# The alternative extrapolation method for Solvency II curves: will Alpha accelerate the deflation of the UFR-benefit?

**April 2020**

As part of the 2020 review of the Solvency II regulations, EIOPA has introduced an alternative method to extrapolate long-term interest rates. This briefing note summarizes this alternative methodology and presents the impact on hedging strategies and an analysis of the main dynamics in comparison to the use of the Smith-Wilson method and an approach without an Ultimate Forward Rate.

## Key Conclusions

- Optimal hedge portfolio has less extreme positions, but requires investments in maturities up to 50Y
- The parameter Alpha to determine the speed of convergence, a new steering tool for regulators?
- The impact of the VA is lower after 20Y compared to the Smith-Wilson methodology

## THE BACKGROUND

The introduction of the alternative methodology is seeking a compromise to include more market information beyond the last-liquid point (LLP) in the extrapolation of the curve and to limit the immediate impact on the valuation of long-term liabilities. Next to the alternative methodology, the EIOPA consultation paper contained two options to change the LLP from 20Y to 30Y and 50Y, which would lead to the inclusion of more market information but would have a severe impact on the valuation of the long-term liabilities.

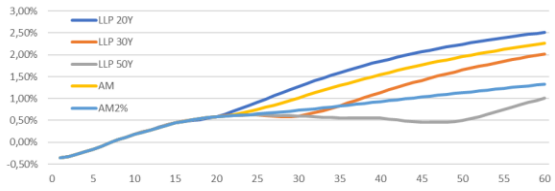


*Figure 1. The resulting interest rate curves when applying the different extrapolation options from the EIOPA consultation paper, using end of 2019 market data.*

As a result of the decrease in interest rates in 2019, the impact from the different extrapolation options on the valuation of insurance liabilities has increased significantly. Compared to the numbers presented in the EIOPA LTG Report, based on FY 2018 data, the impact has almost doubled when using FY 2019 data.[i] An overview of the estimated impact, for a few countries is shown in Table 1. In the remainder of this briefing note we use the Dutch insurance liabilities in the proxy calculations.

| **Impact on liability valuation** | *Smith-Wilson LLP 30Y* | *Smith-Wilson LLP 50Y* | *Alternative Method* |
|---|---|---|---|
| European | 1,5% | 2,6% | 0,7% |
| Belgium | 1,5% | 1,9% | 0,6% |
| Germany | 1,9% | 4,2% | 0,8% |
| Netherlands | 5,1% | 8,1% | 2,1% |

*Table 1. The impact of the different extrapolation options on the valuation of liabilities, using end of 2019 market data (approximated using the information from the EIOPA LTG Report 2019).*

## THE IMPACT ON HEDGING

The strange dynamics of the Smith-Wilson method are well-known by now, in particular the negative duration of the 15Y maturity and extreme positive sensitivity for the 20Y rate. As a short recap: a lower 15Y rate leads to a steepening of the 15Y-20Y forward and consequently a higher speed of convergence and a resulting higher curve. The alternative method is having its particularities as well, although in a less extreme form, shown in Figure 2.

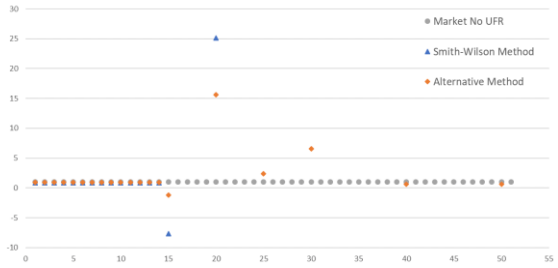


*Figure 2. Insight in the optimal hedge position for different extrapolation method.*

The sensitivity for the 15Y rate remains negative for the alternative method, but significantly smaller than compared to what it is using the Smith-Wilson method. In addition, a less extreme sensitivity is found for the 20Y rate, but still considerable in size (a multiple of 15 compared to normal sensitivity), as well as elevated exposures for the long-term rates.

When setting up a Solvency II ratio hedge, the portfolio still requires a significant amount of rebalancing. The implied short position on the 15Y rate is significantly smaller compared to the Smith-Wilson method, but still present and potentially causing volatility in case of non-parallel movements. In addition, longer interest rate exposure is required with material sensitivities to the 25Y, 30Y, 40Y and 50Y rate, even if liabilities are no longer than 25Y.

## THE IMPACT ON DURATION AND CONVEXITY

To understand the key dynamics of the alternative method, different measures are analyzed and compared to the Smith-Wilson method and an approach where no extrapolation method is applied. The first measure is the first order sensitivity (comparable to duration) measured by a basis point change.

In the first table it is shown that the first order sensitivity of the alternative curve is higher than using the Smith-Wilson method, but still significantly lower than the sensitivity when applying no extrapolation method, in particular on the longer maturities beyond 30Y.

| *Maturity Bucket* | *Market No UFR* | *Alternative Method* | *Smith-Wilson Method* |
|---|---|---|---|
| **0-50** | **16** | **15** | **14** |
| 0-20 | 10 | 10 | 10 |
| 20-30 | 25 | 24 | 23 |
| 30-40 | 34 | 28 | 24 |
| 40-50 | 44 | 30 | 25 |

*Table 2. First order sensitivity of Dutch insurance liabilities represented as a basis point valuation impact per basis point shift in curve, comparable to duration.*

The second measure is convexity, approximated by evaluating the impact of different shock sizes compared to the use of a simple first-order effect. Figure 3 and Table 3 show that the level of convexity of the alternative method is higher and more in line with the 'no UFR approach' compared to using the Smith-Wilson method.

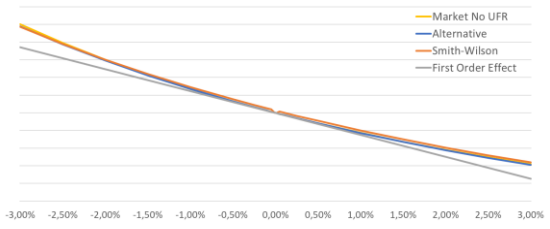


*Figure 3. Visualization of the convexity of Dutch insurance liabilities when calculating different extrapolation methods.*

| Interest Rate Shocks | *-3,00%* | *-2,00%* | *-1,00%* | *1,00%* | *2,00%* | *3,00%* |
|---|---|---|---|---|---|---|
| **Market No UFR** | 54% | 31% | 14% | -11% | -21% | -29% |
| **Alternative** | 41% | 25% | 11% | -10% | -18% | -25% |
| **Smith-Wilson** | 30% | 19% | 13% | -25% | -27% | -31% |

*Table 3. Relative impact of shocks to the value of Dutch insurance liabilities compared to the first-order sensitivity based on a 1 basis point shock.*

## THE ASSUMPTIONS ON ALPHA AND UFR

Clearly the assumptions for the ultimate forward rate (UFR) and the speed of convergence (Alpha) are important for the level and sensitivity of the interest rate curve.

In Table 4 the impact on the value of liabilities for different levels of UFR and Alpha are shown. The green column represents the current proposal of the holistic impact assessment, the orange boxes indicate a change of a parameter.

| **Alpha** | 10,0% | 5,0% | 2,0% | 10,0% | 10,0% | 2,0% |
|---|---|---|---|---|---|---|
| **UFR** | 3,90% | 3,90% | 3,90% | 2,80% | 1,70% | 1,70% |
| **Valuation Impact** | | 1,8% | 3,8% | 1,8% | 3,8% | 5,1% |

*Table 4. Impact on valuation of Dutch insurance liabilities for different levels of Alpha and UFR, using an ultimate alpha of 2% as the potential outcome following current Dutch pension fund legislation.*

The impact of lowering the UFR is well known by now, due to the recent experience in practice over the last couple of years (and further projected in the future). The impact of lowering Alpha is similar to lowering the UFR and will significantly influence the valuation of long-term liabilities. This introduces a new regulatory risk, since in the Smith-Wilson method this could only be achieved by increase the maturity when the UFR was reached which was difficult to justify. The parameter Alpha can be a new steering mechanism for regulators to lower the interest rate curve and hence increase the valuation of the liabilities (see Figure 6). The holistic impact assessment, already indicates a consideration by EIOPA to lower the parameter based on a recent Dutch study.[ii]

## THE ROLE OF THE VOLATILITY ADJUSTMENT

In terms of forward rates the Volatility Adjustment (VA) fades out rapidly, less than a third of the full VA on the first year of the extrapolated part (21Y for Eurozone), in spot rates it takes more time to fade out where approximately 75% of the full VA left on 30Y and less than 60% on 40Y.

In comparison to the Smith-Wilson method it is interesting to note that the relative weight of the VA is approximately 7.5% lower in the alternative method on the long end of the curve (shown in Figure 4). This will have an additional adverse impact on the value of long-term liabilities, especially in times of market stress where the VA should lead to a relief.

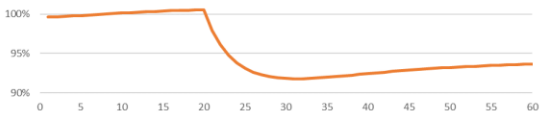


*Figure 4. Relative weight of the VA in the alternative method compared to the Smith-Wilson method.*

For example, when applying the 2020Q1 level of 46 bps the value of the VA is 1.5% lower, equivalent to a 0.1% higher valuation for Dutch insurance liabilities.

## THE ALTERNATIVE METHODOLOGY

The method is not entirely new and is, for example, already part of the Dutch pension fund legislation. The key feature of the alternative method is that it uses market information after the current LLP (20Y for the Eurozone). This is done by the introduction of two new variables, the first-smoothing point (FSP) and the last-liquid forward rate (LLFR). The UFR remains to play a dominant role in the extrapolation methodology.

For the maturities where the market is deemed to be deep, liquid and transparent (DLT), up to 15Y for the Eurozone, basic interest rate calculations are applied such as bootstrapping to obtain zero-coupon rates from par rates, translation into forward rates and use of continuous compounding.

The first complexity arises from the numerical procedure which is required to goal seek the implied forward rate between 15Y and 20Y. This follows the assumption that the one-year forward rate is constant for all years between these two maturities.

The same procedure is repeated to calculate the implied forward rate between all maturities where the DLT assessment has led to liquid point based on average traded notional and the FSP, e.g. forwards between 20Y-25Y, 20Y-30Y, 20-40Y and 20Y-50Y. Figures 5 shows the main output of the DLT assessments as shared in the EIOPA consultation paper.

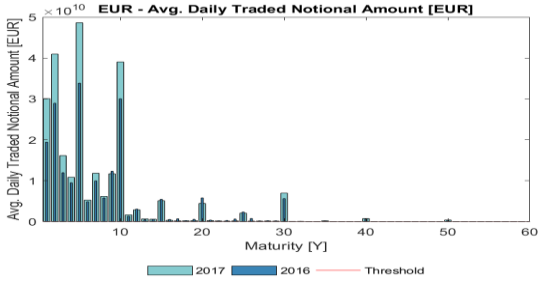


*Figure 5. Overview of average daily traded volumes in EUR swaps for different maturities, part of the DLT assessment (copied from the EIOPA consultation paper).*

The five implied forward rates are combined into the LLFR, using the weights from the DLT assessment.

The extrapolation after the FSP is a linear combination of the UFR and the LLFR. The weight between the UFR and LLFR depends on the speed of convergence parameter Alpha and, obviously, the distance towards the FSP. Figure 6 gives an indication of the impact of the speed of convergence parameter on the spot rates.

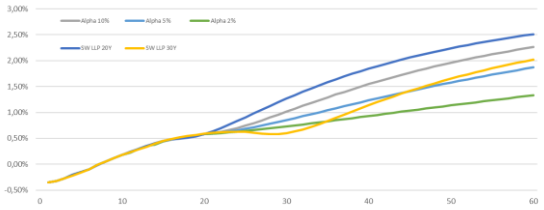

*Figure 6. The impact of Alpha on the extrapolation of the interest rate curve, the grey line represents the current assumption (10%) in the holistic impact assessment and the green line equal to the most recent study outcomes in The Netherlands (2%). Note that the SW curve using LLP 30 is higher after 35Y.*

The Volatility Adjustment (VA) is added to the forward rates up to the FSP and in order to recalculate the LLFR only to the first implied forward rate (between 15Y and 20Y).

## CAPTURING THE COMPLEXITY

All the curves used for the calculations in this briefing note are produced by an Excel add-in developed by Milliman, which generates Solvency II interest rate curves for both the Smith-Wilson method and the alternative method. This gives ample opportunities to analyze the impact of different parameters and to evaluate series of curves for day-to-day interest rate risk management, for projection tools, as well as for analysis around the impact of lowering of the UFR and Alpha assumptions.

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[i] See results in https://www.eiopa.europa.eu/sites/default/files/publications /reports/eiopa-ltg-report2019.pdf

[ii] See https://www.dnb.nl/en/about-dnb/dnb-pension-system/pensions-actuarial-interest-rate/index.jsp for more information and background on the Dutch pension fund legislation.