Comments on the Consultation paper on the Opinion on the 2020 review of Solvency II

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In what follows we provide some comments on the analysis presented in [4, Section 2.4] about the Volatility Adjustment (VA).

At [4, page 83], the following deficiencies of the VA were identified:

1. Impact of VA may over- or undershoot impact of spread exaggerations on asset side.
2. Application of VA does not take into account illiquidity characteristics of liabilities.
3. Cliff effect of country-specific increase, activation mechanism does not work as expected.
4. Misestimation of risk correction of VA.
5. VA almost always positive; not symmetric, i.e. no resilience build up in good times.
6. Underlying assumption of VA unclear.
7. Risk-free interest rates with VA not market-consistent.

At [4, page 97], the following options to change the VA were listed:

1. Undertaking-specific VA-calculating the VA based on the undertaking- specific asset weights.
2. Middle bucket approach-in addition to the current VA an undertaking-specific VA is introduced, but subject to strict application criteria that relate to the asset liability management of the undertaking.
3. Asset driven approach-instead of applying the VA to the risk-free interest rates of technical provisions it would be used to revalue the bonds held by the undertaking by adjusting the bond spreads by the VA.
4. An adjustment that takes into account the amount of fixed-income assets and the asset-liability duration mismatch by means of application ratios.
5. An adjustment that takes into account the illiquidity features of liabilities by means of an application ratio.

6. The risk-correction to the spread is decoupled from the fundamental spread, and instead calculated as a fixed percentage of the spread.

7. Amend the trigger and the calculation of country-specific increase of the VA.

8. Establish a clearer split of the VA between its function as a crisis and a permanent tool.

In what follows we provide an answer to some questions posed in the consultation paper and an analysis of some of the options proposed in the paper, see Appendix A for the notation.

Executive Summary

In a nutshell the main results of our analysis are the following:

- There is some evidence of cliff edge/erratic behavior of the VA in the actual setting.
- There is some evidence of overshooting in the impact of the VA mechanism in the actual setting.
- The VA seems to capture turbulence in financial markets and risk aversion surges, there is almost no evidence that the VA reflects illiquidity in financial markets.
- Small effects associated with removing the zero-lower bound on the spread.
- Considering the risk correction as a fixed percentage of the spread (Option 6), a smoothing effect is observed with respect to the actual mechanism with a higher VA in normal times and a smaller one in crisis periods.
- A smoothing on the activation of the country-specific component (Option 7) would have produced a positive effect on discounting liabilities for insurance companies leading to a reduction of the erratic dynamics of the VA.
- Accounting for the amount of fixed-income assets (Option 4) has a little impact on the effect of the VA with an advantage for insurance companies.
- In Option 8 (Approach 1), considering the moving average to define the risk corrected spread seems to penalize low rating countries. The actual mechanism seems to do a better job yielding higher VA values for low rating countries and, therefore, addressing potential issues related to illiquidity/financial distress.

1 On the deficiencies identified in the paper

We refer to Q2.3 and Q2.4 on the deficiencies identified in [4].

In [1] we reconstructed the VA of nineteen countries according to the EIOPA methodology.[1] The sample is made of monthly observations for the time span December 31, 2015, to April 30,

[1] We deal with fourteen countries with Euro as currency: Austria (AT), Belgium (BE), Germany (DE), Finland (FI), France (FR), Greece (GR), Ireland (IE), Italy (IT), Netherlands (NL), Portugal (PT), Slovakia (SK), and Spain (ES). We also consider some non EURO countries: more precisely we focus on Bulgaria (BG), Czech Republic (CZ), Hungary (HU), Poland (PL), Sweden (SE), and United Kingdom (UK).

2019. The VA is defined as

$$\text{VA} = VA_{cu} + VA_{co}\mathbf{1}_{SRC_{co}>0.01}.$$

We want to express some comments on deficiency 1, 3 and 4.

1.1 Over-undershooting (Deficiency 1)

Exploiting data contained in the annual report on Long-term guarantees, see [2, 3], in [1] we have provided an analysis on the effect of the VA on the SCR ratio in % pts in 2017 and 2018 for the whole markets and for companies using the VA. To this end, we have used some information on the balance sheet of companies adopting the VA: quota of assets invested in corporate bonds, government bonds and Unit/Index linked; quota of corporate bonds and government bonds with low credit quality.

The sample is small (two year data with 50 observations) and the statistical significance of the regression analysis is weak. The analysis shows that companies investing in corporate/-government bonds of low credit quality get a smaller gain from the VA. This result may be interpreted as showing that the actual architecture of the VA is not neutral with respect to the portfolio composition of insurance companies: it favors companies not taking excessive credit risk.

1.2 Cliff edge effect/erratic behavior (Deficiency 3)

Only two countries experienced a $\text{VA} \neq VA_{cu}$ at the end of a month in our sample:

- **Greece**: 31/12/2015, 31/01/2016, 29/02/2016, 31/03/2016, 30/04/2016, 30/06/2016, 31/07/2016 and 31/08/2018
- **Italy**: 31/08/2018, 31/10/2018 and 30/11/2018.

The condition $SRC_{co} > 0.01$ for the activation of the VA_{co} is selective. To evaluate its relevance we consider two different thresholds. First, we assume that there is no constraint for the activation, thus we define

$$\text{VA}_{mod} := VA_{cu} + VA_{co}.$$

Then the threshold is set at 85 bps, and we define VA_{85} as:

$$\text{VA}_{85} := VA_{cu} + VA_{co}\mathbf{1}_{SRC_{co}>0.0085}.$$

In Table 1 we report the countries for which the VA_{co} is activated ($VA \neq VA_{cu}$) under the three different hypotheses: $\mathbf{1}_{SRC_{co}>0.01}$, $\mathbf{1}_{SRC_{co}>0.0085}$, $\mathbf{1}_{SRC_{co}>0}$. All the countries that are not in Table 1 are such that $VA = VA_{cu}$ for all the months of the sample.

As expected, as the threshold increases the number of months/countries with activation of VA_{co} decreases. In particular, we have 116 months/country in which $\text{VA}_{mod} \neq VA_{cu}$ (no threshold), 51 with a threshold at 85 bps and only 11 with a threshold at 100 bps.

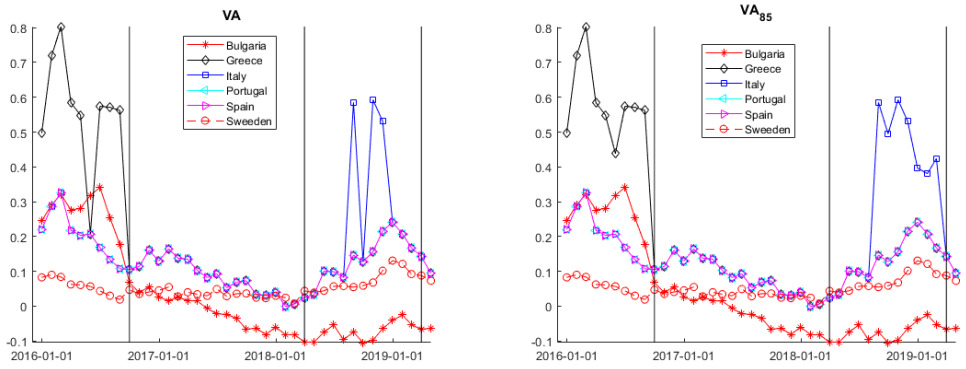

Figure 1: VA (left) and VA_{85} (right) -in percentage- for the countries that display positive VA_{co} with no restriction on SRC_{co}.

This result highlights the magnitude of the cliff-edge issue and the relevance of the size of the threshold on the risk-corrected spread for the activation of the VA_{co}. Notice that the new threshold at 85 bps will render the VA much more dependent on the country specific VA.

Country	Without constraints on SRC_{co}	With constraint $SRC_{co} > 85$bps	With constraint $SRC_{co} > 100$bps
Bulgaria	16	-	-
Greece	26	19	8
Italy	30	9	3
Portugal	18	16	-
Spain	23	7	-
Sweeden	3	-	-

Table 1: Number of months with VA $\neq VA_{cu}$ with or without constraints on SRC_{co}.

In Figure 1(left) we plot the VA for countries that experience positive values for VA_{co} (for all the other countries VA=VA_{cu}). The time series show jumps and erratic dynamics in case of Greece and Italy. In both cases, the activation of the VA_{co} was not persistent: in the case of Greece during the crisis period five months of activation of the VA_{co} were followed by one month of non activation and then other three months with activation; in 2018 the VA_{co} for Italy was activated in a month, then it was not in a month and then again it was activated for two months. Instead, the activation condition $SRC_{co} > 85$ bps shows a much more regular shape, see Figure 1(right).

1.3 Misestimation of risk correction (Deficiency 4)

According to the regulation, the VA should reflect components of the spread that are not related to the credit quality of the assets. This interpretation implies that the VA should mostly reflect exaggerations of the credit spread and the illiquidity of the bond markets.

In [1] we conduct a time series analysis to investigate whether the VA is effective in capturing exaggerations of bond spreads that are not associated with the credit quality of bonds. We

look for determinants of VA as well as of SRC_{cu} and SRC_{co}. On a monthly basis we consider them as dependent variable (Y_t) and we estimate the following autoregressive model for each country:

$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 X_t + \epsilon_t \tag{1}$$

where $\epsilon \sim N(0,1)$. X_t is a vector of exogenous variables that include both country specific and global factors.

It is difficult to identify indicators of "exaggerations" in the bond markets. The classical measure of illiquidity is provided by the bid-ask spread. Unfortunately, this measure is available only for government bond markets. Looking for non fundamental factors that may affect the VA we consider the economic sentiment of the country. We capture the general investors' risk aversion on yield spreads through the difference between the yield of BAA corporate bonds and AAA corporate bonds in the United States (BAA_AAA). As an indicator of uncertainty in financial markets we consider the VIX, which has been widely employed in the literature on the determinants of credit spreads of government bonds. This variable provides a good proxy for turbulence in financial markets that may drive risk aversion in evaluating credit risk.

The VA of all countries mostly depends on factors representing global risk appetite/perceived uncertainty (BAA_AAA, VIX). These results suggest that the VA mostly captures uncertainty and turbulence in financial markets. There is very weak evidence in favor of the hypothesis that illiquidity of government bonds affects the VA (the bid-ask spread of government bonds is not statistically significant). The country riskiness in terms of credit default swap at five years is an important factor in Spain, Greece, Italy, Portugal, Hungary, United Kingdom.

2 No lower bound on the spread

According to the actual mechanism for the computation of the VA, the spread is obtained as the difference between the market yield and the basic risk free. The spread enters the VA computation with a zero-lower bound. As pointed out in [4, page 82], such an approach is weakly justified and may have a negative impact in reaching the first objective of the VA (prevent procyclical investment behaviour). As a matter of fact, with a lower bound on the spread there is no symmetry in the mechanism and this may prevent to take more conservative choices in good times leading to procyclical choices: risky choices in good times relying on the activation of the VA in difficult times.

The proposal is to change the mechanism (see Appendix A for the notation) according to the following formulae:

$$S_{cu} = w_{cu}^{gov} S_{cu}^{gov} + w_{cu}^{corp} S_{cu}^{corp} \tag{2}$$

$$S_{co} = w_{co}^{gov} S_{co}^{gov} + w_{co}^{corp} S_{co}^{corp}. \tag{3}$$

As stated in the report, we do confirm that the change has a small impact on the computation of the VA: the change has no impact on EURO countries, and negligible changes in the other countries, with exception of Sweden and Czech Republic, see Figure 2.

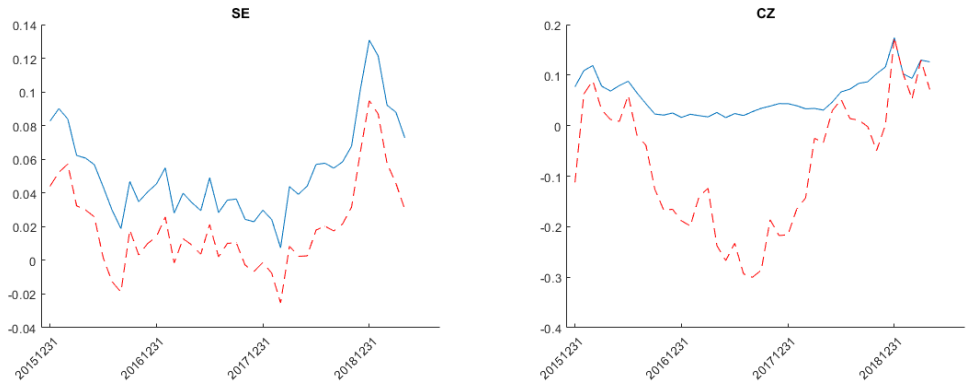

Figure 2: VA (in percentage): No lower bound on the spread (red dashed line) vs regulation in force (blu line).

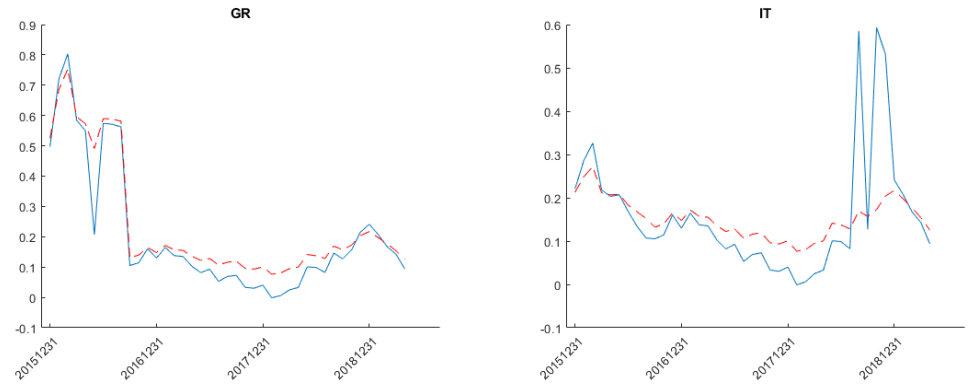

Figure 3: VA (in percentage): Risk-correction calculated as a fixed percentage of the spread (red dashed line) vs regulation in force (blu line).

3 Risk-correction calculated as a fixed percentage of the spread (Option 6)

According to Option 6, the risk-correction should be defined as a fixed percentage of the spread, i.e., $RC = c \cdot S$. The computation is done at a granular level, i.e., for *gov* and *corp* separately [4, page 133, section 2.432], for both the currency and the country risk-corrections. Suggested values for the multiplicative factor are $c = 0.3$ for the *gov* component [4, page 134, section 2.438] and 0.5 for the *corp* one [4, pages 133-134, section 2.440].

In the period considered in our analysis and for all countries, the maximum increase of the VA implementing the option would have been +28bps (Greece, May 31, 2016) and the maximum decrease would have been -42bps (Italy, August 31, 2018), see Figure 3.

We analyze the effect of this change in discounting liabilities. We assume that a national insurance company has to face liabilities having a discounted value (computed according to the EIOPA national risk-free curve-without VA) equal to 100 millions Euro. Our goal is to analyze the effect of VA at the end of each year. We assume the duration of the liabilities equal to the national one as provided in Figure 3 of the International Monetary Fund Report of July

ES	GR	IT	PT	AT
December 31, 2015				
0.0759	-0.2522	0.0689	0.0391	0.1114
December 31, 2016				
-0.1726	-0.1726	-0.1567	-0.0886	-0.2544
December 31, 2017				
-0.5848	-0.5848	-0.5306	-0.2993	-0.8640
December 31, 2018				
0.2289	0.2289	0.2080	0.1182	0.3361

BE	IE	DE	FR	NL
December 31, 2015				
0.0826	0.0826	0.1364	0.1009	0.1162
December 31, 2016				
-0.1880	-0.1880	-0.3122	-0.2302	-0.2657
December 31, 2017				
-0.6372	-0.6372	-1.0622	-0.7810	-0.9023
December 31, 2018				
0.2491	0.2491	0.4114	0.3042	0.3505

Table 2: Risk-correction calculated as a fixed percentage of the spread: discounted values of liabilities (in millions). Difference between the discounted values exploiting the modified VA with the ones obtained with the standard VA.

2018,[2] and we consider the liabilities accordingly with a bell shape (see [1] for details on the construction). In Table 2 we report the difference between the discounted values exploiting the modified VA with the ones obtained with the actual VA (a negative value results in an advantage for the insurance company in case of the modified VA with respect to the actual mechanism). We notice that the reported differences can be either positive or negative. More precisely, the differences are positive at the end of 2015 (during the Greek crisis), with the exception of Greece, and at the end of 2018 (i.e., in the period of a large increase of the Italian spread). Differences are negative at the end of 2016 and of 2017.

We can conclude that, contrary to the spirit of the regulation, it seems that this change on the computation of the risk-correction would bring advantages to insurance companies in periods with no (or weak) financial stress. There is a smoothing effect: with an advantage with a higher VA in normal times and a smaller one in crisis periods.

4 Trigger and calculation of country-specific increase of the VA (Option 7)

The actual VA is defined as

$$\text{VA} = 65\% \left(SRC_{cu} + \mathbf{1}_{SRC_{co}>0.01} \max\{SRC_{co} - 2SRC_{cu}, 0\} \right),$$

[2] https://www.imf.org/en/Publications/CR/Issues/2018/07/19/Euro-Area-Policies-Financial-Sector-Assessment-Program-Technical-Note-Insurance-Investment-46104

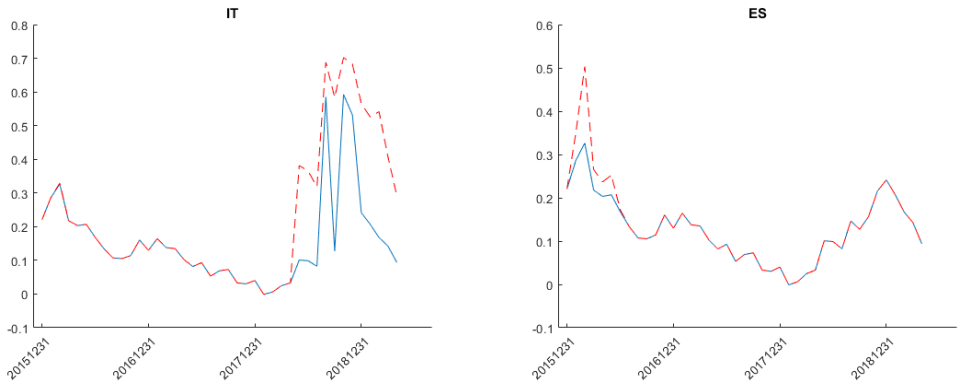

Figure 4: VA (in percentage): Trigger and calculation of country-specific increase of the VA (red dashed line) vs regulation in force (blu line).

[4, pages 146-147, section 2.481] suggests to modify the computation as follows

$$\text{VA} = 65\% \left(SRC_{cu} + w \max\{SRC_{co} - R \cdot SRC_{cu}, 0\} \right),$$

with $R = 1.3$ and w being defined as

$$w = \min\{1, (SRC_{co} - S^L)/(S^H - S^L)\} \, \mathbf{1}_{SRC_{co} > S^L},$$

with $S^L = 0.6\%$, and $S^H = 0.9\%$.

The proposal aims to introduce a smoothing effect in the activation of the country-specific component.

In the considered period, this modification has an impact for Spain, Greece, Portugal and Italy, and the maximum impact is for Italy on September 30, 2018, with an increase of the VA of 46 bps, see Figure 4(left).

As far as the discounting of liabilities is concerned, this modification results in a decrease of the discounting value of 1.40 mln for Greece in December 2015, 0.27 for Portugal in December 2016, and 2.74 for Italy in December 2018. In all the other cases no changes appear. We recall that in this type of analysis we only consider the value of VA at the end of December, therefore no effect is observed for Spain because for this country the modification results in a change of the VA only in the first months of 2016, see Figure 4(right).

5 Adjustment accounting for the amount of fixed-income assets (Option 4)

The actual VA_{cu} is defined as

$$VA_{cu} = 65\% SRC_{cu}$$

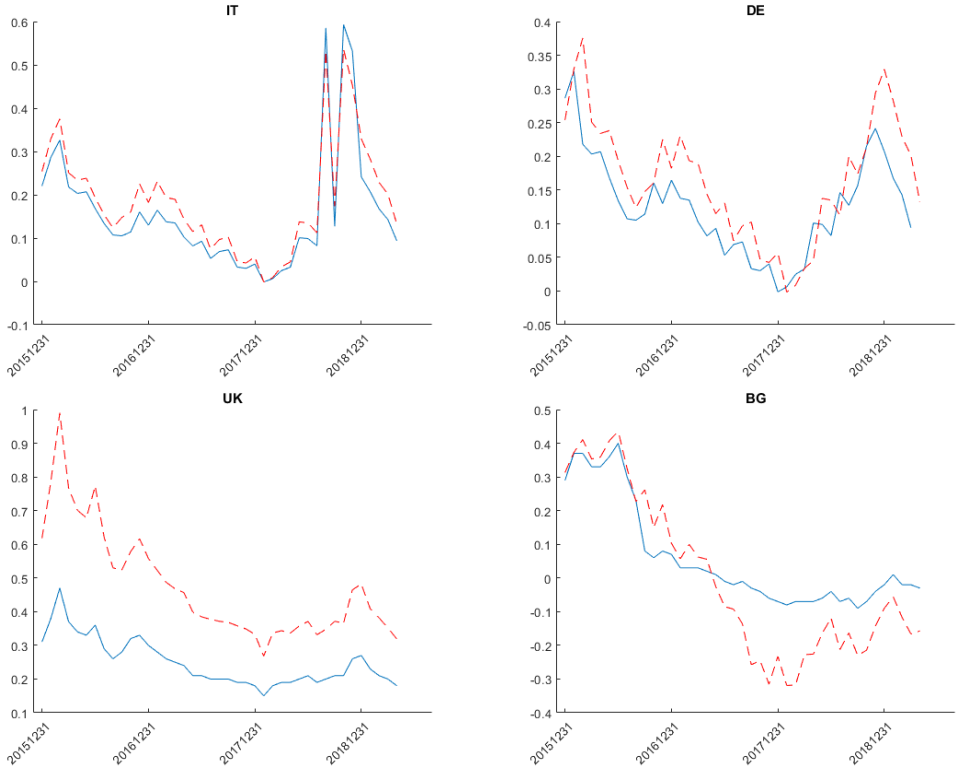

Figure 5: VA (in percentage): Adjustment accounting for the amount of fixed-income assets (red dashed line) vs regulation in force (blu line).

[4, page 113, section 2.363] suggests to modify it as

$$VA_{cu} = 65\% AR \frac{SRC_{cu}}{w_{cu}^{gov} + w_{cu}^{corp}}$$

AR being the application ratio which is lower or equal to 1. In what follows, we assume $AR \equiv 1$ and we study the impact of rescaling the risk-corrected spread by the sum of the currency weights.

According to our analysis, in the considered period, the maximum increase in the VA is 52 bps (UK, February 29, 2016), the maximum decrease is -24 bps (Bulgaria, January 31, 2018), see Figure 5. In Figure 5 we can also evaluate the effect of this modification in two EURO countries (Italy and Germany): the modification seems to have a small impact.

In Table 3 we analyze the effect of this change of the VA on discounting liabilities for five EURO countries. With the exception of Greece at the end of December 2015, we always obtain a gain for insurance companies with respect to the actual VA.

ES	GR	IT	PT	AT
December 31, 2015				
-0.3162	0.3062	-0.2874	-0.1633	-0.4637
December 31, 2016				
-0.5045	-0.5045	-0.4581	-0.2593	-0.7429
December 31, 2017				
-0.1589	-0.1589	-0.1442	-0.0812	-0.2350
December 31, 2018				
-0.8306	-0.8306	-0.7552	-0.4303	-1.2166

BE	IE	DE	FR	NL
December 31, 2015				
-0.3440	-0.3440	-0.5675	-0.4201	-0.4838
December 31, 2016				
-0.5493	-0.5493	-0.9111	-0.6723	-0.7757
December 31, 2017				
-0.1732	-0.1732	-0.2892	-0.2124	-0.2455
December 31, 2018				
-0.9034	-0.9034	-1.4869	-1.1019	-1.2682

Table 3: Adjustment accounting for the amount of fixed-income assets: discounted values of the liabilities (in millions). Difference between the discounted values exploiting the modified VA with the ones obtained with the standard VA.

6 Split of the VA between its function as a crisis and a permanent tool (Option 8)

In this section we deal with the hypothesis to split the VA as a permanent tool ($VA_{permanent}$) and a macro-economic VA (VA_{macro}). More precisely, the VA is computed according to Option 8 described in [4, Page 150]: according to [4, Method 1, Page 151, Section 2.493], the VA is defined as the sum of the macro and the permanent component; according to [4, Method 2, Page 153, Section 2.503], the VA is defined as the maximum between the two. The main difference is that Method 1 is based on the risk-corrected spread, while Method 2 builds on the spread.

In what follows, we analyze Method 2 and Approach 1, i.e., the permanent VA would be determined by combining Options 4, 5 and 6 [4, Page 156-157, Section 2.516]:

- Option 4: Adjustment accounting for amount of fixed-income assets and asset-liability duration mismatch undertaking specific VA, see Section 5 (without considering the duration mismatch component);
- Option 5: Adjustment accounting for the illiquidity of liabilities;
- Option 6: Risk correction calculated as a percentage of the spread, see Section 3.

According to Option 4:

$$VA_{permanent} = GAR_p \cdot AR_p \cdot \frac{SRC_{cu}}{w_{cu}^{gov} + w_{cu}^{corp}},$$

where

- $GAR_p = 65\%$ is the general application ratio,
- AR_p is chosen according to [4, Figure Illiquidity Application Ratios, page 126]. Notice that we do not consider the duration mismatch component of Option 4 due to the lack of data, therefore our AR_p only relies on Option 5,
- $SRC_{cu} = S_{cu} - RC_{cu}$, where S_{cu} is the currency spread and RC_{cu} is the risk correction computed as follows (Option 6):

$$\begin{aligned} S_{cu} &= w_{cu}^{gov} \max\{S_{cu}^{gov}, 0\} + w_{cu}^{corp} \max\{S_{cu}^{corp}, 0\}, \\ RC_{cu} &= w_{cu}^{gov} \max\{0.3\, S_{cu}^{gov}, 0\} + w_{cu}^{corp} \max\{0.5\, S_{cu}^{corp}, 0\}. \end{aligned}$$

Moreover, we have

$$VA_{macro} = GAR_m \cdot AR_m \max\{S_{co} - \overline{S_{co}} - corridor, 0\},$$

where

- $GAR_m = AR_m = 1$ [4, Section 2.524, page 158],
- $S_{co} = w_{co}^{gov} \max\{S_{co}^{gov}, 0\} + w_{co}^{corp} \max\{S_{co}^{corp}, 0\}$,
- $\overline{S_{co}}$ is the average spread over the past 36 months (we consider monthly data, and we deal with 3 years -and not with 5 years- for lack of data),
- corridor is a constant, equal to 0.2%.

In Table 4 we report the effect of these changes on the VA (denoted as "new VA") and on discounting liabilities at the end of December 2018 with different values for GAR_p (65% and 85%, see [4, page 173, section 2.4.6] for the option to modify the ratio) and for the corridor (0 and 0.2%). We also report the VA computed according to the regulation in force (denoted as "EIOPA VA"). We notice that VA_{macro} is larger than $VA_{permanent}$ only for Italy and Belgium, and only for Italy if the corridor is set to 0.2%, as proposed by Option 8. We recall that, due to lack of data, we are not considering the duration mismatch component of Option 4 in the AR_p.

Table 4 shows also that the VA_{macro} component seems to be higher for high rating countries with respect to low rating ones, with the exception of Italy.

Given that the VA_{macro} component builds on the moving average of the spread, to fully analyze its role we compute the VA considering the sample December 2014 (first date for which EIOPA provides the weights for the computation of the VA)-November 2019. The extension was possible using *corp* data from Refinitiv Datastream, instead of Bloomberg: the change of Data Provider results in negligible effects in the computation of the VA.

First of all, we compute

$$S_{co} - \overline{S_{co}},$$

Country	Date	EIOPA VA	VA_{macro}	$VA_{permanent}$	new VA	Liabilities Difference
GAR_p=0.65, corridor=0.2%						
ES	20181231	0.2400	0.0000	0.1334	0.1334	1.0208
GR	20181231	0.2400	0.0000	0.2312	0.2312	0.0838
IT	20181231	0.2400	0.2457	0.2015	0.2457	-0.0491
PT	20181231	0.2400	0.0000	0.2460	0.2460	-0.0295
AT	20181231	0.2400	0.0000	0.2193	0.2193	0.2890
BE	20181231	0.2400	0.0230	0.2104	0.2104	0.3064
IE	20181231	0.2400	0.0000	0.2104	0.2104	0.3064
DE	20181231	0.2400	0.0000	0.2282	0.2282	0.2014
FR	20181231	0.2400	0.0000	0.2164	0.2164	0.2991
NL	20181231	0.2400	0.0000	0.2193	0.2193	0.3013
GAR_p=0.65, corridor=0						
ES	20181231	0.2400	0.0321	0.1334	0.1334	1.0208
GR	20181231	0.2400	0.0348	0.2312	0.2312	0.0838
IT	20181231	0.2400	0.4457	0.2015	0.4457	-1.7551
PT	20181231	0.2400	0.0000	0.2460	0.2460	-0.0295
AT	20181231	0.2400	0.1010	0.2193	0.2193	0.2890
BE	20181231	0.2400	0.2230	0.2104	0.2230	0.1765
IE	20181231	0.2400	0.0381	0.2104	0.2104	0.3064
DE	20181231	0.2400	0.1318	0.2282	0.2282	0.2014
FR	20181231	0.2400	0.1835	0.2164	0.2164	0.2991
NL	20181231	0.2400	0.1529	0.2193	0.2193	0.3013
GAR_p=0.85, corridor=0.2%						
ES	20181231	0.2400	0.0000	0.1744	0.1744	0.6262
GR	20181231	0.2400	0.0000	0.3023	0.3023	-0.5900
IT	20181231	0.2400	0.2457	0.2636	0.2636	-0.2033
PT	20181231	0.2400	0.0000	0.3217	0.3217	-0.4001
AT	20181231	0.2400	0.0000	0.2868	0.2868	-0.6505
BE	20181231	0.2400	0.0230	0.2752	0.2752	-0.3631
IE	20181231	0.2400	0.0000	0.2752	0.2752	-0.3631
DE	20181231	0.2400	0.0000	0.2984	0.2984	-0.9919
FR	20181231	0.2400	0.0000	0.2829	0.2829	-0.5405
NL	20181231	0.2400	0.0000	0.2868	0.2868	-0.6782
GAR_p=0.85, corridor=0						
ES	20181231	0.2400	0.0321	0.1744	0.1744	0.6262
GR	20181231	0.2400	0.0348	0.3023	0.3023	-0.5900
IT	20181231	0.2400	0.4457	0.2636	0.4457	-1.7551
PT	20181231	0.2400	0.0000	0.3217	0.3217	-0.4001
AT	20181231	0.2400	0.1010	0.2868	0.2868	-0.6505
BE	20181231	0.2400	0.2230	0.2752	0.2752	-0.3631
IE	20181231	0.2400	0.0381	0.2752	0.2752	-0.3631
DE	20181231	0.2400	0.1318	0.2984	0.2984	-0.9919
FR	20181231	0.2400	0.1835	0.2829	0.2829	-0.5405
NL	20181231	0.2400	0.1529	0.2868	0.2868	-0.6782

Table 4: EIOPA VA and new VA computed exploiting the macro and permanent VA (in %). In the last column we report the difference between the discounted value of liabilities adopting the new VA with respect to the one obtained with the actual VA (EIOPA VA).

which plays an important role in the definition of VA_{macro}, considering a moving average of

	ES	GR	IT	PT	AT	BE	IE	DE	FR	NL
November 30, 2019										
5 years	-0.3010	-0.6553	-0.1294	-0.4209	-0.1056	0.0559	-0.0895	-0.1475	-0.0495	0.0352
4 years	-0.2441	-0.4304	-0.1354	-0.4008	-0.0792	0.0598	-0.0507	-0.1117	-0.0396	0.0532
3 years	-0.1351	-0.2151	-0.1516	-0.2558	-0.0180	0.0691	0.0127	-0.0495	-0.0161	0.0851
2 years	-0.0871	-0.2357	-0.2326	-0.1362	-0.0193	0.0404	0.0028	-0.0542	-0.0170	0.0505
December 31, 2018 (a)										
4 years	-0.0210	-0.2167	0.4378	-0.0478	0.0715	0.2080	-0.0068	0.0923	0.1681	0.1241
3 years	0.0396	0.0523	0.4319	-0.0429	0.1056	0.2205	0.0453	0.1366	0.1825	0.1551
2 years	0.1687	0.3222	0.4153	0.1359	0.1838	0.2438	0.1268	0.2100	0.2151	0.2062
December 31, 2018 (b)										
4 years	-0.0251	-0.2340	0.4450	-0.0503	0.0712	0.2107	-0.0088	0.0930	0.1712	0.1251
3 years	0.0325	0.0339	0.4459	-0.0489	0.1014	0.2233	0.0382	0.1328	0.1841	0.1535
2 years	0.1692	0.3303	0.4385	0.1210	0.1875	0.2525	0.1300	0.2161	0.2207	0.2132

Table 5: Analysis of the VA_{macro} component $S_{co} - \overline{S_{co}}$ (in percentage) for different lengths of the moving average window.

5, 4, 3 and 2 years.[3] In Table 5 we report the values computed at November 30, 2019 and December 31, 2018. We analyze the results obtained for the two dates, separately.

November 30, 2019. We notice that for all the countries and varying the window of the moving average, the values of $S_{co} - \overline{S_{co}}$ are smaller than the corridor (0.2%), and therefore $VA_{macro} = 0$. In general, increasing the length of the moving average window results in a smaller $S_{co} - \overline{S_{co}}$: in all cases, with the exception of Italy, the 5 years moving average case is smaller than the 2 years case. The exception is due to the financial instability of Italy during the last two years. Notice that $S_{co} - \overline{S_{co}}$ is always positive for Belgium and The Netherlands and it is negative and significantly low for Spain, Greece, Italy and Portugal compared to Germany and France. This result suggests that using $S_{co} - \overline{S_{co}}$ as the main building block for the VA_{macro} may lead to an unexpected outcome: the value of this difference for high rating countries is higher than for low rating countries.

December 31, 2018. In Table 5 we consider two cases: (a) the value of December 31, 2018 is included in the average (as done for November 30, 2019), (b) the value of December 31, 2018 is not included.[4] The two options do not affect the results. Italy exhibits the highest value (end of 2018 was a period of financial stress in Italy). We would like to stress the case of Greece: the difference $S_{co} - \overline{S_{co}}$ strongly depends on the window of the moving average. We guess that a risk corrected spread based on a (long) moving average may create some (un-wanted) distortions in case of a country that experienced a period of financial stress in the past.

To increase the window of the moving average in our analysis, e.g., five years also for December 31, 2018, one possibility is to freeze the weights of the reference portfolios, in order to consider periods before December 2014 date. To understand if this approach is viable, in Table 6 we report the same results of the first part of Table 5, but we freeze the weights of the reference portfolios to November 30, 2019. The two tables exhibit significant differences,

[3]The 5 years case is available only for November 30, 2019.

[4]Case (b) is aligned with what we have done in the analysis developed above.

	ES	GR	IT	PT	AT	BE	IE	DE	FR	NL
					November 30, 2019					
5 years	-0.1046	-1.3851	-0.0366	-0.2177	-0.0416	-0.0262	-0.0201	-0.0173	-0.0183	-0.0246
4 years	-0.0782	-1.0496	-0.0623	-0.2089	-0.0276	-0.0083	-0.0144	0.0008	-0.0068	-0.0049
3 years	-0.0291	-0.7028	-0.1007	-0.0968	0.0048	0.0237	0.0025	0.0347	0.0183	0.0303
2 years	-0.0265	-0.4485	-0.1795	-0.0348	-0.0041	0.0100	-0.0186	0.0331	0.0071	0.0049

Table 6: Analysis of the VA_{macro} component $S_{co} - \overline{S_{co}}$ (in percentage) for different lengths of the moving average period. Weights are freezed at November 30, 2019.

therefore the choice of freezing weights does not seem to be suitable.

Building on these results associated to a risk correction based on the moving average of spread, we investigate some possibilities to modify

$$S_{co} - \overline{S_{co}},$$

as

$$S_{co} - RC_{co},$$

where:
(I) $RC_{co} = w_{co}^{gov} \max\{0.3\, S_{co}^{gov}, 0\} + w_{co}^{corp} \max\{0.5\, S_{co}^{corp}, 0\}$
(II) $RC_{co} = w_{co}^{gov} \max\{RC_{co}^{gov}, 0\} + w_{co}^{corp} \max\{RC_{co}^{corp}, 0\}$.

(I) mimics what happens for the $VA_{permanent}$, while (II) mimics the actual VA mechanism. The analysis on the performance of the two options (at the currency level) is provided in Section 3. In what follows, the focus is their capability to provide a risk correction with respect to the moving average approach.

We also consider the case in which we normalize the weights to one, as it is done in the *currency* component, i.e.,

$$\frac{S_{co} - RC_{co}}{w_{co}^{gov} + w_{co}^{corp}}.$$

We denote by (Ia) and (IIa) the normalized case with the two different definitions of Risk Correction. In Table 7 we report the results.

As expected, confirming what is obtained in Section 5, we observe that using normalized weights results in an increase of the risk corrected spread ($S_{co} - RC_{co}$). The values related to both risk corrections are higher than those obtained in the moving average case. Notice that the risk corrected spread for low rating countries is now higher than for high rating countries. Therefore, the "actual" risk correction mechanism seems to perform a better job than the moving average one in addressing potential contagion/illiquidity of low rating countries.

References

[1] E. Barucci, D. Marazzina, and E. Rroji (2019) An investigation of the Volatility Adjustment, mimeo.

	ES	GR	IT	PT	AT	BE	IE	DE	FR	NL
	November 30, 2019									
I	0.2708	0.4077	0.4610	0.3097	0.1613	0.1830	0.1244	0.1348	0.1533	0.1946
II	0.1905	0.0288	0.4645	0.1218	0.0956	0.1391	0.0677	0.1363	0.1013	0.1689
Ia	0.3782	0.5358	0.6429	0.3946	0.2548	0.2248	0.2186	0.1982	0.2235	0.2654
IIa	0.2660	0.0379	0.6479	0.1552	0.1511	0.1708	0.1189	0.2004	0.1477	0.2304
	December 31, 2018									
I	0.4813	0.7496	0.8123	0.5415	0.2586	0.2611	0.1678	0.2669	0.2687	0.2328
II	0.5017	0.5575	0.9811	0.3341	0.2767	0.2946	0.1782	0.2583	0.3059	0.2670
Ia	0.6235	1.0103	1.0860	0.6898	0.4028	0.3123	0.2918	0.3808	0.3790	0.3229
IIa	0.6498	0.7514	1.3116	0.4256	0.4309	0.3523	0.3100	0.3685	0.4314	0.3703

Table 7: Analysis of the VA_{macro} component $S_{co} - RC_{co}$ (in percentage).

[2] European Insurance and Occupational Pensions Authority (2017) Report on long-term guarantees measures and measures of equity risk 2017.

[3] European Insurance and Occupational Pensions Authority (2018) Report on long-term guarantees measures and measures of equity risk 2018.

[4] European Insurance and Occupational Pensions Authority (2019) Consultation paper on the Opinion on the 2020 review of Solvency II.

A Notation

The regulation in force assume that the VA is made up of two components: the currency VA (VA_{cu}) and the country VA (VA_{co}). The first component is defined as:

$$VA_{cu} = 65\% SRC_{cu},$$

where SRC_{cu} is the risk-corrected currency spread which is given by

$$SRC_{cu} = S_{cu} - RC_{cu},$$

with S_{cu} being the currency spread and RC_{cu} the risk correction computed according to the reference portfolio associated with the currency, i.e.,

$$S_{cu} = w_{cu}^{gov} \max\{S_{cu}^{gov}, 0\} + w_{cu}^{corp} \max\{S_{cu}^{corp}, 0\}, \quad (4)$$

$$RC_{cu} = w_{cu}^{gov} \max\{RC_{cu}^{gov}, 0\} + w_{cu}^{corp} \max\{RC_{cu}^{corp}, 0\}. \quad (5)$$

The variables at currency level are as follows:

- w_{cu}^{gov} denotes the weight of the value of government bonds included in the reference portfolio for that currency;

- w_{cu}^{corp} denotes the weight of the value of bonds other than government bonds, loans and securitisations included in the reference portfolio for that currency;
- S_{cu}^{gov} denotes the average spread of government bonds, loans and securitisations included in the reference portfolio for that currency;
- S_{cu}^{corp} denotes the average spread of bonds other than government bonds, loans and securitisations included in the reference portfolio for that currency;
- RC_{cu}^{gov} denotes the risk correction of government bonds included in the reference portfolio for that currency;
- RC_{cu}^{corp} denotes the risk correction of bonds other than government bonds, loans and securitisations included in the reference portfolio for that currency.

The VA_{co} is computed as:

$$VA_{co} = 65\% \max\{SRC_{co} - 2SRC_{cu}, 0\}. \tag{6}$$

where the risk-corrected country spread SRC_{co} is defined as in the currency case for a country specific reference portfolio, i.e.

$$SRC_{co} = S_{co} - RC_{co},$$

with S_{co} being the country spread and RC_{co} the risk correction computed according to the reference portfolio associated with the country

$$\begin{aligned} S_{co} &= w_{co}^{gov} \max\{S_{co}^{gov}, 0\} + w_{co}^{corp} \max\{S_{co}^{corp}, 0\}, \\ RC_{co} &= w_{co}^{gov} \max\{RC_{co}^{gov}, 0\} + w_{co}^{corp} \max\{RC_{co}^{corp}, 0\}. \end{aligned}$$

Therefore

- VA_{cu} (VA_{co}) is the currency (country) VA,
- SRC_{cu} (SRC_{co}) is the currency (country) risk-corrected spread,
- S_{cu} (S_{co}) is the currency (country) spread,
- RC_{cu} (RC_{co}) is the currency (country) risk correction.