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INTERNSHIP REPORT

IMPACT ASSESSMENT OF THE PROPOSAL FOR THE 2020 REVIEW OF THE SOLVENCY II FRAMEWORK IN THE SCOPE OF THE PORTUGUESE MARKET

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GLOSSARY

ASF - Autoridade de Supervisão de Seguros e Fundos de Pensões

DRS – Department of Risk analysis and Solvency

EIOPA – European Insurance and Occupational Pensions Authority

COM – European Commission

EU – European Union

RFR – Risk-free rate

SCR – Solvency Capital Requirement

VA – Volatility Adjustment

TP – Technical Provisions

CoC – Cost of Capital

BE – Best Estimate

DLT – Deep, Liquid & Transparent

UFR – Ultimate Forward Rate

LLP – Last Liquid Point

FSP – First Smoothing Point

LLFR – Last Liquid Forward Rate

SFCR – Solvency and Financial Condition Report

GAR – General Application Ratio

AR – Application Ratio

RC_S – Risk Corrected Spread

PVBP – Price Value of a Basis Point

MV – Market Value

BEL – Best Estimate Liabilities

CS – Credit Spread

IRR – Interest Rate Risk

ALT – Alternative

SW – Smith Wilson

EOF – Eligible Own Funds

CRA – Credit Risk Adjustment

bp – basis points

ABSTRACT

After implementation of the Solvency II framework in 2016, a need for a review was proposed for the year 2020 to make the European insurance sector more resilient so that in the future it is stable enough to weather crises. This dissertation provides an insight to the impact analysis of the proposed change of the long‑term guarantees measures. The basis being the technical advice of European insurance and Occupational Pensions Authority (EIOPA) and the call for advice from The European Commission (COM). The study is carried out for the period of 2016 to 2020 within the scope of the Portuguese insurance market. The objective is to study the proposed changes and compare the two proposals of the Solvency II 2020 review through a quantitative analysis and to infer on its material impact. The main considerations under the two proposals of this report are to understand the impact of choosing a later starting point for extrapolation of risk-free interest rates after considering the information beyond, to assess the impact of the proposed volatility adjustment (VA) calibration particularly aiming to address overshooting effects and illiquidity of insurance liabilities. Further, we study the change in the interest rate risk capital requirement based on the new proposed calibration formulae and the impact of changing the cost of capital (CoC) rate from 6% to 5% to estimate the risk margin requirements. All inferences were deduced after analysing the change in average Solvency Capital Requirement (SCR) ratios and percentage changes wherever necessary. The change of the CoC rate from 6% to 5% in the estimation of the risk margin proved to have the most material impact on the SCR ratio of undertakings followed by the VA calibration and change in extrapolation method. The new interest rate risk capital requirement under the proposals saw an overall increase.

KEYWORDS: Solvency II Review; Long‑term guarantees measures; Extrapolation;Volatility Adjustment; Interest Rate Risk, Risk margin

SUMÁRIO

Após a implementação do quadro Solvência II em 2016, foi proposta no ano de 2020 uma revisão para tornar o sector segurador europeu mais resistente, de modo a que no futuro seja suficientemente estável para resistir a crises. Esta dissertação fornece uma visão da análise do impacto da proposta de alteração das medidas de garantia a longo prazo. A base é o parecer técnico da EIOPA e o pedido de parecer da COM. O estudo é realizado para o período de 2016 a 2020, no âmbito do mercado de seguros português. O objectivo é estudar as alterações propostas e comparar as duas propostas da revisão Solvência II 2020 através de uma análise quantitativa e inferir sobre o seu impacto material. As principais considerações no âmbito das duas propostas deste relatório são compreender o impacto da escolha de um ponto de partida posterior para a extrapolação das taxas de juro sem risco, após considerar informação posterior, para avaliar o impacto da calibração do VA proposto, particularmente com o objectivo de abordar os efeitos de sobreavaliação e iliquidez das responsabilidades de seguro. Além disso, estudamos a alteração dos requisitos de capital de risco das taxas de juro com base nas novas fórmulas de calibração propostas e o impacto da alteração da taxa de CoC de 6% para 5% para estimar os requisitos de margem de risco. Todas as inferências foram deduzidas após análise da alteração dos rácios dos requisitos médios de SCR e das alterações percentuais sempre que necessário. A alteração da taxa de CoC de 6% para 5% na estimativa da margem de risco provou ter o maior impacto material no rácio de SCR das empresas, seguida da calibração do VA e da alteração do método de extrapolação. A nova exigência de capital de risco de taxa de juro ao abrigo das propostas registou um aumento global.

PALAVRAS-CHAVE: Revisão Solvência II; Medidas de garantia a longo prazo; Extrapolação; Ajustamento da Volatilidade; Risco de Taxa de Juro, Margem de Risco.

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ACKNOWLEDGMENTS

1. INTRODUCTION

The following report is a representation of a six-month internship at Autoridade de Supervisão de Seguros e Fundos de Pensões (ASF), carried out in the Risk Analysis and Solvency department (DRS). DRS works towards performing supervision functions over the Portuguese insurance and pension fund market specifically focusing on analysing risk at a macroprudential level, assessing financial stability of the industry and gauging the impact of regulatory developments.

The purpose of this study is to understand and assess the impact of the 2020 Solvency II review mainly to analyze and draw conclusions on the impact of proposed changes included in the technical advice of the EIOPA following the request of the COM focusing on the long-term guarantees measures. This work focusses on the impact of proposed changes on the Extrapolation of the risk-free rate, VA, Interest rate risk and risk margin.

The Solvency II Directive came into effect in 2016 and ever since insurers around Europe have significantly strengthened governance and risk management practices. On inception itself revisions of the regime were planned so that the methods of estimating capital requirements were updated to better represent the market conditions and to assess the application of long-term guarantees measures and other risk measures. EIOPA's advice essentially focusses on recognizing the economic picture under Solvency II.

The need for a review of the Solvency II regime was made with the aim of encouraging insurers to invest in Europe's future and to make the European insurance sector more resilient so that in the future it is stable enough to weather future crises that may come about. Therefore, this study will focus on assessing how the proposed changes may be supported by ASF's position in European negotiations and to check the quantitative impact in the scope of the solvency position of insurance and reinsurance undertakings in the Portuguese market and under different reference dates to capture different economic scenarios. The review can be an ideal opportunity that should not be missed. It will help entities to acknowledge the specificities of long-term investments. Overall, it will promote the necessary conditions for the economic growth of the European Union (EU), development of new technologies and climate transition, as well as total financial stability.

2.BACKGROUND

The Solvency II regime was effective on 1st January 2016 when countries of the EU recognized the need for a more holistic and harmonious risk-based approach to insurance supervision. It encouraged a common approach to assess and mitigate risks in carrying out insurance and reinsurance activities. Having a legal framework would eliminate the differences and bring about more uniformity in conducting insurance business. The main focus of the regime is to protect the interest of policyholders, by equipping insurance groups with proper financial reporting procedures, legal and regulatory requirements, promote transparency and overall help to strengthen and stabilize the financial system. After being in force for six years the governance models in place have been working well overall and have better aligned the capital requirements of insurance groups with the risks they undertake. However, there has been the need for a gradual review over the years to ensure that the regime was fit to purpose.

The 2020 Solvency II review is set to evolve the current regime mainly in order to take into account the prevalent economic situation, updating the regulatory framework and completing its regulatory toolbox. It needs to better reflect the low interest rate situation around the globe and ensure that the insurers are able to hold long-term investments to meet their long-term illiquid liabilities. EIOPA made a set of proposals for this review based on the call for advice by COM specifically on the long-term guarantees measures, measures on equity risk and the methods associated with calculation of the solvency capital requirements and finally the supervision and capital management measures.

The hushed economic growth was intensified by the Covid -19 pandemic, and it acutely affected the macroeconomic market conditions around the world. In the last quarter of 2020, almost the entire euro swap curve moved to negative territory. This is where EIOPA's advice comes into play to adequately assess a number of options with regard to the interest rate risk, extrapolation of the interest rate curve and the volatility adjustment. These changes envisage to make the resultant estimated interest rates reflect the market conditions more realistically. The review aims to lay down the regulatory framework for a decade and is expected to be resilient with regards to any point in time.

2.1 APPROACH AND METHODOLOGY

On the basis of the call for advice from COM in February 2019, EIOPA was requested to provide its technical opinion on the Solvency II 2020 review. COM proposed to amend the Directive 2009/138/EC with regard to proportionality, quality of supervision, reporting, long-term guarantees measures, macro-prudential tools, sustainability risks, group and cross-border supervision to understand a broad perspective of the functioning of the Solvency II framework. Additionally, the member states had the opportunity to participate in "Expert group" meetings to further have a coherent analysis and to better identify any discrepancies. The timeline for this review is represented below. [1]

Figure1: Timeline of the Solvency II 2020 Review[2]

Each of the proposed measures were evaluated on its effectiveness, efficiency, relevance, coherence, and any added value to the EU. Overall, the objectives of the framework are closely associated and correlated with one another, sometimes making it difficult to assess the impact of each of the proposals individually. It is therefore necessary to rely more on quantitative findings, stakeholders' reports, and supervisory assessment. This study will focus on inferring on impact analysis through quantitative findings. The recommendations proposed by EIOPA mainly impact the financial position of undertakings (the focus of this study), on policyholder protection, on the investments of undertakings, on consumers and products, on competition and level playing field in the EU Insurance market and finally on financial stability.

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[1] Commission Staff Working Document Impact Assessment Report Part 2/4 available at
https://eur-lex.europa.eu/resource.html?uri=cellar:ee978a3f-1c51-11ec-b4fe-
01aa75ed71a1.0001.02/DOC_5&format=PDF
[2] 2020 Review of Solvency II Factsheet, EIOPA available at
https://www.eiopa.europa.eu/sites/default/files/solvency_ii/solvency2-factsheet.pdf

2.1.1 WORKFLOW DIVISION OF THE STUDY

Based on the consultation paper on the Solvency II 2020 review published by EIOPA, the workflow of this study was divided in four sections which are as follows:

- Changing the method and starting point for the extrapolation of risk-free interest rates for the euro.

- Change in the calculation of volatility adjustment applied to the risk-free rate (RFR) to address the overshooting effects and illiquidity of insurance liabilities.

- Increase the calibration of the sub-module interest rate risk of the Solvency Capital Requirement (SCR).

- Change in the rate of the Cost of Capital from 6% to 5% and to analyse the impact of this change on the risk margin.

2.2 RESEARCH QUESTIONS & PROBLEM STATEMENT

Identified problems to be addressed in the review and which will be focused on in this study

1. Article 77a of the Directive describes the current method of extrapolation of risk-free interest rates, the aim in the review was to make the interest rates more reliable and robust in times of market crisis by limiting pro-cyclical effects and underestimation of technical provisions (TP). This change is expected to provide better financial stability and improve an undertaking's solvency position.

2. Under article 77d that illustrates the method of estimating the VA, the two crucial problems identified were with the calibration of the VA. It is of importance that the VA prevents procyclical investment behavior and recognize illiquidity characteristics in liabilities that are considered while estimating the TP. Other problems detected by EIOPA namely that the representative portfolios were only updated on a yearly basis which were not a true representation of its value during a year. Further, the current framework disallowed negative average spreads on both corporate and governments bonds which did not appropriately represent the market in times of crisis which may have exaggerated impacts on the spread.

3. The interest rate risk is a sub-module in the SCR standard formula as per article 105(5a) of the Directive. EIOPA analyzed the current calibration of the module and identified it was severely underestimated i.e., the interest movements have been much stronger than the stresses mentioned in the Delegated Regulation, it does not stress negative interest rates which may be a reality in times of crisis. The risk overall has a material impact on the capital requirements of undertakings which are currently not sufficient.

4. Calculating the right amount of RM under the Solvency II framework is to give meaning to the transfer value concept. The main identified problems by EIOPA were to check if the design of the RM is appropriate after comparing the transfer value and the valuation of the transferred assets and liabilities. The cost of capital (CoC)rate is set in Article 39 of the Delegated Regulation at 6% also was questioned whethera constant rate was the right approach and if its level was appropriate. Finally, the review also analyses the sensitivity of the risk margin to the changes in interest rate.

We first aim to study the existing regulations under the regime and highlight the main features relevant to this study. Further, we attempt to estimate the impact of the proposed changes and to make a comparison between the current and proposed changes both by EIOPA and COM proposals respectively, in order to understand the impact of the changes in different economic situations. The impact on the SCR ratio was estimated for the extrapolation of interest rates, VA and change in CoC to estimate the risk margin. For the interest rate risk, the new calibration method was tested to see the change in capital requirements.

2.3 ASSUMPTIONS OF THE STUDY

1. The entities considered in this study were in the scope of the Portuguese insurance market and were analysed over a period of five financial years from 2016 until the end of 2020

2. For liability cashflows that were recorded over a range of maturities, the RFR rates corresponding to the lowest maturity was used for the range.

3. "Current" refers to the Solvency II regime norms that are prevalent before the 2020 review will come into effect.

4. Only assets, filtered by the CIC codes as stated in the technical specification document were considered in this study.

5. The cashflows of assets were forecasted estimating the fixed coupon rates and then maturity dependent coupon bond value projections.

6. Assets with maturity greater than 100 years or assets that formed a perpetuity were assumed to have a maturity of 100 years to simplify the analysis.

7. Assets without an issue date, were assumed to be zero – coupon bonds.

8. Assets denominated in the EUR currency were only considered.

9. Assets that had maturities in decimals were rounded up to the next nearest integer.

10. AR[5] rates were assumed based on the type of entity, under the estimation of VA. Life 77%, Non-Life 60% and Composite 66%

11. When discounting liabilities both direct business and reinsurance business of each entity was taken into consideration.

12. The reference dates considered throughout the study were at the end of the last month of each year.

13. 21% p.a. was the assumed tax rate throughout the study.

14. In estimating the interest rate capital requirement under the COM proposal, the term structure is unaffected by the shocks for maturities greater than 20 for both assets and liabilities. The shocks are not applied to these maturities. (Refer section 3.3.2)

2.4 SOLVENCY II FRAMEWORK

To facilitate and streamline the activities of carrying out insurance and reinsurance undertakings it is necessary to create an environment where laws of different members of the EU are harmonious which makes it easier for the internal market to run smoothly. Therefore, Solvency II, a regulatory framework was introduced in 2016. It is important to understand that the application of this framework is relative to the size, legal status, and nature of the company. The Solvency II regime is a valuable tool for efficiently and effectively managing risk while also allowing entities to use their own data and calibrate parameters in their SCR ratio estimation using the standard formula. Technical information based on the regulations set in the Solvency II Directive are produced by EIOPA regularly minimally on a quarterly basis (Article 77e). The Directive defines in brief the scope and definitions of the framework all of which are applicable to life, non-life and composite undertakings including companies that only engage in reinsurance business all of whom are established within the territory of a member state of the EU.

2.5 OBJECTIVES OF THE DIRECTIVE
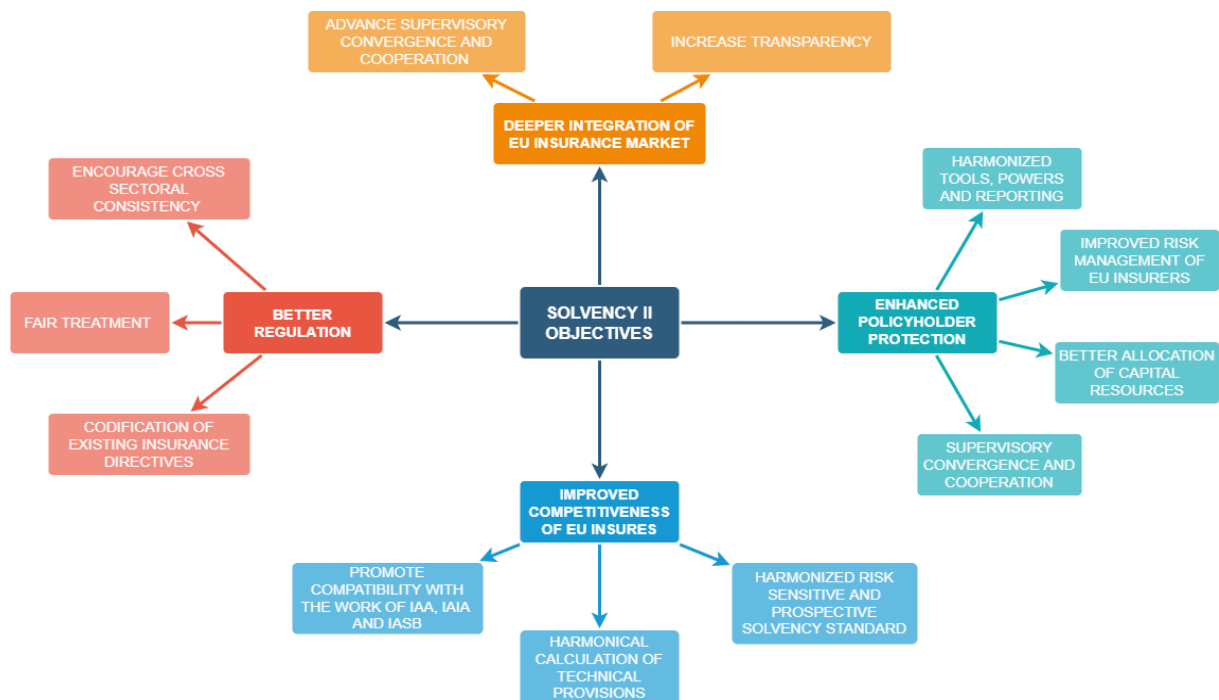
Figure2: Ref: Commission (2007) Staff Working Document – Impact Assessment Report[3]

The main definitions with reference to Chapter VI of the Directive 2009/138/EC that are of essential knowledge to understand the forthcoming sections of this study will be discussed in this section.

Assets and liabilities are valued at their exchange/transferrable amount in accordance with economic principles. TP are estimated as the amount corresponding to the amount an undertaking would have to pay if they had to transfer their insurance portfolio to others. It is the sum of the Best Estimate (BE) and risk margin. Here, BE is the gross (direct and reinsurance business) of the expected present value of future cash-flows, taking into the account of time value of the money using the relevant risk-free interest rate term structure as the basis for discounting. Cash-flow projections shall consider all the inflows and outflows necessary to settle the insurance and reinsurance obligations occurring over a lifetime of an undertaking. Risk margin is that cost that ensures the value of TP is equivalent to approximately the market value of insurance and reinsurance obligations and is computed using the Cost of Capital method.[4]

Life Undertaking: Insurance entities that pursue life activities and will have cash-flows only in life lines of business and are subject to the capital requirements to protect the life policyholders are categorized as life undertakings.

Non-Life Undertaking: Insurance entities that pursue non-life activities will have cashflows only in non-life lines of business (with the possibility of also having "annuities stemming from non-life contracts" in the life lines business only under this heading) and are subject to the capital requirements to protect its non-life activities are called non-life undertakings.

Composite Undertaking: Insurance entities that pursues both life and non-life activities and have cash-flows in both life and non-life lines of business including other life lines of business besides "annuities stemming from non-life contracts", then it is called a composite undertaking. They must manage these activities separately and especially protect the interests of the life policyholders. They are subject to the same capital requirements as carrying out each of the activities separately with taking in to account the increased transferability of capital in this case.

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[4] European Commission Delegated Regulation available at
 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0035&from=EN

At this stage it would be noteworthy to understand the structure and components of the Solvency II balance sheet to understand how the different elements of the study affect the overall balance sheet and consequently on the financial position of the undertaking.
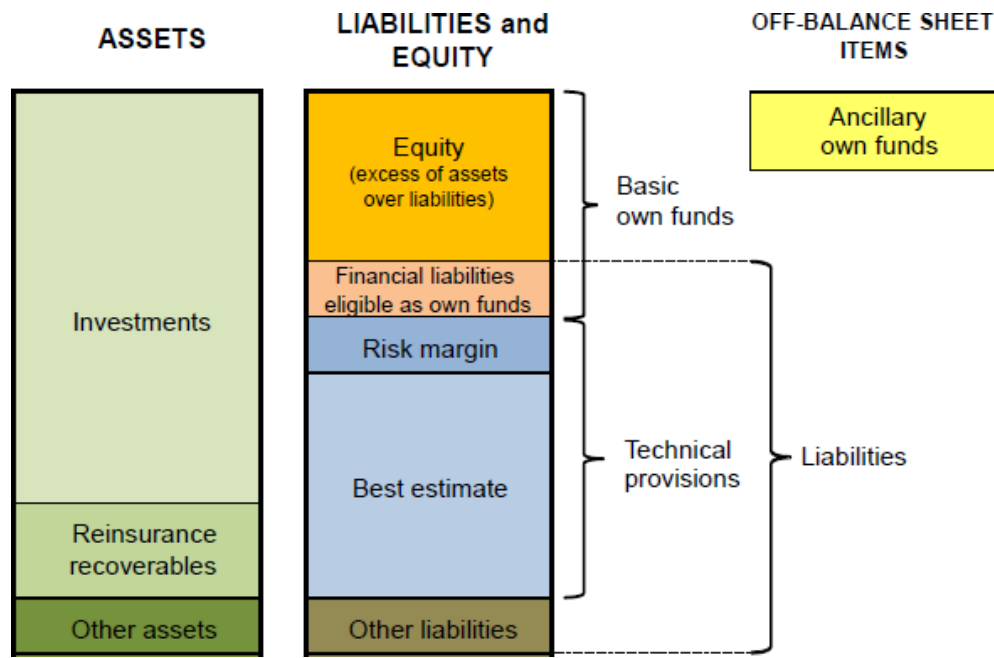
Figure3: Solvency II Balance Sheet and its main elements[5]

Across European insurers the most material aggregated quantitative impact on the SCR ratio i.e., balance sheet (Pillar 1) that are of importance to this study can be observed as follows:

1. Extrapolation (-)
2. Volatility adjustments (+)
3. Interest Rate risk capital requirement (-)
4. Risk Margin (+)

These are based on the impact assessment in the background document carried out by EIOPA[6]

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[5] Adapted from slide 13 of Solvency models\ISEG-UL\2021.09\Hugo Borginho
[6] Societies of Actuaries, Ireland: Slide 9 available at
   https://web.actuaries.ie/sites/default/files/2021-04/All%20slides.pdf

3. LONG-TERM GUARANTEES MEASURES

3.1 EXTRAPOLATION OF RISK-FREE RATES

The risk-free rate term structure mentioned in Article 77(2) of the Directive 2009/138/EC must consistently make use of the information derived from relevant financial instruments and bonds that belong to markets that are deep, liquid, and transparent (DLT). The relevant RFR is calibrated to meet criteria such as no credit risk, realism, reliability, high liquidity, and no technical bias so that prudent valuation of TP is ensured.

For maturities where the instruments in the markets which are not DLT, the RFR term structure is extrapolated. This portion of RFR that is extrapolated is based on the forward rates that converge smoothly from one or a set of forward rates to the ultimate forward rate (UFR). This is also applicable to financial instruments in a DLT market with long maturities that fulfills the same criteria except liquidity. The UFR is determined considering expectations of long-term real interest rates and expected inflation. The UFR will not include a term premium pertinent to extra risk of holding long-term liabilities. These expectations must however be derived in a transparent, prudent, reliable, and objective manner, remaining consistent over time.

EIOPA follows the Smith-Wilson methodology to derive the relevant RFR, that uses available data to fit exactly the bond prices and then extrapolates using a weighted average of last observable point in the dataset and the predetermined UFR. The input parameters for the interpolation and extrapolation are the last liquid point (LLP), UFR, the convergence point and the convergence tolerance. The LLP is the longest maturity for which the RFR can be derived from the DLT markets. The convergence point is the maximum of (LLP+40) and 60 years. Consequently, the convergence period is the maximum of (60-LLP) and 40 years. The convergence tolerance is set at 1 bp. EIOPA publishes the risk-free interest rates for integer maturities from one year to 150 years.[7]

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[7] Pg. 41, Technical documentation of the methodology to derive EIOPA's risk-free interest rate term structures,27October2015 https://www.eiopa.europa.eu/sites/default/files/risk_free_interest_rate/eiopa-bos-21-250-technical-documentation_cl.pdf

3.1.1 EIOPA's PROPOSAL ON THE EXTRAPOLATION OF RFR

To ensure the RFR term structure is stable in several market situations including situations of crisis and periods of increasing interest rates EIOPA advised to extrapolate the term structure for maturities corresponding to the financial instruments that are no longer DLT and where availability of bonds is limited i.e., until the First Smoothing Point (FSP).

EIOPA advises to apply an extrapolation method where interest rates are smoothly extrapolated starting from the FSP to the UFR by means of a last liquid forward rate (LLFR). The FSP is determined based on residual volume criterion and take the same value as the LLP i.e., 20 years. The LLFR 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 based on the last liquid forward rate and the ultimate forward rate as follows:

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

$$B(a,h) = \frac{1 - e^{-ah}}{ah} \tag{2}$$

The parameter h represents the maturity for which the forward rate is determined and the parameter a represents the convergence parameter (towards the UFR). EIOPA advises to set this parameter arbitrarily to 10%. [8] a is by definition independent of market condition. [9]

The LLP was determined according to 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. [10]

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[8] Page 14, Opinion On The 2020 Review Of Solvency II, EIOPA-BoS-20/749, 17December,2020
[9] Extrapolation of the risk-free interest rate term structure in the context of the Solvency II 2020 Review, February 2021 https://actuary.eu/wp-content/uploads/2021/07/AAE-Extrapolation-paper-final.pdf
[10] Pg. 3, Request to EIOPA for technical advice on the review of the Solvency II Directive https://register.eiopa.europa.eu/Publications/Requests%20for%20advice/RH_SRAnnex%20-%20CfA%202020%20SII%20review.pdf

EIOPA considered 5 options to determine the LLP

1. No change
2. LLP stays at 20 years safeguards introduced into pillar 2 and 3
3. LLP increased to 30 years
4. LLP increased to 50 years
5. Alternative extrapolation method
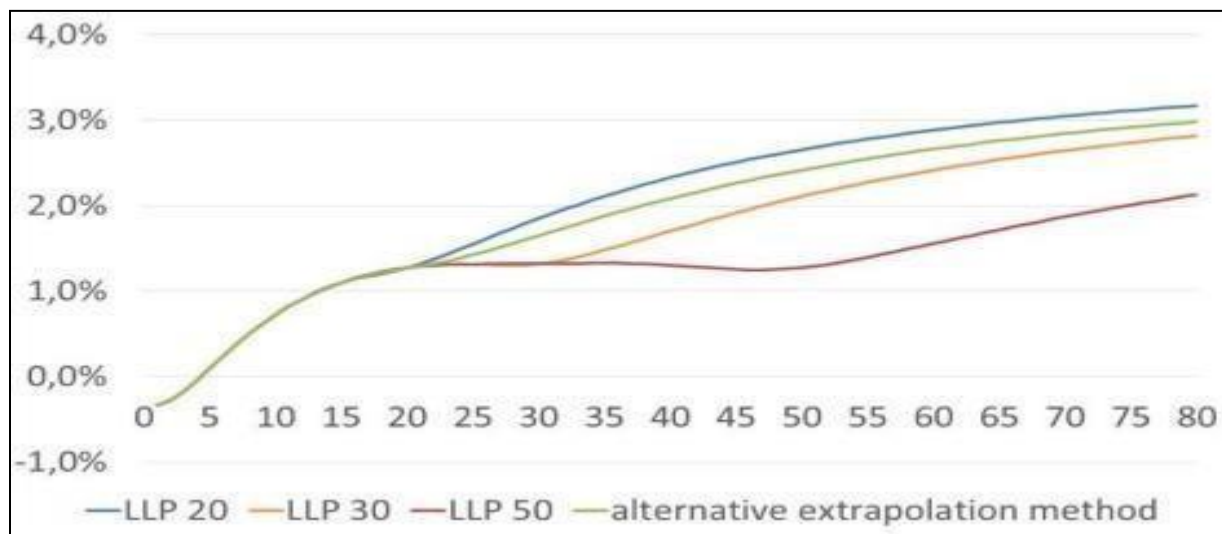
Figure4: Impact of the options considered to extrapolate the RFR, Ref: Page 31, EIOPA
background analysis

EIOPA in its final opinion on the review settled on adopting the alternative option of extrapolation. Under this EIOPA determined that this method would not only affect the RFR term structure for the euro but also for other currencies. It takes into account market data beyond the current LLP and in the alternative extrapolation method the LLP is referred to as the FSP.

This option would target identified issues on risk management incentives with the help of additional requirements in pillar 2 or pillar 3. The requirements are as follows:

- Insurance and reinsurance undertakings should be required to perform prescribed sensitivity analyses, a reduction of the convergence parameter to 5% and include the results in the regular supervisory reporting.
- Undertakings report the results of this sensitivity analyses in the SFCR to foster transparency and market discipline.

- For the alternative extrapolation method, the long-term interest rates are slightly more volatile than under the current method for an LLP of 20 years but are significantly less volatile than compared to the other proposed options.
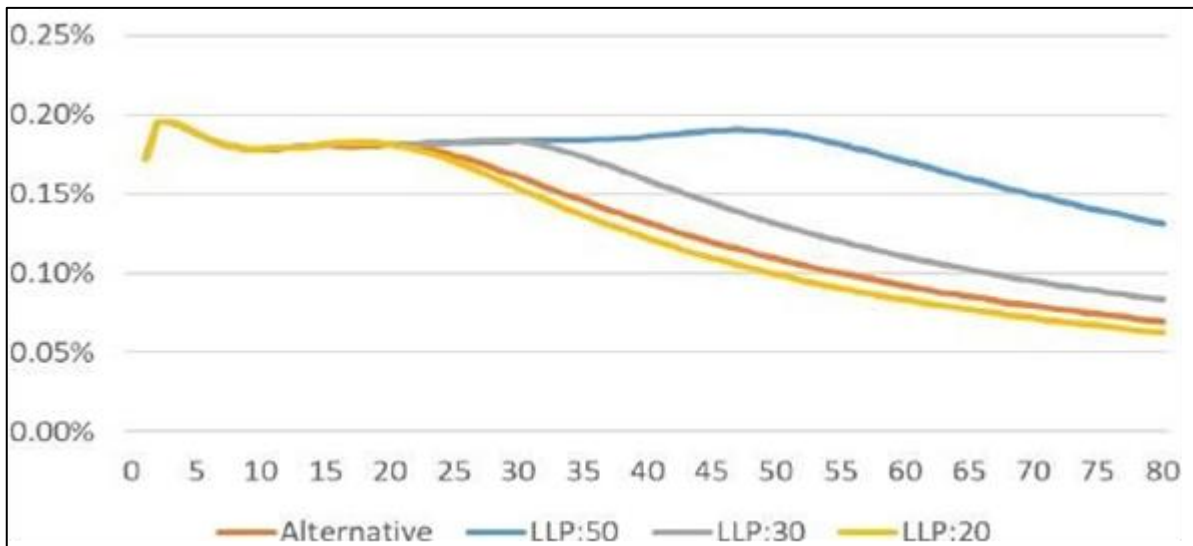
Figure5: Monthly volatility of absolute interest changes, Ref: page 44 of EIOPA Background Analysisdocument of Solvency II Review 2020

3.1.2   COM´s PROPOSAL ON THE EXTRAPOLATION OF RFR RATES

COM intends to adopt the method of extrapolation in line with EIOPA´s advice and will be subjected to a phasing-in period. It aims at improving the risk sensitivity of the long-term guarantees measures by mitigating the undue volatility in extrapolation of risk-free interest rates. In this study, however, we did not consider the effect of the phasing-in mechanism in order to anticipate the full impact of the proposal. The phasing-in period implies updating information system every year until the fully-fledged changes are made. The changes made in this transitional phase; the actual risks may not be fully measured in quantitative terms with limited ability to intervene when required. At the end of the phasing-in period the overall impacts would depend on the market conditions but in any case, would imply an increase in SCR ratios as observed in this study.

3.2 VOLATILITY ADJUSTMENT

The best estimate is calculated by discounting the future cash-flows of liabilities using the RFR. Over RFR, undertakings may apply for the use of the VA mainly to reduce the effect of bond prices falling due to reduced market liquidity when a certain set of criteria is met. The VA is a constant measure applied only to the relevant risk-free rate term structure that are not derived by means of extrapolation in accordance with Article 77a. It was included in the Solvency II framework to recognize insurers with long-term liability driven investors and ensure that they are not exposed to the short-term losses that arise due to changes in credit spreads.

For each relevant currency the VA is based on the spread between the interest rate that could be earned from assets included in a reference portfolio for that currency and the rates of the relevant basic risk-free interest rate term structure for that currency. The reference portfolio for a currency shall be representative for the assets which are denominated in that currency and which insurance and reinsurance undertakings are invested in to cover the best estimate for insurance and reinsurance obligations denominated in that currency. [11]

The spread for each country and currency is calculated as

$$S = w_{gov} \cdot max(S_{gov}, 0) + w_{corp} \cdot max(S_{corp}, 0) \qquad (3)$$

where:

(a) w_{gov} represents the ratio of the value of government bonds included in the reference portfolio of assets for that currency or country and the value of all the assets included in that reference portfolio.

(b) S_{gov} represents the average currency spread on government bonds included in the reference portfolio of assets for that currency or country.

(c) w_{corp} represents the ratio of the value of bonds other than government bonds, loans and securitisations included in the reference portfolio of assets for that currency or country and the value of all the assets included in that reference portfolio.

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[11] Article 77d, TITLE I, Chapter VI, Section2, EIOPA Solvency II Rulebook,
https://www.eiopa.europa.eu/rulebook/solvency-ii/article-2295_en

(d) S_{corp} represents the average currency spread on bonds other than government bonds, loans and securitisations included in the reference portfolio of assets for that currency or country. [12]

The amount of VA applied to the RFR shall correspond to the General Application Ratio (GAR) 65% of the risk-corrected spread. The risk corrected spread represents the average currency spread that is a priori to a realistic assessment of expected losses and other unexpected credit risks.

3.2.1 EIOPA's OPINION ON THE VOLATILITY ADJUSTMENT

EIOPA in its review aimed to assess the quantitative impact on the calculation of the best estimate and solvency position of insurance undertakings. EIOPA assessed the efficiency of the VA and its ability to prevent the pro-cyclical[13] behavior on the financial markets and to mitigate overshooting[14] effects and recognize illiquidity features of liabilities. For this they suggested the VA should be split into permanent VA and a macro-economic VA. Supervisory authority approval is required in all countries. Further, under the review proposal the GAR was raised from 65% to 85% of the risk-corrected currency spread to promote the right impact of the following approaches.

Two main approaches were suggested

Approach 1 – To mitigate overshooting, an application ratio should be introduced into the calculation of the VA which measures the duration and volume mismatch between fixed income investments and insurance liabilities of the undertaking. This ensures that the VA is based on the full spread of the representative portfolio of fixed-income assets exclusively while disregarding the others. This ratio is referred to as AR[4] in the rest of this study.

Approach 2 – To account for illiquidity features, introducing another application ratio that takes into account the weights of own assets of each insurer, this also depends on the level of cash-flow matching of insurance liabilities portfolios. This ratio should be based on a categorization of liabilities which captures the stability and predictability of cash-flows. This ratio is referred to as AR[5] in the rest of this study.[15]

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[12] Pg. 66, Background document on the opinion on the 2020 review of Solvency II, 17Dec2020
[13] The tendency of interest rates to rise during booms and fall during recessions
[14] Short-run behaviour of the exchange rate after economy is hit with a shock
[15] Pg. 64, Background document on the opinion on the 2020 review of Solvency II, 17Dec2020

Further, EIOPA aimed to review the functioning of the increased volatility adjustment per country given its purpose and amend wherever necessary. It is suggested the risk correction should be based on an alpha percentage of the actual spread to manage risk-sensitivity for this component of the VA. This is to ensure the effectiveness of the new VA especially in times when the spreads widen, a lower percentage factor should be applied where the spreads exceed their long-term average value.

The macro-economic VA is said to be an improvement of the current country specific VA mainly to mitigate cliff-edge effects.

With regard to the above, EIOPA proposed the calculate the total VA for an undertaking as

$$VA = VA_{perm} + VA_{macro} \tag{4}$$

Where VA_{perm} represents the permanent VA and $VA_{macro,j}$ represents the macro-VA applicable to the insurance obligations of the undertaking for products sold in the insurance market in country j and denominated in the currency of that country. The VA needs to be determined for each currency of the liabilities it is applied to.

The permanent VA should be calculated according to the below formula

$$VA_{perm} = GAR \cdot AR_4^i \cdot AR_5^i \cdot Scale \cdot RC\_S \tag{5}$$

Where:

- GAR represents the general application ratio.
- AR_4^i is the application ratio on overshooting. It is calculated as the ratio of the 'sensitivity of the undertakings fixed income investments against changes in credit spreads' over the 'sensitivity of the best estimate liabilities against a change in the amount of the volatility adjustment'. This is to target duration and volume mismatches between fixed income assets and liabilities of undertaking i.
- AR_5^i is the application ratio that measures the degree of illiquidity of the liabilities of undertaking i. It is determined on the basis of a bucketing of the liabilities in three categories according to their illiquidity features.
- $Scale$ is the scaling factor of the representative portfolio aimed at bringing the weight of fixed income instruments to 1. It is calculated as the reciprocal of the sum of the weights of government and corporate bonds in the representative portfolio.

- RC_S is the risk-corrected spread of the representative portfolio. [16]

The macroeconomic VA should be determined according to the below formula

$$VA_{macro} = \text{GAR} * AR_4^i * AR_5^i * \omega_j * \max\left(Rcs_j * Scale_j - 1.3 * RCs * Scale; 0\right) \quad (6)$$

$$AR_{1,c}^4 = \max\left\{\min\left(\frac{PVBP \ MV_{i,c}^{FI}}{PVBP \ BEL_{i,c}}; 1\right); 0\right\} \quad (7)$$

Where,

- $MV_{i,c}^{FI}$ denotes the market value of undertaking's i investment in fixed income investments in currency c that are significantly exposed to credit spread risks.

- $PVBP(BEL_{i,c})$ equals the price value of a basis point of the best estimate of the liabilities of undertaking i in currency c.

- $PVBP(MV_{i,c}^{FI})$ equals the price value of a basis point of the fixed income investments of undertaking i in currency c.

Calculating $PVBP(BEL_{i,c})$

This quantity represents the difference in the price value of the best estimate of liabilities with and without applying the part of the VA that does not depend on the specific application ratio.

$$PVBP\left(BEL_{i,c}\right) = \frac{BEL_{i,c}\left(RFR_c\right) - BEL_{i,c}\left(RFR_c + 85\% \ RC\_S_{i,c}\right)}{GAR \ . \ RC\_S_{i,c}} \quad (8)$$

Where,

- RFR_c denotes the basic risk-free interest rate term structure for currency c.

- $RFR_c + 85\% \ . \ RC\_S_{i,c}$ denotes the basic risk-free interest rate term structure, to which a volatility adjustment of size $85\% \cdot RC\_S_{i,c}$ is applied.

- $RC\_S_{i,c}$ denotes the average risk corrected spread of the fixed income investments of the reference portfolio in currency c.

- GAR denotes the general application ratio; it is set at 85% under EIOPA's approach.[17]

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[16] Pg. 17, Opinion on the 2020 review of the Solvency II, 17December2020
[17] Annex 2.9, Background document on the opinion on the 2020 review of Solvency II, 17December202

Calculating $PVBP(MV_{i,c}^{FI})$

This quantity is the difference of price value of the market value of assets against current spreads and when spreads have increased but that part of the VA that does not depend on the undertaking specific AR.

$$PVBP(MV_{i,c}^{FI}) = \frac{MV_{i,c}^{FI}(CS) - MV_{i,c}^{FI}(CS + 85\%.RC\_S_{i,c})}{GAR.RC\_S_{i,c}} \tag{9}$$

Where CS represents the current level of spreads.

Calculating AR[5]

$$AR^5 = \max\left\{\min\left(\frac{BE_I.AR_{5,I} + BE_{II}.AR_{5,II} + BE_{III}.AR_{5,III}}{BE_I + BE_{II} + BE_{III}} ; 100\right) ; 60\right\} \tag{10}$$

- BE_I, BE_{II}, BE_{III} corresponds to the amount of BE allocated in each of the three buckets.

- $AR_{5,I}, AR_{5,II}, AR_{5,III}$ are the application ratios applicable to each bucket.[18]

In this study the AR^5 was assumed to be a constant percentage according to the "bucketing approach" categorized on the basis of the type of undertaking i.e., life, non-life and composite. The reason behind this is the lack of information to implement the full "bucketing approach". The percentages were based on previous internal analysis already carried out by ASF.

3.2.2. COM's PROPOSAL ON THE VOLATILITY ADJUSTMENT

Apart from allowing a higher percentage of the risk adjusted spread to be included in the VA, COM proposed to introduce a safeguard ratio to avoid overshooting effects of the VA that is however non-mandatory but only potentially applicable at the request of the undertaking. Therefore, the total VA calculation under COM only included the AR^4 component. The formula to calculate the AR^4 is equivalent as mentioned above.

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[18] Annex 2.9, paras A.246-A.263. Background document on the opinion on the 2020 review of Solvency II

3.3 INTEREST RATE RISK

A large part of an insurer's balance sheet, namely both the assets, and liabilities side are continually exposed to the interest rates and therefore are subject to changes in the yield curve. Article 105(5a) of the Solvency II Directive illustrates the interest rate risk. It is a sub-module of the SCR standard formula which is specified in Articles 165 - 167 of the Delegated Regulation. The estimation of capital requirements for the interest risk module are based on the impact on own funds of certain economic scenarios that are defined by the *downward* and *upward* stresses of the term structure of interest rates. The sum over all currencies of the capital requirements for the risk of an increase in the term structure of interest rates and for the risk of the decrease in the term structure of interest rates are estimated. The final IRR capital requirement is then the larger of the two estimates. (Article 165). The interest rate risk is a sub-module of the market risk module.
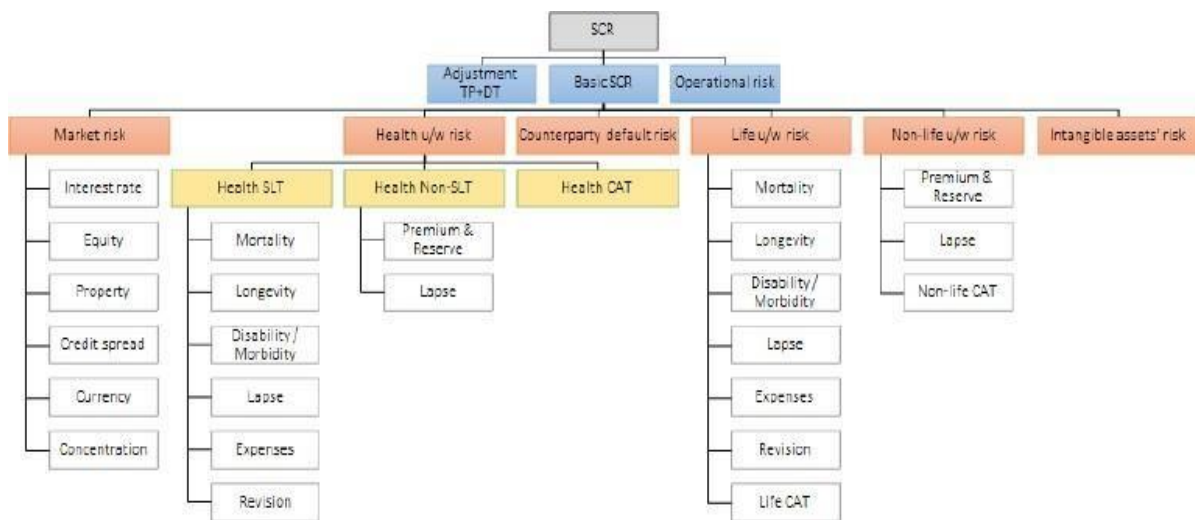
Figure6: Risk modules that impact the estimation of the SCR[19]

The RFR used to estimate the IRR capital requirement under the current Solvency II regime were subject to the following '*up*' and '*down*' shocks.

TABLE I – CURRENT CALIBRATION OF 'UP' AND 'DOWN' SHOCKS TO THE RFR CURVE

Maturity (in years)	Increase (%)	Decrease (%)
1	70	75
2	70	65
3	64	56
4	59	50
5	55	46
6	52	42
7	49	39
8	47	36
9	44	33
10	42	31
11	39	30
12	37	29
13	35	28
14	34	28
15	33	27
16	31	28
17	30	28
18	29	28
19	27	29
20	26	29
90	20	20

3.3.1 EIOPA's OPINION ON INTEREST RATE RISK

EIOPA strongly advises to change the way capital requirements for interest rate risk are calculated in the Delegated Regulation. This change was also suggested when the Delegated Regulation was updated in 2018. It proposed to model interest rate risk in the standard formula with a relative shift approach, parameters of which vary in function of the maturity.

The increased term structure for a given currency shall be equal to:

$$r_t^{up}(m) = r_t(m) \cdot \left(1 + s_m^{up}(\theta_m)\right) + b_m^{up} \tag{11}$$

where $r_t(m)$ represents the risk-free interest rate in the corresponding currency, m represents the maturity b_m^{up} and s_m^{up} are the calibrated maturity dependent *up*-shock components.

The decreased term structure for a given currency shall be equal to:

$$r_t^{down}(m) = r_t(m) \cdot \left(1 - s_m^{down}(\theta_m)\right) - b_m^{down} \tag{12}$$

Where $r_t(m)$ represents the risk-free interest rate in the corresponding currency, m represents the maturity and b_m^{up} and s_m^{down} are the calibrated maturity dependent *down*-shock components.[20]

EIOPA advises that the parameters for the increased and decreased term structures should take into account the starting point of the extrapolation of the euro term structure. The risk-free rates derived from the alternative extrapolation method in section 3.1 were subject to the following shocks under EIOPA's recommendations in the review.

TABLE II – EIOPA CALIBRATION OF *'UP'* & *'DOWN'* SHOCKS TO RFR CURVE IN 2020 REVIEW

Maturity (In years)	$s_m^{down}(\%)$	$b_m^{down}(\%)$	$s_m^{up}(\%)$	$b_m^{up}(\%)$
1	58	1.16	61	2.14
2	51	0.99	53	1.86
3	44	0.83	49	1.72
4	40	0.74	46	1.61
5	40	0.71	45	1.58

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[20] See page 31, EIOPA Consultation on the opinion on the 2020 review of Solvency II

6	38	0.67	41	1.44
7	37	0.63	37	1.30
8	38	0.62	34	1.19
9	39	0.61	32	1.12
10	40	0.61	30	1.05
11	41	0.60	30	1.05
12	42	0.60	30	1.05
13	43	0.59	30	1.05
14	44	0.58	29	1.02
15	45	0.57	28	0.98
16	47	0.56	28	0.98
17	48	0.55	27	0.95
18	49	0.54	26	0.91
19	49	0.52	26	0.91
20	50	0.50	25	0.88
90	20	0	20	0

For maturities shorter than one year the value of s_m^{up} and b_m^{up} shall be equal to 61% and 2.14% respectively. For maturities shorter than one year the value of s_m^{down} and b_m^{down} shall be equal to 58% and 1.16% respectively. For maturities between 20 and 90 years, the value of s_m^{up} and s_m^{down} shall be linearly interpolated. For maturities of 90 years and up the value of s_m^{up} and s_m^{down} shall be 20%. For maturities between 20 and 60 years the value of b_m^{up} and b_m^{down} shall be linearly interpolated. For maturities of 60 years and up the value of b_m^{up} and b_m^{down} shall be 0%. The shocked interest rates in the downward scenario should not be lower than -1.25%. [21]

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[21] See page 32, EIOPA Consultation on the opinion on the 2020 review of Solvency II

3.3.2 COM's OPINION ON INTEREST RATE RISK

The Commission plans to modify the capital requirements for the IRR to reflect the experience of a low interest rate environment. It also suggested that the term structure beyond the LLP of 20 years after applying *up* and *down* shock scenarios would need to be extrapolated until the UFR assuming the maximum annual change for this rate (+/-15 basis points). Due to time constraint and the relatively low added value of such an analysis comparing to the complexity of the work, we assumed that the risk-free rates beyond 20 years would remain unaffected by the shocks calibration. This assumption was applied both in the discounting of assets and liability cashflows.

3.4 RISK MARGIN

The risk margin is an element of the total technical provisions and represents the portion that is expected to be required by another insurance undertaking in order to transfer or take over the portfolio of insurance and reinsurance obligations. The standard formula to calculate it is as follows:

$$RM = CoC \cdot \sum_{t \geq 0} \frac{SCR(t)}{(1+r(t+1))^{t+1}} \tag{13}$$

(a) CoC represents the Cost-of-Capital rate.

(b) the sum covers all integers including zero.

(c) SCR(t) represents the Solvency Capital Requirement referred to in Article 38(2) of the Delegated Regulation after t years.

(d) r (t + 1) represents the basic risk-free interest rate for the maturity of t + 1 years.

The basic risk-free interest rate r (t + 1) is chosen as per the currency used by the insurance and reinsurance undertaking to create its financial reports. The RM is calculated for all lines of business under the whole portfolio of the insurance and reinsurance undertaking.[22]

3.4.1 EIOPA's OPINION ON RISK MARGIN

Here, the objective was to reduce the sensitivity of the risk margin to the interest rate changes. This would aim to reduce the amount of the risk margin in particular for long-term liabilities. Further, a floor parameter was proposed as a safeguard for risk margin to not fall below a certain threshold level.

3.4.2 COM's OPINION ON RISK MARGIN

Proposed to change the risk margin to make it less volatile and less sensitive to interest rates. The Commission indicated that it would develop a version of the amended risk margin formula proposed by EIOPA and (in contrast to EIOPA's advice) consider reducing the cost-of-capital rate from 6% to 5%

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[22] See page 37, Article 37 of Delegated Regulation
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0035&from=EN

4. USE AND IMPACT OF MEASURES

4.1 EXTRAPOLATION OF RISK-FREE RATE CURVES

To study the proposal of the new alternative extrapolation method we first obtained the zero rate curves based on the parameters defined in the following table. This estimate was done with no additional VA add-on and for a maturity period of 120 years.

TABLE III – PARAMETERS SET TO CALCULATE THE RFR TERM STRUCTURE CURVES

Currency	Extrapolation Method	Reference Date	FSP	LLP	UFR (%)	CRA[23]
Euro	ALT & SW	31-12-2016	20	20	4.20	10
Euro	ALT & SW	31-12-2017	20	20	4.20	10
Euro	ALT & SW	31-12-2018	20	20	4.05	10
Euro	ALT & SW	31-12-2019	20	20	3.90	10
Euro	ALT & SW	31-12-2020	20	20	3.75	10

The resultant RFR curves were derived using a tool not available to the public and were the basis of discounting the liability cashflows. The rates for the end of the last month of each year were taken into consideration. Following is the graphical representation of the RFR curves under the SW and ALT extrapolation methods.
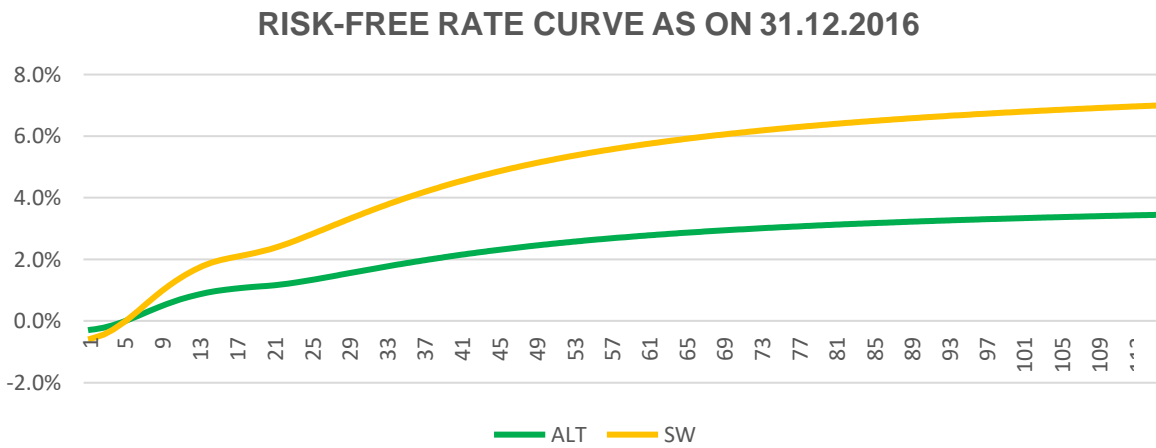
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[23] CRA – Credit Risk Adjustment

RISK-FREE RATE CURVE AS ON 31.12.2016

Figure7: Extrapolation of the RFR under Smith Wilson & Alternative extrapolation method as on 31.12.2016
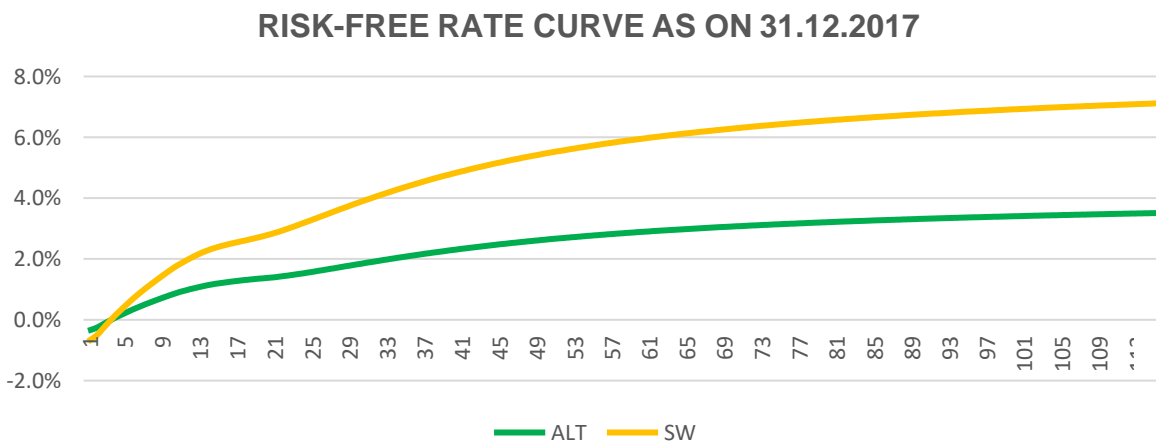

RISK-FREE RATE CURVE AS ON 31.12.2017

Figure8: Extrapolation of the RFR under Smith Wilson & Alternative extrapolation method as on 31.12.2017
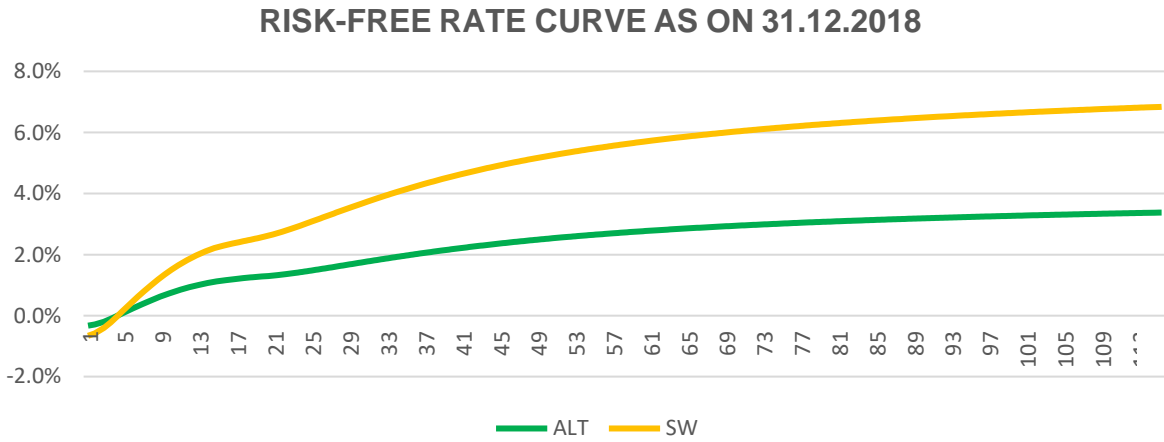
Figure9: Extrapolation of the RFR under Smith Wilson & Alternative extrapolation method as on 31.12.2018
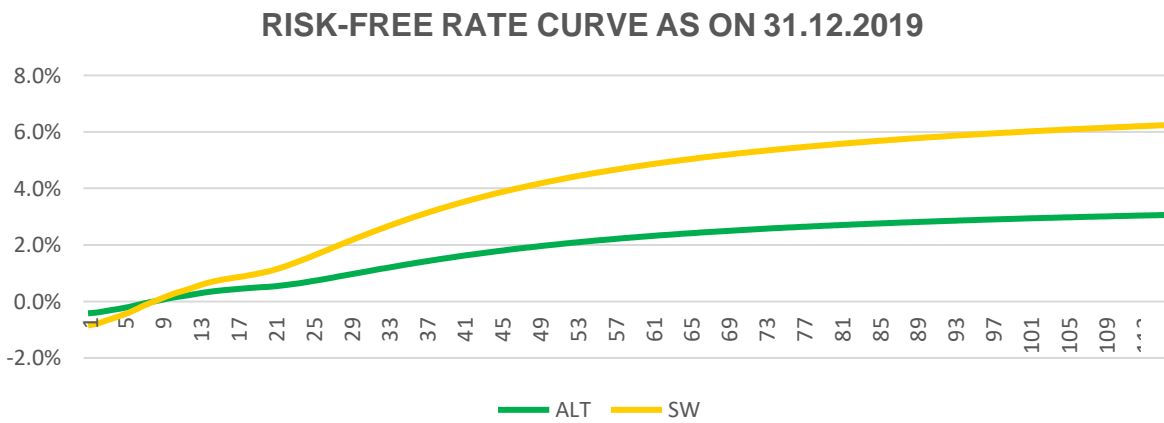

Figure10: Extrapolation of the RFR under Smith Wilson & Alternative extrapolation method as on 31.12.2019
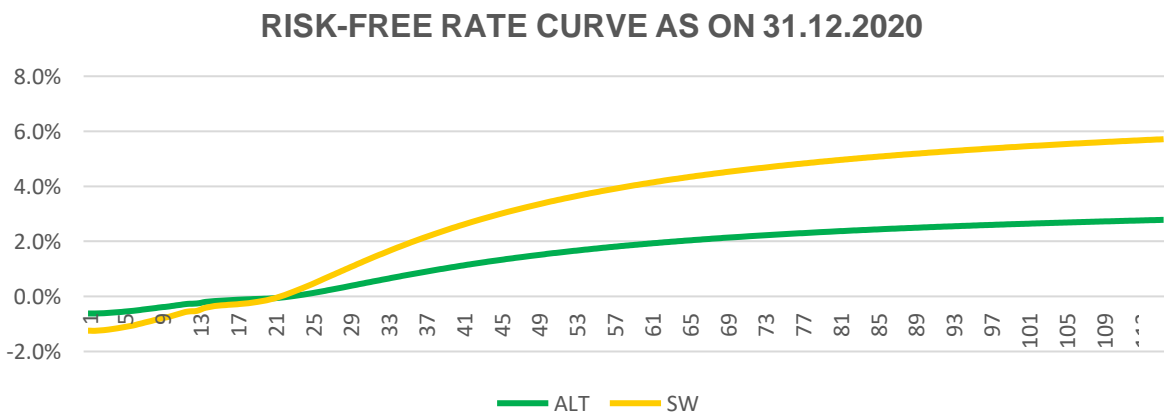

Figure11: Extrapolation of the RFR under Smith Wilson & Alternative extrapolation method as on 31.12.2020

The liability cash-flow data for 44 entities from Quantitative Reporting Template (QRT) was extracted. On calculating the net cashflows for all undertakings, the resulting cashflows were then discounted using both the SW and ALT risk-free zero rates. The net cashflows were calculated using the formula

$$Net\ Cashflows = "Cash\ Outflows\ (Benefits\ \&\ Expenses\ paid\ out)\ -$$
$$Cash\ Inflows\ (Premiums\ \&\ others)" \tag{14}$$

For non-life entities the net liability cashflows are calculated separately for the premium and claims provisions. Aggregating the now discounted cash flows over all possible maturity dates gives us the BE for each undertaking to ascertain the impact on the overall TP. To understand the impact on the solvency position of the undertaking we estimate the change in SCR ratio under the two methods of extrapolation.

The SCR ratio is calculated using the below mentioned formula:

$$SCR\ Ratio = \frac{Eligible\ Own\ Funds\ to\ cover\ the\ SCR}{SCR} \tag{15}$$

The SCR ratio for life, non-life and composite entities was estimated using the standard formula and a graphical comparison was made to understand the impact of the two types of interest rate term structure. The SCR was not recalculated in this study. It is ideal to have an SCR ratio greater than 100%. The comparison represented below is an average of the SCR ratios of undertakings over the 5-year period.
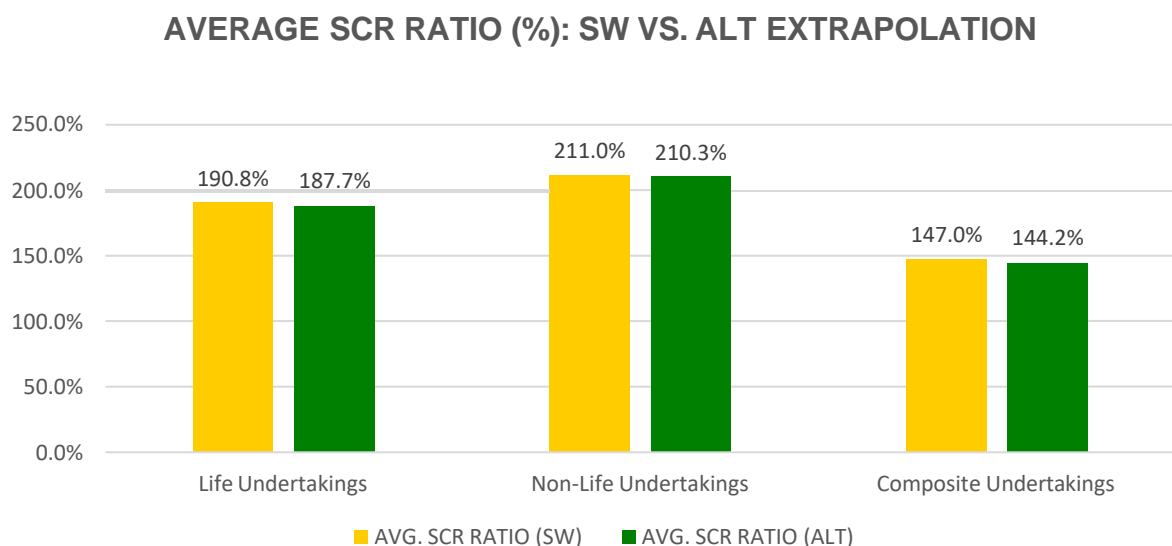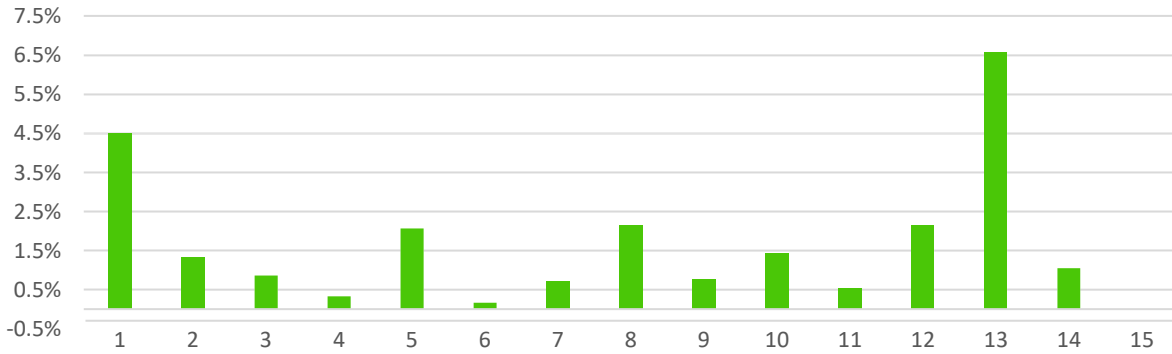
4.1.1 IMPACT ON SCR RATIO OF UNDERTAKINGS

AVERAGE SCR RATIO (%): SW VS. ALT EXTRAPOLATION

Figure12: Comparison of average SCR ratio of undertakings under SW & ALT methods of extrapolation.

% CHANGE IN SCR RATIO: SW VS. ALT EXTRAPOLATION - LIFE UNDERTAKINGS

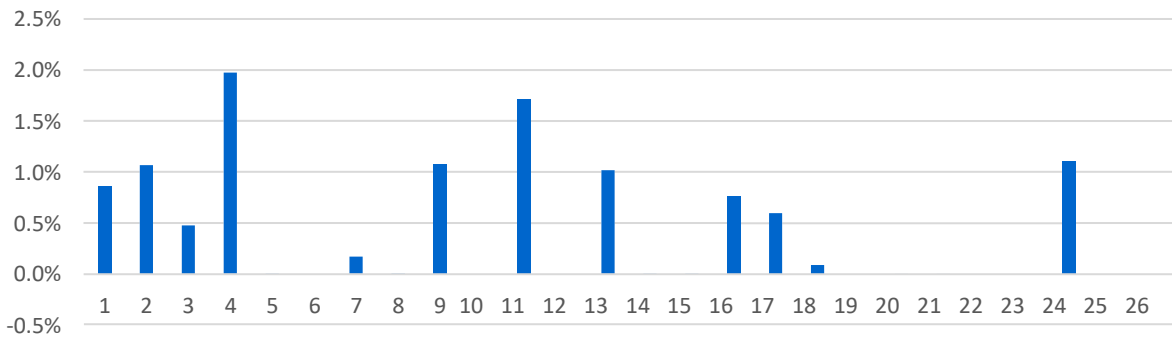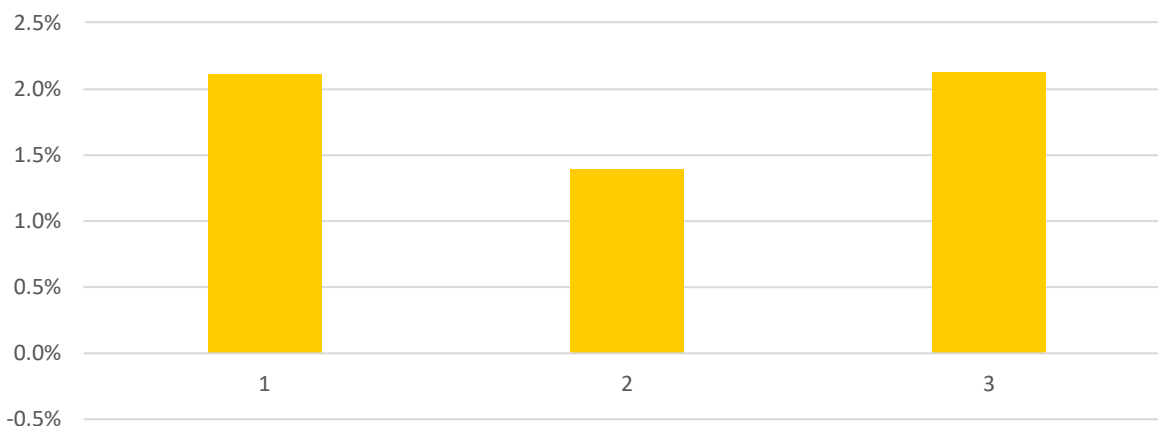*Figure13: % change in SCR ratio of life undertakings under SW & ALT methods of extrapolation.*

% CHANGE IN SCR RATIO: SW VS. ALT EXTRAPOLATION - NON-LIFE UNDERTAKINGS

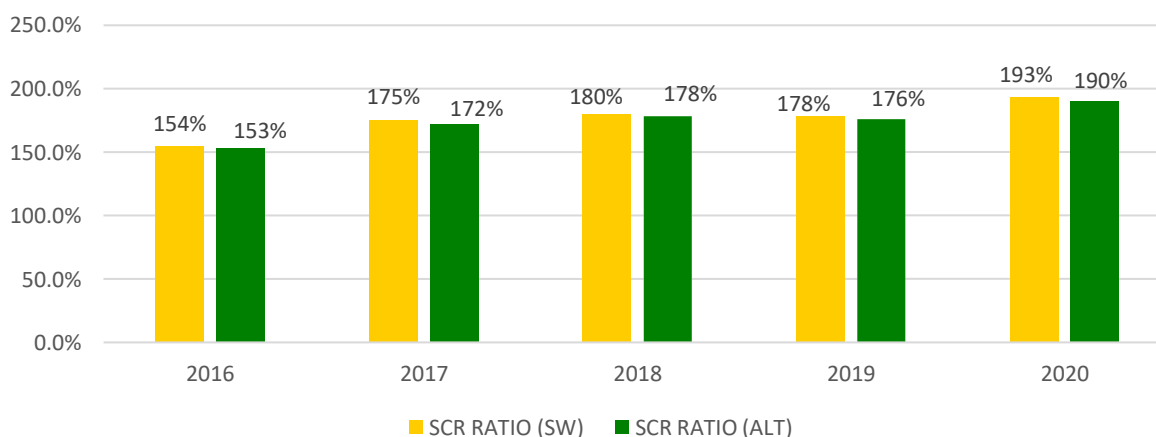*Figure14: % change in SCR ratio of non-life undertakings under SW & ALT methods of extrapolation.*

Figure15: % change in SCR ratio of composite undertakings under SW & ALT methods of extrapolation.

4.1.2 MARKET IMPACT

Following figure below describes the overall market impact due to change in the method of extrapolation of the risk-free rate curves. This is a cumulative result for all undertakings in the study per year. Obtained by cumulating the BE of all undertakings per year under each of the extrapolation methods and consequently estimating the impact on the total eligible own funds (EOF)[24] per year after taxes. This change in EOF is used to estimate the new SCR ratios.

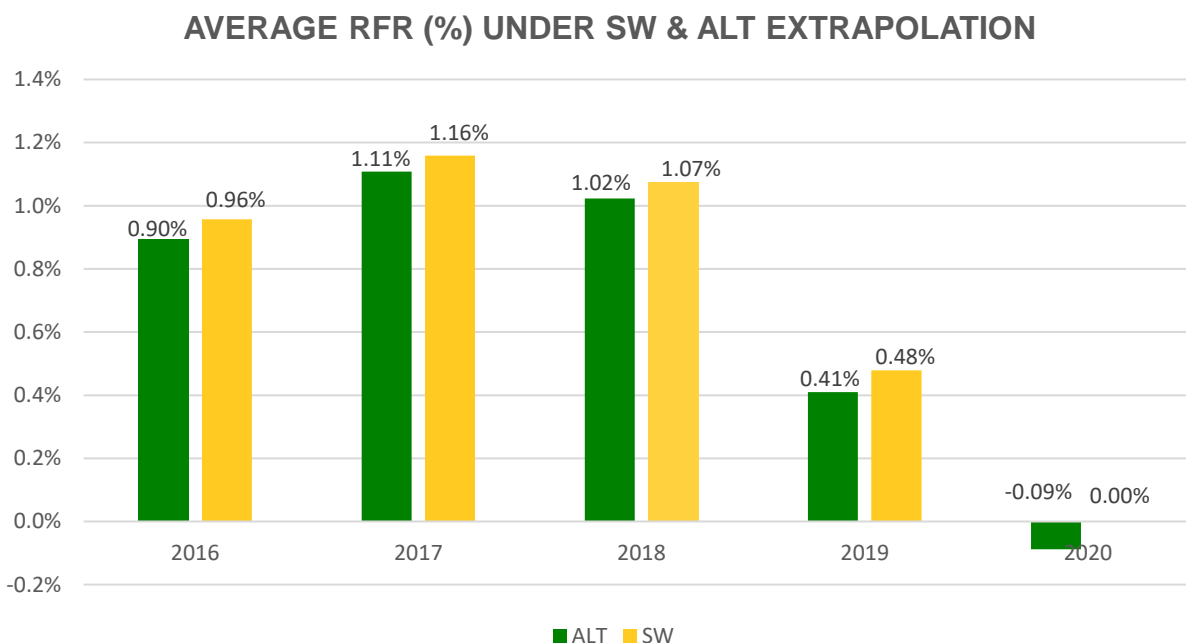*Figure16: SCR ratio (%) of all undertakings per year under SW & ALT methods of extrapolation.*

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[24] EOF – Eligible Own Funds, is the component of actual Own Funds which are eligible to qualify for the coverage of the SCR and MCR after meeting certain criteria.

Figure17: Average risk-free rates (%) per year under SW & ALT methods of extrapolation.

4.1.3. INFERENCE

Drawing inferences from the above set of figures, we notice expected results i.e., there is a low impact on the SCR ratio for undertakings under the new alternative method of extrapolation. The reason for this being that our liability cashflows have relatively low duration. We do not estimate the absolute impact on the own funds and SCR since the impact is less material in comparison with the impact on EOF. Further, from figures 16 and 17 we can assess the differences year on year to also comment that the SCR ratio is not only impacted by the evolution of the RFR curves under each of the extrapolation methods only because there may be other factors that impact the own funds and SCR that have not been considered in this study. Taking the example of the year 2020 where the RFR structure was the lowest, but the SCR ratios was the highest.

4.2 VOLATILITY ADJUSTMENT

Estimating the impact of applying a volatility adjustment on the overall SCR ratio of each undertaking included a number of steps.

- Calculated the ALT zero rates by setting certain set of parameters (with and without VA).

- Estimate the projected future cashflows of assets, and discount these using the ALT zero rates derived in the previous step.

- Estimate the discounted liability cash flows of each undertaking using the ALT zero rates.

- Estimating AR[4] using the formula given by EIOPA mentioned in section 3 and assigning the AR[5] ratios based on the type of undertaking.

- Calculating the total VA and applying this to the risk-free ALT zero rates and understanding its impact on the SCR of the undertakings and drawing a comparison between EIOPA & COM suggestions.

Calculating the ALT risk-free rates

Firstly, a number of parameters mentioned in Table III were set as per the corresponding reference date including the VA calculated under EIOPA's approach setting the AR to 100%. The input for this calculation was the zero rates in basis points (BP) under the SW method of extrapolation that were published by EIOPA for each of the reference dates. The calculated rates were used here on out in the impact estimation on the SCR ratio after applying the new VA calibration. Refer to table IV to note that the national add-on was only triggered in the year 2016 under EIOPA's approach to calculate the VA.

TABLE IV: CALCULATION OF CURRENT VA PER REFERENCE DATE

Reference Date (In years)	Currency VA (bp)	Country VA (bp)	Currency VA (bp)	Country VA (bp)
	Current		AR 100, new RC & GAR 85%	
2016	13	0	29	20
2017	4	0	20	0
2018	24	0	39	0

2019	7	0	20	0
2020	7	0	19	0

To ascertain the future asset cashflows the data was sorted based on the CIC criteria given in the EIOPA's technical specification and only assets transacted in Euros were considered.

TABLE V: ASSET CLASSIFICATION (REF: TECHNICAL SPECIFICATION OF THE INFORMATION REQUEST ON THE 2020 REVIEW OF SOLVENCY II)[25]

CIC Third Position	Asset Class	Fixed Income Asset
1	Government Bonds	Yes
2	Corporate Bonds	Yes
3	Equity	No
4	Collective Investment Undertakings	For investment funds look through should be performed and fixed income assets within should be identified. If no look through is possible, only debt funds (CIC 42) are eligible
5	Structured Notes	Only CIC 52 (structured notes mainly exposed to interest rate risk) and 54 (structured notes mainly exposed to credit risk)
6	Collateralized Securities	Only CIC 62 (collateralized securities mainly exposed to interest rate risk) and 54 (Collateralized securities exposed to credit risk)
7	Cash and Deposits	No
8	Mortgages & Loans	Yes
9	Property	No

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[25] See page 6 of https://www.eiopa.europa.eu/sites/default/files/solvency_ii/technical_specification_v1.1.pdf

18 undertakings were considered for the VA analysis, out of which 9 were life undertakings, 8 non-life undertakings and 1 was a composite undertaking. The cash flows were estimated using the standard bond valuation methods and were discounted.

To apply the formula of $PVBP(MV_{i,c}^{FI})$ the credit spread rates were extracted using data provided by EIOPA and the relevant parameters were estimated to calculate the numerator in the calculation of the AR[4]. The present price value of these asset cash flows for each undertaking was then cumulated to estimate the market value of financial instruments for each entity.

The AR[5] was assumed based on the type of undertaking and was subsequently used to calculate total VA applicable to each entity using the formula

$$VA\,perm = GAR\,.\,AR_4^i\,.\,AR_5^i\,.\,Scale\,.\,RC\_$$

TABLE VI: WEIGHTED AVERAGE OF AR[4], AR[5], EIOPA VA & COM VA

YEAR	Weighted Average ratio of AR[4]		Weighted Average ratio of AR[5]	Weighted Average EIOPA VA (bp)	Weighted Average COM VA (bp)
	EIOPA	COM	EIOPA	EIOPA	COM
2016	1	1	76.15%	20	26.2
2017	1	1	76.25%	24.1	31.6
2018	1	1	76.16%	16.5	21.7
2019	1	1	76.24%	19	25
2020	1	1	76.25%	15.1	19.8

The above table illustrates the average values per year of AR[4], AR[5] weighted with the BE calculated using the EIOPA VA and COM VA. Further, the average VA applicable to an entity per year under the EIOPA and COM proposal weighted on the BE estimate calculated using each of the VAs respectively.

In order to understand the impact on SCR ratio, the final BE was estimated using the ALT zero rates with the new VA computed under the EIOPA and COM proposals respectively. At the same time to make a fair comparison the BE was also estimated using the current regime to calculate the VA as published by EIOPA in its monthly RFR reports which is the approach currently in place.

To understand the estimated impact on the SCR ratio of undertakings, the following comparisons were made.
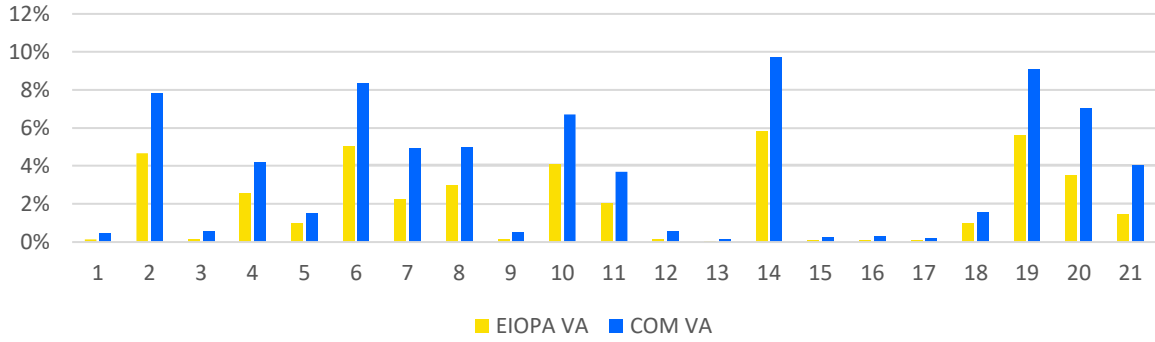
- The average SCR ratio of all undertakings under the proposed and current methods of VA calibration.
- The percentage difference between the three methods of VA calibration including all entities for all years.

AVERAGE SCR RATIO (%) UNDER EIOPA, COM & CURRENT VA CALIBRATION
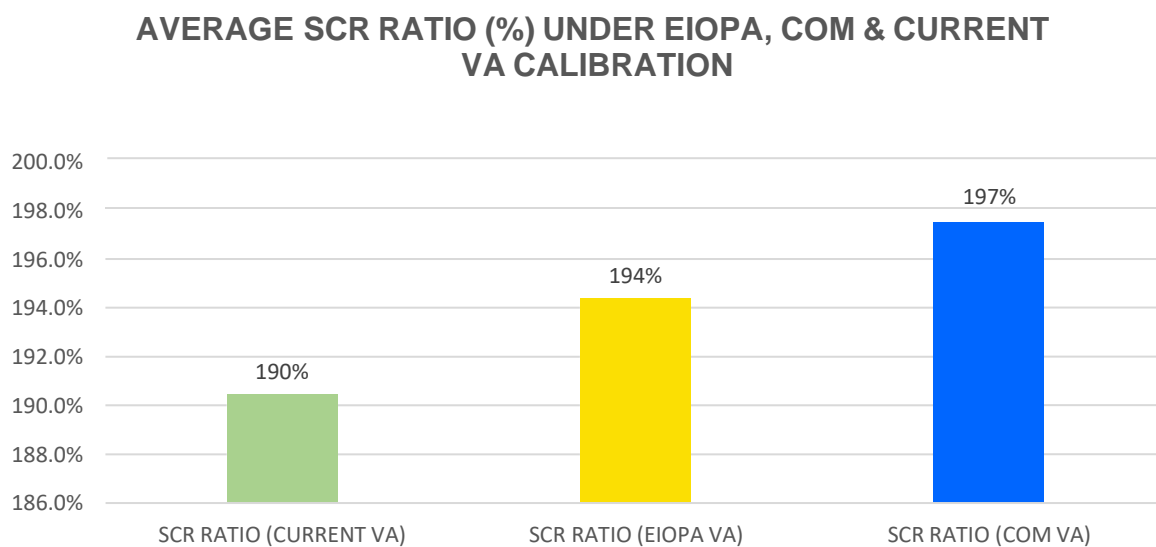
Figure18: Average SCR ratio (%) of all undertakings for all years under EIOPA, COM and Current methods of VA calibration.

From figure 18, we can clearly note that the new VA calibration under the 2020 review increases the SCR ratio which indicates that the undertakings have sufficient assets to cover its insurance liability obligations.

## % CHANGE IN SCR RATIO UNDER EIOPA & COM VA VS. CURRENT VA CALIBRATION

Figure19: % change in SCR ratio of all undertakings for all years under EIOPA & COM methods of VA calibration vs. current VA calibration.
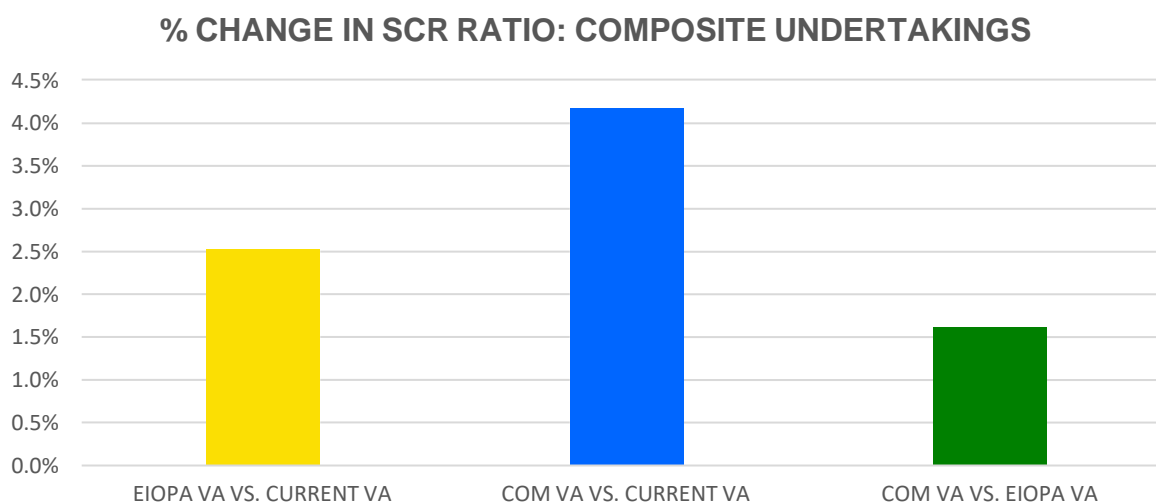
% CHANGE IN SCR RATIO: LIFE UNDERTAKINGS
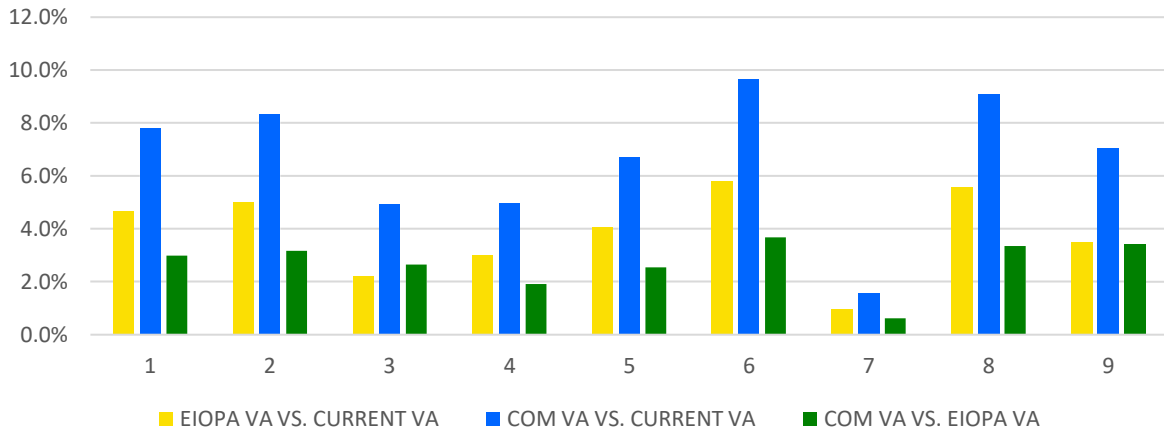
*Figure20: % Change in SCR ratio of life undertakings after applying different VA calibration methods.*

% CHANGE IN SCR RATIO: NON-LIFE UNDERTAKINGS
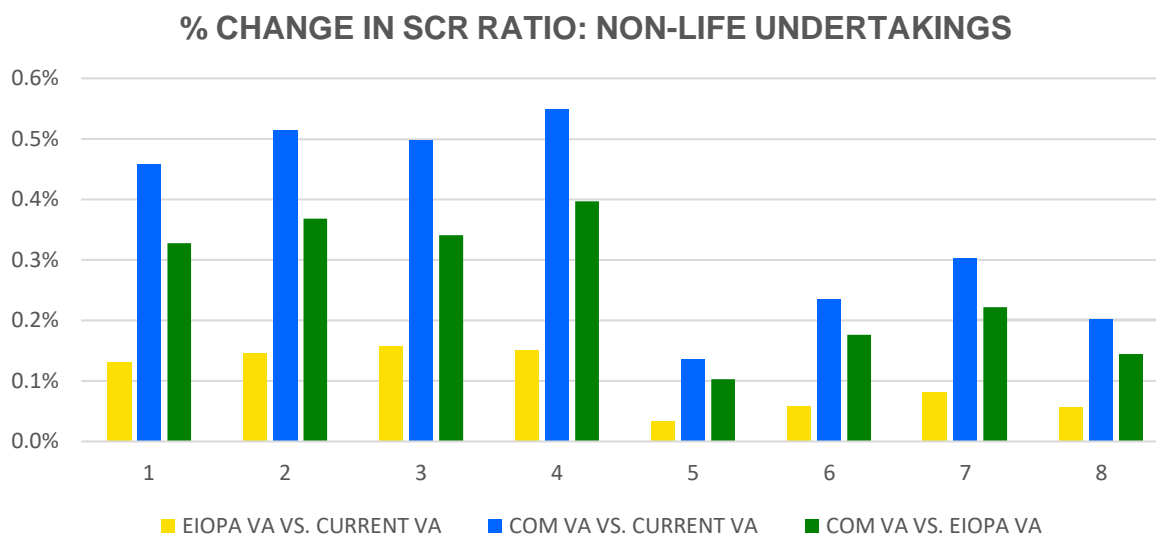
Figure21: % Change in SCR ratio of non-life undertakings after applying different VA calibration methods.

% CHANGE IN SCR RATIO: COMPOSITE UNDERTAKINGS

Figure22: SCR ratio of composite undertakings after applying different VA calibration methods.

The COM proposal has significantly the highest % change in the SCR ratio when compared with the SCR ratio calculated under the current calibration. The green bars aim to understand the difference between the EIOPA and COM proposals. It would be of importance to see which of these methods of calibration are more suitable in times of crises. This would further throw light on the importance of the application ratios AR[4] & AR[5].

4.2.1 MARKET IMPACT OF VA ON SCR RATIO

MARKET IMPACT ON SCR RATIO -COMPARISON OF CURRENT VA, EIOPA VA & COM VA
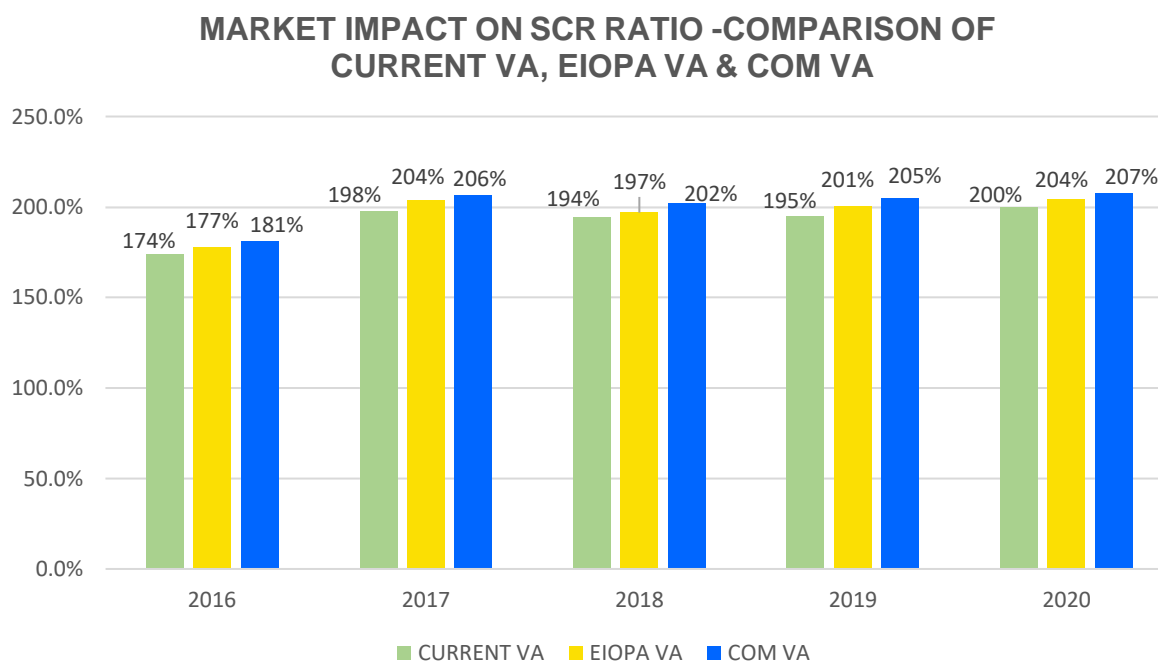
Figure23: Comparison of SCR ratio of all undertakings per year considering different VA calibration methods.

4.2.2 INFERENCE

On the whole there was an increase in the SCR ratio after applying the ALT extrapolated risk-free rates and applicable VA. The average SCR ratio under the COM proposal was noticeably higher than under the EIOPA proposal. A reason for this is since the COM proposal does not take into the ratio AR[5] that is based on the weights of own assets holdings of each insurer depending on the level of cash-flow matching of insurance liabilities portfolios.
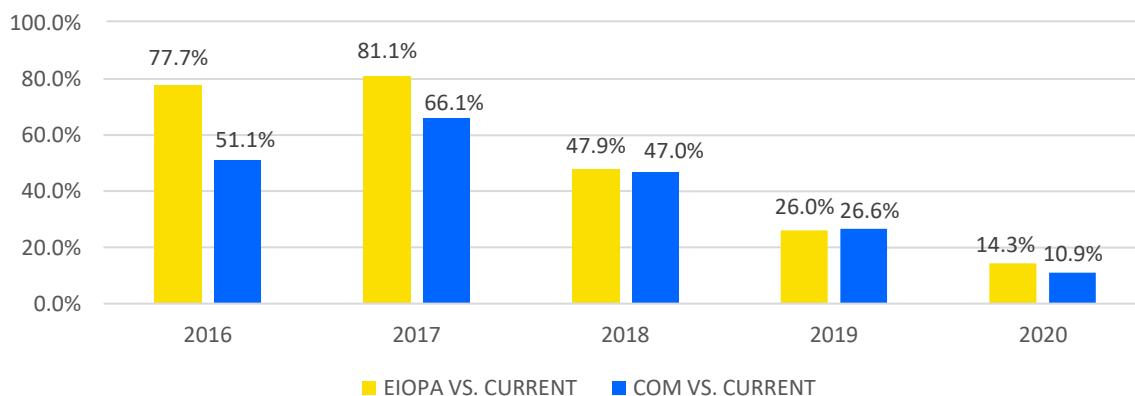
4.3 INTEREST RATE RISK

The aim under this section is to assess the proposed changes to calculate the interest rate capital requirements through the application of shocks to the risk-free rate term structure. The calibration of these shocks shall correspond to the 99.5 percentile of the distribution of relative interest rate changes for the *up* shock or 0.5 percentile for the *down* shock. [26]A comparison is drawn between capital requirements under the current RFR and calibration of the *up* and *down* shocks and the Alternative rates with EIOPA & COM proposed shocks. The discounted cash flows under the current regime were estimated and similarly under the new proposed shock calibration by EIOPA and COM. In this study the actual impact of a change in the IRR estimation on the SCR taking into account diversification benefits was not concluded on due to a time constraint and for proportionality reasons. Also, due to time constraints we could only perform this assessment for 13 undertakings that apply the VA (making use of the estimated asset cash flows in the scope of the VA assessment). We present the average level of capital requirement observed and the % change in capital requirements when comparing the different regimes. The results are as follows:

OVERALL IRR CAPITAL REQUIREMENT UNDER CURRENT, EIOPA & COM PROPOSALS
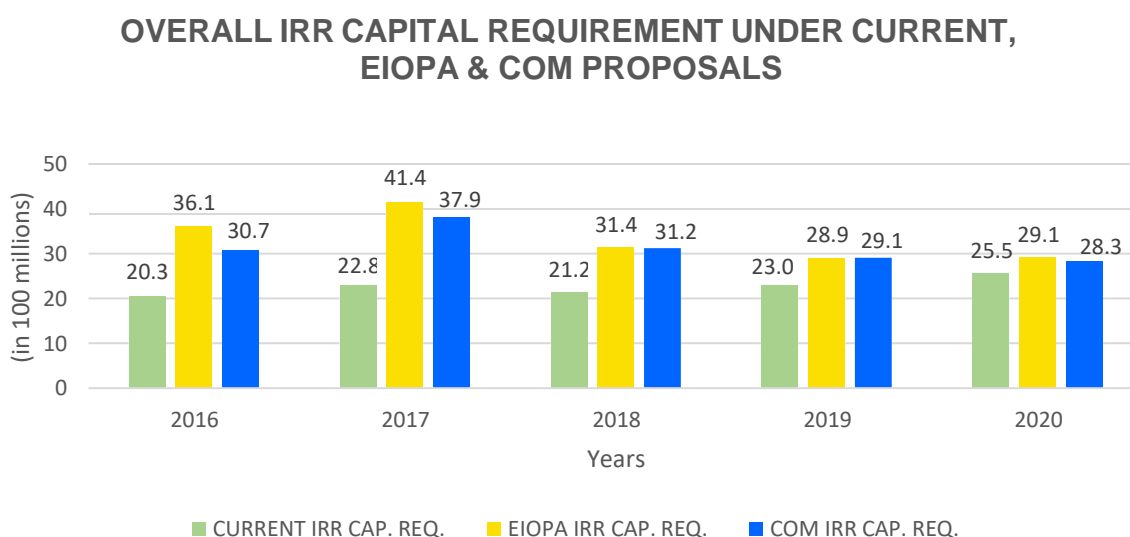
Figure24: Comparison of overall IRR capital requirements of all VA applying undertakings considered.

[26] See page 240, Background Analysis on the opinion on the 2020 review of the Solvency II

Figure25: Comparison of average % change in IRR capital requirements of all VA applying undertakings.

4.3.1 INFERENCE

Here we focused on how the calibration of the new shocks under the proposal affect the estimated IRR capital requirements. However, the real quantitative impact on the SCR ratios can be estimated only after accounting for diversification benefits under this module. Glancing at the results we see that the new shocks have increased the IRR capital requirements in both the EIOPA and COM proposal. Looking at figure 24 which compares the change with the current IRR capital requirements we observe a greater change under EIOPA's proposal as compared to COM. This is due to the assumption we made for the RFR beyond 20 years of maturity under COM proposal would remain unchanged.
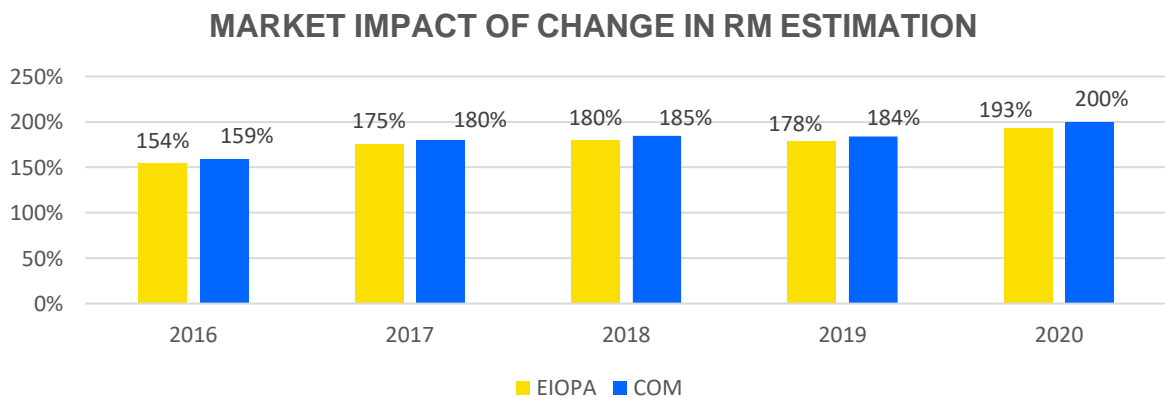
4.4 RISK MARGIN

Under this section our analysis is focused on the difference in the CoC proposed by COM since EIOPA suggests keeping the CoC unchanged. Here, the risk margin of all 44 entities were accumulated to estimate the total risk margin (from life and non-life cashflows) which is a component of TP along with the BE. COM proposed a change in the CoC from 6% to 5%. Therefore, the risk margin under the COM proposal will be 5/6th of the original cumulated risk margin. This difference of 1/6th of the risk margin is the added to eligible own funds after allowing for 21% tax. The overall SCRratio was impacted in the following way

AVERAGE SCR RATIO (%) UNDER EIOPA & PROPOSED COM RM CALIBRATION
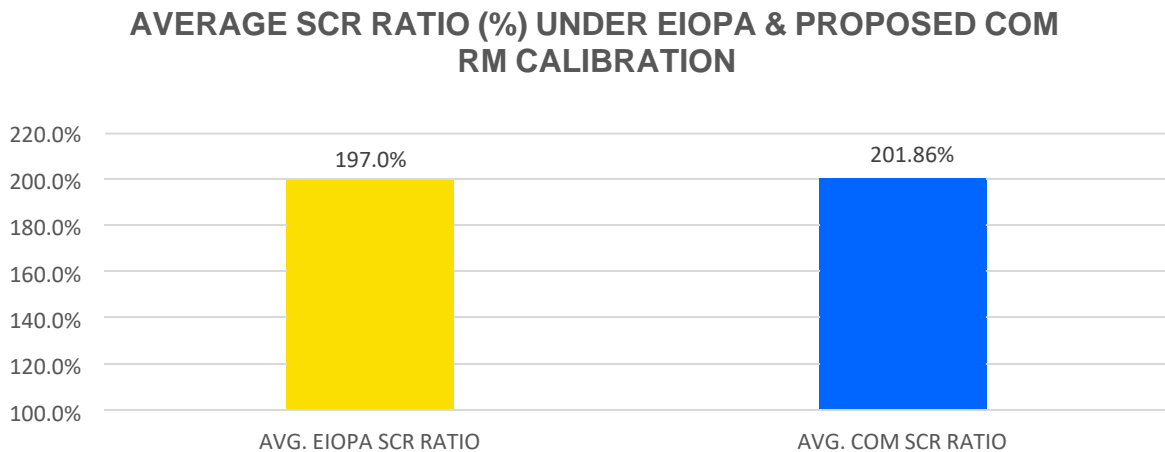
Figure26: Risk margin impact on average SCR ratio of all undertakings for all years.

4.4.1 MARKET IMPACT OF CHANGE IN RISK MARGIN

MARKET IMPACT OF CHANGE IN RM ESTIMATION

*Figure27: Overall SCR ratio based on new risk margin calibration of all undertakings per year*

4.4.2 INFERENCE

Here EIOPA & current calibration are the same. We observe an overall increase in average SCR ratio under the COM proposal signifying a material impact of reducing the CoC by 1%.

5. OVERALL IMPACT

In this chapter we try to estimate and quantify the impact on the SCR ratios of entire EIOPA and COM proposals in the scope of this study i.e., under the four long-term guarantees measures we analysed.

The analysis was carried out for two groups of undertakings the non-VA applying and the VA applying. The SCR ratios of the non-VA applying entities are impacted only by the change in extrapolation method and the change in RM under COM proposal.
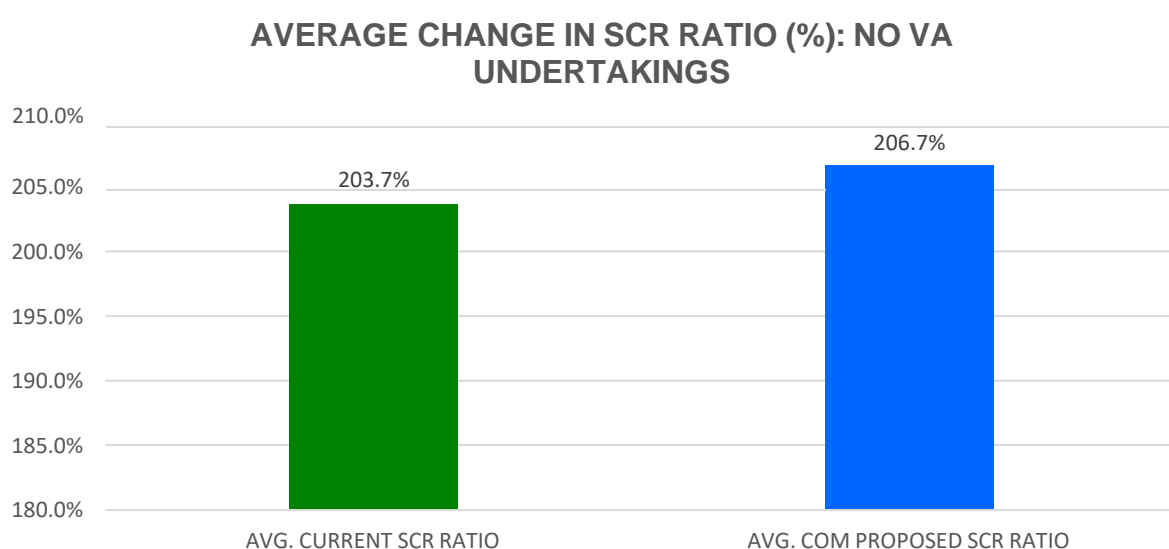
Figure28: Comparison of average proposed SCR ratio vs. current SCR ratio based on COM proposals of non-VA applying undertakings for all years.

From the inference drawn in section 4.1 of this report we expect to see a decrease in the SCR ratio after applying the new ALT extrapolation method of the RFR. Ultimately, we notice an increase in the average SCR ratio suggesting that the impact of the change in the RM estimation had a greater impact on the SCR ratio. Therefore, reducing the CoC rate increased on an average the SCR ratio by a greater extent.

The SCR ratios of the VA applying entities are impacted by the change in extrapolation method, VA calibration under both proposals. The change in RM is estimated only under the COM proposal.

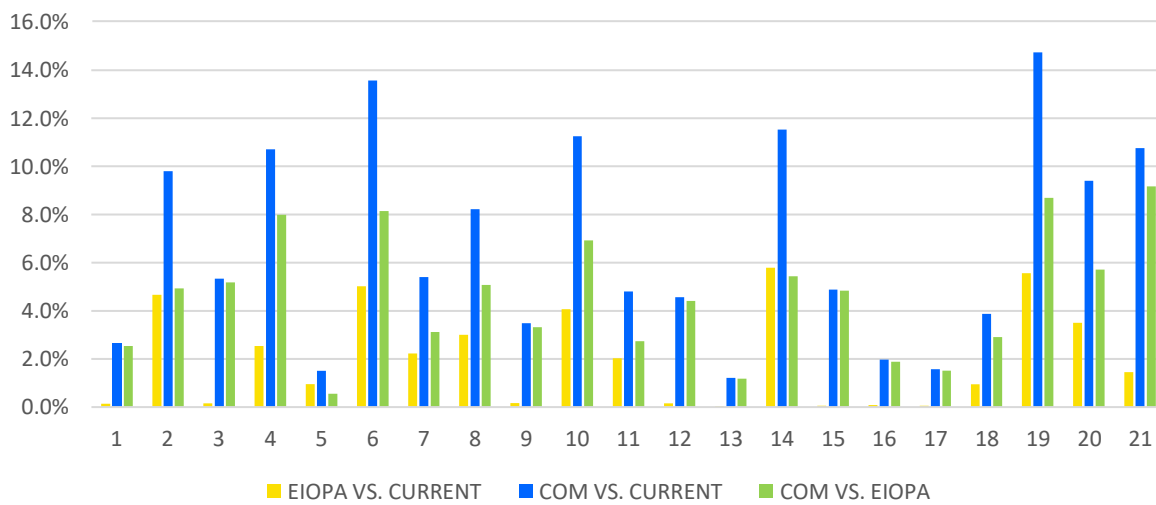**AVERAGE CHANGE IN SCR RATIO (%): VA UNDERTAKINGS**
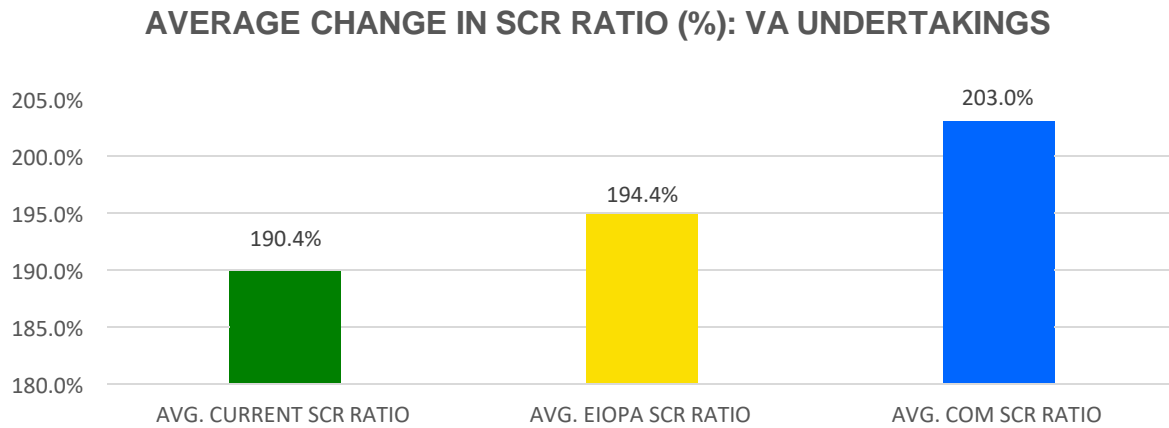
Figure29: Comparison of average proposed SCR ratio vs. current SCR ratio based on EIOPA & COM proposals for VA applying undertakings for all years.

With reference to figure 28, the VA applying undertakings, we observe that although the SCR ratio under both the EIOPA and COM proposals decreased on an average after applying the alternative extrapolation method, on applying the new VA calibration to the RFR under each proposal, the average SCR ratio was greater in both the cases as compared to the current calibration, however the extent of increase was greater under the COM proposal. The main difference was observed in the change of the RM calibration i.e., by reducing the CoC by 1%. Quantitatively this can be seen by observing the difference in the average SCR ratio after the VA application that were 194% and 197% under EIOPA and COM respectively whereas after the change in the RM calibration the SCR ratios are 194% and 203% respectively.

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% CHANGE IN SCR RATIO (%): NON-VA APPLYING UNDERTAKINGS
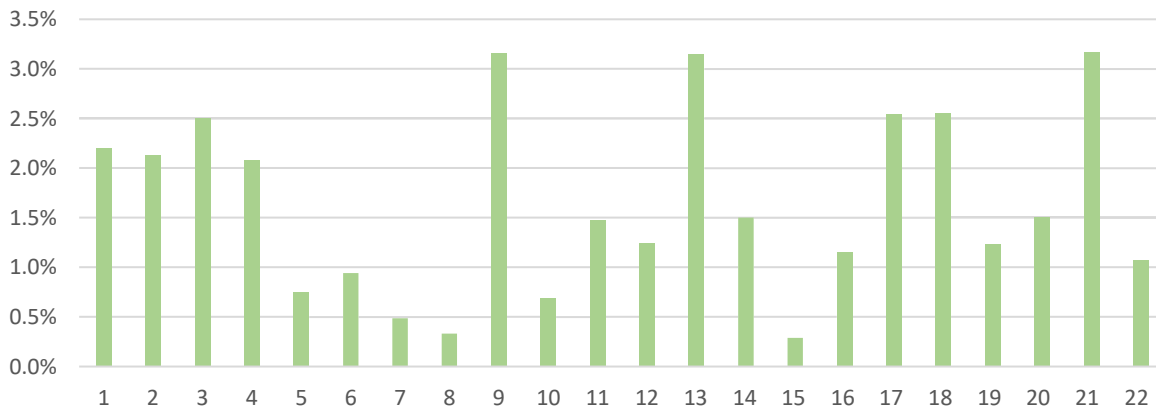
% CHANGE IN SCR RATIO (%): VA APPLYING UNDERTAKINGS

Figure30: Comparison of average proposed SCR ratio vs. current SCR ratio based on EIOPA & COM proposals of all undertakings for all years.

Overall, we can conclude that there is a clear increase in the SCR ratios for all undertakings under the reviewed proposals. It will be of relevance to see the impact of this increase in times of crisis.

6. CONCLUSIONS AND NEXT STEPS

After considering all the changes considered in this study, RM implies a decrease in TP by 1/6 of the risk margin which can be material as observed irrespective of the undertaking's exposure to market and other risks which is always prevalent. The VA can have a higher or lower impact in TP depending on a lot of factors such as the spread levels, duration of assets and liabilities, asset portfolio composition and even the type of liabilities (in this later case concerning EIOPA's approach) and we can see that for the set of years that we analysed the change in CoC dominated the impact.

We can glance at the below table to understand the quantitative impact of all the changes

TABLEVII: OVERALL IMPACT OF PROPOSALS ON AVERAGE SCR RATIO (%)

Years	Proposal	Undertakings Considered	Current Avg. SCR ratio	EIOPA Avg. SCR ratio	COM Avg. SCR ratio
2016-2020	Extrapolation of RFR	44	181.28 %	177.31 %	
2016-2020	Volatility Adjustment	21	192.06 %	196.6 %	200.3 %
2016-2020	Risk Margin	44	176.08 %	176.08 %	181.46 %

From Table VII, we can clearly conclude that the change in risk margin estimation had the most material impact on the average SCR ratio followed by the VA calibration and the extrapolation of RFR. Therefore, the change in CoC rate from 6% to 5% had the most material impact on the average SCR ratios of undertakings. In the case of the interest rate risk, the capital requirement impact was greater under the EIOPA proposal as compared to the COM proposal due to the underlying assumption.

6.1 NEXT STEPS

Overall, the proposed changes in the long-term guarantees measures addressed some of the issues identified. However, more studies need to be performed in order to justify such a change in the SCR ratios that were mainly impacted by the change in the risk margin calibration and to especially ascertain if this is appropriate in times of crisis and how it interlinks with the interestrate levels.

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8. ANNEXURES

DLT Assessment

Solvency II sets out market consistency as a core principle for the assessment of the financial and solvency position of insurance and reinsurance undertakings. The principle of market consistency applies to both assets and liabilities. In particular, for the calculation of technical provisions the relevant risk-free interest rate term structure should be used. That term structure should be based on upon up-to-date and credible information. These principles form the basis of the assessment of the depth, liquidity, and transparency of markets where the interest rates are observed.

As well as providing assurance that the relevant DLT requirements are met, the DLT assessment should foster the optimal use of the information provided by financial markets. In developing the methodology applied for the DLT assessment, EIOPA has analysed the generally applied practices and the academic literature on the issue. This analysis highlighted the process of the liquidity assessment but has also considered the available measures of depth and transparency.

The definition of 'liquidity' for the purpose of the Liquidity Coverage Ratio (LCR) in the banking sector is quite similar to its definition in the case of the DLT assessment in the insurance sector. Having said that, the purpose of the DLT assessment is focused on ensuring the reliability of market interest rates rather than the need to convert assets into cash. There are several factors influencing the liquidity (and depth) of financial markets.

EIOPA is of the view that the assessment of the depth of a financial market should consider the existence of appropriate supervision; such supervision can be an effective mechanism to ensure that large transactions will only affect prices according to the natural trends of the market, and not because of any spurious influence. Another relevant qualitative consideration for the assessment of market depth is the way in which market prices are collected; market data providers have developed effective methods and controls that can help to give reassurance that the influence of large transactions or unusual trades on prices is likely to be immaterial.

DLT assessment of EEA currencies

The list of criteria mentioned below should be considered as non-exhaustive. EIOPA has focused on criteria that may be helpful in assessing the credibility of market data for interest rate swaps and government bonds. Additional criteria consider the general bond market. The criteria are as follows:

a. Bid-ask spread: the price difference between the highest price a buyer would pay and the lowest price for which a seller would sell

b. Trade frequency: number of trades that take place within a defined period of time

c. Trade volume

d. Trader quotes/dealer surveys (incl. dispersion of answers);

e. Quote counts (1): number of dealer quotes within a window of a few days;

f. Quote counts (2): number of dealers quoting

g. Number of pricing sources

h. Assessment of large trades and movement of prices (depth)

i. Only applicable to the euro: residual volume approach for bonds.

DLT assessment of non-EEA currencies

The DLT assessment of non-EEA currencies is based, in addition to qualitative analysis, on the joint consideration of three main methodologies:

a. volatility analysis;

b. analysis of bid-ask spreads;

c. quantitative analysis.