Regulatory risk-free yield curve properties and macroprudential consequences

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Executive Summary

The regulatory risk-free yield curve has a direct impact on the behaviour of insurers. It affects their provisioning and may influence hedging and investments choices. As a result, its design and derivation from market data are important. This report considers the macroprudential consequences of the regulatory risk-free yield curve with a view to informing the ongoing work at the European Insurance and Occupational Pensions Authority (EIOPA) on the methodology for deriving this yield curve, as well as the upcoming Solvency II reviews.

Macroprudential requirements for the regulatory risk-free yield curve call for the use of a market-based curve. The requirements used for insurance regulation are: (1) realistic estimates of liability values, (2) consistent derivation and application of the curves, (3) adequate risk management incentives, and (4) prevention of procyclical behaviour. The first three requirements are better achieved when the regulatory risk-free yield curve is based on market data. The fourth requirement may conflict with the market valuation of insurers' balance sheets. As there is some initial evidence on the procyclical behaviour of insurers (Bank of England, 2014; De Nederlandsche Bank, 2015), potential procyclical effects should be monitored and further work needs to be undertaken to consider how these effects and/or their causes could be addressed through, for example, macroprudential policy measures beyond the basic risk-free yield curve.

There are divergent views on deriving the regulatory yield curve for longer maturities where financial markets are less liquid. For longer maturities, swap markets and sovereign bond markets are less liquid. Solvency II takes this into consideration by using a hybrid of market rates and extrapolations. This report assesses whether, within this setting, the relevant parameters of the regulatory risk-free yield curve are set in accordance with macroprudential requirements.

For the long end of the regulatory risk-free yield curve, the realistic setting of the last liquid point (LLP) and the ultimate forward rate (UFR), and the convergence between them, is essential. To derive the long end of the regulatory risk-free yield curve, Solvency II applies the Smith-Wilson technique, which is based on: (1) market values for the liquid part of the curve; (2) the LLP, which is the maturity beyond which market rates are not used; (3) the level of the UFR, which is the assumed one-year forward rate in the distant future; and (4) the convergence speed from the LLP to the UFR. This technique delivers fairly stable levels of regulatory risk-free yields for the long end of the curve. The setting of these parameters determines the regulatory risk-free yield curve.

In April 2017, EIOPA developed a methodology to derive the UFR on an ongoing basis (European Insurance and Occupational Pensions Authority, 2017a), which will be applied from 1 January 2018 onwards. Using this methodology, the UFR for the euro is calculated to be 3.65%. The methodology includes a limit on the annual change of the UFR of 15 basis points. The limit implies that the UFR will be changed from 4.2% to 4.05% in 2018 and, ceteris paribus, linearly onwards. A large majority of European Systemic Risk Board (ESRB) members favoured this reduction of the current level of the UFR, and made a policy observation that the transition appears to be too slow, should a “low-for-long” scenario prevail over the next decade.

This report makes three proposals, which, under current market conditions and together with the forthcoming reduction in the UFR, would result in a lower regulatory risk-free yield curve. The findings of this report suggest that the current curve may underestimate insurers' liabilities and, thus, generate unrealised losses. The exact impact of the proposed changes on the technical provisions of life insurers' solvency should be carefully assessed, taking into account the whole landscape of European insurers, before arriving at a conclusion about further changes to the regulatory[1] risk-free yield curve. Comparison with the low-for-long yield stress curve used in the 2016 EIOPA stress test indicates that the overall impact of the proposals put forward in this report should be less significant than that of the abovementioned stress test. Potential second-round effects of a lower risk-free yield curve, such as those caused by insurers hunting for duration, should be monitored and may require additional macroprudential policy measures.

Specifically, the report proposes considering one or more of the points below, taking into account that their combined implementation may require more fundamental changes to the derivation of the regulatory risk-free yield curve:

- **A new method to derive the LLP and to extend the LLP for the euro regulatory risk-free yield curve from 20 to 30 years.** According to common liquidity measures, there is little difference in liquidity between euro swap rates at 20-year and 30-year maturities. The same holds for liquidity in euro sovereign bond markets. On the basis of the liquidity of swap and bond markets, the LLP for the euro regulatory risk-free yield curve should be moved to 30 years.
- **Extending the convergence period (from LLP to UFR) from 40 years to 100 years.** This would reduce the weight of the UFR and increase the weight of the liquid part of the regulatory risk-free yield curve when deriving the illiquid part of the regulatory risk-free yield curve.
- **Blending the extrapolated part of the curve partly with market data, provided that sufficiently reliable market data are available, as, for instance, is done in the regulation of Swedish and Dutch pension funds.** The requirement to extrapolate the risk-free yield curve from an LLP that is set at a single maturity can lead to excessive risk exposure to interest rate risk around that maturity and, potentially, to procyclical hedging behaviour. Furthermore, based on the properties of the extrapolation method, it may necessitate a relatively short-term realisation of unrealised losses when maturity buckets of liabilities approach the LLP over time.

The analysis performed in this report provides a basis for further, ongoing reviews of the regulatory risk-free yield curve. In particular, this report concentrates on the euro, but when reviewing the regulatory risk-free yield curve, EIOPA may wish to analyse the regulatory risk-free yield curves for a broader range of currencies. Since liquidity varies over time, a regular reassessment of the LLPs, based on a fixed methodology, seems warranted.

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1 The terms “relevant” or “regulatory” risk-free rate curve are used interchangeably in this report.

Section 1
Introduction

This report brings a macroprudential perspective to the discussion on the design of the regulatory risk-free yield curve used in insurance supervision.[2] The design of the regulatory yield curve is determined by the legislative framework, Solvency II. The insights presented in this report may inform possible amendments to Solvency II. The following two high-level questions are central to this report:

- Why is a risk-free yield curve relevant from a financial stability perspective?
- How is a regulatory yield curve constructed and which properties would be desirable from a macroprudential perspective?

The report is structured as follows: Section 2 outlines why the regulatory risk-free yield curve matters, including from a macroprudential perspective; Section 3 contains the requirements that the regulatory risk-free yield curve should fulfil from a macroprudential perspective; Section 4 describes how the regulatory risk-free yield curve is designed in Solvency II; and Section 5 compares the current design with the macroprudential requirements and draws policy conclusions.

2 Throughout the report data available up to 31 March 2017 are considered.

Section 2
Importance of the regulatory yield curve in insurance

The business model of insurers fundamentally differs from that of banks. In exchange for premiums that are known ex ante, insurers promise to make payments to policyholders if certain insured events materialise. To be able to fulfil these promises, they usually invest these premiums in marketable securities, such as bonds and stocks. In contrast, banks take deposits or issue short to medium-term securities in order to fund longer-term assets, such as loans that are of an illiquid nature.

For insurers, the value of liabilities needs to be estimated. In supervising any financial intermediary, regulators have to determine whether the amount of equity is sufficient to reasonably buffer against unforeseen losses. Since the value of banks' liabilities corresponds closely to their face value, the difficulty lies in making sure that the reported values for assets that are not traded publicly – the lion's share of a bank's assets – are a realistic representation of their true value. The opposite is the case for insurers: the value of their assets is often observable (since market values are available), but the value of their liabilities – promises to policy holders – can only be estimated (see Figure 1).

Figure 1
Stylised example of an insurer's balance sheet

Assets	Liabilities
Marketable securities (bonds, stocks, cash)	Fair value of the technical provisions: • best estimate of future cash flows (discounted and summed) • risk margin Own funds (equity and subordinated debt)

The regulatory risk-free yield curve is central to estimates of long-term liabilities. For long-dated promises – the main business of traditional life insurers – one of the central ingredients for estimating their value is the rate at which future liabilities are discounted. If these liability cash flows are certain, the discount curve should be the risk-free yield curve, i.e. risk-free rates at all relevant maturities for different currencies. Risk-free rates are applied to both best estimates of future liabilities and to the risk margin (see Box 1).

In normal times, the design of the regulatory risk-free yield curve does not only have an impact on balance sheet reporting; it may also affect risk management. The regulatory risk-free yield curve implicitly sets incentives for product development and risk-taking, because it determines the value of the technical provisions and the capital position of an insurer. The choice of a regulatory yield curve may thus have implications for intergenerational distribution of costs and returns.

In periods of stress, the regulatory risk-free yield curve determines when the supervisor can intervene and whether an insurance portfolio can be transferred as a resolution strategy. For instance, when the regulatory risk-free yield curve is too high, an insurer could try to generate short-term profits by taking on long-term liabilities, which regulation undervalues, given that discount rates used are too high. If the capital position of the insurer deteriorates over time, the portfolio of long-term liabilities can only be transferred to another insurer at a discount, to the detriment of policyholders. This is because other insurers would probably not calculate the price of those liabilities using the same regulatory risk-free yield curve, but a lower risk-free yield curve that more closely reflects market rates.

Box 1

The risk Margin

Risk-free rates are applied to the best estimates of future liabilities and to the risk margin. The risk margin is a component of the technical provision, representing the cost of capital. Its calculation has three important inputs: (1) projection of the solvency capital requirement (SCR) (in respect of non-hedgeable risks), (2) cost of capital (currently set at 6%), and (3) risk-free interest rate used to discount the cash flows in respect of (1) and (2). Therefore, the risk margin is sensitive to interest rates. A fall in interest rates would lead to an increase in the risk margin.

The sensitivity of the risk margin to interest rates adds to the systemic impact of the risk-free rate. It also adds to balance sheet volatility due to changes in the risk-free rate. In addition, wrong estimates of the long end of the risk-free curve lead to overestimating or underestimating the risk margin and thereby to sector-wide biased levels of reserving.

Across the world, a wide variety of long-term liability valuation methods are applicable. With the exception of China, in most jurisdictions, including those in the European Union (EU), some form of market-based valuation of long-term liabilities is used (see Annex 1). However, in Japan and the United States locked-in assumptions are applied, i.e. calculations rely on the market values at the time of writing the insurance contract. This differs from the market-based valuation in the EU, which focuses on current market rates. Furthermore, in the United States the discount curve applied is not risk-free, as it is in the EU and other countries, but includes a risk premium.

Section 3
Macroprudential requirements for the regulatory risk-free yield curve

Regulatory risk-free yield curves should be realistic, consistent, incentivise adequate risk management and prevent procyclical behaviour. Such curves can be determined in several ways. From a macroprudential perspective, regulatory risk-free yield curves should:

- reflect a realistic estimate of the time value of money, in order to arrive at best estimates of technical provisions and thereby promote sufficient provisioning;
- be consistently derived and applied throughout the EU, in order to promote transparency and comparability across the EU;
- provide incentives to insurers for adequate risk management in order to minimise common vulnerabilities to interest rate risk;
- prevent procyclical investment and hedging behaviour.

3.1 A realistic estimate of the time value of money

A market-based estimate of the technical provisions prevents the build-up of hidden losses. When discount rates are too high, insurers might be incentivised to sell off assets needed to cover their technical provisions, possibly hampering their promised payments to policyholders. In the insurers' balance sheet, this deficiency would only show up in the future, when they actually earn a lower rate on investments than the guaranteed rate of their liabilities. In that situation, insurers would incur a loss that reduces their own funds. Where insurers have long-term liabilities discounted with risk-free rates that are too high, the losses from inappropriate discounting may consume all their own funds and eventually put the survival of some insurers at risk. In such a situation, it would also be difficult to find a third party willing to take over the portfolios at the price implied by an inflated discount rate.

If a large part of the sector carries such hidden losses in the balance sheet, risks may become system-wide. In that case, the insurance sector may not be able to fulfil its function in financial markets and the real economy, such as the protection against risks and the provisions of savings vehicles (European Systemic Risk Board, 2015). Hidden losses could generate intergenerational conflicts and lead to consumer distrust in the sector's services, which perform important economic tasks, such as intertemporal purchasing power stabilisation.

3.2 Consistent application

Consistent derivation and application of the regulatory risk-free yield curve promotes transparency and comparability. By defining a consistent set of criteria to derive the risk-free yield rates across the EU, a uniform valuation basis for the regulatory framework across the EU is created. By doing so, it is possible to avoid insurers choosing their own discount rates on an arbitrary basis. Thus, such a uniform regulatory risk-free yield curve makes balance sheets more transparent and thereby more comparable.

If the uniform regulatory risk-free yield curve is set at credible levels, it promotes market discipline. Having transparent and comparable balance sheets using uniform discount curves for each currency means that market participants do not have to assess whether each firm has used the correct discount curve to estimate the value of its liabilities, thus promoting market discipline. However, if the uniform risk-free yield curve is not set at credible levels, market participants have to correct the value of liabilities of each firm, which is cumbersome and perhaps even impossible.

At the same time, uniformity in application may also contribute to the build-up of systemic risks, if the level of the regulatory yield curve is not appropriate. There is fundamental uncertainty about the true values of risk-free rates, particularly at the long end of the yield curve. Consistent application implies that any error in its construction will get amplified through underestimation of the technical provisions, but possibly also correlated portfolio and hedging choices, and product design. In other words, forced application of the same yield curve model may – on an aggregate level – magnify parameter risk and model risk.

3.3 Adequate risk management

Adequate risk management prevents sector-wide vulnerabilities to interest rate risk. It includes:

- sound product design which reflects underlying risks;
- matching of assets and liabilities;
- hedging through the use of derivatives;
- sufficient capital buffers to absorb losses following adverse interest rate changes.

Market-based discount rates provide incentives for adequate risk management. In particular, if discount rates are set too high, insurers may be incentivised to guarantee unsustainable returns to policyholders. On the other hand, if discount rates are based on prices from liquid swap markets, such swaps can be used to hedge the sensitivity of the value of liabilities to interest rate changes. Owing to such discount rates, set at market consistent levels, capital requirements can also be based on realistic sensitivities to interest rate changes.

3.4 Limiting procyclicality

Purely market-based risk-free yield rates may, on the other hand, bear procyclical risks. Procyclical behaviour is mostly associated with insurers' investments resulting from market valuation of assets. But changes in risk-free rates may also induce procyclical behaviour if discount rates are purely market based. When the long-term risk-free rate declines and liabilities are valued using market rates, all else being equal, insurers' solvency positions deteriorate, given that the liabilities of most insurers have longer durations than their assets (European Insurance and Occupational Pensions Authority, 2016a). In reaction to this insurers may: (1) sell off risky assets and buy safe-haven assets in order to reduce capital requirements (Koijen and Yogo, 2015); (2) extend the duration of the assets to better match the duration of their liabilities (Domanski, Shin and Shushko, 2015); and/or (3) hedge their interest rate sensitivity, for instance by paying the floating part of an interest rate swap. These strategies, although prudent from a microprudential perspective, may push long-term risk-free rates in financial markets further down if applied by a large part of the sector at the same time.

Empirical evidence is mixed: insurers may also react in a countercyclical manner if discount rates are market based. The International Monetary Fund (IMF) finds that life insurers with capital ratios closer to the required minimums allocate significantly more of their investments to higher-risk assets (International Monetary Fund, 2016). The low interest-rate environment has accentuated these patterns of behaviour. Both EIOPA and the European Central Bank (ECB) observe tendencies towards a search for yield by EU insurers, attributing this to the low interest rate environment (European Insurance and Occupational Pensions Authority, 2016b; European Central Bank, 2016).[3] If insurers sell safe-haven assets to buy riskier assets, risk-free yield rates will increase. On the other hand, under the risk-based Solvency II framework, investing in riskier assets may lead to an increase in capital requirements and/or to a more volatile solvency position, which may necessitate the build-up of additional buffers to ensure continuous compliance with regulatory requirements. These effects may limit incentives for an excessive search for yield.

The composition of assets on which the discount curve is based may impact insurers' investment behaviour. To match assets and liabilities insurers have an incentive to own investments that reflect the composition of the regulatory risk-free yield curve. Although perhaps prudent from a microprudential perspective, this incentive may entail macro risks if many companies invest in the same asset class. For instance, if the regulatory risk-free yield curve is composed of sovereign bond yields, insurers have an incentive to invest in these bonds. This could be exacerbated during times of stress, where insurers might reallocate their portfolio to better align it with the risk-free yield curve. In some countries this has, at times, given rise to self-reinforcing market dynamics, e.g. in Denmark where market-based discount curves have been used since 2002. The Danish authorities therefore have some experiences with the impact of risk-free yield curve dynamics on investment behaviour (Box 2).

Box 2

Denmark's experience of asset composition of the market-based risk-free yield curve

During the European sovereign debt crisis, Danish government bond yields dropped below German government bond yields (see Chart 1). Because the liabilities of Danish insurers were discounted using euro swap rates plus the spread between Danish and German government bonds, and insurers owned many German government bonds, the value of their liabilities increased more than the value of their assets. This reduced their excess capital from already low levels and gave them the incentive to sell German government bonds and buy Danish government bonds to align their investments with the discount curve. This procyclical behavior resulted in further downward pressure on Danish government bond yields, the Danish krone strengthened and, in the end, it started a process of self-reinforcing dynamics. Given the size of the sector, potential reallocations in response to yield changes could have had a large impact on the bond and foreign exchange markets. Against this backdrop, the composition of the risk-free yield curve was adjusted to ensure that current spread changes received a lower weight in the yield curve, thereby reducing insurers' incentive to reinforce market movements (after the change, the spread between Danish and German government bonds was replaced with a 12-month average spread between Danish and German government bond zero coupon yields with a lower bound of 0).

[3] EIOPA currently conducts a comprehensive survey on the investment behaviour of insurers. The purpose of this survey is to identify changes and trends in the investment behaviour of insurers over the last five years given the persisting low yield environment, including identifying, where possible, a potential "search for yield".

Chart 1

Spread between ten-year Danish and German government bond yields

Source: Nationalbanken.

3.5 Conclusion of Section 3

Overall, macroprudential requirements for the regulatory risk-free yield curve call for market-based regulatory risk-free yield curves. The first three requirements are better achieved when the regulatory risk-free yield curve is based on market data. The fourth requirement, the prevention of procyclicality, may conflict with the market valuation of insurers' balance sheets. Two recent analyses by the Bank of England (2014) and De Nederlandsche Bank (2015) have shown some initial evidence of procyclical investment behaviour. As this report focuses on the basic risk-free yield curve, obtaining realistic estimates of liability values, ensuring the consistent application of the curves and incentivising adequate risk management are considered the most important characteristics for determining the setup of this basic risk-free curve. With the introduction of Solvency II, the European solvency regime has now moved into a market-based assessment, which means there is also a danger that procyclicality will increase. Potential procyclical effects should therefore be monitored and further work needs to be done to consider how they could be mitigated, e.g. through macroprudential policy measures beyond the basic risk-free yield curve.

A mix of market data, adjustments and approximations should be used to arrive at market-based estimates. To achieve a realistic estimate of the time value of money, the curve should, as much as possible, be based on observable financial market data. The selection of these market data may influence insurers' investment decisions. Beyond certain maturities, financial markets are not sufficiently deep, liquid and transparent for them to be a reliable basis for a realistic estimate of the time value of money. As a result, those maturities need to be approximated, which implies model risk for the entire sector. Moreover, insurers may have little capacity to hedge against a change in risk-free rates determined for those maturities.

Section 4
Current calibration of the regulatory risk-free yield curve

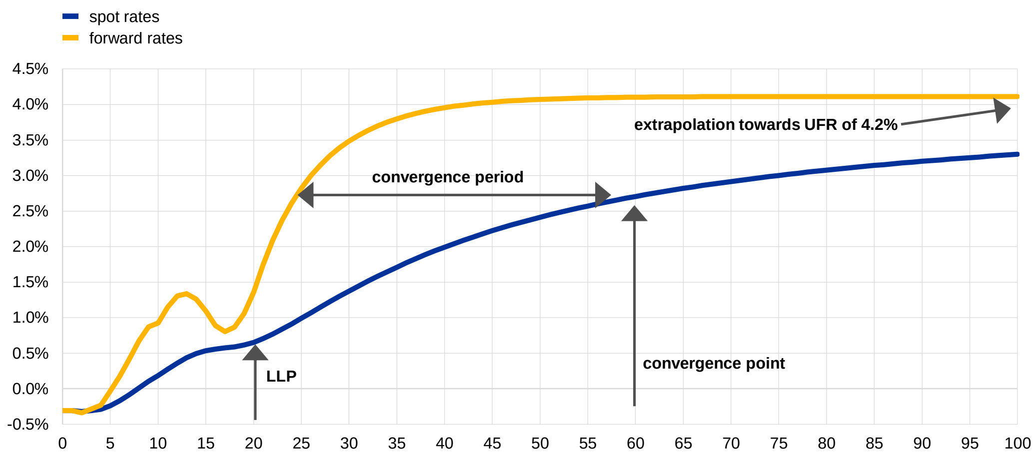
This section outlines how the regulatory risk-free yield curve is derived for Solvency II. The regulatory risk-free yield curves are calculated and published by EIOPA. The European Commission can make them binding for all insurers and reinsurers subject to Solvency II by transposing them into implementing acts. A detailed description of the methodology for deriving the regulatory risk-free yield curves can be found on EIOPA's website.[4]

EIOPA derives regulatory risk-free yield curves for 33 currencies. These currencies are considered most relevant for the valuation of insurance and reinsurance liabilities of European insurers. These currencies include all those of the European Economic Area (EEA).

Deriving the regulatory risk-free yield curve consists of four elements (see Chart 2). These are: (1) the market values of the liquid part of the curve; (2) the LLP, which is the maturity beyond which market rates are not used; (3) the level of the UFR, which is the assumed one-year forward rate in the distant future; and (4) the extrapolation method, including the convergence period, which connects the forward rate at the LLP with the UFR.

Chart 2
Euro risk-free interest rate curve (September 2016)

(x-axis: maturity in years; y-axis: risk-free interest rates)



Source: EIOPA.

The risk-free interest rates may include a matching adjustment or a volatility adjustment. These adjustments relate to the spread of bonds in which insurers are invested. These measures have a widespread use in the European market, and have a large impact on the value of technical

[4] See the technical documentation on the methodology for deriving EIOPA's **risk-free interest rate term structures**.

provisions and the solvency positions of the insurers.[5] This report focuses on the (unadjusted) basic risk-free rate curve. Future work should consider the effects of the matching and volatility adjustments on the regulatory risk-free yield curve under Solvency II, the impact on the behaviour of insurers, and related macroprudential considerations.

4.1 The liquid part of the curve

The liquid part of the regulatory risk-free yield curves is derived from different financial instruments, depending on the currency. Interest rate swaps, provided they are available from deep, liquid and transparent financial markets are typically used. Otherwise government bonds from deep, liquid and transparent financial markets are used.[6]

The swap rates and government bond rates are adjusted for credit risk. For swaps, the credit risk adjustment (CRA) is half of the spread between the rate of the floating leg of the swap and a corresponding overnight indexed swap (OIS) rate.[7] The spreads are averaged over one year to stabilise the amount of the adjustment. All CRAs are subject to a floor of 10 basis points and a ceiling of 35 basis points. Since the first publication of regulatory risk-free interest rates for December 2014, the euro CRA has been 10 basis points. In addition, the CRAs for other EEA currencies are currently at 10 basis points, with the exception of the risk-free interest rates for the pound sterling, which has a CRA of 17 basis points.[8]

4.2 The last liquid point

The regulatory risk-free yield curves are based on financial instruments up to the LLP. This point is the longest maturity for which the market of the relevant financial instruments (swaps or government bonds), as well as the bond market, are deemed to be deep, liquid and transparent (see Table 1)[9], in order to allow insurers to cover their cash outflows up to the LLP with bonds.[10]

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5 According to the EIOPA long-term guarantees (LTG) report 2016, at the start of Solvency II, 852 undertakings located in 23 countries use the volatility adjustment, and 38 undertakings in two countries (Spain and the United Kingdom) use the matching adjustment. Using the volatility adjustment (respectively, the matching adjustment) leads, on average, to an increase of the solvency capital requirement (SCR) ratio by 34% (respectively, 70%).

6 Government bonds are currently used to derive the risk-free interest rates for the Croatian kuna, Hungarian forint, Polish zloty, Romanian leu, Icelandic króna, Brazilian real, Indian rupee, Mexican peso and Taiwan new dollar. For the Bulgarian lev and the Danish krone, which are pegged to the euro, the risk-free interest rates are derived from euro interest rate swaps. For that purpose, the euro swap rates are adjusted downwards, currently by 1 basis point for the krone and 5 basis points for the lev, in order to reflect currency risk.

7 For rates derived from swaps where a sufficiently developed OIS market is not available, and for rates derived from government bonds, two mutually exclusive options apply: (i) for EEA currencies, the same CRA as for the euro applies; and (ii) for non-EEA currencies, the CRA is calculated from the CRA of the USD rates by scaling it up or down according to the relative level of the rates.

8 CRAs for end-August 2016.

9 Article 77a of the Solvency II Directive states: “The determination of the relevant risk-free interest rate term structure referred to in Article 77(2) shall make use of, and be consistent with, information derived from relevant financial instruments. That determination shall take into account relevant financial instruments of those maturities where the markets for those financial instruments as well as for bonds are deep, liquid and transparent.”

10 Recital 30 of the Omnibus II Directive states: “The choice of the starting point of the extrapolation of risk-free interest rates should allow undertakings to match with bonds the cash flows which are discounted with non-extrapolated interest rates in the calculation of the best estimate.”

Table 1
Current LLPs for different EEA currencies

LLP	Currencies
50 years	Pound sterling
25 years	Swiss franc
20 years	Euro, Bulgarian lev, Danish krone
15 years	Czech koruna, Hungarian forint
10 years	Polish zloty, Romanian leu, Swedish krona, Norwegian krone
9 years	Croatian kuna
8 years	Icelandic króna

Source: EIOPA.

There are no common thresholds with regard to indicators of depth and liquidity, but one threshold is set for the euro. EIOPA decides on the LLP based on trade volume, trade frequency and the bid-ask spread of the financial instruments. Although not related to an economic assessment of the liquidity of the swap or bond market, Recital 21 of Commission Delegated Regulation (EU) 2015/35 sets a volume-based threshold for the bond market: "Under market conditions similar to those at the date of adoption of Directive 2014/51/EU, when determining the last maturity for which markets for bonds are not deep, liquid and transparent anymore in accordance with Article 77a of Directive 2009/138/EC, the market for bonds denominated in euro should not be regarded as deep and liquid where the cumulative volume of bonds with maturities larger than or equal to the last maturity is less than 6 percent of the volume of all bonds in that market." This report does not consider this threshold in great detail as it is not economically linked to the liquidity of these relevant financial instruments.

4.3 The ultimate forward rate

The extrapolation from the LLP is currently based on a UFR of 4.2% for most currencies including the euro. For the euro this rate is derived from long-term averages of past real interest rates (2.2%) and the inflation target of the ECB (2%). For the Swiss franc and the Japanese yen, a UFR of 3.2% is used, and for the Brazilian real, the Indian rupee, the Mexican peso, the Turkish lira and the South African rand a UFR of 5.2% is used. These ultimate forward rates were derived in 2010 as the sum of a long-term average of real rates since 1950 and expected inflation.

EIOPA developed a methodology for deriving the ultimate forward rates on an ongoing basis (European Insurance and Occupational Pensions Authority, 2017a). The methodology was published in April 2017 and will be applied from 1 January 2018. Accordingly, the expected real interest rate will be derived as the long-term average of past annual one-year realised real interest rates from 1961 to the date of derivation of the UFR. The real interest rates are taken from Belgium, France, Germany, Italy, the Netherlands, the United Kingdom and the United States. That approach provides an expected real rate of 1.65%. The expected inflation rate equals the communicated inflation target of the central banks of the currencies, i.e. 2% for the euro. The UFR for the euro calculated with this methodology is therefore currently 3.65% (if the current low yield environment persists, the UFR will decrease further). The methodology includes a limit on the annual change of the UFR of 15 basis points. The limit implies that the UFR will change from 4.2% to 4.05% in 2018.

A large majority of ESRB members favoured the reduction of the current level of the UFR, and observed that the transition appears to be too slow, should a “low-for-long” scenario prevail over the next decade.

4.4 Extrapolation method and convergence period

For maturities beyond the LLP, extrapolation is based on the Smith-Wilson technique (Smith and Wilson, 2001). The extrapolated forward rates converge to the UFR. The Smith-Wilson technique allows the speed of convergence towards the UFR to be controlled and thereby delivers stable long-term risk-free rates. The speed of convergence is chosen in such a way that the forward rates are, up to an immaterial difference, equal to the UFR for maturities at a specified convergence point.

The convergence point of EIOPA’s regulatory risk-free yield curve is 60 years and at least 40 years past the LLP. For example, for the euro the convergence point is 60 years, while for the pound sterling the convergence point is 90 years. The Swedish krona is an exception, with a convergence point of 20 years (convergence period of ten years).

Section 5
Assessment of the current regulatory risk-free yield curve

This section compares the design of the Solvency II regulatory risk-free yield curve with the above macroprudential requirements. In particular, it assesses the calibration of the liquid part of the curve, the choice of the LLP and the design of the illiquid part of the curve.

5.1 The liquid part of the curve

The upper limit of the CRA makes the risk-free yield for some currencies too high, leading to unrealistic values of liabilities. The CRA to swap rates and government bond rates is limited to 35 basis points. In particular, for government bonds this limit may lead to an underestimation of the credit risk and consequently to risk-free interest rates that are too high. For example, the risk-free interest rates for the Brazilian real are derived from government bond rates. Brazil has a sovereign rating of BB and the Credit Default Swaps (CDS) for Brazil for sovereign debt exposures in US dollars are above 200 basis points at the time of writing, and hence significantly higher than the current CRA of 35 basis points for sovereign bonds in local currency.

5.2 The last liquid point

The LLP for the euro risk-free yield curve, which is set at 20 years, causes inconsistent application of risk-free curves across the EU, as the LLP for the pound sterling is set at 50 years. Market analysis does not justify this difference in the outcome of the liquidity assessment up to a maturity of 30 years, for the following reasons:

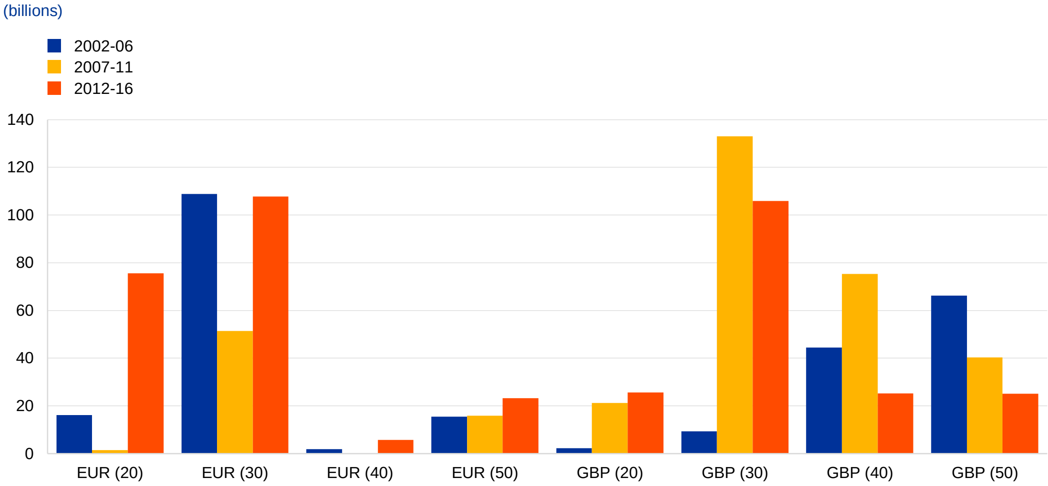
- The over-the-counter (OTC) market for euro swaps is three times larger than the OTC market for pound sterling swaps (Bank for International Settlements, 2016).
- Amounts of sterling-denominated sovereign bonds issued with a maturity of 50 years seem to justify an LLP of 50 years for the pound sterling regulatory risk-free yield curve. But euro-denominated sovereign bonds with a maturity of 30 years were issued, between 2012 and 2016 (red bar), in similar amounts as pound sterling-denominated sovereign bonds with a maturity of 30 years (see Chart 3a).
- Further, as evidenced in Chart 3b, the cash flow projections for 20 years and 30 years in the future are on the same order of magnitude; matching the cash flows of liabilities for insurers with bond investments would not be more difficult at 30 years than it is at 20 years[11].

Insurers active in the euro area are thus treated differently from those active in the United Kingdom. The next sections assess the liquidity of the euro swap market and euro sovereign bond markets in greater detail.

[11] EIOPA annually conducts deep, liquid and transparent (DLT) assessments of the markets for interest rate swaps, government bonds and for the general bond market to determine the relevant financial instruments to derive the risk-free interest rates and the LLP.

Chart 3a

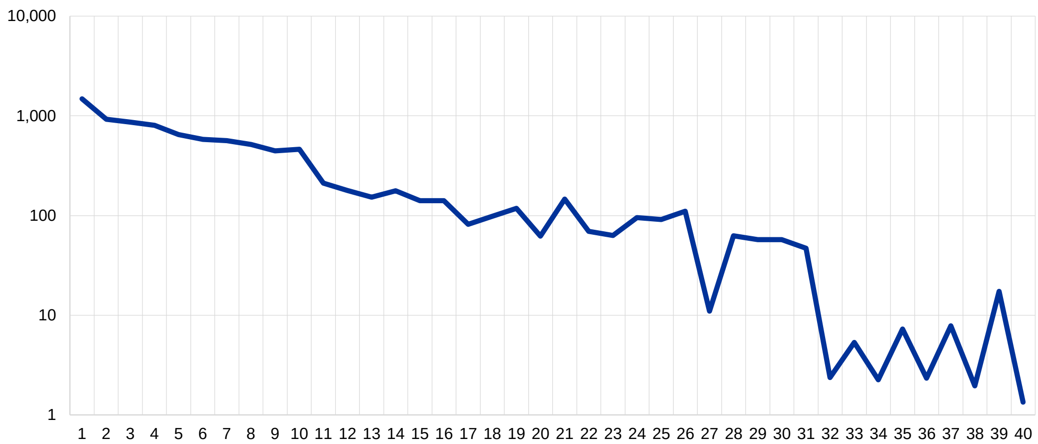
Long-term sovereign bond issuance for different maturities, denominated in euro versus pounds sterling



Sources: Bloomberg and ESRB Secretariat calculations.
Note: EUR (x) are Euro-denominated sovereign bonds of original maturity x+/-1. Colours denote the years of issue.

Chart 3b

Cash flows from euro-denominated government bonds, by maturity



Sources: Bloomberg and ESRB Secretariat calculations.
Notes: Y-axis: logarithmic scale, EUR billions. X-axis: numbers denote year of the cash flow counting from end-2016, thus 1 means cash flows in 2017, etc. Cash flows include principal and coupon payments from all active euro-denominated sovereign bonds available in Bloomberg.

5.2.1 Liquidity of euro swap markets

Evidence from the swap market suggests that, for the euro, the swap markets are deep and liquid up to 30 years. European Market Infrastructure Regulation (EMIR) data have been used to test whether the Euribor six-month swap markets are deep, liquid and transparent beyond the current LLP of 20 years. On three out of four measures of liquidity – price dispersion[12] (see Chart 4b), the Amihud measure[13] (see Chart 4c) and numbers of trades per day (see Chart 4d) – 30-year swaps appear, if anything, more liquid than 20-year swaps. Only on the measure of daily turnover do 30-year swaps score slightly less than 20-year swaps (see Chart 4a). In addition, earlier analysis of EMIR data shows that there are more outstanding 30-year swaps than 20-year swaps (Abad et al., 2016; Chart 9). Finally bid-ask spreads are not significantly higher for swaps with maturities of 30 years compared with swaps with maturities of 20 years (see Chart 5).

Chart 4a
Average total daily turnover

(x-axis: maturity; y-axis: EUR total daily turnover)

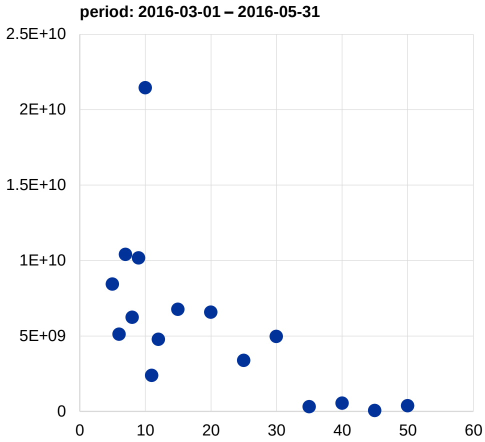
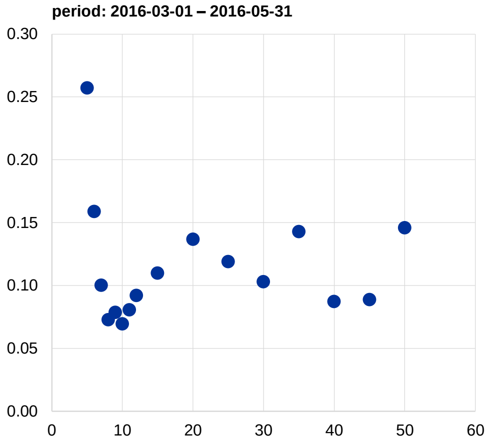


Chart 4b
Media price dispersion

(x-axis: maturity; y-axis : average price dispersion)



[12] Price dispersion is a measure of intra-day price variation. Variation in prices may be driven in part by intra-day volatility in fundamentals, by market micro-structure effects such as bid-ask bounce or by trade level effects, such as market impact through trade size. High values of price dispersion are typically seen as an indicator for low market liquidity.

[13] The Amihud measure considers inter-day price variation relative to turnover. It thereby proxies the classic concept of market impact. A high Amihud measure is typically seen as an indicator for low market liquidity. For details, see Benos, Payne, and Vasios (2016).

Chart 4c
Median Amihud measure of liquidity

(x-axis: maturity; y-axis: median amihud [1/1e12EUR])

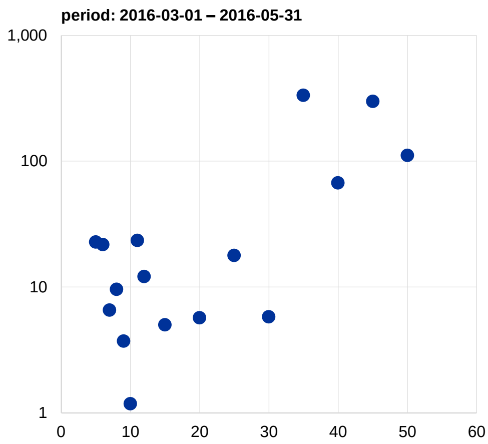
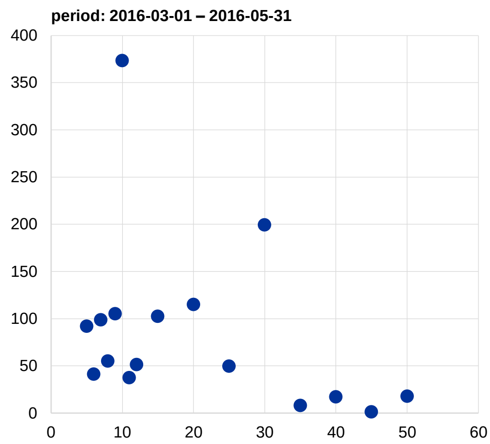


Chart 4d
Average total daily number of trades

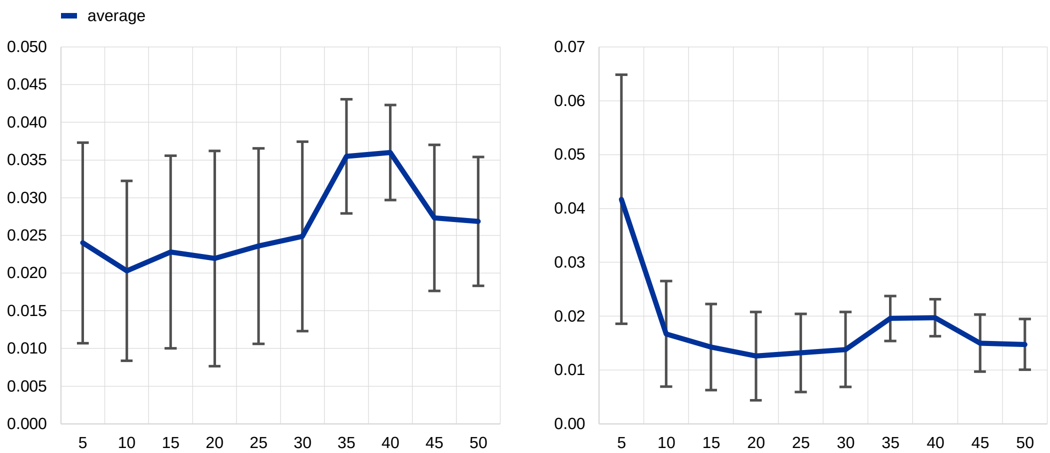
(x-axis: maturity; y-axis: # trades/day [EUR])



Sources: EMIR data and ESRB Secretariat calculations.
Note: Based on six-month Euribor interest rate swap transactions in March, April and May 2016.

Chart 5
Bid-ask spreads of six-month Euribor for different maturities

(percentage points; normalised by the averages of the absolute mid-price in the right-hand graph)



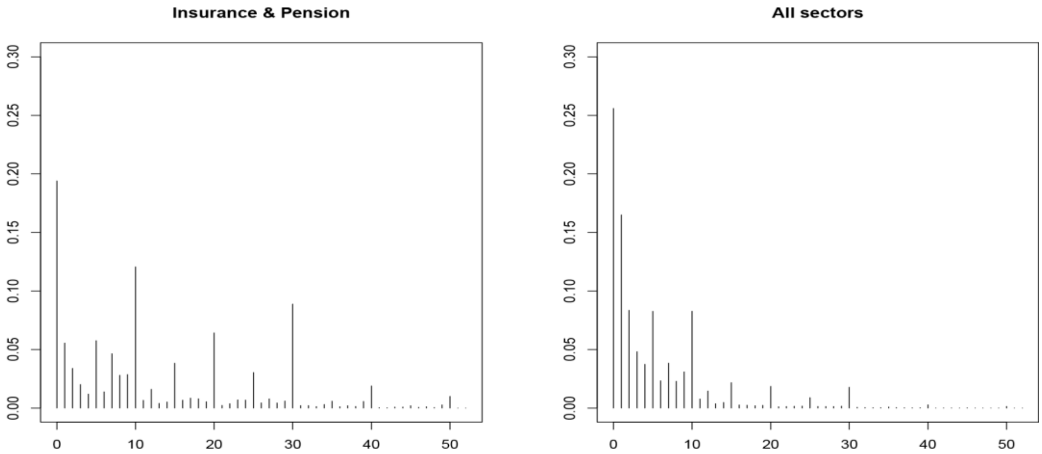
Source: Bloomberg.
Notes: Averages of historical data over the last four years. The bars show the +/- 1 standard deviation.

In fact, for a given instrument, insurers and pension funds use more derivatives with a maturity of 30 years than with a maturity of 20 years. This is not caused by specific conditions and regulations of the insurance and pension sector. Looking at all interest rate derivatives traded (of which insurance and pension companies account for a small percentage), a similar outstanding notional amount is present in the European market for 20-year and 30-year maturities (see Chart 6).

Chart 6

Distribution of interest rate derivatives in Europe by total notional amount across original maturity

(fractions)



Sources: EMIR data and ESRB Secretariat calculations.
Notes: All open trades in euro-denominated interest rate derivatives at mid-October 2016. The left-hand graph only shows the trades where at least one of the counterparties is a firm belonging to the insurance and pension sector. The right-hand graph includes all open trades, regardless of the counterparties.

ECB market intelligence suggests that there is little observed difference in liquidity between interest rate swaps of 20-year and 30-year tenors. Typical bid-offer spreads are said to be around 0.25 basis point wider than at the ten-year tenor. Further, market participants note that euro interest rate swaps are more liquid than the pound sterling interest rate swaps at longer tenors. However, market participants also note that during periods of market stress, liquidity at longer tenors may be non-existent, similar to the cash bond market. At the same time, it is not possible to know the relative impact of such an event on different tenors ex ante.

5.2.2 Liquidity of euro sovereign bond markets

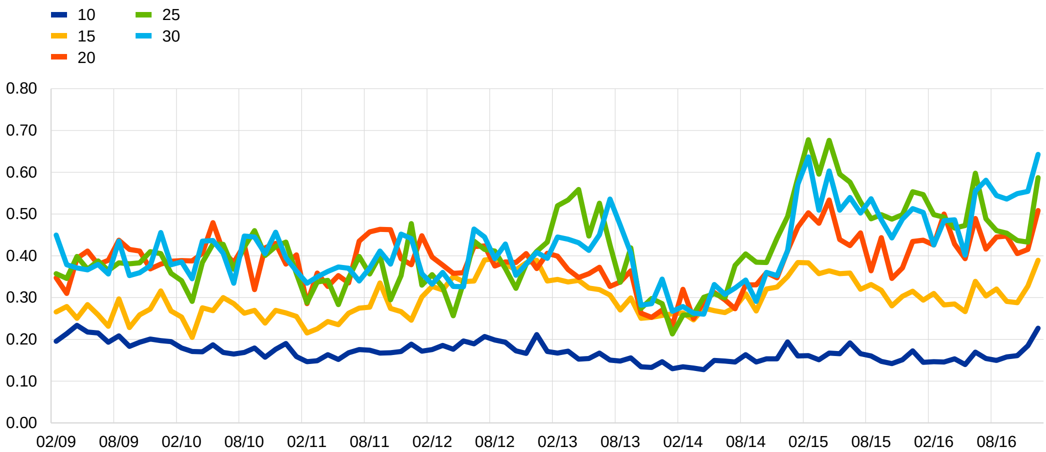
The European Banking Authority (EBA) does not find significant liquidity differences between long maturities of euro-denominated government bonds. Next to the liquidity of swap markets, the LLP should also take into consideration the liquidity of sovereign bond markets. The (EBA) has undertaken empirical analysis aimed at identifying the liquidity features of financial instruments, including sovereign bond markets, on the basis of a range of liquidity metrics (European Banking Authority, 2013). For maturities beyond ten years, there were no significant differences in liquidity measures between different maturities or maturity buckets.

Trade data show liquid markets for euro-denominated sovereign bonds beyond a maturity of 20 years. Bid-ask spreads of bonds traded on MTS (a fixed income trading electronic platform, mostly sovereign bonds) with a remaining time to maturity of 20 years are not consistently lower than those of bonds with a remaining time to maturity of 30 years (see Chart 7). The number and volume of trades of these bonds with a remaining maturity of 20 and 30 years are similar, and only significantly outperformed by the bonds with a remaining maturity of ten years (see Charts 8a and 8b).

Chart 7

Average bid-ask spread of all euro-denominated bonds traded on MTS, by maturity

(basis points)



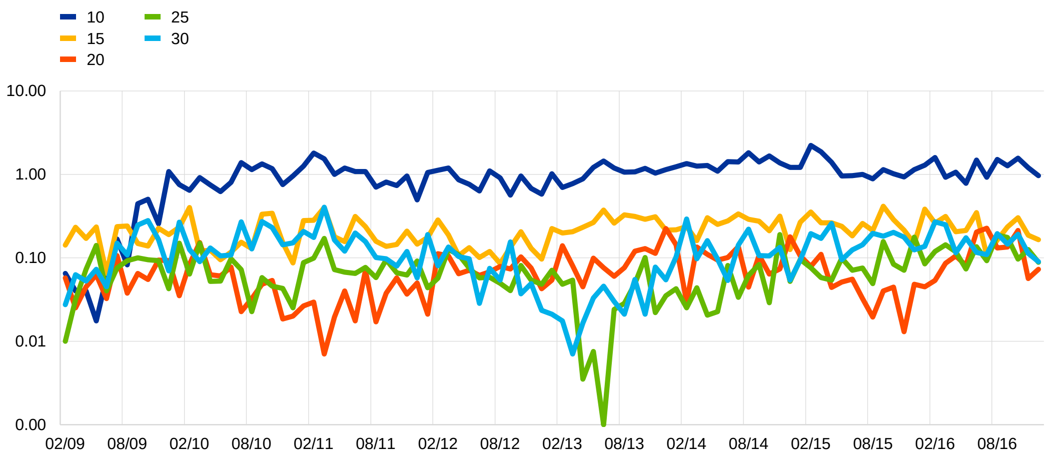
Source: MTS.

Notes: Mostly sovereign bonds with a very limited amount of corporate bonds traded on MTS. Grouped by time to maturity, benchmark maturities (+/- 1 year).

Chart 8a

Monthly volume of all euro-denominated bonds traded on MTS by maturity

(EUR billions; log scale)

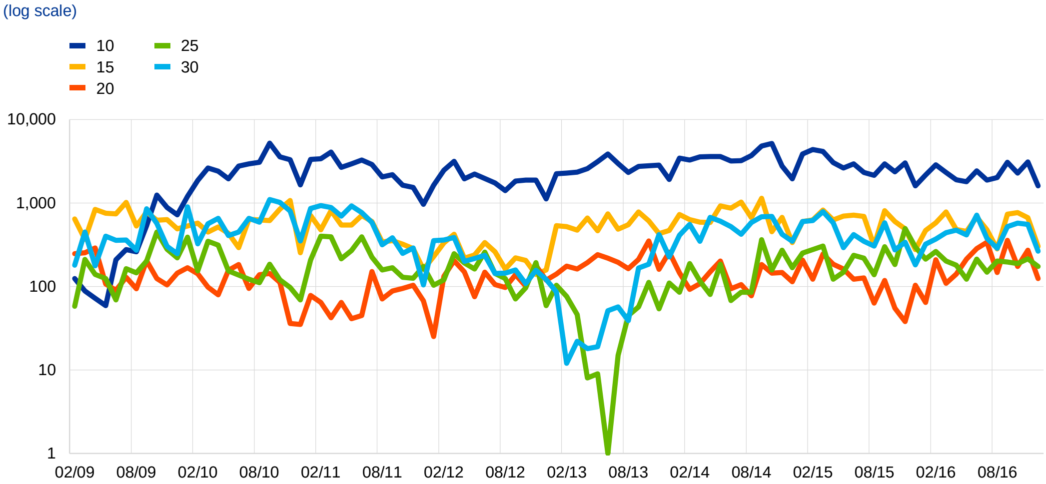


Source: MTS.

Notes: See note 4b. Log scale represents orders of magnitude.

Chart 8b

Monthly number of trades of all euro-denominated bonds traded on MTS by maturity



Source: MTS.
Notes: See note 4b. Log scale represents orders of magnitude.

Market conditions have changed since the threshold used for arriving at the LLP from relevant market data was set. EIOPA may deviate from the pre-set threshold in the Commission Delegated Regulation if market conditions change compared to those at the date of transposition of the Omnibus II Directive, i.e. 2014. Bond markets in Europe have been greatly affected by the ECB's Quantitative Easing (QE) programme, which was introduced in March 2015. Most notably, this programme has put a firm lid on peripheral debt spreads ever since.

The increased issuance of euro-denominated sovereign bonds with a maturity of 30 years or more alleviates concerns about the availability of sufficient long-term investment options. However, one may have concerns about the availability of long-term asset cash flows, which insurers can use to match their liability cash flows.[14] Comparing liability cash flows of European life insurers, as reported in the 2016 EIOPA stress test, with the issuance of euro-denominated sovereign debt with a maturity of 30 years (since 2012 more than €20 billion annually; see Chart 3a), it seems that asset cash flows denominated in euro with a maturity of 30 years are sufficiently available to cover life insurers' liability cash flows up to 30 years, even though life insurers are not the only ones looking for these long-term bonds. Furthermore, as shown in Chart 3b, cash flows from sovereign bonds with maturities of between 20 and 30 years are of the same order of magnitude. Given that insurers' liability cash flows do not increase with respect to

[14] This is relevant to Recital 30 of Directive 2014/51/EU of the European Parliament and Council of 16 April 2014 (i.e. the Omnibus II Directive), which states that "The relevant risk-free interest rate term structure should avoid artificial volatility of technical provisions and eligible own funds and provide an incentive for good risk management. The choice of the starting point of the extrapolation of risk-free interest rates should allow undertakings to match with bonds the cash flows which are discounted with the non-extrapolated interest rates in the calculation of the best estimate. Under market conditions similar to those at the date of entry into force of this Directive, the starting point for the extrapolation of risk-free interest rates, in particular for the euro, should be at a maturity of 20 years […]." Some members argued this would not be the case for liabilities between 20 and 30 years. It should be noted that the analysis and recommendations set out in this paper are not based on the legal framework for Solvency II, but on the macroprudential objectives identified for the yield curve. Independent from the legal framework, the analysis presented above indicates no significant difference in bond market liquidity and cash flows between 20 and 30 years.

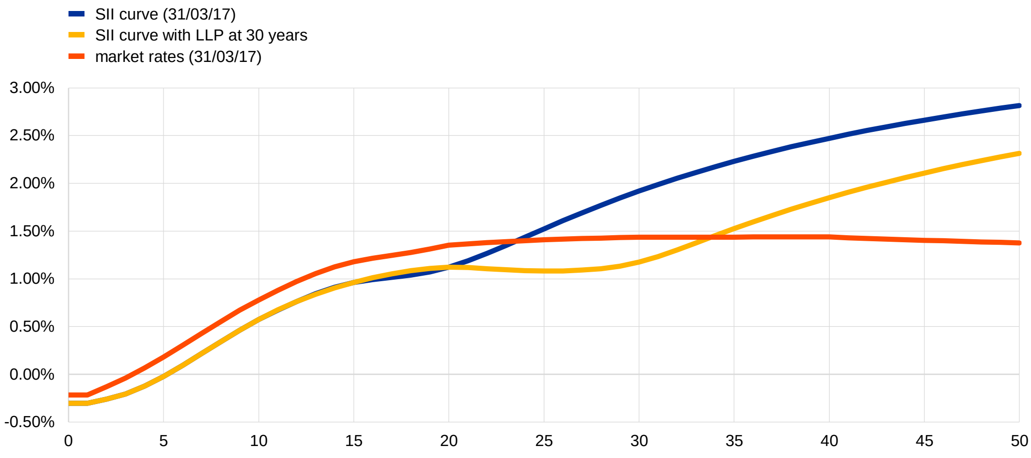
maturity dates,[15] it is plausible that insurers have a similar ability to match their liabilities with bonds with a 30-year maturity compared to a 20-year maturity. However, this does not preclude the risk of procyclical asset duration extension (hunting for duration, see Section 3.4), which should be monitored and, if necessary, be addressed by additional policy measures.

5.2.3 Conclusion on liquidity analysis

The above analysis on the liquidity of euro swap markets and euro sovereign bond markets suggests moving the LLP to 30 years for the euro. This would naturally result in the best estimate of the technical provisions beyond 20 years which is closer to market rates (see Chart 9). As liquidity varies over time, such analysis should be performed regularly so that the regulatory risk-free yield curve is always up to date.

Chart 9
Solvency II risk-free yield curve for the euro using different LLPs

(x-axis: term to maturity in years; y-axis:risk-free interest rates)



Sources: EIOPA and ESRB.

5.2.4 Hedging incentives around the LLP

Insurers are heavily exposed to interest rate risk around the LLP. Hedging the Solvency II risk-free yield curve does not necessarily constitute prudent risk management. Insurers should hedge the risks they are exposed to in reality, not those on the regulatory balance sheet. But insurers under financial strain may be forced to hedge their regulatory balance sheets in order to remain above regulatory required capital levels. In that case, with a single LLP of 20 years, all their liabilities with a remaining maturity of more than 20 years are dependent on the risk-free rate at 20 years. In addition to being exposed to the level of interest rates, insurers are exposed to the difference between the swap rate at the maturity of the LLP and the swap rates for marginally shorter maturities, because these two rates determine the slope of the extrapolated part of the

[15] See Figure 39 of the 2016 EIOPA Insurance Stress Test Report.

regulatory risk-free yield curve to a greater extent. This concentrated exposure to this forward rate is not economically motivated.

This exposure may lead to unintended hedging behaviour. The LLP set at one date and used to extrapolate from that date incentivises simultaneous large long and short positions in swaps around the LLP, as insurers under financial strain may want to hedge not only the level of the risk-free rate at the maturity of the LLP, but also the slope of the risk-free curve around the LLP. To maintain an effective hedge, these positions need to be rebalanced continually (Ovtchinnikov, 2015; Lagerås and Lindholm, 2016), as shown in Annex 2. Rebalancing large hedge portfolios implies high transaction costs for insurers and potential procyclical effects. If insures' hedging activity affects the market price of interest rate swaps, solvency positions of other insurers will be affected as a consequence. To date, such hedging rebalancing has not yet been observed in practice. This can partly be explained by the solvency of the European insurance sector, which has improved significantly during the years since the global financial crisis. Insurers with a stronger solvency position have less need to hedge interest rate risk. Under a situation of financial strain, the need to do so grows larger. The incentives for uneconomic hedge positions implied by the current risk-free rate (RFR) methodology may thus materialise in a financial scenario that would negatively impact the solvency of the European insurance sector, causing unintended procyclical behaviour. If the LLP were to be increased to a maturity where bond markets are no longer deep and liquid, insurers would need to expand their hedging activities against changes in the risk-free rates for those maturities. That is why this report takes into account the liquidity characteristics of the bond market when proposing a new LLP. It could, however, be worth investigating whether a change in liquidity in the bond markets would trigger an increased demand for hedging strategies. This increase could potentially create additional costs for the industry and unintended procyclical consequences.

This potential procyclicality around the last liquid point can be fixed. The Swedish financial supervisory authority adopted a modified model with much smaller rebalancing needs due to an extrapolation method that attributes gradually decreasing importance to market data beyond the LLP. In addition for Solvency II, an alternative extrapolation method could reduce the concentration to the LLP, as the exposure could be spread over several maturities. Such an extrapolation method would prevent large exposures to the LLP and LLP-1 (minus one year) maturities and reduce procyclical hedging incentives as described above and shown in Annex 2. It would also corroborate the assessment that liquidity does not suddenly disappear beyond a certain point. Care needs to be taken to align the weights of market data used with their underlying reliability.

Technically there are several ways to extrapolate the risk-free yield curve using more than one LLP. There are two methods currently applied.

- In Sweden the regulatory risk-free yield curve for pension funds is calculated by gradually phasing out market quotes. The extrapolation method is based on forward rates. Forward rates between ten and 20 years are a weighted average of market forward rates and the UFR, increasing the weight to the UFR as maturity extends. As a consequence, the hedging demand is spread over several maturities and the rebalancing need is reduced.
- In the Netherlands, the regulatory euro risk-free yield curve for pension funds is derived by extrapolating from the first smoothing point (FSP) at 20 years to the UFR. Hence, the yield curve is based on the euro swap curve up to 20 years. For extrapolation purposes, the UFR is set equal to the historic 120-month moving average of 20-year forward rates. Based on the FSP rates observed at month-end, a last liquid forward rate (LLFR) is calculated as the weighted average of market forward rates for the maturities of 25, 30, 40 and 50 years. The post-FSP forward rates are then estimated by a combination of the UFR and LLFR, gradually

giving more weight to the UFR and less weight to the LLFR as the maturity increases. In this setting, the extrapolated curve for long maturities converges automatically to the designated long-term UFR-level without ever reaching it.[16]

5.3 Methods to derive the long end of the risk-free curve

There are differences of opinion on how to derive an appropriate curve for longer maturities, for which swap and sovereign bond markets are less liquid. Some argue this causes price distortions and therefore these markets cannot be relied upon for longer maturities. Others argue that swap rates with long maturities are informative about the markets' perception of longer-term yields, even though they do not formally pass certain liquidity assessment criteria.

There are several ways to derive the long end of the risk-free interest rate curve, resulting in different curves. A popular way of interpolating (and extrapolating) yield curves, also popular among central banks, was proposed by Nelson and Siegel (1987). Their approach reduces the shape of the curve to three parameters which can be estimated from market data and is quite flexible in terms of yield curve shapes. Similar to a regression line, the modelled curve does not match market yields exactly. Furthermore, the long end of the curve depends on the data input and varies with time. Out of a desire to "stabilise" the long-run risk-free yield, EIOPA chose instead to adopt the method proposed by Smith and Wilson (2001). Both methods rely on "curve fitting" and will, in general, result in yield curves that are not arbitrage free. As an alternative, a recent discussion paper by Balter, Pelsser and Schotman (2015) explores the implications of an arbitrage-free (model-based) extrapolation approach, taking into account term premia and convexity effects. It quantifies the large amount of uncertainty inherent in estimating the long end of the regulatory risk-free yield curve. At the end of 2013, the point in time for which they estimated the model, their method provides an extrapolation that lies above both the Nelson-Siegel and Smith-Wilson approaches for maturities up to 100 years, due to the term premium effect dominating the convexity effect.

In Solvency II Smith-Wilson was used because of the lower volatilities of its outcomes compared with Nelson-Siegel. However, there is a trade-off with realism, because Smith-Wilson does not use observations beyond the LLP. The parameters used for Smith-Wilson – LLP, UFR and convergence speed – need to be set appropriately in order to arrive at a realistic regulatory risk-free yield curve. This is assessed in the following sections.

5.4 The ultimate forward rate

The current level of the UFR, set at 4.2%, is too high. Currently, long-term swap rates are consistently significantly below the risk-free rates of Solvency II (see Chart 10). This can at least partly be attributed to the level of the UFR being set at 4.2%. Due to the decrease of swap rates during the first three quarters of 2016, the difference between the Solvency II curve and swap rates has increased for maturities beyond 20 years.

In April 2017 EIOPA developed a methodology to derive the UFR on an ongoing basis (European Insurance and Occupational Pensions Authority, 2017a) that will be applied from

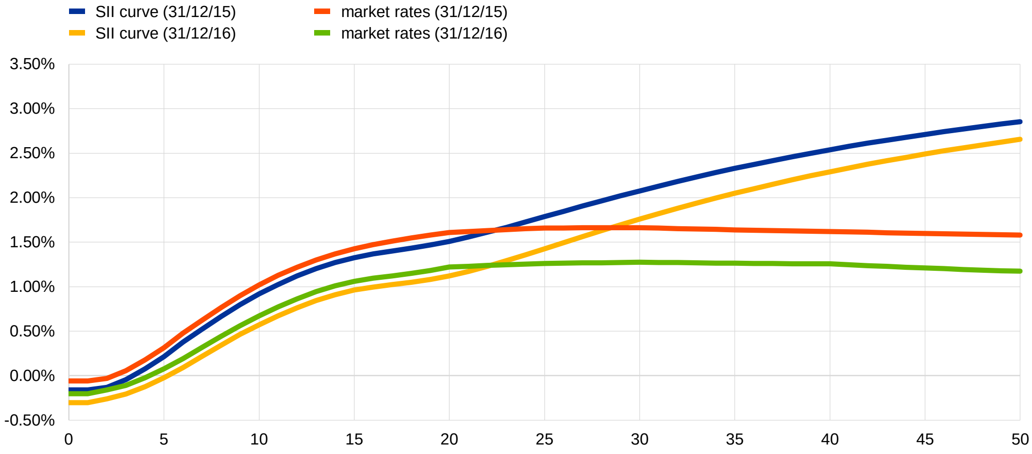
16 See the **technical explanation of this method**.

1 January 2018 onwards. The UFR for the euro calculated with this methodology is 3.65%. The methodology includes a limit to the annual change of the UFR of 15 basis points. The limit implies that in 2018 the UFR will change from 4.2% to 4.05%. A large majority of ESRB members favoured the reduction of the current level of the UFR, although the transition period was considered to be too slow if a "low for long" scenario were to prevail over the next decade.

Chart 10

Solvency II risk-free yield curves versus swap curves for the euro

(x-axis: term to maturity in years; y-axis: risk-free interest rates)



Sources: EIOPA and Thomson Reuters Datastream/ICAP six-month Euribor.

5.5 Convergence period

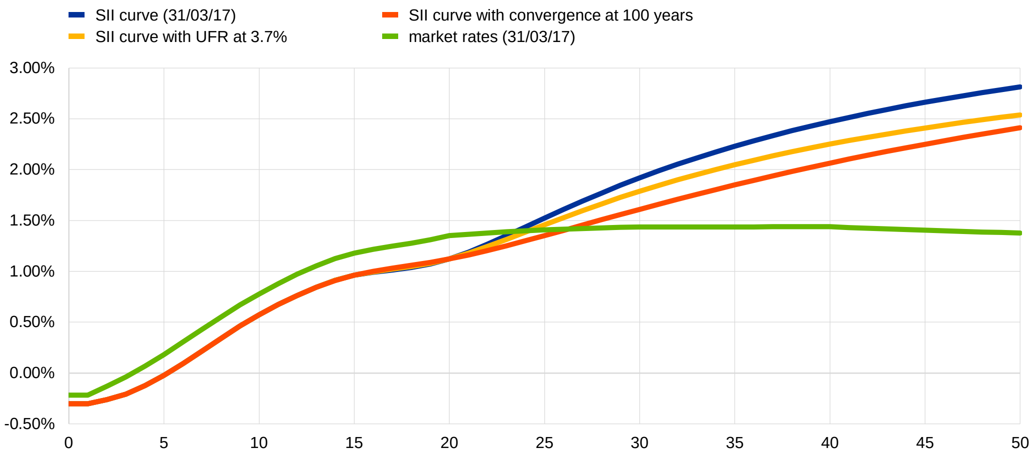
The convergence period determines the weight that is placed on the UFR when deriving the regulatory risk-free yield curve. Applying a short period makes the regulatory risk-free yield move quickly from the LLP to the UFR, giving the latter a greater weight. Applying a longer convergence period makes the regulatory risk-free yield move slowly from the LLP to the UFR, giving the former a greater weight.

Extending the current convergence period from 40 to 100 years would smooth the current regulatory risk-free yield curve. Short convergence periods result in a bump in the regulatory risk-free yield curve just beyond the LLP, especially when the UFR deviates significantly from the LLP. Extending the convergence period would make the shape of the regulatory risk-free yield curve smoother (removing what is seen in Chart 2) and further align it with swap market values (see Chart 11). At the same time, extending the convergence period gives less weight to the UFR, and hence may lead to less stable risk-free rates in the extrapolated part of the risk-free yield curve, depending on market conditions.

Chart 11

Solvency II risk-free yield curve for the euro with different convergence periods and different UFRs

(x-axis: term to maturity in years; y-axis: risk-free interest rates)



Sources: EIOPA and ESRB.
Notes: UFR of 3.7% is assumed in line with EIOPA's consultation proposal. The impact of the difference between 3.65% and 3.7% is minimal.

An extension of the convergence period should be accompanied by the use of several units of market data for the extrapolated part of the risk-free yield curve. Extending the convergence period increases the weight of the liquid part of the curve, including the LLP. It thus exacerbates the distorted hedging incentives around the LLP, as described in Section 5.3. In order to avoid this, the extrapolated part could no longer be based on a single LLP, but had to take into account market data with longer maturities. Nevertheless, the data used for this extension should be reliable.

5.6 Conclusion of the assessment of the current regulatory yield curve

Leaving the parameters of the regulatory risk-free yield curve unchanged results in the curve being biased. As a consequence, the value of long-dated insurance liabilities could be biased downwards. Should this be the case, the best estimate of life insurance obligations would be too low. This would, in the absence of any other corrective measures, also imply that insurers report unrealistically high Solvency Capital Requirement (SCR) coverage ratios. As the calibrations of the SCR standard formula are based on a one-year VaR of 99.5%, the true probability of a capital shortfall would be higher. As a consequence, insurers' balance sheets would contain hidden or unrealised losses (Section 2).

This type of forbearance may undermine the transferability of portfolios. On the one hand, the regulation does its job. It forbears immediate measures due to yields at historically low levels and gives insurers more time to adjust. On the other hand, the best estimates of liabilities do not reflect the market value at which portfolios of liabilities may be transferred among undertakings, a central concept of Solvency II.

Hidden losses resulting from this deviation may materialise in the near future. Take a hypothetical cash outflow of €100 in 25 years. Today, the best estimated value using the September 2016 Solvency II curve is €78.20, while using the swap curve it is €80.50. In five years, this €2.30 difference will have to be taken as a reduction of own funds. The reason is that, in five years, this cash outflow will have a maturity of 20 years and the Solvency II risk-free rate at this maturity will reflect swap rates.

The deviation from market values may give the wrong incentives for adequate risk management. Discount rates beyond 20 years being too high, relative to swap market values, could induce insurers to sell policies with guarantees that are also too high. They could also allow insurers to pay out dividends rather than to build up capital. In the past year, European insurers have had a higher dividend yield than European banks and the broad European market.[17] Moreover, taking the example of the Netherlands, the deviation between swap rates and the Solvency II risk-free curve has resulted in different behaviours between insurers with strong balance sheets and those with weaker Solvency II positions. In particular, the former hedge the economic value of their cash flows, whereas the latter hedge the Solvency II value of their cash flows in order to protect against Solvency II ratio volatility, which is a less economic, and therefore suboptimal, hedge strategy.[18]

[17] On 1 December 2016 the one-year dividend yield of Euro Stoxx Insurance is 5.1%, compared with 4.6% for Euro Stoxx Banks and 3.7% for Stoxx Europe 600. Source: Bloomberg.

[18] J.P. Morgan Cazanove (2016), Europe Equity Research, pp. 35-36, September.

Section 6
Proposals

Section 5 argues that the parameters for deriving the regulatory euro risk-free yield curve should be reset. This report takes into account the new UFR methodology as published by EIOPA in April 2017. Furthermore, the liquidity analysis of euro swap and sovereign bond markets suggests an LLP of 30 years for the euro. The convergence period should also be extended in order to arrive at a smoother regulatory risk-free yield curve, which better reflects levels of long-term swap rates.

This report proposes amending the regulatory risk-free yield curve for the euro in three ways. Two of these may be considered for implementation by EIOPA without further methodological work[19]:

- increase the LLP to 30 years;
- extend the convergence period to 100 years.

The analysis of hedging incentives also suggests considering the idea of not applying a single LLP, but rather several weighted points at the long end of the curve, so as to alleviate the cliff edge effect stemming from the use of a single LLP. This would require more fundamental changes to the RFR extrapolation methodology and a careful consideration of its interaction with the calibration and length of the convergence period. The third proposal would then be to review the RFR methodology and base the extrapolated part of the curve on weighted market observations for several maturities:

- use several market data beyond this LLP with gradually declining weights for the extrapolation to the UFR;
- align the convergence point in view of the use of market data in the extrapolated part of the curve.

The analysis performed in this report provides a basis for further ongoing reviews of the regulatory risk-free yield curve. In particular, this report concentrates on the euro, but when reviewing the regulatory risk-free yield curve, EIOPA may wish to analyse the regulatory risk-free yield curves for a broader range of currencies. Since liquidity varies over time, a regular reassessment of the LLPs, based on a fixed methodology, seems warranted.

The changes suggested in the first two proposals would push the regulatory risk-free yield curve down (see Chart 12). Extending the LLP has more impact than reducing the UFR or extending the convergence period. The impact of the alternative proposal has not been analysed in detail, since it would require a technical specification of the design of the revised RFR methodology. Should EIOPA wish to consider this alternative, the experiences of the Swedish and Dutch supervisory authorities would be relevant to consider. The methods used in Sweden and the Netherlands are detailed in Section 5.3.

The combined effect of a change of LLP, UFR and convergence would be significant[20]. Comparison with the low-for-long yield stress curve used in the 2016 EIPOA stress test indicates

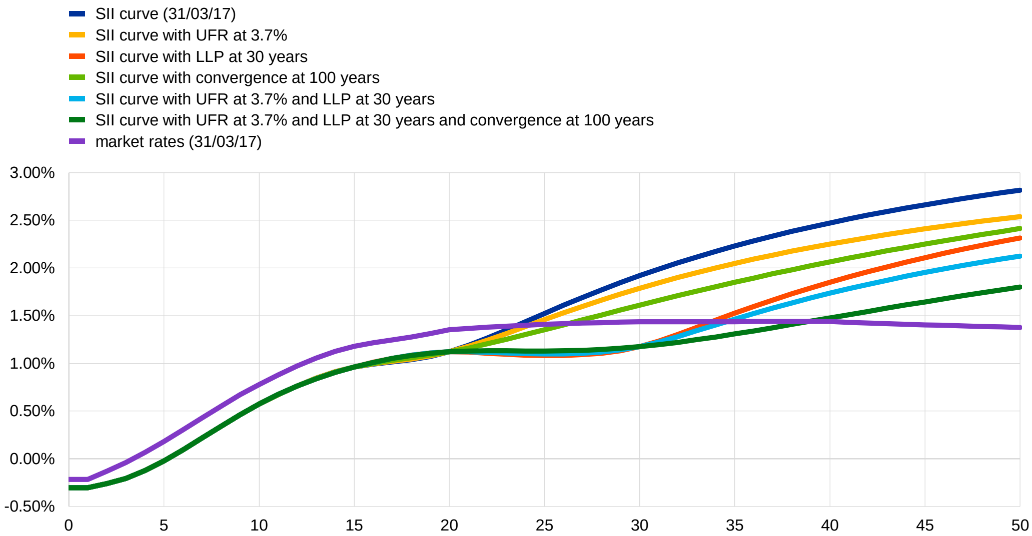
[19] This report abstracts the legal constraints, focusing instead on the economic and macrorpudential aspects.

that the overall impact of the proposals put forward in this report should be less significant than that of the mentioned stress test. One of the two scenarios in this stress test assumes yields to be low for long, resulting in a lower Solvency II risk-free yield curve including a UFR of 2% (European Insurance and Occupational Pensions Authority, 2016a). The impact of the proposed changes would be smaller than in the stress test scenario, which did not have an insurmountable impact on the insurance sector, as can be seen in the stress test report (see Chart 13). Both assets and liabilities change significantly in this low-for-long scenario (see Table 2). Reducing the regulatory risk-free yield curve, as proposed in this report, would increase insurers' liabilities by more than €100 billion, which calls for a transition period so insurers can adapt.

Chart 12

Solvency II risk-free yield curves for the euro with different parameters

(x-axis: term to maturity in years; y-axis: risk-free interest rates)



Sources: EIOPA and ESRB.

Notes: UFR of 3.7% is assumed in line with EIOPA's consultation proposal. The impact of the difference between 3.65% and 3.7% is minimal.

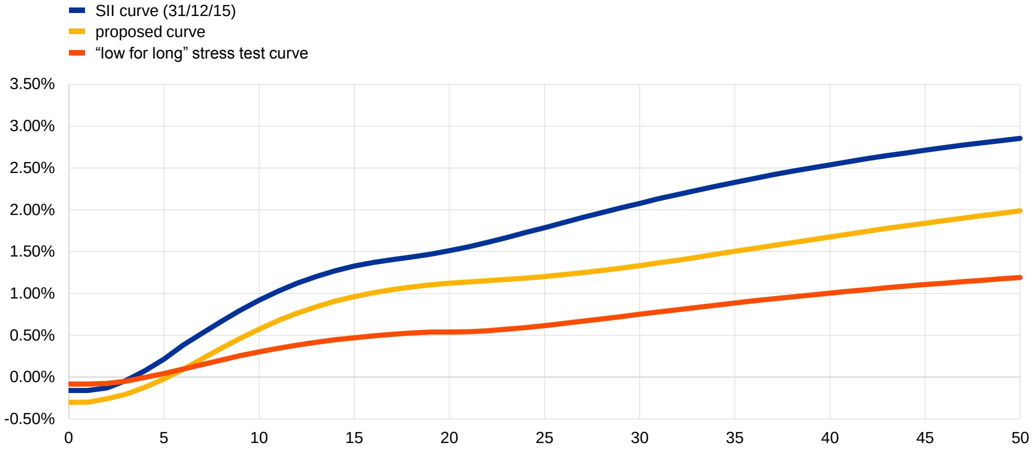
Any change to the regulatory risk-free yield curve should be informed by a careful impact assessment. Given that the preliminary assessments outlined above point at a significant impact, a more thorough and dedicated impact assessment should be undertaken by EIOPA in order to allow for a more informed decision on the exact changes and required transition path.

[20] In the context of the LTG Review Project, EIOPA has conducted a European information request to undertakings which contains three pre-specified scenarios with respect to the extrapolation: an increase of the LLP for the euro to 30 years, an increase of the minimum convergence point for all currencies by 30 years and a decrease of the UFR for all currencies by 100 basis points.

Chart 13

Proposed Solvency II risk-free yield curve, market swap rates and the risk-free yield curve in the low for long stress scenario of the 2016 EIPOA stress test (all for the euro)

(x-axis: term to maturity in years; y-axis: risk-free interest rates)



Sources: EIOPA and ESRB Secretariat calculations.
Notes: UFR of 3.7% is assumed in line with EIOPA's consultation proposal. The impact of the difference between 3.65% and 3.7% is minimal.

Table 2

Impact of low for long scenario on EU life insurance sector

	EUR billions	%
Change of liabilities	381	6.7
Change of assets	282	4.5
Change of assets over liabilities	99	18.0

Source: European Insurance and Occupational Pensions Authority (2016a).

Annexes

Annex 1 Discounting liabilities in different solvency regimes

Country – sector	Calculation of liabilities	Discount curves applied
EU – insurance (Solvency I)	Not harmonised	
EU – insurance (Solvency II)	Discounting best estimate and risk margin with the RFR curve	Based on swap market and sovereign bond markets with the euro extrapolation from LLP at 20 years to UFR of 4.2% at 60 years. Moving average and variance added
Australia – insurance	Discounting best estimate with the RFR curve	Based on Australian government bonds
China – insurance	No market-consistent valuation	
Mexico – insurance	Discounting best estimate and risk margin with the RFR curve	Countercyclical elements are considered
Japan – insurance	Best estimate valued with locked-in assumptions and cash flow analysis	Statutorily defined based on Japanese government bond yields
Singapore – insurance	Best estimate and risk margin discounted with RFR	Moving average is intended to be introduced
Switzerland – insurance	Best estimate discounted with RFR	
United States – life insurance	Best estimate valued with locked in assumptions and cash flow projections	Based on yields of insurer's typical investment portfolio
Netherlands – pension funds	Best estimate discounted with RFR	Based on swap curve, several weighted LLPs, unlimited convergence to UFR at 3%
Sweden – pension funds	Best estimate discounted with RFR	Solvency II curve with static credit risk adjustment and alternative extrapolation method towards a UFR of 4.2%

Sources: The Geneva Association and ESRB members.

Annex 2 Incentives for hedging long-term liabilities using a single LLP or several market rates

Table 3

Hedging and rebalancing needs with the current LLP or an alternative extrapolation

		Current Solvency II: LLP at 20 years		Using market rates at 20, 25 and 30 years	
Year	Cash flow insurance contract today [1]	Hedge need today [1]	Rebalancing need after one year [1]	Hedge need today [1]	Rebalancing need after one year [1]
1-17	0	0	0	0	0
18	0	0	49.8	0	0
19	0	-49.8	-113.0	0	-4.7
20	1	66.6	63.5	5.7	4.3
21	1	0	0	0	0
22	1	0	0	0	0
23	1	0	0	0	0
24	1	0	0	0	0
25	1	0	0	7.8	0.5
26	1	0	0	0	0
27	1	0	0	0	0
28	1	0	0	0	0
29	1	0	0	0	0
30	1	0	0	3.2	0.,3
31-39	1	0	0	0	0
40+	0	0	0	0	0

Source: Swedish FSA.
Note: Hedging and rebalancing needs are based on an insurance contract which requires annual pay-outs of 1 from year 20 up to year 39.

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