

ACTUARIAL ASSOCIATION OF EUROPE SOLVENCY II PROJECT

EXTRAPOLATION OF THE RISK-FREE INTEREST RATE TERM STRUCTURE IN THE CONTEXT OF THE SOLVENCY II 2020 REVIEW

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Contributors

Siegbert Baldauf
Daphné De Leval
Nils Dennstedt
Malcolm Kemp
Declan Lavelle
Debbie Ramdien-Sonai
Frank Schiller

The authors are members of the Solvency II working group of the Actuarial Association of Europe (AAE). The views expressed in this paper reflect a thorough analysis of specific components of the Solvency II review and should not be considered in isolation.

Introduction

On request of the EU-Commission, EIOPA analysed the extrapolation process of the risk-free interest rate term structure (RFR) as part of the Solvency II -2020 review. More concrete, EIOPA was asked to provide evidence on criteria to determine the last liquid point. A proposal to change of methodology was not requested. In this document we deal with EIOPA's advice provided in their Opinion on the 2020 Review of Solvency II from 17 December 2020 (EIOPA-BoS)-20/749) concerning the extrapolation of the risk-free interest rate curve (RFR). EIOPA's assessment of the impact is based on the Holistic Impact assessment¹ (HIA) with reference date 31 December 2019 and in the Complementary Impact Assessment (CIR)² with reference date 30 June 2020.

¹ EIOPA-BoS-20/107 2 March 2020 Technical specification of the information request on the 2020 review of Solvency II Holistic impact assessment

² EIOPA-BoS-20/422, 1 July 2020: Technical specification of the complementary information request on the 2020 review of Solvency II

Our main concern is the adequate treatment of long-term insurance business in a risk-based Solvency II- framework. In this regard the focus is on the risk-free interest rate term structure which is the core element in the valuation of technical provisions.

A market-consistent valuation is required for assets and liabilities as well. The calculation of technical provisions requires a discounting of cash flows by means of a risk-free interest rate curve. These risk-free rates are taken from deep, liquid and transparent (DLT) markets as long as these are existing. In a first step, it is therefore necessary to analyse capital markets and assess the DLT-character. The longest identified duration for which such markets exist is the last liquid point (LLP). The duration of insurance contracts can exceed this duration considerably. To allow an adequate valuation also for such long-term business, it is necessary to prolong the interest rate curve beyond the LLP. The required extrapolation process depends on a determined long-term expectation (Ultimate forward rate – UFR) and on the methodology to approach this target value.

An appropriate extrapolation process consisting of a methodology, a convergence period and a convergence tolerance is required. Currently such a process is prescribed for the euro. Starting at a LLP of 20 years, the Smith-Wilson method is used to reach the UFR within a period of 40 years with a tolerance of 3 bps at the convergence point. For other currencies the convergence process is not prescribed in detail (see appendix III).

Our demands on an extrapolation methodology are:

- I. Facilitating an appropriate valuation of long-term insurance business.**
- II. Ensuring a reliable convergence to a long-term mean level (UFR).**
- III. Considering appropriately particular constraints resulting from national legislation.**
- IV. Mitigating the impact of short-term market turmoil on insurers' solvency.**
- V. Avoiding artificial volatility and thus contributing to market stability even in stress situations.**
- VI. Considering interrelations with risk margin, volatility adjustment, interest rate risk**
- VII. Promoting sound risk management.**

Taking into account the result of our analysis below and the identified weaknesses in EIOPA's advice we do not support a change of the extrapolation methodology and of the current LLP for the Euro.

Concerning EIOPA's advice we have identified the following shortcomings:

- I. The requested DLT-analysis is not complete. Furthermore, it does not properly consider the character of the insurance business where investments are driven by liabilities and the general risk management perspective where insurers might be forced to invest predominantly in bonds and not in swaps. For further details and analysis, reference is made to section I 'Analysis of Depth and liquidity of markets'.
- II. The alternative extrapolation method gives more weight to data from swap-markets post the starting point of the extrapolation without considering potential inherent weaknesses,

especially the increase of volatility. Convergence process to the Ultimate Forward Rate (UFR) depends on the chosen mean reversion parameter alpha and a last liquid forward rate (LLFR) as starting value by waiving clear specifications concerning convergence period and tolerance. This enables a carrying forward of the impact of short- or mid-term distortions to the entire RFR. For further details and analysis, reference is made to section II 'Alternative extrapolation methodology'.

- III. The risk of artificial volatility of technical provisions and own funds is not analysed in different economic contexts (e.g. high versus low interest rate environment and different markets volatility levels), but also taking into account given evolutions (UFR) and other proposed changes (risk margin, interest rate risk, volatility adjustment). The distortion of capital markets caused e.g. by activities of the European Central Bank (ECB) are not considered, although interest and swap rates for long durations are admittedly compressed by these activities. The Covid-19-pandemic amplified these effects. For further details and analysis, reference is made to section II 'Alternative extrapolation methodology'.
- IV. The alternative extrapolation methodology undermines the importance of long-term expectation concretised by EIOPA in the publication "Risk-free interest rate term structures Specification of the methodology to derive the UFR". For further details and analysis, reference is made to section III 'Instability induced by new treatment of the UFR'.
- V. The impact assessment does not allow the analysis on country level and for different types of undertakings. Although long-term life insurance is significantly exposed to effects resulting from a change of the extrapolation method, the impact cannot be assessed reliably. For further details and analysis, reference is made to section IV 'Impact Assessment'.

I) Analysis of Depth and liquidity of markets³

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

Swap markets analysed for years 2016-2019:

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.*

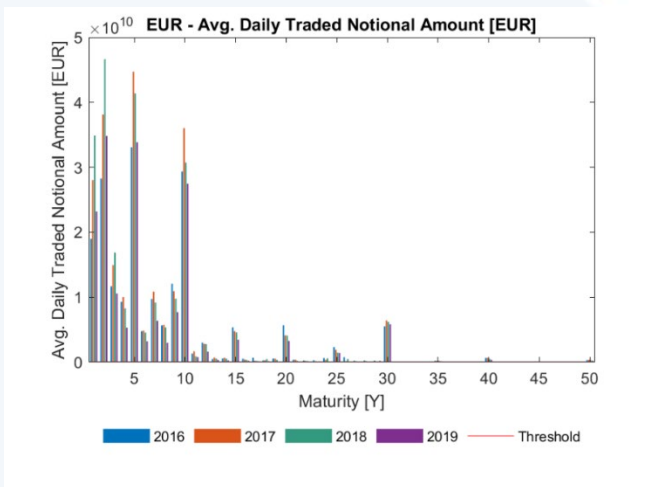
Only single-currency fixed-to-floating swaps should be considered for assessing the criteria. The assessment should be made separately for each currency and maturity. Where possible the thresholds should be assessed on the basis of data that cover the period of one year.

These thresholds are the same as the ones proposed by ESMA 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.

The following picture⁴ illustrates the result of this analysis.

³ See 21) Annex 2.1

⁴ See 21) p. 748



The swap market for the Euro in these years is DLT for maturities 1 to 12, 15, 20, 25, 30, 40 and 50 years. In 2017 and 2018 also for maturities 13, 14 years.

The adequacy and usability of the thresholds used in identifying DLT markets need to be checked. €50m may not be sufficient for large institutional investors such as insurance undertakings. This is important with regard to a possible LLP set to 50 years, which according to EIOPA, is the only value that would allow a market consistent valuation of technical provisions⁵.

Bond markets: no data delivered for the Euro-countries (“With regard to the euro a particular obstacle to the assessment is that there are no consistent data across the euro area 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)
	2018: 15 years (23 years)
2018:	“liability data may not be complete”; LLP might be too high

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

Resulting LLP:	2016: 21 years
	2017: 22 years
	2018: 22 years
	2019: 22 years
	Q1 2020: 22 years
	Q2 2020: 22 years

⁵EIOPA-BoS-20/751, 17 December 2020: Background document on the opinion on the 2020 review of Solvency II **Impact assessment**

Values for thresholds 3% and 10% are provided as well.

Conclusions – Analysis DLT:

Only for swap markets a DLT characteristic can be identified for longer durations than 20 years. It is questionable if the available volume is sufficient in consideration of the volumes invested by insurance undertakings and pension funds.

The analysis should be extended to not only consider volume but also effects observable in distorted markets - like e.g. inverse structure of swap curves, observable since mid-2020 for duration of more than 20 years. The upcoming IBOR-transition might in addition affect the DLT-characteristic of swap markets.

The lack of bond data is a major deficiency. Due to legal or accounting requirements and depending on their business, insurers might be forced to invest predominantly in bonds and not in swaps.

Altogether the result of EIOPA's analysis of DLT-characteristic of markets is not sufficient to substantiate a LLP of more than 20 years for the euro.

II) Alternative extrapolation methodology

The starting point for the alternative extrapolation methodology is the so-called first smoothing point (FSP). It is determined by the residual volume criterion and like the current LLP 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. Alpha cannot be derived from market data and has to be chosen arbitrarily⁶. Nevertheless it has a significant impact on the resulting extrapolated curve⁷. EIOPA assigned the value of 10% to alpha. This value is compared to the value of 2% used in the Netherlands, and is assumed to be a step towards a "more market-consistent" parameter⁸.

The prominent role of the mean reversion factor can lead to increased volatility of technical provisions and own funds and can hence also discourage insurers from offering long-term products and thus from playing their expected role as long-term investors. In addition, the trust in this method is undermined by EIOPA's advice that undertakings should repeat the calculation with an alpha of 5% and disclose the results in their Solvency and Financial Condition Report (SFCR). This should be mandatory for undertakings with a significant portfolio of long-term business.

Compared to the current methodology, the alternative extrapolation methodology waives a fixed convergence process towards the UFR. Based on the following formula for the calculation of the forward rates of "h" years post the FSP, neither a convergence point nor a convergence tolerance are stipulated.

⁶ See 21) A.90

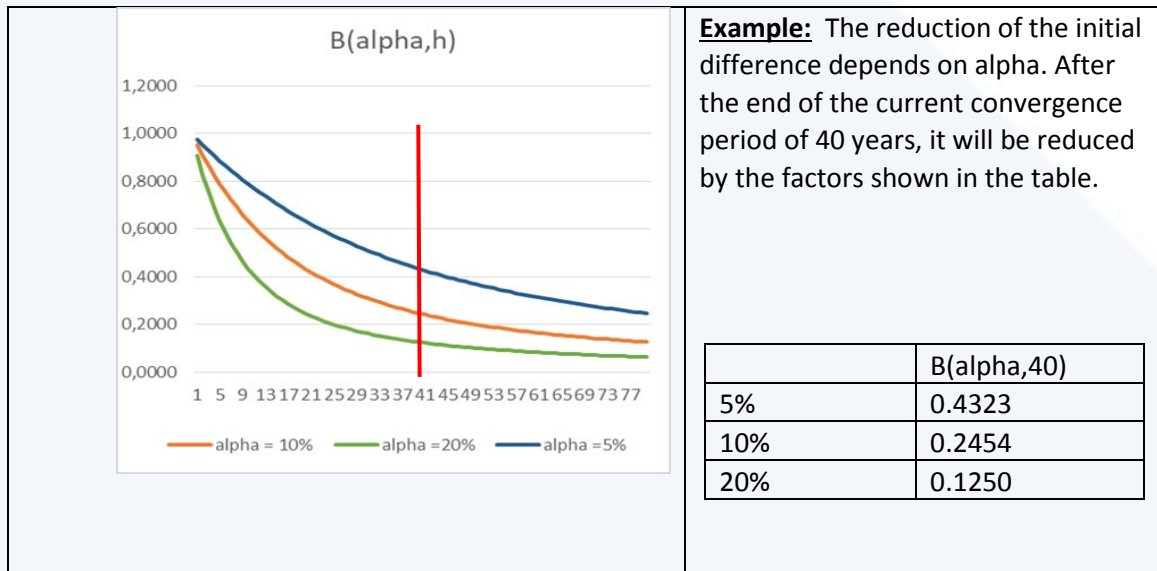
⁷ To consider: The interest rates in 2013 (when the Dutch document has been published) have been two percentage points higher than today.

⁸ See 21), footnote 368 on page 786: 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>.

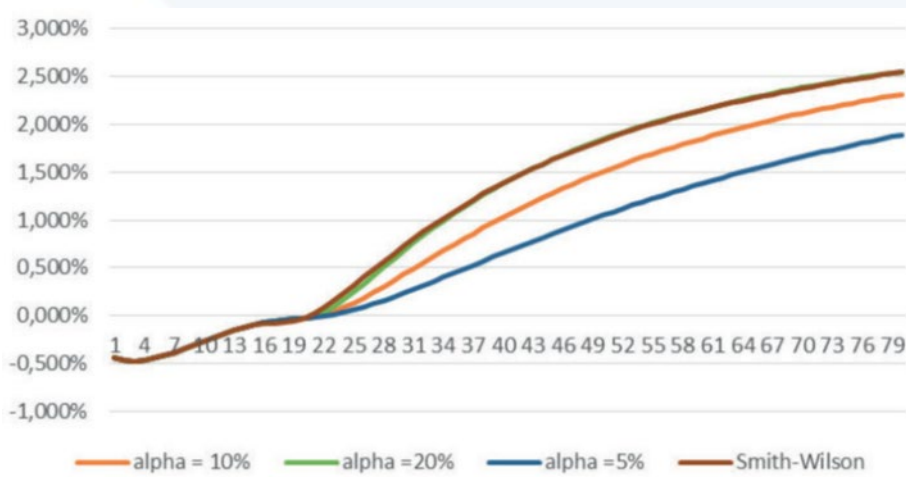
$$f_{20,20+h} = \ln(1+UFR) + (LLFR - \ln(1+UFR)) * B(\alpha, h) \quad \alpha = \text{alpha}$$

For year "h" post the FSP, the difference between LLFR and ln(1+UFR) is reduced by applying the factor $B(\alpha, h) = (1 - e^{-\alpha h}) / \alpha h$, which only depends on "h" and the mean reversion factor alpha. This factor is by definition independent of market condition.



The thus determined forward rates determine the zero coupon rates which for the year h after the FSP are calculated as:

$$z_{20+h} = \exp\left(\frac{20 * z_{20} + h * f_{20,20+h}}{20+h}\right) - 1$$



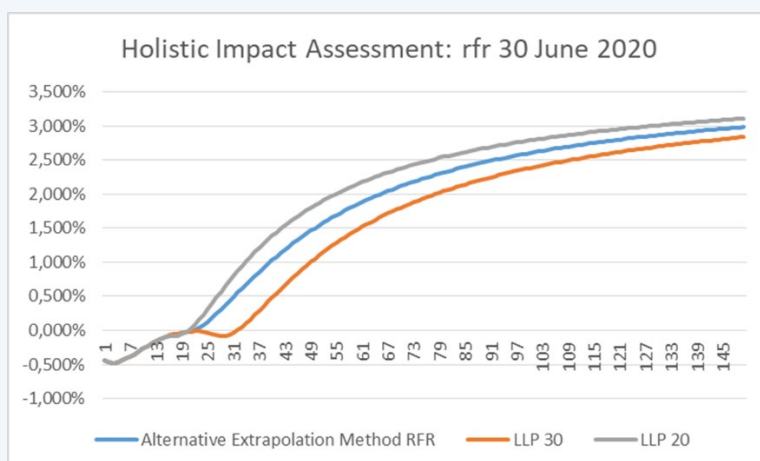
RFR for the Euro, reference date 30 June 2020

In a low interest rate environment, the alternative extrapolation method systematically leads to a lower RFR than the Smith –Wilson method in the extrapolated part. In a high interest rate environment this effect will reverse and lead to higher RFR. This is a direct consequence of the weakening of the convergence process to the UFR.

Some sensitivities of the alternative methodology are analysed in a) to c) below.

a) Dependency on LLFR

The volatility of capital markets post FSP is reflected in the LLFR and thus affects the entire extrapolated part of the RFR. The LLFR is the starting level of the extrapolated curve at the FSP. The table below is based on data from HIA and CIR. It shows in column 3 the effect resulting from a (fictive) change of the LLFR. On 30 June 2020 the LLFR is below the swap rate at FSP. This is caused by an inverse structure of the swap curve after 20 years. An LLFR of 0.200% instead of -0.037% (comparable to the values at 31 December 2019) would already lead to reduction of 60-year zero coupon rates of only **0.257%** (instead of 0.296 %).



Alternative Extrapolation	12/31/2019	06/30/2020	06/30/2020
	1	2	3
UFR	3.9%	3.75%	3.75%
B(10%,40)	0.2454		
Spot Z ₂₀	0.512%	-0.027%	-0.027%
LLFR	0.705%	-0.037%	0.200%
Zero Coupon Z ₂₀₊₄₀	2.235%	1.854%	1.893%
Zero Coupon SW (60)	2.472%	2.150%	2.150%
Difference alternative - SW	-0.237%	-0.296%	-0.257%

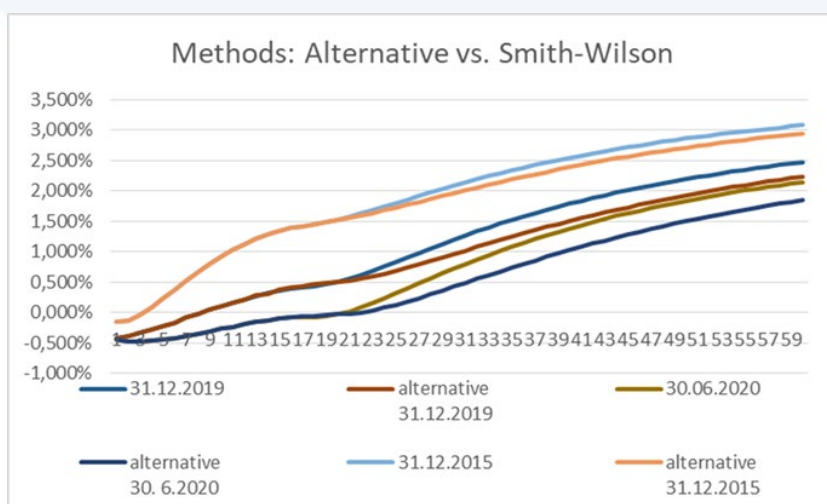
b) Dependency on level of interest rates

Besides the LLFR, the interest rate at FSP determines the alternative extrapolation. Interest rates at FSP closer to the UFR diminish the difference to the Smith-Wilson method. This can be seen in the following table. The RFR published by EIOPA with reference date 31 December 2015 is extrapolated using the alternative method. The interest rate at FSP had been one percentage point higher compared to end of 2019. As the LLFR was not available, it is set to 1.750% which comparable to end of 2019 is higher than the spot rate Z₂₀. The values resulting from this curve are shown in column 3 of the table.

In this environment, the difference between the thus determined alternative RFR and the RFR published by EIOPA is lower due to the methodology. The difference between the zero rates after 60 years is **0.137%**. It was **0.237%** end of 2019 and **0.296%** end of June 2020.

The difference between the RFRs determined with the two methodologies is lower if the interest rate at FSP is closer to the UFR.

Alternative Extrapolation	12/31/2019	06/30/2020	12/31/2015
Input data - parameter			
UFR	3.9%	3.75%	4.2%
Year post FSP (h)	40		
alpha (a)	10%		
Input data - market			
Spot Z_{20}	0.512%	-0.027%	1.527%
LLFR	0.705%	-0.037%	1.750%
Derived data			
B(10%,40)	0.2454		
Calculated rates			
Zero Coupon Z_{20+40}	2.235%	1.854%	2.906%
Informatory (Smith-Wilson)			
Zero Coupon SW (60)	2.472%	2.150%	3.079%
Delta Zero coupon rates	-0.237	-0.296	-0.173%



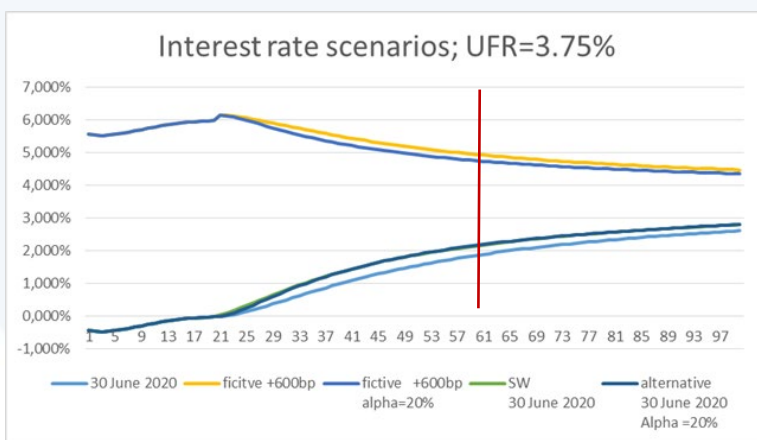
c) Behaviour in high interest rate environment

In order to analyse the behaviour in a high interest rate environment, the RFR with reference date 30 June 2020 has been shifted by 600bps upwards. To focus on the convergence process, the UFR has been set to 3.75% in both scenarios.

The Smith-Wilson curve for this high interest rate scenario is not available. In both cases the alternative extrapolation with an alpha of 20% has been taken as an approximation for the RFR determined by use of the Smith-Wilson method. The LLFR is in both scenarios 0.010% below the spot rate z_{20} . (This is comparable to situation end of Q2 2020).

The alternative extrapolation method leads to a higher RFR compared to the current method. A higher LLFR would increase the effect. In hindsight, the current method proves to be more risk-adequate in such an environment.

Alternative extrapolation method	30 June 2020		Fictive +600 bp	
	alpha = 10%	alpha =20%	alpha =10%	alpha=20%
Approximation		current		current
Input data - parameter				
UFR	3.75%			
Input data - market				
Spot z_{20}	-0.027%		5.973%	
LLFR	-0.037%		5.963%	
Derived data				
ln (1+UFR)	0.03681			
LLFR-ln(1+UFR)	-3.718%		1.886%	
Calculated values				
B(a,40)	0.2454	0.125	0.2454	0.125
Zero Coupon z_{20+40}	1.854%	2.158%	4.937%	4.774%
Difference current - alternative method	0.304%		-0.163%	



Conclusions – Alternative extrapolation methodology:

- The alternative methodology leads to lower differences compared to Smith-Wilson method in an environment where the interest rate at FSP is closer to the UFR-level.
- Significant differences are observed in a low or a high interest rate environment and in case of distorted markets in the liquid part of the curve, due to waiving binding convergence requirements.
- The results can be affected in addition by distortions post FSP which are considered in the LLFR (like inverse structure of swap curve)

The UFR together with a reliable convergence process proved to be an important stabilising element for undertakings' financial position in the past five years.

In order to avoid or to limit artificial volatility:

- Any extrapolation needs a reliable long-term expectation which should not be blurred by short- or mid-term distortions of liquid capital markets. It should work in all market circumstances.
- In order to achieve this goal, a fixed convergence period and convergence tolerance are crucial - independent of the chosen methodology.

III) Instability induced by new treatment of the UFR

As demonstrated above, the alternative extrapolation methodology undermines the importance of long-term expectation that had been concretised by EIOPA in the publication “Risk-free interest rate term structures Specification of the methodology to derive the UFR” (EIOPA-BoS-17/072; 30 March 2017). This long-term expectation is implicitly weakened by giving higher weights to currently observable long-term yields.⁹

Currently observable long-term yields must not be set equal with long-term expectation.

Long-term yields can be, and currently apparently are, significantly exposed to short- or medium-term activities of market participants. Currently, activities of the European Central Bank (ECB) dominate and distort the market for bonds. Asset purchase programs, although timely limited, admittedly lead to a significant compression of interest rates, especially for bonds. Depending on the ECB’s own assessment, the effect amounts to about 140bp for ten year sovereign bonds in 2018¹⁰.

A term structure for the valuation of long-term business must consider short- or medium-term effects appropriately. They should not blur the relevance of a long-term expectation by assuming an unrestricted continuation of such effects over decades.

Such considerations are especially important with regard to the alternative extrapolation method, where in addition a possibly volatile LLFR is considered, while requirements concerning the convergence towards the UFR are relinquished.

⁹ *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*

¹⁰ Philip R. Lane: The yield curve and monetary policy, Speech at University College London (UCL), London, 25 November 2019

The valuation of long-term insurance business can be significantly impaired by this approach.

Conclusions – Instability induced by UFR treatment:

Temporarily limited interventions or distortions in the liquid part of the RFR must not affect the long-term expectation as reflected in the UFR.

The proposed alternative extrapolation method leads to a carrying forward of distortions currently observed in DLT swap markets to the entire RFR.

Especially observable in a low or a high interest rate environment, the alternative extrapolation method leads to an undermining of the role of the UFR.

The effect is comparable to an adaptation of the UFR following to market movements.

IV) Impact assessment¹¹

The abovementioned weaknesses of the alternative extrapolation methodology became apparent in EIOPA’s impact assessments HIA and CIR. In both cases EIOPA’s proposal with an expected higher impact on the solvency ratios have been tested in a combined scenario (scenario 1) for a reference date end of 2019 (HIA) and end of Q2 2020 (CIR). Scenario 2 differs from scenario 1 only by omitting the changed interest rate risk calibration.

Significant changes in the liquid part of the RFR in the first half of 2020 led to a huge impact on undertakings’ capital surplus. Although contribution of a single proposal cannot be identified reliably, most of this effect can be assigned to the alternative extrapolation method. EIOPA provided the following table:

Approximate impact on capital surplus		
Changes to	HIA	CIR
Volatility adjustment	+16 bn	+13 bn
Risk margin	+16 bn	+18 bn
Extrapolation	-34 bn	-61 bn
Correlations	+ 5 bn	+5 bn
Interest rate risk	-21 bn	-20 bn

The capital surplus was decreased significantly due to the alternative extrapolation method. Lower interest rates and the inverse structure of the swap curve after 20 years triggered this effect. This effect – resulting from the higher volatility inherent in this methodology - provoked the introduction of a phasing-in procedure (“mechanism”) until 2032 to be applied in case the interest rate at the FSP is below 0.5% observed end of 2019 (see appendix II).

This measure cannot cover the weaknesses of the methodology. Even in a situation comparable to that observed end of 2019 (columns HIA) the proposed changes would lead to a significant reduction of the solvency ratios of life insurance undertakings across Europe. The effect will differ considerably between countries depending on their business models.

Type of undertaking	Solvency ratios: Impact of HIA and CIR					
	all		life		life and composite	
	HIA	CIR	HIA	CIR	HIA	CIR
Baseline	247%	226%	260%	228%	255%	223%
Scenario 1	234%	204%	229%	186%	228%	188%
Scenario 2	248%	216%	255%	204%	255%	206%
Scenario 1 - baseline	-13%	-22%	-31%	-42%	-27%	-35%
Scenario 2 - baseline	1%	-10%	-5%	-24%	0%	-17%

¹¹ EIOPA-BoS-20/751, 17 December 2020: Background document on the opinion on the 2020 review of Solvency II **Impact assessment**

Balancing of the overall impact of the proposals was one of EIOPA's goals announced in the Factsheet¹². (“**Balanced updating of the regulatory framework:** EIOPA proposes changes in several areas but **with balanced overall impact on insurers**. This reflects the fact that Solvency II is overall working well”).

Conclusions – Impact assessment:

- The goal of balancing the overall impact of the proposals was not even achieved end of 2019 – contradicting EIOPA's assessment.
- EIOPA disregarded that a balancing was only possible on EU-level by ignoring differences between types of undertakings and without considering the effects of the impact resulting from the change of the interest rate risk.
- In a very low interest rate environment the mechanism aims at ensuring an impact comparable to that observed end of 2019 at the begin of the phasing-in process. It is a tailor-made solution for the particular market distortion observed in 2020.
- EIOPA's impact assessment with regard to the mechanism makes use of the cash flows provided by undertakings in the CIR. It is based on a stylised and simplified run-off model which e.g. does not cover alternating capital markets during the transitional period or when used with a later starting date.

Altogether EIOPA's proposal does not meet the requirement of the EU-Commission to ensure the stability of the RFR in different market situations (see Appendix I).

¹² Factsheet, 2020 Review of Solvency II keeping the regime fit for purpose

Appendix I: Commission's request to EIOPA

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

Requested by the EU-Commission:

3.1. Extrapolation of the Risk-Free Interest Rate term structure (Art. 77a) ¹³

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.

Not requested by the EU-Commission:

A change of the methodology was not explicitly requested as part of this review.

According to Article 43 (5) of the Delegated Regulation a technique, data specification or parameter, including the ultimate forward rate, the last maturity for which the basic risk-free interest rate term structure is not being extrapolated and the duration of its convergence towards the ultimate forward rate, shall be modified by EIOPA at the request of the Commission.

¹³ EU-Commission: Ref. Ares(2019)782244 - 11/02/2019, Request to EIOPA for technical advice on the review of the Solvency II Directive

Appendix II: EIOPA's advice

The determination of LLPs and also the methodology used for extrapolation have already been broadly analysed earlier in EIOPA's consultation paper¹⁴. Five options have been presented and discussed accompanied by first rough impact assessments. Replacing the current extrapolation methodology by an alternative methodology developed in the Netherlands¹⁵ was among these options.

Such a change of the methodology is now the technical advice given to the Commission as part of EIOPA's opinion¹⁶

Two main objectives can be identified in EIOPA's advice. Firstly, all data available from DLT-markets should be considered, secondly a consistent treatment across currencies should be achieved, removing special rules for the euro introduced as part of the Omnibus II Directive.

EIOPA's advice

EIOPA advises to apply an extrapolation method where interest rates are smoothly extrapolated from the first smoothing point to the ultimate forward rate by means of a last liquid forward rate (LLFR), which is determined as a weighted average of forward rates before and after the first smoothing point where the weights depend on the liquidity of the respective rates according to the notional amount traded at a particular maturity as determined in EIOPA's annual DLT assessment. Forward rates beyond the first smoothing point (FSP) should then be determined on the basis of the last liquid forward rate and the ultimate forward rate as follows:

$$f_{FSP,+h} = \ln(1+UFR) + (LLFR - \ln(1+UFR)) * B(a,h)$$

$$(a,h) = (1 - e^{-ah}) / ah$$

The parameter h denotes the maturity for which the forward rate is determined and the parameter alpha denotes the convergence parameter. EIOPA advises to set this parameter to 10%.¹⁷

Ambiguous disclosure requirements proposed

Report to supervisor

2.10: EIOPA recommends that insurance and reinsurance undertakings with long-term liabilities **should report to the supervisory authorities** the outcome of a sensitivity analysis regarding a change of the convergence parameter of the extrapolation method to 5%. Undertakings should report the impact on their financial position, including on the amount of technical provisions, the Solvency Capital Requirement (SCR), the Minimum Capital Requirement (MCR), the basic own funds and the amounts of own funds eligible to cover the SCR and the MCR.

¹⁴ EIOPA-BoS-19/465: Consultation paper on the Opinion on the 2020 review of Solvency II (15 October 2019)

¹⁵ <https://www.government.nl/documents/publications/2013/10/06/advisory-report-of-the-ufr-committee>.

¹⁶ EIOPA-BoS-20/749 17 December 2020: Opinion on the 2020 review of Solvency II g

¹⁷ For the Swedish krona a special treatment should apply – comparable to the status quo. The convergence parameter should be 40% for the Swedish krona.

2.11: The disclosure should only be mandatory for those undertakings exceeding the following threshold: sum of cash-flows beyond the FSP is higher than 10% of the total sum of cash-flows.

Disclosure in SFCR

2.56: In view of the proposed extrapolation method, EIOPA recommends that insurance and reinsurance undertakings with long-term liabilities **should disclose in their SFCR** the outcome of a sensitivity analysis regarding a change of the convergence parameter of the extrapolation method to 5%. Undertakings should disclose the impact on their financial position, including on the amount of technical provisions, the SCR, the MCR, the basic own funds and the amounts of own funds eligible to cover the SCR and the MCR.

2.57 The disclosure should only be mandatory for those undertakings exceeding the following threshold: sum of cash-flows beyond the first smoothing point is higher than 10% of the total sum of cash-flows.

Mechanism for the introduction of the extrapolation method

During periods of very low interest rates for a currency the convergence parameter α of the extrapolation method should be modified in order to limit the impact of introducing the method¹⁸. The modification should phase out until 2032 when also the transitionals on risk-free interest rates and on technical provisions will end. To achieve this the parameter α should be equal to:

- 10% when the risk-free interest rate at the FSP is 0.5% or higher
- X when the risk free interest rate at the FSP is -0.5% or lower
- Linearly interpolated for an interest rate at the FSP is between -0.5% and 0.5%

X should be equal to 20% during the first year of application of the alternative extrapolation method and decrease linearly to 10% in 2032. For currencies with a FSP of less than 15 years, the starting value for X should be 14%.

¹⁸ See 21) p.47

Appendix III: Extrapolation methodology

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

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

- 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) Legal background

Currently Article 77a of the Solvency 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 LLP and the appropriate convergence period to the UFR are 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 with a threshold of 6%. 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 market¹⁹."

In order to achieve a uniform treatment across all currencies, EIOPA used the Solvency II-review process to also test an alternative extrapolation methodology.

b) Commonalities in current and alternative extrapolation methodology

¹⁹ 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

The extrapolation of the RFR depends on the identification of DLT markets and a LLP or a so-called first smoothing point (FSP) in the alternative method. Both are determined by using the residual volume criterion²⁰. 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 methods of extrapolation

The alternative extrapolation method aims at taking into account identified liquid points beyond the FSP. They constitute the basis for the calculation of the LLFR. The extrapolation and thereby the convergence towards the UFR starts at the FSP with the LLFR. A convergence parameter alpha and a weighting function B depending on alpha and the number of years h post the FSP are used to model the forward rates of the extrapolated part. EIOPA propose to use an alpha of 10%, although this value cannot be substantiated. Moreover: “No unequivocal evidence can be found in the economic empirical literature for the convergence factor and the existence of a convergence factor greater than zero is also often called into doubt.”²¹

The shape of the resulting RFR roughly – depending on the current interest rate environment - 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 especially in low or high interest rate environments.

Contact:

Monique Schuilenburg, Operations Manager, AAE moniques@actuary.eu **Twitter: @InfoAAE**
Lauri Saraste, Chairperson Insurance Committee, AAE Lauri.Saraste@lahitapiola.fi
Siegbert Baldauf, Solvency II Project Manager, AAE Siegbert.Baldauf@aktuar.de

²⁰ 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.

²¹ Background document on the opinion on the 2020 review of Solvency II **Analysis** (EIOPA-BoS-20/750) 17 December 2020