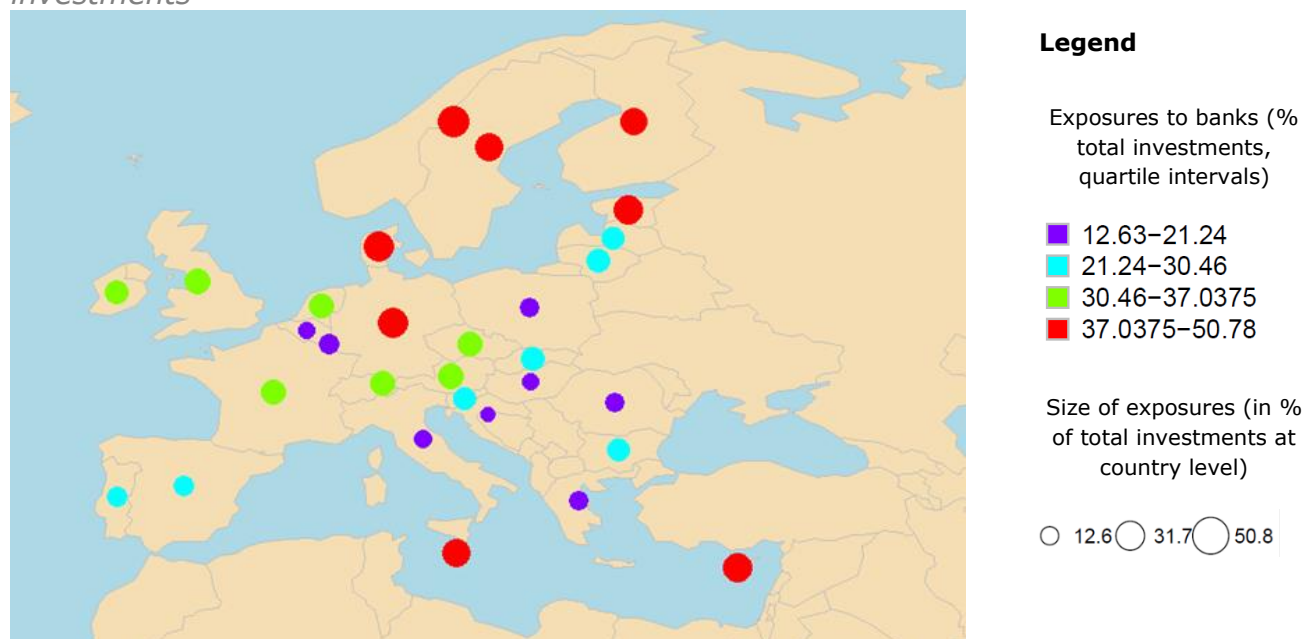
From a financial stability point of view, higher exposures towards other sectors increase the risk of contagion in case of distress in the financial markets. On an aggregated level, insurers' exposure towards banks ranges from 12.63% in HR to 50.78% in NO as a percentage of their total investment assets. The colour and the size of the bubble in Figure 5.19 indicates in which quartile interval the country is situated depending on how much insurers are exposed to banks on aggregate level. While non-performing loans ratio of banks have continued improving confirming the downward trend (4.5% in Q2 2017), there is still a wide spread dispersion among EU countries with ratios ranging from 0.9% to 46.5%.⁶¹ This suggests that some insurers might be potentially vulnerable towards banks with high NPL ratios.

⁵⁹ The data presented is obtained by filtering the issuer with the NACE code K64 i.e. financial service activities, except insurance and pension funding and by excluding K64.1.1 central banking.

⁶⁰ The underlying data is computed as the percentage of total exposures towards banks of insurers in the amount of total investment assets at country level.

⁶¹ EBA, Risk Dashboard, data as of Q2 2017.

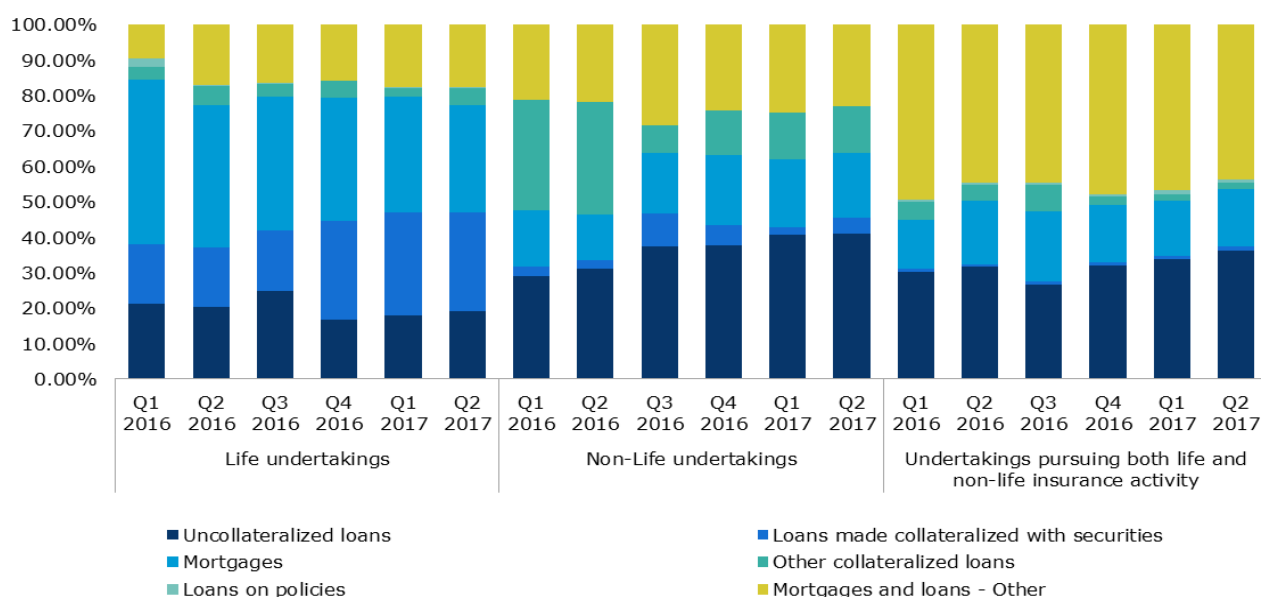
Figure 5.19: European insurers' exposures towards banks as a percentage of total investments



Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA)
Reporting Reference Date: 30/06/2017

Vulnerability for insurers might occur through the types of instruments they use. Non-life insurers make predominantly use of uncollateralised loans while life insurers prefer mortgages (Figure 5.20). While uncollateralized loans which are more risky increased in the exposure of non-life insurers, for life undertakings the exposure toward banks has increased in terms of mortgages throughout the quarters of 2016 and 2017.

Figure 5.20: Exposures to banks by subcategory of instruments by type of undertaking



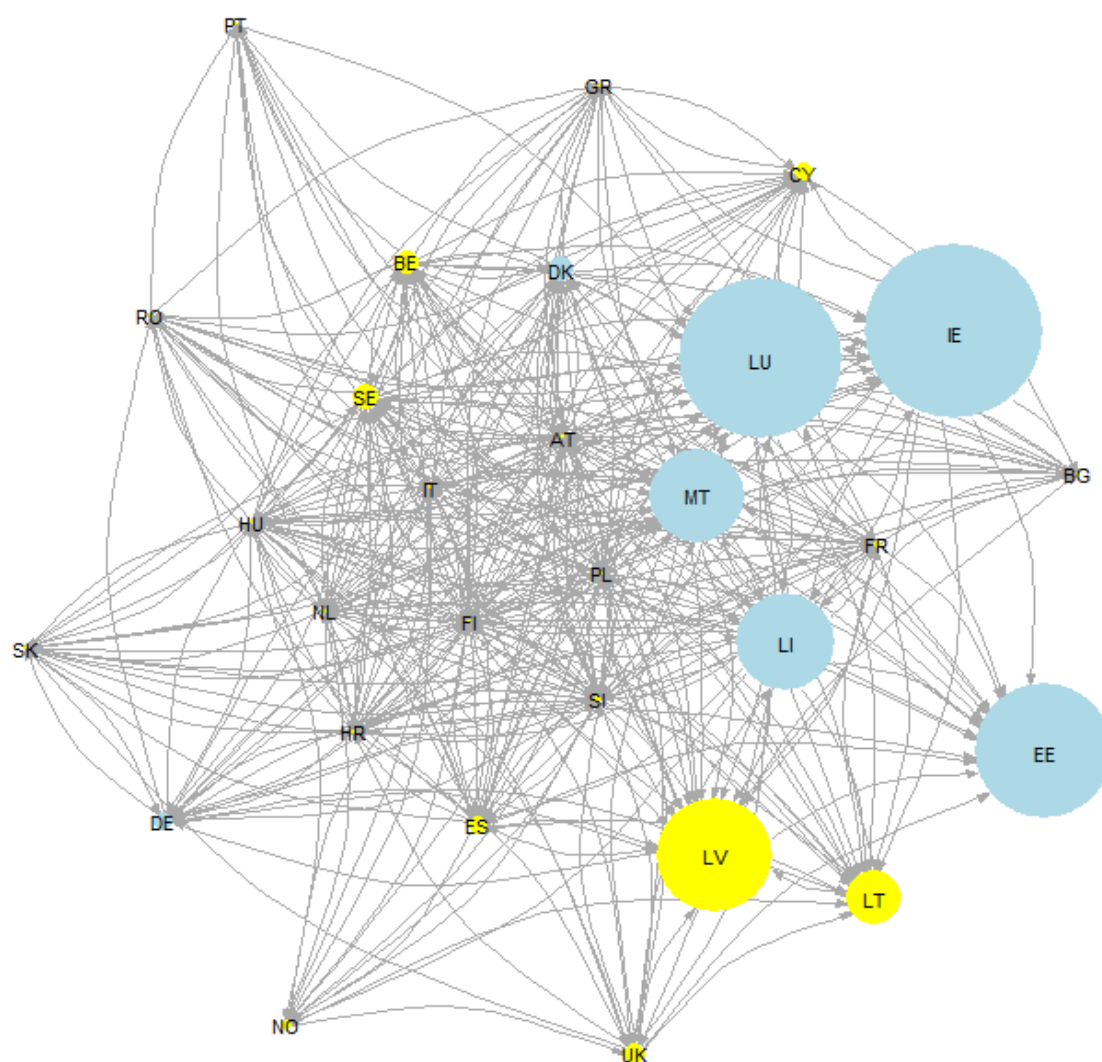
Source: EIOPA (sample based on 2027 solo insurance undertakings in EEA)
Reporting Reference Date: 30/06/2017

Cross-border exposure is a potential channel of risk transmission. Financial turmoil in the banking sector of one country might spill over due to cross-border holdings by insurers. But also, excessive domestic exposure, which can be seen as a lack of diversification, might be a potential weakness or source of risk. Insurers may carry out insurance activities in another EEA country via Freedom of Establishment (FoE) or via Freedom of Services (FoS) (See Box in Chapter 2).

The financial interlinkages derived from the cross border business support risk diversification at country level leading to a more robust network, but also facilitate transmission of shocks generating a network more prone to systemic risks, yet more fragile in case of financial stress. Countries that receive more premiums than they receive as a percentage of their total GWP are coloured in yellow ("receiver country") while the blue colour suggests that the country subscribes more cross-border ("donor country") as a percentage of their total GWP. Moreover, the size of the bubble shows the size of the percentage of outgoing premiums in total GWP (Figure 5.21).

LU, IE and EE report more than 50% of their premiums subscribed cross-border, so they are the biggest "donors". The evidence shows that the geographical factor is an important determinant of cross-border linkages. In particular EE insurers subscribe in LT and LV.

Figure 5.21: Cross-border business among EEA countries in terms of GWP

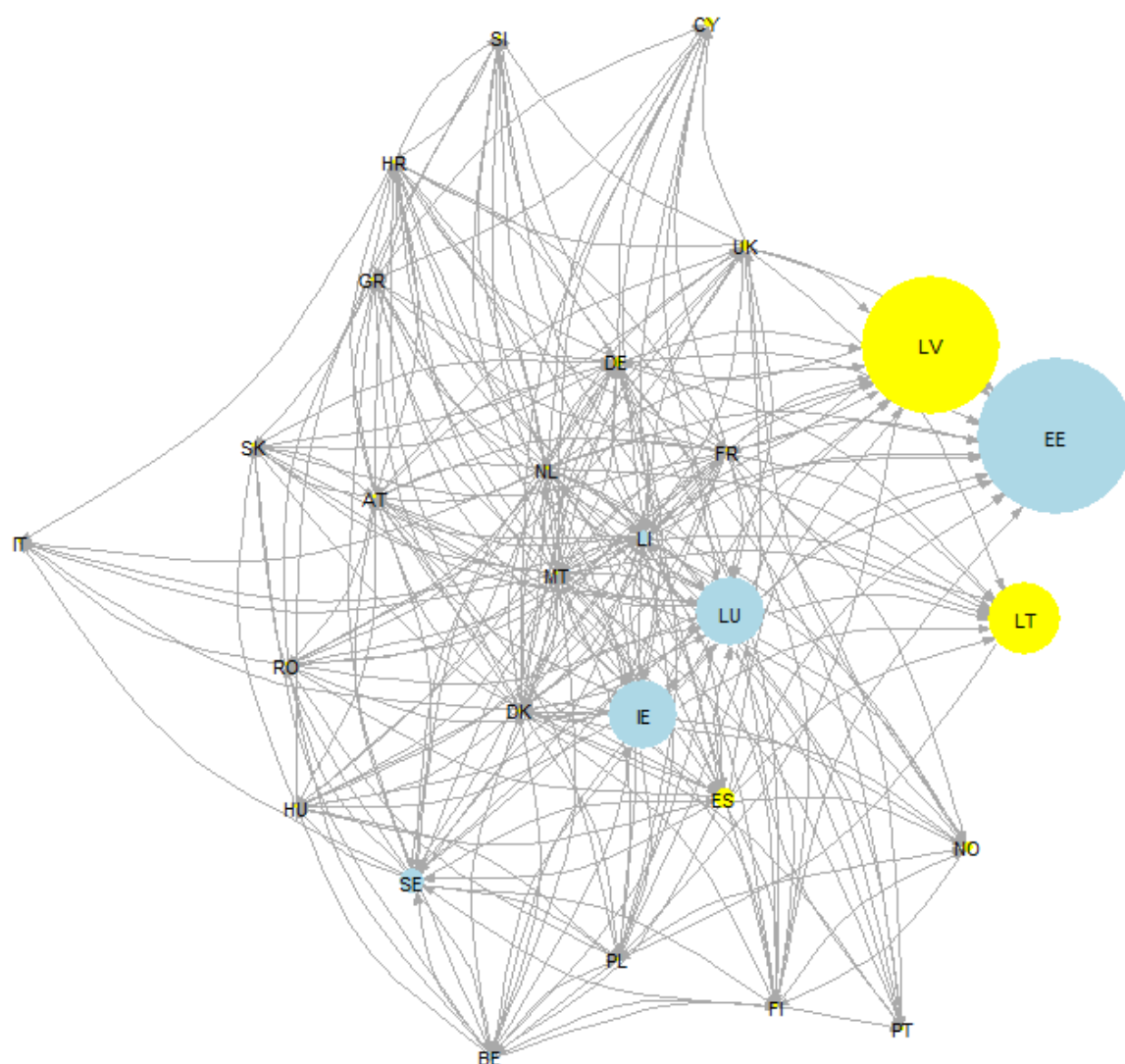


Source: EIOPA. Sample of 2800 solo insurers
Reporting Reference Date: 31/12/2016

Risks are typically higher in a network where "receiver" countries have a significant concentration of exposures to a few sources (Figure 5.22). Thus, a higher concentration reduces the benefit of the risk diversification given by the domestic insurance mechanism. On the other side, a growing cross-border business could lead to higher volatility (more capital inflows and outflows) and uncertainty. Countries that receive more claims than they receive as a percentage of their total incurred claims are coloured in yellow ("receiver country") while the blue colour shows that the country subscribes more cross-border ("donor country") as a percentage of their total incurred claims. The size of the bubble shows the size of the percentage of outgoing incurred claims in total incurred claims.

LU, IE and EE are the biggest "donor" countries in terms of claims due to the large percentage of premiums that are subscribed cross-border as seen in the previous network.

Figure 5.22: Cross-border business among EEA countries in terms of incurred claims



Source: EIOPA. Sample of 2800 solo insurers
Reporting Reference Date: 31/12/2016

6. Background information and Data description

Overview and data

EIOPA publishes statistics based on quantitative Solvency II reporting from insurance undertakings and groups in the European Union and the European Economic Area (EEA). These statistics are published on a quarterly basis. Every publication is accompanied by a note describing the key aspects of the statistics published. The tables and charts are available in PDF and Excel format and are based on information from the statistics at the publication date.⁶²

The new supervisory regime Solvency II came into force in full on 1 January 2016 as a result of timely preparation and appropriate transitional periods.

The Solvency II Directive (Directive 2009/138/EC) introduces advanced solvency requirements for insurers based on a holistic risk assessment, and imposes new assessment rules for assets and liabilities, which must be assessed at market values.

Currently the following type of information is available:

Indicators based on Individual insurance undertakings (solo data)

Quarterly and annual publication of statistics based on solo prudential reporting data and available on a country-by-country basis.

Indicators based on Insurance groups (group data)

Annual publication of key indicators based on group reporting and available at EEA level from autumn 2017.

Indicators based on reporting for financial stability purposes

Pursuant to Art. 51 Solvency II Directive 2009/138/EC insurance companies have to publish annual Solvency and Financial Condition Reports (SFCR) for groups as well as solo reports for its Solvency II regulated legal entities since May 2017. Hence, annual data with the reference date of end-2016 is available for the first time since the new supervisory regime entered into force on 1 January 2016. As this annual data is available for the first time, no comparative information is available when used.

The structure of this Financial Stability Report covers Q2 2017 and focuses on European (re) insurance undertakings and groups that report regularly under Solvency II. EIOPA bases its analysis mainly on Quarterly Prudential Reporting Solo for Q2 2017. But as not all companies report under Quarterly Prudential Reporting Solo, EIOPA also uses Quarterly Financial Stability Reporting Group (QFG).

Information is provided on different sample sizes as some (re)insurance companies are exempted from quarterly reporting in accordance with Art. 35 (6). Therefore the sample of undertakings is not identical in the annual and quarterly publications. Each Figure EIOPA uses in this report is hence accompanied by a source mentioning the sample size and a note on data (if needed).

⁶² <https://eiopa.europa.eu/Pages/Financial-stability-and-crisis-prevention/Insurance-Statistics.aspx>

Insurance sector

In order to smooth the transition towards the new regulatory framework, Solvency II has put in place transitional measures, some of which will apply until 2032, by which time the balance sheet position of insurance companies will be fully estimated at market value. For a period of 16 years after the start of Solvency II (re)insurance undertakings may apply the transitional measure on the technical provisions and the risk-free interest rate. Hence, in the following years the use is expected to decrease.

The use of transitional measures is transparent and insurance companies published their solvency ratios with and without the application of these measures. Transitional measures form an integral part of Solvency II and are intended to limit the procyclicality of the regulatory changes and to facilitate the entry into the new regime by giving companies the time needed to adapt to the new solvency requirements. The EIOPA Insurance Stress Test Report 2016 and the Report on Long-Term Guarantees (LTG) have shown that, in the absence of the easing effect of the LTG measures, insurers might be induced to force sales and de-risk in order to lower their SCR and MCR, possibly pushing asset prices further down, adding to the market volatility and potentially affecting financial stability.

Pursuant to Art. 51 Solvency II Directive 2009/138/EC solo insurance companies were required to publish annual Solvency and Financial Condition Reporting (SFCR) for the first time in May 2017, followed by groups at the end of June. Hence, this report uses a huge amount of comprehensive information on Solvency II results for the first time since the new supervisory regime entered into force on 1 January 2016. Aside from the quarterly data, yearly data is now available.

The publication of SFCR reports gives access to Solvency II results. Capital requirements under Solvency II are twofold. The Solvency Capital Requirement (SCR) is the level above which there is no supervisory intervention for financial reasons. Supervisors will take measures once the SCR is breached and ultimate measures (loss of licence) once the MCR is breached.

While the quarterly templates do contain SCR and MCR information, the SCR is not necessarily recalculated for the quarterly templates which only require annual recalculation. Hence, the quarterly SCR ratios will represent a snapshot, but not necessarily fully recalculated SCR ratios.

Also, the MCR might be affected by this because the SCR is used to define a cap and a floor for the MCR value.

The SCR ratio is calculated either by using a prescribed formula, called the standard formula, or by employing an undertaking-specific partial or full internal model that has been approved by the supervisory authority. Being risk-sensitive the SCR ratio is subject to fluctuations and undertakings are required to monitor it continuously. A variety of degrees of freedom and options in the calculation of Solvency II results allows insurance companies to adjust the calculation of the SCR ratio to their risk profile.

Reinsurance sector

The section is based on information released in the annual and quarterly reports of the largest European reinsurance groups. The global and European market overview is based on publicly available reports, forecasts and quarterly updates of rating agencies and other research and consulting studies.

Pension fund sector

The section on pension funds highlights the main developments that occurred in the European occupational pension fund sector, based on feedback provided by EIOPA's Members. Not all EU countries are covered, in some of them IORPs (i.e. occupational pension funds falling under the scope of the EU IORP Directive) are still non-existent or have recently been established. Furthermore, in other countries the main part of occupational retirement provisions is treated as a line of insurance business, respectively underwritten by life insurers, and is therefore not covered. The country coverage is 84% (26 out of 31 countries).

Data collected for 2016 was provided to EIOPA with an approximate view of the financial position of IORPs during the covered period. Several countries are still in the process of collecting data for 2016 and in some cases 2016 figures were incomplete or based on estimates which may be subject to major revisions in the coming reports.

In addition, the main valuation method applied by each country varies due to different accounting principles applied across the EU. Moreover, data availability varies substantially among the various Member States, which hampers a thorough analysis and comparison of the pension market developments between Member States. For RO, the data refers to 1st Pillar bis and 3rd Pillar private pension schemes only.

Finally, it is worth noting that due to differences in objective, scope, coverage and reporting period or timing of the data received by EIOPA, information reported in the different EIOPA reports may differ.

Country abbreviations

AT	Austria	IT	Italy
BE	Belgium	LI	Liechtenstein
BG	Bulgaria	LT	Lithuania
CY	Cyprus	LU	Luxembourg
CZ	Czech Republic	LV	Latvia
DE	Germany	MT	Malta
DK	Denmark	NL	Netherlands
EE	Estonia	NO	Norway
ES	Spain	PL	Poland
FI	Finland	PT	Portugal
FR	France	RO	Romania
GR	Greece	SE	Sweden
HR	Croatia	SI	Slovenia
HU	Hungary	SK	Slovakia
IE	Ireland	UK	United Kingdom
IS	Iceland	CH	Switzerland

PART II

Thematic Article

Macroeconomic fundamentals and latent factor of the EU yield curve

Marius Acatrinei⁶³

The content of this study does not reflect the official opinion of EIOPA. Responsibility for the information and the views expressed therein lies entirely with the authors.

Abstract

Since the portfolio of the insurers consists largely of bonds, out of which a significant weight consists of Government bonds, insurers are mainly exposed to interest rate risk and sovereign risk. We are motivated to contribute to the debate around the effect of the low yield environment and the effect on the insurers' portfolio due to their high exposure to government bonds. In this respect, any rise in macroeconomic risk across Europe could lead to a joint hit to insurers. The paper provides a broader look of the impact of the macroeconomic variables on the underlying factors that describe the yield curve and their overall effects to the insurers' portfolio. We show that the macroeconomic shocks have a different impact on bonds depending on their maturity. The life insurers are more affected by the low interest rate because the duration of long-term liabilities rises more than the one of the short-term assets. Therefore, the sensitivity of the long-term bonds to interest rate change is important for life insurers. We have estimated a structural VECM model to explore the interaction between the macroeconomic variables and the estimated factors of the yield curve. We conclude that 1) any change in the actual inflation can lead to small increases in the level factor, leaving almost unchanged the bond prices 2) the slope factor decreases faster after the monetary policy shocks affecting mostly the short-term bonds 3) a positive shock in monetary policy rate leads to a strong increase of the level factor.

Keywords: insurance, yield curve, Dynamic Factor Model, structural VECM.

JEL Codes: G22, C32, D53

Introduction

Holding assets that account for about two-thirds of European GDP, the European insurance sector is a significant part of the financial sector and one of the largest institutional investors. Insurers provide protection against financial and economic risks and an important source of long-term funding since they have a long-term strategy. They act mostly as shock absorbers in financial markets, but some latest developments show that they become more interconnected with the financial markets. In the case of liquidity swaps, the banks have access to the liquidity of insurers' asset portfolios. The banks borrow highly liquid government bonds and provide illiquid assets as collateral. Thus the vulnerability of insurers to financial system impairment is increased and passed through in the financial markets as liquidity risk.

The EIOPA Insurance stress test (2016) highlighted that prolonged low interest rate environment, combined with other factors could have a substantial negative impact on many European insurers reflected by a decrease in total excess of assets over

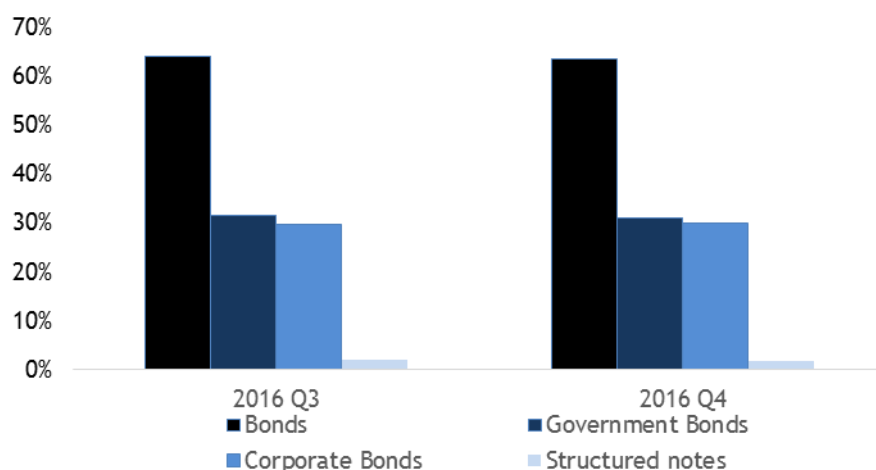
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liabilities. In this scenario⁶⁴, the impact of macroeconomic variables gains more importance on the insurers' profitability and solvency. Low interest rates coupled with a low growth environment characterized by declining asset prices can have significant financial stability implications. Expectations of a low-for-long scenario could lead insurers to invest in riskier, illiquid assets, thus increasing their probability of defaults.

According to the Solvency II balance sheet data⁶⁵, the weight of the bonds in the investments insurers' portfolio was around 63% in Q4 2016, out of which 31% were government Bonds (Figure A.1).

As a significant weight consists of bonds and government bonds, the insurers are mainly exposed to interest rate risk and sovereign risk. The insurers have a greater exposure to market risk through asset and liability duration mismatches, given the increased sensitivity of their investment portfolio to interest rates. The risk increase is mainly due to the high commonality in exposures to aggregate risk and thus they are nowadays more likely to be affected by any difficulties of the financial system.

Figure A.1: Weight of bonds in the European insurers' balance sheets



Source: EIOPA, Balance Sheet data

The academic research on the term structure of the interest rates showed that the yield curve can be described by a few statistical factors. While the Diebold et al (2006) paper analyses both the impact of the macroeconomic factors on the yield curve and vice versa, we are more interested to understand the shock of macroeconomic variables on the European yield curve. In this respect we have estimated a dynamic factor model which includes three observable macroeconomic factors: inflation, monetary policy rates and industry capacity utilizations along the yields of European government bonds. Since the factors that shape the structure of the yield curve have an important effect on the European economic climate, we study the impact of economic variables through an Impulse Response function.

After the global financial crisis of 2007-2009, the macroeconomic models were criticized for failing to properly capture the negative consequences of macrofinancial interlinkages between the financial sector and the macroeconomy.

⁶⁴ It has to be considered that there were some deviations from the SII regulation, e.g. in the so called "low-for-long" scenario the UFR was decreased to 2%. There was also no recalculation of the capital requirements after stress in the hypothetical scenarios.

⁶⁵ See EIOPA Statistics, Solo/Quarterly/Published 20170918 / Data extracted 20170829 (1) and FS/Annual/Published 20170918 / Data extracted 20170828.

Ang and Piazzesi (2003), Hordahl (2008) and Rudebusch and Wu (2008) developed models on the yield curve which included macroeconomic variables. Hordahl (2008) showed that although a hawkish monetary policy rule reduces the inflation risk premia embodied in the term structure of interest rates, it doesn't necessarily flatten the yield curve.

The models which explore the relationship between yield curve and macroeconomic variables are dynamic and are cast in the framework of Nelson and Siegel (1987) by extracting three latent factors from the yield. The Nelson-Siegel framework is used in practice by Central Banks, investment banks etc. for estimating the yield curve of the treasury bonds.

There are different narratives on how the macroeconomic factors influence the yield curve. Ang and Piazzesi (2003) showed that inflation and economic activity explain the dynamics of short and medium-term yield curves. Rudebusch and Wu (2008), Afonso and Martins (2012) have included macroeconomic variables in order to analyze the monetary and fiscal shocks on the yield curve. In order to identify the shocks, the authors implemented a sign restriction scheme (Canova and de Nicolo 2002) and a block diagonal strategy as in Mumtaz and Surico (2009) because they assumed that the macro variables affect simultaneously the yield curve factors. The level and slope factors are negatively correlated. The level factor accounts for the parallel shift in the yield curve, while the second factor explains the steepness of the curve in the slope. Usually when the level factor increases, the slope factor decreases.

Following this line of reasoning, the volatility of the term structure was analyzed by using the second factor of the yield curve. The motivation was that the second factor can provide information of the uncertainty of the future interest rate.

There is a rich literature on economic factors affecting the yield curve factors. Hardle (2012) used five macroeconomic variables: the harmonized consumer price index, the manufacturing capacity utilization, the unemployment rate, industrial production and the real Gross Domestic Product. The results show that the first factor is mainly driven by three factors: the inflation rate, the real Gross Domestic Product and the industrial production. It should be noted that the macroeconomic fundamentals could not explain the dynamics for the second factor.

The focus of the macroprudential policies is to bring light on the factors that may pose significant threats to the economy. Our paper may provide a broader look of the impact of the macroeconomic variables on the latent factors on the macroeconomic developments and as a basis for macrofinancial stress testing.

Data

We have used the yields of European Government bonds with maturities of 3, 6, 12, 24, 36, 48, 60, 72, 84, 96, 108 and 120 months. The data was provided by Datastream Thompson. The yields were not transformed in zero coupon yields because the differences were very small.

As the industry capacity utilisation is quarterly data and seasonally adjusted, we have disaggregated the series in monthly data using the Industrial Production Index with a small state space model as in Matteo Pelagatti (2015). The industrial production index is published monthly with a lag of one month and is available on Eurostat. The Harmonised Consumer Price Index (HICP) (2010=100) is published monthly with a lag of one month and is available on Eurostat. The monetary policy rate (Euro Short Term Repo Rate) is available on the website of the European Central Bank.

Following Diebold et al (2006) methodology, three underlying factors (level, slope and curvature) were extracted from the European government yields during 2008-2017. These factors can explain most of the variation of the yield curve. The level factor can be linked to inflation expectations, while the slope factor is related with the business cycle and with the uncertainty of the future interest rate.

Model

Nelson-Siegel equations for fitting the curve yield

According to Nelson-Siegel (1987) the instantaneous forward interest rate is the solution to a second order differential equation. The Nelson-Siegel equation for the yield curve is

$$y(x) = L + S \left(\frac{1 - e^{-\lambda x}}{\lambda x} \right) + C \left(\frac{1 - e^{-\lambda x}}{\lambda x} - e^{-\lambda x} \right)$$

The latent factors extracted from the yield curve (y) are known in the literature as Level (L), Slope (S) and Curvature (C).

A dynamic factor model allows the analysis of the extracted factors as they are transposed in a state space model

$$y(x) = L + S \left(\frac{1 - e^{-\lambda x}}{\lambda x} \right) + C \left(\frac{1 - e^{-\lambda x}}{\lambda x} - e^{-\lambda x} \right)$$

Diebold and Li (2002) showed that the factors L , S and C are time dependent in a dynamic model and therefore can be modeled as

$$y(x) = L_t + S_t \left(\frac{1 - e^{-\lambda x}}{\lambda x} \right) + C_t \left(\frac{1 - e^{-\lambda x}}{\lambda x} - e^{-\lambda x} \right)$$

Interpretation of the latent factors

We did not extract the factors with a PCA model (principal component analysis) as a PCA model considers the factors as orthogonal (uncorrelated). In a state space model with full diagonal specification for the state error covariance matrix, we can see how they influence each other.

The first factor is the level factor as any change in it leads to parallel shifts in the term structure of interest rate, meaning that it brings a shifting of the interest rate for any maturity. The level factor usually explains around 80% of the total variation of the yield curve. By construction the loading of the level factor does not change with maturity and thus affects all yields by the same amount.

The second factor is the slope as any change in it brings an asymmetric response on the short and long-term maturities. A shock to the slope means that the short-term bonds increase faster than the long-term ones. It explains around 15% of the yield curve. The loading of the slope factor equals one at zero maturity and declines to zero as the maturity increases.

The third factor is called curvature as the shocks to it leads to changes in the middle of the yield curve. It explains around 5% of the yield curve. The monetary policy rate affects primarily the short-term interest rate. The long-end of the curve yield depends on the market expectations and risk aversion on future economic developments.

State-space representation of the dynamic factor model

We assume that the factors L_t, S_t, C_t are following a Vector autoregressive process of order 1 (VAR1). Since any ARMA process may be written in the state space framework (Hamilton, 1994), the equations are written as follows:

Transition equation

$$\alpha_{t+1} = T\alpha_t + \eta_t, \eta_t \sim (0, Q)$$

The state vector of factors follows a first-order autoregressive process. We discard the mean from the state variables

$$\alpha_{t+1} - \mu = T(\alpha_t - \mu) + \eta_t$$

$$\begin{bmatrix} L_{t+1} - \mu_L \\ S_{t+1} - \mu_S \\ C_{t+1} - \mu_C \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} L_t - \mu_L \\ S_t - \mu_S \\ C_t - \mu_C \end{bmatrix} + \begin{bmatrix} \eta_t(L) \\ \eta_t(S) \\ \eta_t(C) \end{bmatrix}$$

We don't assume that the Q matrix is diagonal which means that the shocks of the state variables influence each other.

The column vector of yields of the European government bonds is y_t

Measurement equation

$$y_t = Z\alpha_t + \varepsilon_t, \varepsilon_t \sim (0, H_t)$$

$$\begin{pmatrix} y_{1,t} \\ \vdots \\ y_{N,t} \end{pmatrix} = \begin{pmatrix} 1 & \frac{1 - e^{-\lambda x_1}}{\lambda x_1} & \frac{1 - e^{-\lambda x_1}}{\lambda x_1} - e^{-\lambda x_1} \\ \vdots & \vdots & \vdots \\ 1 & \frac{1 - e^{-\lambda x_N}}{\lambda x_N} & \frac{1 - e^{-\lambda x_N}}{\lambda x_N} - e^{-\lambda x_N} \end{pmatrix} \begin{pmatrix} L_t \\ S_t \\ C_t \end{pmatrix} + \begin{pmatrix} \varepsilon_{1,t} \\ \vdots \\ \varepsilon_{N,t} \end{pmatrix}$$

where λ is a parameter which controls the strength of the relationship between the latent factors and the observed yields, that is the speed of exponential decay with smaller values associated with slow decay rates. The measurement errors (ε_t) allows for movements in the yields that are not explained by the state variables.

We assume that the measurement errors and the state errors are orthogonal such as

$$\begin{pmatrix} \eta_t \\ \varepsilon_t \end{pmatrix} \sim N \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} Q & 0 \\ 0 & H \end{pmatrix} \right]$$

Empirical Results

Following Diebold et al. (2006) we have estimated a dynamic factor model with a full diagonal specification for the state error covariance matrix in order to inspect the influence between factors.

In order to assess the influence of macroeconomic variables on the yield curve, we have re-estimated the model by adding monetary policy rate, inflation and industry capacity utilization. The industry capacity utilization (CAP) is a proxy for the economic activity. Since the monetary policy rate (Repo) influences all the interest rates in the economy, it is usually used in all models in the literature surveyed. Inflation (HICP) is added to the model in order to see the causal relation between macroeconomic policy, real economy and bond yields.

We have estimated the model with the Kalman filter (smoother filter). The smoothed values will be presented in the graphs below in order to check the fit of the model. The likelihood test and the Wald test for the diagonality of Q matrix show that we can reject the null hypothesis that Q is a diagonal matrix and accept the alternative hypothesis that Q is not diagonal.

$$\begin{bmatrix} L_{t+1} - \mu_L \\ S_{t+1} - \mu_S \\ C_{t+1} - \mu_C \\ CAP_{t+1} - \mu_{CAP} \\ Repo_{t+1} - \mu_{repo} \\ HICP_{t+1} - \mu_{HICP} \end{bmatrix} = \begin{bmatrix} 0.91 & \mathbf{0.12} & -\mathbf{0.02} & -0.07 & -\mathbf{0.13} & 0.02 \\ 0.27 & 0.99 & \mathbf{0.03} & 0.06 & -\mathbf{0.02} & -0.1 \\ -\mathbf{0.1} & -\mathbf{0.13} & 0.91 & \mathbf{0.02} & 0.46 & -0.27 \\ 0.77 & 0.65 & 0.05 & 0.98 & -1.11 & 0.18 \\ 0.26 & 0.29 & 0.01 & -0.02 & 0.6 & 0.11 \\ \mathbf{0.12} & \mathbf{0.13} & \mathbf{0.03} & -\mathbf{0.004} & -0.23 & 1.06 \end{bmatrix}$$

$$\begin{bmatrix} L_t - \mu_L \\ S_t - \mu_S \\ C_t - \mu_C \\ CAP_t - \mu_{CAP} \\ Repo_t - \mu_{repo} \\ HICP_t - \mu_{HICP} \end{bmatrix} + \begin{bmatrix} 4.14 \\ -3.31 \\ -4.01 \\ 81.13 \\ 1.24 \\ 2.42 \end{bmatrix}$$

*bold: not significant values (pvalue > 0.05)

The results show a persistent dynamic for the first three factors with their previous lag respectively 0.91 for L_t , 0.99 for S_t and 0.91 for C_t . The dynamics between the latent factors is as follows: L_t is not influenced by S_t or C_t , S_t is influenced by L_t (0.27) and C_t is not influenced by the first two factors.

The relationship between the latent factors and the macroeconomic variables is: L_t is negatively influenced by capacity utilization and positively by inflation. On the contrary S_t is positively influenced by capacity utilization and negatively by inflation.

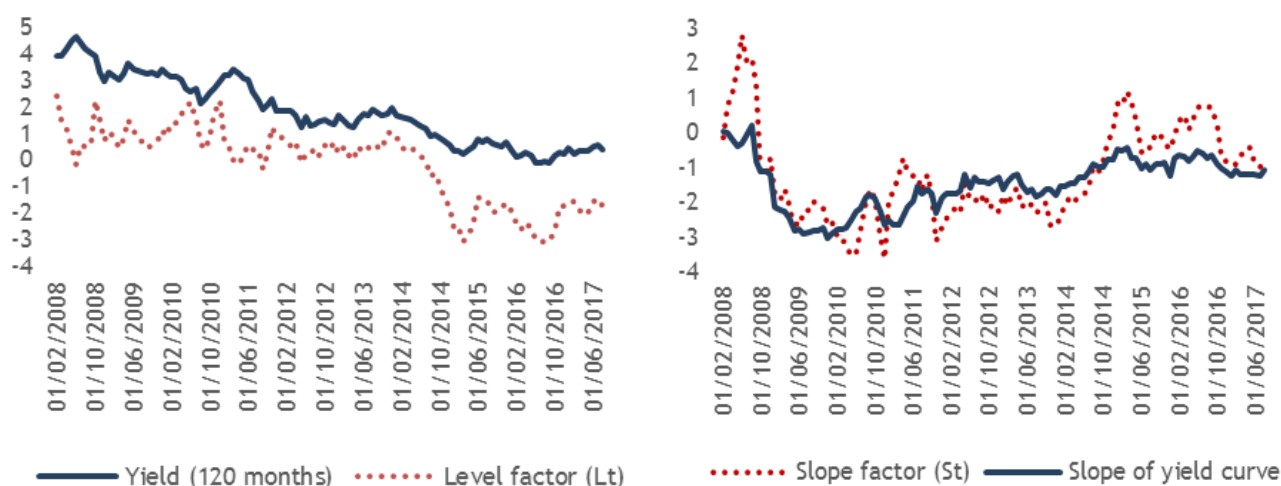
The correlation between the Hodrick-Prescott (HP) cycles between S_t and capacity utilization in industry is 0.175 and suggests that S_t is linked to the business cycle.

Table A.1. Estimated Q matrix (state error covariance matrix)

	L_t	S_t	C_t	CAP	Repo	HICP
L_t	0.05 (0.0000)					
S_t		0.09 (0.0000)				
C_t			0.37 (0.0000)			
CAP				0.17 (0.0000)		
Repo					0.01 (0.0000)	
HICP						0.07 (0.0000)

The transition shock volatility is lower for the first two factors while for the third factor is higher (0.37). We may note that the shock volatility for the first factor is quite low due to the very small changes in the L_t in the last years.

Figure A.2: Estimated factors versus their empirical proxies



Source: Author's own calculation

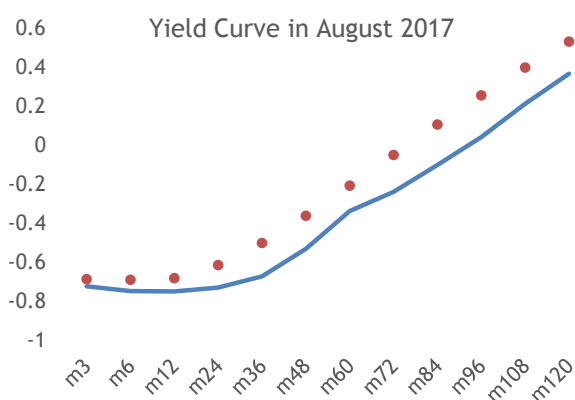
The empirical proxy for the level factor is the long-term yield of 10 years' bonds. The level factor is highly correlated with the long-term yields (120 months) and it can be interpreted as including inflation expectations.

The empirical proxy for the slope factor is the difference between short-term yield (3 months) and long-term yields (120 months). When the curve is negative it means that the yields tend to increase as the maturity increases and describes a normal economy while an inverted yield curve is described by a positive slope.

The results show that until the end of 2014 the decrease in the monetary policy rate coincided with a decrease in the slope factor, while after 2014 the slope began to increase.

We show that the fit of the model by plotting the actual versus fitted yield curve for August 2017. The estimation errors are very small and they tend to be slightly bigger for the long-term yields.

Figure A.3: Actual (blue line) and Fitted (red circles) yield curves



Source: Author's own calculation

Vector Error Correction Model

As both the latent factors (level factor, slope factor) and macroeconomic variables (monetary policy rate, inflation rate, industry capacity utilization,) are nonstationary variables, we have fitted a structural VECM model with two lags and two cointegrating relations in order to analyze the causal patterns between the macroeconomic variables and the factors that characterize the yield curve. We have imposed 10 short-term restrictions and a recursive identification scheme for the shocks. The variables were ordered from the most exogenous to the least exogenous (monetary policy rate, level factor, slope factor, inflation, and capacity utilization). The variables that are most exogenous affect contemporaneously variables as level factor and slope factor, while affecting other variables with a lag.

Table A.2: Estimated B matrix

	monetary policy	L_t	S_t	HICP	CAP
monetary policy	0.0445	-0.0584	0	0	0
L_t	0.2069	0.3137	0	0	0
S_t	-0.217	-0.342	0.1071	0.018	0
HICP	0.014	-0.0211	0	0.0929	-0.0132
CAP	0	-0.0134	0	0.0094	0.061

Source: Author's own calculation

We choose this ordering due to the fact that since our data are monthly, it takes time for economic agents to react to economic developments and policy decisions, while other variables react immediately.

Figure A.4: Cointegration graph



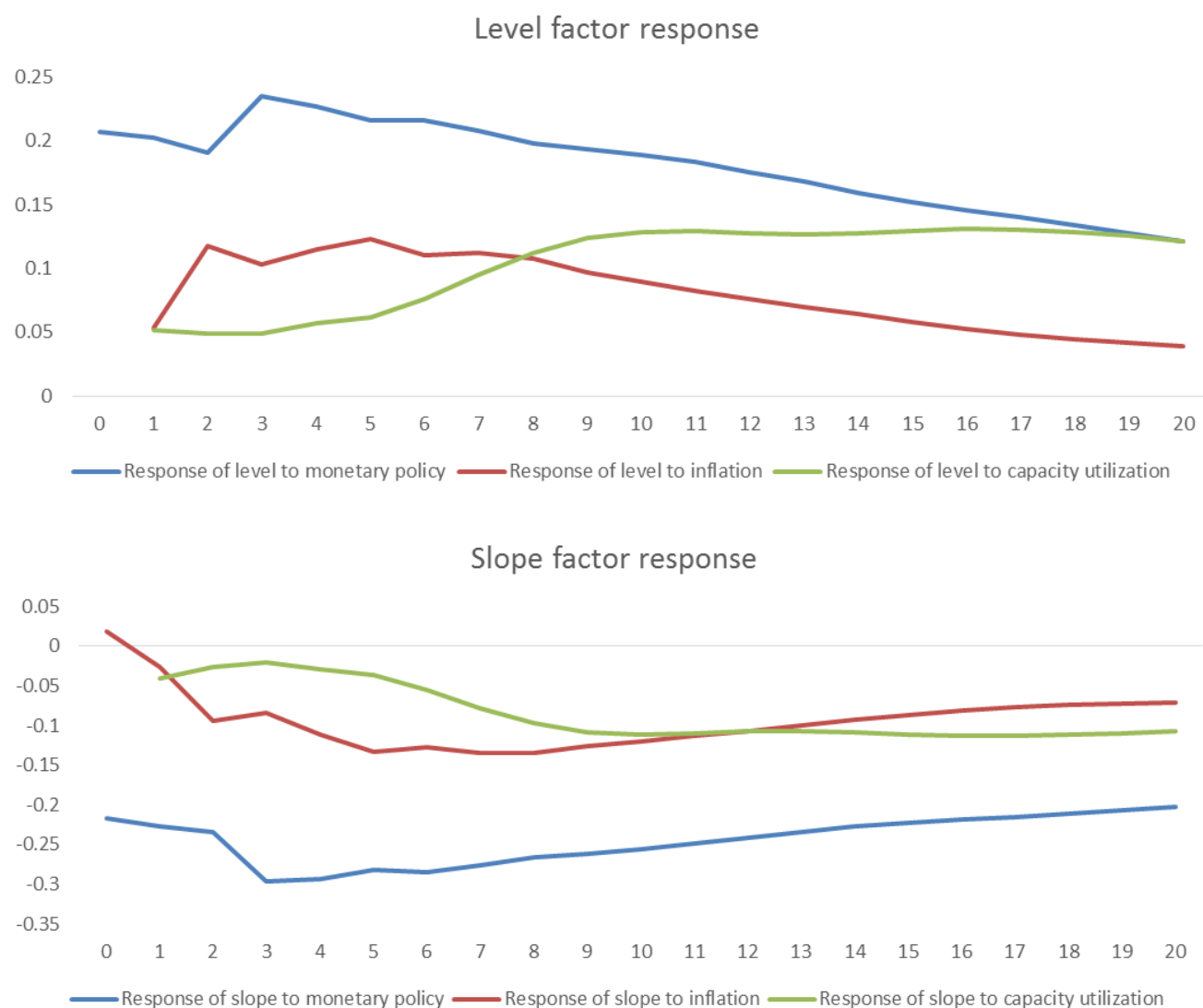
Source: Author's own calculation

The cointegration plot shows that the deviations from equilibrium are very small since 2014.

Impulse-response analysis is typically used to describe the response in the variables chosen due to a shock in other variables. The impulse is defined as generalized impulse (Pesaran and Shin, 1998) so as not to depend on the variable ordering.

In the following we will present only the impulse-response from the macroeconomic variables to the latent factors. Since the model is VECM, most shocks don't die out.

Figure A.5: Impulse Response Functions



Source: Author's own calculation

Conclusions

We have used monthly data between January 2008 and August 2017 for 12 European Government yields with maturities ranging from 3 to 120 months, inflation rate excluding energy and food (HICP), industry capacity utilization and the ECB monetary policy rate. Then we have estimated a structural VECM model to analyze the interaction between the first two statistical factors (level and slope) and the three selected macroeconomic variables, the ECB monetary policy rate, industry capacity utilization and inflation rate.

The results showed that the increases in the level factor are usually associated with the inflation expectation. While the increases in the level do not have a contemporaneous increase of the slope factor, an increase in the slope factor has a negative contemporaneous effect on the level.

A positive shock in inflation (HIPC less energy and food) leads to an increase in level and decrease the slope. Rudebusch and Wu (2008) showed that movements in the inflation rate may explain around 66% of the level factor dynamics. In normal market conditions, the increase in inflation expectations leads to an increase of long-term yields in order to compensate the investors for the losses caused by inflation. In the low yield environment, the relationship between inflation and inflation expectations is marred by the low growth expectations for the long-run. Any change in the actual inflation can lead to small increases in inflation expectations, meaning that the bond prices will be almost unchanged.

The shocks to the economic activity affects the yield curve, through the demand channel since companies are issuing more long-term bonds. A modest increase in the growth of the European economy will have only a marginally decrease in the bond prices. A shock in the industry capacity utilization brings about a positive shock in the level factor and a positive shock in the level factor and a negative shock to the slope factor since the short-term loans are used to finance business operations.

A positive shock in the monetary policy rate (monetary policy tightening) leads to a decrease in the inflation expectations and to an increase in the level factor, but also to a decrease in the slope factor which measures the uncertainty around the future interest rate. The slope factor reacts contemporaneously to any news regarding the change of the monetary policy rate. After the official release, since the uncertainty is abated, the shock persists since is affected also by the level factor.

The slope factor decreases faster after any shock in the monetary policy, meaning the short-term bond prices are the most affected.

As the macroeconomic shocks have different effects on bonds given the term structure of insurers' portfolios, the effects of the macroeconomic variables on the insurers' assets distribution depend on the weight and maturity of bonds held by insurers.

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