

Extrapolation of the risk free interest rate term structure

Alternative methodology

On request of the EU-Commission, EIOPA analyses the extrapolation process of the risk-free interest rate term structure (RFR) as part of the Solvency II -2020 review. The objective of this paper is the analysis of EIOPA's expected proposal to replace the current extrapolation methodology by an alternative extrapolation. Two main objectives can be identified. Firstly, all data available from deep, liquid and transparent markets should be considered, secondly a consistent treatment across currencies should be achieved, removing special regulation introduced by the Omnibus II Directive. Achieving these objectives by changing a methodology requires a thorough consideration of possible weaknesses and expected impact on the own funds and solvency position of insurance undertakings.

Our special concern is the adequate treatment of long-term insurance business in a risk-based Solvency II- framework. In this regard our main focus is on the risk—free interest rate term structure (RFR) as a core element in the valuation of technical provisions. Concerning this business, it is inevitable to use a mark-to-model approach for durations where deep, liquid and transparent markets do not exist. An appropriate extrapolation shall serve this purpose. In this document we deal with EIOPA's tentative proposal and the analysis performed to support this proposal.

We have identified the following shortcomings:

- The DLT-analysis requested by the EU-Commission is not complete
- Distortion of capital markets caused by activities of the European Central Bank (ECB) are not considered. Interest rates for long durations are admittedly compressed by these activities
- The alternative extrapolation by giving more weight to these market data post the starting point of the extrapolation without considering this fact.
- Convergence process to the Ultimate Forward Rate (UFR) depends on the chosen mean reversion factor alpha by waiving clear convergence specifications amplifying the impact of distorted markets.
- The risk of artificial volatility of technical provisions and own funds is not analysed in different market scenarios (e.g. significantly higher interest rates)

Taking into account these observations we do not support a change of the current LLP for the Euro and of the extrapolation methodology at this point in time.

0 Valuation of technical provisions

Solvency II requires a consistent valuation of assets and liabilities. The calculation of technical provisions should be consistent with the valuation of assets and other liabilities, market consistent and in line with international developments in accounting and supervision (citation 54).

Specifications for the calculation are made Article 76 and 77 of the SII-Directive¹ and in the Articles 77a – 77e of the Omnibus II-Directive².

Basically, it requires projecting the future cash-flows expected from insurance contracts. The expected present value of these cash-flows is the best estimate component of the technical provisions. The total technical provisions are calculated as the sum of the best estimate component and a risk margin.

The present value is calculated by discounting the cash-flows using a currency-dependent RFR published by EIOPA on a regular basis. The RFR is constructed by reference to risk-free financial instruments, the value of which is available in capital markets.

A remaining challenge is the treatment of long-term insurance business, where the duration of the contracts is considerably longer than that of financial instruments traded in deep, liquid and transparent (DLT) markets. For such durations the liquid part of the RFR is extrapolated in line with Article 77a of the Omnibus II-Directive (mark-to-model) to cover the maximum duration of contracts.

The extrapolated part of the RFR shall be based on forward rates *converging smoothly from one or a set of forward rates in relation to the longest maturities for which the relevant financial instrument and the bonds can be observed in a deep, liquid and transparent market to an ultimate forward rate (UFR)*³.

The Omnibus II Directive prescribes in citation (30) a currency-specific treatment for the Euro. It specifies a starting point for the extrapolation, convergence period and a convergence tolerance. The starting point for the extrapolation should be at a maturity of 20 years. The extrapolated part of the RFR should converge in such a way to the ultimate forward rate that for maturities 40 years past the starting point of the extrapolation the extrapolated forward rates do not differ more than three basis points from the ultimate forward rate.

The extrapolation is one of the long-term guarantees measures and is thus subject to the 2020 review of Solvency II. The EU-Commission requested EIOPA to analyse the extrapolation process.

I) Commission's request to EIOPA

With regard to the extrapolation EIOPA is asked to provide technical information and evidence especially concerning the determination of the last liquid point in accordance with a list of criteria embracing financial instruments, time periods and different market conditions.

¹ DIRECTIVE 2009/138/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II)

² DIRECTIVE 2014/51/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 amending Directives 2003/71/EC and 2009/138/EC and Regulations (EC) No 1060/2009, (EU) No 1094/2010 and (EU) No 1095/2010 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)

³ Omnibus II-Directive Article 77a

3.1. Extrapolation of the Risk-Free Interest Rate term structure (Art. 77a) ⁴

In order to ensure that the rules applicable to the last liquid point in the Solvency II Risk-free interest rate term structure ensure its stability in different market situations, including market crisis situations and periods of increasing interest rates, EIOPA is asked to provide evidence, for all currencies of the Union, on criteria to determine the last liquid point. As a minimum, evidence should be provided on the value of the last liquid point in accordance with the following criteria:

- *the depth, liquidity and transparency of swap and bond markets in a currency;*
- *the ability of insurance and reinsurance undertakings to match with bonds the cash-flows which are discounted with non-extrapolated interest rates in a currency;*
- *for all relevant maturities, the cumulative value of bonds with maturities larger than or equal to the relevant maturity in relation to the volume of bonds in the market.*

This evidence should be provided at the very least for the time period 2016-2018, and ideally several years further in the past, including to the extent possible periods of market stresses and increased interest rates, and be accompanied by a variation analysis of those parameters relevant for determining the last liquid point per currency.

If EIOPA's analysis suggests inappropriateness of any currently implemented last liquid points, EIOPA is requested to provide a comprehensive impact assessment of potential modifications to these last liquid points on volatility of insurance and reinsurance undertakings' own funds and solvency coverage ratio, as well as on financial stability. This impact assessment should be provided in a sufficient level of detail, as a minimum on country level.

II) EIOPA's tentative advice

The identification of LLPs and also the methodology used for extrapolation have been broadly analysed in EIOPA's Consultation paper⁵. Five options have been presented and discussed accompanied by first rough impact assessments. Replacing the current extrapolation methodology for the Euro by an alternative methodology developed in the Netherlands⁶ in was among these options. This analysis did not immediately lead to an advice. The technical specifications for the holistic impact assessment ⁷ (HIA) combined in one scenario those proposed changes with a material impact on the solvency position of undertakings. The alternative extrapolation method was among these changes and can be assessed as EIOPA's tentative advice to the Commission.

The current extrapolation method and the alternative extrapolation method show some significant difference, which need to be considered because of the importance of their outcome.

⁴ EU-Commission: Ref. Ares(2019)782244 - 11/02/2019, Request to EIOPA for technical advice on the review of the Solvency II Directive

⁵ EIOPA-BoS-19/465: Consultation paper on the Opinion on the 2020 review of Solvency II (15 October 2019)

⁶ <https://www.government.nl/documents/publications/2013/10/06/advisory-report-of-the-ufr-committee>.

⁷ EIOPA-BoS-20/107 2 March 2020 Technical specification of the information request on the 2020 review of Solvency II Holistic impact assessment

The RFR is the core element of Solvency II for the valuation of liabilities resulting from insurance obligations. The RFR affects several items of the Solvency II balance sheet.

- a) Technical provisions are calculated by discounting cash flows by means of the RFR.
- b) The RFR constitutes the basis for the calculation of the SCR in the standard formula. The value of options and guarantees significantly depends on this term structure.
- c) The volatility adjustment, spread risk and to some extent currency risk are affected by the RFR.
- d) The RFR (and the SCR) are determinants in the calculation of the risk margin.

All of these components have a significant impact on the amount of own funds and on the solvency ratio of the undertakings.

A thorough analysis, considering all these aspects and the inherent interrelations, is essential if changes to the RFR are being considered. In particular, the long-term character of some insurance business activities must be adequately considered.

III. Extrapolation methodology

a) Legal background

Currently Article 77a of the Omnibus II-Directive describes the basic requirements for the determination of the RFR and the criteria for extrapolation.

Article 77a: The determination of the relevant risk-free interest rate term structure 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. For maturities where the markets for the relevant financial instruments or for bonds are no longer deep, liquid and transparent, the relevant risk-free interest rate term structure shall be extrapolated.

The extrapolated part of the relevant risk-free interest rate term structure shall be based on forward rates converging smoothly from one or a set of forward rates in relation to the longest maturities for which the relevant financial instrument and the bonds can be observed in a deep, liquid and transparent market to an ultimate forward rate (UFR).

The starting point for the extrapolation is termed the last liquid point (LLP), and the appropriate convergence period to the UFR is determined by taking into account the characteristics of the local bond and swap markets. For all currencies the Smith-Wilson method is then used to extrapolate the forward rates and to achieve a smooth convergence to the UFR.

The Omnibus II- Directive prescribes in citation (30) a specific treatment for the extrapolation of the RFR for the Euro. Starting with a LLP of 20 years the extrapolated forward rates for maturities 40 years past the LLP shall not differ more than three basis points from the UFR. An important criterion for the determination of the LLP for the Euro was the residual volume criterion. This states „...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 market⁸.“

In order to achieve a uniform treatment across for all currencies, EIOPA use the SII-review process also to propose and test an alternative extrapolation methodology. (HIA).

b) Commonalities in current and alternative extrapolation methodology

The extrapolation of the RFR depends on the identification of deep, liquid and transparent (DLT) markets and a LLP or a first smoothing point (FSP) in the alternative method. Both are determined by using the residual volume criterion⁹. Market data are used prior to the LLP / FSP. A mark-to-model approach is required for those durations longer than this LLP / FSP considering a “long-term expectation”.

In line with the Delegated Regulation the UFR specifies this long-term expectation. EIOPA introduced the methodology to determine the UFR in the year 2017. Article 46 requires a smooth convergence to the UFR.

The outcome of the DLT-assessment plays a crucial role in both methods.

c) Differences in the method of extrapolation

The alternative extrapolation method aims at taking into account those liquid points beyond the FSP. They constitute the basis for the calculation of a so-called last liquid forward rate (LLFR). A weighted combination of this LLFR and the UFR is used to model the convergence towards the UFR. An important parameter steering this process is the mean reversion factor alpha. Alpha is currently set to 10% by expert judgement and cannot be calibrated using market data. The resulting RFR resembles the curve generated with the existing extrapolation method. However, the alternative method is lacking a convergence requirement towards the UFR. This leads to considerable differences in the extrapolated interest rates.

IV) Analysis of Depth and liquidity of markets¹⁰

The criterion used by EIOPA to assess depth and liquidity of swap markets is also used by ESMA:

Markets are considered deep liquid and transparent based on the two thresholds:

- *the average daily notional amount traded is at least EUR 50 000 000,*
- *the average daily number of trades is at least 10.*

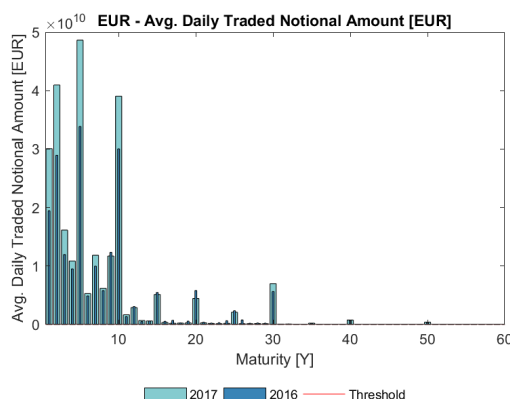
⁸ COMMISSION DELEGATED REGULATION (EU) 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) – recital 21

⁹ Delegated Regulation: (21) 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.

¹⁰ EIOPA’s Consultation paper, page 727f

Only single-currency fixed-to-floating swaps should be considered for assessing the criteria. The assessment should be made separately for each currency and maturity. Where possible the thresholds should be assessed on the basis of data that cover the period of one year. These thresholds are the same that ESMA proposed for assessing liquidity for the purpose of MiFiD 2 (see page 92 of the draft RTS on transparency requirements for trading venues and investment firms in respect of bonds, structured finance products, emission allowances and derivatives.

These thresholds are exceeded in swap markets for durations 1-10, 12, 15, 20, 25, 30, 40 and 50. The result for Euro Swap market is depicted in the following picture (p. 744 of the Consultation Paper).



The traded volume of durations higher than the FSP (20 years) is significantly lower than the traded volume of swaps with shorter duration. Focusing on deep and liquid points beyond the FSP tends to overstate the importance of traded volumes with longer durations for insurer's investment activities. The adequacy and usability of the thresholds used in identifying DLT markets need to be checked. €50m may not be sufficient for institutional investors such as insurance undertakings.

EIOPA provided the following evidence on the value of the LLP in accordance with the criteria asked in Commission's request.

Swap markets analysed only for years 2016, 2017:

Swap market for the euro in these years is deep, liquid and transparent for maturities 1 to 15, 20, 25, 30, 40 and 50 years (not for other years)

Bond markets: no data delivered for the Euro-countries

Matching criterion: Analysed with and separately without unit-linked and index-linked business (value in brackets)

Maximum LLP:	2016: 10 years (10 years)
	2017: 15 years (15 years)
probably not complete data:	2018: 15 years (23 years)

Residual volume criterion: The LLP depending on outstanding volumes of bond cashflows is calculated based on a threshold of 6%. Data available since 2006.

Resulting LLP: 2016: 21 years

2017: 22 years
2018: 22 years
Values for thresholds 3% and 10% determined.

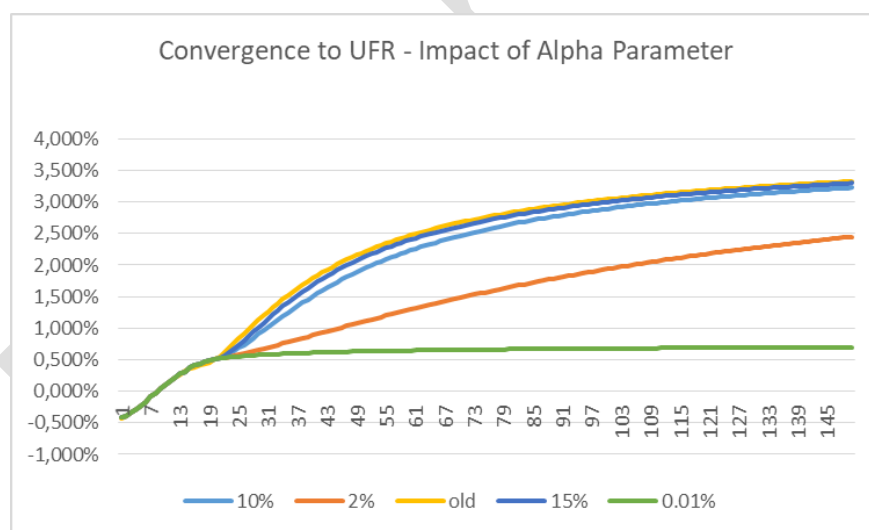
The lack of bond data is a major deficiency. From a general risk management perspective, insurers invest massively in bonds and not in swaps.

The analysis should not be performed in the current low interest rate environment. Tests with higher interest rates like those observed about 20 years ago and tests in stressed capital markets are necessary.

Altogether EIOPA's analysis of DLT-characteristic of bond markets, of the matching criterion and of the residual volume criterion did not substantiate a higher LLP than 20 years.

V) Alternative extrapolation methodology

The starting point for the alternative extrapolation methodology (FSP) is determined by the residual volume criterion and is 20 years. Liquid points post the FSP are used to calculate a last liquid forward rate (LLFR) which together with a mean reversion factor alpha determines the convergence towards the UFR. EIOPA assigned the value of 10% to alpha. This value is compared to the value of 2% used in the Netherlands, assumed to be a step towards a “more market-consistent” parameter– whatever this means.¹¹ Alpha has to be set arbitrarily and cannot be calibrated using market data. Although it cannot be reliably substantiated, it has a significant impact on the resulting extrapolated curve.



Compared to the current methodology, the alternative extrapolation methodology neither stipulates a convergence point nor a convergence tolerance. This can lead to increased volatility

¹¹ EIOPA's Consultation paper on the Opinion on the 2020 review of Solvency II says on page 785 in footnote 341: In the Netherlands, the convergence factor has been recently estimated at 2%. The estimation is based on recent data used in two versions of the Vasiček model. In the proposed method, 10% is used as a step towards a more market-consistent parameter, in line with the initial advice by the committee, see <https://www.government.nl/documents/publications/2013/10/06/advisory-report-of-the-ufr-committee>.

of the results and hence discourage insurers from offering long-term products and hence from playing their expected a role as long-term investors.

In order to avoid artificial volatility:

The UFR together with a reliable convergence process proved to be an important stabilizing element. Any extrapolation needs a defined convergence period and a convergence tolerance independent of the chosen methodology.

VI) Instability induced by new weighting of UFR

The alternative methodology undermines the importance of long-term expectation as required in the determination of the UFR. This long-term expectation is adjusted by giving higher weights to currently observable long-term yields.¹²

These two terms must not be set equal.

Long-term yields can be, and currently apparently are, significantly exposed to short- or medium-term activities of market participants. The forward rates observed for the liquid points contribute considerably to the level and structure of the liquid part of the RFR.

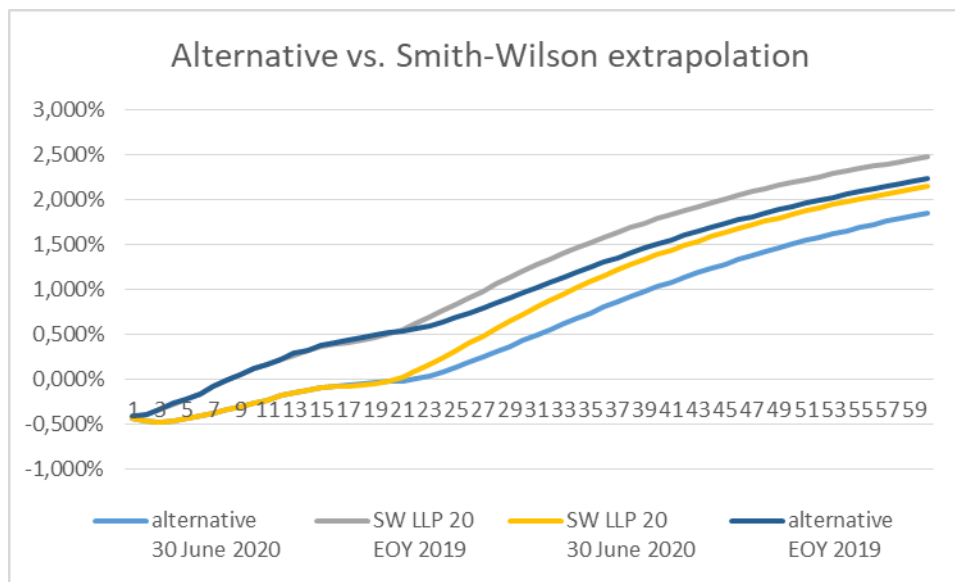
Currently activities of the European Central Bank (ECB) dominate and distort the market for bonds. Asset purchase programs, although timely limited, admittedly result in a significant compression of interest rates, especially for long-duration bonds. Depending on the ECB's own assessment, the effect amounts to 45bp - 140bp.

Deriving a term structure for the valuation of long-term business must consider short- or medium-term effects appropriately. They should not be assumed unrestricted to continue over decades. Such considerations are especially important with regard to the alternative extrapolation method, which uses the data from all identified DLT-markets including those after the FSP. Although the impact of these liquid points is mitigated by weights to consider the average traded notional amount with these durations, they still affect the convergence to the UFR and the final shape of the curve. The distortions are thus carried to the whole RFR.

¹² Equating currently observable interest rates with the long-term expectation can also be found in EIOPA's Financial Stability Report published in December 2019:

Another implication is the increase in the gap between the Solvency II Ultimate Forward Rate (UFR), and the current level of swap rates at 20, 30 or 50 years, resulting in a higher difference between the observed level of swap rates and the extrapolated rates under the Solvency II framework. This fosters the supervisory concern that the technical provisions are underestimated as interest rates for long-term maturities (and thus long-term liabilities) are discounted with too optimistic interest rate assumptions

The sensitivity can be seen by comparing data provided by EIOPA in the technical information for the HIA. The LLFR reduced by more than 70 bp from 0.705% to -0.037% between the end of 2019 and the end of June 2020 respectively. This drop is considerably higher than the reduction of the RFR before the LLP of 20 years, which amounted to less than 53 bp. (please note: The UFR in 2019 was 3.75%; in 2020 it is reduced to 3.6%)



The valuation of long-term insurance business is significantly impaired by this approach. The effects resulting from time-limited distortions of capital markets are further amplified by the alternative extrapolation methodology and the reduced weighting of the UFR. .

The absence of a prescribed convergence period and convergence tolerance, by taking simultaneously into account liquid points beyond the FSP, leads to a carrying forward of currently observable yields for long-term investments in distorted markets and unduly influence the RFR.

VII) Further implications

The negative effect on the solvency position of undertakings can be further amplified via

- i) the proposed of capital requirement for interest rate risk. This does not take into account the one-year horizon required by SII. Extending and applying the interest rate down-stress to the extrapolated part of the RFR and the UFR as well, is not compatible with the methodology to calculate the UFR as developed by EIOPA in 2017 and should be adapted. The value of interest rate guarantees and thereby the solvency capital requirement is significantly affected on the one hand by this stress and on the other hand by the alternative extrapolation.

- ii) the calculation of the risk margin which is based on expected future solvency capital requirements and on the RFR to discount these. The alternative extrapolation affects both components and thus leads to a significant increase of the risk margin.

VIII) Conclusive remarks

A change of the extrapolation methodology would constitute is a serious change of the Solvency II framework. It should only happen after a really comprehensive analysis and sensitivity testing.

Admittedly there is a need to introduce a mark-to-model approach for the valuation of long-term business. The character of this business, especially the illiquidity of liabilities, has to be considered adequately. In this context, the meaning of market-consistent valuation in times of non-efficient or even non-existent markets has to be established and considered.

Our demands on an extrapolation process are:

- (i) Facilitating an appropriate valuation of insurance business – in the context of extrapolation, especially of long-term business.**
- (ii) Avoiding artificial volatility and**
- (iii) Promoting sound risk management and financial stability**

Taking into account the result of our analysis and the identified weaknesses we do not support a change of the extrapolation methodology and of the current LLP for the Euro at this point in time.