AMICE Position Paper on Volatility Adjustment

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1 Executive Summary

The volatility adjustment has been established in order to limit the excessive and undue impact of market spreads volatility on the solvency position of undertakings. During market turmoil spreads may increase sharply and decrease the market value of fixed income assets to levels that are not justified by tangible default risk. This loss in market value may induce a decrease of the net asset values and solvency positions beyond true economic levels and spur non-desirable pro-cyclical investment behaviours.

In order to achieve the objective of mitigating the exaggeration of bond spreads, bearing in mind the proportionality and risk management principles the following proposal is made to apply the VA.

- (Re-)insurers are able to decide not to use the VA if this is not in line with their risk management and risk characteristics of the investment mix and their ALM considerations;
- All the (re-)insurers using the VA will use as default, the VA standard formula based on the currency reference portfolio adjusted with a country mechanism where necessary;
- If the basis risk is too significant considering the risk characteristics of the (re-)insurer, the (re-)insurer is able to ask the supervisory authorities to use the own asset as basis for the weightings applied in the application of the VA;
- The default approach to calculate the VA should be: **VA = GAR × AR4 × $Scale_c$ × Risk corrected spread + CA**
  - The GAR, as a starting point, is equal to 100% subject to the liquidity indicator or liquidity scenario. Based on proportionality reasons, the GAR may be set at 65%;
  - AR4 is similar to EIOPA's in its meaning but adapted to a more realistic fit.
  - The Country Adjustment (CA) will result in an adjustment of the currency VA based on spread developments for a country within a shared currency zone after the breach of certain triggers according to the latest advanced proposition by EIOPA under the HIA.
- Where the remaining basis risk[1] is too significant for an insurer and after endorsement of the competent supervisor of the appropriateness to use this approach considering the risk appetite, ORSA risk appropriateness and ALM, the insurer is able to use the own investment mix as basis for the calculation of the Risk corrected spread. If this option is applied, the CA does not exist.

Is applying the VA aligned with the risk management approach of the

yes

Is it appropriate to use the standard approach in determining the VA considering recognition of

yes / no

Use the default approach

Contingent on supervisory approval, use the own investment mix as basis

This framework results a **proportional application** of the Volatility Adjustment and **addresses the volatility** in an appropriate manner ensuring **good risk management** and projections of the

[1] Remaining basis risk is defined as the difference in the credit quality of the own investment mix compared to that of the reference portfolio as used in the standard approach. All the other calculations are equal to the standard approach.

2 Introduction

Following the introduction of the Solvency II legislation, insurers have strengthened their risk management and governance mechanisms.

One of the main objectives of the introduction of the Solvency II regime was to introduce a harmonised and advanced prudential regulation focused on high-quality governance and risk management at the service of policyholder's protection and broader financial market stability. Pillar 2 is the core building block of Solvency II and complements Pillar 1 where it comes short of providing a complete picture notably where risks cannot be factored in lone present value figures and there is a need to investigate further across additional dimensions.

Recital 15 of the Directive 2009/138/EC describes "*In line with the latest developments in risk management, in the context of the International Association of Insurance Supervisors, the International Accounting Standards Board and the International Actuarial Association and with recent developments in other financial sectors an economic risk-based approach should be adopted which provides incentives for insurance and reinsurance undertakings to properly measure and manage their risks. Harmonisation should be increased by providing specific rules for the valuation of assets and liabilities, including technical provisions*.".

In the Solvency II legislation several requirements (Directive/Delegated acts/EIOPA guidelines) are targeting the risk management and governance system within a (re-)insurer.

The investment mix of an insurer results from a process which starts with the risk appetite and subsequent statements that are both feeding and fed by the Asset Liability Management and the Prudent Person Principle.

In principle, a (re-) insurer defines a risk appetite i.e. how much risk the (re-)insurer is willing to take in accordance with the level of capital it targets. Based on the market perception, the (re-)insurer will sell (re-)insurance products in one of more markets. Based on the contractual commitments, the risk appetite and desired capital levels, the (re-) insurer decides on the appropriate investment mix. An important feature is whether the risk returns of the investments are aligned with the risk returns of the insurance liabilities.

The investments are managed according to the Prudent person principle in line with the risk appetite statements. Also, when the investments are managed by asset managers and/or custodians the principles apply.

The above process in general ensures that the (re-)insurer invests in an appropriate manner their entrusted amounts and premiums gathered form their policyholders.

However, after the endorsement of the Directive 2009/138/EC, the European parties saw that there was an issue with the exaggeration of bond spreads following the financial crises of 2008 and 2012.

Omnibus II Directive introduced the LTGA package enabling (re-)insurers to cope with the volatility that market consistent valuations may bring if not adequately reflected/adapted in insurance long term business models with a risk of creating spurious volatility in solvency ratios and assessments for instance in times of exaggeration of bond spreads. Financial information is key and constant monitoring of the market is needed.

Yet this does not mean that the values of the different market variables that may change rapidly and drastically over short period of times are values to retain and spread all along the durations of a long-term business model. Historical data series provide information that help build views across the cycles and elaborate long term convergence values.

In recital 32 of the Omnibus II Directive, the objective of the VA is mentioned "*In order to prevent pro-cyclical investment behaviour, insurance and reinsurance undertakings should be allowed to adjust the relevant risk-free interest rate term structure for the calculation of the best estimate of technical provisions to mitigate the effect of exaggerations of bond spreads……*".

The use of the VA was embedded in the risk management practices of (re-)insurers and did not result in onerous investment behaviour.

From 2016 onwards, (re-)insurers did apply the VA based on their risk management considerations and principles. The application of the VA by (re-)insurers is scrutinised by EIOPA and the National Supervisory Authorities. EIOPA published LTGA reports and ALM reports. In their reports, EIOPA did not indicate that there was a shift in investment behaviour of (re-)insurers following the use of the VA.

In the last LTG report, EIOPA stated "*The feedback from national supervisory authorities indicates that there is no specific case yet where undue capital relief was observed for an undertaking due to the application of the LTG measures or measures on equity risk*." And "*Most of the national supervisory authorities have identified no relevant and significant trends in the investment behavior of the insurance undertakings they supervise*.".

Following the requirement of the Solvency II legislation, the use of the LTGA package had to be reviewed.

In the Omnibus II Directive and other Solvency II legislation, a review was required of several aspects of the enforced Solvency II legislation. To this end the EC asked EIOPA for advice, which in their turn asked the various stakeholders for information and opinions through data calls, discussion papers and consultations. In the consultation EIOPA analysed thoroughly the use of the LTGA package in general and the VA in particular. From their perspective, flaws/issues were identified with the use of the VA and proposals suggested to remedy those flaws. From AMICE's perspective not all flaws/issues and proposals to mitigate those flaws/issues were shared. However, AMICE does recognise the issues/flaws with respect to the under- and overshooting of the VA (e.g. basis risk), the artificial volatility in certain cases and in the application of the country mechanism (see also response of AMICE to the consultation).

EIOPA followed up the various consultations with the Holistic Impact Assessment (HIA) and following the COVID-19 crisis, the Complimentary Holistic Impact Assessment. In the HIA, EIOPA included their preferred solutions s. AMICE did provide specific feedback on the HIA (see attachment).

Based on the considerations mentioned above, AMICE has built a proposal that aims to address the flaws that EIOPA still fails to address satisfactorily with a bias towards conservatism that cripples the benefits of the VA.

The proposal of AMICE does relate to the principle of proportionality, the state of play within the HIA, the analysis presented by EIOPA in the consultations, the LTGA and ALM report as submitted by EIOPA to their stakeholders and the CMU report as presented by the HLF.

3 Volatility Adjustment

3.1 Ability not to use the VA

The use of the VA should be embedded in the risk management policies of the (re-)insurer and should be aligned with the ALM practices and risk characteristics of the (re-)insurer notably with regards the buy and hold intention of fixed income portfolios.

The first step in applying the VA when determining the capital position is to assess whether there is a need to apply the VA. A (re-)insurer assess the risk characteristics of the liabilities and the ALM aspects of the investment mix. Based on this assessment, the (re-)insurer can decide that using the VA is not a good reflection of the ALM risk and that the exaggeration of the bond spreads is not a relevant issue. A second reason for not willing to use the VA can be found in the principle of proportionality. (Re-)Insurers could decide not to apply the VA because the benefits of using the VA does not outweigh the administrative burdens of using the VA.

Based on these two considerations, the (re-)insurer can opt not to use the VA when determining the capital position.

3.2 Default approach

When applying the VA, every (re-)insurer will start using the default approach. The default approach uses a reference portfolio based on the average investment mix of (re-)insurers within the same currency of the liabilities.

The general formula of the VA is:

$$VA = GAR \times AR4 \times Scale_c \times \text{Risk corrected spread} + CA$$

In the next sections the formula is described in more detail.

In order to ensure consistency across the European market, EIOPA would continue to provide a market wide VA computed with AR4 and GAR both set at 1 and adjusted afterward by undertakings in order to meet their specific situations considering the liquidity indicator or liquidity scenario as described further.

3.2.1 General Application ratio (GAR)

Objective of the GAR

The function of the General Application ratio is to indicate the ability of the insurer to avoid forced sales on the Economic Balance Sheet and therefore the recognition of any unrealized gains embedded in the economic value of the investments used to determine the VA.

AMICE has the view, that (re-)insurers in general are able to avoid forced sales. A view which is also shared by the High-Level Forum in their report “A new vision for Europe’s capital market”. When justifying one of their recommendations, the High-Level Forum argues “*Given the nature of their assets and liabilities, however, insurers can generally take a long-term view and avoid being forced sellers. Therefore, the real risks they face would relate to long-term underperformance, which requires less capital than the forced selling risk.*”.

In AMICE’s proposal for the VA, the GAR starts at 100% contingent on the possibility to avoid forced sales.

Liquidity measurements and possibility to avoid forced sales depend on risk profile. An undertaking with a duration of assets lower than the duration of liabilities is likely to be less exposed to forced sale than another undertaking in the opposite situation. Moreover, the characteristics of the liabilities and the possibility to redeem contracts differ among various undertakings and their specific portfolio mix. **A sound measurement of illiquidity and liquidity (the two sides of the same coin) constraints should gather all these aspects with an ALM based approach. To this end, two options are possible.**

First option for the GAR: Liquidity indicator

The first option is based on our answer to HIA and aims to reduce operational complexity with the following single indicator suited to the actual relevant time horizons that underpin liquidity needs:

$$\frac{\text{Highly Predictable Inflows}_T}{T \times \frac{\text{BE}}{\text{Dur}_{\text{BE}}}}$$

On the numerator side, we define a measure of "Highly Predictable Inflows" over the given T horizon constituted by cash flows not exposed to market risk. They are constituted by Redemptions, Coupons, Rents, Cash and Cash equivalents, Dividends, Interest payments and principal on loans as well as Future Premium within contract boundaries. Where appropriate, the cash-flows should be netted by the default expected rate.

On the denominator side, we propose to approximate an average annual cash outflow thanks to the best estimates divided by their duration.

Both measures are estimated on a given T horizon. **In our experience, this horizon should be set to a duration of 3 years maximum** and correspond to what a sound ALM should ensure in terms of avoiding immediate liquidity gaps.

Second option for the GAR: Liquidity scenario analysis

The second option is based on previous AMICE's proposals. The demonstration of the ability to avoid forced sales is to be done by an assessment over a planning horizon of at most 3 years. The (re-) insurer is faced with an instantaneous shock equal to a 1 in 10 event. The 1 in 10-year event is based on the diversified aggregation of the Solvency II scenarios resulting in a cash outflow for the (re-)insurer (such as Counterparty Default Risk, Operational Risk, Mortality Risk, Catastrophe Risk, etc.). Risks which does not have an impact on the actual cash outflows will be disregarded). For the diversification, the correlation matrix as defined in Directive 2009/138/EC Annex IV will be used.

The (re-)insurer will apply this event and project the cash in and outflows over a business plan period of 3 years maximum. If the (re-)insurer is able to withstand the liquidity scenario without having to sell investments used to calculate the VA and which are not categorised as LTEI, GAR will be 100%.

GAR modulation for undertakings not able to meet criteria

If the (re-)insurer is not able to demonstrate the ability to avoid forced sales, the GAR will be scaled to take into account the shortcomings of the liquidity plan.

The scaling should be performed with a smooth formula preventing threshold effects and we propose the scaling to take place between 100% and 65%. The 65% refers to current level of GAR. A smooth bridge between the cap and the floor avoid cliff effects. The formula would be:

$$GAR = 100\% - (100\% - 65\%) \times \left(1 - Min\left(\frac{\text{Highly Predictable Inflows}_T}{T \times \frac{\text{BE}}{\text{Dur}_{\text{BE}}}}; 1\right)\right)$$

For most companies, with a good ALM and no liquidity gaps in the forthcoming 3 years, the GAR will be set at 100%. In the worst-case scenario, undertakings will be eligible to a 65% GAR in line with current situation (where no liquidity requirement is in place). It is noteworthy that a value below 100% does not suggest that the company is insolvent, but only that it will be forced to sell assets in order to meet its engagements.

Proportionality

The application ratio is also to accommodate for (re-)insurers willing to apply the proportionality principle and not having to submit the demonstration of the ability of the (re-) insurer to avoid forced sales. If the (re-)insurer meets the criteria eligible for the use of the proportionality principle (article 88[2] of Regulation 2015/35), **GAR will be set at 65%**.

3.2.2 The volume and duration issues through an adjustment factor AR4

AR4 aims at catering for duration and volume mismatches to fix overshooting but also undershooting issues.

At AMICE we are mostly concerned about the undershooting issue that we find widespread among non-life players with relatively short best estimates durations in conjunction with significant levels of own funds with long durations.

For the undershooting correction to be fully effective, AR4 should not be artificially limited with the introduction of a cap set to 1 in the formula. Rather AR4 should fully allow for the compensation of all the volatility that may rise from fixed income asset portfolios in due proportion to their volume and duration:

$$AR4 = \frac{PVBP\left(MV_{i,c}^{FI}\right)}{PVBP\left(BEL_{i,c}\right)}$$

The individual components equal the specifications as used by EIOPA in their technical specifications and as submitted in the HIA.

Volumes of fixed income assets may well exceed best estimates values because of the volumes of assets backing own funds. AMICE has a long-standing position on own funds and claimed several times that own funds allow companies to take a long-term stance. We would like to recall that own funds provide a safety buffer against both adverse events (SCR coverage) and liquidity needs. This extra safety in terms of liquidity allows to chase illiquidity premium or risk premium and to limit the risk of forced sales at a loss.

One of the objectives of VA was to limit pro-cyclicality. However, if own funds are not accounted for in the VA adjustments the pro-cyclicality is not completely addressed. **We could reach an ambiguous situation where pro-cyclicality comes from own funds which are supposed to dampen pro-cyclical behaviour.**

3.2.3 Scaling factor

The scaling factor is a normalisation reverting factor similar to EIOPA's in order to allow a meaningful application of AR4 to achieve a full balance sheet approach. The determination of the scaling factor equals the formula as applied by EIOPA in their technical specification as submitted in the HIA.

$$Scale_c = \frac{1}{w_{gov,c} + w_{corp,c}}$$

The individual components have the specifications as used by EIOPA in their technical specifications as submitted in the HIA.

[2] The (re-)insurer applies the proportionality principle and where appropriate the use will be discussed in the Supervisory Review Process after the submission of the Solvency information.

3.2.4 Risk corrected spread

The last factor included in the default approach deals with the risk correction of the market spreads. Based on the risk characteristics (CQS) of the individual investments in the reference portfolio the yields are derived from which the spreads are calculated. Based on the CQS and other characteristics a risk correction reflecting the risk of default is to be applied.

For the risk correction, AMICE proposes to stick with the current design of the Risk Correction. Thus,

$$RC = w_{gov} \, . \max(RC_{gov}, 0) \; + \; w_{corp} \, . \max(RC_{corp}, 0)$$

Here, the two components of the risk correction are given by:

- RC^{gov} = 30% Long Term Average Spread for exposures to governments of EEA member states
- RC^{corp} = 35% Long Term Average Spread for exposures to other governments and corporates

The cost of migration and default is also included in the current design of the risk correction for corporate bonds. However, the part of the formula that is related to the LTAS is dominant. Both the current approach by EIOPA as well as their new proposals (from the consultation paper and the Holistic Impact Assessment) are considered to be very conservative. **In the Appendix to this document extensive comparisons are made for the risk correction with historic credit losses.**

To explain why the proposals currently put forward and tested under the HIA are not considered to be appropriate for the risk correction, it is first emphasized that the application ratio should address:

- Stability of liability cash flows,
- Amount of matching,
- Avoidance of forced selling.

Such points should not be re-addressed by the risk correction. **As a result, the risk correction should consider cash flow losses (credit risk) of fixed-income instruments only**, which are independent of the cash-flow measures of a specific insurance company. Credit risk losses have been very accurately measured over a long period of time, including many financial crisis. It is thus highly feasible to present a detailed calibration of the risk correction that is line with historically observed credit losses.

In the most recent proposals by EIOPA, the risk correction is proposed to be a large fraction (40% to 50%) of the actual spread. In this setup, it is implicitly assumed that an increase in credit spreads now will have a lasting impact on the credit risk over the full lifetime of bonds. Credit spreads can fluctuate strongly over periods of months, whereas in a buy-and-hold strategy the credit risk correction charge should be a representative measure for a period of years (typically 5 to 10 years and even beyond). **Moreover, migration and default risk are mean-reverting, so that any impact of a one point in time spread rises is reduced over the lifetime of bonds. Such important effects are not taken into account in the calibration by EIOPA, which is considered a major gap in the proposed framework.**

In the appendix, an industry-standard stochastic credit risk model is calibrated on historical data including most recent credit crises that can address the effects of expected and unexpected credit loss as well as the impact of a spread rise over the lifetime of bonds.

From the performed detailed analyses a risk correction of at most 10% of the LTAS, the actual spread or a combination of the two is found to be in line with historically observed credit losses, even in times of crises.

We propose to lower the percentage of the risk correction from the current 30% for governments and 35% for corporates. Moreover, it is strongly favored to have the risk correction as a fraction of the LTAS (in contrast to the actual spread), since the risk correction has to be representative over the full lifetime of the bonds and avoid pro-cyclicality.

3.2.5 Dynamic VA

For the credit instrument in the scope of spread risk the VA should be adjusted in case of spread shock. This adjusted VA, the DVA, is used in discounting liabilities after a spread shock.

Practically, the re-computation of DVA would imply to review:

- risk corrected spread, with new spreads' levels
- AR4, to account for changes in PVBP occurring from spread changes
- GAR, in line with changes in best estimates

Similar to VA, in order to ensure consistency, EIOPA would provide a market wide DVA with AR4 and GAR both set at 1 and modified by undertakings in order to meet their specific situations.

3.2.6 Country Adjustment

For the country adjustment, AMICE agrees with the approach taken by EIOPA in the consultation (cf formula in 2.478 and further). and the Holistic Impact Assessment.

3.3 Use of Own asset

In certain instances a (re-)insurer can be faced with a significant basis risk on the reference portfolio's risk corrected spread as used in the default standard formula compared to the insurers' own risk corrected spread derived from its own fixed-income assets portfolio. In these instances the (re-)insurer is able to use the own investment mix as basis for the weightings when applying the above formula (default approach without the country adjustment).

The derivation of the own risk corrected spread based on own assets is only allowed after endorsement of this request by the competent authorities. The (re-)insurer is required to demonstrate that the use of the own assets results in a better mitigating of the basis risk.

The (re-)insurer will use the information as presented in the QRT S06.02 to determine the appropriate weightings. Where appropriate the indices and information published by EIOPA for the default approach is used.

The (re-)insurer will present for each calculation the difference between the components of the VA with that of the previous period. The (re-)insurer will explain any material differences to the competent authorities. If the competent authorities is not satisfied with the explanation and/or has indications that the (re-)insurer changed the investment mix solely for the purpose of obtaining higher benefits of applying the VA, the competent authority can require a calculation based on the previous investment mix and/or disallows the further use of the own asset VA.

Treatment of non-rated mortgage loans

In some Member states, specific investment exposures exist which are not treated appropriately within the reference portfolio. The lack of granularity of indices used will hamper a proper reflection of the spreads and risks of these exposures. This also ensures that the country mechanism does not work properly especially if these exposures are more significant in a country.

Mortgage loans issued to individuals represent a significant exposure not adequately reflected in the spreads. EIOPA treat these exposures as corporate bonds while the risk characteristics of the mortgage loans are very much different. This results in under/overshooting and more artificial volatility.

The issue with respect to mortgage loans is the lack of clear indices or quoted information. An index can be either derived from a top down analysis of mortgage rates in a Member State and/or is able to use data derived from the ECB. The risk correction can be derived from a translation of "loan to value" towards the CQS.

3.4 Disclosures

In the Omnibus II Directive, the European parties insisted that insurer would disclose the impact of applying the Volatility Adjustment or Matching Adjustment. Although, AMICE does not state this information is useful and should be assessed by the relevant stakeholders, the disclosure of ratios with and without does not do justice to the Solvency II ratios. The VA and MA are measures, part of the capital ratios and integrated into the governance system. The publication of two ratios will only confuse the general public.

The ratio without the MA/VA does not serve the purpose of informing the general public in a appropriate manner. If no VA would be applied, different investment decision could be taken in order to mitigate that economic situation.

The general public is more served with certain sensitivity analysis. Sensitivity analysis which is closely related with the actual risk characteristics of the (re-)insurer.

4 Appendix: Quantitative framework for the risk correction

EIOPA has specified the following points of attention for the risk correction [1]:

- Almost insensitive to credit spread changes
- Does not reflect actual default losses
- Does not reflect credit risk premium for unexpected losses
- Unnecessarily reflects cost-of-downgrade

To address these points, we need a quantitative framework that can address (both expected and unexpected) default losses of fixed income instruments, where also the relation to credit spread changes is included.

4.1 Observed credit losses

For the quantitative framework of the risk correction, we assume that liability cash flows are stable. We also assume that liability cash flows are matched by fixed income assets and that forced selling of assets can be avoided over the full contractual lifetime. **Deviations from these assumptions are addressed by the application ratio and not by the risk correction.** Then, only the cash flow risk of fixed income assets (credit risk) remains. The cumulative credit loss at maturity T is denoted by CL_T. We consider in first instance the cumulative credit loss CL_T to be observed. In this setting, the risk correction can unambiguously be specified.

Consider a stable liability cash flow L_T at maturity T. The matching asset is a zero-coupon bond with notional $N_T = \frac{L_T}{1-CL_T}$, because $N_T(1 - CL_T) = L_T$ remains at maturity after including the observed credit loss. The value of the replicating asset is given in terms of the risk-free rate r_T and the spread s_T as:

$$V_A = N_T e^{-(r_T+s_T)T} = \frac{L_T}{1 - CL_T} e^{-(r_T+s_T)T}$$

The value of the liability is by definition of the volatility adjustment va_T given by:

$$V_L = L_T e^{-(r_T + va_T)T}$$

In case of perfect illiquidity and replication, the application ratio equals 1 to avoid inconsistent valuation. Using $va_T = (s_T - rc_T)$ with rc_T the risk correction and $V_A = V_L$, we obtain:

$$RC_T = -\frac{1}{T}\log\left(1 - CL_T\right) \qquad (1)$$

This is the (continuously compounded) expression for the risk correction of assets covering liabilities in case of “no need for forced sale of the asset before redemption” in terms of cumulative credit loss over the maturity T of the bond. We use Equation (1) in the following to transform cumulative credit losses to the risk correction.

Cumulative credit losses for corporate bonds are standardly reported by data reports of credit agencies. Typical historical average cumulative credit losses for 5-year BBB bonds are 50 bps, corresponding to an historical average risk correction of 10 bps. Expressed as a percentage of the long-term average spread (LTAS), this leads to a risk correction of about 5% of the LTAS. **Compared to the currently applied 35%, the current choice is seen to very conservative.** During most recent crisis years cumulative default rates have been somewhat higher than the historical average (e.g. considering 5-year cumulative default rates for the cohort starting 2008), but the observed increase in credit losses has been much less than the increase in spreads.

The spreads for 5-year BBB financial bonds have risen to 1500 bps during the credit crisis. If a risk correction of 40% is applied, then the risk correction corresponds to an implied cumulative credit loss of about 2600 bps or 26% $(\text{namely } 1 - e^{-5 \cdot 0.4 \cdot 0.15})$. Considering a recovery rate of 70%, this means that the cumulative default probability implied by the proposed risk correction is about 40%. The observed 5-year cumulative default rates for BBB corporate bonds issued in 2008, which thus includes all crisis years, is somewhere around 1%. Even though central governments have bailed-out several financial institutions, the default probabilities implied by a risk correction of 40% are very high compared to observed default rates. **Based on this comparison with historical crisis default data, the proposal for the risk correction of 40% is considered to be about one order of magnitude too high.**

4.2 Credit risk model

To make further progress in addressing EIOPA’s points of attention, we consider an industry-standard credit risk model, that can address all mentioned points by EIOPA. The credit risk model deals with expected and unexpected credit losses, and accounts for the effect of credit spread changes. An industry-standard credit risk model is the CreditMetrics model by J.P. Morgan [2]. The basic equation for this credit risk model is:

$$X_{i,t} = \sqrt{\rho} Z_t + \sqrt{1-\rho}\,\varepsilon_{i,t} \qquad (2)$$

Here, $X_{i,t}$ represents the continuous credit risk score of obligor i at time t. If $X_{i,t}$ falls below a threshold then a default takes place. Upon considering multiple thresholds also rating migrations can be included. The factor Z_t represents systematic credit risk. Individual risk factors are represented by $\varepsilon_{i,t}$, which are standard normal distributed. The parameter ρ determines the impact of the systematic risk factor and also causes the defaults of obligors to be correlated.

Following CreditMetrics [2], the systematic risk factor Z_t follows an AR(1) process, so that mean reversion is incorporated. **After crisis years default rates tend to return to their average.** This is important to include in the calibration of the risk correction, since the latter applies to the full lifetime of bonds. The process is given by:

$$Z_t = \sqrt{\gamma} Z_{t-1} + \sqrt{1-\gamma}\eta_t \tag{3}$$

Here, γ determines the mean-reversion strength and η_t is the unexpected systematic credit risk shock. It is also assumed that η_t is standard normal distributed. As shown by Lamb and Perraudin [3], it then follows that Z_t and $X_{i,t}$ are also both normally distributed with (unconditional) variance equal to one. This allows the thresholds for $X_{i,t}$ to be directly related to the average historical transition matrices using the standard normal distribution [2].

From Equation (2) it follows that a rating or default threshold θ for $X_{i,t}$ corresponds to a threshold of $(\theta - \sqrt{\rho}Z_t)/\sqrt{1-\rho}$ for $\varepsilon_{i,t}$. Conditional on the systematic risk factor Z_t, transition probabilities $P_{j,k}$ from initial rating j to final rating k are given by the probability between adjacent thresholds [2]:

$$P_{j,k} = \Phi\left(\frac{\theta_{j,k-1} - \sqrt{\rho}Z_t}{\sqrt{1-\rho}}\right) - \Phi\left(\frac{\theta_{j,k} - \sqrt{\rho}Z_t}{\sqrt{1-\rho}}\right) \tag{4}$$

Here, rating 1 corresponds to AAA up to rating 7 corresponding to CCC, rating 8 to default, and $\theta_{j,0} \to \infty$, $\theta_{j,8} \to -\infty$. The model can be directly calibrated to yearly observed migration and default transitions. We follow a similar approach to CreditMetrics [2], resulting in $\hat{\rho} = 0.055$. This result is more conservative than in Ref. [2], where $\hat{\rho} = 0.016$ is obtained on data history 1980 to 2000. This is not surprising because we have used the years 2000 to 2018 which contain severe crisis years for migration and default. For the mean-reversion parameter, we obtain $\sqrt{\hat{\gamma}} = 0.38$ which is quite similar to the result by CreditMetrics.

Next, we study whether increased migration and default risk follow after increased credit spreads (first point of attention by EIOPA). In two recent credit crisis years, we have observed that market credit spread shocks (in 2008 and 2011) were indeed followed by deteriorating transition matrices (in 2009 and 2012). We use a simple linear regression to study this effect. In particular, we study whether a lagged market spread shock ΔS_{t-L} has predictive power for the migration and default shock η_t. Here, L is the number of lagged years. We use the historical residuals $\hat{\eta}_t$ from the estimation procedure for the model in Equation (3) and linearly regress these residuals against lagged credit spread shocks[3].

For a one-year lag we obtain a significant relationship with a regression coefficient of 0.70. This means that a one-standard deviation credit spread shock gives a 0.7 standard deviation shock for Z_t in the next year. The effect disappears for lags of two years or more, which is very relevant for the risk correction. This is because for the risk correction we need to consider the impact of an initial credit shock over the full lifetime of relevant bonds, which may have a 5-year or even a 10-year horizon. **For these bonds, the impact of the initial credit spread shock is strongly reduced.**

4.3 Calibration of risk correction

We apply the credit risk model to calibrate the risk correction for corporate bonds in the EIOPA benchmark portfolio of June 2020. To this end, we start by simulating Z_t from Equation (3). After this step, all one-year transition matrices can be directly computed using Equation (4). Multiyear-year cumulative default rates are obtained by multiplying yearly transition matrices. In this way we can compute expected and unexpected T-year cumulative default rates through simulation: any quantile of the credit loss distribution over any time horizon can be determined in this way.

[3] Actually we used the (standardized) first principal component of yearly shocks in multiple credit spread time series of different ratings and maturities.

In order to study the impact of increasing credit spreads, we perform the following steps. First, we determine an initial spread shock, for example 2 standard deviations. Next, we translated this shock ΔS into a (deterministic) initial shock for $Z_{t=1}$ using the established regression relation in the previous paragraph. We also add a stochastic shock for $Z_{t=1}$ in the first year. For later years, we simulate Z_t according to Equation (3), containing a yearly mean reverting drift and stochastic yearly shocks. As a result, the impact from the initial spread shock is reduced in later years by mean-reversion. For each initial spread shock, we can simulate the full distribution of default rates over any time horizon. In order to translate simulated default rates to credit losses, we use a loss given default (LGD) of 70%, which is in line with the recovery rate of 30% prescribed by Solvency II. The credit loss is obtained by multiplying PD with LGD, and we use using Equation (1) to translate credit loss to the appropriate risk correction.

As already mentioned, this procedure allows to simulate the full distribution of the cumulative credit loss $CL_{i,T}(\Delta S_{i,T})$ for maturity T and initial rating i after an initial spread shock of $\Delta S_{i,T} = S_{i,T} - LTAS_{i,T}$. Taking the average of the simulated credit loss distribution allows to calibrate the best estimate risk correction for different initial spread shocks. In the next paragraph we discuss how to also include unexpected credit losses.

We propose to use the results from the full simulation calculation to calibrate a simple formula for the risk correction. If a dependency on the initial credit spread $S_{i,T}$ is to be included, then it is natural to consider:

$$RC_{i,T}(S_{i,T}) = \alpha_{i,T} \max(LTAS_{i,T}, 0) + \beta_{i,T} \max(S_{i,T} - LTAS_{i,T}, 0) \tag{2}$$

The first term captures the expected through-the-cycle credit loss, while the second term captures the expected increased (point-in-time) credit losses due to rising credit spreads. We can calibrate $\alpha_{i,T}$ and $\beta_{i,T}$ from the simulated average cumulative credit losses after no initial spread shock and after a $2\sigma_{i,T}$ spread shock in the following way:

$$\alpha_{i,T} = \frac{RC_{BE,i,T}(LTAS_{i,T})}{LTAS_{i,T}}, \qquad \beta_{i,T} = \frac{RC_{BE,i,T}\left(LTAS_{i,T} + 2\sigma_{i,T}\right) - RC_{BE,i}\left(LTAS_{i,T}\right)}{2\sigma_{i,T}}$$

Here, $RC_{BE,i,T}(x)$ is the risk correction based on simulated average credit loss over horizon T for initial rating i and initial spread level x.

As an explicit example, the average of the five-year probability of default (PD) from the model without initial credit shock was found to be about 45 bps for corporate bonds with rating A, i.e. $PD_{BE,A,5}\left(LTAS_{A,5}\right) = 0.43\%$. This is in line with historically observed (through-the-cycle) default rates reported in Annual Default Reports from rating agencies and reported by EIOPA. After multiplication with an LGD of 70% and applying Equation (5), we obtain 6 bps for the risk correction for a 5-year corporate bond with rating A. Similarly, considering an initial credit spread of 2 standard deviations for the same bond, we find a (point-in-time) expected cumulative default rate of 0.74%. Using that the $LTAS_{A,5} = 153$ bps for a 5-year financial bond with rating A, we find a factor $\alpha_{A,5} = 4\%$. This is much lower than the current risk correction of 35%. Using a standard deviation for $\sigma_{A,5}$ =130 bps, we find a $\beta_{A,5} = 1.7\%$ which is much lower than the (HIA) proposal of 40% by EIOPA.

Performing similar calculations for other bonds in the benchmark portfolio are shown in Table 1. Determining the average value for α and β for the EIOPA benchmark portfolio by using the asset weights w from June 2020, we find $\alpha = 5\%$ and $\beta = 3\%$

Category	w	$PD_{BE}(0)$	$PD_{BE}(2\sigma)$	$PD_{99.5}(0)$	$PD_{99.5}(2\sigma)$	α	β
Fin (AAA, 8)	0.19	0.09%	0.13%	0.47%	0.65%	2.2%	0.3%
Fin (AA, 7)	0.14	0.28%	0.43%	1.17%	1.72%	3.0%	1.1%
Fin (A, 5)	0.22	0.43%	0.74%	1.75%	2.82%	4.0%	1.7%
Fin (BBB, 5)	0.12	1.47%	2.37%	5.09%	7.57%	6.2%	2.1%
NonFin (AAA, 8)	0.03	0.09%	0.13%	0.47%	0.65%	5.2%	0.7%
NonFin (AA, 8)	0.06	0.37%	0.55%	1.51%	2.10%	4.7%	2.7%
NonFin (A, 6)	0.09	0.60%	0.96%	2.28%	3.44%	7.6%	4.2%
NonFin (BBB, 5)	0.13	1.47%	2.37%	5.09%	7.57%	13.5%	8.0%

Table 1: results for calibration of $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$. The first column shows the category, rating and maturity of the bond. The second column shows the weight in the benchmark portfolio of June 2020 (BB bonds with weight 1% have been omitted). Column 3 to 6 show the cumulative default probability over the maturity of the bond. Both the expected result as the 99.5% quantile is shown. Also the result without initial spread shock (initial spread level equals LTAS), as well as a 2 standard deviation (2σ) initial spread increase are shown. The final columns show the calibrated $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$. The credit risk model does not explicitly distinguish between financial and non-financial bonds. The difference in $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ is mainly caused by differences in LTAS and σ. The modelled average and stressed default rates are in line with observed average and crisis default rates.

4.4 Unexpected credit loss

So far, we have not yet considered the effects of unexpected credit losses explicitly. Including a risk charge for uncertainty around the expected loss is common in valuation. Solvency II prescribes how to charge unexpected cash flow risks through the risk margin. The charge should be such that the capital costs to maintain solvency each year with a certainty of 99.5% is included over the lifetime of the financial contract. We apply this regulatory preferred approach to the valuation of unexpected credit losses for the risk correction. Using the credit risk model we can calculate any quantile of the credit loss distribution over any time horizon for any initial spread shock. The stressed PD is multiplied by the LGD to obtain the stressed credit loss ($CL_{99.5\%,i,T}$).

The total unexpected cumulative credit loss is given by $UCL_{i,T} = (CL_{99.5\%,i,T} - CL_{BE,i,T})$ for initial rating i over time horizon T, which corresponds to an time-average yearly unexpected credit loss of $(CL_{99.5\%,i,T} - CL_{BE,i,T})/T$. Multiplying the yearly unexpected credit losses by the cost-of-capital ($CoC = 6\%$) and summing over the lifetime of the contract, we obtain the following approximate expression for the cost-of-capital charge RM_T:

$$RM_{i,T} = CoC \cdot T \cdot (CL_{99.5\%,i,T} - CL_{BE,i,T})/T = CoC \cdot (CL_{99.5\%,i,T} - CL_{BE,i,T})$$

We can include the above cost-of-capital for unexpected credit loss to obtain the expression for the total risk correction that includes both the costs of expected and unexpected credit loss:

$$RC_{Tot,i,T} = -\frac{1}{T}\log\left(1 - CL_{BE,i,T} - RM_{i,T}\right)$$

Again, we emphasize that from the credit risk model, we can readily determine the full distribution of credit losses for any initial rating and over any time horizon, so that the total risk correction is readily determined. Moreover, we can perform this calculation for any initial spread shock allowing to calibrate α and β similarly as before. **Including the risk margin for unexpected credit loss increases the**

values for α and β by about 20%. Determining the average value for α and β for the EIOPA benchmark portfolio by the instrument weights, we find $\alpha = 6\%$ and $\beta = 3\%$ for the risk correction parameters including unexpected credit loss.

References

[1] EIOPA, Consultation Paper on the Opinion on the 2020 review of Solvency II
[2] Belkin et al. (1998), A one-parameter representation of credit risk and transition matrices, CreditMetrics Monitor
[3] Lamb and Perraudin (2008), Dynamic default rates, Working paper, Imperial College