Consequences of Solvency II extrapolation methods in the higher interest rate environment

Evaluation of the implications of a change in extrapolation method at higher interest rate levels

By [Floris Brull](#), [Joost Broens](#), [Sijbo Holtman](#), and [Tarik Aouragh](#)

24 April 2024

Interest rates have increased significantly in the last few years. In 2020, EIOPA introduced an alternative extrapolation method through its opinion on the 2020 review of Solvency II (SII).[1] In a previous note,[2] we assessed in detail this method's impact in a low interest rate environment. In this note, we examine its effects at current interest rate levels. Furthermore, EIOPA updated the Ultimate Forward Rate (UFR) for 2024 to 3.30%. A key question we now consider: how do these variations in extrapolation methods and UFR level influence the valuation of insurance liabilities?

Summary

This paper examines the implications of a change in Solvency II extrapolation method at higher interest rate levels. In line with previous analyses, we assess the impact for the cash flow profile of an average Dutch life insurance company. Our analysis incorporates both the current Smith-Wilson (SW) extrapolation method and the alternative extrapolation method (AM) proposed by the European Insurance and Occupational Pensions Authority (EIOPA). The analysis is repeated at various UFR levels.

We conclude that liability valuation and its rate sensitivity remain similar at higher rate levels for the different extrapolation methods. Interestingly, we observe that at lower UFR levels the current reduction in liability value due to the SII curve extrapolation can turn into an increase of the liability valuation.

A practical consequence is that current SII driven hedge positions are likely to require limited adjustments if the proposed SII review is implemented at current rate levels. If rates would decrease, then more attention is needed.

Background

Currently, the Solvency II liability discount curve is based on market rates that are extrapolated to an Ultimate Forward Rate using the SW extrapolation method. In its opinion on the 2020 SII review, EIOPA introduced the alternative extrapolation method. A key parameter in this method is the speed-of-convergence to UFR parameter (alpha). EIOPA advised to set this parameter to 10%. However, in recently agreed provisional amendments it is stated that: "For maturities of at least 40 years past the first smoothing point the weight of the UFR shall be at least 77.5%."[3] The closest value to 10% of alpha that satisfies this condition is 11%.

This paper explores the impact the alternative method—under the newly expected parametrisation—would have in the higher interest rate environment of 2023 compared to 2020. Notably, despite the rising interest rates, the UFR has been on a downward trend, with the UFR for 2024 (and 2025) set at 3.30%,[4,5] a 15 basis points (bps) decrease from its 2023 value of 3.45%. The main reason for the downward trend is the recent low real rate levels feeding into the UFR derivation.

Since its inception, the UFR has significantly influenced the liability value of an insurance company. We explore how this effect has changed in recent years.

SII and market curves

In Figure 1, the interest rate curves for the market,[6] SII SW curve and SII AM curve are shown as of 2020 Q4 and 2023 Q3. These curves represent low and high points of interest rates at quarter-ends in recent years.

Figure 1: Liability discount curves at 2020 Q4 and 2023 Q3 for various extrapolation approaches (including credit risk adjustment and excluding volatility adjustment)
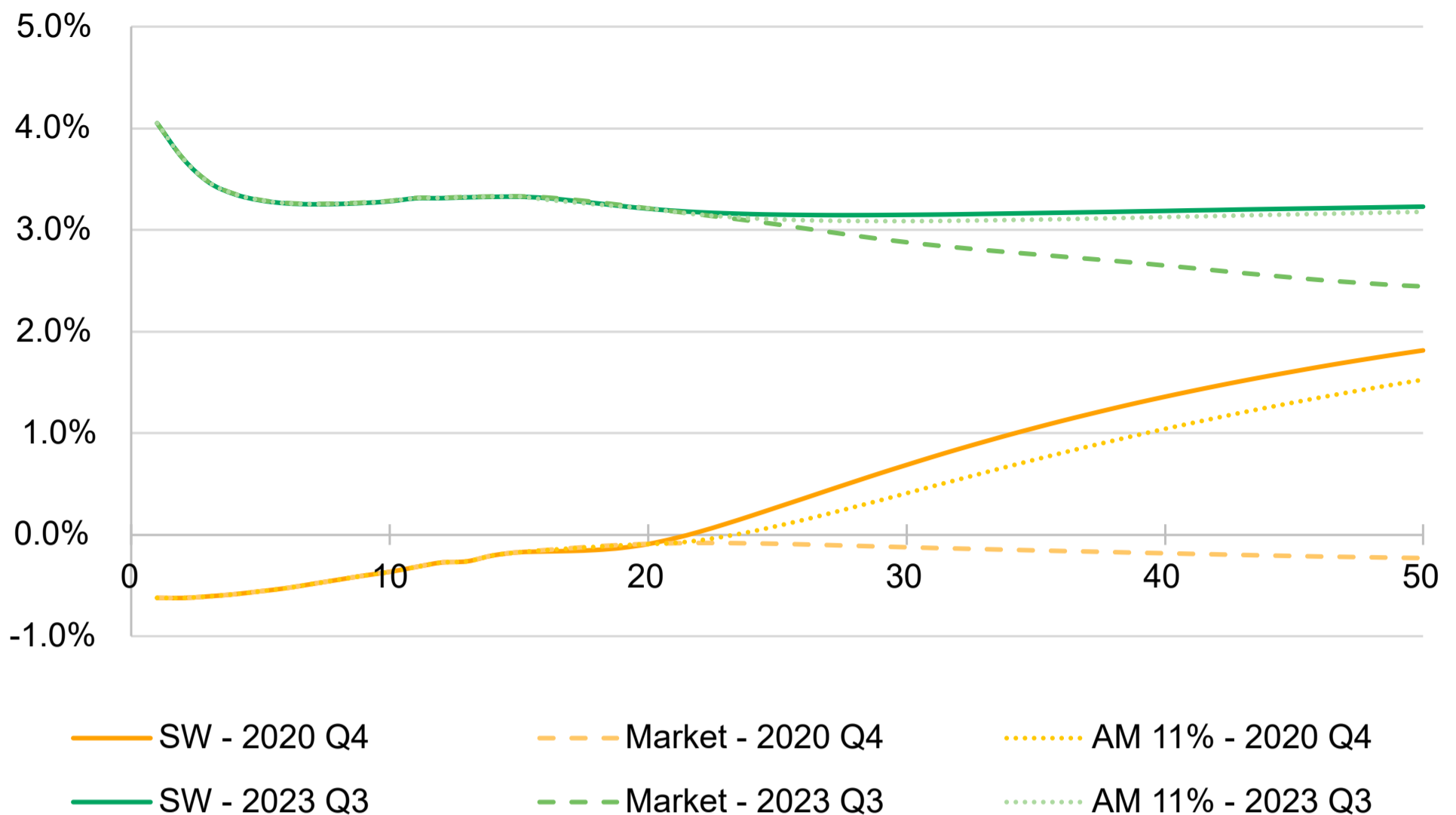
In general, the market curve of 2020 Q4 trends upwards and starts declining slightly at a maturity of 20 years, while maintaining a higher level than the very short-term maturities. This pattern has changed significantly in recent years: per 2023 Q3 the curve starts high and generally trends downwards until a maturity of 50 years.

Upon examining the SII curves, it stands out that the UFR impact is more pronounced for the 2020 Q4 curves. This is expected, as long-term rates were substantially lower then. This can also be partially attributed to the higher UFR per 2020 Q4 (3.75%) than per 2023 Q3 (3.45%).

Furthermore, the SII curves using the alternative method are slightly lower than those using the current Smith-Wilson method. The level of the long-term rates—captured in the alternative method through the so-called "last liquid forward rate"—is the main driver of the difference.

To a lesser extent the recent changes in the difference between the 15-year and 20-year rates also play a role in the differences between the curves.

Impacts on liability discounting and interest rate sensitivity

Having evaluated the differences in curves, we expand upon this by evaluating the impact on the best estimate liability (BEL) for a representative Dutch life insurance company, where changes in extrapolated rates would have significant impact.[7]

Figure 2: Best estimate liability and impact UFR for the SII curves at 2020 Q4 and 2023 Q3

BEL	Market curve	SW curve	AM (11%) curve	Impact UFR SW	Impact UFR AM
2020Q4	112.2	100.0	102.4	-11%	-8.7%
2023Q3	66.3	64.7	64.9	-2.5%	-2.1%
Delta	-45.9	-35.3	-37.5		

In Figure 2, the BEL for both the market and SII curves is shown. First, it is seen that the impact of using AM instead of SW extrapolation becomes smaller as interest rates rise. Furthermore, in the low interest rate environment of 2020, the application of the UFR to the base curve leads to a substantial decrease in the BEL for both extrapolation methodologies. With recent rate increases, the UFR impact on the BEL is substantially reduced. When interest rates were at a high point in 2023, the UFR impact decreased more than 75% compared to 2020 Q4.

Figure 3: DV01 and impact UFR for the SII curves

DV01	Market curve	SW curve	AM (11%) curve	Impact UFR SW	Impact UFR AM
2020Q4	0.21	0.14	0.16	-33%	-27%
2023Q3	0.09	0.08	0.08	-16%	-14%
Delta	-0.12	-0.07	-0.08		

A similar effect can be observed for the interest rate sensitivity. In Figure 3 the impacts are shown when a parallel shock of 1 bp is applied to the curves (DV01[8]) used to discount the BEL. It is observed that the impact of the UFR on the DV01 is considerably less at higher rate levels, and that the gap in interest rate sensitivity between the SW and AM extrapolation methodology has decreased.

An updated UFR

Now that we have explored the effects of the UFR under rising interest rates and the application of the new extrapolation method, we consider the effects of changing the UFR level.

EIOPA has established the applicable UFR rate as of 1 January 2024 at 3.30%. The UFR is tied to the real annual interest rate. Following the methods prescribed by EIOPA,[9] the forecast of the UFR exhibits a declining trend. So what happens if the UFR drops?

In Figure 4, we present the impact of the UFR on the BEL and DV01 per 2023 Q3.

Figure 4: Relative impacts of different UFR rates on BEL and DV01 compared to 2023 Q3 market curve-based numbers

UFR	Impact	SII SW	SII AM
3.45%	BEL	-2.5%	-2.1%
	DV01	-16%	-14%
3.30%	BEL	-2.3%	-1.9%
	DV01	-16%	-13%
2.25%	BEL	-0.9%	-0.6%
	DV01	-13%	-11%
1.35%	BEL	+0.7%	+0.8%
	DV01	-11%	-8%

From this analysis an interesting phenomenon emerges: when UFR rates are significantly lower, the SII extrapolation starts having an increasing effect on the BEL. However, such events are less likely when the curve on the long end is significantly downward sloping, causing the market curve to remain below the SII curve. Additionally, a UFR of 2.25% is unlikely if interest rates remain at current levels. A UFR of 1.35% would require 13 years of gradually lowering the UFR by 15 bps. Increasing effects on the BEL are also possible in scenarios of long-term curve steepening or further rate increases versus 2023 Q3.

We also observe that rate sensitivities are affected less by a change in UFR level for the AM approach than for the SW method. This is expected because the UFR carries less weight under the proposed new extrapolation approach.

Conclusion

We conclude that a high interest rate environment is less impactful for life insurance companies when Solvency II switches to the alternative curve extrapolation method. Having analysed the effects of a changing interest rate environment in 2020 and 2023, the impact of changing the extrapolation method to the AM is far less impactful at current rate levels than it was in 2020. Furthermore, changing the extrapolation method is more robust to upcoming changes in UFR.

[1] EIOPA's opinion on the 2020 review of Solvency II is available at https://www.eiopa.europa.eu/publications/opinion-2020-review-solvency-ii_en.

[2] Ruissaard, M. & Zandbergen, F. (November 2020). The Impact of Alternative Extrapolation Methods and Assumptions in Times of Decreasing Rates. Milliman Briefing Note. Retrieved 21 April 2024 from https://www.milliman.com/en/insight/the-impact-of-alternative-extrapolation-methods-and-assumptions-in-times-of-decreasing-rates.

[3] See page 172 of the provisional amendments to the SII directive (agreed between the European Parliament, European Council and European Commission), which can be found at: https://data.consilium.europa.eu/doc/document/ST-5481-2024-INIT/en/pdf.

[4] EIOPA (27 April 2023). EIOPA Publishes the Ultimate Forward Rate (UFR) for 2024. Retrieved 21 April 2024 from https://www.eiopa.europa.eu/eiopa-publishes-ultimate-forward-rate-ufr-2024-2023-04-27_en#:~:text=As%20of%201%20January%202024,Ultimate%20Forward%20Rate%20for%202024.

[5] EIOPA (27 March 2024). EIOPA Publishes the Ultimate Forward Rate (UFR) for 2025. Retrieved 21 April 2024 from https://www.eiopa.europa.eu/eiopa-publishes-ultimate-forward-rate-ufr-2025-2024-03-27_en.

[6] The market curve including credit risk adjustment is based on (an interpolation of) market observable rates until year 50.

[7] The underlying—internally constructed—proxy cash flow used is calibrated to represent a life insurance best estimate liability with duration 14 at 2020 YE when applying the Solvency II curve excluding the volatility adjustment (VA).

[8] The DV01 is measured here as the increase in value of a portfolio when interest rates decrease with 1 bp. Therefore, the reported DV01 are all positive.

[9] EIOPA (30 March 2017). Risk-Free Interest Rate Term Structures: Specification of the Methodology to Derive the UFR. Retrieved 21 April 2024 from https://register.eiopa.europa.eu/Publications/Reports/Specification%20of%20the%20methodology%20to%20derive%20the%20UFR.pdf.

About the Author(s)

Floris Brull

Amsterdam

Joost Broens

Amsterdam

Sijbo Holtman

Amsterdam

Tarik Aouragh

Amsterdam

For 75 years, we have combined technical expertise with business acumen to create elegant solutions for our clients.

Today, we are helping organizations take on some of the world's most critical and complex issues, including retirement funding and healthcare financing, risk management and regulatory compliance, data analytics and business transformation.