

## B Euro area insurers and the low interest rate environment<sup>131</sup>

*The current environment of protracted low interest rates poses major challenges to euro area insurance companies. This special feature discusses how a prolonged low-yield period might affect the profitability and the solvency of euro area insurers. In the article, it is argued that if interest rates were to stay low for a long time, this could have material implications for the profitability and the solvency of many insurers. However, it is also shown that the impact of low interest rates is likely to differ markedly across insurance companies depending on their business model and balance sheet structure. In particular, the impact is expected to be highest for small and medium-sized life insurers with large government bond portfolios and high guarantees to policyholders that reside in countries where these guarantees are rigid and where contracts embed a long time to maturity.*

### Introduction

There is a general consensus that the current low interest rate environment constitutes the main risk for the European insurance industry.<sup>132</sup> This is mainly due to two generic characteristics of insurers' business models: (i) the large amount of fixed-term investments that insurers have on their balance sheet; and (ii) the strong influence of long-term interest rates on the discount rate of insurance liabilities. Moreover, in Europe, the life insurance business is often characterised by the presence of products embedding financial guarantees, i.e. instruments granting a minimum rate of return to policyholders. In times of low interest rates, this business model might represent a threat to the profitability and the solvency of life insurance companies, especially in countries where products with relatively high guaranteed returns sold in the past still represent a prominent share of the total portfolio.

It is, however, important to keep in mind that European insurers differ substantially in their investments and in the maturity structure of their liabilities, depending on their business strategy and geographical location. In particular, the underwriting of insurance policies constitutes the core activity of any particular company, and the investment strategy is subordinated to underwriting needs, typically in the form of asset-liability management or matching techniques. Taking all these factors into account, it is difficult to have a clear picture of the final impact of low (long-term) interest rates, and this impact may, in any case, differ substantially across insurance companies and countries.

Given the generally long-term nature of life insurance liabilities and the ensuing possibility to wind down assets over a reasonably long time should problems arise,

---

<sup>131</sup> Prepared by Elia Berdin, Christoffer Kok, Katri Mikkonen, Cosimo Pancaro and Josep Maria Vendrell Simon.

<sup>132</sup> For recent evidence, see, for example, past editions of the ECB's Financial Stability Review and the EIOPA Financial Stability Report, as well as the EIOPA 2014 insurance stress test.

low yields by themselves are unlikely to cause a major disruption in the sector.<sup>133</sup> However, a persistent situation would require major adjustments in business models, especially for life insurers (as discussed below).

This special feature seeks to gauge how a prolonged low-yield period might affect the profitability and solvency of European insurers. Starting from a few stylised facts, a regression analysis of European insurers' profitability is presented, demonstrating a strong significant relationship between long-term bond yields and insurers' profitability. Next, a model-based scenario analysis is conducted to assess the potentially adverse impact of a prolonged period of low long-term interest rates on the profitability and solvency position of the life insurance sector in the four largest euro area countries.

## How do low yields affect insurers?

Insurers are affected by low yields mainly through two channels.

First, there is a slow-moving so-called "income channel" whereby owing to the sector's high exposure to long-term fixed income assets (see Chart B.1) investment income will suffer as the net cash flow from paid premiums and maturing investments needs to be gradually re-invested at lower rates. Data from the EIOPA 2014 insurance stress test show that the average duration of government bonds on the balance sheets of insurers participating in the low yield exercise amounted to 8.6 years at the end of 2013.<sup>134</sup> The degree of vulnerability to the income channel is dependent on the business model of individual firms. Small and medium-sized, non-diversified life insurers are typically more exposed, in particular if they have sold policies with high levels of guarantees.

Second, the so-called "balance sheet channel" reflects that low interest rates will tend to have an impact on the balance sheet via a valuation effect, as low rates induce increases in the values of both assets and liabilities. A market-consistent valuation of assets and liabilities, such as prescribed in Solvency II, typically results in higher increases in the value of the latter when long-term yields decline because the magnitude of the assets invested in fixed-term instruments is a fraction of the total liabilities (see Chart B.2). In addition, the duration of the liabilities is often longer than that of the assets. Thus, whereas the impact on profitability through the investment income channel takes time, a low-yield environment can affect the solvency of the insurers directly and immediately through the balance sheet channel,

---

<sup>133</sup> The situation might, however, change in interaction with other factors. See, for example, Box A on the experiences in Japan in this special feature and Section 3.1.2 on the risks related to a potential sudden increase in yields.

<sup>134</sup> See EIOPA 2014 insurance stress test, available at <https://eiopa.europa.eu/Publications/Surveys/Stress%20Test%20Report%202014.pdf>. Participants in the United Kingdom had the highest average duration of 13.3 years, whereas in the euro area, the highest average duration (12.4 years) was in the Netherlands. High asset durations are typically matched with high liability durations, indicating attempts on the part of the firms to reduce asset-liability mismatches.

with those insurers with large duration mismatches being the most vulnerable to this channel.<sup>135</sup>

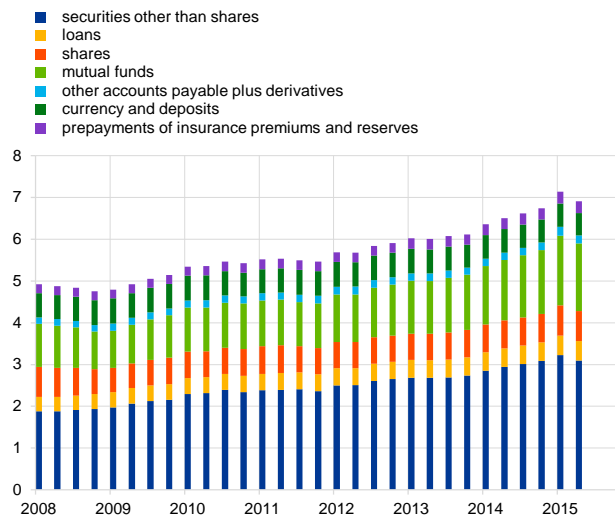
Gauging the impact of the switch to the forthcoming Solvency II regime on the size of liabilities is complicated, although on average the size of liabilities is expected to increase. Most importantly, the impact will depend on the valuation rules currently in place, which differ across jurisdictions. In addition, the measures in the so-called long-term guarantee package are expected to reduce the volatility and – for most insurers – also the size of liabilities.<sup>136</sup> Some participants in the EIOPA 2014 insurance stress test chose the option to present results using the long-term guarantee measures. The estimate of the impact calculated this way indeed showed that the measures can significantly improve the Solvency II capital ratio. Finally, many large insurers are expected to use internal models for solvency calculations.

### Chart B.1

Insurers invest predominantly in fixed-term securities

#### Assets of euro area insurance corporations

(2008-2015; EUR trillions)

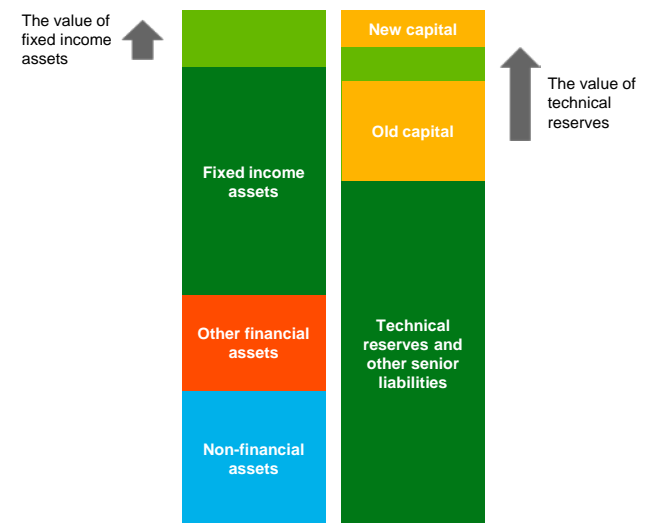


Source: ECB data on the balance sheets of insurance corporations and pension funds.

### Chart B.2

As interest rates decrease, the increase in the value of fixed income assets is typically dominated by the increase in the value of technical reserves

#### Impact of a decrease in long-term interest rates on a stylised life insurance balance sheet



Source: ECB.

Note: The graph is a simplistic depiction of the direct impact of a decrease in interest rates and excludes all indirect effects.

<sup>135</sup> The average duration mismatch for the European insurers participating in the low yield module of the EIOPA 2014 stress test amounted to 4.2 years in the baseline scenario. In the euro area, participants from Germany and Austria had the highest duration mismatches of around 10 years.

<sup>136</sup> The long-term guarantee package measures aim to mitigate artificial volatility in balance sheets that does not reflect changes in the financial position or risk exposure of an insurer. These measures include volatility and matching adjustments to discount rates, the extrapolation of the long-term risk-free interest rate, transitional measures for the calculation of liabilities and the possibility for an extension of the recovery period under exceptional market conditions. See Directive 2014/51/EU of 16 April 2014 in respect of the powers of the European Supervisory Authority (European Insurance and Occupational Pensions Authority) and the European Supervisory Authority (European Securities and Markets Authority).

Empirical evidence on the impact of long-term interest rates on the performance of insurers is scarce. But where tested, it seems that it is the volatility, rather than the low levels per se, of long-term interest rates that can increase the financial fragility of insurers.<sup>137</sup>

A few studies have also conducted more forward-looking analyses under the assumption of a continued and prolonged period of low interest rates. While the majority of these studies on the impact of low interest rates on insurers have been mainly of a qualitative nature,<sup>138</sup> a few recent studies have quantitatively investigated the impact of low yields on the performance of life insurers.<sup>139</sup> The studies all point to the likely negative effects that a protracted period of low interest rates would have on the solvency position of insurers.

Intuitively, slow-moving insurance balance sheets suffer in times of rapid movements in interest rates, as any adjustment will necessarily take time. In the long term, insurers can resort to diverse adjustment mechanisms. In this regard, EIOPA's low interest rate environment stock-taking exercise conducted in 2014 provided evidence that European insurers have, in particular, resorted to diversification into non-life and asset management businesses, lowered the guaranteed rates on new policies and increased the use of interest rate derivatives.<sup>140</sup> The experience of insurers in Japan during the late 1990s and early 2000s provides the most compelling evidence to date of the potential impact of low long-term interest rates for an extended period, in particular if adjustment is slow (see Box A).

## Box A

### Japanese life insurers' experience with a period of prolonged low interest rates

---

The Japanese life insurance industry offers a real-world example of what can happen when interest rates suddenly decrease and stay low for an extended period of time.<sup>141</sup> The yield on Japanese

---

<sup>137</sup> See, for example, Browne, M.J., Carson, J.M. and Hoyt, R.E. (1999), "Economic and market predictors of insolvencies in the life-health insurance industry", *Journal of Risk and Insurance*, Vol. 66, No 4, pp. 643-659; and Cheng, J. and Weiss, M.A. (2012), "The role of RBC, Hurricane Exposure, Bond Portfolio Duration, and Macroeconomic and Industry-Wide Factors in Property-Liability Insolvency Prediction", *Journal of Risk and Insurance*, Vol. 79, No 3, pp. 723-750.

<sup>138</sup> See, for example, Tower, I. and Impavido, G. (2009), "How the financial crisis affects pensions and insurance and why the impacts matter", *IMF Working Papers*, No 151; and Antolin, P., Schich, S. and Yermo, J. (2011), "The economic impact of protracted low interest rates on pension funds and insurance companies", *OECD Journal: Financial Markets Trends*, No 01/2011.

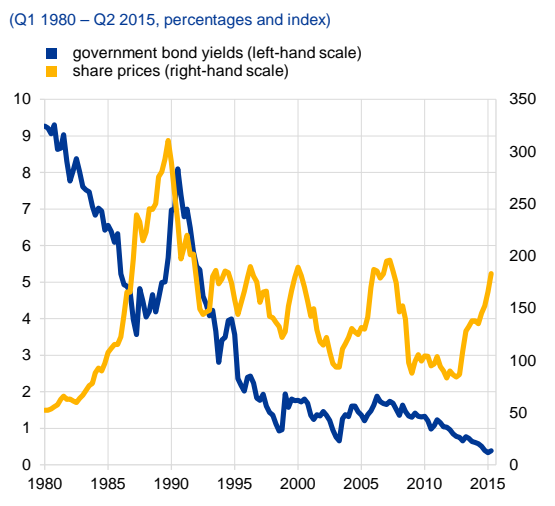
<sup>139</sup> See Berdin, E. and Gruendl, H. (2015), "The effects of a low interest rate environment on life insurers", *The Geneva Papers*, 40; Kablau, A. and Weiss, M. (2014), "How is the low-interest-rate environment affecting the solvency of German life insurers?", *Deutsche Bundesbank Discussion Papers*, No 27/2014; and Wedow, M. and Kablau, A. (2011), "Gauging the impact of a low-interest rate environment on German life insurers", *Deutsche Bundesbank Discussion Papers*, No 02/2011.

<sup>140</sup> The study is available at <https://eiopa.europa.eu/financial-stability-crisis-prevention/financial-stability/insurance-stress-test/insurance-stress-test-2014>

<sup>141</sup> See, for example, Fukao, M. (2002), "Financial Sector Profitability and Double-Gearing", *National Bureau of Economic Research Working Papers*, No 9368, December; Hoshi, T. and Kashyap A.K. (2004), "Japan's Financial Crisis and Economic Stagnation", *Journal of Economic Perspectives*, Vol. 18, No 1, pp. 3-26; SwissRe (2012), "Facing the interest rate challenge", *sigma*, No 4; Geneva Association (2015), "U.S. and Japan Life Insurers Insolvencies Case Studies – Lessons learned from resolutions", edited by Baranoff, E., January; and J.P.Morgan Cazenove (2015), "European and Japanese life insurance", February.

government bonds decreased rapidly in the course of the 1980s and again at the beginning of the 1990s, and has decreased further since 2006 (see Chart A).

**Chart A**  
Japanese government bond yields and stock market prices



Sources: IMF International Financial Statistics.  
 Notes: Government bond yield refers to one or more series representing yields to maturity of government bonds or other bonds that would indicate longer-term rates. Indices shown for share prices relate to common shares of companies traded on the national stock exchange.

Altogether, eight life insurance companies were liquidated or taken over between 1997 and 2003.<sup>142</sup> The causes of the failures include macroeconomic factors, but also industry-wide business practices that became detrimental once the economic environment changed. The rapid decline in the interest rate in the 1980s induced companies to invest in stock markets, which subsequently also faced a downturn when the stock market bubble burst in 1989 (see Chart A). The insurers also faced significant losses in foreign currency holdings in the mid-1980s, following a large appreciation of the yen. At the same time, insurers continued to offer guarantees to policyholders in the order of 5.5% until the mid-1990s, amid fierce competition from government-sponsored financial institutions. The combined effect of the low government bond yields, stock market returns and foreign currency holdings made it very difficult to meet these guarantees in a profitable way.

Insurers eventually started decreasing their guaranteed rates. This in turn led to a loss of policyholder confidence and a surge in surrenders, which at that time were not penalised through any value decrease.<sup>143</sup> As a consequence, bankruptcy became inevitable for seven of the eight above-mentioned life insurers, whereas one received a capital injection from a foreign company.

The Japanese life insurance case can be characterised as having had systemic causes, and it had a significant impact on the Japanese life insurance industry. The assets of the seven failed companies amounted to 8.6% of total life insurance assets in Japan in 2000. Yet, the overall impact on the financial markets and on the real economy remained contained. Altogether, the seven failed insurers had negative equity of JPY 2.68 trillion, or 0.5% when measured in terms of Japan's GDP in the year 2000. No public money was used to bail out the companies; however, policyholders faced an average 10% loss in savings, and the rest was borne by the industry-funded Policyholder Protection Fund.

The Japanese insurance sector has since recovered, partly owing to price developments in the stock markets and returns on investments in very long-term bonds. In addition, companies have adjusted their business models away from dependence on investment income and savings-type

<sup>142</sup> Seven companies failed and one company received a capital injection from a foreign company.

<sup>143</sup> A surrender refers to a full cancellation of a life insurance policy. Most insurers in Europe nowadays attach penalty fees to surrenders. This feature makes life insurance distinct from taking sight deposits that can be redeemed at any time without penalty. The fact that insurance runs have been rare can indeed be attributed to the existence of surrender fees.

policies towards a larger focus on earnings from underwriting mortality and longevity risks. Finally, in terms of policy, the Japanese Insurance Act was revised in 2003, allowing the renegotiation of guarantees with policyholders without the insurer having to declare bankruptcy first.

---

All in all, both from a conceptual perspective and judging from actual experiences, prolonged low interest rates should be expected to exert a negative influence on insurers' profit generation capacity and on their solvency. This is further explored below with the help of quantitative analysis.

### The impact of low yields on insurers' profitability: an empirical analysis

In the following, a regression analysis is conducted in order to gauge the impact of interest rate levels on the financial performance of a sample of 127 European insurers over the period 2005-14.<sup>144</sup> We regress a measure of insurers' profitability (measured by institution-specific return on assets<sup>145</sup>) on the level and volatility<sup>146</sup> of long-term interest rates (measured as the ten-year sovereign benchmark bond yields), while controlling for other key driving factors of profitability, such as institution-specific developments in underwriting performance (here measured as annual growth in gross premiums written) as well as country-specific macroeconomic factors including real GDP growth and inflation.

We use a system generalised method of moments<sup>147</sup> dynamic panel estimation approach in order to account for the potential time persistence of profitability via the inclusion of the lagged dependent variable among the regressors of the estimated model and to address the potential endogeneity of the firm-specific variables. Acknowledging the impact of different insurance business models and strategies, balance sheet and income data for individual insurers are included in the regression alongside the macroeconomic variables at the country level. In order to further account for heterogeneity, we run regressions for sub-samples of companies,

---

<sup>144</sup> We use an unbalanced panel of annual data from 2005 to 2014 for a sample of European insurers established in 15 European countries; namely in Germany (37), the United Kingdom (16), France (13), Denmark (11), Spain (9), Sweden (9), Italy (8), the Netherlands (5), Austria (4), Ireland (4), Belgium (3), Finland (3), Poland (2), Slovenia (2) and Portugal (1). The selection of insurance companies was constrained by limited data availability. More specifically, insurers with less than five years of observations for selected variables were dropped from the sample. Company-specific data is taken from SNL Financial. Macroeconomic data is taken from the ECB and Eurostat.

<sup>145</sup> This is computed as the return on average assets, i.e. net profit as a share of average assets over a given period. The results hold when using other measures of profitability such as return on equity.

<sup>146</sup> Volatility is defined as the yearly average of the annualised moving 20-day standard deviation of price changes. First differences are taken for long-term interest rates and their volatility to ensure stationarity.

<sup>147</sup> Linear dynamic panel-data models include  $p$  lags of the dependent variable as covariates and contain unobserved panel-level effects, fixed or random. By construction, the unobserved panel-level effects are correlated with the lagged dependent variables, making standard estimators inconsistent. Arellano and Bond (1991) derived a consistent generalised method of moments (GMM) estimator for this model; for a more detailed description of the empirical methodology applied, see Special Feature B in the May 2015 FSR. See also the EIOPA Financial Stability Report May 2015, Part II - Thematic Articles: Insurance Sector Profitability and The Macroeconomic Environment.

segregated according to the size<sup>148</sup> of the company (*large versus small and medium-sized*) and the business lines (*multiline, property and casualty or life and health*).

Table B.1 shows the regression results for these different sub-samples on the explanatory variables discussed above. Throughout the different regressions, most of the estimated coefficients display the expected signs when significant.<sup>149</sup>

**Table B.1**  
Regression results – determinants of EU insurers' return on assets

		Full sample	Large insurers	Small and medium insurers	Multiline	Property & casualty	Life & health
Insurance-specific factors	Return on assets (lagged one period)	-0.215*** (0.076)	-0.087* (0.046)	-0.216*** (0.075)	0.061** (0.025)	0.120 (0.131)	-0.326*** (0.032)
	Growth in gross premiums written	0.021* (0.013)	0.007 (0.011)	0.015 (0.012)	-0.006 (0.007)	0.003 (0.009)	0.008 (0.016)
Macroeconomic factors	Real GDP growth	0.043 (0.035)	0.048* (0.029)	0.037 (0.039)	0.028 (0.027)	-0.049 (0.097)	0.170** (0.483)
	Inflation rate	-0.136 (0.138)	-0.354* (0.199)	-0.084 (0.137)	-0.221 (0.140)	-0.104 (0.083)	-0.134 (0.089)
	Long-term interest rate	0.419** (0.219)	0.022 (0.030)	0.465** (0.244)	0.046* (0.026)	0.035 (0.104)	1.311* (0.741)
	Long-term interest rate volatility	-0.035* (0.021)	-0.006 (0.010)	-0.039* (0.023)	-0.007 (0.007)	-0.010 (0.011)	-0.022 (0.028)
	Number of observations	857	134	723	274	224	359
	Number of insurance companies	127	19	108	39	34	54
	Heteroskedasticity and autocorrelation robust standard errors in parentheses						
	* p<0.10; ** p<0.05; *** p<0.01						

As expected, long-term interest rates are found to exert a positive impact in all specifications, having a bigger (and more statistically significant) impact on small and medium-sized insurers and the life and health sector. However, the impact of domestic long-term interest rates is not significant for large insurers (which tend to be better diversified in terms of businesses, asset classes and geographies) or for the property and casualty sector, which may reflect the fact that non-life insurance typically has a short pay-out pattern, and contracts are made on a yearly basis, with the possibility to increase prices at renewal. Therefore, the sector is less dependent on financial market developments.<sup>150</sup> This contrasts with the life insurance sector which faces the challenge of long-term liabilities and the need to match them with suitable assets, typically long-term bonds. Thus, not surprisingly, the positive impact of long-term interest rates on profitability appears to be the largest for the life and health sector.

The impact of interest rate volatility is less clear-cut: although the signs are negative, the impact is only weakly significant, except for small and medium-sized insurers.

<sup>148</sup> A "large" company is defined as having total assets in excess of €80 billion in December 2014.

<sup>149</sup> All regressions have been tested for over-identification restrictions and for serial correlation in the first-differenced errors of order higher than one. Time-fixed effects are considered in the regressions to ensure the absence of correlation across insurance companies in their idiosyncratic error terms.

<sup>150</sup> See also SwissRe (2012), "Facing the interest rate challenge", *sigma*, No 4.

Taken together, these results highlight the complexity of channels through which long-term interest rates affect the profitability of insurers. In times of interest rate volatility, the balance sheet channel transmits unrealised gains (if interest rates decrease) or losses (if interest rates increase); at the same time, the income channel transmits the opposite impact for assets that are being reinvested at the time. In the end, it seems that the negative effect prevails for the least diversified small and medium-sized firms in times of interest rate change.

The institution-specific and macroeconomic control variables tend to have the expected, and statistically significant, signs. Thus, focusing on the “full sample” regression, increasing economic activity tends to increase profitability, while higher inflation tends to have a negative effect.<sup>151</sup> Growth in premiums has a positive effect on profitability.<sup>152</sup>

Finally, the lagged dependent variable is found to have a negative impact in all but two specifications, suggesting weak persistence of profitability over time.

This regression analysis highlights the importance of long-term interest rates for the profitability of European insurers. However, the impact of a prolonged period of low interest rates also needs to be assessed in a forward-looking manner. The next section seeks to do this.

## The impact of low yields on euro area life insurers’ profitability and solvency: a scenario analysis

In the following, a stochastic simulation model of the insurance sector is employed with the aim of assessing and quantifying the effects of a prolonged period of low interest rates on the solvency and profitability of a representative life insurer in the four largest euro area insurance markets<sup>153</sup>, i.e. Germany, France, Italy and the Netherlands. For a description of the modelling strategy, see Box B.

### Box B

#### A stress test model of the insurance sector<sup>154</sup>

---

The stylised model of the insurance sector used in this analysis relies on country-specific calibrations, encompassing different asset allocations, liability structures, duration mismatches between assets and liabilities, and regulatory requirements. In this context, the balance sheet of a representative life insurer in each of the four considered countries is projected seven years ahead

<sup>151</sup> Domestic real GDP growth has the expected positive sign in all but one specification. The inflation rate is found to have a negative coefficient suggesting that it negatively affects profitability by hindering demand for new business and increasing non-life insurance claims and expense ratios.

<sup>152</sup> The impact of premium growth is found to be generally positive but rather small, which might reflect the effects on profitability of competition, pricing and the initial expenses associated with new business.

<sup>153</sup> Measured in terms of total gross written premiums; source: Insurance Europe, Statistics N°50 European Insurance in Figures, 2014.

<sup>154</sup> The model presented here is based on Berdin, E., Kok, C. and Pancaro, C. (2015), “A stress test model to assess the solvency and profitability of European insurers in a low interest rate environment”, unpublished *working paper*. The model is an extension of the work by Berdin and Gruendl (op.cit.).



and the evolution of its profitability and solvency is investigated. In particular, the analysis focuses on a marked-to-market balance sheet in line with the forthcoming Solvency II regulatory regime.<sup>155</sup>

More specifically, the modelling approach aims to reproduce the liability structure and asset allocation for the life insurance sector in each of the four countries.<sup>156</sup> Moreover, the balance sheet of each country's representative life insurer is calibrated to feature a duration gap in line with those reported by EIOPA, thereby providing an additional source of heterogeneity in the business models.

The liability structure only considers business at shareholders' risk, and consequently excludes unit-linked business. As a result, only two representative products are modelled; namely, an endowment policy with financial guarantees and mandatory profit distribution (where applicable) and a term life contract that pays upon death. For each country, the local regulatory framework, the level of outstanding guarantees in 2014 and the dynamics of the underlying population are also taken into consideration. Prices of products are computed alike in each country, thereby allowing for a fair degree of comparability. The level of guarantees given to policyholders plays a prominent role: in order to create a realistic set of guarantees, it is assumed that each year the insurer issues one cohort of contracts with fixed time to maturity (from 15 to 25 years, depending on the country) at the maximum allowed guarantee at the moment of inception. Consequently, at the start of the simulation period, the insurer holds different cohorts of guarantees with different maturities.<sup>157</sup> This feature helps reproduce the typical situation that life insurers currently face, i.e. portfolios consisting, at least partly, of old guarantees which have become increasingly expensive to fund as interest rates remain low.

The asset portfolio comprises four asset classes: sovereign bonds, corporate bonds, stocks and real estate. Bonds are differentiated either by reference country or issuer. Stocks and real estate are proxied by indexes representing the corresponding relevant markets.<sup>158</sup> Overall, the asset portfolio is tailored for each country to reproduce: i) the typical asset allocation and ii) the typical duration.

Furthermore, the initial solvency ratio is set equal to 165% for all countries' representative life companies, in line with EIOPA (2011)<sup>159</sup>, to ensure cross-country comparability and to allow for a better assessment of the riskiness of the different business models.<sup>160</sup>

---

<sup>155</sup> Although relevant metrics are at market values, the book values (or historical cost) balance sheet still plays a role in life business since the amount of profit to be distributed to policyholders is still often computed on the book value balance sheet.

<sup>156</sup> The modelling approach aims to capture the legacy business, which can be a major source of financial distress for life insurers in certain financial scenarios. This is done by calibrating a representative balance sheet for life insurance companies with an existing back book of contracts and an asset portfolio at time  $t$  created by accumulating backward-in-time underwritten contracts (for the liability side) and available coupons (for the asset side). At the beginning of the simulation period, a fixed number of cohorts of insurance contracts is obtained, matched by cohorts of bonds with a residual time to maturity which ranges between one year and their expected time to maturity (i.e. maximum 20 years).

<sup>157</sup> At each point in time one cohort of contracts matures and a new one enters the portfolio: this implies that at the beginning of the simulation, one cohort is still running for one year, whereas all others run from two years up to the time to maturity chosen for the country.

<sup>158</sup> While for sovereign bonds, the calibration relies fully on the data reported by EIOPA (2014), in the case of stocks and real estate, since detailed information is not available, a synthetic stock and real estate portfolio featuring a strong home bias (as reported by EIOPA (2014)) is built; in particular, 60% of the return computed yearly on both stocks and real estate is indexed to the home index for stocks and real estate, whereas the residual is spread equally among the other countries in the sample.

<sup>159</sup> See EIOPA (2011), *EIOPA Report on the fifth Quantitative Impact Study (QIS5) for Solvency II*.

<sup>160</sup> The initial solvency capital requirement has been set equally across countries also owing to the lack of information on the insurers' solvency positions under the Solvency II regime.

Finally, the model features a set of simplified managerial rules: in every period the insurer pays out dividends<sup>161</sup> upon reaching a minimum solvency level computed according to the standard formula applied under Solvency II; the model also rebalances the portfolio in order to keep the asset allocation fixed and the duration gap fixed over the seven-year period. In this context, as time progresses in the simulation, old contracts get liquidated and new contracts with new (lower) guarantees enter the portfolio. A specific regulator's reaction function, which sets the maximum allowed level of guarantee (or technical discount rate), is built into the model and tailored at country level.

Against this backdrop, for the scenario analysis, a stochastic term structure of interest rates as well as stochastic stock market and real estate returns are generated to simulate the investment returns of a stylised life insurance business portfolio in a multi-period setting. In addition, the analysis incorporates stochastic mortality.

---

For the purpose of assessing the vulnerability of insurance sector business models across countries to a prolonged period of low interest rates, two adverse scenarios featuring different stochastic term structures of interest rates and diverse stochastic stock, corporate bond and real estate returns are calibrated.

The first scenario, or adverse scenario, encompasses a situation in which interest rates remain low for a protracted period of time, while bond, stock and real estate returns revert to pre-2008 trends.<sup>162</sup> The second scenario, or severely adverse scenario, encompasses a situation in which interest rates remain low for a protracted period of time and the bond, stock and real estate returns are calibrated on the period 1999-2014, i.e. are also affected by the financial crisis. Using this different time period for the calibration mainly implies that the volatility of the interest rates and the returns is, on average, higher under the severely adverse scenario than under the adverse scenario.

Under the adverse scenario, there is a general reduction in the return on assets.<sup>163</sup> The pace of the reduction is consistent with the business model of life insurers which typically hold fixed income assets (which constitute the majority of their holdings) to maturity in order to match their liabilities. Indeed, life insurers have a relatively low asset turnover, which implies a gradual adjustment of portfolio returns to the new interest rate level.

---

<sup>161</sup> It is assumed that, in each period, insurers cannot pay out more than 7% of their equity as dividends.

<sup>162</sup> More specifically, under the adverse scenario, future realisations of the AAA euro-denominated term structure of interest rates are simulated assuming a median (target) value for the 10-year yield to maturity of 1%. In this respect, the models for interest rates and for returns are calibrated for the period from January 1999 to December 2007. During the first three to four periods of the simulation, there is a positive probability of negative interest rates in the short end of the term structure, which is in line with some bond market developments observed in 2015.

<sup>163</sup> In this context, the return on assets is defined as the sum of coupons, dividends and rents collected during the period, divided by the book value of assets. It therefore excludes capital gains. This definition makes it possible to replicate the typical profit-sharing mechanism used in Europe, which in turn provides an indication of the future expected return that policyholders might expect, as well as the returns that shareholders might expect.

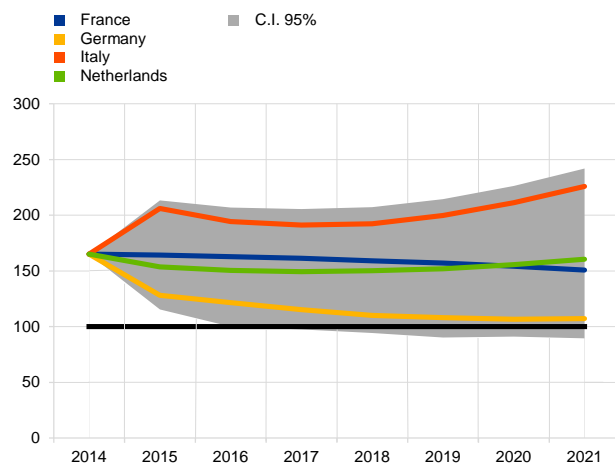
Moreover, it is important to mention that the liability portfolio typically adjusts more slowly owing to its higher duration, especially in countries where contracts embed a long time to maturity. The natural implication of this characteristic is that financial guarantees sold in the past stay in the portfolio for longer periods and, therefore, the adjustment to the prevailing interest rate regime is slower for the liabilities than for the assets. This feature largely drives the impact of the low yield scenario on the solvency ratio of life insurers.

### Chart B.3

Insurers would be able to cope with the “adverse” scenario in most of the simulations...

#### Projection of solvency ratios under the “adverse” scenario

(2014-2021; solvency capital requirement ratio)



Sources: ECB calculations.

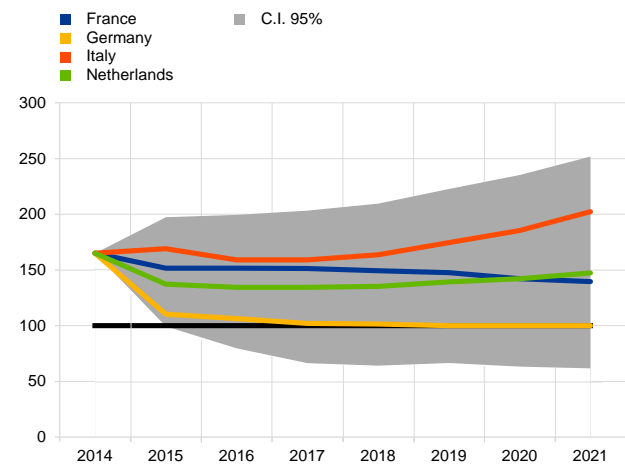
Notes: The black solid line represents the solvency capital requirement of 100%. The other solid lines represent the median solvency ratios, defined as own funds over solvency capital requirements. C.I. is the confidence interval containing 95% of the simulated solvency ratios for the considered countries.

### Chart B.4

...whereas under the “severely adverse” scenario, the likelihood of insurers falling below the solvency capital requirement would be higher.

#### Projection of solvency ratios under the “severely adverse” scenario

(2014-2021; solvency capital requirement ratio)



Sources: ECB calculations.

Notes: The black solid line represents the solvency capital requirement of 100%. The other solid lines represent the median solvency ratios, defined as own funds over solvency capital requirements. C.I. is the confidence interval containing 95% of the simulated solvency ratios for the considered countries.

Under the adverse scenario, the German, French and Dutch representative life insurers experience a decline in their solvency ratios (see Chart B.3). The German insurer displays a material decline in its solvency ratio (which, over the medium term, in some cases, falls under the solvency capital requirement of 100%) owing to the high cost of the guarantees still in its portfolio and to the relatively wide maturity mismatch. However, the French and Dutch insurers are not strongly affected under this scenario owing to the more rapid adjustment of their liability portfolios to the prevailing interest rate regime, to the relatively lower cost of their guarantees and to the different regulation on guarantees and profit participation. Finally, the Italian insurer, which displays the best duration match, experiences an increase in the

solvency ratio, mainly owing to the revaluation of its asset portfolio, and the highest return on assets.<sup>164</sup>

Under the severely adverse scenario, the reduction in the return on assets is slightly faster and the effect on solvency is much stronger (see Chart B.4). The combination of a protracted period of low interest rates and higher volatility in credit spreads, stock and real estate returns can be highly deleterious for the modelled representative life insurers. The German insurer experiences a strong reduction in the solvency ratio at a very early stage of the simulation period. In particular, in the last three years of the scenario, the solvency capital requirement is breached in about 50% of the simulations. The Italian insurer also experiences a reduction in its solvency ratio, mainly owing to the high home bias in sovereign holdings in its asset portfolio, which, under this scenario, experience higher volatility. In the middle of the simulation period, the solvency capital ratio falls below the requirement in some simulations. The French and the Dutch insurers are also more adversely affected by this harsher scenario. However, the solvency capital requirement is not breached in any of the simulations.

Overall, the results of this analysis suggest that a prolonged period of low interest rates would affect the profitability and the solvency situation of life insurers. Should the low interest rate environment be accompanied by high volatility in financial returns, the effect on life insurers' solvency ratios would be even more pronounced. However, the extent of these effects would be heterogeneous across companies and would largely depend on their specific features, such as their asset allocation, duration mismatch and level of guarantees provided.<sup>165</sup>

## Concluding remarks

The qualitative and quantitative analyses presented in this article confirm that the level of long-term interest rates has a significant impact on the profitability and, in a market-consistent valuation regime, on the solvency of insurance companies.

These findings should nevertheless be interpreted with due caution. In particular, the scenario-based stress test analysis, although based on the market-consistent valuation used under Solvency II, assumes no changes in asset allocations or portfolios. In reality, Section 3.1.2 on large euro area insurers in this and previous editions of the FSR has showed that such adjustments have already been taking place for some time, and they are likely to continue. Additionally, the analysis does not take into account the long-term guarantee measures, which are an important part

---

<sup>164</sup> The Italian insurer has the highest return on assets owing to its large reliance on its own country's sovereign bonds, which benefit from higher returns and do not suffer from a higher solvency capital requirement.

<sup>165</sup> In this context, it is worth mentioning that the results of this analysis rely on a set of simplifying assumptions which heavily influence the results through the calibration of the model. In particular, underlying assumptions on the portfolios of assets and liabilities, as well as on the dynamics of policyholders and shareholders' decisions are strong determinants of the results presented here.

of the Solvency II package. These measures, intended to reduce unhelpful balance sheet volatility, have been shown to have a significant impact.<sup>166</sup>

The long-term guarantee package also includes transitional measures that smoothen the move to Solvency II, the use of which requires supervisory approval. The firms using transitional measures are required to make their impact public. In this regard, it is important that the transition time is used effectively to ensure that business models are sustainable in the new regulatory regime and in the presence of a prolonged period of low interest rates.<sup>167</sup>

---

<sup>166</sup> See the EIOPA 2014 insurance stress test, available at <https://eiopa.europa.eu>

<sup>167</sup> This statement was also made by Gabriel Bernardino, Chairman of EIOPA, in his keynote speech entitled "Milestones of preparation for Solvency II", given at the European Insurance Conference in London on 3 June 2015. See <https://eiopa.europa.eu/Publications/Speeches%20and%20presentations/2015-06-02%20European%20Insurance%20Conference.pdf>