EUROPEAN INSURANCE
AND OCCUPATIONAL PENSIONS AUTHORITY

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Financial Stability Report

December 2015

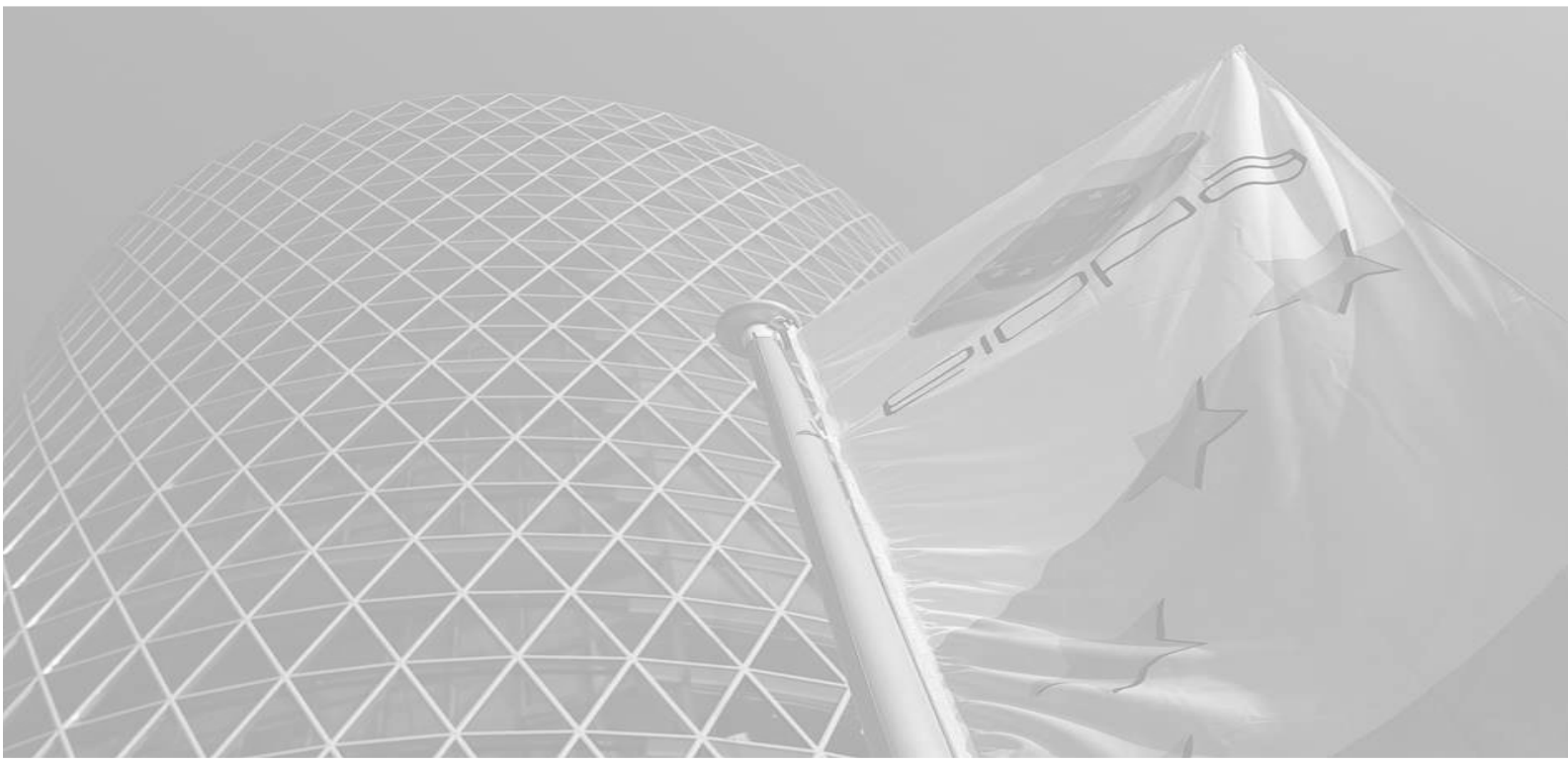


Table of Contents

Foreword by the Chairman

The past months have continued to demonstrate a very challenging macro-economic and financial environment for the insurance and pension fund sectors. While economists are actively debating whether we have a cyclical or a structural problem with interest rates, policymakers need to continue striving for the right balance between policyholders' interests and ensuring financial stability, while at the same time removing barriers to overall economic growth.

The persistent low interest rate environment is affecting the solvency position of insurers and pension funds and challenging the sustainability of their commitments and business models. The search for yield is a natural but not risk free reaction. Insurance companies and pension funds are thereby investing beyond traditional asset classes and increasing the diversification of their holdings. This could have a positive effect, but could also increase the risk profile of their investments. For this reason, insurance companies and pension funds should avoid exceeding their individual capacity to bear risk. Nowadays more than ever risk management is a crucial and essential tool.

The successful transition to Solvency II and its implementation as of 1 January 2016 is the top priority. It is a huge step forward for policyholder protection and for the implementation of a true single market across the European Economic Area, whilst increasing the resilience of the European insurance sector. However, deeper resilience also requires further work. Resilience could be improved by cancelling or deferring dividends for relevant business models, reducing the maximum guarantees offered in new contracts, and by limiting participation features and commission levels. Solvency II brings a better alignment of risk and capital management as well as improvements in the identification and mitigation of risks. Moreover, to help mitigate procyclicality Solvency II provides tools such as transitional periods, a volatility adjustment, a matching adjustment and an extension of recovery periods.

Going forward, EIOPA will continue conducting credible stress tests, a key preventive supervisory tool for identifying the main risks and vulnerabilities, as well as issuing clear recommendations fir mitigate these risks and vulnerabilities. The pension stress test conducted European Union wide and for the first time in 2015 is an important milestone in assessing the resilience of occupational pension funds. In 2016, we shall see the third biennial regular stress test for insurance companies. This exercise will assess the sector's vulnerability to the prolonged low yield environment as well as to

the potentially harmful effect of a risk reversal scenario combining low risk free rates with an increase in risk premiums. I am confident that the design and magnitude of the shocks included in this exercise will allow EIOPA and national supervisory authorities once again to devise appropriate measures to mitigate key risks and define areas for further investigation.

Finally, in line with the EIOPA long-term strategy to stimulate the discussion on issues important for the positive and sustainable development of the European insurance and occupational pension sectors, this report includes a special article entitled "Assessing Systemic Risk of the European Insurance Industry". For EIOPA it is extremely important to further contribute to the ongoing constructive dialogue with national supervisors and academia on systemic risks.

Executive Summary

In the second quarter of 2015, the macroeconomic environment continued to be weak. Low yields and the subsequent reinvestment risk remain the main concern in the European insurance sector, especially for life insurers. Although the latest economic indicators suggest a slow economic recovery, persistent unemployment, high public and private indebtedness and market fragmentation prevail. Furthermore, the inflation rate among the EU is still substantially below the ECB's inflation target. Recently, the negative development in emerging economies mirrored in significant market turbulences as also reflected in insurers' share prices. Despite the recent decrease, the volatility of 10-year government bonds' yields involved in the QE program remains high suggesting a reduction of the market liquidity. These conditions might trigger a risk premium re-assessment. Increasing premia jointly with low risk free rate would imply a double hit scenario (decreasing assets' value and sustaining value of liabilities) with a severe impact on the European insurance and pension sector.

Gross written premiums (GWPs) grew in the first two quarters of 2015 although the pattern is very heterogeneous, with non-life business experiencing much higher growth rates than life. The trend towards unit-linked policies continues in the second half of 2015 as well. On average a confirmation of low but still relatively stable return on assets (ROA) and return on equity (ROE) can be seen. At the same time the sustainability of profitability remains questionable in the current low yield environment. In this context, "search for yield" is often discussed. Not all insurers are equally affected by the low interest rate environment due to diverging market conditions, different product lines or duration mismatches. Changes in product portfolios and business models may lead to a further shifting of risks from insurers to policy holders. In addition, especially for life insures with high negative duration gaps, an ongoing low interest rate environment will put a severe strain on the solvency position. On the other hand, the risk sensitiveness introduced in the Solvency II regime as of January 2016 is expected to have a positive impact on the resilience of the European insurance industry. Reinsurance premiums have remained under pressure, in soft market conditions caused by excess capital, a benign catastrophe environment and a weak global economy. The current environment has prompted a wave of mergers and acquisitions, as reinsurers seek to diversify, and reduce expense ratios through greater economies of scale. Alternative capital continues to flow into the reinsurance market, albeit to a lesser extent than before.

With regards to the European occupational pension fund sector, total assets significantly increased in 2014. Cover ratios also increased in most countries. Investment allocation remained broadly unchanged and the average rate of return increased for most of the countries. The recent fall in equity markets, if it persists, can potentially incur losses in the pension funds over 2015 and create additional pressure given that a big part of their investments is in equity.

The regular EIOPA qualitative risk assessment confirms that the low interest rate environment remains a key risk for both the insurance and pension sector. If it prevails, the gap between investment and guaranteed returns will put further pressure on insurance solvency and profitability. Despite these challenging conditions, our analysis points out a moderate but positive increase in profitability both for life and non-life insurance companies alike. Furthermore, empirical evidence reveals a positive trend in the insurance market growth. This is supported by the increasing contribution of cross-border business. These results are associated with a slight increase in the risk appetite of insurers adjusting their allocation shifting from fixed-income to equity investments. Finally, the applied econometric model suggests that the exposure of the sector to systemic events, even if increasing, remains limited.

The report consists of two parts – the standard part and the thematic article section. The standard part is structured as following. The first chapter discusses the key risks identified for insurance and occupational pension sectors. 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. This assessment is done in terms of the scope as well as the probability of their materialization using econometric techniques and qualitative questionnaires. Finally, the thematic article further elaborate on the analysis of the systemic risk for the financial service industry used also in the quantitative analysis section assessing systemic relevance of the main European (re)insurers.

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 examples that could potentially make the financial system, as a whole, less capable of absorbing (financial) shocks. Finally, (re)insurance undertakings might engage in non-traditional/non-insurance business such as the provision of financial guarantees or alternative risk transfer, which also 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 2015

EIOPA has updated its report on financial stability in relation to the insurance, reinsurance and occupational pension fund sectors in the EU/EEA. The current report covers developments in financial markets, the macroeconomic environment, and the insurance, reinsurance and occupational pension fund sectors as of 11th November if not stated otherwise.

PART I

1. Key developments

Overall, the macroeconomic outlook has deteriorated since June 2015. Although many European countries continue to recover, economic growth still remains fragile reflecting high public debt and only slowly decreasing unemployment in the EU.

The Quantitative Easing (QE) seems to have had some positive effects on the economy and improved confidence. If economic growth accelerates it will have a favourable impact on the European insurance although challenges will be created as the low level of risk free rates creates pressure on insurance solvency positions and pension funding ratios. This negative effect to insurers could further deteriorate the outlook compared with what was initially expected.

The current macroeconomic reality puts pressure on insurers to maintain profitability without taking in more risks, especially if interest rates will remain low. Sustaining current business models will be challenging as market participants could be re-allocating their portfolios towards more risky markets or more risky assets making themselves more vulnerable to adverse market developments. Although the situation in Greece has stabilised somewhat, geopolitical risks including further potential terrorist attacks and their potential adverse consequences on the European market cannot be ruled out. Still, developments there and in other regions such as the Middle East will be of course on the daily monitoring agenda. This also entails the standstill in the Ukraine. Further challenges to the EU economy and financial markets cannot be ruled out with interest rates remaining low. Additionally, the recent stock market crisis in China has had a negative impact on the European insurance market with spill-over effects to both advanced and emerging markets. Still, it is currently too early to identify the full effect on both insurers and the global economy. An emerging point of interest would be to assess the funding and capital capabilities of any insurance undertakings owned by Chinese investors. Concerns about Brazil also need to be watched. The currencies of these countries have all recently depreciated against the Euro. The overall business sentiment in Europe has dipped slightly especially in some of the largest economies although not as far as expected. Although the risk of deflation has diminished, inflation is lower than ever. Commodity prices have been falling supporting consumer demand and caused markets to revise their inflation expectations downward

The anticipated change in the US monetary policy might substantially affect the European financial market. The key determinant of such an impact will be when and how the monetary policy will be changed from accommodative to restrictive. For now,

the current weaknesses in the global economy were reflected in the previous decisions made this year by the U.S. Federal Reserve Bank to postpone raising interest rates. Finally, Europe's refugee crisis has only started and might have further economic consequences.

1.1. Low yield environment

Low yields and the subsequent reinvestment risk remain the main concern in the insurance sector (Figure 1.1a). Hence, long-term investors such as insurance companies and pension funds have difficulties reinvesting their assets at a reasonable level. Moreover, given the current fragile growth and low inflation in many countries, the accommodative monetary policy in Europe could further prolong the current low yield environment (Figure 1.1b).

Figure 1.1a: EUR swap curve

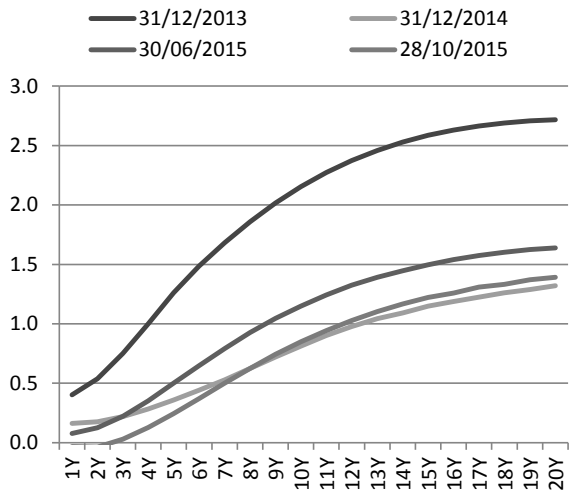
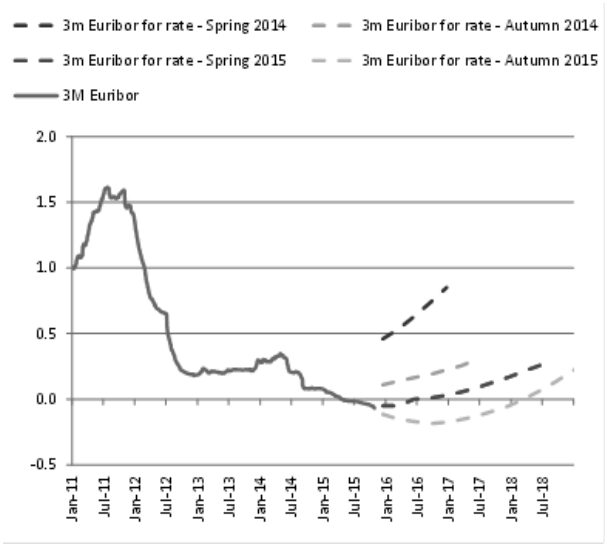


Figure 1.1b: 3M EURIBOR



Source: Bloomberg - Final observation: 30 October 2015

Government bond yields stay at very low levels. After the turbulence (increase in yields) caused by the situation in Greece in June and July 2015, euro area government bond yields have further temporarily dropped (Figure 1.2 and Figure 1.3). The current market environment will continue to squeeze insurers' earnings and put pressure on balance sheets.

Figure 1.2: 10-year government bond yields (%)

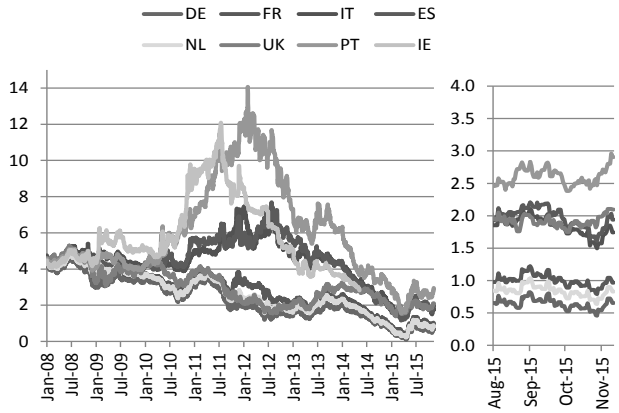
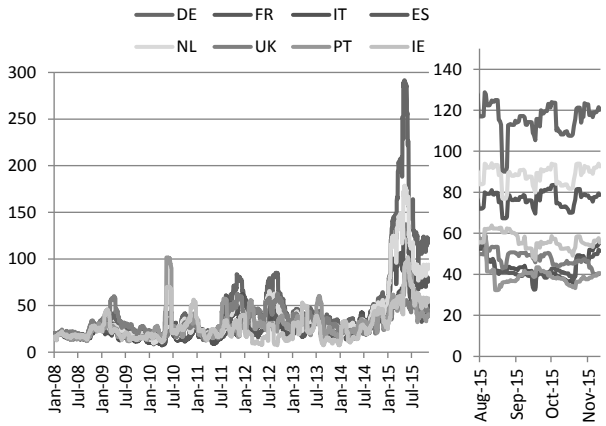


Figure 1.3:10-year government bond 30-day volatility (%)



Source: Bloomberg; Last observation: 11 November.2015

Similarly, Euro area corporates yields (financials and non-financials) remain overall at very low levels (Figure 1.4 and Figure 1.5). Insurers might increase their efforts to search for yields in higher risk assets.

Figure 1.4. EMU Financial (%)

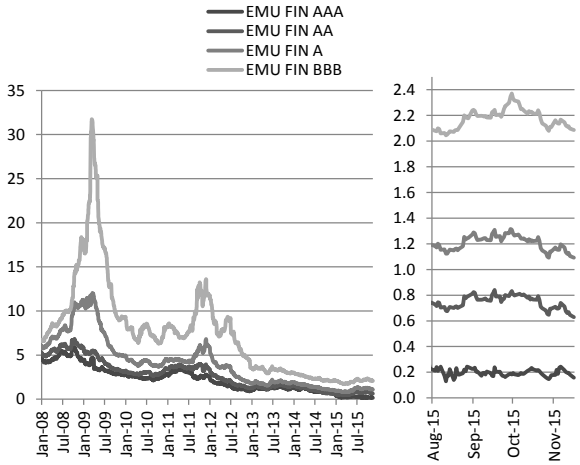
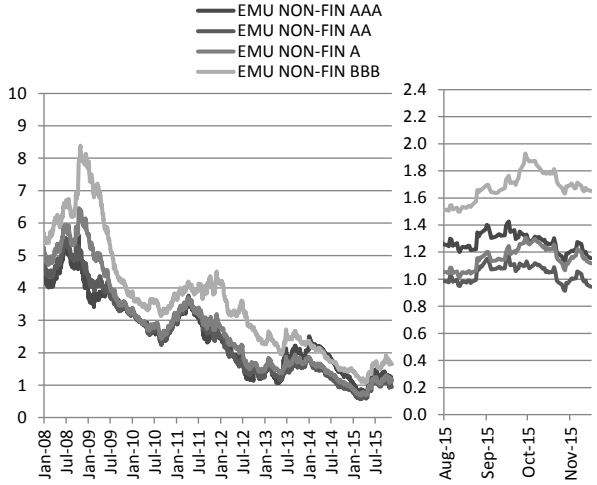


Figure 1.5. EMU Non-financial (%)



Source: BofA Merrill Lynch Global Research, used with permission ; Last observation: 11 November 2015

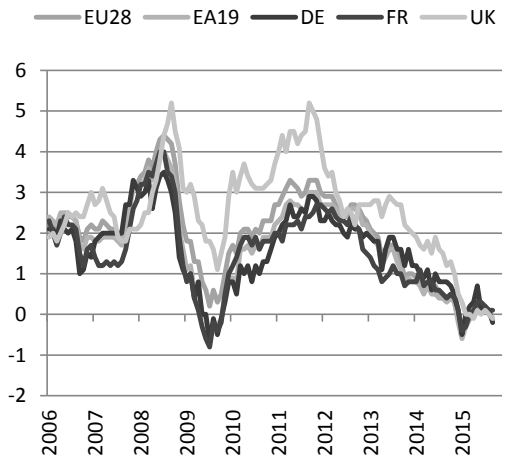
Interest rate volatility decreased but remains high for 10-year government bonds involved in the QE program. The substantially higher volatility of the government bonds involved in the QE program suggests that the market liquidity is somewhat reduced. In such an environment, relatively limited trading volumes can have a substantial impact on prices. Under such a scenario insurers and pension funds could be negatively affected by increase of risk premiums and keeping low risk free rates at very low levels at the same time. This so called double hit scenario was identified as a main risk with severe consequences for the European insurance sector

by the Insurance Stress Test 2014. Similarly, EIOPA conducted a pension stress test in 2015 which will assess the impact of this scenario on DB pension plans.

Furthermore, the inflation rate among the EU is still substantial below the ECB's inflation target (Figure 1.6). This is primarily due to a renewed fall in oil prices (Figure 1.7) that were about 50% lower in September 2015 than a year ago. On the other hand, deflation pressures have been somewhat reduced since mid-2015.

The ECB recently announced that purchases of mainly government bonds - at EUR 60bn a month - are now seen running until at least March 2017 instead of next September. The ECB also reduced the interest rate on the deposit facility by 10 basis points to -0.30%, with effect from 9 December 2015. This decision came after the publication of an ECB analysis supporting the idea that the QE program implemented so far produced positive effects on the European economy, but the return to price stability must continue to be consolidated.

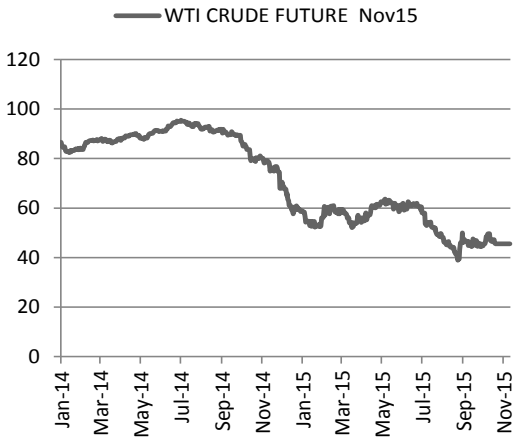
Figure 1.6: Inflation rate (in %)



Source: ECB and Eurostat

Last observation: September 2015

Figure 1.7: Oil price



Source: Bloomberg

Last observation: 11 November 2015

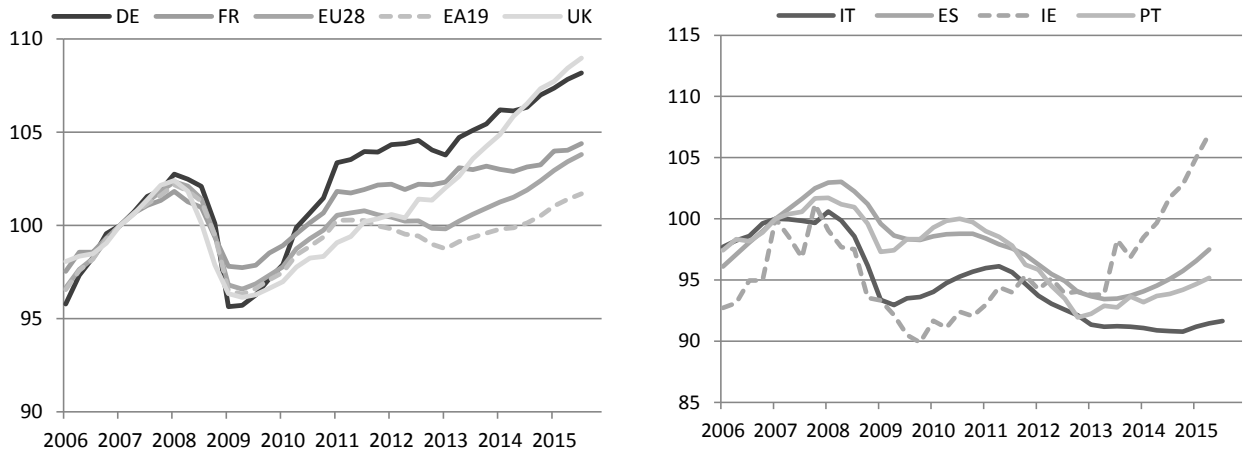
1.2. Weak macroeconomic environment

According to the latest economic forecasts[1], the outlook has been slightly improved in both the EA and EU since May 2015. The recovery is expected to continue at a modest pace in 2016 despite the challenging conditions in the world economy. However, differences can still be observed among the EU countries especially when looking at fiscal consolidation. Note that the development is very

[1] See EC: http://ec.europa.eu/economy_finance/eu/forecasts/2015_autumn_forecast_en.htm

heterogeneous in Europe though as some countries are still far from pre-crisis levels (Figure 1.8).

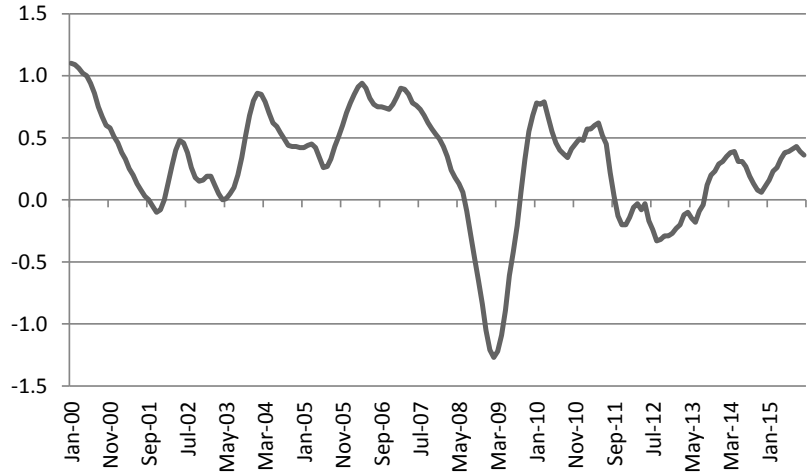
Figure 1.8: Real GDP development (index 2007Q1=100)



Source: Eurostat and EIOPA calculations - Last observation: Q3 2015 (IT, ES and PT 2015Q2)

The lower growth expectation is also suggested by some other indicators. The Eurocoin Growth Indicator estimates positive but slow quarter-on-quarter growth for the euro zone during recent months (Figure 1.9).

Figure 1.9: Eurocoin Growth Indicator (quarter-on-quarter growth rate)

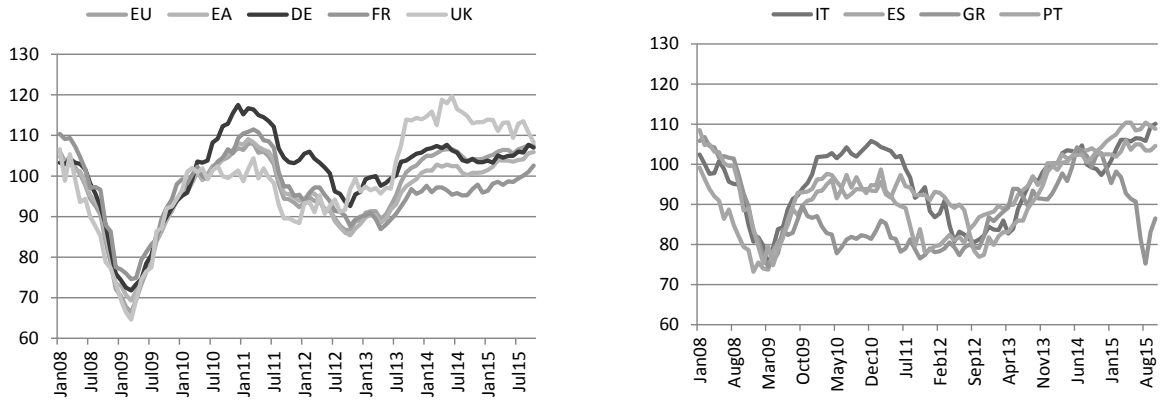


Source: Bloomberg- Last Observation: October 2015.

The Economic Sentiment Indicator (ESI) continued to increase (Figure 1.9). The stabilisation of the euro-area sentiment resulted from important increases in confidence in retail trade and construction which were partly outweighed by the deterioration in services and consumer confidence. Amongst the largest euro-area economies, the ESI brightened in France (+1.6) and Italy (+0.9), while it decreased

e.g. in Germany and Spain (-0.7) and, also, more markedly, in the Netherlands (-2.4).

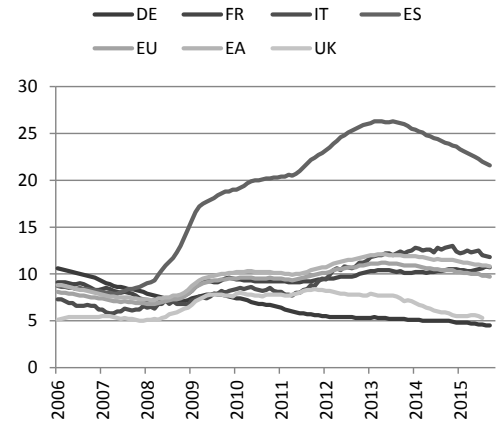
Figure 1.9: Economic Sentiment Indicator (ESI)



Source: European Commission - Last observation: October 2015

Unemployment remains very high in some countries although signs of improvement can be seen in a few cases (Figure 1.10). In the EU, the unemployment rate has fallen from 10.1% in September 2014 to 9.4% in September 2015. In the Eurozone the unemployment rate stands at 10.8%, its lowest level since January 2012. Nevertheless, these high levels negatively impact economic growth.

Figure 1.10: Unemployment rate - (in % of the labour force)



Source: Eurostat; Last observation: October 2015

China caused significant market turbulence in late August 2015. Due to lower growth projections this could have a strong negative impact on the long-term growth in international trade. The lower expected economic growth in China might reflect the correction of the speculative bubble in the credit, stock and real estate markets.

Turbulences in China's stock market were also reflected by the drop in international stock markets, including insurance stocks. The turbulences spilled

over to other emerging markets but also to advanced economies including Europe (Figure 1.11). The DJ STOXX 600 Insurance index is still outperforming the DJ STOXX EUROPE Banks (Figure 1.12), but has suffered major losses over the last quarter. Insurance equity prices have been negatively affected in line with the overall market drop.

Figure 1.11. Chinese stock markets (01/01/2014=100)

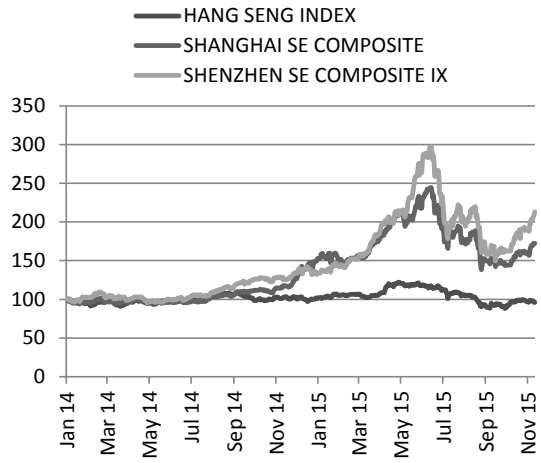


Figure 1.12. European stock markets (01/01/2014=100)

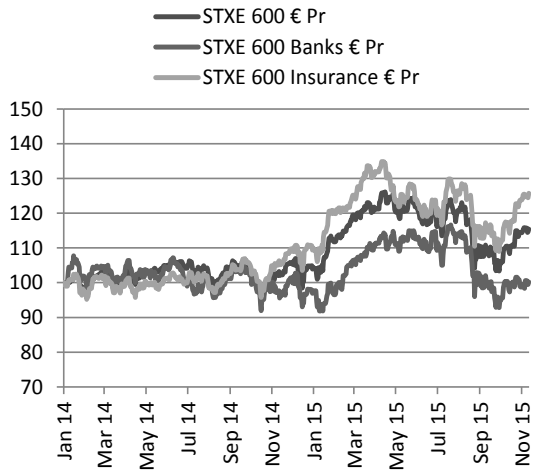
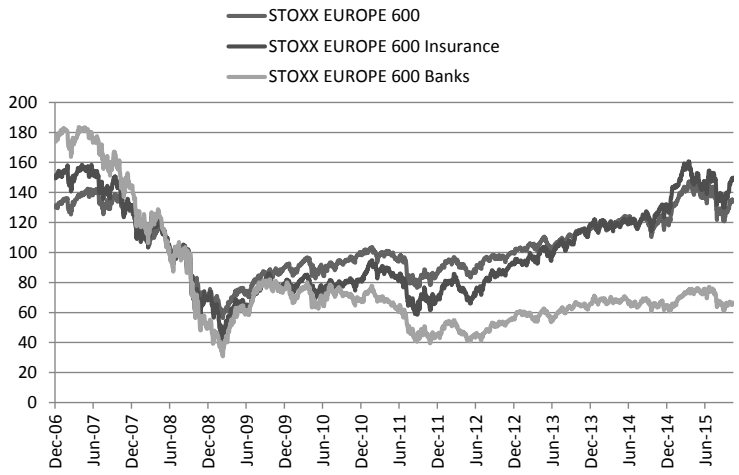


Figure 1.13. Stock market developments (index:2008=100)

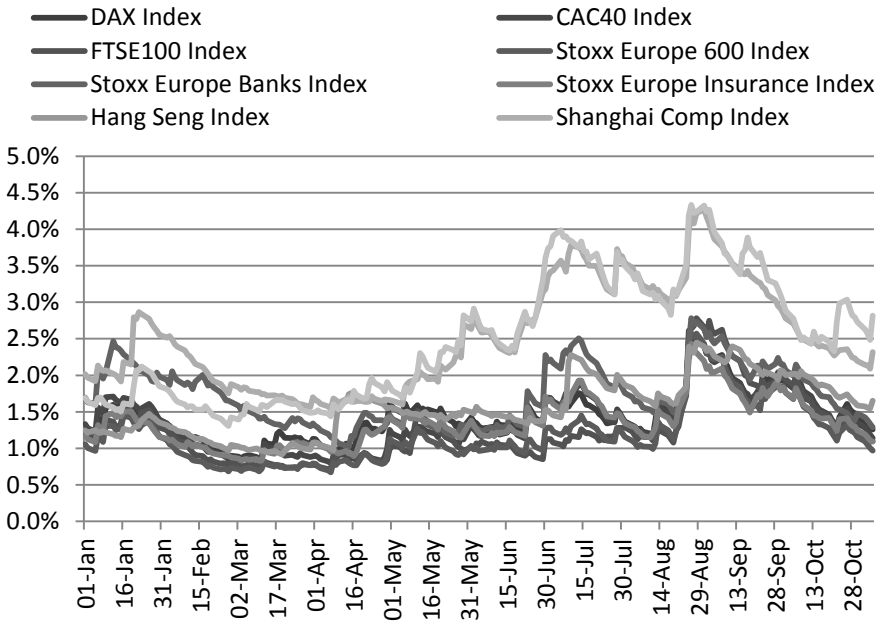


Source: Bloomberg; Last observation: 11 November 2015

The increase in equity volatility originating from China was transmitted almost simultaneously to the European markets but with significantly lower amplitude. After the peak registered at the end of August or beginning of September, the daily volatility for most European equity indices (including the ones for insurance and banking sectors) gradually declined. Currently they returned to levels from the first half of the year. Although the volatility of Chinese stock indices

declined to some extent, for the time being it still remains at significantly higher levels comparing with the European markets (Figure 1.14).

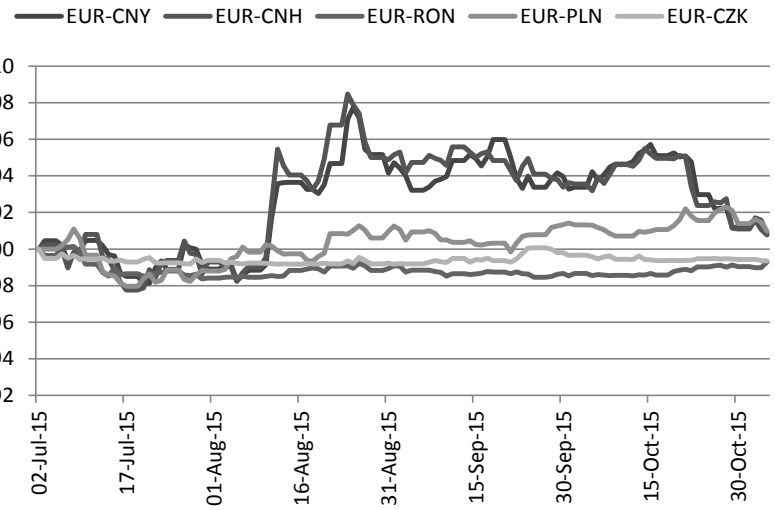
Figure 1.14: Equity markets daily volatility during 2015



Source: Bloomberg and EIOPA calculations using an ARMA (1.1) + GARCH (1.1) model; Last observation: 5 November 2015

The Foreign Exchange rates for the Chinese currency (RMB) also fluctuated significantly recently, but there were no significant spillover effects to other European emerging markets currencies (Figure 1.15).

Figure 1.15: Emerging markets currencies against EUR (rebased: June 30th 2015=1)



Source: Bloomberg; Last observation: 5 November 2015

The negative impact of the current macroeconomic environment affects mostly life insurers. The challenging macroeconomic environment is reflected in the

overall insurance stock market performance. The lowest performance is related to life insurance while non-life insurance records positive returns due to the lower sensitivity to the macroeconomic environment and its shorter-term business nature (Figure 1.16.).

Figure 1.16: Market Returns

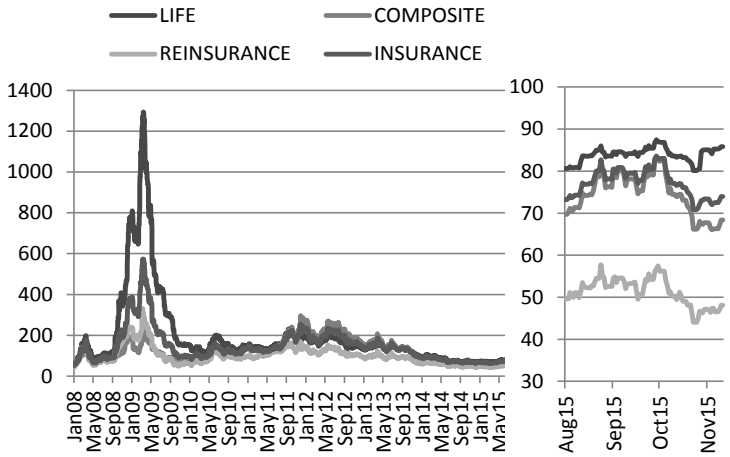
	1M	3M	6M	12M	3Y
Life	3.7%	-6.8%	-10.9%	0.4%	59.9%
Non-life	10.5%	8.7%	15.8%	33.0%	60.1%
Composite	6.7%	0.0%	-1.5%	12.2%	65.8%
Reinsurance	12.3%	8.0%	13.1%	37.6%	67.2%
DJ STOXX INSURANCE	7.9%	1.3%	1.6%	18.9%	74.2%

Source: Bloomberg; Based on data of 11 November 2015

1.3. Credit risk

In line with stock market turbulences, a slight increase in credit default spreads can be seen albeit from extremely low levels (Figure 1.17). The future months will show whether a general pattern of higher risk aversion emerges.

Figure 1.17: 5-year Credit Default Swaps - Insurance



Source: Bloomberg

Last observation: 11 November2015

2. The European insurance sector

Overall, the development of premiums written continued to be in line with EIOPA projections and expectations that anticipate a further slight improvement of premium growth in 2016 and 2017.

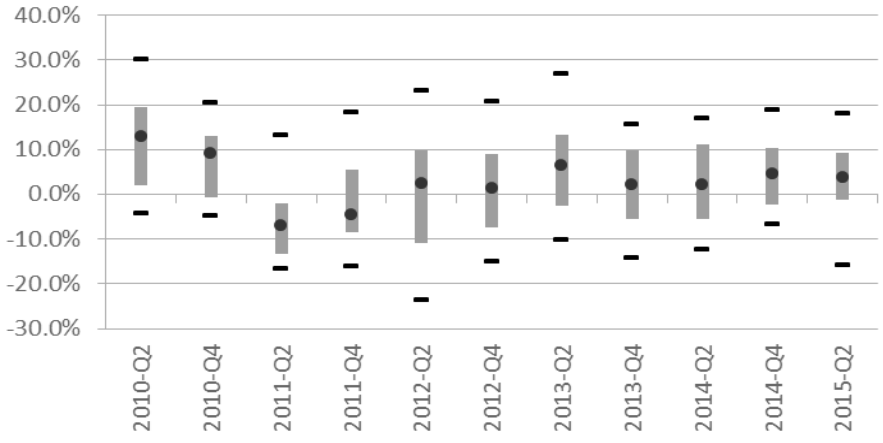
2.1. Market growth

The pattern for premium growth is very heterogeneous, with non-life business experiencing much higher growth rates owing to mandatory insurance lines. The median growth was 4.8% and 3.7% for non-life and life companies respectively.

LIFE INSURERS

In general, average quarterly life insurance premium growth has been lower than non-life growth (Figure 2.0). The 10th percentile continued to be negative, indicated by a negative growth rate of 15.9% in Q2 2015, whilst the 90th percentile grew by a relatively high rate of 18% in the same period (following growth of 21% in Q1 2015). Demographic shifts and pressure on public insurance schemes may increase demand for life insurance as longevity has increased substantially more and faster than predicted. People live much longer than expected and hence receive benefits for a much longer period of time. Hence, insurers, but also pension funds, offering annuities could be exposed to higher than expected pay-outs. Often, growth is being driven by developments in the corporate segment of the market where the increase in employment has resulted in a rise in the number of group risk schemes.

Figure 2.0: Year-on-year growth - Gross written premiums - Life. Median, interquartile range and 10th and 90th percentile

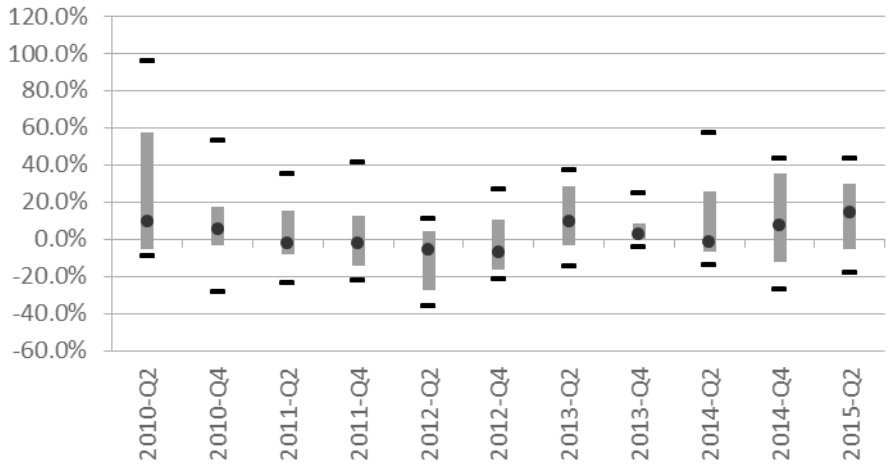


Source: EIOPA based on 32 large insurance groups in EU and Switzerland)

The trend towards unit-linked policies continues in the second half of 2015 (Figure 2.1) in some countries (e.g. France) insurance undertakings also try to convert existing contracts with interest rate guarantees into unit-linked guarantees. Hence, the onus will eventually fall on policy holders and their advisors to consider the insurer they plan to invest with and to bear any failure out of their own pocket. The ups and downs of financial markets are also important for the payouts to policy holders of unit-linked policies.

Figure 2.1: Year-on-year growth - Gross written premiums, unit-linked. Median, interquartile range and 10th and 90th percentile

Life insurance – Unit-linked



Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

Policy holders may surrender or lapse their insurance contract. One of the main prevention items against this is the contractual penalty which policy holders need to pay in case they lapse or surrender[2]. These penalties are not always applied though and many of the penalties which do exist -, such as the right of the insurer to defer payment of the surrender value for a period of several months under some contracts - would in practice only be applied by insurers under extreme circumstances. The application of such rights under normal operating conditions would inevitably damage insurers standing in the market and lead to a decline in new business prospects.

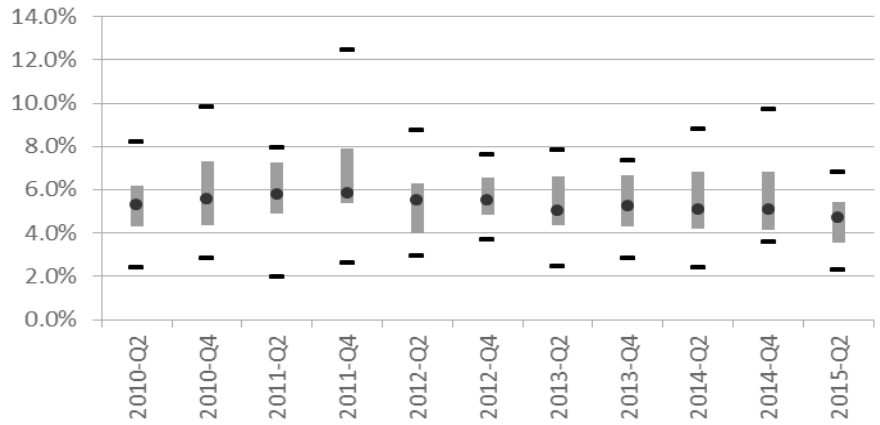
[2] Please note that adverse fiscal consequences provide a main item of protection against surrender. These consequences go beyond a mere contractual penalty and are often beyond the control of the insurance company (i.e are part of the overall fiscal policy)

In fact, more than 50% of the technical provisions of 19 large EU life insurers do not contain these penalty clauses[3]. Insurers are expected to receive sufficient premiums throughout the year to pay-out lapses, but this should not be taken for granted. Some large insurers reported lapses which were higher than their net premium income. For example, some insurers currently face net cash outflows on their life portfolio due to high lapse rates (Figure 2.2), a shift of clients to other saving products and the abolishment of certain tax advantages for life insurance policies. Overall, lapses are at their lowest level ever in 2015 Q2. However, if interest rates were to hike substantially (low probability, high impact), there is also a risk of policy holders with low guarantee rates to surrender their policy.[4] This observation should be examined further in the future.

[3] Source: ESRB data collection questionnaire (2014)

[4] Feodoria and Förstemann (2015): Lethal lapses – how a positive interest rate shock might stress German life insurers. Deutsche Bundesbank, Discussion Paper No 12/2015

Figure 2.2: Lapse rates – Life. Median, interquartile range and 10th and 90th percentile



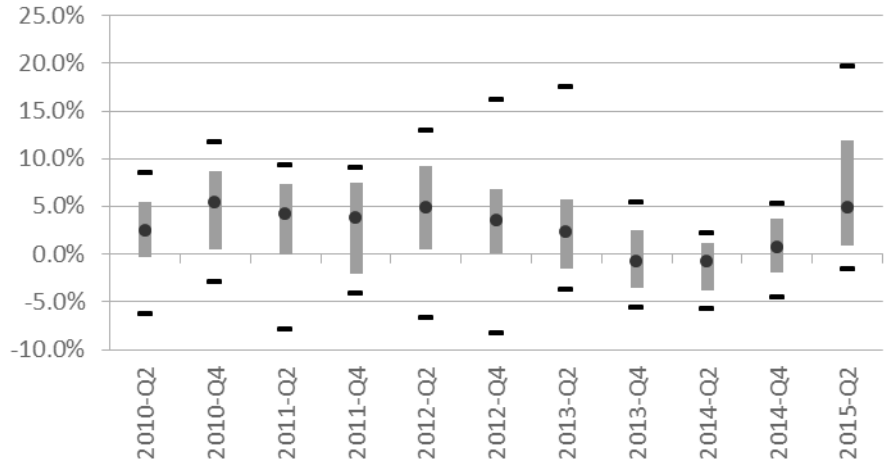
Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

NON-LIFE INSURERS

On the one hand, non-life premiums did not only grow for the median but also e.g. for the 90th percentile by a very high growth rate 19.6% in Q2 2015. In contrast, a small number of countries reported a huge decline in non-life premiums due to an intensely competitive market which is likely to have prevented any significant increase in premium rates.

Looking forward, non-life business is likely to remain a fairly stable component of the insurance sector and the European economy in general (Figure 2.3). Insurance penetration is expected to increase in some member states as their level of income converges to the EU average. Intense competition could eventually affect premium rates and subsequently create a possible risk of under-pricing. Future trend will depend on the evolution of the economic context, where several downside risks still prevail.

Figure 2.3: Year-on-year growth - Gross written premiums – Non-Life. Median, interquartile range and 10th and 90th percentile



Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

2.2. Profitability

The second quarter of 2015 showed on average a confirmation of low but stable return on assets (ROA) and return on equity (ROE). This is due to sound underwriting business and cost cutting initiatives supported by some premium growth as described in the previous chapter. At the same time the low yield environment had a negative effect on investment results. Yields are close to their lowest level ever and offering competitive rates to policy holders becomes increasingly difficult. A prolonged period of poor results will eventually affect insurers' strategies as already noticed through the increased merger and acquisition activity (M&A) that was witnessed recently. In 2014 a total of almost 360 completed deals were reported globally[5]. In general there are more deals for life than for non-life companies and there tend to be fewer acquisitions in Europe and North America, whilst mergers in the Asian Pacific region are on the

[5] A couple of recent examples are Legal & General and Canada Life, where the European Commission has approved the acquisition of Legal & General International Limited of Ireland and the life insurance portfolio of Legal & General Deutschland by Canada Life of the UK. The UK life insurer Aviva took over Friends Life. Anbang, a Chinese group acquired the Dutch insurance undertaking Vivat, a subsidiary of the Dutch banking conglomerate SNS REAAL). On the reinsurance front, the XL Group acquired Catlin in 2015 and ACE acquired Chubb (deal not fully completed yet). The announced offer from Zurich to acquire RSA did eventually not happen.

rise[6]. As a new source of capital, private equity will bring further dynamic in future M&A activities.

In the current low yield environment maintaining profitability is getting more and more difficult. This applies especially for life insurers who have guaranteed returns on their books where some old contracts have guarantees with maximum values between 4% and 5% and no possibility to change the terms and conditions of these contracts, e.g. in Belgium, Germany or France. Some countries on the other hand are more flexible and can change the terms and conditions of existing contracts (see Appendix for an overview of maximum guaranteed rates as reported in a survey conducted by EIOPA's Financial Stability committee in September 2015)

"Search for yield" is a term that is often heard these days. However, one should bear in mind that there is no clear definition or classification of "search for yield" behaviour. Strictly speaking, all kinds of investment decisions seek to optimise or maximise returns and in that sense, all of them entail a logical "search for yield" environment. However, there is a need, to differentiate between usual behaviours to optimise yields by re-allocation of portfolios from undesired behaviours resulting in an uncontrolled or unsustainable increase in risk exposure. The term "search for yield" as used in this report refers to the latter. From this point of view, a search for yield may become undesirable if the undertaking's risk appetite exceeds its risk bearing capacities and risk management capabilities. A "search for yield" behaviour might also lead to an abrupt yield reversal, and therefore to the materialisation of the double-hit scenario (as described in Chapter 1).

Not all insurers are equally affected by the low interest rate environment due to diverging market conditions, different product lines or duration mismatches. Still, as a consequence of the persistent low yield environment insurers may turn to other investment classes previously dominated by the banking industry like mortgages, infrastructure loans and asset backed securities including mortgage backed securities. These asset classes show promising characteristics for insurers, in particular long-term cash flows which can be used to match the long term liabilities of insurers.

Changes in product portfolios and business models may lead to a further shifting of risks towards policy holders. The majority of insurers currently move

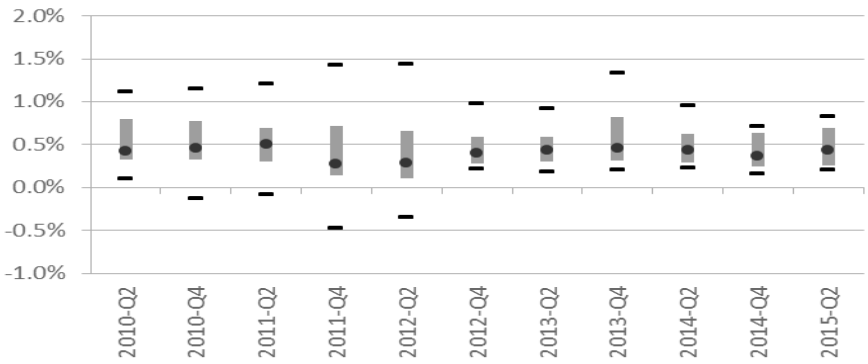
[6] "Swiss Re Sigma, No 3 2015: M&A in insurance: start of a new wave?" and "Standard & Poor's RatingsDirect: Regulatory and Economic Uncertainty isn't stopping global multiline insurers' M&A pursuits

away from traditional fixed guaranteed interest rate contracts. Guarantees in these old contracts pose challenges and risks to insurers. Hence, they now focus on more flexible structures and unit-linked business where the risk lies with the policy holder to remain profitable. This will indeed help companies decreasing their interest rate risk exposure and the required capital requirements. Indeed, new business product strategies often see decreasing guarantee levels or even the complete stop of commercialising certain guaranteed products. Also in some countries products are currently introduced that enable insurers to revise their promised guarantees as and when needed. The challenge will be to keep clients interested in these type of products, i.e. insurers who no longer offer fixed guarantees, will probably have to prove more their added value compared to other investment/banking products, especially in those countries which offered fixed guarantees. Despite this trend, there is a large legacy portfolio which will still be in "run-off" for several years and often does not allow decreasing the outstanding guarantees (as for some products these guarantees were even promised for future incoming premiums).Market participants could also be re-allocating their portfolios towards more risky assets which would make them more vulnerable to adverse market movements.

LIFE INSURERS

Return on assets (ROA) continues to be low. Based on the reported data, the average return on assets (as a percentage of total assets) is relatively stable (Figure 2.4). The ROA for the median company was 0.4% in Q2 2015. Low bond yields have not yet resulted in a decreasing ROA in the past quarter due to positive stock market developments along with some gains from derivative positions in some countries as well as some bonds' sells to cash out the profit.

Figure 2.4: ROA – Total. Median, interquartile range and 10th and 90th percentile

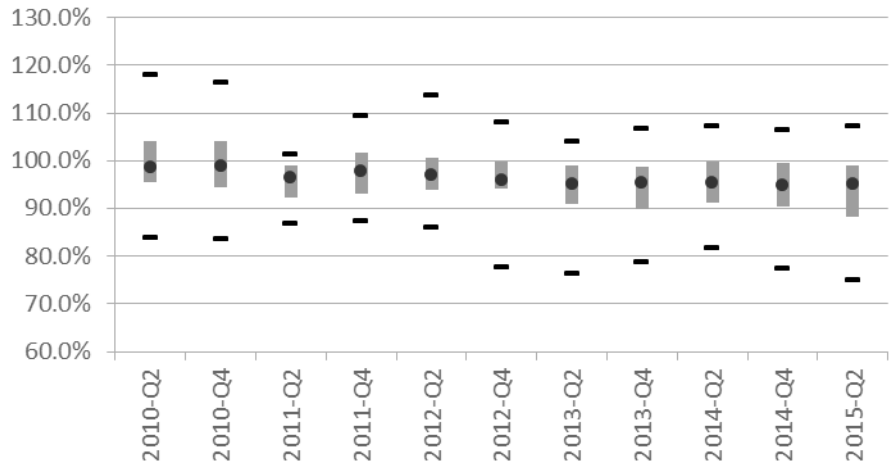


Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

NON-LIFE INSURERS

The Combined Ratio (CR) provides a quick assessment on whether underwriting is profitable and the degree of profitability (Figure 2.5). Below 100% implies an underwriting profit, above 100% implies an underwriting loss. For the median company, the Combined Ratio averaged about 95% in Q2 2015 given the very limited severity of natural catastrophes over the past two quarters. Pressure still arises in loss-making business lines such as long-tail motor insurance which is also one of the non-life sectors that is most affected by low interest rates within Europe. In addition, non-life business in some countries is impacted by the low interest rates for business that has significant long-term liabilities such as Payment Protection Order (PPO) and latent claims, e.g. asbestos.

Figure 2.5: Combined Ratio – Non-Life. Median, interquartile range and 10th and 90th percentile

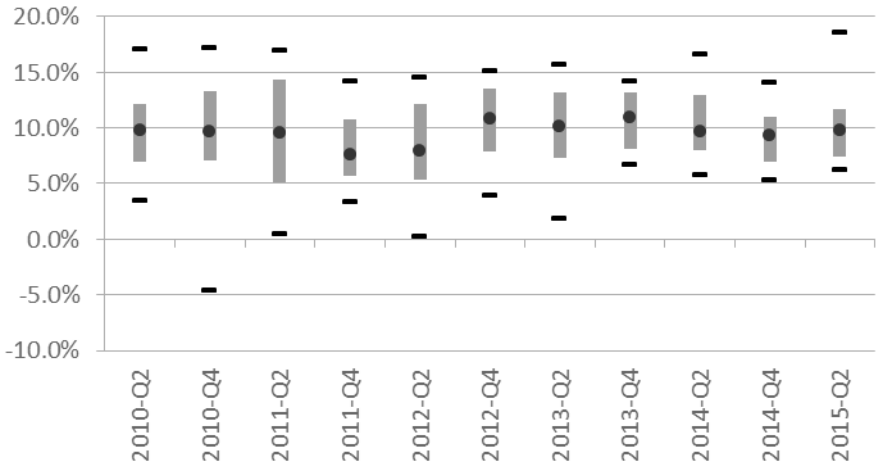


Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

LIFE AND NON-LIFE INSURERS

The ROE has slightly improved in Q2 2015 (Figure 2.6). For the median company it is a high 9.8% in the second quarter of 2015 (compared with 9.4% in Q1 2015).

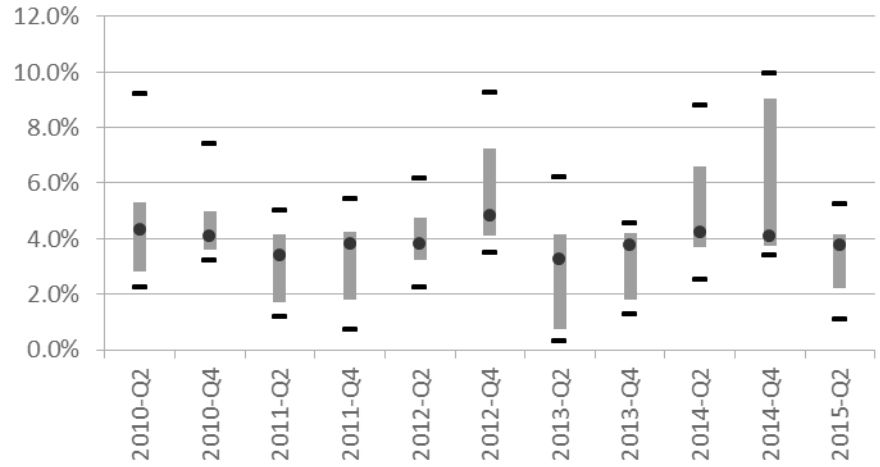
Figure 2.6: ROE – Total, Median, interquartile range and 10th and 90th percentile



Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

On the other hand, the investment return deteriorated from above 4% to 3.8% for the median company in Q2 2015 (Figure 2.7). Given the low yield environment it is, furthermore, far from certain that the investment return will remain at this relatively high level in the future.

Figure 2.7: Return on Investment – Total. Median, interquartile range and 10th and 90th percentile



Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

2.3 Solvency

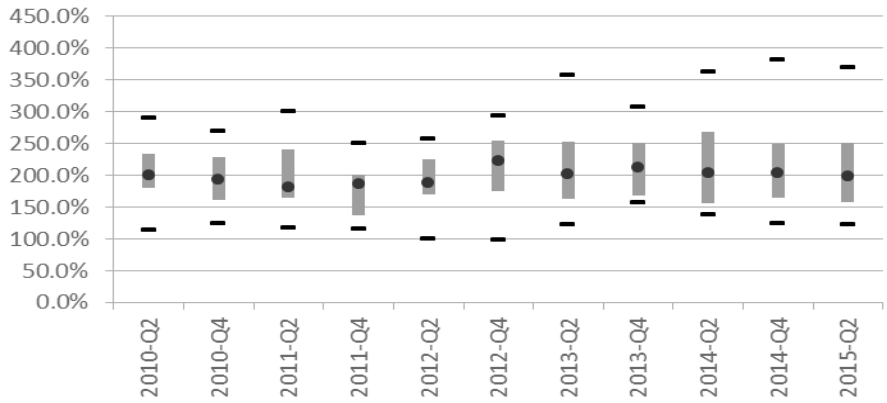
The Solvency ratio shows the ability of a company to meet its policy holder obligations. The risk sensitiveness introduced in the Solvency II regime as of January 2016 is expected to make the industry more resilient. In Solvency II the SCR aims at

ensuring that a company is able to meet its obligations over the next 12 months with a probability of at least 99.5%. Under specific circumstances, insurers might make use of the so-called LTG package (the Long-Term Guarantees Assessment LTGA).

LTG measures may alleviate part of the impact of any correction but this may not be relevant, if market perceptions of insurers' capital adequacy change. In any case, some supervisors will have to decide on whether and under which conditions to approve these requests. Solvency II has a market risk module that is divided into seven sub-modules. E.g. spread risk, interest rate risk and equity risk could signal the risk that companies are taking. Currently, national implementation is still underway. In the long run, it will also be interesting to see the impact of LTG measures on the solvency position of undertakings.

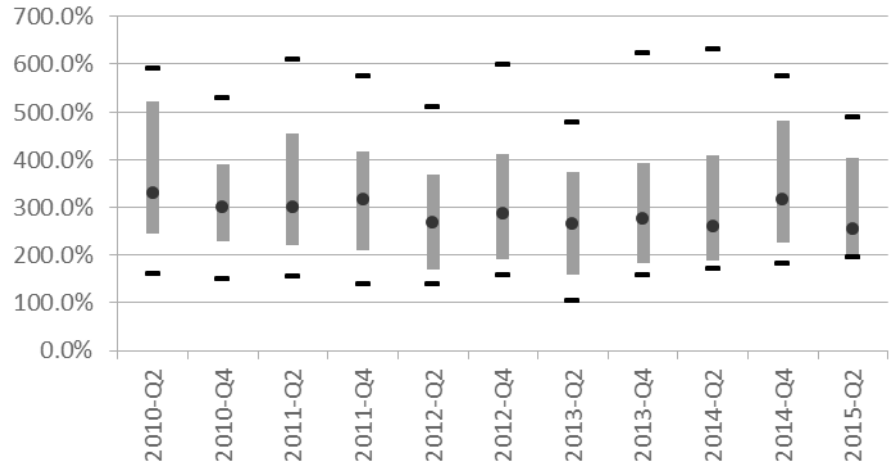
The Solvency I ratio has dropped for the whole European insurance sector. For life insurers it deteriorated from 204.1% in Q4 2014 to 198% in Q2 2015 and for non-life it dropped from 317.2% to 254.4% in the same period (Figure 2.8 and Figure 2.9). Under Solvency I, national regimes are not sensitive to market price changes and the impact of the low yield environment on the solvency ratios becomes only visible incrementally and risks might be significantly misjudged in the short term.

Figure 2.8: Solvency I Ratio - Life. Median, interquartile range and 10th and 90th percentile



Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

Figure 2.9: Solvency I Ratio, Non-Life. Median, interquartile range and 10th and 90th percentile



Source: EIOPA (sample based on 32 large insurance groups in EU and Switzerland)

Especially for life insures with negative duration gaps, an ongoing low interest rate environment will put a severe strain on the solvency position. Typically, their duration of liabilities is longer than the duration of their assets. As a consequence, a scenario with prolonged low interest rates leads to a structurally higher level of liabilities that is not matched with a similar higher level in the value of assets. Hence, an ongoing low interest rate environment will result eventually in lower solvency levels.

2.4 Regulatory developments

In September 2015 the EU Commission adopted an amended Delegated Regulation for Solvency II. The main amendment is related to the creation of a new asset class of qualifying infrastructure investments, which would benefit from a lower risk calibration. The amended Delegated Regulation also includes European Long-Term Investment Funds (ELTIFs) and equities traded on Multilateral Trading Facilities (MTFs) to benefit from the same capital charges as equities traded on regulated markets. The scope of the transitional measure for equity investments was extended to include unlisted equities and a simplification for the application of the equity transitional measure for equities held in collective investment funds was introduced.

EIOPA has submitted the final set of draft Implementing Technical Standards to the Commission, for adoption before the end of 2015. The wide range of technical standards are intended to ensure uniform conditions of application of Solvency II in

several areas, such as: harmonised technical input to the standard formula, capital add-ons, procedures for assessing external credit assessments, disclosure of information by supervisory authorities, information exchange between supervisory authorities, regular supervisory reporting and public disclosure by insurance undertakings.

With respect to regular supervisory reporting, the draft Implementing Technical Standards includes the common European templates for the submission of information to the supervisory authorities for individual insurance and reinsurance undertakings and for groups. In 2016, undertakings starting with the financial year between 1 January and 1 July 2016 will be reporting their opening information including reporting of the MCR, SCR and own funds, as well as the opening valuation of the assets and liabilities. All undertakings will be submitting quarterly reporting in the course of 2016. The taxonomy which supports the use of XBRL as the standard for reporting data between National Competent Authorities (NCAs) and EIOPA is available on EIOPA's website.

NCAs and EIOPA have tested the reception of the reporting from NCAs during the Preparatory Phase. The first reports with reference to 31 December 2014 were received in June-July and the quarterly reports with reference to 30 September 2015 will be received between November 2015 and January 2016.

A fist set of guidelines was issued by EIOPA in February 2015 to ensure a consistent and uniform implementation of Solvency II from 2016 onwards. These guidelines are aimed to provide the necessary level of detail for a consistent approach across the European insurance sector in areas such as the calculation of technical provisions, solvency capital requirements or own funds. In September-October 2015 EIOPA published a second set of guidelines related to other areas such as undertakings' system of governance, ORSA, valuation of assets and liabilities, long-term guarantee measures or supervision of branches of third-country insurance undertakings or financial stability reporting.

In particular the guidelines on financial stability reporting are aimed to ensure a consistent and uniform approach on the collection of data for financial stability purposes to enable EIOPA to: monitor and assess market developments; inform the other European Supervisory Authorities, the European Systemic Risk Board (ESRB) and the European Parliament, the Council and the Commission about the relevant trends, potential risks and vulnerabilities; and provide the ESRB with regular and timely information necessary for the achievement of its tasks.

EIOPA has continued to test the production of the risk free interest rate term structure for the calculation of technical provisions and the technical information on the symmetric adjustment of the equity capital charge under Solvency II.

EIOPA has carried out a community testing exercise, publishing the coding of the term risk-free rate information in order to ask interested parties to locate any errors and to suggest improvements, which would then feed into the term structure to be published for 2016. EIOPA is also conducting a review of the methodology for the derivation of the Ultimate Forward Rate (UFR). The review will include a public consultation in 2016. EIOPA intends to decide on the outcome of the review and on how and when to implement it in September 2016. It is not intended to change the currently used UFRs before the end of 2016 in order to ensure the stability of the Solvency II framework by insurance and reinsurance undertakings and supervisory authorities. The UFRs to calculate the risk-free interest rate term structures for Solvency II, in particular the UFR of 4.2% for the term structure for obligations denominated in euro, will hence remain unchanged until the end of 2016.

The risk-free rate and the equity capital charge are key elements for the assessment of the insurance companies' solvency and financial position. The risk-free interest rate structure and its adjustments determine the value of the liabilities of the undertakings and, to a large degree, the amount of capital which European insurers need to hold against their liabilities. The symmetric adjustment of the equity capital charge (also referred as equity dampener) aims to mitigate undue potential pro-cyclical effects of the financial system and avoid a situation in which insurance companies are unduly forced to raise additional capital or sell their investments as a result of adverse movements in financial markets.

EIOPA also issued two opinions. The opinion on the preparation for Internal Model (IM) applications addresses three areas where different approaches from NCAs would lead to inconsistent modelling of some risks and could jeopardise the joint-decision making processes for group internal models. With regard to the modelling of Sovereign Exposures, NCAs should require that the risks related to Sovereign Exposures are appropriately taken into account in internal models. The opinion also addresses the practical preparation of the IM application in the absence of some related formal decisions (e.g. no delegated act of the Commission deeming a third country to be equivalent). Furthermore, the opinion considered the use of comparative studies as a complementary tool in the analysis of an IM to be a good practice for NCAs to gain insights from the comparison of different internal models.

Furthermore, the opinion considered the use of comparative studies as a complementary tool in the analysis of an IM to be a good practice for NCAs to gain insights from the comparison of different internal models.

The EIOPA opinion on the group solvency calculation in the context of equivalence intends to ensure convergent supervisory practices in relation to groups with related insurance or reinsurance undertakings in an equivalent or provisionally equivalent third country when the group solvency is calculated using the deduction an aggregation method[7]. Under this method, the aggregated group SCR is calculated as the sum of the SCR of the participating undertaking and the proportional SCR of the related undertakings. Also the aggregated group eligible own funds are calculated as the sum of the eligible own funds of the participating undertaking and the proportional share of the eligible own funds of the related undertaking. In this context, EIOPA has identified the risk of competitive disadvantage arising from diverging approaches in such calculations, in particular as regards to the SCR of the related third country insurance or reinsurance undertaking to be aggregated in the group SCR; the assessment of the availability at group level of the eligible own funds of that related undertaking; and the monitoring of the group solvency position.

[7] Method 2 referred in Article 233 of the Solvency II Directive

3. The global reinsurance sector

3.1. Market growth

Reinsurance premiums have remained under pressure, in soft market conditions caused by excess capital, a benign catastrophe environment and a weak global economy. Globally, net premiums fell by more than 6% in the first half of 2015 versus the same period in the prior year, although this decline appears largely due to the impact of exchange rate movements[8]. There are some signs of pricing stabilisation within the sector as the rate of price decrease seems to be slowing.[9]

Despite this, reinsurance capacity continues to exceed demand, reflecting a longer-term trend for primary insurers to retain more risk on their balance sheets. Competitive primary markets as well as low investment returns have forced insurers to be increasingly price sensitive, whilst their risk management capabilities have also developed over time.

Thus, overall, the general environment remains largely unchanged. Rates continued to soften in 2015. Along with rate reductions the terms and conditions for reinsurance placements have improved further, e.g. expanded hours clause[10] or improved reinstatement provisions[11].

Natural catastrophe losses for the half-year 2015 remained significantly below the long-term average. Global insured losses of EUR 11bn were below both the 30-year average of EUR 12bn, and just over half of the 10-year average of EUR 20bn. This was also the case for overall economic losses, with 32bn EUR witnessed during the first-half of 2015, hence falling significantly below the 10-year (EUR 71bn) and 30-year (EUR 48bn) averages.

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[8] See Willis Re: Reinsurance Market Report, September 2015, page 3.

[9] http://www.artemis.bm/blog/2015/06/04/june-renewals-show-reinsurance-price-decline-moderating-guy-carpenter/

[10] Reinsurance contracts often rely on an "hours clause" designed to regulate recovery of multiple losses and bring certainty to the often difficult and contentious area of aggregation of catastrophe losses. The hours clause attempts to do this by stipulating a time period during which multiple losses arising from a covered peril can be recovered as a single aggregated loss under a reinsurance contract. Typically, the time period is fixed at 72 or 168 hours (although longer periods are becoming increasingly common).

[11] Under many forms of reinsurance and insurance, the payment of a claim reduces an aggregate limit by the amount of the claim. Provision is sometimes made for reinstating the policy limit to its original amount when the original limit has been exhausted. Depending on policy conditions, it may be done automatically, either with or without premium consideration (i.e., a reinstatement premium), or it may be done only at the request of the insured in return for an additional premium.).

Table 1: The five largest natural catastrophes in the first half of 2015, ranked by insured losses (in EURm)

Date	Event	Region	Fatalities	Overall losses	Insured losses
16-25.2.2015	Winter storm	USA, Canada	39	2,100	1,600
30.3-1.4.2015	Winter storm Niklas	Europe	11	1,300	900
7-10.4.2015	Severe storms	USA	3	1,200	890
18-21.4.2015	Severe storm	USA	0	980	700
23-28.5.2015	Severe storm	USA	32	1,200	680

Source: Munich Re, NatCatSERVICE

The costliest natural catastrophe in terms of overall economic losses was the devastating earthquake which struck Nepal in April, which took the lives of 8,850. Whilst the economic losses totalled 4bn EUR, only 120m EUR was insured, or 3.1% of the overall loss, reflecting low levels of insurance coverage within this region.

The costliest natural disaster event for the insurance industry during the first half of the year came from the severe winter weather in northeast of the USA and Canada. As in the previous year, the winter in the northeast of the USA was exceptionally cold and snowy. The direct overall losses from the harsh winter in the USA totalled to USD 4.3bn, of which USD 3.2bn was insured.

Catastrophes within the third quarter of 2015[12] have included (i) Super Typhoon Soudelor, which caused widespread damage in Taiwan and China, resulting in economic losses of USD 3.2bn; (ii), drought conditions intensified over parts of Central and Eastern Europe, amounting to economic losses of more than USD 2.6bn, and (iii) the port explosion in Tianjin, China, where insured losses of USD 1.5bn have been estimated. At the timing of writing the hurricane season has been benign.

3.2 Profitability

Reinsurers remain profitable, despite pricing pressure and the low yield environment. However the benign catastrophe environment has masked the full impact of falling rates within traditional reinsurers, as they have come under pressure from alternative capital providers. An average Combined Ratio (CR) of 91.6% in the

[12] See AON Benfield: July, August 2015 Global Catastrophe Recap.

first half of 2015 represents a fall from 92.1% in 2014, driven by low levels of natural catastrophe losses. On an accident year basis, ex catastrophe losses, CRs rose, reflecting downward pressure on prices. [13]

On average reinsurers reported a ROE of 10.4%, versus 13.7% for the same period in 2014. However, these returns are inflated somewhat by the combined effect of reserve releases and low natural catastrophe losses. It is estimated that more "normal" catastrophe losses would reduce the ROE to approximately 5%[14]. In addition, there is a risk that excessive reserve releases by reinsurers will leave them vulnerable upon occurrence of a significant natural catastrophe event.

The current environment has prompted a wave of M&A, as reinsurers seek to diversify, and reduce expense ratios through greater economies of scale. This market consolidation can foster more efficient use of underwriting capacity and reduce undeployed capital. However, a meaningful decline in the number of reinsurers could also reduce the cedents' ability to diversify risk exposures. [15] From a financial stability perspective, a decline in the number of reinsurers could result in increased concentration risk in the market.

There is an expectation that supply of reinsurance will continue to exceed demand for the upcoming January 2016 renewals. For that reason reinsurers' profitability will remain under pressure. Disciplined underwriting will be essential in order to compensate for low investment returns and a diminished ability to release prior year reserves. Against this background attaining risk-adequate prices at the January 2016 renewals is crucial for reinsurers.

3.3. Solvency

Global reinsurer capital totalled USD 565bn at June 2015, a reduction of 2 percent since the end of 2014 (USD 575bn).[16] The reduction is driven in part by movements in exchange rates, but is also impacted by the capital management programs of a number of large traditional reinsurers. These reinsurers have been returning excess capital to shareholders through dividend payments and share

[13] See AON Benfield: July, August 2015 Global Catastrophe Recap.

[14] See Willis Re: Reinsurance Market Report, September 2015, page 2 and 4.

[15] See AON Benfield: July, August 2015 Global Catastrophe Recap.

[16] See AON Benfield: Reinsurance Market Outlook September 2015, page 2.

buyback programmes, as they reduce the capacity on offer to certain peak perils, and seek to remain disciplined on price.[17]

3.4 Alternative capital vehicles

Alternative capital continues to flow into the reinsurance market, albeit to a lesser extent than before. Whilst increases of approximately 7% have taken place during the year, this represents a slowdown from increases of 25% recorded previously[18]. Levels of alternative capital totalled USD 68.4bn (note the small size in comparison to the total global reinsurance capital, i.e. 12.1% of total capital) at end June 2015[19]. The bulk of this was collateralized reinsurance (USD 32.5bn) and outstanding insurance-linked securities (ILS, USD 23.5bn). According to Artemis, the total outstanding ILS amounted to USD 25.0bn (2014: USD 22.9bn) by the end of September.

In the current investment environment, the diversification and yield provided by insurance-linked investments continues to prove attractive to investors, producing an over-supply of capital and placing downward pressure on rates. Whilst alternative capital has largely been focussed on the non-proportional catastrophe business, this new capital seems set to expand into other reinsurance lines. Furthermore, investor´s acceptance of indemnity-based triggers has increased, tightening spreads between indemnity and other trigger types. In turn, this development is likely to further enhance the attractiveness of ILS for both new and repeat sponsors. These trends seen are bound to continue, despite the absence of a major catastrophe event that would provide a true test of the resilience of ILS structures.

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17 http://www.artemis.bm/blog/2015/07/02/reinsurance-rates-stabilising-at-renewal-ils-discipline-contributes-willis-re/

18 See AON Benfield: Reinsurance Market Outlook September 2015, page 1.

19 See AON Benfield: Reinsurance Market Outlook September 2015, page 2.

4. The European pension fund sector[20]

The European occupational pension fund sector has continued to face a challenging macroeconomic environment with low interest rates exerting upward pressures on IORP liabilities. Total assets increased in 2014, largely due to favourable equity returns and falls in bond yields that increased the market value of existing bond holdings. Investment allocation across the sector remained broadly unchanged for another year, reflecting the fact that pension schemes hold assets with a long term view and are less prone to shifts in investment strategy due to short term market changes. Low interest rates and other risks related to the IORP sector (such as longevity) make traditional defined benefit (DB) plans less attractive for employers. For 2014, these issues are further assessed in greater detail by the pension stress test exercise undertaken by EIOPA which will be published in the beginning of 2016.

Despite a clear trend towards defined contribution (DC) schemes, DB schemes still represent the largest part of the sector and the share of DC schemes is relatively limited in terms of assets. In some countries new types of hybrid (HY) schemes, which combine elements of both DB and DC schemes, have emerged.

During 2015, continued low interest rates and the fall in equity markets have put additional pressure on scheme funding levels. It is possible that within 2015, based on their funding positions, many schemes could have increased deficits requiring external support or recovery plans. In these cases, additional payments from employers may be required. This may raise issues regarding the financial capacity of some sponsors to accommodate increased payments with potential implications for the real economy.

4.1 Market growth

Total assets owned by occupational pension funds increased by 12% in 2014 following a more moderate growth of 4% in 2013 (Figure 4.1). This increase was partly caused by the drop in interest rates over 2014 (which increased the market value of bond portfolios) and the high performance of the equity markets in 2014 compared to 2013. Two countries, the UK and the Netherlands, account for most of the European occupational pensions sector (81% per cent of the total assets, see Table 1). The huge heterogeneity across countries is partly due to the different relative share of private and public provisions of IORPs. In addition to this, the

[20] All data employed in this section refers to IORPs pension funds.

legislative systems tend to vary a lot by Member State. Pension funds under Pillar I are not covered by this chapter.

Table 4.1: Total assets per country as a share of total assets reported for 2014

UK	NL	DE	IT	IE	ES	NO	BE	AT	SE	IS	PT
44.61%	36.81%	6.41%	3.40%	2.90%	1.15%	0.97%	0.74%	0.61%	0.57%	0.54%	0.51%
DK	**RO**	**LI**	**FI**	**SI**	**LU**	**SK**	**PL**	**LV**	**HR**	**BG**	**Total**
0.19%	0.14%	0.14%	0.13%	0.07%	0.05%	0.047%	0.013%	0.009%	0.004%	0.0001%	100%

Source: EIOPA

Note: The figure for UK contains DB and HY schemes only.

The size of the occupational pension fund sector with respect to GDP (penetration rate) increased somewhat in 2014 compared to the previous year. This ratio is calculated as the total size of assets over GDP and gives an indication of the relative wealth accumulated by the sector (Figure 4.2). In 2014 the un-weighted average of the penetration rate across the countries of the sample increased by 2% compared to 2013 (the weighted average by total assets increased by 10% in 2014). In most of the countries penetration rates increased in the course of 2014.

Figure 4.1: Total Assets

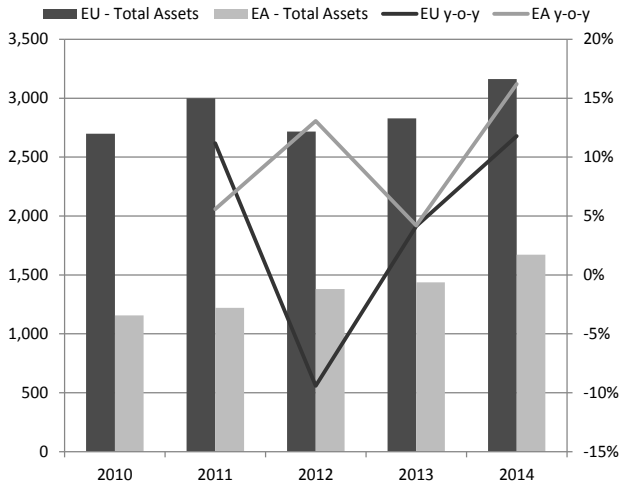
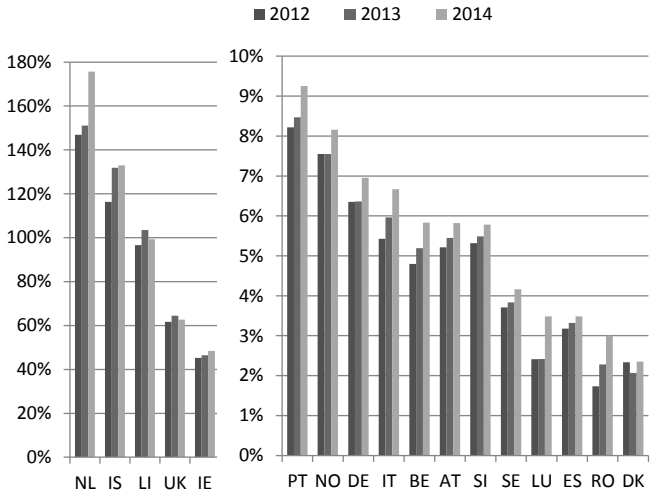


Figure 4.2: Penetration rates (total assets as % of GDP)



Source: EIOPA

Note: Penetration rates for SK, FI, LV, HR, PL and BG are lower than 2%.

4.2 Performance and Funding

In aggregate terms, the investment allocation of pension funds has remained almost unchanged in the recent years (Figures 4.3 and 4.4). Debt and fixed income securities 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 45% per cent in 2014. Pension funds have a long-term horizon regarding investments so debt and equity generally represents a much higher investment share than in the insurance sector (equity is 21 per cent for the countries of the sample in 2014).

This investment mix for IORPs is generally stable over time also due to strict legal or contractual obligations which are justified by prudential reasons. In some countries minor shifts in investment mix were reported. In the UK, e.g. a continuing gradual shift towards fixed income securities and away from equities which suggests a trend towards de-risking. Two additional trends can be identified among the reporting countries: (1) the increase of investment allocation to equity especially among DC schemes. This change over the course of 2014 had positive consequences. However, in 2015 pension funds will probably incur losses in case the recent poor market performance continues. (2) Given the low returns of bonds, signs of 'search for yield' to more 'risky' and 'higher yielding' investments was highlighted by some members. Both trends require caution and close monitoring.

Figure 4.3: Investment Allocation (in %)

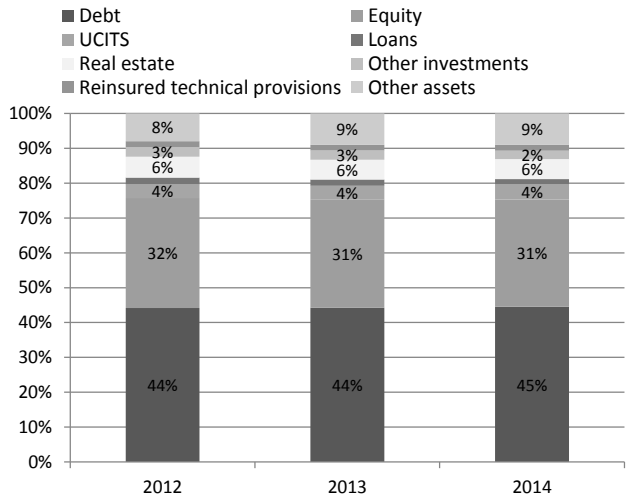
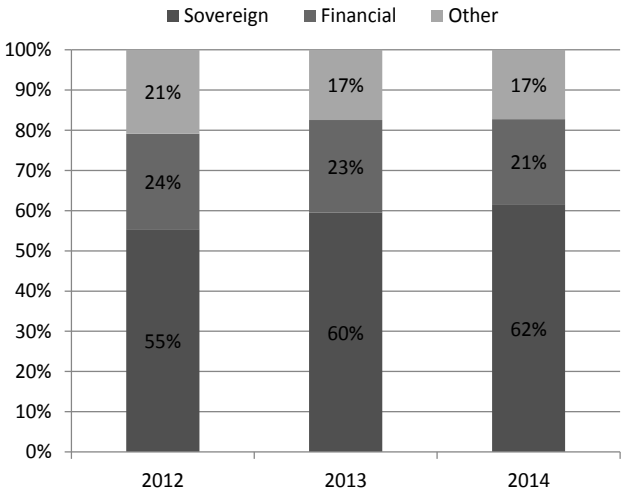


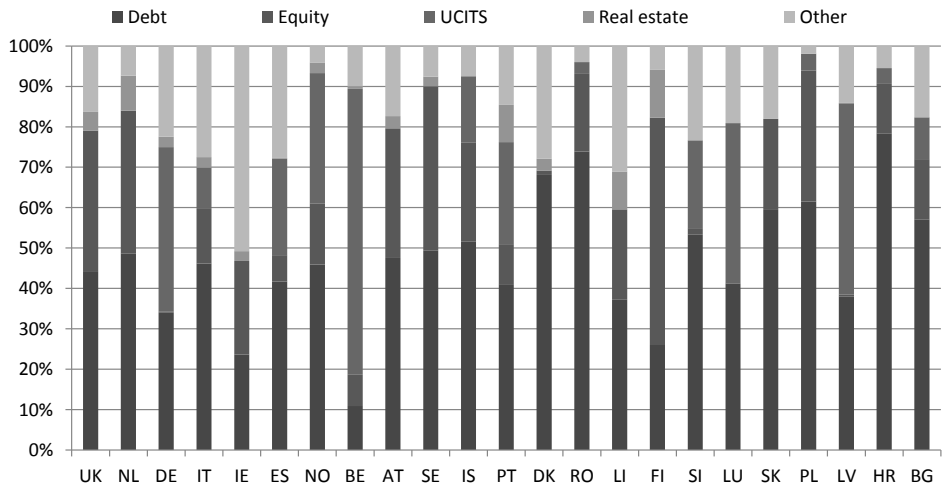
Figure 4.4: Bond investments breakdown for 2014 (in %)



Source: EIOPA

Note: The UK figure used for the calculations of these figures relates only to DB and HY schemes. In the investment allocation chart, loans and Reinsured technical provisions make approximately 4% of total assets for the three years depicted in the chart. For SE, FI and SI the debt breakdown was not available

Figure 4.5: Investment Allocation per country (in %)

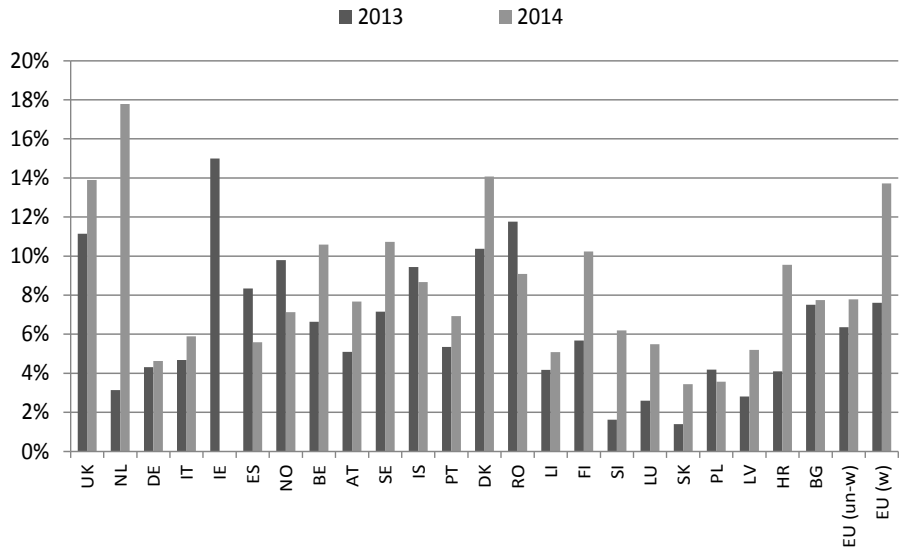


Source: EIOPA

Note: 'Other' includes: Derivatives, Loans, Reinsured technical provisions, other investments and other assets.

The average rate of return increased in 2014 and was significantly positive in all countries. The average ROA (Figure 4.5) in 2014 (un-weighted 7.8%, weighted 13.7%) was higher compared to 2013 (un-weighted 6.4%, weighted 7.6%). This can be attributed to the exceptionally good performance of the equity and fixed income markets during 2014. However, the key issue is whether these returns have kept pace with the increase in IORP liabilities.

Figure 4.5: Rate of return on assets (ROA)

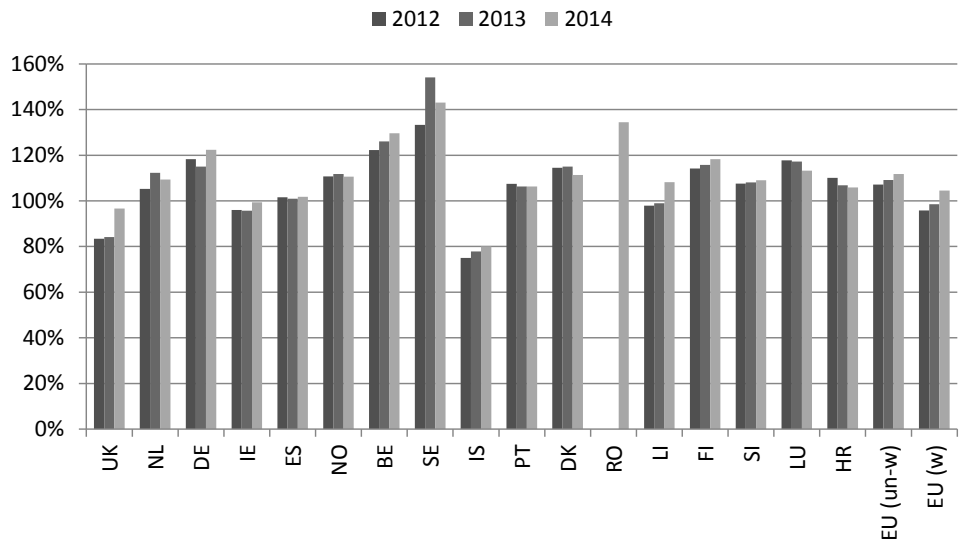


Source: EIOPA

Note: Both the weighted and un-weighted averages for ROA were calculated on the basis of the 23 countries that provided data and are depicted in the chart. The weighting was based on total assets.

Cover ratios for DB schemes have increased but remain a big concern for a number of countries.[21] Overall, the average cover ratio slightly increased in 2014. The weighted average cover ratio increased from 99% in 2013 to 104% in 2014 whereas the un-weighted average cover ratio increased from 109% to 112% for the same period (Figure 4.6). 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% remain a concern for the sector if low interest rates persist. In some countries there is full sponsor support and guarantees 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 cost increases. In some countries, during the course of 2014, a number of pension funds had to reduce benefits, because their funding ratios were too low.

Figure 4.6: Cover ratio (%)



Source: EIOPA

Notes:

(1) Cover ratios refer to DB schemes. Pure DC schemes present in IT, AT, SK, PL, LV and BG 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 17 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 fully comparable across jurisdictions.

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

Overall active membership slightly decreased in 2014 by 0.6% and the number of IORPs kept on decreasing in Europe by a further 3.6% compared to 2013 (Figures 4.7 and 4.8). Many countries reported a declining number of occupational pension funds. A trend of consolidation can be identified in the sector. This process increases the average number of members in various individual schemes.

Figure 4.7: Number of Institutions

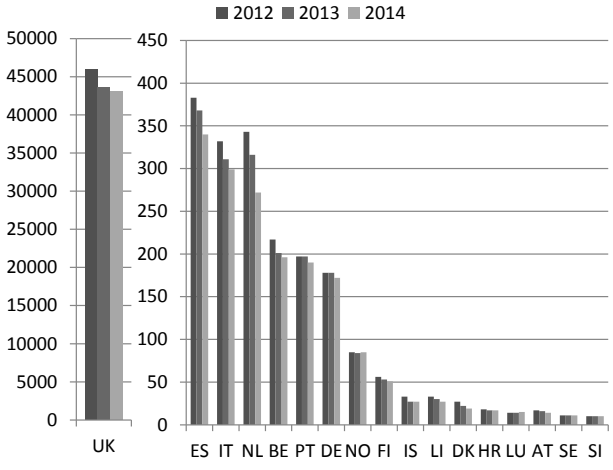
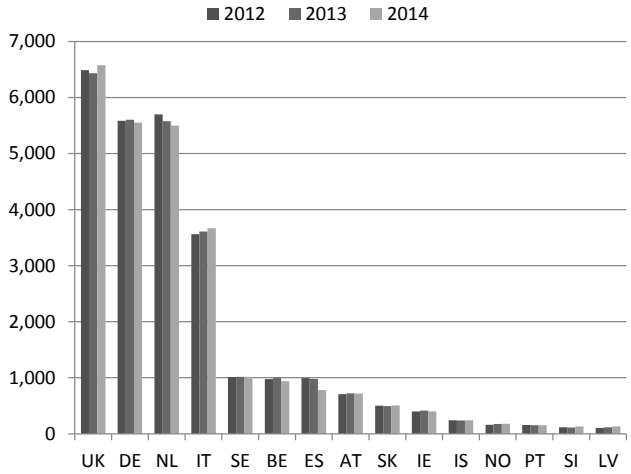


Figure 4.8: Active members (in thousands)



Source: EIOPA

Note: In the number of institutions chart, for the UK, approximately 85% of the institutions are DC, the rest are DB and HY. For the same chart data for IE and RO are not available. LV, SK, PL and BG are not depicted because they have less than 10 institutions. In the active members chart, LI, HR, PL, FI, LU, RO, BG and DK have below 100 thousand members.

5. Risk assessment

Current data and projections reveal a stable picture of the European insurance market. The profitability projection, within the limit of the applied model, is positive for the whole insurance sector and this is mainly driven by a positive forecast of stock indices and GDPs. GWPs are expected to grow both for life and non-life business under the contribution of policies underwritten outside the reference jurisdiction. The analysis of the systemic risk of the financial service industry and in particular of the insurance industry currently shows low level of riskiness. Nevertheless positive signals come with several points of attention that need to be thoroughly overseen.

Profitability may be based on changes both in business models and investment strategies. Despite empirical evidence limited to a change in the investment behaviour emerges from the available data, the persistent low yield environment may increase the risk appetite of insurers both on the asset side (search for yield) and on the liability side (exposure to non-policyholder liabilities). Foreign dependence of GWP growth could represent another point of attention; in fact, despite the fact that average growth rate of extra-EU markets is expected higher than the average rate of GDP growth of mature economies, signals of an economic slowdown arrives from China. Concerning systemic risk, the level of interconnectedness of the financial service industry is currently low, but with an increasing trend towards more fragile situations.

5.1. Qualitative risk assessment

The low interest rate environment as a key risk for both insurance and pension sectors has further increased (Figure 5.1 and 5.2). Qualitative risk assessment is an important part of the overall financial stability framework. Based on the responses of the Autumn Survey among national supervisors[22], the key risks and challenges classified as the most imminent in terms of their probability and potential impact remain broadly unchanged. The survey suggests increased risk of the impact of the low interest rate environment as well as equity risks for both insurance and pension sectors over the last six months.

[22] The survey was responded by 27 and 23 Member States (for insurance and pension funds sector respectively).

Figure 5.1: Risk assessment for the insurance sector

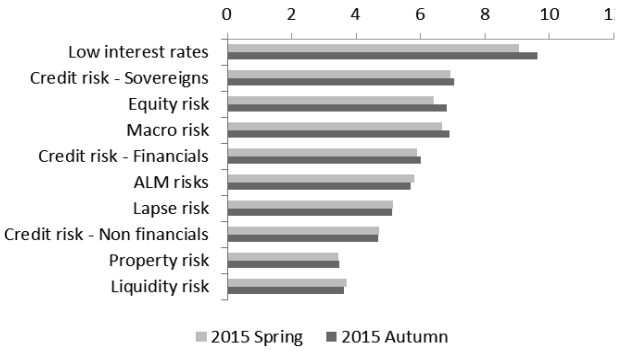
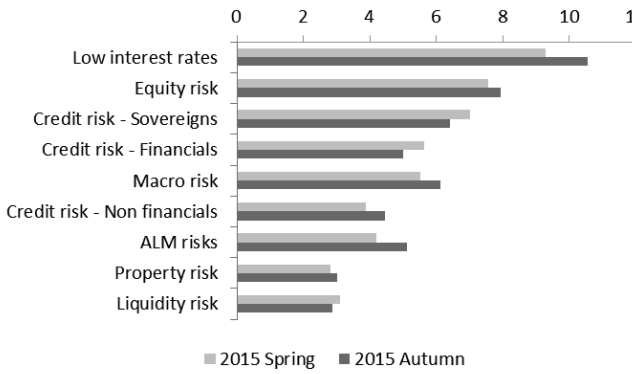


Figure 5.2: Risk assessment for the pension funds sector

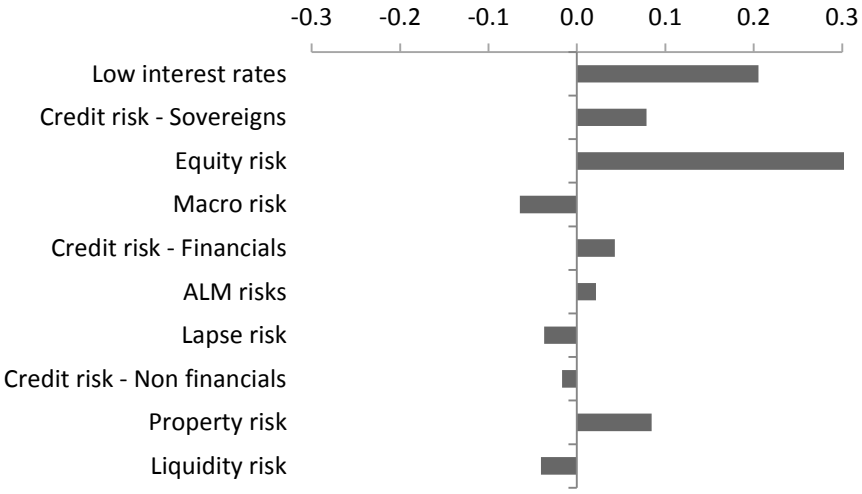


Source: EIOPA

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.

EIOPA updates this survey every six months in order to track the changes in risk assessment. Based on the latest responses, further increase of the main risks is expected in the future by the national supervisors (see Figure 5.3).

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



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.

Persistent low interest rates affect insurers in different ways. On the liabilities side, they lead to an increase in firms' obligations in today's terms and, consequently, to a deterioration of their financial position. On the assets side, low interest rates have a positive impact on investment valuation, but typically not offsetting negative

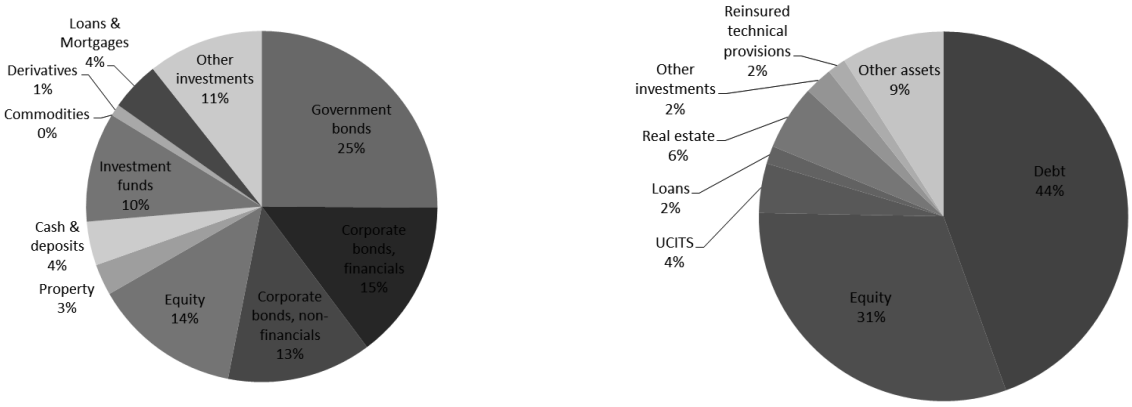
impacts on liabilities due to the longer duration. Furthermore, the prolonged low yield environment increases the reinvestment risk. This problem is even more pronounced where guaranteed rates of returns defined at the inception of long-term contracts have been offered to policyholders. In the case of short-term non-life insurance business, lower returns reduce the financial margin available to offset adverse underwriting results. Furthermore, low interest rates may encourage other business model changes both on the assets and liability sides. On the asset side, a "search for yield" may alter the asset allocation towards more risky assets. On the liability side the constant pressure on profitability may lead insurers to pursue non-core insurance activities increasing their non-policyholder liabilities, which make them more prone to systemic events.

If the current low interest rate environment prevails for long, the gap between insurance returns and formerly guaranteed rates could widen and thereby endanger the solvability and profitability of at least some companies. This is an issue for both life and non-life insurers. For life insurers who have embedded minimum guarantees in their products there is a risk of negative interest margins, i.e. the bond yields being lower than the minimum guarantees. If life insurers are required to value liabilities on a market-consistent basis lower investment returns will increase liabilities thus negatively impacting capitalisation. For non-life insurers, who predominantly invest in bonds, lower investment returns mean that it will be more difficult for them to compensate underwriting losses with investment gains.

Investment portfolios are largely concentrated on fixed income instruments. Companies in most countries did not actively change their asset mix during the first half of 2015 as profiles of insurers' back books also showed in the past (Figure 5.4 a)). This means that, in general, minor changes in exposures to equity risk are due to market movements. Some countries also mention that interest rate risk on liabilities is effectively mitigated by the prevalent use of interest rate derivatives by insurance companies. It also appears that insurers have extended their portfolio maturities in order to reduce the asset-liability maturity mismatch by purchasing ultra-long term government bonds. In particular life insurers have faced duration gaps between assets and liabilities and the associated reinvestment risks. Within the EU duration gaps significantly differ though. Finally, it was noticed that this risk is to some extent passed on to policy holders through unit-linked contracts in the recent past.

Figure 5.4 a). Average composition of the investment portfolio of the insurance sector Q2 2015 vs. year-end 2014

Figure 5.4 b): Pension fund Investment Allocation - 2015

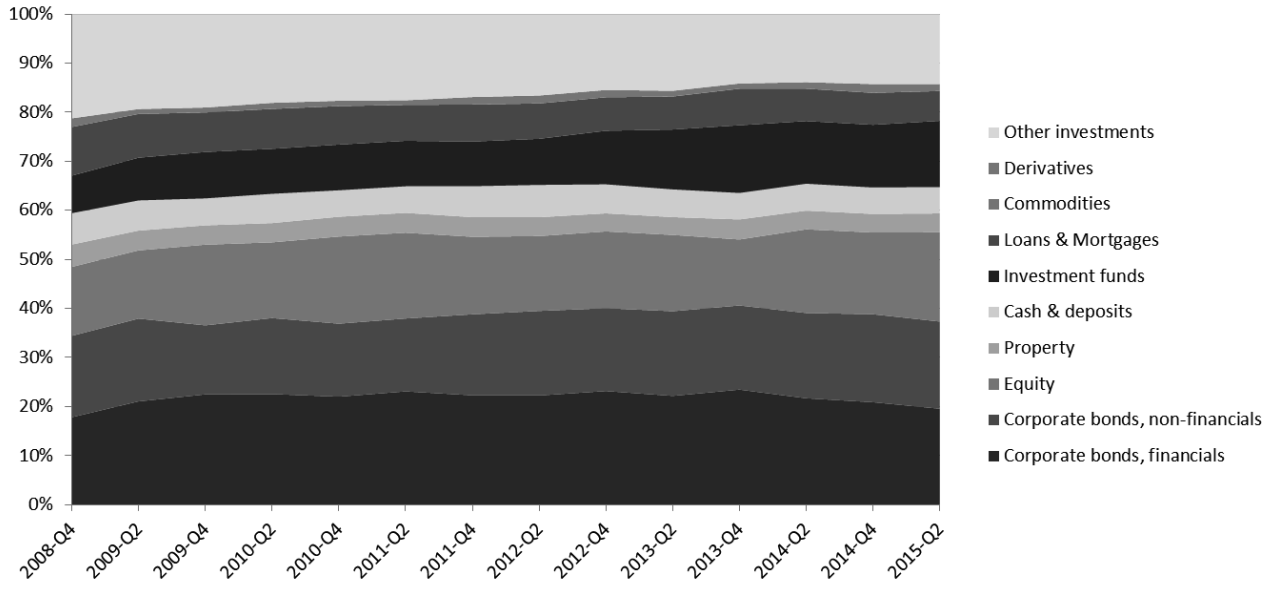


Source: EIOPA. Note: The estimation for the insurance figure is based on a sample of 32 large insurers

For the pensions chart - variable definitions are available at: EU/EEA occupational pensions statistics - *Annex 2*

To preserve investment returns in the long run an increased risk appetite is empirically seen from 2008 to 2014 (Figure 5.5), namely an increase in portfolio weight of equity (from 10% in 2008 Q4 to 14% in 2015 Q2) against a reduction in corporate bonds – financials and non-financial (from 17% in 2008 Q4 to 14% in 2015 Q4) can be observed over time

Figure 5.5. Evolution of the investment portfolio of the insurance sector over time



Source: EIOPA

Note: estimation based on a sample of 32 large insurers

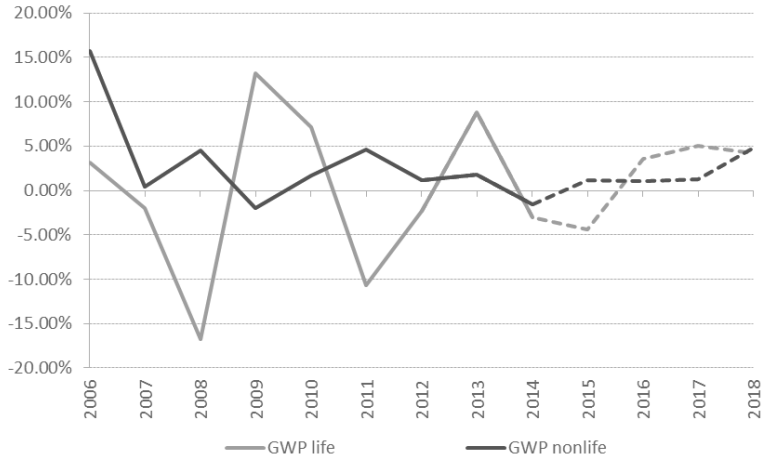
5.2. Quantitative risk assessment

This chapter is devoted to investigate relevant risk factors included in the insurers' risk profile that can impair the stability of the European insurance sector. The most relevant topic is still the prolonged low-yield environment. Thus its direct and indirect impacts on the different aspects of the industry are investigated. At first, the growth in written premiums - the main cash inflow in insurance - is projected. An updated analysis of the scale and the drivers behind the expansion of insurers in foreign markets follows. In addition, the direct impact of the declining interest rates on the market valuation of assets and reserves is analysed. Finally, the evolution of the profitability in the insurance market is investigated. The section concludes with a contribution on the systemic implication of the insurance industry investigated through the analysis of the level of interconnectedness of the global financial market and its evolution over time.

In a persistent low-yield environment projected cash flows of insurers are relevant figures to check in order to investigate the stability of the insurance market in general and of life insurance companies exposed to long-term guaranteed contracts in particular. GWPs represent a relevant part of insurers' cash inflow hence they require particular attention.

The pattern of the market growth for life and non-life business over a 12 year horizon (Figure 5.6) displays a high variance of the market growth in particular for the life business that reports the lowest value in correspondence to the past financial crises (2008, 2011). It confirms how the life business is more prone to financial crises than the non-life business that reports a more stable growth rate. Market growth for life and non-life insurers is expected to be positive from 2016 to 2018 with some distinctions. On the one hand, the life business displays a positive slope of the growth curve in the first 2 years of the projection. On the other hand non-life business, although characterised by a positive increase in GWP, reports a flat curve in 2016 and 2017 and a slight positive slope in 2018 only. From that we can infer that non-life insurance is less sensitive to economic growth than life, with the latter reacting faster to recovery signals coming from the European economy. In addition, compulsory business lines tend to stabilise the non-life market.

Figure 5.6: Gross Written premiums (GWP) projection for the euro zone

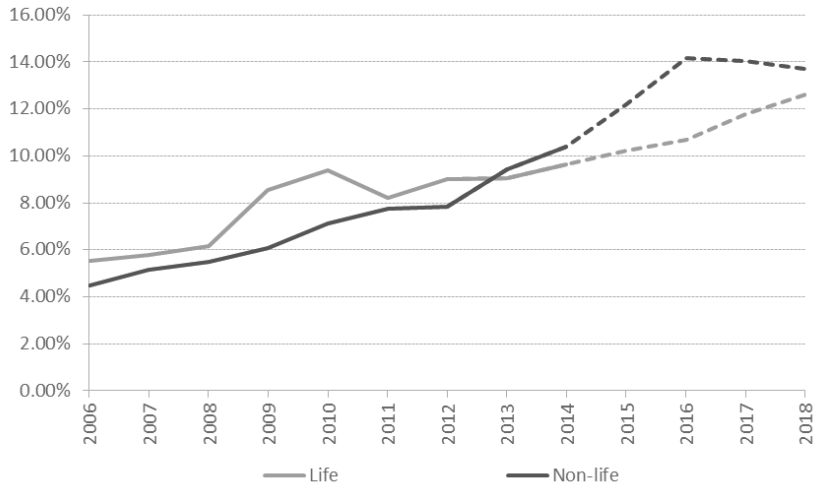


Source: EIOPA and ECB Survey of Professional Forecasters (SPF)

Note: Data corresponds to aggregates for the euro zone dashed lines represent the EIOPA projection using macro scenarios based on ECB SPF developed according to Christophersen, C. and Jakubik, P. (2014) Insurance and the Macroeconomic Environment. EIOPA Financial Stability Report, May 2014.

Growth rates of the European insurers are supported by expansion outside national borders (Figure 5.7). The increasing trend of the share of GWP abroad in the past years is confirmed by the projections (until 2016) for both life and non-life insurers where non-life has a higher increase as life business. After 2016 the almost linear growth of life insurers is confirmed, whilst a slight decrease of the foreign component of GWP for the non-life is displayed. Cross-border expansion is a necessary choice for insurers constantly looking for higher returns. This applies in particular to life insurers with no short-term perspective of increase in the interest rates. The constant increase of activities in emerging countries characterized by more volatile business cycles and, in some regions, geopolitical risks, would affect the risk profile of insurers.

Figure 5.7: Share of Gross Written Premium (GWP) abroad



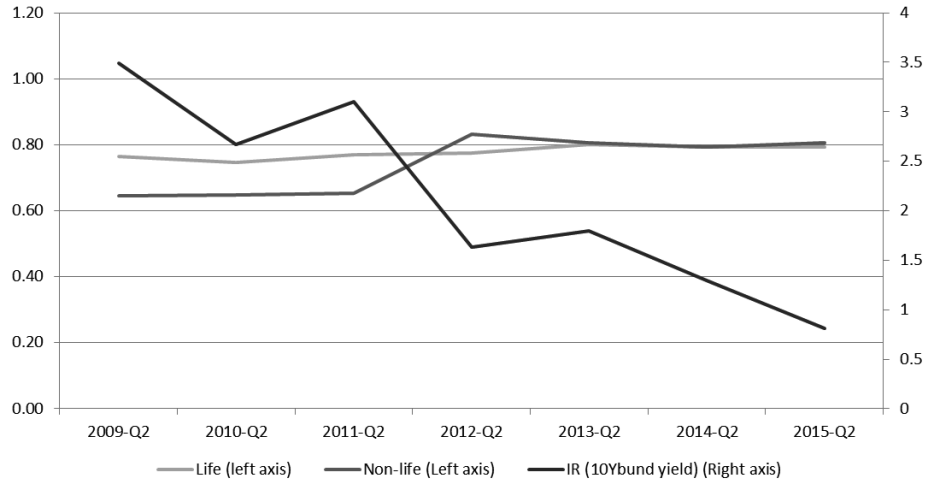
Source: EIOPA

Note: Data corresponds to aggregates for EU/EEA countries, dashed lines represent the EIOPA projection using a macro scenario based on the IMF World Economic Outlook, October 2015 developed according to Christophersen, C. and Jakubik, P. (2014) Insurance and the Macroeconomic Environment. EIOPA Financial Stability Report, May 2014.

Decreasing interest rates in the euro area and their impact on insurance market are one of the most investigated topics among regulators and practitioners. Hence, it is useful to analyse the impact of the interest rates on the ratio between technical provisions and assets (Figure 5.8). On the one hand, non-life business presents an almost flat curve with the exception of 2011/12 driven by regulatory changes. One the other hand, life business displays an increase from 2010 onwards. This can be determined by the discount rate or the variation in flows (lapse rates or new underwritten contracts). The fact that flows do not show a clear increasing/decreasing pattern suggests that the upward trend in the ratio between technical provisions and assets is mostly driven by decreasing trend of interest rate[23]. This observation corresponds with a typically higher duration mismatch for life compared to non-life insurers.

[23] European long-term interest rate is approximated with the 10-year German Bund. The average European 10-year government bond reports a constant positive spread over the 10-year Bund, but it displays a comparable pattern over time.

Figure 5.8: Ratio of technical provisions over total assets



Source: EIOPA

Note: Data corresponds to aggregates for EU/EEA countries. Life curve reports the technical provisions over total assets. Both technical provisions and total assets are reported at market values.

The persistent low-yield environment and adverse macro-economic conditions threatened the profitability of the European insurance industry. Monetary policy intervention, despite keeping interest rates around zero, is slowly revamping the economies of European countries partially offsetting the negative effects of the low-yield environment on the profitability of (re)insurers.

Life business (Figure 5.9 a)) reports a ROA curve characterised by frequent inversion of the slope. After a two years recovery from the sovereign debt crisis of 2011, the profitability of the life industry drops below 0.4% in 2014. From 2014 onwards the profitability increased and a positive trend is confirmed by EIOPA projections based on the model proposed by Dorofti and Jakubik (2015) in their contribution "Insurance Sector Profitability and the Macroeconomic Environment". As a matter of fact the curve displays a slow but constant increase from 2015 to 2017 and a flat pattern in 2018 mainly driven by the improving economic conditions. The projection on ROE (Figure 5.9 b)) reports a slight decrease for year 2015, in line with a trend that started in 2013. This trend inverts in the following years with a recovery up to 10% by 2018.

The data suggests high sensitivity of the life business to financial trends and macro-economic changes.

Figure 5.9: a) Return on Assets - Life insurers

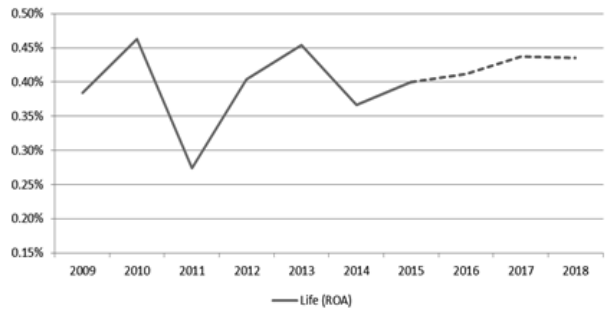
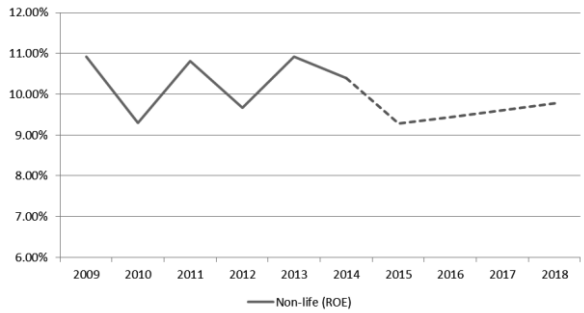


Figure 5.9 b) Return on Equity - Non-life insurers



Source: EIOPA

Note: Data corresponds to aggregates for EU/EEA countries. Dashed line represent the EIOPA projection using a macro scenario developed according Dorofti, C. and Jakubik, P. (2015) Insurance Sector Profitability and the Macroeconomic Environment. EIOPA Financial Stability Report May 2015.

The quantitative section concludes with an analysis on the systemic implications of the insurance industry. The analysis aims at understanding i) whether and to what extent the effects of the 2011 sovereign debt crisis are still present on the market and ii) if insurers are prone to spill-over effects from the insurance industry as such or from other financial sectors. In this context, we assess the systemic risk of the financial service industry via network analysis.[24] More specifically we follow the approach proposed by Billio et al (2012) in their contribution "Sovereign, Bank and Insurance Credit Spreads: Connectedness and System network" by applying a linear Granger Causality test to the CDS time series (monthly data). This time series comprises a sample of 118 institutions that is divided into 39 insurers, 62 banks and 17 sovereigns.[25]

The Granger causality test particularly aims to test the dynamic propagation of shocks to a system due to its ability in providing information not only about the connectedness between institutions but also about the directionality of the relationship

[24] A comprehensive overview of the available methodology applied to the financial service industry is proposed by Bisias, D., Flood, M., Lo, A. W., and Valavanis, S. (2012). A survey of systemic risk analytics. Annual Review Finance. Econ., 4(1):255-296. A specific overview on the insurance industry is proposed by Eling, M. and Pankoke, D. (2012). Systemic risk in the insurance sector. What do we know? University of St. Gallen, School of Finance Working Papers, (2012/22).

[25] We thank Professor Pelizzon and the SAFE Research Centre - Goethe Universität Frankfurt for running the model and providing the graphs displayed in Figure 5.10.

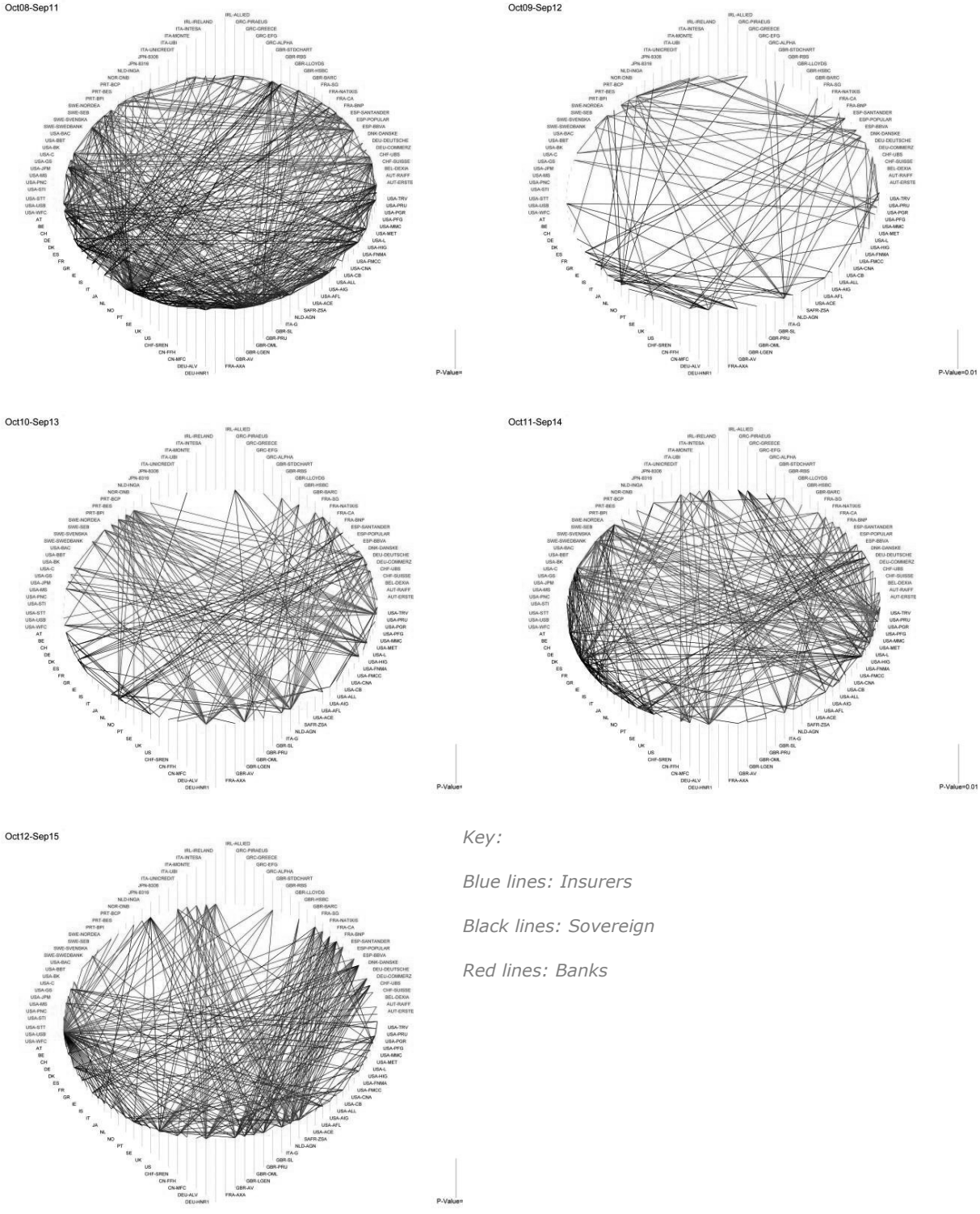
thereof. This characteristic allows inferring who is responsible for spill-over effects and who is prone to that.

To appreciate how the degree of interconnectedness is able to capture the level of distress of the financial system and its evolution over time, the significant "causing" connection among the selected institutions is reported in Figure 5.10. This is done for five different rolling windows from Q3 2008 - Q3 2011 to Q3 2012 - Q3 2015 and this provides a clear picture of how crises periods are associated to a higher level of connectivity among companies (Q3 2011) compared to tranquil periods (Q3 2012 and Q3 2013). The low level of connection in Q3 2012 shows how the sovereign debt crisis has been absorbed by the financial system. In the following periods, the density of connections is gradually increasing. However, the number of significant connections is still far from the pre-crisis level.[26] This trend does not allow the conclusion that a new systemic event is approaching, but indicates that the system is potentially becoming more fragile due to the increased level of interconnectedness.

Insurers (marked in blue colour in the graphs below) tend more to "cause" than to "receive" during the crisis but play an opposite role in tranquil periods acting as a net recipient especially form banks. The most recent period shows how insurers and banks playing an equally active role increase the mutual level of interconnectedness.

[26] For a thorough analysis of the European Sovereign debt crises see Billio, M., Getmansky, M., Gray, D., Lo, A., Merton, R. C., & Pelizzon, L. (2013): Sovereign, bank and insurance credit spreads: Connectedness and system networks, Sloan School of Management Working Paper, Massachusetts Institute of Technology.

Figure 5.10: Network diagram of linear Granger-causality relationship



Source: SAFE - Goethe Universität Frankfurt

Note: Graphs display the statistically significant (1%) "cause" relationship based on the linear Granger-causality test among the monthly changes of the expected losses of the different entities (Banks, Insurance undertakings, and Sovereigns). The type of "causing" entity is defined by colour.

5.3. Maximum Guaranteed Interest Rate in Europe as of September 2015

Under the current Solvency I regime, several jurisdictions are characterised by setting a maximum guaranteed interest rate for all or certain life insurance contracts prompting, amongst others, the question of whether or not this system will continue under the future Solvency II regime. In order to map the latest state of affairs and have an idea of the future evolutions across Europe, EIOPA's Financial Stability Committee issued a survey in the course of 2015 to get an overview of the situation. The table below gives an overview of the countries currently applying a system which sets a maximum guaranteed interest rate, the height of this rate (as of September 2015), and whether or not the system will continue to exist under the upcoming Solvency II regime. A total of 30 countries participated in the survey of which the countries mentioned below have a maximum guaranteed rate in place.

Country	**Maximum guaranteed interest rate/maximum discounting rate by legislation (in %)**	**What will happen under Solvency II?**
Austria	1.50	Continuation of the system of maximum guaranteed interest rate
Belgium	3.75	Continuation of the system of maximum guaranteed interest rate
Czech Republic	1.30	No continuation of the system of maximum guaranteed interest rate
Denmark	1.00	Continuation of the system of maximum guaranteed interest rate
France	0.00	Continuation of the system of maximum guaranteed interest rate
Germany	1.25	Currently under review
Greece	3.35	No continuation of the system of maximum guaranteed interest rate
Italy[27]	1.00	No continuation of the system of maximum guaranteed interest rate
Luxembourg	0.75	Continuation of the system of maximum guaranteed interest rate
Lichtenstein	1.50	Continuation of the system of maximum guaranteed interest rate
Norway	2.00	No continuation of the system of maximum guaranteed interest rate
Romania	2.50	No continuation of the system of maximum guaranteed interest rate

[27] The revised Insurance Code (which implements the SII directive) states that, by performing its supervisory functions and in periods of financial market turbulence, IVASS can set limits to the technical assumptions used for the construction of tariffs and to the guarantee interest rates related to life insurance contracts, which are applicable for a defined period of time.

The average maximum guaranteed rate following the survey equalled 1.66%. Belgium and Greece are characterized by the highest rates (both are above 3%), the rate for France was the lowest actually equalling 0% at the time the survey was closed. The fixing of the maximum guaranteed interest rate is often linked or, at least, inspired by the rate of the home-country government bonds[28], but differences in calculation algorithms are observed e.g. the observation period to take into account when calculating the average of the government bond rates. Furthermore, for some countries, the rate is determined in a more or less automatic way by directly following the evolution of certain government bond rates e.g. France or Italy Other countries, apply a more 'subjective' approach, i. e. e.g. Austria, Germany or Belgium

The system of maximum guaranteed interest rates explained above, should not be mixed up with a system of maximum discounting rates which are applied under Solvency I/Local GAAP in order to restrict the discounting benefit insurance companies can apply when calculating the value of their technical provisions. Applying a system of maximum guaranteed interest rates should mainly be understood as a prudential mechanism which tries to prevent insurance companies, taking into account the economic environment, from selling insurance products with interest rate guarantees which can be difficult to maintain. To some extent, such mechanisms recognize that, under a certain commercial pressure, insurance companies might be tempted to sell products which do not correspond to their risk-bearing capacities. Even under Solvency II, where such 'dangerous' commercial behaviour would be directly translated in higher technical provisions requirements and insurers will have to demonstrate on an ongoing basis that they have the capabilities to face risks embedded in their business (i.e. under risk management and ORSA requirements), such a system could do its worth. The survey shows that, in any case, a number of countries is currently envisioning a continuation of the system under the new prudential regime. Given the low yield environment, countries applying a system with maximum guaranteed interest rates could face strong(er) debates about the system, being confronted with both the pros and cons. On the one hand, and as explained above, the system helps to prevent insurance companies from the negative consequences of excessive commercial behaviour by keeping prudential limits (over the risk sensitive Solvency II framework) on the interest rate risks they can accumulate during a low yield environment. Finally, the continuation of different national regimes on this issue would keep a legislative fragmentation among different

[28] As per article 20 of Directive 2002/83/EC

jurisdictions, despite the Solvency II regime. On the other hand, all parties should be aware that a low maximum guaranteed interest rate (although the capital is guaranteed) might hamper the attractiveness of long term insurance saving contracts, putting at least more focus on tax advantages taking conferred to some life insurance policies and the profit sharing schemes which insurance companies will try to apply in order to convince the consumers of the added value of a long term life insurance savings contract compared to other saving products.

PART II

Thematic Article

Assessing Systemic Risk of the European Insurance Industry

Elia Berdin[29], Matteo Sottocornola[30]

Abstract

This paper investigates the systemic relevance of the insurance industry. We do it by analysing the systemic contribution of the insurance industry vis-á-vis other industries by applying three measures, namely the linear Granger causality test, conditional value at risk and marginal expected shortfall, to three groups, namely banks, insurers and non-financial companies listed in Europe over the last 14 years. Our evidence suggests that the insurance industry shows i) a persistent systemic relevance over time, ii) it plays a subordinate role in causing systemic risk compared to banks. In addition, iii) we do not find clear evidence on the higher systemic relevance of SIFI insurers compared to non-SIFIs.

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

1. Introduction

Following the 2007-2009 financial crises and the 2010-2012 European sovereign debt crises, the interest around systemic risk has become increasingly relevant.[31] After the collapse of Lehman Brothers in particular, the debate on systemic risk has been primarily focused on banks. However, recent empirical evidence suggests that institutions not traditionally associated with systemic risk, such as insurance companies, also play a prominent role in posing it. In particular, some authors find that the insurance industry has become a non-negligible source of systemic risk (e.g. Billio et al. (2012) and Weiß and Mühlnickel (2014)). This is partially in contrast to other authors, who do not find evidence of systemic relevance for the industry as a whole (e.g. Harrington (2009), Bell and Keller (2009) and the Geneva Association

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[31] Throughout this paper, we rely on the definition of systemic risk given by The Group of Ten (2001): Systemic risk is the risk that an event will trigger a loss of economic value or confidence in a substantial segment of the financial system that is serious enough to have significant adverse effects on the real economy with high probability.

(2010)). Finally, other authors take a more granular perspective and argue that insurance companies might be systemically relevant, but that such risk stems from non-traditional (banking-related) activities (Baluch et al. (2011) and Cummins and Weiss (2014)) and that in general, the systemic relevance of the insurance industry as a whole is still subordinated with respect to the banking industry (Chen et al. (2013)).

As the current literature does not provide a common understanding and clear evidence regarding the systemic relevance of the insurance industry, we aim with this paper to fill this gap by empirically investigating its systemic relevance vis-á-vis other industries.

To do so, we test three equity return-based measures of systemic risk, namely 1) the indexes based on linear Granger causality tests proposed by Billio et al. (2012) (Granger test), 2) the Conditional Value at Risk proposed by Adrian and Brunnermeier (2011) (CoVaR) and 3) the Dynamic Marginal Expected Shortfall proposed by Brownlees and Engle (2012) (DMES), on 3 groups: banks, insurers and non-financial companies, all listed in Europe. We test the systemic relevance of each institution with respect to the total system intended as the sum of the companies included in the 3 groups. Based on these estimations, we rank financial institutions according to their average systemic risk contribution over time and create an industry composition index.

Our evidence suggests that the insurance industry tends i) to persistently pose systemic risk over time and ii) to play a subordinate role with respect to the banking industry with some distinction in specific periods when the insurance industry becomes more systemic than the banking industry.

The paper is organized as follows: section 2 provides a comprehensive literature review, section 3 describes the methodology, section 4 the data; section 5 describes the results and section 6 concludes the analysis.

2. Literature review

The literature on systemic risk has been steadily growing following the crises. In particular, a wide range of new methodologies for testing the systemic contribution of financial institutions has been proposed. Moreover, both academia and regulators have dedicated more attention to the role of non-banking financial institutions: among

these institutions, insurance companies emerged as a potential source of systemic risk.[32]

Before the crisis, there was substantial agreement among scholars in considering the insurance industry to be not systemically relevant. However, in the literature that emerged in the aftermath of the crisis, although many studies still consider the insurance industry non-systemically relevant as a whole, a clear-cut indication does not emerge anymore.

As a matter of fact, looking at the evidences stemming from market based data that rely on the assumption that prices reflect all the necessary information[33], substantial differences in the evaluation of the insurance industry emerge. For instance, Acharya et al. (2010) argue that insurance companies are overall the least systemically relevant financial institutions. The authors provide estimations of the spillover effects through a measure of conditional capital shortfall, i.e. Systemic Expected Shortfall (SES) and Marginal Expected Shortfall (MES) for the US financial industry during the 2007-2009 crises. The contribution of Adrian and Brunnermeier (2011) extends the traditional value at risk concept to the entire financial system conditional on institutions being in distress (ΔCoVaR). The authors apply the measure to a set of institutions, including banks and thrifts, investment banks, government sponsored enterprises and insurance companies and find no distinction between the systemic relevance of different types of institutions. By contrast, Billio et al. (2012) apply the linear and non-linear Granger causality test to a sample of banks, insurers, hedge funds and broker dealers operating in the U.S. in order to establish pairwise Granger causality among equity returns of financial institutions. Their evidence suggests that during the 2008 financial crisis, besides banks, insurance companies were a major source of systemic risk. This conclusion is partially in contrast to Chen et al. (2013): the authors agree that the linear Granger causality test attributes to insurance companies a systemic relevance comparable with the systemic relevance of banks. However, they argue that when applying a linear and non-linear Granger causality test to the same series corrected for heteroscedasticity, banks tend to cause more systemic risk and for longer periods of time then insurance companies.

[32] A comprehensive review of the literature on systemic risk in the insurance industry is provided by Eling and Pankoke (2012).

[33] A comprehensive review of the models applied to systemic risk is provided by Bisias et al. (2012).

Both theoretical and empirical research that take into consideration fundamentals of the insurance industry provide ambiguous indications about the systemic relevance of insurers. Even though the common understanding classifies the insurance industry as not systemically relevant, distinctions mainly driven by the engagement in specific business lines emerge.

The Geneva Association (2010) conducts an analysis on the role played by insurers during the 2008 crisis and argues that the substantial differences between banks and insurance companies, namely the long-term liability structure of insurers compared to banks and the strong cash flow granted by the inversion of the cycle, is sufficient to rule out any systemically implications of the insurance industry during the financial crises aside from the companies highly exposed towards non-core insurance activities.

The higher systemic relevance of non-traditional versus traditional insurance activities is analysed by other authors such as Bell and Keller (2009) who investigate the relevant risk factors stemming from an insurance company, or Cummins and Weiss (2014) who analyse primary indicators and contributing factors. More specifically, Cummins and Weiss (2014) add a further distinction to the dichotomy between traditional and non-traditional activities, namely the higher systemic relevance of traditional life compared to the P&C business: this is mainly driven by the higher leverage, interconnectedness and exposure to credit, market and liquidity risk. Similar conclusions are reached by Baluch et al. (2011), who find that the fundamental reason behind the systemic relevance of the bank-like business type is due to the massive amount of interconnectedness, and by Harrington (2009) who concludes that systemic risk is potentially higher for life insurers due to the higher leverage, sensitivity to asset value decline and potential policyholder withdrawals during a financial crisis.

An additional strand of research based both on market and accounting data tend to confirm the difficulties in defining the insurance industry as systemically relevant. Weiß and Mühlnickel (2014) estimate the systemic risk contribution based on CoVaR and MES for a sample of US Insurers during the 2007-2008 crisis, inferring that insurers that were most exposed to systemic risk were on average larger, relied more heavily on non-policy holder liabilities and had higher ratios of investment income to net revenues. Weiss et al. (2014) analyse a much broader sample of insurers over a longer time horizon and find that the systemic risk contribution of the insurance sector is relatively small. However, they also argue that the contribution of insurers to systemic risk peaked during the 2007-2008 financial crisis and find that the

interconnectedness of large insurers with the insurance industry is a significant driver of the insurers' exposure to systemic risk. Finally, they argue that the contribution of insurers to systemic risk appears to be primarily driven by leverage, loss ratios and funding fragility.

It is also worth noting that an ambiguous position is attributed to reinsurance companies: studies by Swiss Re (2003) and by The Group of Thirty (2006) exclude any systemic relevance for the reinsurance business. However Cummins and Weiss (2014) claim that, despite historical evidence, both life and P&C insurers are indeed exposed to reinsurance crises. In conclusion, the existing literature provides a diversified and controversial picture of the systemic relevance of the insurance industry. On the one hand, some studies argue that due to its nature, the insurance industry does not pose systemic risk; on the other hand, some studies provide evidence on the role of the insurance industry in posing systemic risk and its growing importance in recent years, particularly driven by the engagement of insurers in non-traditional activities. Moreover the position of reinsurers appears unclear.

This paper, shed further light on the systemic relevance of the European insurance industry compared to other industries, namely banks and non-financial institution. Moreover, we aim at assessing the contribution to the riskiness of the whole system of the systemically important vis-á-vis non-systemically important insurance companies.

3. Methodology

In order to compare the systemic relevance of the insurance industry with the systemic relevance of other industries we define three groups, namely banks, insurers and non-financials and apply to them three widely used equity-based measures of systemic risk: 1) the Granger causality test proposed by Billio et al. (2012), 2) the ΔCoVaR proposed by Adrian and Brunnermeier (2011) and 3) the DMES proposed by Brownlees and Engle (2012).[34]

The literature proposes several equity-based models to assess the systemic relevance of institutions, anyhow no consensus among academia has been found on the best approach. We thus opted for the mentioned three due to i) their diffusion (many central banks and regulators apply these models), ii) their robustness (the models have been thoroughly discussed and challenged both in academia and industry, and

[34] An extensive mathematical treatment of the three measures is provided in Appendix A.1.

finally iii) our willing to approach the measurement of the systemic relevance of an industry by different perspectives.

The three systemic risk measures tend to capture different phenomena and therefore need to be correctly interpreted. The Granger causality test is a measure that allows us to quantify the degree of connectedness of an institution vis-á-vis a system of institutions. By creating a network of pairwise statistical relations, we do not only observe the amount of interdependence, but also the direction thereof. The measure is thus a good proxy for an analysis at an aggregate level (for example industry or other clusters), but its estimation could become cumbersome when the objective is to test the individual interconnection with respect to a system of institutions as proxy for the market.[35]

The ΔCoVaR measures the difference between the CoVaR conditional on the distress of an institution, i.e. the value-at-risk of the system conditional on an institution being in distress, and the CoVaR conditional on the normal state of the institution. It is therefore able to capture the marginal contribution of a particular institution to the overall systemic risk. Finally, the DMES measures, in a dynamic setting, the expected drop in equity value of an institution when the system is in distress. It is worth mentioning that this is not a direct measure of systemic risk, but is highly related to it. The contribution of Brownlees and Engle (2012) originates from the proposal of Acharya et al. (2010), in which the marginal expected shortfall of an institution is coupled with its leverage to originate the Systemic Expected Shortfall (SES). SES measures the expected capital shortage of an individual firm conditional on a substantial reduction in the capitalization of the system. Brownlees and Engle propose a similar measure called SRISK, which is based on a dynamic estimation of the Marginal Expected Shortfall (MES) and leverage ratios. A major advantage of such a contribution is its ability to capture time-varying effects, effects which are not observable in the framework of Acharya et al. (2010). However, both measures rely on the estimation of the MES and of pre-determined leverage ratios: in order to avoid additional assumptions that might cast doubts on the reliability of the estimation within the insurance industry,[36] we simply rely on the directly observable part of the

[35] By market, we essentially mean a broad measure and proxy for the (real) economic activity such as a major stock index. Throughout the paper, we therefore interchangeably use the terms system and market as (almost) perfect substitutes.

[36] However, it is worth noting that Brownlees and Engle (2012) provide a series of robustness checks on the stability of the parametrization of the SRISK measure.

measure, i.e. the DMES, which is sufficient to provide information on the individual fragility of the individual institution with respect to market tail events, which in turn have potential systemic implications.[37]

In addition, for each systemic risk measure and for each group, we compute the average contribution of the individual institution towards the total system composed by the three groups.[38] We then calculate the average contribution of each industry by taking the median of the month (for the ΔCoVaR and the DMES, whereas the Granger causality test is calculated on a monthly basis) and the average through the institutions of the same industry.[39]

Finally, at each point in time, we rank the institutions systemic relevance with respect to the total system from the most to the least systemically relevant according to each measure. We then select the top ten institutions at each point in time and calculate the relative weight of each industry within the top ten over time, thereby creating three indexes. Finally, we group all three indexes and form the Industry Composition Index displaying in percentage the top ranked institutions by industry.

4. Data

The data set for the industry analysis consists of equity returns of 60 companies listed in Europe over a time window of 14 years, from January 1999 to December 2013, which is 17 years (i.e. from January 1996 to December 2013) for the Granger causality test due to the lag on the series.[40] For each control group, we select the top 20 institutions in terms of capitalization from STOXX® Euro 600 Banks, STOXX® Euro 600 Insurance and STOXX® Europe 600 for banks, insurers and non-financials respectively.[41]

Table 1, displayed in Annex A.3, reports the list of the selected institutions for each group.

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[37] Another major issue we face regarding the estimation of the SRISK is the frequency of the accounting data: since we focus on European insurers, we do not possess sufficiently long quarterly series of balance sheet data.

[38] An extensive mathematical explanation of how the three cases are calculated is provided in Appendix A.1

[39] A formal representation of the index's construction is provided in Appendix A.3

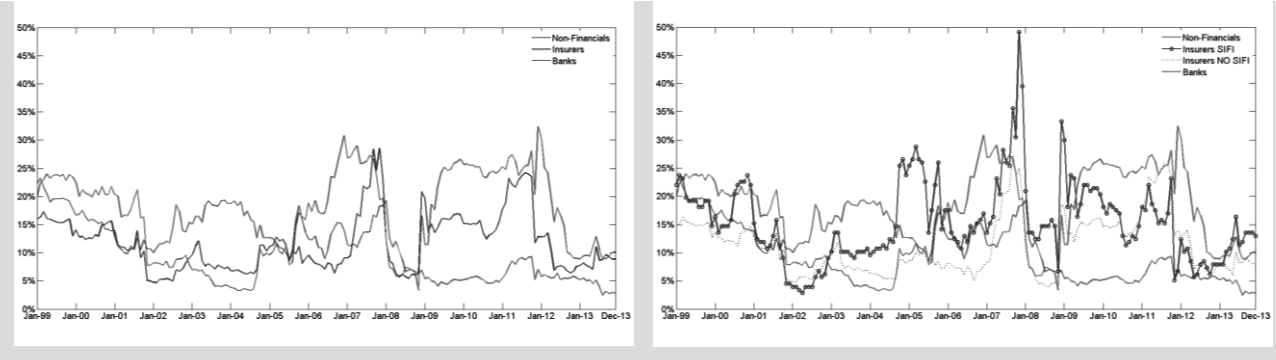
[40] Data was downloaded from Datastream®

[41] Within each control group, companies are ranked according to the yearly average market capitalization over the 14-year time frame. We selected those companies which were continuously listed over the period. The list of the companies included in each group is reported in Appendix A.3

Data were collected both at daily and monthly frequencies. To calculate the ΔCoVaR, we rely on a set of state variables as proposed in Adrian and Brunnermeier (2011), namely i) Market volatility (VIX for Europe), ii) Liquidity spread (3M Repo - 3M Bubill), iii)} change in the short-term interest rate (3M Bubill), iv) the slope of the yield curve (10Y Bund - 3M Bubill), v) credit spread (BAA 5-7Y Corporate (Bank of America) - EURO Sovereign 5-7Y (Barclays)), vi) market returns (STOXX EURO 600 All shares).

5. Empirical results

5.1. The Granger causality test (Billio et al., 2012)



(a) Full insurance group *(b) Insurance group split into SIFI and Non-SIFI*

Figure 1: Total cause connections towards total system.
The figure displays for each group the number of significant cause and receives linear Granger causality connections over the total number of possible cause and receive connections. The statistical significance level is set at 5%. Results are calculated using Newey West standard errors.

Figure 5.1a above reports the evolution over time of the total number of causing (Granger-causal) significant connections over the total number of possible connections from each group towards the total system.

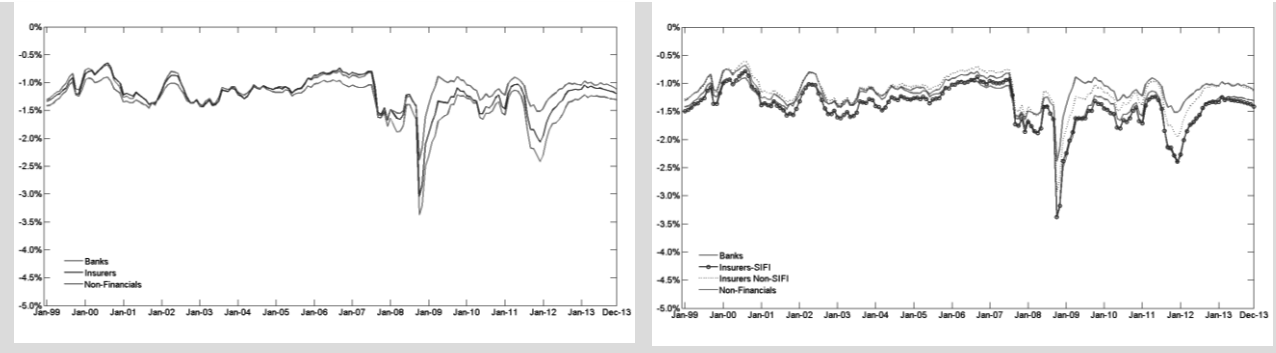
During the pre-crisis period the measure reports a generalized decrease in the connectivity level across the three groups: particularly in the period from 1999 to the end of 2004, the level of connectivity goes from roughly 20%-25% to 10%-15%. Starting form 2005 the graph shows a general increase of the significant connections that move to average values of 20%-25% with peaks of 35% in the beginning of 2007 and 2012. Looking at the single curves it is worth noting how during tranquil periods, namely in a low level relevant connection environment, the non-financial sector tends to play a more active role in comparison to the financial sector. The opposite occurs when the financial crises approach: financial companies almost doubled the number of relevant causing connection. As a matter of fact, starting from 2008 when Lehman Brothers filed for bankruptcy and American International Group (AIG) was bailed out, the index signals a small increase for non-financial and a jump in the connectivity

level for the financial service industry. This is evidence that these two events represent more of a shock to the financial industry than to the non-financial industry. Among the financial sector insurers display always a lower level of connectivity with respect to banks.

Figure 5.1b above reports the average results for those insurers labelled as SIFIs: this distinction is particularly relevant since regulators indicated some common characteristics among these institutions which should make them more systemically relevant compared to the median insurer. Results show a higher average degree of causality compared to the non-SIFI group with observable significant peaks during the Lehman Brothers bankruptcy and AIG bailout. In general, we can see that despite a higher causality compared to non-SIFIs, this sub-group of institutions still tends to play a minor role compared to banks in the aftermath of the Lehman crisis.

In summary, the outcome provided by the Granger causality test gives a fairly clear picture over time of who causes systemic risk: non-financials behave as a source of systemic risk during tranquil periods, whereas banks appear to be the most prominent cause in the aftermath of the crises. In particular, among financial institutions, insurers display an ambiguous behaviour and on average play a subordinated role compared to banks, especially during the 2007-2009 financial crisis and its aftermath. This is in line with existing findings for American insurance companies.[42] Findings apply both to non-SIFI and SIFI insurers, with the SIFI insurers reporting higher degree of causality than non-SIFI insurers, but on average lower than banks.

5.2. ΔCoVaR (Adrian and Brunnermeier, 2011)



(a)Full insurance group. *(b) Insurance group split into SIFI and Non-SIFI.*

Figure 2: Average institutions' ΔCoVaR towards total system.
The figures display the industry monthly average calculated on single institution's median value.

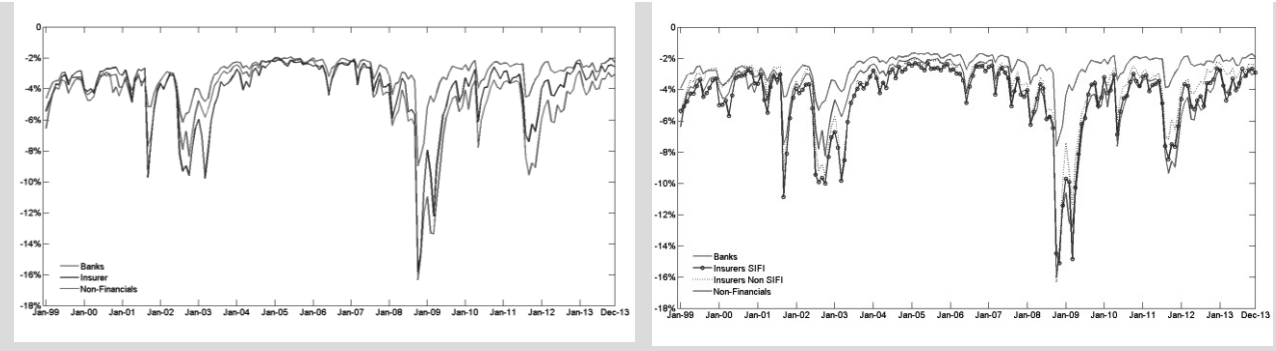
[42] See, among others, Chen et al. (2013).

Figure 5.2a reports the results of the average individual institutions' ΔCoVaR towards the total system. The figure displays slight differentiation between financial and non-financial institutions with the curves almost perfectly co-moving up to mid-2007. From 2007 onwards the curves start to diverge: after the crises, the contribution to systemic risk of financial institutions increases dramatically, with banks once again dominating insurers in terms of marginal contribution. Even though the differences appear modest, we should stress the fact that the measure is estimated on daily returns and averaged through many institutions. Therefore the average marginal contribution of banks after 2008 can be estimated as being roughly 20% higher compared to insurers, which leaves it significantly higher.

Figure 5.2b reports a widespread increase of systemic contribution of SIFI insurers measured by CoVaR in comparison to the non-SIFI sample and even compared to banks. As a matter of fact, before the crisis SIFIs could be identified as the most systemically relevant institutions, whereas in the aftermath of the 2007 crisis their level of systemic relevance substantially matches the level displayed for banks.

In summary, ΔCoVaR provides a fairly clear indication of the behaviour of financial and non-financial institutions, which is in line with the Granger causality test. Besides, once more, insurers tend to play a subordinated role compared to banks, with the exception of a SIFIs' subsample that reports a high degree of systemic relevance, i.e. being highest in tranquil periods and providing almost the same contribution as banks during crises.

5.3. DMES (Brownlees and Engle, 2012



(a)Full insurance group. *(b) Insurance group split into SIFI and Non-SIFI.*

Figure 3: Average institutions' DMES towards total system.
The figures display the industry monthly average calculated on single institution's median value.

Figure 5.3a reports the results for the average marginal contribution of the individual institution towards the whole system. The pattern of each group is comparable with

the one obtained with the other two measures, in particular with the ΔCoVaR. The two measures present the same peaks during the financial crises and report a higher level of systemic riskiness after the crises compared to the pre-crises period. Differences from the previous measures can be found in the spikes at the end of 2001 and 2003 reported by DMES: these spikes are mainly driven by the insurance industry and can be traced back to industry-specific events such as 9/11 and severe natural catastrophes occurring in Europe in 2003. Consistent with the design of the measure, these peaks are well captured by DMES due to its focus on the tail of the distribution, i.e. severe events. In general, financial institutions report lower average DMES values than non-financial institutions, with some differences between banks and insurers depending on the period: in the aftermath of the crises, banks pose more risk than insurers.

Figure 5.3b reports the result for the DMES highlighting the behaviour of SIFIs: among the three measures, the DMES displays the smallest differences between SIFI and non-SIFI insurers. Moreover, in the period following the Lehman Brothers bankruptcy the systemic contribution of SIFI insurers remain inferior to the contribution of banks. Such an outcome stems from the high weight attributed by the measure to extreme events that affect the whole insurance industry's companies independently by being or not SIFIs. In summary, the DMES confirms the results obtained from the other two measures, attributing a higher systemic relevance to financial institutions, among which insurers prevail before Lehman Brothers and banks in its aftermath. Insurers display a higher systemic relevance than banks only for specific severe events properly captured by the measure. The measure, due to its construction, does not distinguish between SIFI and non-SIFI insurers over the observed time frame.

5.4. Industry Composition Index

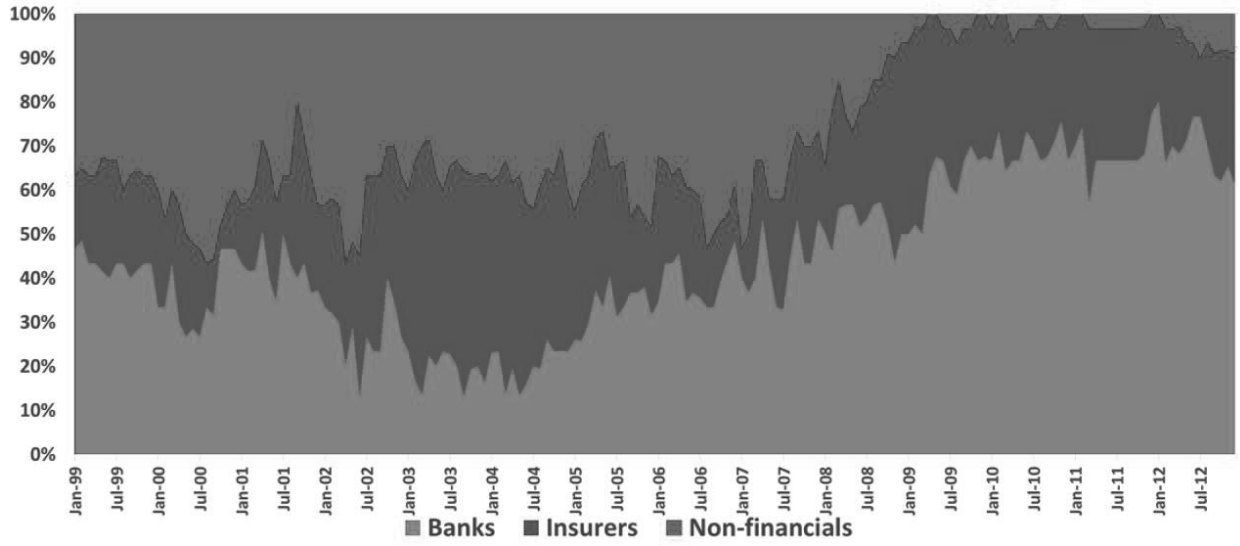


Figure 4: Cumulative index.

The graph reports the average industry composition of the 3 indices at each point in time.

In order to provide a straightforward representation of the systemic relevance of the three groups according to the three measures, we display in Figure 5.4 the ten most systemically relevant institutions grouped by industry at each point in time. The systemic relevance of the three groups is summarized into a synthetic indicator that displays at each point in time the industry composition of the top ten most systemic institutions.[43]

The index clearly shows the alternative role of banks and non-financial companies over the observed period with non-financials dominating the index before Lehman, whereas banks dominate it thereafter. Insurers always tend to play a subordinated role both before and after the Lehman bankruptcy with respect to non-financial and to banks. However, it is worth noting that insurers are persistently present among the top ten systemic relevant institutions all over the observed period: if banks tend to replace non-financial institutions in the aftermath of the crises the number of insurance companies remains almost constant. Moreover, the progressive disappearing of non-financial companies from the top ten in the aftermath of the crisis and the European sovereign debt crisis that followed, allows appreciating the financial nature of these crises.

Concluding, we can summarize our findings: i) the three measures make a clear distinction between financial and non-financial institutions; ii) among financial institutions, banks dominate insurers in terms of contribution to systemic risk in the

[43] See equation 24 in Appendix A2

aftermath of the crises, with insurers still displaying a persistent contribution to systemic risk over time; iii) there is no clear-cut evidence on higher systemic relevance of SIFI insurers; iv) trends in systemic risk contributions are time-dependent and tend to change rapidly, making the choice of the time span of analysis a crucial variable. Moreover, it is worth mentioning that the three measures were developed to capture different features of the systemic risk contribution of institutions, therefore inconsistencies over time should not be seen as lack of accuracy, but rather as emphasis on different factors that contribute to systemic risk.

6. Conclusion

In the present work, we propose an analysis of the role of the insurance industry in posing systemic risk. We conduct an aggregated industry analysis based on three measures of systemic risk on three different groups, Banks, non-financials and insurers operating in the European market. By doing so, we aim to test the relative systemic risk contribution of the insurance industry vis-á-vis other industries.

Our evidence suggests that financial institutions tend to cause more systemic risk than non-financial institutions and among financial institutions, banks pose more systemic risk than insurers, especially in the aftermath of crises.

Results are then summarized in the index reporting the top ten institutions by systemic relevance over time. The graphs show how the role of financial institution became preponderant after the crises and that despite the subordinate role of the insurers to banks, insurers are the most persistent companies over the observed period.

In addition we computed the contribution to systemic for the sub-sample of SIFI insurers. The Granger based measure and CoVaR distinguish between SIFIs and non-SIFIs, whereas DMES does not. Therefore our results do not allow inferring clear-cut evidence on the higher contribution to systemic risk posed by SIFI compared to non-SIFI insurers.

Our results provide a contribution to the debate on the systemic relevance of the insurance industry: this is particularly relevant in the light of the ongoing discussion on the role of SIFIs and on the specific regulations they might be subjected in the future.

Appendix

A.1 Systemic Risk Measures

The Granger causality test (Billio et al., 2012)

We measure the systemic importance of an institution in terms of the total number of statistically significant pairwise connections based on linear Granger causality tests. This approach allows us to infer when equity price movements of an institution influence price movements of another institution over a given period of time.

The Granger causality test measures the ability of two time series to forecast each other. We can write the system of equations as follows

$$y_{t+1}^{i} = \alpha^{i} y_{t}^{i} + \beta^{ij} y_{t}^{j} + \varepsilon_{t+1}^{i} \quad (1)$$

$$y_{t+1}^{j} = \alpha^{j} y_{t}^{j} + \beta^{ji} y_{t}^{i} + \varepsilon_{t+1}^{j} \quad (2)$$

in which coefficients α^{i}, β^{ij}, α^{j}, β^{ji} are estimated via linear regression and in which time series j is said to "Granger-cause" times series i if lagged values of j contain statistically significant information that helps in predicting i.

The causality indicator is defined as follow:

$$i \to j = \begin{cases} 1, if\ j\ Granger\ cause\ i \\ 0, otherwise \\ 0, for\ j \to j \end{cases} \quad (3)$$

Equation three allows us to calculate a series of indexes based on the total number of significant relations among institutions at a specific point in time.[44] The Degree of Granger Causality thus represents the fraction of statistically significant relationships over the total number of possible connections among the full sample,

$$DGC = \frac{1}{N(N-1)} \sum_{i=1}^{n} \sum_{j \neq n} (j \to i) \quad (4)$$

Moreover, we can differentiate between causing and receiving connections which are defined as follows:

$$Out: (j \to S)|_{DGC \geq K}\ \frac{1}{N-1} \sum_{i \neq j} (j \to i)|_{DGC \geq K} \quad (5)$$

$$In: (S \to j)|_{DGC \geq K}\ \frac{1}{N-1} \sum_{i \neq j} (i \to j)|_{DGC \geq K} \quad (6)$$

We then compute the number of statistically significant in and out connections of one institution with respect to the total system:

[44] The level of significance k is set at 0.05.

$$\left(j \to S^{-j}\right)|_{DGC \geq K} \frac{1}{3N-1} \sum_{i \neq j} \left(j \to S^{-j}\right)|_{DGC \geq K} \quad (7)$$

$$\left(S^{-j} \to j\right)|_{DGC \geq K} \frac{1}{3N-1} \sum_{i \neq j} \left(S^{-j} \to j\right)|_{DGC \geq K} \quad (8)$$

The two indexes represent the contribution of each individual institution. We then calculate industry averages by summing the total number of institutions' connections across each group.

ΔCoVaR (Adrian and Brunnermeier, 2011)

The measure extends the concept of Value at Risk (VaR) designed for individual institutions to the system as a whole. The CoVaR represents the VaR of a system conditional on institutions being in distress. The systemic contribution of an individual institution to the system is computed as the difference between the CoVaR of the institution in distress and the CoVaR in the median state, hence ΔCoVaR.

Following Adrian and Brunnermeier (2011), we calculate the ΔCoVaR using quantile regressions by setting the median state at the 50 percentile and the distress situation at the 95 percentile. We also include in the regressions a set of 6 state variables M_{t-1}, namely market volatility, liquidity spread, changes in the short-term interest rates, the slope of the yield curve, credit spreads and total equity returns, using one week lag.

Estimations are based on the following equations

$$X_t^i = \alpha^i + \gamma^i M_{t-1} + \varepsilon_t^i \quad (9)$$

$$X_t^S = \alpha^{S|i} y_t^j + \beta^{S|i} X_t^i + \gamma^{S|i} M_{t-1} + \varepsilon_t^{S|i} \quad (10)$$

where i represents the individual institution and S is the index representing the set of institutions under consideration. The predicted values from the regressions are then plugged into the following equation to obtain both the VaR of the individual institution and consequently the CoVaR:

$$VaR_t^i(q) = \hat{\alpha}_q^i + \hat{\gamma}_q^i M_{t-1} \quad (11)$$

$$CoVaR_t^i(q) = \hat{\alpha}^{S|i} y_t^j + \hat{\beta}^{S|i} VaR_t^i(q) + \hat{\gamma}^{S|i} M_{t-1} \quad (12)$$

Finally, the contribution of each institution to the system is calculated as follows:

$$\Delta CoVaR_t^i(q) = CoVaR_t^i(5\%) - CoVaR_t^i(50\%) = \hat{\beta}^{S|i}(VaR_t^i(5\%) - VaR_t^i(50\%)) \quad (13)$$

The total system is defined as follow:

$$X_t^S = \frac{\sum_{j \neq i} \omega_{t-1}^j r_t^j}{\sum_{j \neq i} \omega_{t-1}^j} \quad (14)$$

with ω =market capitalization, r= return, j= total system,

$$\overline{\Delta CoVaR}_t^{total\ system|i} = \frac{1}{N}\sum_i^N \Phi^{-1}(0.5)\Delta CoVaR_{t\to t+h}^{total\ system|i} \quad (15)$$

where $t \to t+h$ indicates 1 calendar month of daily ΔCoVaR and N represents the number of institutions for each of the 3 groups. In order to avoid correlation biases we exclude institution i from the index representing the reference group.

DMES (Brownlees and Engle, 2012)

The measure is based on the expected loss conditional to a distressed situation (e.g. returns being less than a certain quantile): Brownlees and Engle (2012) extend the measure proposed by Acharya et al. (2010) by introducing a dynamic model characterized by time varying volatility and correlation as well as nonlinear tail dependence. The market model is defined as follows

$$r_{mt} = \sigma_{mt}\epsilon_{mt} \quad .$$

$$r_{it} = \sigma_{it}\rho_{it}\epsilon_{mt} + \sigma_{it}\sqrt{1-\rho_{it}^2\xi_{it}} \quad (16)$$

$$(\epsilon_{mt}, \xi_{mt}) \sim F \quad .$$

where r_i is the market return of the i^{th} institution and σ_{it} is its conditional standard deviation, r_m is the market return of the system considered and σ_{mt} is its conditional standard deviation, ϵ and ξ are the shocks that drive the system and ρ_{it} is the conditional correlation between i and m.

The one period ahead DMES can be expressed as follows

$$DMES_{it-1}^1(C) = \sigma_{it}\rho_{it}E_{t-1}\left(\epsilon_{mt}\middle|\epsilon_{mt} < \frac{C}{\sigma_{mt}}\right) + \sigma_{it}\sqrt{1-\rho_{it}^2}E_{t-1}(\xi_{it}|\epsilon_{mt} < \frac{C}{\sigma_{mt}}) \quad (17)$$

where C is the conditioning systemic event which we assume to be equal to the 95th percentile of the total period market return, i.e. $C = \Phi^{-1}(0.95)r_m$.[45] The conditional standard deviations and the conditional correlation are estimated by means of a TARCH and a DCC model respectively.[46] The tail expectations $E_{t-1}\left(\epsilon_{mt}\middle|\epsilon_{mt} < \frac{C}{\sigma_{mt}}\right)$ and $E_{t-1}\left(\xi_{mt}\middle|\epsilon_{mt} < \frac{C}{\sigma_{mt}}\right)$ are calculated by means of a non-parametric kernel estimator and are given by the following equations:

[45] The choice over the $VaR_{0.95}$ of the market allows for a more direct comparison with the estimations of the ΔCoVa For further mathematical details, see Brownlees and Engle, 2012.R.

[46] For further mathematical details, see Brownlees and Engle, 2012.

$$\hat{E}_h(\epsilon_{mt}|\epsilon_{mt} < k) = \frac{\sum_{i=1}^{n} \epsilon_{mt} K_h(\epsilon_{mt} - k)}{(n\hat{p}_h)} \quad (18)$$

$$\hat{E}_h(\xi_{mt}|\epsilon_{mt} < k) = \frac{\sum_{i=1}^{n} \xi_{mt} K_h(\epsilon_{mt} - k)}{(n\hat{p}_h)} \quad (19)$$

$$\hat{p}_h = \frac{\sum_{i=1}^{n} K_h(\epsilon_{mt} - k)}{n} \quad .$$

The total system is defined as follow:

$$r_{mt} = \frac{\sum_{j \neq i} \omega_{t-1}^{j} r_t^j}{\sum_{j \neq i} \omega_{t-1}^{j}} \quad (20)$$

with ω=market capitalization, r= return, j= total system,

$$\overline{DMES}_t^{total\ system|i} = \frac{1}{N} \sum_i^N \Phi^{-1}(0.5) DMES_{t \to t+h}^{total\ system|i} \quad (21)$$

where $t \to t+h$ indicates 1 calendar month of daily DMES and N represents the number of institutions for each of the 3 groups. In order to avoid correlation biases we exclude institution i from the index representing the reference group.

A.2 Industry Composition Index

The group of selected institutions at each point in time is defined as

$$S_t^k = \{i_{1,t} > \cdots > i_{n,t} > \cdots > i_{10,t}\} \quad (22)$$

in which i_n represents an institution ranked from the most to the least systemic (with $n = 1 \to most\ systemic$) according to the k measure, with k = Granger, ΔCoVaR, DMES. Then, the index for each systemic risk measure k is obtained as follows

$$I_t^k = \begin{cases} \frac{\sum_{n=1}^{10} \mathbb{I}_{i_{n,t}=Bank}}{10} \\ \frac{\sum_{n=1}^{10} \mathbb{I}_{i_{n,t}=Insurer}}{10} \\ \frac{\sum_{n=1}^{10} \mathbb{I}_{i_{n,t}=Non-Financial}}{10} \end{cases} \quad (23)$$

in which $\mathbb{I}$ is an indicator function that takes value 1 if the condition (e.g. if $i_n = Bank$) is met and 0 otherwise. Sums are then scaled between 0 and 1.

Finally, we group all three indexes and form the total index, which is given by

$$I_t^k = \begin{cases} \frac{\sum_k \sum_{n=1}^{10} \mathbb{I}_{i_{n,k,t}=Bank}}{10} \\ \frac{\sum_k \sum_{n=1}^{10} \mathbb{I}_{i_{n,k,t}=Insurer}}{10} \\ \frac{\sum_k \sum_{n=1}^{10} \mathbb{I}_{i_{n,k,t}=Non-Financial}}{10} \end{cases} \quad (24)$$

A.3 Tables

Table 1: List of the institutions included in the three control groups.

Banks		**Insurers**		**Non-Financials**	
name	*country*	*name*	*country*	*name*	*country*
HSBC HDG.	UK	ALLIANZ	DE	BP	UK
BANCO SANTANDER	ES	PRUDENTIAL	UK	VODAFONE GROUP	UK
UBS 'R'	CH	AXA	FR	NOVARTIS 'R'	CH
BNP PARIBAS	FR	ZURICH INSURANCE GROUP	CH	NESTLE 'R'	CH
LLOYDS BANKING GROUP	UK	MUENCHENER RUCK.	DE	GLAXOSMITHKLINE	UK
ROYAL BANK OF SCTL.GP.	UK	SWISS RE	CH	ROYAL DUTCH SHELL A	UK
BARCLAYS	UK	ING GROEP	NL	TOTAL	FR
CREDIT SUISSE GROUP N	CH	ASSICURAZIONI GENERALI	IT	ROCHE HOLDING	CH
BBV.ARGENTARIA	ES	SAMPO 'A'	FI	ENI	IT
DEUTSCHE BANK (XET)	DE	LEGAL & GENERAL	UK	TELEFONICA	ES
UNICREDIT	IT	AVIVA	UK	SANOFI	FR
SOCIETE GENERALE	FR	AEGON	NL	NOKIA	FI
STANDARD CHARTERED	UK	MAPFRE	ES	SIEMENS (XET)	DE
INTESA SANPAOLO	IT	HANNOVER RUCK.	DE	ASTRAZENECA	UK
NORDEA BANK	SE	AGEAS (EX-FORTIS)	BE	L'OREAL	FR
KBC GROUP	BE	RSA INSURANCE GROUP	UK	E ON (XET)	DE
DANSKE BANK	DK	VIENNA INSURANCE GROUP A	AT	BRITISH AMERICAN TOBACCO	UK
COMMERZBANK (XET)	DE	SCOR SE	FR	RIO TINTO	UK
SVENSKA HANDBKN.'A'	SE	SWISS LIFE HOLDING	CH	LVMH	FR
SEB 'A'	SE	BALOISE-HOLDING AG	CH	DIAGEO	UK

__: Systemically important insurance company

References

Acharya, V. V., Pedersen, L. H., Philippon, T., and Richardson, M. P.: Measuring systemic risk, FRB of Cleveland Working Paper, no.10-02, 2010.

Adrian, T. and Brunnermeier, M. K.: Covar, National Bureau of Economic Research Working Paper, no.17454, 2011.

Baluch, F., Mutenga, S., and Parsons, C.: Insurance, systemic risk and the financial crisis. The Geneva Papers on Risk and Insurance-Issues and Practice, v.36, n.1, 2011, pp.126-163.

Bell, M. and Keller, B.: Insurance and stability: the reform of insurance regulation. Zurich Financial Services Group Working Paper, 2009.

Billio, M., Getmansky, M., Lo, A. W., and Pelizzon, L.: Econometric measures of connectedness and systemic risk in the finance and insurance sectors. Journal of Financial Economics, v.104, no.3, 2012, pp.535-559.

Bisias, D., Flood, M., Lo, A. W., and Valavanis, S.: A survey of systemic risk analytics. Annu. Rev. Financ. Econ., v.4, no.1, 2012, pp.255-296.

Brownlees, C. T. and Engle, R. F.: Volatility, correlation and tails for systemic risk measurement. NYU Working Paper, 2012.

Chen, H., Cummins, J. D., Viswanathan, K. S., and Weiss, M. A.: Systemic risk and the interconnectedness between banks and insurers: An econometric analysis. Journal of Risk and Insurance, v.81, no.3, 2014, pp.623-652.

Cummins, J. D. and Weiss, M. A.: Systemic risk and the US insurance sector. Journal of Risk and Insurance, v.81, no.3, 2014, pp.489-582.

Eling, M. and Pankoke, D.: Systemic risk in the insurance sector. What do we know? University of St. Gallen, School of Finance Working Papers, no.22, 2012.

Geneva Association: Systemic risk in insurance: an analysis of insurance and financial stability. Technical report, Special Report of The Geneva Association Systemic Risk Working Group, Switzerland, 2010.

Gray, D. F. and Jobst, A. A.: Modelling systemic financial sector and sovereign risk. Sveriges Riksbank Economic Review, no.2., 2011.

Harrington, S. E.: The financial crisis, systemic risk, and the future of insurance regulation. Journal of Risk and Insurance, v.76, no.4, 2009, pp.785-819.

Huang, X., Zhou, H., and Zhu, H.: Systemic risk contributions. Journal of Financial Services Research, v.42, no.1-2, 2012, pp.55-83.

Swiss Re: Reinsurance-a systemic risk. Sigma, no.5, 2003.

The Group of Ten: Report on consolidation in the financial sector. Basel, Switzerland: Bank of International Settlement, 2001.

The Group of Thirty: Reinsurance and international financial markets. Washington D.C., US, 2006.

Weiss, G. N., Bierth, C., and Irresberger, F.: Systemic risk of insurers around the globe. Working Paper, 2014.

Weiß, G. N. and Mühlnickel, J.: Why do some insurers become systemically relevant? Journal of Financial Stability, v.13, 2014, pp.95-117.

Appendix

Data coverage and disclaimer - The insurance sector

EIOPA collects consolidated figures from 32 large insurance groups[47]. The data is provided by undertakings through the national supervisory authorities on a best effort basis. This means that the data is not subject to internal or external audit. Although effort is made to keep the sample for each indicator as representative as possible, the sample may vary slightly over time. As data is provided on an anonymous basis, it is not possible to track the developments on a consistent sample. EIOPA also collects EU/EEA-wide statistics on country level. This data is collected annually and published as statistical annexes together with the Financial Stability Report.

Data coverage and disclaimer - The 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.

Data coverage and disclaimer – The 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 Members. Not all EU countries are covered, in some of them IORPs (i.e. occupational pension funds falling under the scope of the EU IORPs Directive) are still non-existent or are just starting to be established. Furthermore, in other countries the main part of occupational retirement provisions is treated as a line of insurance business respectively held by life insurers, and is therefore also not covered. The country coverage is 77% (24 out of 31 countries)[48].

Data collected for 2014 was provided to EIOPA with an approximate view of the financial position of IORPs during the covered period. Several countries are in the process of collecting data and in some cases 2014 figures are incomplete or based on estimates which may be subject to major revisions in the coming months. In addition, the main valuation method applied by each country varies due to different accounting

[47] The list of insurance groups is available in the background notes for the risk dashboard published on https://eiopa.europa.eu/publications/financial-stability/index.html.

[48] Countries that participated in the survey: AT, BE, BG, DE, DK, EE (only qualitative information), ES, FI, HR, IE, IS, IT, LI, LU, LV, NL, NO, PL, PT, RO, SE, SI, SK and the UK.

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 refer to 1st Pillar bis and 3rd Pillar private pension schemes only.

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