EUROPEAN INSURANCE
AND OCCUPATIONAL PENSIONS AUTHORITY

Financial Stability Report

December 2014

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Foreword by the Chairman

The second half of the 2014 brought new challenges driven by increased downside risks reflected in the revised European economic outlook. Although we have observed positive developments in equity markets and further improvements in sovereign spreads, macroeconomic imbalances have increased suggesting asset price misalignments in an environment of excessive liquidity supported by accommodative monetary policies. On the one hand, we can see an increasing likelihood of the potential risk reversal scenario, which will have a substantial impact on insurance and pension sectors if it materialises. On the other hand, subdued economic growth and deflationary pressures support a continuation of the low yield environment as the main risk driver for both insurance and pension sectors.

Hence, it is extremely important, that EIOPA conducted an EU-wide insurance stress test 2014 to provide a clear vision on the resilience of the sector to different shocks and to identify vulnerabilities that require further supervisory action. The results obtained help both insurers and supervisors to address the revealed weaknesses and increase awareness of those risks more generally. Moreover, the valuable information gathered in the exercise will support development of new techniques, which could further contribute to enhance the overall financial stability framework. The Pension stress test that EIOPA will run in the course of the next year will be an opportunity to yield important insights on the resilience and vulnerabilities of occupational pensions in the EU.

Looking ahead, risks will be captured and supervised more comprehensively under the Solvency II regulatory regime implying increased transparency and improved governance for insurers. However, investors and analysts need to understand the new framework to avoid misinterpretation that could have a negative effect on markets. This is an important element for successful implementation of the new regime and an increasing dialogue between supervisors, insurers, investors and market analysts will be essential.

In the current report, EIOPA continues to assess main risks using analytical tools which are being gradually developed to better capture systemic risks for insurers and pensions. We also continue to include the thematic article section that elaborates more detailed analysis of specific issues and broader policy discussions. Moving to the Solvency II regime will bring better information to assess risks, but will also require a redesign and recalibration of the current analytical framework. This will be a big challenge, but I am confident that EIOPA will succeed in benefitting from the new data to contribute to the overall financial stability of the European insurance and occupational pension sectors.

Gabriel Bernardino

Executive Summary

Although some positive developments in equity markets and further improvements in sovereign spreads can be seen, overall downside risks have increased. This is driven by a contradictory market view given remaining macroeconomic imbalances indicating some asset price misalignments caused by excessive liquidity supported by accommodative monetary policies. A potential risk premia reassessment would have a substantial impact on insurance and occupational pension sectors via decreasing asset values. For insurers, this impact would be more visible, accurately captured and better supervised under the Solvency II regulatory framework. Looking ahead, the key risks and vulnerabilities for the insurance companies and occupational pension funds continue to be seen: the weak macroeconomic environment, a continuation of the low yield environment and credit risk.

The Eurozone prospects remain weak and geopolitical risks have increased, notably in Ukraine and the Middle East. GDP levels have not reached pre-crisis levels; the economy continues to be affected by high debt levels in both private and public sectors and by insufficient job creation in many countries. Increasing deflationary risk in the euro area supports the persistency of the low yield environment. Credit risk displays another challenge despite some signs of nascent improvement.

This environment prompts insurance companies to review and adapt their business model. This is especially true for life insurance companies as their guaranteed business is the most exposed to a prolonged period of low interest rates. Low interest rates also evoked new developments such as increased reserving, reducing profit shares or setting-up specific reserve funds or additional technical provisions. Low economic growth has already led to relatively low growth or no growth at all in life business in the past. Still, the sector is well positioned to source growth from the needs for retirement, savings and health solutions. This shows in the current overall positive premium growth for life insurance companies but also stabilised non-life insurance premiums. The overall profitability of insurance companies is still relatively robust but results remain pressurised. Solvency I levels both for life and for non-life insurers dropped slightly but insurers are still capitalised to a sufficient level.

The global reinsurance sector continued its robust growth in Q2 2014. Loss activity remained benign in the first half of 2014. The sector continued to post strong underwriting results and capital returns continue to be excellent. The dynamic of the issuance of catastrophe bonds continues its robust growth, albeit the absolute volumes remain low.

For the European occupational pension fund sector, the current low yield environment is putting significant pressure on returns. The average ROA in 2013

was lower in comparison to 2012. On the other hand reported cover ratios slightly increased in 2013.

A further increase in macroeconomic risks has dampened insurance market growth. EIOPA's qualitative as well as quantitative assessment is pointing to positive premium growth for both life and non-life insurers in 2016. Contrary, in 2015 positive premium growth is anticipated for non-life insurers only. However, the situation is heterogeneous among different countries. The limited growth opportunity in Europe often leads to better prospects for growth in emerging markets and subsequently drives insurers into these markets.

The embedded value reports published by major European insurers confirm their vulnerability to equity price shocks. On the other hand, sensitivity to reduced interest rates varies which could be the result of a different degree of provided guarantees.

The report consists of two parts – the standard part and the thematic article section.

The standard part is structured as follows: 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 identified and monitored in previous chapters. This assessment is done in terms of the scope as well as the probability of their materialization using econometric techniques and questionnaires.

The second part with one thematic article elaborates on one specific topic in more detail and underpins the analysis and discussions provided in the standard part. The article focuses on financial institution interconnectedness which is considered as a key component to systemic risk supervision.

PART I

1. Key macro-prudential risk developments

Financial stability vulnerabilities overall remain stable, but downside risks have slightly increased. Although geopolitical risks remained elevated, notably in Ukraine and the Middle East, sovereign ratings in the euro area have stabilized since the European sovereign debt crisis. Subdued economic growth in Europe resulting in low inflation drives continuous expectations of quantitative easing. This supports a strong investor appetite that is depressing yields and volatility across a range of asset markets and contrasts with incomplete fiscal adjustment, persistently large fiscal deficit and high public sector indebtedness in many European countries. A highly fragile market equilibrium could be disrupted by some large or several small unexpected negative events and, as a consequence, risk premia might need to be reassessed. Market access for lower-rated issuers might hence be limited and funding costs would increase for sovereigns, banks and corporates with negative consequences on the real economy. Under such a scenario, price changes would have a substantial impact on insurance and occupational pension sectors via decreasing value of their assets. However, this impact is mostly visible, when market consistent valuation is applied. Therefore, a large part of this effect could be realised for insurance companies when moving from the Solvency I to Solvency II regulatory framework.

The currently positive market sentiment contributed to increased stability of the large insurance companies. This also corresponds with the distribution of rating outlooks. As of October 2014 over 80% of the top 30 European insurance companies have a stable outlook. Looking ahead, the following key challenges continue to be seen: the weak macroeconomic environment (see 1.1), a continuation of the low yield environment (see 1.2) and credit risk (see 1.3).

1.1. Weak macroeconomic environment

The prevailing difficult macroeconomic environment remains a challenge for insurance and occupational pension market growth. Even though GDP has improved slightly since year-end 2013 for the majority of countries, the future recovery will be gradual and compared with pre-crisis GDP levels the economic development is still far away for most countries (Figure 1).

Figure 1: Real GDP development (index 2007Q1=100)
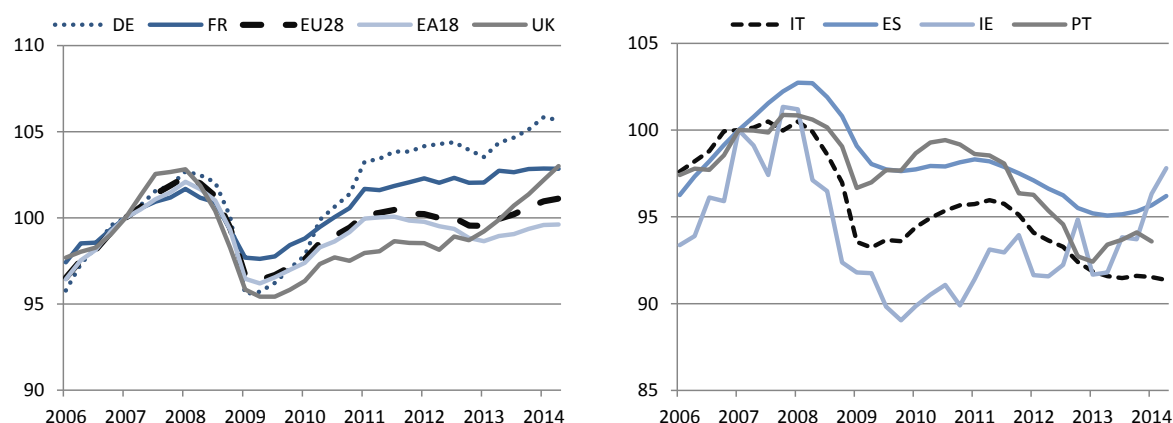
Source: Eurostat and EIOPA calculations
Note: Last observation: 2014 Q2; 2014 Q1 for PT

The Economic Sentiment Indicator (ESI) picked up in both the euro area and the EU in October 2014 following a period of stagnation or decline (Figure 2). The stabilisation resulted from an improvement in confidence in all the business sectors. Especially the construction sector benefited from rises. Confidence among consumers remained broadly stable. Industry and services confidence remained virtually unchanged. Such a development has a positive consequence on premium growth both for life and non-life insurers. However, the economic outlook for 2015 and beyond is currently below expectations and also has recently been revised.

Figure 2: Economic Sentiment Indicator (ESI)
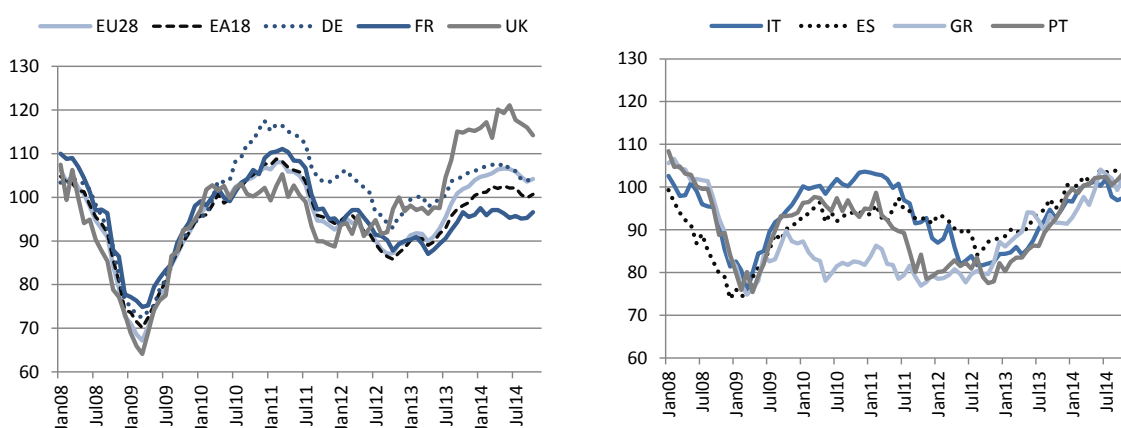
Source: European Commission
Last observation: October 2014

Labour market improvement on the other hand is very limited and high unemployment persists in many countries, albeit substantial cross-country differences still exist (Figure 3). Overall, the decline in the unemployment rate will most likely not be significant over the next couple of quarters. As a result, particularly on the life insurance side, insurers will have to continue to adapt their business models and product offerings to weaker demand. At the same time, it will be key for companies to maintain underwriting discipline in their non-life insurance business to maintain strong earnings results. Inroads into emerging markets can also be seen.

Despite prevailing macroeconomic imbalances, markets seem to be relatively optimistic on the future development of the European insurance sector. DJ Stoxx Europe has recovered from sovereign crisis levels and is moving towards pre 2008 crisis levels. The DJ STOXX Insurance is still outperforming the DJ STOXX EUROPE Banks in 2014 (Figure 4).

Figure 3: Unemployment rate (in % of the labour force)

Figure 4: Stock market development (index:2007=100)
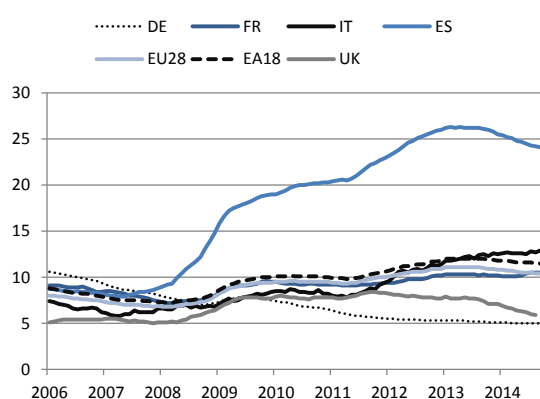
Source: Eurostat
Last observation: September 2014
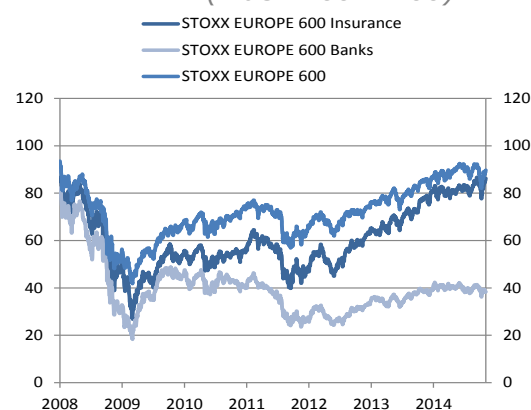
Source: Bloomberg
Last observation: November 2014

1.2. Low yield environment

The prevailing low yield environment poses a significant challenge for insurance companies' profitability (Figure 5). Concerning this environment, it prompts some life insurers, especially those with a high exposure to traditional life business with guarantees, to restructure their business towards less interest sensitive products with reduced, flexible or no interest guarantees and more attention towards developing effective ALM tools in order to steer and manage their business. At this time, non-life insurers focus increasingly on pricing, preventing an explicit dependency on investment returns. In some cases, significant reserves have been released from insurance companies raising questions regarding the long-term sustainability of this strategy. Because of the low yield environment, there have been some tendencies towards search for yield to improve the overall profitability. For example, there has been infrastructure financing and shifts towards higher yield but lower quality bonds.

Figure 5: Corporate bond yields in the euro area
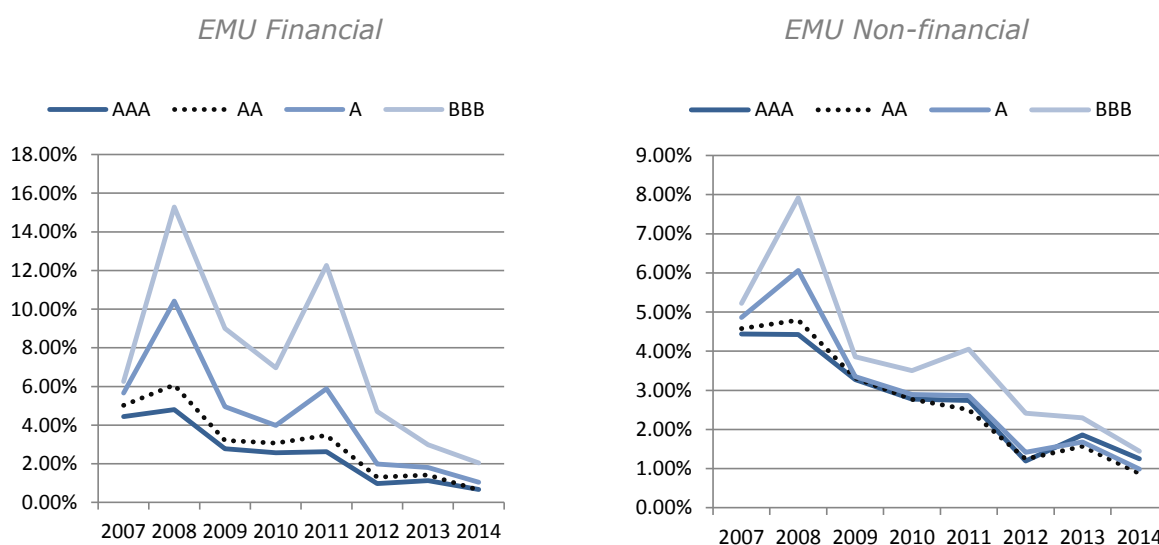
EMU Financial	EMU Non-financial

Increasing deflationary risk in the euro area supports persistency of the low yield environment (Figure 6). Recent developments suggest that inflation will remain lower than the ECB's long-term goal resulting in further monetary easing. However, the development is far from uniform as the markets are very fragmented across the Eurozone.

Figure 6: Inflation rate (in %)

Market data are pointing to a continued low yield environment (Figure 7 and Figure 8). A further decrease in the 10-year swap rates and short-term forward rates indicates a market expectation of the maintenance of the current European monetary policy strategy supported by deflationary tendencies.

Figure 7: 10-Y Swap rates
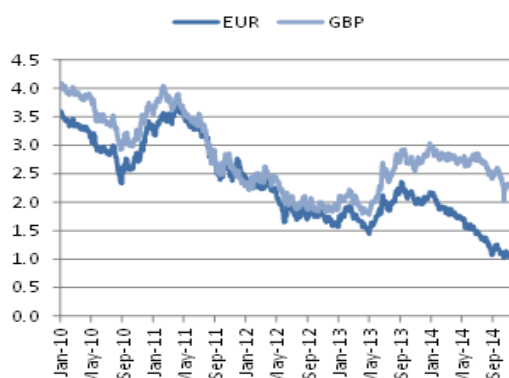
Source: Bloomberg
Last observation: November 2014

Figure 8: 3M EURIBOR
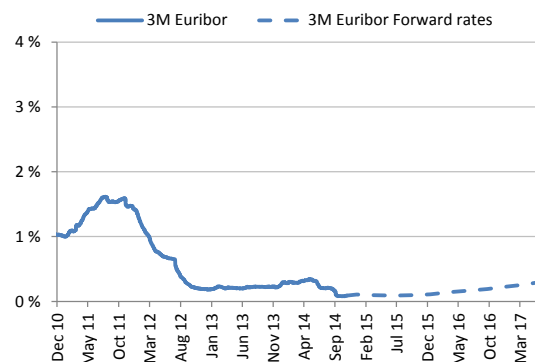
Source: Bloomberg

1.3. Credit risk

Credit risk displays another challenge despite some signs of nascent improvement (Figure 9). Credit spreads on insurance bonds are now tightening, which reflect the positive view on insurance market performance.

Figure 9: Credit default spreads

Insurance 5-year CDS (long-term)
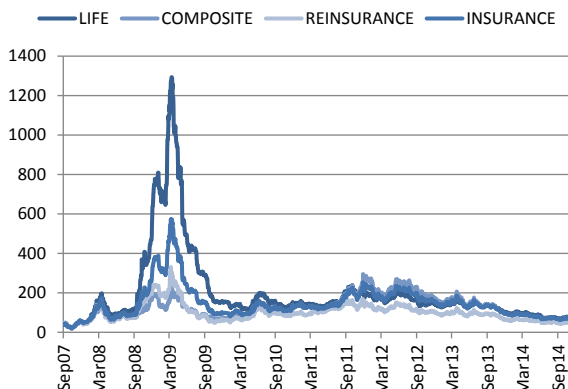
Insurance 5-year CDS (short-term)
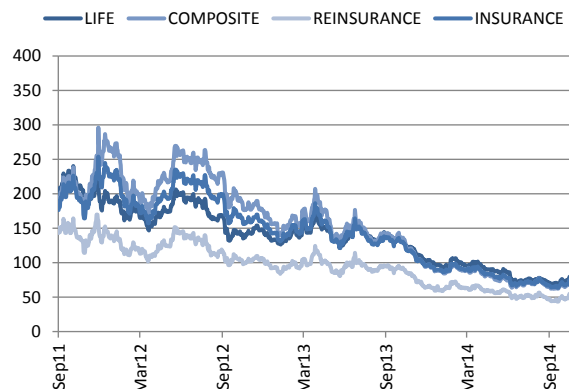
Source: Bloomberg
Last observation: November 2014

However, market future expectations do not seem to be in line with the current economic conditions. A change in the current relatively positive market sentiment might reignite sovereign debt sustainability concerns reflecting incomplete policy reforms and insufficient fiscal consolidation. Sovereign balance sheets remain weak and primary surpluses are not expected to improve substantially in the medium term. Despite market indicators suggesting a decrease in sovereign risks, large budget deficits and high public sector indebtedness do not correspond to the currently positive market sentiment. The observed divergence has further increased since our last review (Figure 10).

Figure 10: Government debt against 10-year sovereign bond spreads

Belgium

France

Ireland

Italy

Portugal

Spain
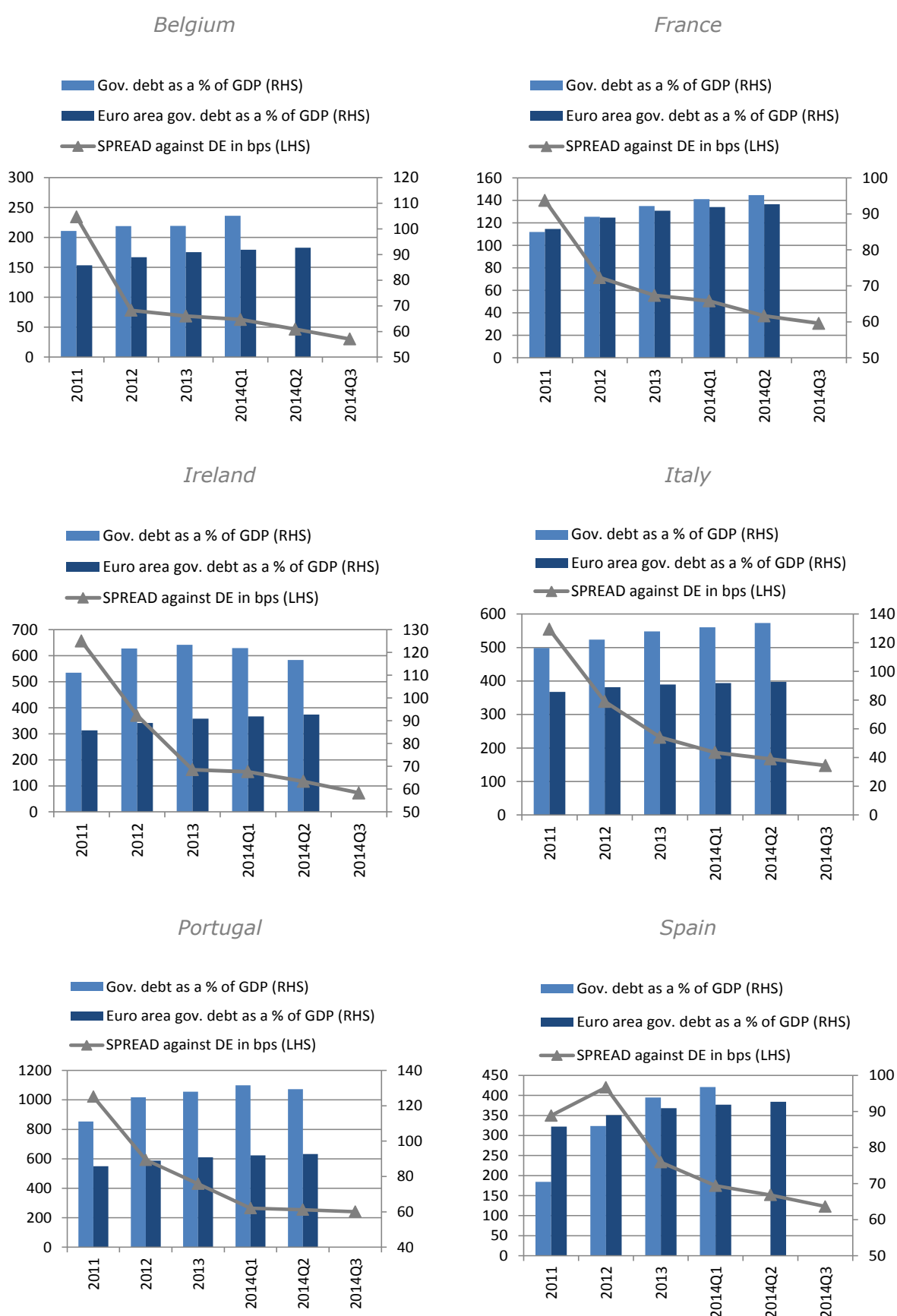
Source: Eurostat and Bloomberg

2. The European insurance sector

Insurance companies are still exposed to the low interest rate environment. Long-term interest rates are especially of importance to life insurers, since these institutions typically have long-term obligations to policyholders that become more expensive in today's terms when market rates are low. The financial position of these firms typically deteriorates under such conditions, in particular where the duration of liabilities exceeds that of assets. This problem will be more pronounced with higher guaranteed rates of return offered to policyholders and longer duration of liabilities.

A prolonged period of low interest rates may also have an adverse impact on non-life insurers pursuing a business model where investment returns are used to compensate for weak underwriting results. Non-life insurers may also be affected in a situation where low yields do not provide sufficient returns to counteract the effects of inflation on longer tailed business. This is a more difficult situation, since it requires inflation hedging over a long maturity.

2.1. Market growth

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In life insurance, guaranteed business is the most exposed to a prolonged period of low interest rates since there may be a 'yield spread compression'. In this case, as assets are (re)invested at low(er) rates, the achievable spread between returns on assets and guaranteed rates shrinks. This reinvestment risk is the primary means by which the impact of low interest rates affects the financial position of firms in a historic cost accounting environment.

In terms of guaranteed business, there are no immediate options available in relation to existing business which must be addressed through more medium term measures, such as enhancing asset-liability management, increased reserving, reducing profit shares or setting-up specific reserve funds or additional technical provisions. New business, on the other hand presents more options in terms of changes in product design to 'de-risk' them or changes in the mix of business. Firms have already started to respond by utilising these options. Some countries even require insurers to set aside reserves to support existing contracts with high guarantees.

Political uncertainties remain high on the agenda in many countries. In some countries life insurance contracts also no longer benefit from fiscal advantages. The erosion of these fiscal benefits to effect life policies threatens growth. Low economic growth has already led to relatively low growth or no growth at all in life business in the past. Markets are relatively mature but the sector is still well positioned to source growth from the needs for pension, savings and health solutions.

Hence, growth in life premiums remains overall positive. In fact, life insurance premiums continued to grow in many cases by about 2% until Q2 2014 as Figure 11 shows. The 90th percentile, shows that some companies are still reporting negative premium growth. However, substantial heterogeneity driven by market fragmentation and different consumer behavioural patterns can be observed.

However, despite the fragile expected economic recovery new opportunities are on the horizon. People are increasingly concerned about the sustainability of State-provided retirement and health benefits. The prospects of further gradual transfers of retirement and health provision to the private sector render the insurance market even more attractive to insurance groups possessing experience of successfully offering those products. Demographic trends and the increase in life expectancy also point towards potential growth in savings products. At the same time, longevity risk has risen.

Figure 11: Year-on-year growth Gross written premiums - Life. Median, interquartile range and 10th and 90th percentile
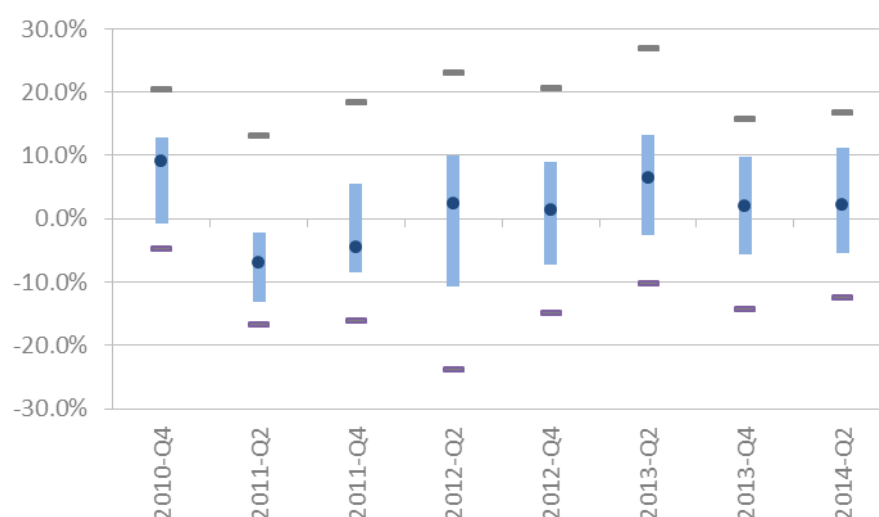
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

Life growth carries on but the unit-linked market is indeed not as attractive any more as it used to be (Figure 12). In times of low interest rates people increasingly seek suitable investment and savings vehicles for their income. Whilst unit-linked products are more profitable than guaranteed products, as they require less risk capital, unit-linked policies' return depends on the return of the chosen investment instruments. The share of unit-linked policies in itself contributes to a reduction of risk for the insurance company, but results in a transfer of risks to households.

The strong equity market performance in 2013 has not led to a higher appetite for unit-linked business. As a result, the unit-linked share decreased in Q2 2014

and the median company even reported negative growth on average. Policyholders are not willing to take on additional risks in this low interest rate environment.

Figure 12: Year-on-year growth in gross written premiums, unit-linked. Median, interquartile range and 10th and 90th percentile

Life insurance – Unit-linked

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

Life insurance – Non-linked
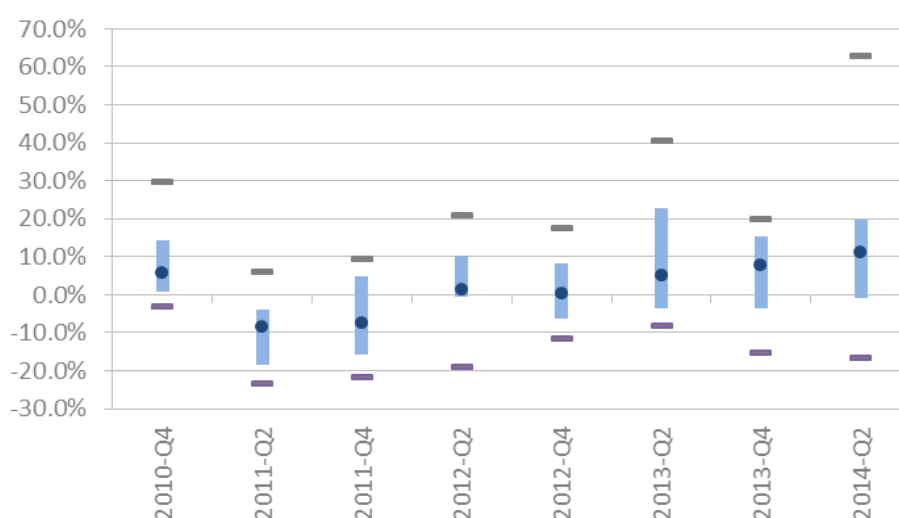
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

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Non-life insurance premiums have stabilised over the Q4 2013 and the previous drop in premium did not repeat itself in Q2 2014 (Figure 13. In general, non-life premiums are more stable than life premiums as many insurance types are also mandatory. Personal property and motor (Figure 14) constitute the majority of the market's premium.

The previous decline in motor business was due to the combined effect of falling compulsory motor vehicle third party liability insurance, market competition and bodily injury claims. New car registrations rose during the last quarter, at least in some countries. This increase in sales stems from the greater use of car financing and should provide a boost to motor premiums, especially as the insured value of the new vehicles will be higher than those they replace. That said, the lower motor premiums of recent quarters were partially offset by the positive impact on premiums.

Figure 13: Year-on-year growth in gross written premiums, non-life. Median, interquartile range and 10th and 90th percentile
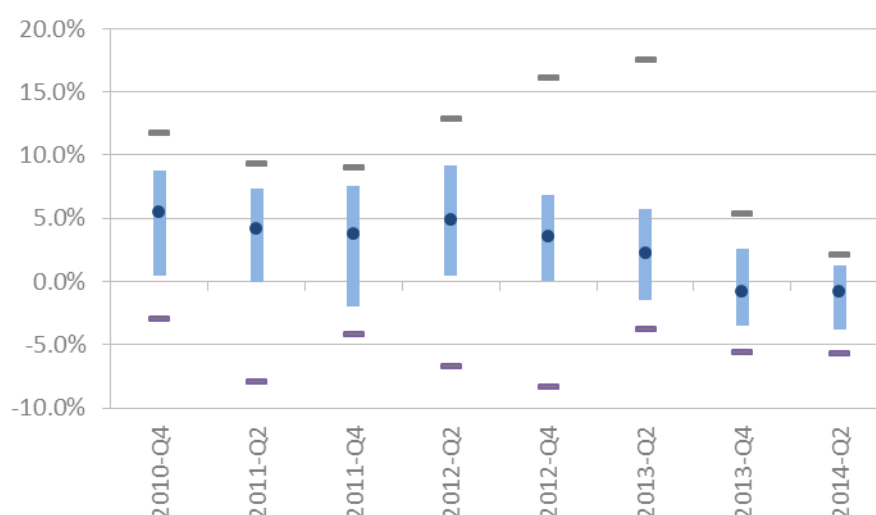
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

Figure 14: Year-on-year growth in gross written premiums, motor, Median, interquartile range and 10th and 90th percentile

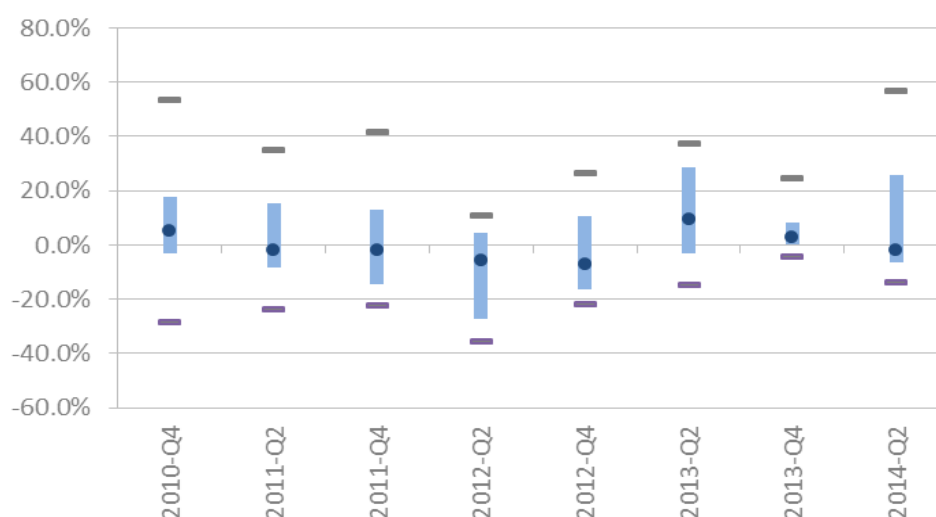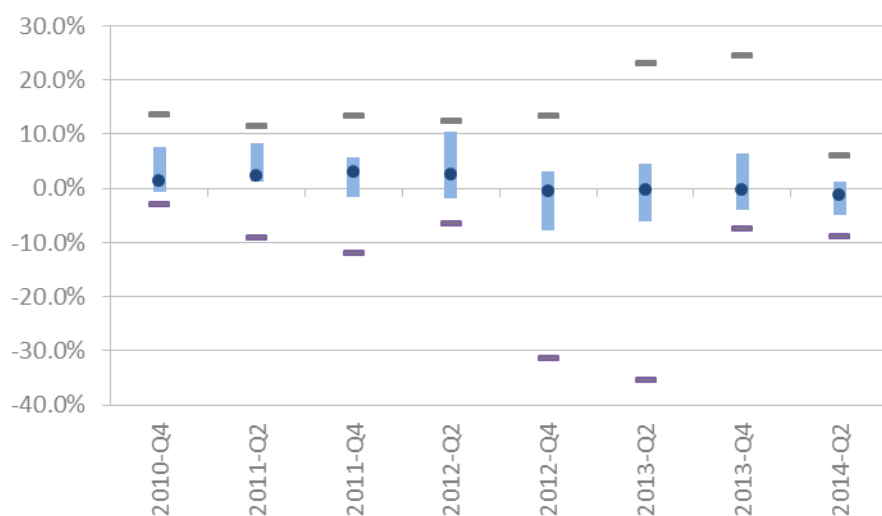*Source: EIOPA (sample based on large insurance groups in EU and Switzerland)*

LIFE AND NON-LIFE INSURERS

Overall premium growth is still driven by emerging markets. This applies to both life and non-life insurance companies. However, euphoria about the significant opportunities in emerging markets would be premature at this stage. There are e.g. a few clouds on the horizon for South Korean life insurers whose life premiums decreased by more than 12%[1] following the tax reforms. In addition, the Central Eastern markets experienced some slowdown in premiums. Moreover, the rating agencies even predict that one-fifth of emerging market companies are most likely downgraded in the near future.[2]

Nevertheless, emerging markets contributed to 6.4% of life premium growth in 2013. Non-life premium growth in these markets is looking even better. Whilst advanced markets are saturated and a low premium growth is not surprising (1.1% in 2013), emerging countries contributed to 8.3% of premium growth during this time. The economic recovery will for sure support premium growth in both advanced and emerging markets. The market for premium growth in emerging markets is not saturated yet. Asian insurers contributed to 28% of

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[1] See 'Swiss Re sigma study on world insurance in 2013 says premium growth slowed largely due to weak life sales in advanced markets', June 2014.
[2] Credit Trends: Global Corporate And Sovereign Rating Actions And Outlook: While The Global Credit Outlook Remains Stable, One-Fifth Of Emerging Market Companies Are Poised For A Downgrade, Oct 13, 2014.

overall premiums in 2013 (South America 4% and Oceania/Africa 3%), compared with 35% in Europe and 30% in North America.[3]

Insurers are now not only beginning to diversify into other countries but also into other business areas such as sickness insurance and long-term care. Some governments also cut the guaranteed interest rate on life insurance savings policies to help insurers meet their inforce guarantee commitments over the longer term. This will also further encourage the development of new products with alternative guarantees. The reduction in guaranteed rates may make traditional life products less attractive to policyholders, reducing the sector's growth prospects on the one hand. On the other hand, this may well accelerate the trend toward developing new products with varying guarantee features in order to offset potentially weaker new business for traditional guaranteed products. This trend of developing new products could create, for life insurers throughout Europe and around the globe, a good potential for further growth.

2.2. Profitability

Profitability in insurance is driven by a combination of investment and underwriting income, in addition to strong management of claims and expenses. In some countries insurers are required by law to allocate a certain share of their investment returns to policyholders. Historically, insurers have allocated a higher share than the regulatory minimum, and competition is likely to lead them to continue doing so in the future. This view is also supported by the fact that some countries increased profit-sharing rules for their policyholders. In some jurisdictions insurers now have to allocate at least 90% of the investment return to their policyholders. Insurers' investment yields hence generate a sufficient and desirable return for their customers.

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The average return on equity (ROE) is at approximately 10% in mid-2014 for the median company (Figure 15). Volatility is relatively low and results have shown relative stability in the last years although the last quarter showed a slight decline in ROE.

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[3] See "European Insurance – Key Facts – August 2014", Insurance Europe.
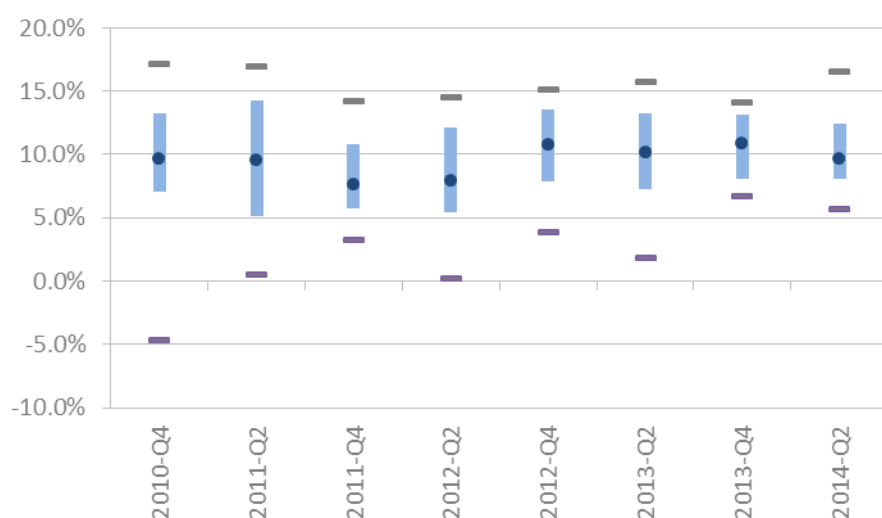
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

Despite persisting low interest rates, the investment return (on average 4.3% for the median company in Q2 2014 compared with 3.9% at year-end 2013 as shown in Figure 16) showed relatively strong results. Due to falling bond yields and ongoing low interest rates these good results should gradually dampen though in the future. This quarter's increase was partly due to write-ups and to life insurers realising reserves to be in a position to make the required allocations to the additional interest provisions.

Figure 16: Return on Investment – Total. Median, interquartile range and 10th and 90th percentile
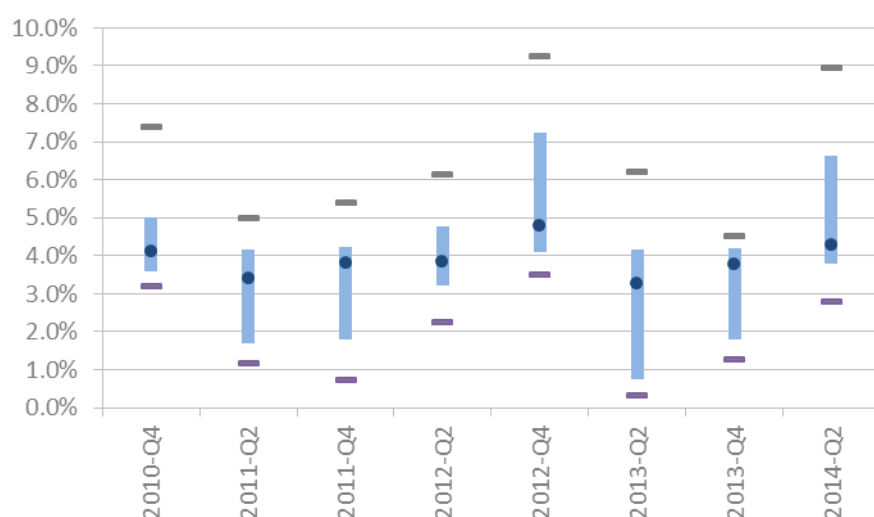
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

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Return on assets (ROA) continues to be stable (Figure 17). Based on our data, the average return on assets is relatively low and close to 0.4% in Q2 2014. However, the ROA seems to be declining for those insurers whose business models depend heavily on interest-rate-sensitive product lines such as traditional long-term savings products with fixed guarantees.

Moreover, many companies in the market have already taken steps to improve their operational efficiency as Solvency II approaches. The scope for supporting earnings levels from future efficiency gains is therefore less pronounced than in recent years. To preserve profit, insurers must further reduce expenses. Expense-reduction gains will be derived from restructuring, process and productivity improvements. Obviously, more streamlined operations and simpler organizational structures are necessary to improve efficiency. Insurers could accomplish this by taking advantage of regional platforms and hub arrangements and implementing shared services.

Figure 17: Return on Assets – Total. Median, interquartile range and 10th and 90th percentile
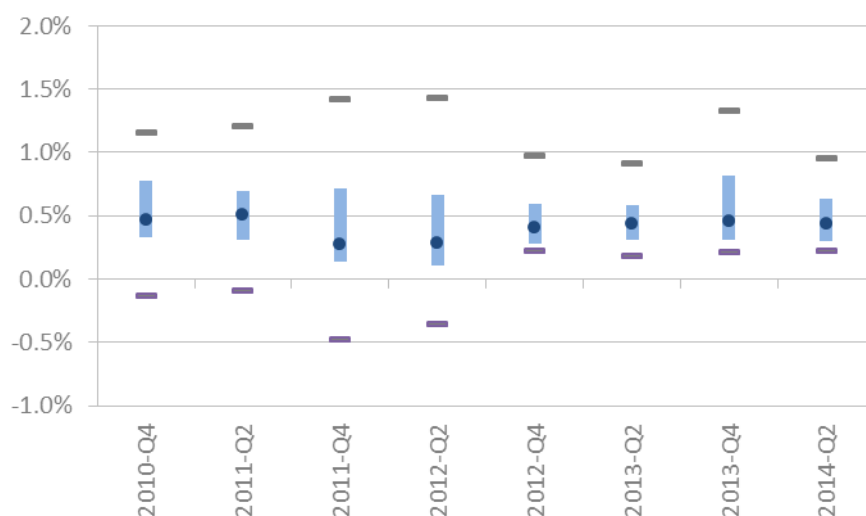
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

Generally, life savings contracts can only be cancelled with the imposition of severe penalties in most countries. Lapse generally refers to termination without a payout to policyholders while surrender generally refers to termination when a cash surrender value is paid to the policyholder. In the last quarter, lapse rates increased a little (Figure 18). At about 5% for the median company in Q2 2014, this rate is still relatively low and unlikely to change drastically in the near term.

Lapse rates are typically low in life insurance contracts due to the long-term nature of the policies.

Figure 18: Lapse rates – Life. Median, interquartile range and 10th and 90th percentile
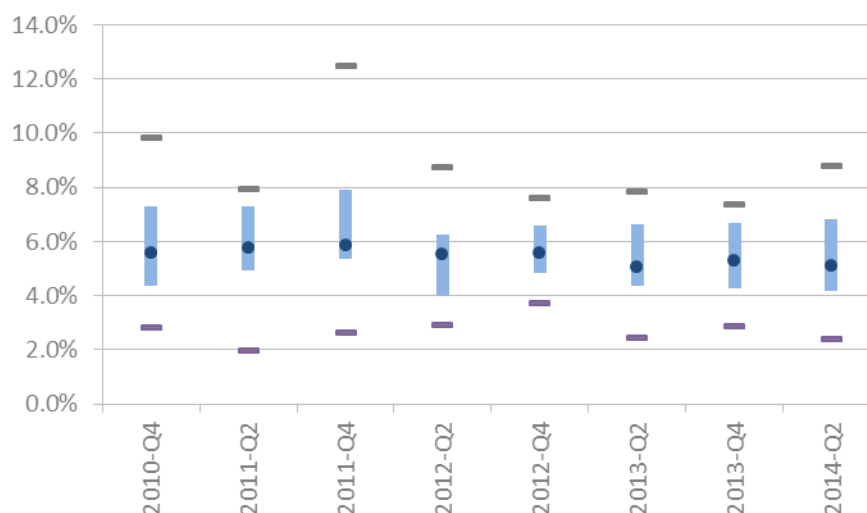
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

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For the median company, the Combined Ratio remains stable (Figure 19). Combined ratios have been below 100% for the last three years. Pressure arises mainly from personal lines, namely motor and property. This intense competition is likely to continue weighing on the results because well-established players face increasing competition from structures set up by e.g. hedge funds in many countries. In addition, personal property insurance seems to be suffering from increased claim frequencies due to the overall dampened economic environment.

Competition and natural catastrophes, and their frequency, will affect the development of the combined ratio in years to come.

Figure 19: Combined Ratio – Non-Life. Median, interquartile range and
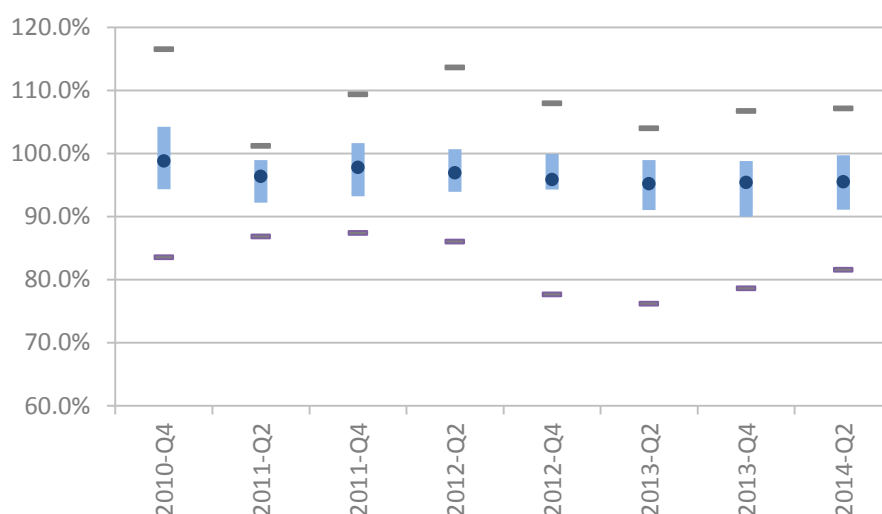
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

2.3 Solvency

The Solvency I ratio for life insurers and non-life insurers dropped slightly. Robust and stable levels of capitalisation are one of the strengths of the insurance market and one of the key characteristics of Solvency I. This capital strength provides the industry with the time to adapt itself to challenges and opportunities. Figure 20 and Figure 21 show the required minimum margin for 2010 to 2014 for life and non-life companies.

The margin for non-life insurers did drop in Q2 2014 to 244.1% (from 264.7% for the median company in the end of 2013). Some results might have looked even worse without significant reserve releases. Life solvency ratio has dropped to 211.9% in Q2 2014 (from 216.3% for the median company in the end of 2013). Life insurers might have had to tap into own funds where income generated was not sufficient to cover the guaranteed policyholders' profit participation share.

However, it should be noted that Solvency I levels in EU could be inflated due to falling interest rates (assets up, liabilities unchanged).

The increased search for yield might put insurers in a position where more capital is needed as Solvency II might led to increased capital requirements for some investments such as infrastructure and securitisation.

Figure 20: Solvency 1 Ratio, Life. Median, interquartile range and 10th and 90th percentile
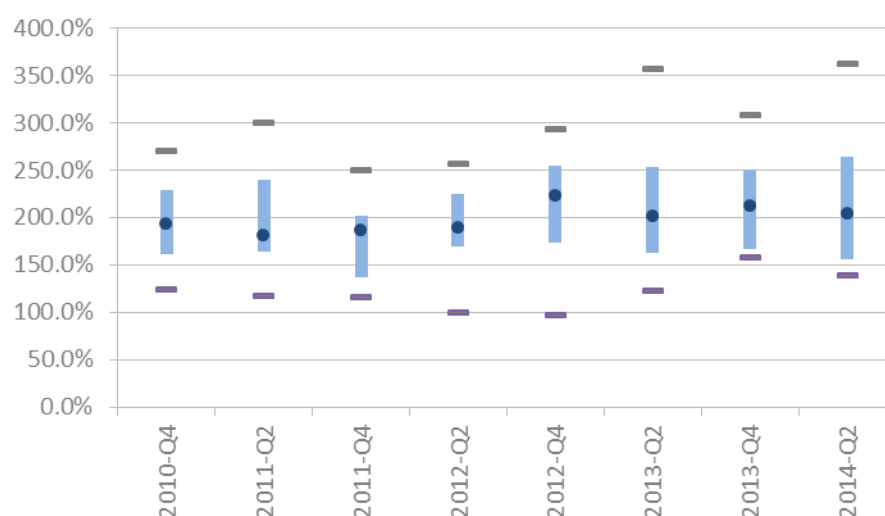
Figure 21: Solvency 1 Ratio, Non-Life. Median, interquartile range and 10th and 90th percentile
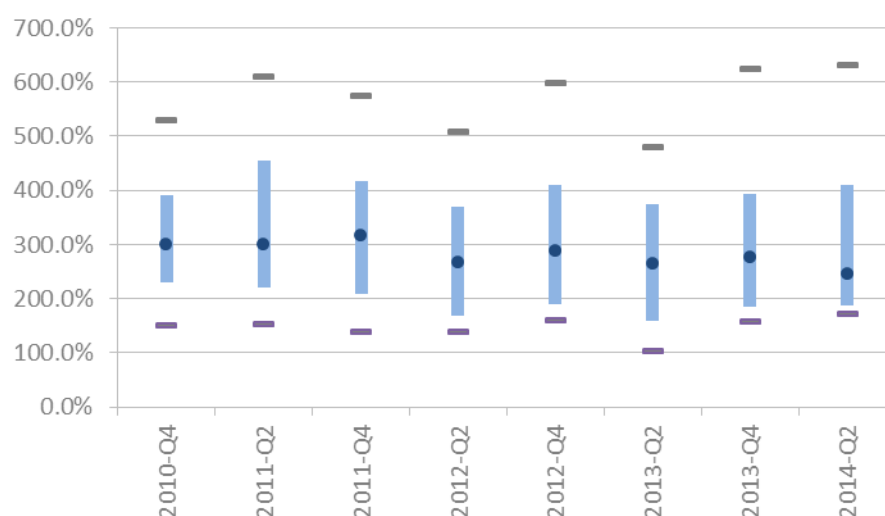
Solvency II will introduce a market-consistent valuation of assets and liabilities which might lead to a better understanding of both the impact of and the sensitivity to capital market developments on the solvency position of insurance companies. The aim of Solvency II is to better capture long-term risks by valuing assets and liabilities transparently, and in a risk-appropriate and market-consistent manner.

EIOPA has been highlighting for some time the potential solvency risks arising from a prolonged period of low interest rates. In 2014 EIOPA carried out a stress test including a 'core module' and a 'low yield module'. The first module focused

on the impact of asset price and insurance specific stresses. The second module tested the effect of the prolonged low interest rate environment. This exercise helped to detect the resilience of the insurance sector to different shocks and identified potential issues that may require further supervisory response (see more discussion in chapter 5).

2.4 Regulatory developments

On the international arena, the International Associations of Insurance Supervisors (IAIS) continues to work on the development of Global Insurance Capital Standards contributing to the overall effort of the G20 to enhance global financial regulation in the aftermath of the financial crisis.

The IAIS announced in October 2014 that it has concluded the development of the Basic Capital Requirements (BCR) for global systemically important insurers (G-SIIs), which has also been endorsed by the Financial Stability Board (FSB). The BCR constitutes the foundation for the upcoming Higher Loss Absorbency (HLA) requirements for G-SIIs. When the ICS is finalized, it will replace the BCR in its role as the foundation for HLA. The IAIS has developed the BCR to apply to all group activities, including non-insurance activities of G-SIIs. The BCR is the first of several steps in the IAIS process to develop group-wide global insurance capital standards. The development of the HLA is due to be completed by the end of 2015. The final element is the development of a more sophisticated risk-based group-wide global insurance capital standard (ICS), which should be finalized by the end of 2016. The ICS will be part of ComFrame which is expected to become applicable to all Internationally Active Insurance Groups (IAIGs) from 2019.

Also in the context of systemic risk regulation with relevance for the insurance sector, the FSB re-issued the 'Key Attributes of Effective Resolution Regimes for Financial Institutions', incorporating new guidance on resolution of Financial Market Infrastructure (FMI), resolution of insurers, client asset protection and information sharing. A public consultation on guidance for the identification of critical functions of systemically important insurers was also started in October 2014.

In Europe, the new Solvency II rules will be applicable starting from 1 January 2016.

Solvency II introduces harmonised solvency rules in the EU. Its aim is to ensure the financial soundness of insurance undertakings thus protecting policyholders and the stability of the financial system. The framework rests on three pillars (quantitative requirements, requirements for governance and risk management as well as for the effective supervision of insurers and disclosure and transparency requirements). Among other elements the new supervisory regime

- looks at all risks (total balance sheet approach),

- introduces risk-based capital requirements,

- strengthens the role of risk management,

- requires more disclosure of information to the public,

- introduces the Supervisory Review Process (SRP) allowing supervisors to identify potential problems earlier, and

- strengthens the role of the group supervisor.

3. The global reinsurance sector

3.1. Market growth

Reinsurer capital continued to increase in Q2 2014. It now accounts for USD 570bn which corresponds to an increase of 6% compared with year-end 2013 and includes both traditional and alternative forms of reinsurance capital[4]. However, Standard & Poor's predicts the market to be growing further, albeit not at the current rates.[5]

Loss activity remained benign in the first nine months of 2014. The overall losses and the insured losses caused by global natural disasters declined further and are below previous year results and average catastrophe losses. In mid-2014 insured losses were USD 22bn (compared with 31bn and 65bn in 2013 and 2012 respectively).[6]

Table 1: The largest natural catastrophes in the first nine months of 2014, ranked by insured losses

Date	Event	Region	Victims	Overall losses USDbn	Insured losses USDbn
6-18.2.2014	Winter damage	Japan	51	5.0	>2.5
8-10.6.2014	Severe storm, hailstorm	Western Europe	6	3.1	2.5
5-8.1.2014	Winter damage	USA	0	2.5	1.7
18-23.5.2014	Severe storm	USA	0	2.0	1.6
27.4-1.5.2014	Severe storm	USA	40	1.7	1.1
2-15.9.2014	Flooding	India/Pakistan	648	18*	
10-16.9.2014	Typhoon Kalmaegi	China/Philippines	31	3*	
10-17.9.2014	Flooding	China	50	1.4*	

*Source: Munich Re, NatCatSERVICE[7]; Note: * refers to economic losses*

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[4] Reinsurance Market Outlook, September 2014, AON Benfield
[5] "A record volume of catastrophe bonds highlights increasing competition in the insurance-linked securities market", July 2014
[6] Reinsurance Market Outlook, September 2014, AON Benfield
[7] http://reliefweb.int/sites/reliefweb.int/files/resources/Munich-Re-Natural-catastrophes-first-half-year-2014.pdf

The first half-year of 2014 was characterised by weather-related events, especially by a harsh winter in Asia and North America. In February 2014 two snowstorms hit Tokyo and central Japan resulting in overall losses of around USD 5bn (and insured losses of more than USD 2.5bn). These snowstorms were the most single severe event in the first half-year. Extremely cold temperatures and heavy snowfalls hit also North America, with a severe negative impact on business, as companies were forced to stop production. The most costly snowstorm occurred in the first week of January causing insured losses of USD 1.7bn and overall losses of USD 2.5bn.

The most single severe event in Europe was a storm front in June that passed over France, Belgium and western Germany. There was heavy damage caused by wind squalls and hailstones. In total the overall losses in the various countries amounted to USD 3.1bn, of which USD 2.5bn was insured.

Further major catastrophes occurred in the third quarter of 2014.[8] In July Super Typhoon Rammasun made separate landfalls in the Philippines and China, causing widespread damage and killing at least 206 people. The overall economic losses amounted to USD 6.5bn, the highest losses, so far, in 2014.

In August once again China was hit by a severe catastrophe, this time by an earthquake in the Yunnan Province. At least 617 people were killed by the magnitude-6.1 earthquake. Overall losses were expected to reach at least USD 6.3bn. A further earthquake struck San Francisco and the Napa Valley in California. The magnitude-6.0 earthquake was the strongest for 25 years. Total overall losses were estimated in excess of USD 2.0bn. In particular the hurricane season was very benign this year.

3.2. Profitability

For the time being the sector continued to post strong underwriting results. Due to low catastrophe losses, the overall combined ratio remained at about 85% (compared with a 90.7% five year average). ROE showed a strong 12% return in 2013 (compared with a 10.2% five-year average) which is expected to slightly decline.[9]

Compared to the increased reinsurance capacity, reinsurance demand remains flat. As a long-term trend direct insurers tend to raise retention as they increasingly focus on risk management.

Thus, overall, the reinsurance market saw modestly softening rates in 2014. Along with rate reductions also the terms and conditions for reinsurance

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[8] See AON Benfield: July, August 2014 Global Catastrophe Recap
[9] See "Tough competition could put ratings on global reinsurers under pressure", S&P Ratings Direct, August 2014

placements improved, e.g. expanded hours clause, broadened terrorism coverage, improved reinstatement provisions.[10]

Altogether, there is an expectation that the supply of reinsurance capacity will continue to exceed the demand of insurers for the upcoming January 2015 renewals in most global regions. This will result in a continuing decreasing reinsurance price level. For this reason reinsurers' profitability will remain under pressure, because underwriting results need to be improved in order to compensate increasingly low investment returns and lower re-investment rates due to the ongoing challenging economic environment. Moreover, the ability to release reserves from previous years appears to have been diminished. Standard & Poor's also predicts that this will continue to be the case from 2014 to 2016. [11] To avoid a deteriorating profitability getting risk-adequate prices at the January 2015 renewals is crucial for the reinsurance companies.

3.3. Solvency

Capital continues to be high. The capital itself reached a new all time high of USD 570bn in Q2 2014 (USD 540bn in 2013), because of below average catastrophe losses, unrealised investment gains and a continued influx of capital.[12] Reinsurance supply remains higher than demand in all global regions. The reinsurance market does not only suffer from high competition due to the capital-inflow from non-traditional sources. Reinsurers have mostly benefited from access to capital markets via sidecars, contingent capital and other means of financing.

3.4. Insurance-Linked Securities

A record volume of catastrophe bonds was reached by Q2 2014 as investors are keen to diversify their risks. Cat bond issuance for the first three quarters of 2014 exceeded the prior year period by almost 15% reflecting the increasing investors' appetite for this sector.

The prolonged relative benign catastrophe activity had a further dampening effect on the rates, especially regarding the catastrophe business. However, the most depressing effect on the rates in 2014 had the further enhanced capital-inflow into the reinsurance market from non-traditional sources leading to the lowest cost of underwriting capital in a generation.[13]

Capital market investors, as hedge funds and pension funds, are increasingly involved in the reinsurance sector through non-equity participations. According to Aon Benfield this alternative capital-inflow into the reinsurance market

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[10] See AON Benfield: Reinsurance Market Outlook September 2014, page 9.
[11] Standard & Poor's, Tough competition could put ratings on global reinsurers under pressure, August 2014
[12] AON Benfield: Reinsurance Market Outlook September 2014, page 4.
[13] AON Benfield: Reinsurance Market Outlook September 2014

totalled USD 58.6bn by the end of August 2014, mainly because of collateralized reinsurance transactions and outstanding insurance-linked securities (ILS). According to Artemis the total outstanding ILS amounted to unprecedented USD 22.9bn by the end of September[14] whilst AON Benfield's estimation is at USD 22.4bn a bit lower[15]. AON Benfield Securities and others also predict e.g. a continued expansion of the ILS market but at a more moderate rate. The absolute volumes, though sharply increasing, remain modest.

The large amount of alternative capital in the reinsurance market is increasing competition and reducing the risk spreads for cat bonds which, despite attracting new capital, are gradually deteriorating the performance of the ILS portfolio[16]. This is leading to price reductions, a broadening of terms and conditions on the cat bond side and a general trend to cost cuts for public placements[17]. The increased issuance of e.g. catastrophe bonds also creates links between reinsurers and financial markets. It may also result in some degree of opaqueness where it is not entirely clear who holds the risk. This makes the reinsurance market vulnerable to investors' procyclical behaviour as well. For instance, the ongoing search for yield in the current environment attracts investors in catastrophe bonds, which in turn drives down the price of risks (even though the risk itself has not changed).

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

Furthermore, the investor's acceptance of indemnity-based triggers has increased and along with that the spreads have tightened between indemnity and other trigger types. This will raise the attractiveness of ILS further for both new and repeat sponsors, which are expected to issue into the ILS market not only for diversification and complement of overall reinsurance purchases but also due to the alternative market's competitive pricing and broadening indemnity coverage.[18]

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[14] http://www.artemis.bm/dashboard
[15] AON Benfield: Insurance-Linked Securities, September 2014
[16] Munich Re: Insurance-Linked Securities (ILS) Market update Q2 2014,
[17] S&P Ratings Direct, "A record volume of catastrophe bonds highlights increasing competition in the insurance-linked securities market", July 2014
[18] See Guy Carpenter: Capital Markets Report September 2014

4. The European pension fund sector

The European occupational pension fund sector has continued to face a challenging macroeconomic environment with the low interest rate environment exerting downward pressure on returns. Total assets increased, albeit at a slower pace than before, largely due to favourable equity returns in developed markets. Investment allocation across the sector remained broadly unchanged for another year. Low interest rates and other risks related to the IORP business (such as longevity) make traditional defined benefit (DB) plans less affordable for employers.

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 (26% in 2013). In order to increase available options, in some countries new types of hybrid (HY) schemes have emerged. HY schemes combine elements of both DB and DC types.

4.1. Market growth

Total assets by occupational pension funds increased by 6% in 2013 following growth of 13% in 2012 (Figure 22).[19] Two countries, the UK and the Netherlands, still account for most of the European occupational pensions sector (87.8% per cent of the total assets, see Table 2). Differences across countries are generally driven by the relative share of private and public provision of pensions.

Table 2: Total assets per country as a percentage of total assets reported (2013)

UK	NL	DE	IT	IE	ES	NO	BE	AT	SE	PT
58.31%	27.37%	5.00%	2.67%	2.37%	0.95%	0.83%	0.57%	0.49%	0.46%	0.40%
DK	**LI**	**FI**	**SI**	**SK**	**LU**	**PL**	**LV**	**HR**	**BG**	**Total**
0.20%	0.12%	0.11%	0.05%	0.04%	0.03%	0.014%	0.007%	0.003%	0.0001%	100.00%

Source: EIOPA
Note: UK figure for 2013 is based on EIOPA estimates. The UK figure relates to the whole pension sector (DB, DC and HY schemes).

The penetration rate of the occupational pension fund sector remained relatively stable in 2013. 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 23). In 2013 the unweighted average of the penetration rate across the countries of the sample increased by 2% to 24% compared to 2012. Differences in the presence and importance of IORPs across the European countries are significant.

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[19] Figures are not directly comparable with previous reports as DC schemes from the UK were not previously included.

Figure 22: Total Assets (in volumes; EUR bn, rates in %)
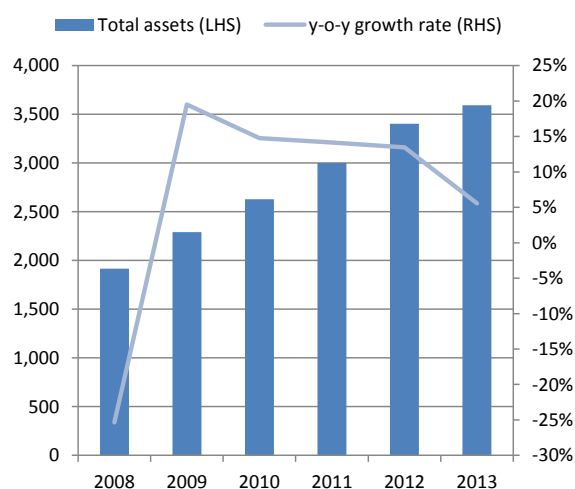
Source: EIOPA
Note: UK figure for 2013 is based on EIOPA estimate. In comparison with the previous reports, the figures for the UK refer to the whole pension sector (DB, DC and HY) for all years.

Figure 23: Penetration rates (total assets as % of GDP)
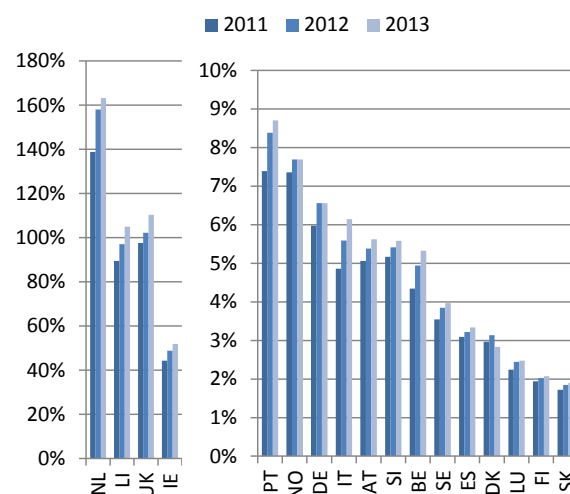
Source: EIOPA
Note: UK figure for 2013 is based on EIOPA estimate. In comparison with the previous report, the figures for the UK refer to the whole pension sector (DB, DC and HY) for all years. Rates for LV, HR, PL and BG are lower than 1%

4.2 Performance

Debt and fixed income securities account for the highest share in the portfolio investment allocation of pension funds (Figure 24). The total exposure to sovereign, financial and other bonds added up to 44.5 per cent in 2013. Due to the long-term horizon of pension funds, equity generally represents a much higher share of investments in the pension fund sector than in the insurance sector (approximately 32 per cent for 2013).

In recent years in the UK, there has been a shift in DB asset allocation away from equities in favour of fixed income investments, although this trend appears to be slowing down. This shift, in part reflected the growing maturity of DB schemes and therefore the desire to reduce deficit volatility. In the Netherlands, changes in the asset mix were relatively small with allocations to fixed income securities increasing and to equities and real estate slightly decreasing. In Spain, there was an increase in the exposure to Spanish public debt due to the favourable yields. Finally, exposures to corporates in Germany and exposures to equity in Italy slightly increased over the course of 2013.

Figure 24: Investment allocation (in %)

Legend:
- Other assets
- Real estate investments
- UCITS
- Equity and other variable-yield securities (excluding UCITS)
- Debt and other fixed income securities

	2011	2012	2013
Other assets	15.50%	13.55%	14.19%
Real estate investments	5.93%	5.86%	5.59%
UCITS	4.31%	3.91%	4.01%
Equity and other variable-yield securities	32.98%	32.26%	31.74%
Debt and other fixed income securities	41.28%	44.42%	44.47%
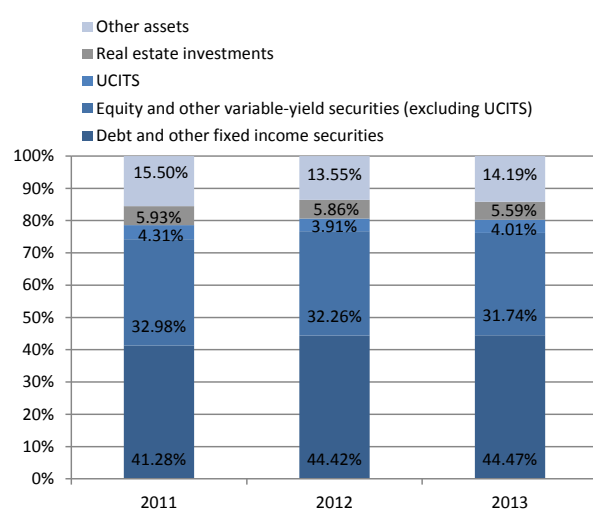
Source: EIOPA
Note: UK relates only to DB and HY; UCITS stands for Units in undertakings for collective investments in transferable securities.

Figure 25: Investment allocation (in %) for debt and other fixed income securities

Legend:
- Sovereign
- Financial
- Other/Unallocatted

	2011	2012	2013
Other/Unallocatted	16.96%	18.71%	15.74%
Financial	27.09%	25.93%	24.35%
Sovereign	55.95%	55.36%	59.91%

Source: EIOPA
Note: UK relates only to DB and HY. Figure 25 is based on information sent by 12 out of 21 countries where the debt breakdown is available. Debt and fixed income securities used in this chart represent 96.2% of the total debt owned by IORPs across Europe

***Investment returns of pension funds were positive, largely due to the increase in equity prices in developed markets.*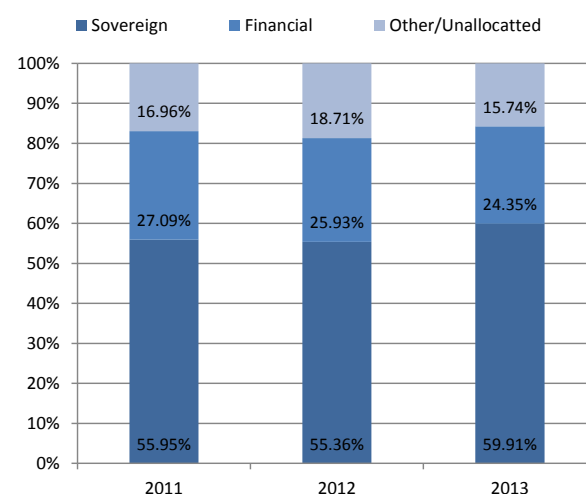** The average ROA in 2013 (unweighted 5%, weighted 2.5%) was lower compared to 2012 (unweighted 8.1%, weighted 5.4%)[20], see Figure 26.[21]

The current low yield environment continues to exert downward pressure on funding ratios. Average cover ratio marginally increased in 2013 to 110.4% (was 108% in in 2012) (Figure 27).[22] This indicator is defined as net assets covering technical provisions divided by technical provisions for each country. Countries where the sector is purely DC have cover ratios of 100%. These countries are not depicted in the chart and are not included in the calculation of the average.

Moreover, due to different calculation methods and legislation in the countries concerned, the reported cover ratios are not directly comparable. In order to calculate cover ratios countries use different methods of discounting. Hence, there is no international comparison possible.

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[20] Both the unweighted and weighted average relates to the countries of Table 1. The weighting is based on total assets.
[21] UK data covering DB, DC and HY was employed for the calculation of ROA.
[22] Note that due to different calculation methods and legislation, the reported cover ratios are not fully comparable across jurisdictions.
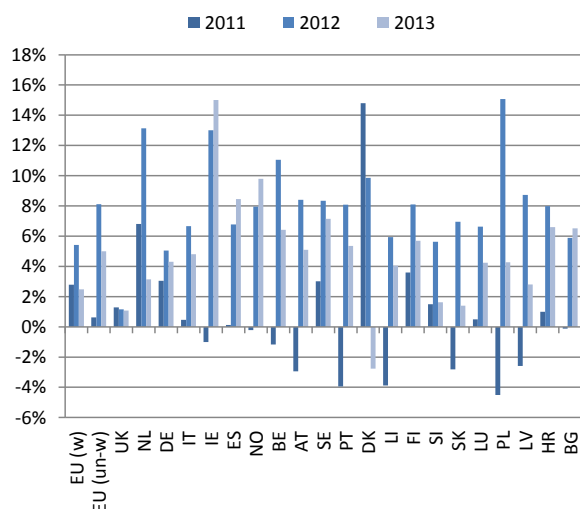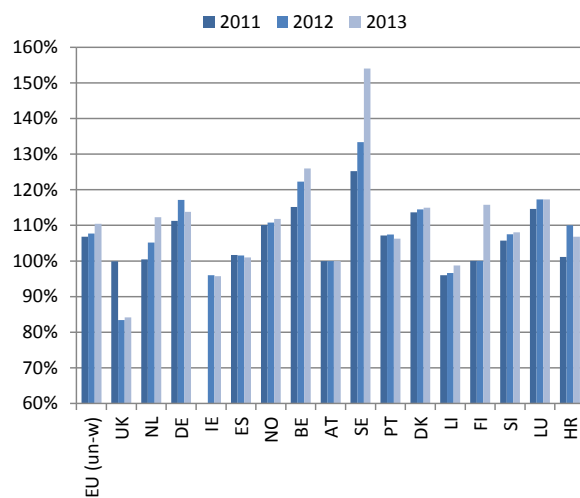
Source: EIOPA

Source: EIOPA

Overall active membership slightly increased in 2013 by 2.5% and the number of IORPs kept on decreasing in Europe by a further 5% (Figures 28 and 29). Many countries reported a declining number of occupational pension funds. In several countries obligations of pension funds have been transferred to insurance companies or consolidated with other pension funds. Overall, this process increases the average membership in individual schemes.[23]

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[23] In the UK, since October 2012 UK employers have a duty to automatically enrol certain staff into qualifying pension schemes. The process has been staged by employer size, with the largest employers being first subject to the automatic enrolment duties. All employers will be subject to the duties by 2018. It is anticipated that automatic enrolment will increase occupational pension's participation in the UK by between 6 to 9 million members. The Pensions Regulator confirms that nearly 5 million workers had been automatically enrolled into pension schemes since October 2012.

Figure 28: Active members
(in thousands)
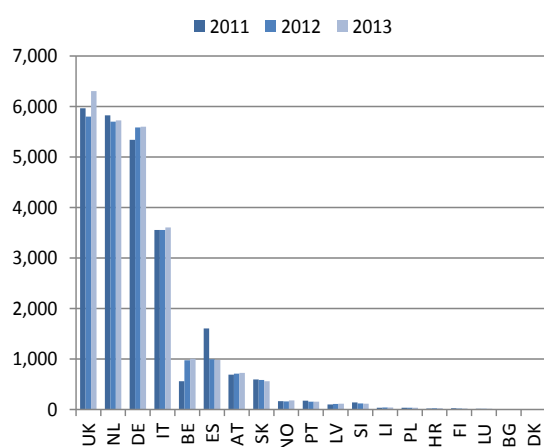
Source: EIOPA

Figure 29: Number of IORPs in Europe

Source: EIOPA
Note: UK and IE are not included in the chart

5. Risk assessment

This chapter assesses the risks that were identified in the first chapter and elaborated in the earlier chapters of this report.

5.1. Qualitative risk assessment

Qualitative risk assessment is an important part of the overall financial stability framework. EIOPA conducts regular bottom-up surveys among national supervisors to rank the key risks to financial stability for the insurance, as well as for the occupational pension sector. This chapter summarizes the main findings revealed from the survey.

Figure 30: Risk assessment for the insurance sector
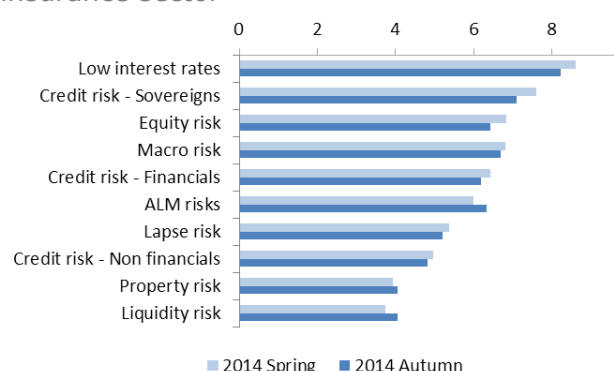
Figure 31: Risk assessment for the pension funds sector
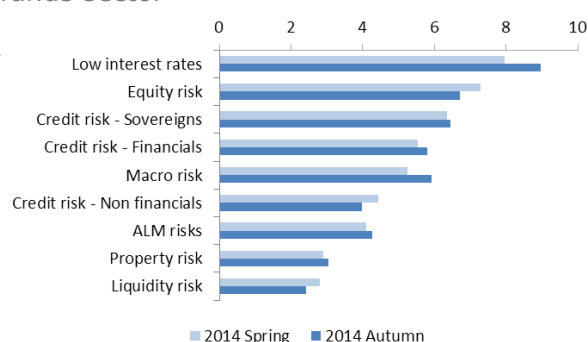
Source: EIOPA
Note: Risks are ranked according to probability of materialisation (from 1 indicating low probability to 4 indicating high probability) and the impact (1 indicating low impact and 4 indicating high impact). The figure shows the aggregation (i.e. probability times impact) of the average scores assigned to each risk.

Figure 32: Supervisory risk assessment for insurance and pension funds – expected future development
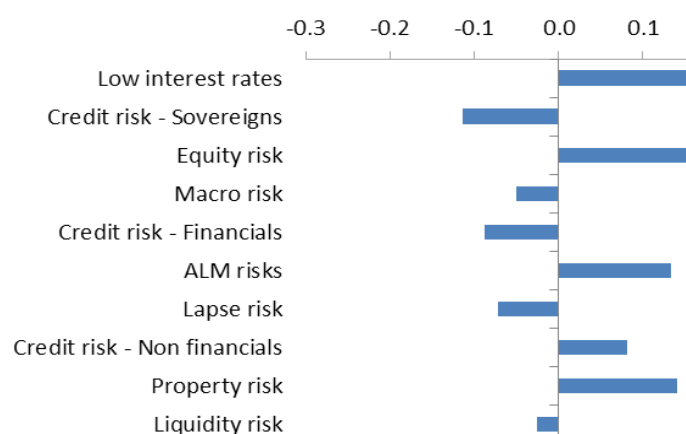
Source: EIOPA
Note: EIOPA members indicated their expectation for the future development of these risks. Scores were provided in the range -2 indicating considerable decrease and vice versa

Since the previous publication in spring 2014, this survey summarises the fragile nature of the macro environment. In particular, the pension sector sees a further increase in the macro risk environment as a number of issues, including high indebtedness, geopolitical risks and the low interest rate environment persist.

Indeed, the risk from the low interest rate environment continues to be the major risk factor, both for insurance and pension companies alike (Figure 33). The longevity growth is, without doubt, one of the main factors that contribute to this challenge. At the same time, the challenging economic and financial environment prompts some portfolio shifts in pension funds' and insurers' investment policies towards corporate bonds and some new asset classes. This should contribute overall to a more diversified investment policy and reduce the sometimes excessive concentration of investments in sovereign and bank bonds. In addition, the latter development seems to reflect both a search to enhance yields and a desire for diversification.

Figure 33: Guaranteed interest rate in life insurance vs. investment return, Euro area 10-year government bond
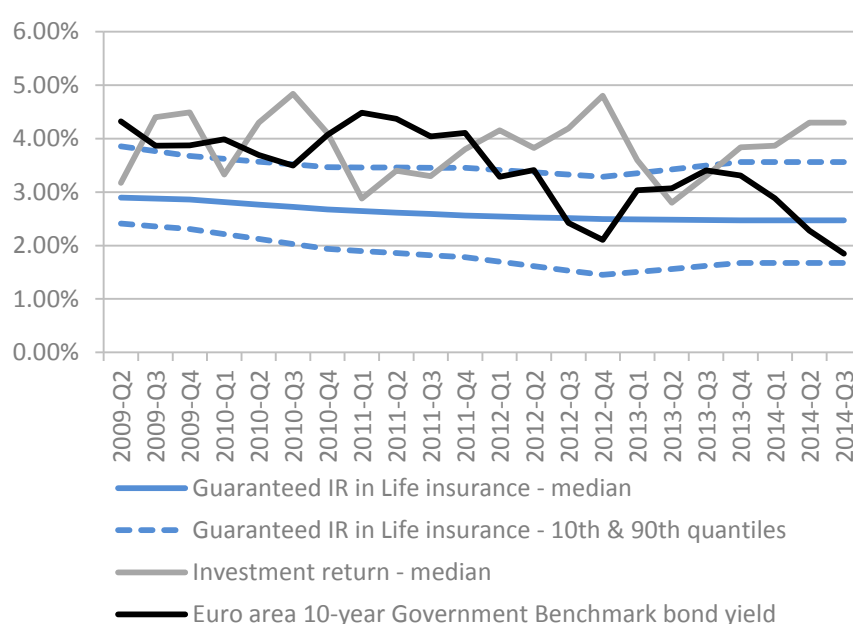
Source: EIOPA (sample based on 30 large insurance groups in EU and Switzerland) and ECB
Note: The figures represent annual guaranteed rates for businesses where such guarantees are applied

In a low yield environment the impact of the duration mismatch also needs to be considered. Life insurance companies typically operate with a duration mismatch, as the duration of the liabilities is usually greater than the duration of assets. Figure 34 shows the duration of the bond portfolio which has been increasing over the last year. This duration gap can pose a risk to

companies. In a low yield environment, the risk of reinvestment is especially high for insurers offering high guaranteed rates.

Figure 34: Duration of bond portfolio
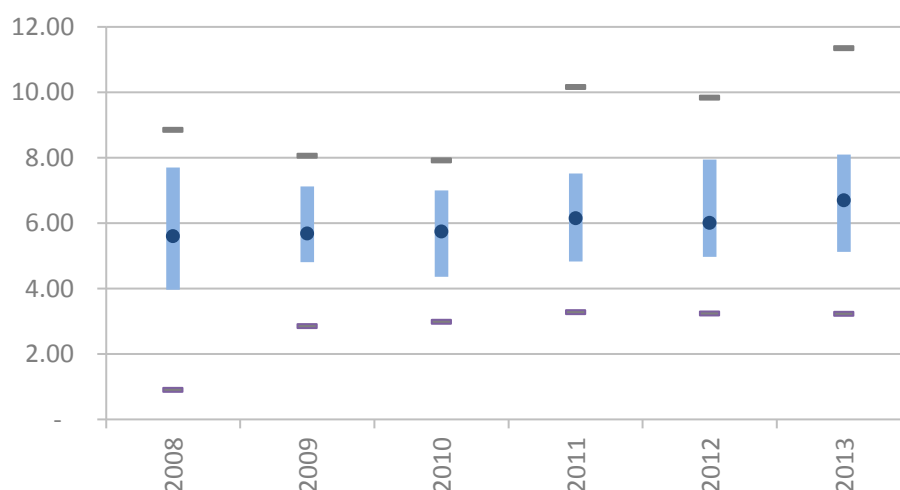
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

Figure 35: Life – Duration of bond portfolio (including derivatives) to duration of technical provisions
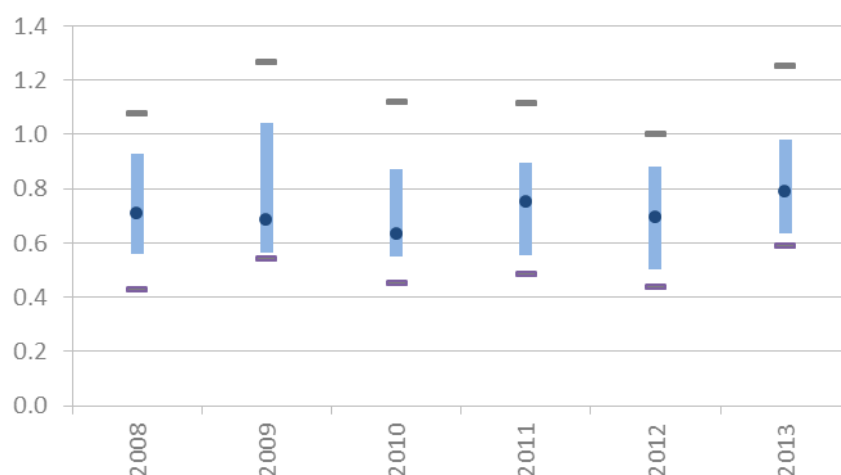
Source: EIOPA (sample based on large insurance groups in EU and Switzerland)

The survey also points at increasing concerns over equity markets. Risks relating to equity markets remain elevated and equity markets might come under pressure.

Figure 36: Average composition of the investment portfolio at the end of 2013

Insurance sector

Pension fund sector
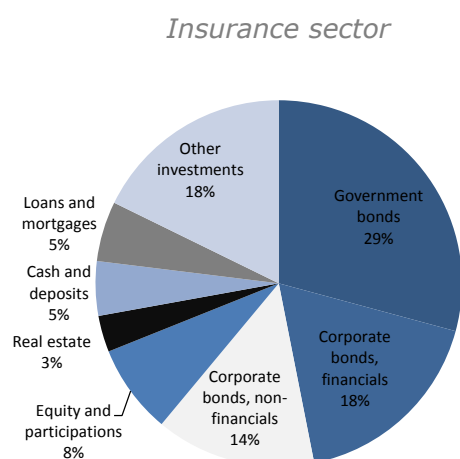
Source: EIOPA
Note: Estimation based on a sample of 32 large
insurers
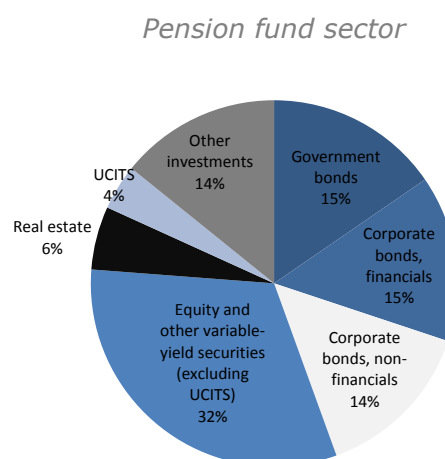
Source: EIOPA
Note: Undertakings for Collective Investment in
Transferable Securities Directives (UCITS)

5.2. Quantitative risk assessment

The key risks identified in the previous chapters are assessed in more detail in the following sections as part of a quantitative financial stability framework EIOPA is developing for the insurance sector. First, growth in written premiums – a key insurance variable – is projected (Figure 37). Second, the scale and the drivers behind the expansion of insurers in emerging markets are tested empirically. Finally, using embedded value reports published by large European insurers, the sensitivity of the sector to changes in interest rates and market prices is explored.

Market growth for both life and non-life insurers is expected to be positive in 2016. The latest EIOPA estimates suggest positive development in growth for non-life insurance benefiting from compulsory business lines and a potential economic recovery. Contrary, life insurance will be further negatively affected by the persistently high level of unemployment and is projected to recover in 2016 only.

Figure 37: GWP projection for the Eurozone
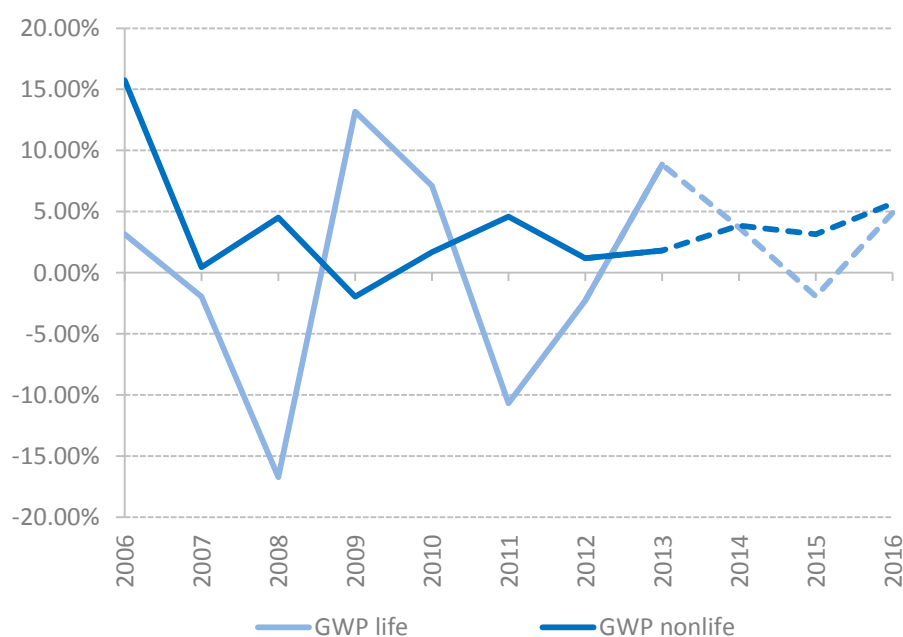
Source: EIOPA and ECB Survey of Professional Forecasters (SPF)
Note: Data corresponds to aggregates for the Eurozone, dashed lines represent the EIOPA projection using macro scenario based on ECB SPF.

Insurance companies continue to expand outside their national boundaries for new growth opportunities (Figure 38). The persistent low yield environment and the fragile economic development in Europe pressure insurers to look for new growth opportunities, in particular in emerging markets. The analysis suggests that firms are expanding into new markets when

significantly higher economic growth abroad compared to domestic prevails. The latest EIOPA projection employing the IMF's World Economic Outlook suggests a further increase in the share of premiums underwritten abroad. Insurers' cross-border activities will be further raised with increasing economic development and living standards in emerging markets.

Figure 38: Share of GWP abroad
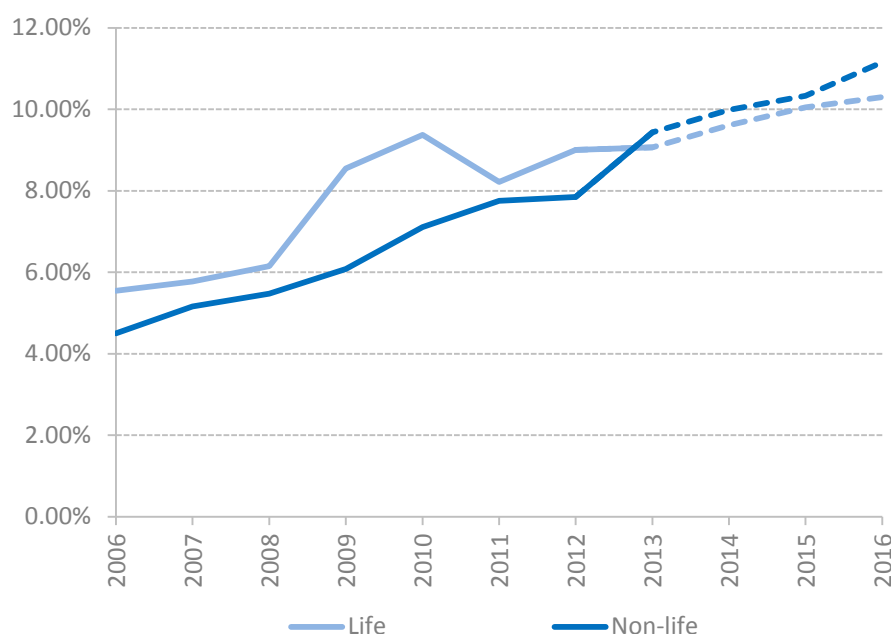
Source: EIOPA
Note: Data corresponds to aggregates for EU/EEA countries, dashed lines represent the EIOPA projection using a macro scenario based on the IMF World Economic Outlook, October 2014.

Embedded value reports suggest that most insurers are vulnerable to equity price shocks, while sensitivity to reduced interest rates varies. The embedded value reports published by several large European insurers cover sensitivities changes in interest rates and market prices. Figure 39 points out to two main groups of insurance companies. The first group is highly sensitive to interest rate changes, possibly due to relatively rigid guarantees in the current portfolio. The second group, on the other hand, is largely insensitive to interest rates developments, but is on average equally sensitive to declines in market prices.

Figure 39: Embedded value sensitivities to interest rate and property price changes in 2013
(x-axis: change in embedded value in % after interest rate drop,
y-axis: change in embedded value in % after equity/property price drop)
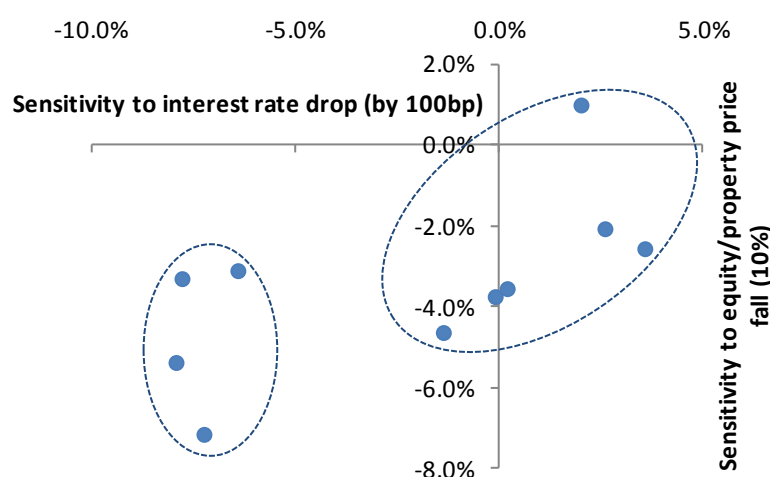
Source: Embedded value reports by a set of European insurers and EIOPA calculations. Both market consistent embedded value reports and European embedded value reports are included.

Sensitivity of insurance companies to interest rate changes seems to decrease gradually over time. The latest publicly available data confirmed a decreasing sensitivity to interest rate risk between 2012 and 2013. This development corresponds with lower average guarantees in the European life insurance sector. However, the situation is heterogeneous among insurers and for some of them the impact of a further fall in interest rates could be very disruptive (see Figure 40).

Figure 40: Aggregated embedded value sensitivities to interest rate and equity/property shocks between 2008 and 2013.
(weighted average by embedded value)
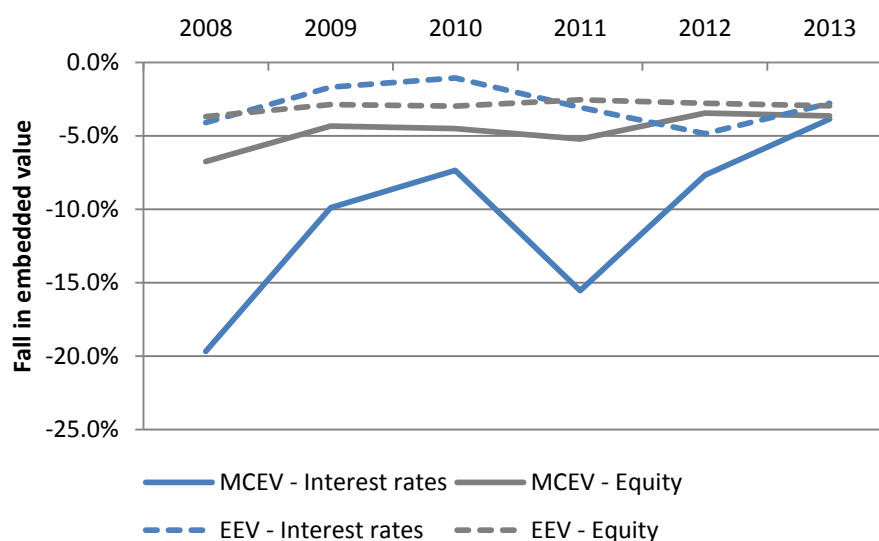
Source: Embedded value reports by a set of European insurers and EIOPA calculations. Both market consistent embedded value reports and European embedded value reports are included. Assumed interest rate drop is 100bp and assumed equity price fall is 10%.
Note: Negative sensitivity implies a decline in embedded value.

EIOPA insurance stress test 2014 evaluated the key risks and vulnerabilities for the European insurance sector. It confirmed the relevance of various risks discussed in this report. A severe reversal in markets would have a significant impact on the capitalisation of the sector. Moreover, a majority of participants stated (according to a qualitative questionnaire) that a need for immediate restructuring was seen after considering the impact of one of the market stress scenarios, which can be regarded as the main source of contagion. This restructuring would be attained through an increase of capital, a change of the investment portfolio and other measures. In addition, the structural analysis of insurers reveals duration and interest rate risk mismatches across several jurisdictions. All in all, these main findings may help to strengthen the supervision practices and lead to better risk management.

5.3. Conclusion

In order to ensure a sufficient capital position that can withstand adverse market scenarios and addresses identified weaknesses, insurers need to be in a position to maintain appropriate levels of capitalisation. A potential risk premia reassessment would have a significant impact on the capitalisation of the insurance sector via a decrease of the assets values. Furthermore, insurance companies continue to be negatively affected by the low yield environment. Embedded value reports reveal that the impact of a further fall in interest rates could be very disruptive. A challenging macroeconomic environment has a negative effect on growth in written premiums which are projected to be positive for both life and non-life insurers in 2016 only. In addition, insurance companies continue to expand outside their national boundaries to compensate for limited growth prospects in domestic markets. These opportunities will be further raised with increasing economic development and living standards in these markets.

PART II

How to Measure Interconnectedness?

Jean-Cyprien Héam[24]

Abstract

Interconnectedness is considered as a key component to systemic risk supervision. However, there is little guidance on its measurement. Using a unique dataset of bilateral exposures between 21 French financial institutions, we analyse and compare several strategies to measure interconnectedness. We show that these measures tackle interconnectedness from different vantage points: substitutability, integration, core-periphery, systemic importance and systemic fragility. Without promoting one strategy as a panacea to measure interconnectedness, we provide insights on the pros and cons of each measure.

1. Introduction

The latest financial crisis with the defaults of AIG, Lehman Brothers or Bear Stearns has highlighted the risk of contagion through financial institutions' interconnections. Consequently, interconnectedness is a significant concern for supervisory and regulatory authorities. In particular, the Financial Stability Board [see FSB (2009)] uses three criteria –size, substitutability and interconnected-ness to identify Systematically Important Financial Institutions (SIFIs). Qualifying a financial institution as SIFI may lead to requirements in terms of additional loss absorption requirements. Interconnectedness is defined as 'linkages with other components of the system' and in case of banking groups and insurance groups as well, it is mainly measured by 'intra-financial system assets and liabilities' [see IAIS (2013), BCBS (2011)]. Although very convenient, this measurement of interconnectedness can be upgraded to account for contagion risks. Several academics or researchers in supervisory authorities have proposed alternative strategies. From a policy perspective, the outcome is a large set of measures potentially inconsistent between themselves.

The objective of our paper is to propose guidelines to understand and assess the features of three main strategies to measure interconnectedness. Actually, we show that these measures assess different aspects of interconnectedness. Therefore, we do not advocate using one ultimate measure but rather propose to

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pick up measures according to policy concerns. To illustrate the different measures, we use a unique dataset of bilateral exposures between 21 French financial institutions.

The remainder of the paper is organized as follows. Section 2 presents briefly the data set. In Section 3 we analyse risk indicators. Section 4 proposes a way to compare interconnectedness of two financial institutions. In Section 5 we discuss the results of identifying a core-periphery structure, as well as topological indicators. In Section 6 we derive interconnectedness measure from outcome of contagion stress-test. Section 7 concludes by providing general guidelines on interconnectedness measure from a supervisory perspective.

2. Dataset

The perimeter is shaped by 21 large French financial institutions combining 4 pure banks, 11 pure insurers and 6 financial conglomerates[25], representing at least 85% of the French financial sector. In terms of size, the 6 conglomerates represent about half of the sector while pure banks and pure insurers account for about a quarter each. Combining large exposure reports for banks and security-by-security reports for insurers, we gather all exposures between the 21 financial institutions distinguishing bonds from shares, as at 31/12/2011. In large exposures reports, banking groups provide all their exposures above EUR 300mn or 10% of their equity. All French insurers fill security-by-security reports. The bond category gathers all types of debt securities (secured/unsecured, subordinated…) and loans. The share category encompasses all equity securities (traded shares, capital investment…). Our final dataset is composed of three exposure matrices: one for shares, one for loans and one for total exposures. Table A1.1 represents the network of total exposures between the 21 institutions.

The institutions report a total of EUR 227bn of which about 90% is composed of debt securities. There are 261 nonzero bilateral exposures (over 420 possible links) leading to a density of 62%. The distribution of exposures is very specific. First, 38% of potential exposures are zero. Second, among the 62% exposures that are non-zero, there is a large mass of very small exposures, even if there are few large exposures. With round numbers, half of exposures are lower than EUR 250mn, and only a quarter of them are higher than EUR 800mn.

To describe more accurately the allocation of exposures between the institutions, we report two indicators distinguishing the nature (conglomerate or pure bank or pure insurer) of the counterpart. First, we present the local density which is the

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[25] We have a continental European point of view that contrasts with an Anglo-Saxon vocabulary. In this paper, a financial conglomerate has banking activities (collecting deposit, granting loans, investment…) and insurance activities. Our perspective is in line with the European Directive 2002/87/EC.

fraction of non-zero bilateral exposure between specific types of institutions. At one extreme, conglomerates form an almost complete network with 97% of potential links. On the contrary, pure banks report almost no exposures to pure insurers. Pure insurers seem to have a funding role in the network since they are exposed to almost all conglomerates and pure banks whereas few pure banks or conglomerates are exposed to them. This feature can be explained by the nature of insurance activity with respect to the banking activity as well as a diversification motive.

Table A1.1: Local density (proportion of non-zero exposures) according to institution type

	Exposures	on		
		Conglomerates	Pure Banks	Pure Insurance
from	Conglomerates	97%	92%	51%
	Pure Banks	70%	33%	7%
	Pure Insurance	91%	80%	52%

Example: the ratio of non-zero bilateral exposures between conglomerates over all potential exposures between conglomerates is 97%. The ratio of non-zero bilateral exposure of conglomerate to pure bank is 92%.

Second, we adopt a quantitative perspective and report the proportion of exposures between groups of institutions (over the total of EUR 227bn) in Table A1.2. First, about half of the exposures are between conglomerates. Second, exposures of pure insurers to conglomerates account for about 20%. Then, exposures of conglomerates to pure banks and to pure insurers represent about 10% each of the total volume.

Table A1.2: Breakdown of volume exposures according to institution type

	Exposures	on		
		Conglomerates	Pure Banks	Pure Insurances
from	Conglomerates	47.7%	9.8%	8.2%
	Pure Banks	4.7%	0.4%	0.1%
	Pure Insurance	20.8%	6.0%	2.3%

Example: 47.7% of the total volume of exposures concern exposures between conglomerates. 20.8% of the total volume of exposures are reported by insurers on conglomerates.

These first summary statistics draw four stylized facts. First, the exposures are modest: about one third of potential exposure are zeros and on the two last third most exposures are small. However, large exposures are not absent. Second, the conglomerates appear to be the most important players in terms of number of links and in terms of volume. Third, pure insurers are mostly net fund providers to other institutions, in particular of conglomerates. This behaviour is

in line with basic economic arguments. Fourth, debt instruments are the most common instruments of exposures.

3. Summary risk statistics

Representing exposure in volume, *i.e.* in bn Euros, may be misleading since size effect may blur the picture. Actually, an exposure represents a credit risk for the owner and a funding risk for the issuer. Since the sizes of the owner and of the issuer can differ, we need to derive two risk metrics that take control for their respective sizes. For simplicity, we build a credit risk matrix by dividing exposures by the equity of the owner and we build a funding risk matrix by dividing exposures by the equity of the issuer. Considering basic descriptive statistics of the lines of these matrices provide us with interconnectedness measures. We call them *summary risk statistics*.

Figure A1.1: Network of French financial institution (all instruments)
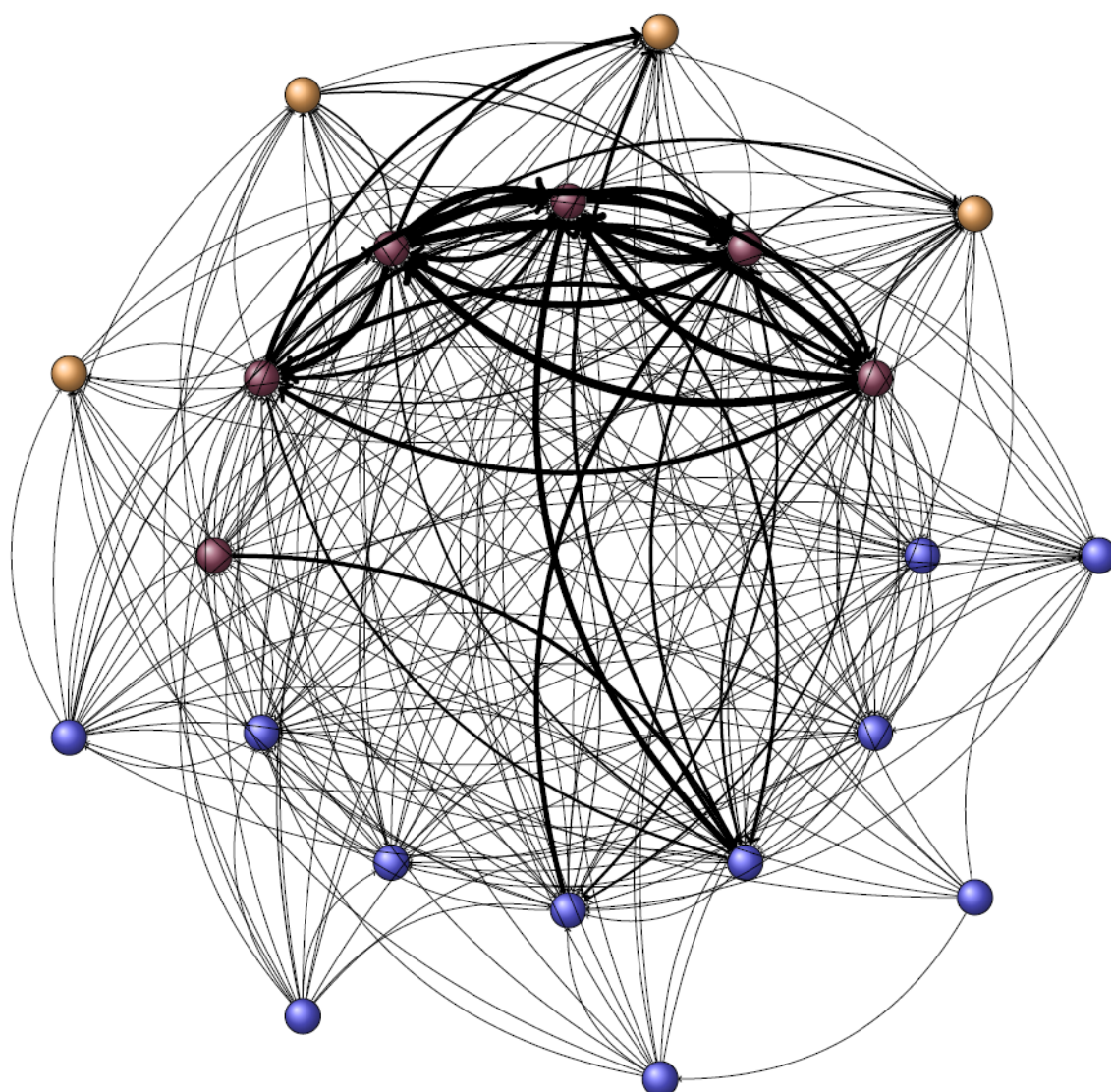
Note: Node colour indicates legal status (red for conglomerates, blue for pure insurers and yellow for pure banks). Edge width is proportional to exposure.

Table A1.3 provides the summary statistics of these indicators over the whole population. With round numbers, half exposures represent less than one percent of the equity of the owner and less than one percent of the equity of the borrower. The tail of credit risk is fatter than the tail of funding risk. A quarter of exposures represent more than 7.5% of the equity of the owner while a quarter of exposures represent more than 2.46% of the equity of the borrower. In other words, funding sources seem to be more diversified than investment targets.

Summary risk statistics are easy to compute. They disentangle credit risk from funding risk controlling size effects. However, they lack robustness. For instance, two institutions may have the same summary risk statistics but may be exposed to counterparties that differ widely with respect to their fragilities. Therefore, such risk statistics should be seen as additional summary statistics with clear interpretation and limits.

Table A1.3: Summary risk statistics

	Credit Risk	Funding Risk
1st quartile	0.48%	0.22%
Median	1.34%	0.80%
4th quartile	7.50%	2.46%

Example: Half of the exposures represent less than 1.34% of the equity of the lender.

4. Substitutability and integration

Facing the interconnectedness concern, one strategy may be to not measure – give a figure—for each institution but only to compare them. In that respect, we propose to analyse two dimensions of interconnectedness: *substitutability* and *integration*. We state that two financial institutions are close with respect to integration (to the network) if their exposures are similar regardless of the counterparts. We state that they are close with respect to substitutability (in the network) if they have similar exposure and exposure to the same counterparts. Note that the substitutability criterion is stronger than the integration criterion: if two institutions are close in terms of substitutability, they are necessary close in terms of integration. These definitions correspond to usual statistical tests to compare two random distributions. Substitutability analysis and integration analysis can be computed on volume matrix, and also on credit risk matrix and funding risk matrix to control for size. Based on the closeness between every couple of institutions, we can build a group of institutions with similar integration and similar substitutability.

Applied to our dataset, we conclude that conglomerates form a clear group with respect to integration on volume while we cannot distinguish pure banks from pure insurers. However for integration on funding risk, conglomerates do not shape a specific group and there is no group mixing pure banks and pure insurers. In other words, even if the type of institutions explains partially volumes allocation, they lose their power when a risk perspective is adopted.

Integration and substitutability are pair-wise measures of interconnectedness: they cannot be used to provide an interconnectedness score to each institution of the network. Nevertheless, they can unveil unexpected (di)-similarity of the investment profile and of the funding profile between financial institutions.

5. Core – peripheral institutions and topological indicators

Although interconnectedness matter is relatively new in supervision, economists, sociologist or IT scientists have already investigated the topic. Some researchers propose a technological transfer. In particular, economists in game theory show that some stylized structure of networks characterized the setup of cost-benefit balance to link formation (see Figure A1.2 for few examples). Empirical papers on banking network usually conclude that the banking system adopts a *core-periphery structure* [see Anand *et al.* (2014)]. In this framework, banks fall into two groups. The few banks of the core are completely interconnected between themselves. The banks of the periphery are connected to only one bank of the core. In Figure A1.2, the star network can be interpreted as an extreme core-periphery structure with a core composed of a single institution.

Figure A1.2: Example of stylized network structures
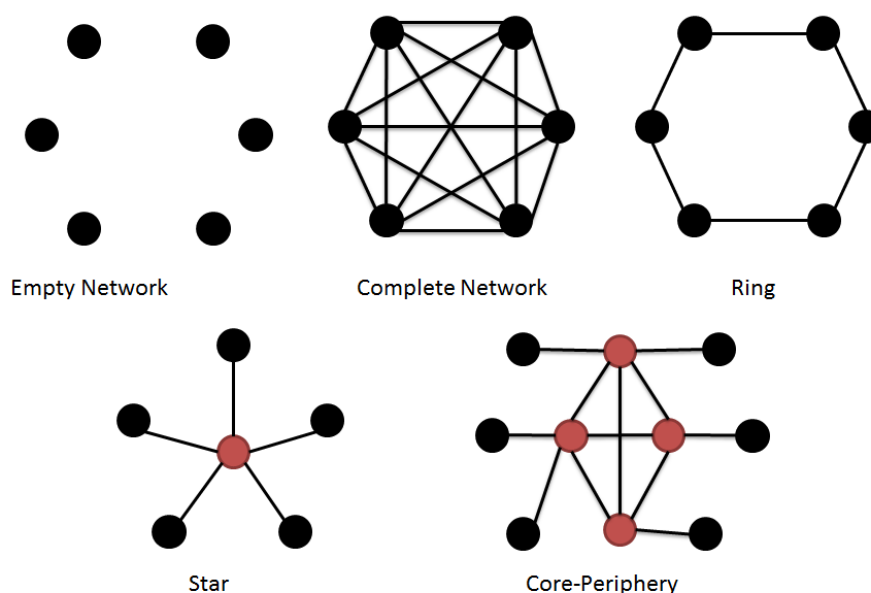
The methodology relies on two elements. First, the exposure matrix, which contains continuous information, has to be converted into an adjacency matrix which is composed of 0 (absence of link) and 1 (presence of link). In order to eliminate noise, we recommend introducing a free threshold. Second, a distance between the observed adjacency matrix and a theoretical one is to be defined. In Craig and von Peter (2014), the distance is linked to the number of discrepancies between the observed adjacency matrix and the theoretical adjacency matrix. Building on these two steps, an algorithm selects the

allocation of the institution of the system between the core and the periphery that minimizes the distance between the observed adjacency matrix and the theoretical adjacency matrix.[26] This optimal partition provides the set of core institutions and peripheral institutions.

We applied this methodology on the volume, credit risk and funding risk matrices. Results are reported in Table A1.4. The core-periphery structure appears relevant when considering the volume (with only 5% of errors): the score is composed of 5 conglomerates. However, when size is taken into account, the picture becomes blurry. For credit risk, fitting is much less accurate (15.7% of errors). Moreover, the core is almost as large as the periphery, whereas usually the core institutions are much less numerous than the peripheral ones. For funding risk, there is no core-periphery structure since there are about 71.4% errors. In other word, the core-periphery structure is not relevant when we get rid of the size effect. It may come from the fact that the considered network is limited in reality to a French entity.

Finally, the core-periphery structure is a good candidate for flow analysis, or volume of exposures. When adopting a risk perspective, this structure is no longer relevant. In particular, using the membership of an institution to the core as a flag for a high degree of interconnectedness is severely corrupted by size. Furthermore the core-periphery structure does not hold for funding.

Table A1.4: Results of Core-Periphery Identification

	Volume	Credit Risk	Funding Risk
Core	5 conglomerates	5 conglomerates 3 pure banks 2 pure insurers	2 conglomerates
Periphery	1 conglomerate 4 pure banks 11 pure insurers	1 conglomerate 1 pure bank 9 pure insurers	4 conglomerates 4 pure banks 11 pure insurers
Distance	5%	15.7%	71.4%
Threshold	Euro 1.5bn	1%	0.1%

Note: in the process, the threshold is optimized in order to minimize the distance.

Beside the identification of a stylized structure, a related strand promotes using topological indicators such as closeness, betweenness, and centrality. Although these indicators are very pertinent in sociology or computer sciences, we are cautious using them in a financial network. As in the core-periphery identification, most of these indicators are derived from adjacency matrix with

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[26] See the background paper for more methodological details.

no consideration of size or noise-filtration. This does not hamper results when relationships concepts are qualitative (friendship, neighbour, alumni…). Moreover, the interpretations are often assuming some kind of independence on the exposures: this assumption is very strong in a financial framework. For instance, having a new friend on an on-line social network is almost costless whereas providing a new loan means to fail providing it to another potential partner and implies to engage a counterparty risk analysis. We take the view that these indicators can be transposed only with reliably adapted guidelines to finance.

6. Systemic importance and systemic fragility

As mentioned in the introduction, interconnectedness is considered as a characteristic of systemic institutions for contagion risk concerns. Over the last decade, contagion models have been developed to analyse how an external shock is propagated through a financial system. These contagion models are widely used to run network stress-tests. We use the model developed in Gourieroux *et al.* (2012). The authors propose a model for solvency contagion distinguishing shares and debt securities. This model is relevant to analyse long-term positions but includes no liquidity features (such as fire-sale or debt rolling-over).

Following Alves *et al.* (2013), we derive two metrics of interconnectedness. *Systemic importance* is the impact of one institution on the other institutions (the direction is 'firm-to-system'), whereas *systemic fragility* is the sensitivity of one institution to the defaults of the other institutions (the direction is 'system-to-firm'). We run 21 stress-test scenarios where one institution is assumed to be initially in default. For each scenario, we analyse the loss of all other institutions. We measure systemic importance of one institution as the number of institutions who lose more than 10% of their equity. Symmetrically, we measure systemic fragility of one specific institution as the number of institutions which default generates a loss higher than 10% of the specific institution's equity. The threshold of 10% is arbitrary. Note that using another threshold (5% for instance) would change the systemic importance score and the systemic fragility score of all institutions. Therefore, we do not interpret the exact figures but the overall relative scores of institutions.

Figure A1.3 provides the systemic fragility and importance for the French financial institutions. Three groups are visually identified: financial institutions that are only systemically fragile, financial institutions that are only systemically important, and financial institutions that are neither systematically fragile nor systemically important. Generally speaking, important institutions are conglomerates, which are also the largest institution in the system. Most insurers fall in the group 'neither'. Since there is no institution jointly systematically fragile and systemically important, we deduce that a long chain of contagion – the so-called 'domino effect' – is unlikely. Policy implication could be to provide incentives to fragile institutions to diversify further their exposures to rely less on systemically important institutions.

Measuring contagion risk through stress-test exercises is often more costly in terms of operational resources than using measurement of interconnectedness based on statistical tools (such as descriptive statistics or the closeness analysis previously presented). Therefore, it is tempting to assess the correlation between the results of the various methods in order to predict the results of contagion risk. Such a strategy needs a clear assessment of the 'predictive power' of the statistical measures.

To do so, we compare our results based on descriptive and statistical methods for the three groups identified according to systemic importance and systemic fragility. Statistical theory helps us to formalize the match between groups. We find that systemic importance can be linked to statistical measures of interconnectedness. However, we fail to uncover any clear association between these statistical measures and systemic fragility. Consequently, running contagion models on a regular basis is a paramount tool to assess contagion risk and measure interconnectedness from a supervisory perspective. Results should be read with respect to the limits of the underlying contagion model.

7. Policy perspective

We presented several strategies to measure interconnectedness. We do not think that there is only one way to measure interconnectedness. Interconnectedness is in all likelihood a multi-faceted concept that requires therefore several measures to be accounted for. Ultimately, the choice of measure is to be driven by the accurate objectives of the policy makers: the right tool for the job.

Figure A1.3: systemic importance and systemic fragility of French financial institutions
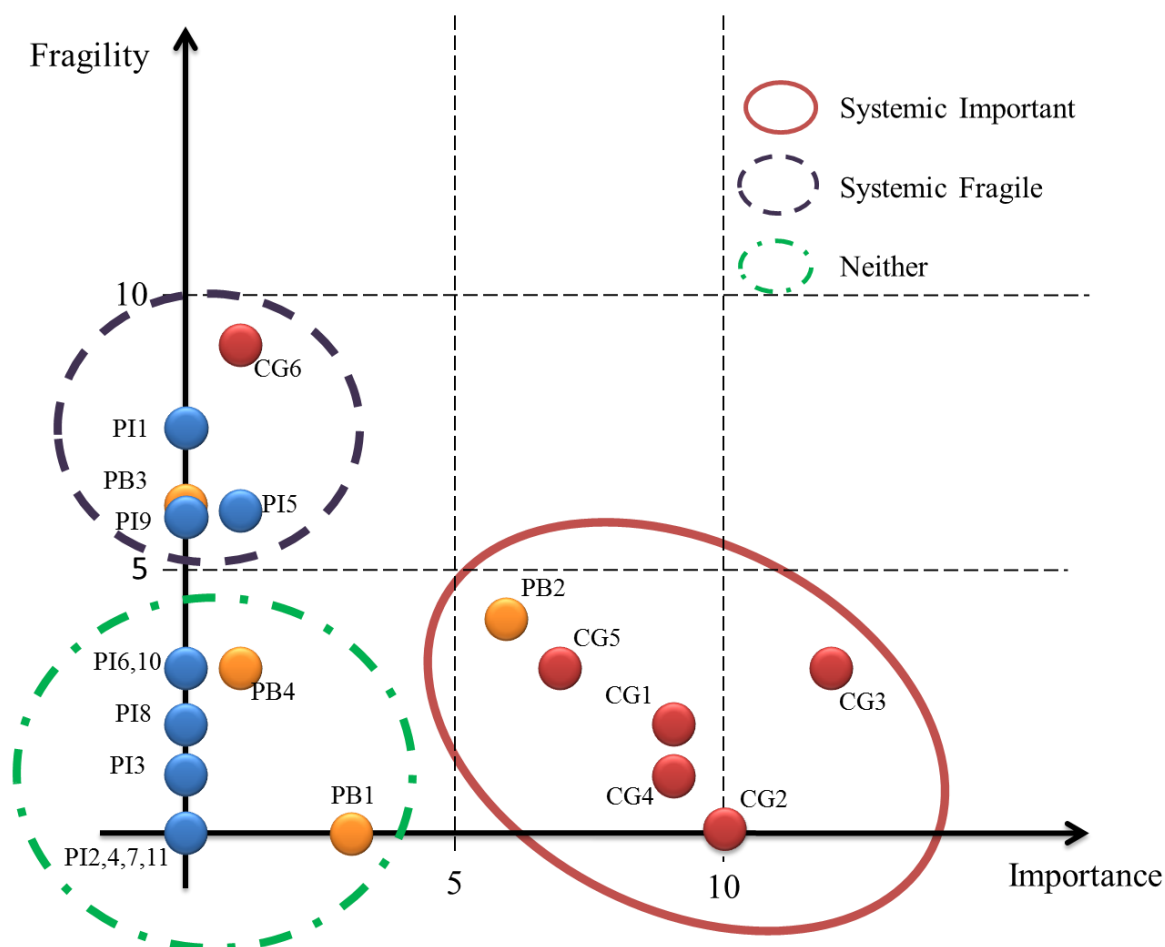
Note: Systemic fragility and systemic importance are defined using a threshold equal to 10% of equity.

First at all, we recommend picking interconnectedness measures with parsimony to avoid unnecessary complexity. Provided a volume exposure matrix, we recommend deriving a credit risk matrix and a funding risk matrix. The *descriptive risk statistics* are very informative to have the broad picture of the interconnection in a risk analysis perspective.

Comparing pair-wise institutions along *substitutability* and *integration* is useful to assess similarities between institutions or to detect outliers. However, this strategy does not provide individual scores of interconnectedness.

Identifying *core-periphery structure* is to be handled with care. Our results suggest that this method is mainly driven by a size effect. A formal identification of the core of a network helps see where volumes dwell but does not necessarily pinpoint riskiness. Moreover, note that the results are binary ratings of interconnectedness – either in the core or in the periphery – and give no score of interconnectedness.

Contagion models provide two clear measures of interconnectedness: *systemic importance* representing the contagion risk generated by the institution and *systemic fragility* catching the exposure to contagion risk. These last measures provide scores and robustness can easily be carried out. Nevertheless, these measures depends on the model used, in particular the contagion channels that are included. Therefore, score should be read keeping in mind the limits of the underlying model.

The general characteristics of each strategy are summarized in Table A1.5.

Table A1.5: Summary of the potential strategy

Strategy	Interconnectedness design	Interconnectedness measure	Implementation	Identified potential bias	Policy Concern
Descriptive risk statistics	continuous individual	quantitative	easy		usual monitoring
Integration & substitutability	continuous pair-wise	none	easy		cross-market comparison
Core-Periphery identification	binary system-wide	qualitative	complex	size effect	SIFIs identification
Systemic importance and fragility	continuous system-wide	quantitative	complex	model dependence	SIFIs identification

8. Concluding remarks

Taking into account interconnectedness of financial institutions is mandatory to supervisory authorities to prevent contagion risks. If the general objective is clear, there is no consensus on the best way to measure interconnectedness. Using a unique dataset of bilateral exposures between 21 French financial institutions –6 financial conglomerates, 4 pure banks and 11 pure insurers– we describe and analyse several strategies to measure interconnectedness. Without promoting one strategy as a panacea to measure interconnectedness, we provide insights on the pros and cons of each measure.

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Appendix

Data coverage and disclaimer - The insurance sector

EIOPA collects consolidated figures from 32 large insurance groups.[27] 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. The data is used in figures which present developments in individual countries.

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 68% (21 out of 31 countries).[28]

 Data collected for 2013 was provided to EIOPA with an approximate view of the financial position of IORPs during the covered period. In some cases 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 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.

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[27] 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.
[28] Countries that participated in the survey: AT, BE, BG, DE, DK, ES, FI, HR, IE, IT, LI, LU, LV, NL, NO, PL, PT, SE, SI, SK and the UK.

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