

EBA/CP/2019/03  
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## Consultation Paper

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Draft Regulatory Technical Standards on mapping of derivative transactions to risk categories, on supervisory delta formula for interest rate options and on determination of long or short positions in the Standardised Approach for Counterparty Credit Risk under Article 277(5) and Article 279a(3) of proposed amended Regulation (EU) No 575/2013 (Capital Requirements Regulation 2 - CRR2)

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# 1. Responding to this consultation

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The EBA invites comments on all proposals put forward in this paper and in particular on the specific questions summarised in 5.2.

Comments are most helpful if they:

- respond to the question stated;
- indicate the specific point to which a comment relates;
- contain a clear rationale;
- provide evidence to support the views expressed/ rationale proposed; and
- describe any alternative regulatory choices the EBA should consider.

## Submission of responses

To submit your comments, click on the 'send your comments' button on the consultation page by **dd.mm.yyyy**. Please note that comments submitted after this deadline, or submitted via other means may not be processed.

## Publication of responses

Please clearly indicate in the consultation form if you wish your comments to be disclosed or to be treated as confidential. A confidential response may be requested from us in accordance with the EBA's rules on public access to documents. We may consult you if we receive such a request. Any decision we make not to disclose the response is reviewable by the EBA's Board of Appeal and the European Ombudsman.

## Data protection

The protection of individuals with regard to the processing of personal data by the EBA is based on Regulation (EC) N° 45/2001 of the European Parliament and of the Council of 18 December 2000 as implemented by the EBA in its implementing rules adopted by its Management Board. Further information on data protection can be found under the Legal notice section of the EBA website.

## 2. Executive Summary

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The proposed draft amendments to Regulation (EU) No 575/2013<sup>1</sup> (the Capital Requirements Regulation 2 – CRR2) implement in EU legislation, *inter alia*, the revised Standardised Approach for Counterparty credit risk (SA-CCR).

The EBA has developed these draft RTS based on the proposed legislative text for the CRR2<sup>1</sup>. To the extent that the proposed text changes in the run-up to its final adoption, the EBA may need to adapt the draft accordingly. The EBA may also introduce other changes into the draft RTS in order to appropriately reflect comments received, including in response to this consultation paper.

The exposures under the SA-CCR consist of two components: replacement cost (RC) and potential future exposure (PFE). One of the key steps in determining the counterparty credit risk own funds requirements under the SA-CCR is computing an add-on, which is part of the PFE and specific for each risk category.

The mapping of each derivative transaction to one or more of the risk categories is set out in Article 277 therein. This mapping, which is a novelty compared to the current version of the Capital Requirements Regulation (CRR), is to be done on the basis of the material risk drivers of each derivative transaction.

CRR2 entrusts the EBA with the drafting of regulatory technical standards specifying the method for identifying those material risk drivers. Building on the approach proposed in the Discussion Paper on the implementation in the European Union of the revised market risk and counterparty credit risk frameworks<sup>2</sup> published on 18 December 2017, the EBA is proposing, in this consultation paper (CP), a three-pronged approach for the assignment of a derivative transaction to a risk category:

- **First approach: a qualitative approach** identifying derivative transactions that have clearly only one material risk driver, thus easily being mapped to the corresponding risk category; this approach is based on a simple criterion to be satisfied and is meant to provide proportionality in the assessment, in the sense of rendering the mapping of ‘simple’ derivative transactions straightforward and without requiring the computation (and comparison) of sensitivities. This first approach is expected to provide the mapping for the majority of transactions.
- **Second approach: a qualitative and quantitative approach** requiring a more detailed assessment of, and applicable to, those derivative transactions for which the mapping cannot immediately be done on the basis of the first approach. Under this approach, after the qualitative identification of all the risk drivers of the derivative transaction and an assessment

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<sup>1</sup> [http://www.europarl.europa.eu/doceo/document/TA-8-2019-0369\\_EN.pdf](http://www.europarl.europa.eu/doceo/document/TA-8-2019-0369_EN.pdf)

<sup>2</sup>

<https://www.eba.europa.eu/documents/10180/37073/Discussion+Paper+on+EU+implementation+of+MKR+and+CCR+revised+standards+%28EBA-DP-2017-04%29.pdf/a5f47920-54be-4b68-a25c-119c70606186>

of their materiality to identify material risk drivers, institutions have to use quantitative inputs, typically sensitivities. Ultimately, this assessment leads to the mapping of the transaction to one or more than one risk category, reflecting the material risk driver(s).

- **Third approach: a fallback approach**, in case the assessment performed in accordance with the second approach does not allow to determine which of the risk drivers are material, institutions are required to simply allocate the derivative transaction to all the risk categories corresponding to all the risk drivers (material or not) of the transaction.

The methodology for calculating the add-ons for each risk category also allows for partial or full offsetting, which is recognised when transactions within a single netting set depend on the same or similar risk drivers. For reflecting the dependence of transactions on risk drivers, institutions need to compute a supervisory delta, which is determined according to the direction (long or short) and type (option, CDO tranche or neither of the two) of the position.

Article 279a(3) requests the EBA to draft regulatory technical standards specifying:

- **The formula that institutions shall use to calculate the supervisory delta of options**, when mapped to the interest rate risk category, which is compatible with negative interest rates; and
- **The method for determining whether a transaction represents a long or short position** in a material risk driver.

Considering that the supervisory delta formula is already provided for call and put options, the consultation paper (CP) focuses on adjustments that allow situations of negative interest rates to be reflected without fundamentally changing the formula.

In the Discussion Paper, the EBA proposed to allow the use of a  $\lambda$  shift in the context of the Black-Scholes formula to move the interest rate into positive territory.

Finally, the EBA is specifying within the present CP a method suitable for determining the direction of the position in a material risk driver, in accordance with the definition provided in the CRR2.

## 3. Background and rationale

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1. The new Standardised Approach for Counterparty Credit Risk (SA-CCR) was adopted by the BCBS<sup>3</sup> in March 2014 and is intended to replace all non-internal model approaches (i.e. the Current Exposure Method (CEM) and the Standardised Method) for measuring the exposure at default (EAD) for counterparty credit risk in the Basel framework.
2. In November 2016 the European Commission issued a legislative proposal on revisions to Regulation (EU) No 575/2013<sup>1</sup> (the Capital Requirements Regulation 2 – CRR2), which implements in EU legislation, *inter alia*, the SA-CCR. The CRR2 proposal is currently being debated by the EU legislators (the Council and the European Parliament) in the framework of the co-decision procedure.
3. In anticipation of the finalisation of the legislative text for the CRR2, the EBA has developed this draft RTS in accordance with the mandate contained in Article 277(5)(a), Article 277(5)(b), Article 279a(3)(a) and Article 279a(3)(b) of the CRR2 proposal.
4. The EBA may need to adapt the draft RTS in accordance with the final version of the CRR2 text before submitting it to the European Commission for adoption. The EBA may also wish to introduce other changes into the draft text in order to appropriately reflect comments received from interested stakeholders, including in response to this consultation paper.
5. Under the SA-CCR, the EAD is given by the sum of two components, the replacement cost (RC) and the potential future exposure (PFE), multiplied by a supervisory multiplier, alpha. The PFE measures the potential change in the transaction value over a 1-year horizon. The PFE is composed of two elements: a multiplier, which allows the partial recognition of excess collateral, and an aggregated add-on component, developed for each broad risk category considered under the SA-CCR.
6. One of the parameters used in the computation of the add-on component is the supervisory delta. Specific formulae are provided for options and tranches of synthetic securitization. For all other transactions, the supervisory delta is  $\pm 1$ , depending whether the transaction is long or short in the primary risk driver.
7. The CRR2 proposal is consistent with the BCBS one and proposes the same five risk categories proposed in the Basel standards: interest rate risk, foreign exchange risk, credit risk, equity risk and commodity risk. In addition, it proposes a sixth risk category in order to take into account ‘other risks’.
8. One of the key steps for computing each risk category add-on as part of the PFE calculation is the mapping of each derivative transaction to one or more of the risk categories that are set out in the

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<sup>3</sup> <https://www.bis.org/publ/bcbs279.pdf>

CRR2 proposal. This mapping is done based on the primary risk driver of each derivative transaction, where it exists, or on material risk drivers if there are several.

9. Although most derivatives have one obvious risk driver (e.g. interest rates for interest rates swaps (IRS), foreign exchange (FX) for FX options, credit rating of the reference entity for credit derivatives), more complex derivatives may have more than one risk driver. Consistent with this, the Basel standard on the SA-CCR states that, ‘When this primary risk driver is clearly identifiable, the transaction will fall into one of the asset classes described above’ (paragraph 151) while ‘For more complex trades that may have more than one risk driver (e.g. multi-asset or hybrid derivatives), banks must take sensitivities and volatility of the underlying into account for determining the primary risk driver’ (paragraph 152).
10. Other than these general principles, however, the Basel standard does not provide any specific methodology for the mapping of transactions to one or more than one risk category. As a result, the CRR2 proposal entrusts the EBA with devising a methodology for the allocation of derivative transactions (trading book and non-trading book derivative transactions) to one or more risk categories, depending on either the primary risk driver or the material/most material risk driver(s).
11. On 18 December 2017 the EBA published for consultation a Discussion Paper on the implementation in the EU of the revised market risk and counterparty credit risk frameworks. The paper discussed some of the most important technical and operational challenges to implement the FRTB and SA-CCR in the EU. The mapping of derivative transactions to risk categories was one of the topics of the DP. Some preliminary views on how to address possible implementation issues were collected, together with early feedback from the stakeholders on the proposals.

## General approach for mapping transactions to risk categories

12. Many derivative transactions have a single risk driver (disregarding interest rates for the purpose of discounting), defined by its reference underlying instrument (e.g. a tenor of an interest rate curve for an interest rate swap), or several risk drivers referring unambiguously to the same risk category. This provides a straightforward basis for the mapping of those transactions to the relevant risk category consistently with the CRR2 proposal. In other words, for all the plain vanilla products that are driven by a single risk driver (or several risk drivers referring unambiguously to a single risk category), the single risk category could be directly identified.
13. In this context, it should be noted that ‘complex product’ does not necessarily mean complex allocation to risk categories. Some bespoke structured products might be sophisticated but still be related to a single risk category. The definition of a certain criterion, suitable for triggering an immediate mapping, is referred to henceforth as approach 1.
14. In the event that a unique material risk driver cannot be clearly identified, a methodology will be triggered to determine the material risk drivers of the transaction. This methodology is either ‘qualitative’ or ‘quantitative’: based on a decision-tree leading to the relevant material risk factor(s) or following a particular algorithm using pre-specified data from the transactions. From a theoretical point of view, a quantitative method is deemed more appropriate, as it enforces an impartial treatment, homogeneous across Institutions. Such a method is based on sensitivities.

However, it should be noted that sensitivities may not be available for all transactions. This is referred to henceforth as approach 2.

15. In any case, a fallback approach should be available for cases where the identification of the most material risk drivers is either impossible or too burdensome. This is referred to henceforth as approach 3.

16. As a result, it is envisaged to specify an allocation process structured along the three following approaches:

- First, where the allocation is straightforward, refer to a simple criterion identifying all the instruments with only one material risk driver.
- Then, where allocation is not straightforward, assess the derivative transaction in more detail based on a quantitative approach (using sensitivities), to determine which risk drivers are material, including the most material of these risk drivers.
- Finally, if the assessment in the second step does not make it possible to conclude which of the risk drivers are the material ones, including the most material of these risk drivers, the fallback treatment consists in the allocation of the derivative transaction to each of the risk categories corresponding to all its risk drivers.

### Approach 1

17. For those derivatives whose features allow the relevant risk category to be easily identified, it is possible to envisage a quasi-automatic approach, based on a list that matches the risk category, the primary risk driver and the transaction type. This allows for each transaction to be mapped to the relevant risk category without triggering any materiality assessment but simply by considering the features of the transaction.

18. Such a qualitative approach can at the same time:

- provide (ex-ante) clarity for banks, given that every bank would know the treatment applicable to instruments which satisfy a simple criterion;
- limit the overall operational cost of the use of the SA-CCR.

19. The only material risk driver has to be determined at a level of granularity that also allows allocation of the transaction to the appropriate hedging set as set out in Article 277a of the CRR2 proposal.

20. In Table 1 a list of simple derivatives for the assessment is outlined. Following the feedback received during the consultation on the DP, a slight modification of the statement of the relevant criterion allows to automatically include many derivatives that were highlighted by respondents as clearly dependent on a unique material risk driver (e.g. inflation swaps, commodity swaps, dividend swaps, FX fader options and FX target redemption forwards).



21. Under approach 1, discounting is disregarded as a potential risk driver, given that the presumption behind the approach is that the transactions in scope should not materially depend on the discount rate. However, under approach 2 or 3, discounting should be considered as a possible risk driver.

Table 1: List for the mapping of instruments to the risk category

Risk category	Risk driver	Relevant criteria and examples
Interest rate	Interest rate curve in the respective currency	Instruments whose cash flows depend only on interest rates or inflation. E.g.: IR swap; IR future; floating rate agreement; if underlyings are in the same currency as the settlement currency
Foreign exchange	Foreign exchange rate of the respective currency pair	Instruments whose cash flows depend only on FX rates. E.g.: FX forward; FX future; FX swap;
Equity	Equity prices and payouts	Instruments whose cash flows depend only on equity prices and dividends. E.g.: Equity future; equity index future; equity forward; equity swap; if underlyings are in the same currency as the settlement currency
Credit	Reference entity	Instruments whose cash flows depend only on credit quality or spreads. E.g.: CDS single name or index; if underlyings are in the same currency as the settlement currency
Commodities	Commodity price with respect to the relevant commodity type (i.e. energy, metals, agricultural goods, climatic conditions and other commodities)	Instruments whose cash flows depend only on commodities. E.g.: Commodity future; commodity forward; if underlyings are in the same currency as the settlement currency

## Approach 2

22. Transactions that have not been identified under approach 1 are presumed to have more than one material risk driver, thus leading to a more detailed assessment of the risk drivers of a transaction, including their materiality.

23. This requires:

- first, the qualitative and exhaustive identification of all the risk drivers of the transaction;
- second, the assessment of the materiality of each risk driver of the transaction, leading to the identification of the material risk drivers of the transaction;
- finally, the identification of the most material among these material risk drivers.

24. In other words, after identification of all the risk drivers of the derivative transaction and assessment of the material ones, institutions need to map the transaction to each risk category for which they have identified at least one material risk driver. The identification of the most material risk driver is essentially relevant for the sub-allocation to certain hedging sets (e.g. interest rate, FX, commodities), as the most material risk driver per risk category will be considered the 'primary risk driver' for the purposes of the allocation of the derivative transaction to hedging sets under Article 277a of the CRR2 proposal.

25. The quantitative methodology proposed hereafter is based on the computation of the sensitivities of each risk driver related to the specific transaction. Sensitivities are, then, compared with each other in a consistent fashion, i.e. considering aspects that could bias the assessment.

26. Besides sensitivities, the volatility of the underlying instruments, explicitly mentioned as a potential criterion in the BCBS standard, can also be accounted for in determining the materiality of multiple risk drivers. In particular, it is not necessarily the risk category associated with the highest sensitivity that would lead to the highest exposure under the SA-CCR calculation.

27. Among the four proposals put forward on the DP with regard to possible quantitative methodologies that could be used, a clear preference emerged from the feedback to the DP for Option 2, i.e. assessing the materiality of risk drivers using an indicator that considers jointly sensitivity and volatility. In addition, according to the feedback received in the DP, sensitivities could be used in conjunction with either FRTB SA risk weights or SA CCR risk weights, i.e. parameters that account for the expected volatility of the underlying risk category.

28. The proposed methodology develops, considering all the aforementioned features, a multistep approach whereby first all the sensitivities of an instrument are computed, then ranked in terms of relative relevance, with only those that are deemed to be material being finally selected (i.e. most relevant to the total). In particular, the following steps are envisaged:

- 1) Compute <sup>4</sup> all the  $n$  sensitivities  $(s_i)_{i=1}^n$ , multiply them with the corresponding risk weights  $(s_i * RW_i)_{i=1}^n$  and aggregate them in the corresponding risk category  $rc_k$ .
- 2) Rank the results obtained from the previous step  $(rc_k)_{k=1}^6$ , from the greatest to the smallest in absolute terms, to obtain a monotonic decreasing sequence of entries  $(a_k)_{k=1}^6$ , where  $a_1 = \max(|rc_1|, \dots, |rc_6|)$  i.e. the greatest absolute term,  $a_2$  is the second greatest term and so on<sup>5</sup>.
- 3) Starting from  $a_1$ , i.e. from the greatest absolute value, for each  $a_i$  compute  $\frac{\sum_{j=1}^i a_j}{\sum_{k=1}^6 a_k}$  and check if

$$3i) \frac{\sum_{j=1}^i a_j}{\sum_{k=1}^6 a_k} < Y\% .$$

In the case the condition is verified, then allocate the trade to the risk category of  $a_i$ , as risk drivers belonging to that category are assessed to be material, and repeat point 3) for the element  $a_{i+1}$ . Otherwise, the material risk drivers are the ones included in  $a_1, \dots, a_{i+1}$  and no further analysis for elements  $a_{i+2}, \dots, a_6$  is required.

However, it has been considered that, with the 50% or 60% thresholds, some risk categories for which a derivative transaction has relatively high sensitivities could be neglected. Consider the example of a transaction where there are two relevant risk categories, one accounting for the 61% of the aggregate sensitivities, the other for the remaining 39%: under either  $Y\%=50\%$  or  $Y\%=60\%$ , the second category would be deemed as not material. The application of an additional threshold could overcome problems arising in these types of situations. In particular, institutions could be required to consider material, on top of the abovementioned  $a_1, \dots, a_{i+1}$  risk categories, each additional risk category that represents a significant share ( $Z\%$ ) of the aggregate sensitivities, i.e. for each of the elements  $a_{i+2}, \dots, a_6$  institutions should compute  $\frac{a_i}{\sum_{k=1}^6 a_k}$  and the following additional condition should be verified

$$3ii) \frac{a_i}{\sum_{k=1}^6 a_k} \geq Z\% .$$

Institutions should additionally allocate the trade to the risk categories excluded in point 3i) but for which condition 3ii) is verified, as risk drivers belonging to those categories are assessed to be material too.

<sup>4</sup> Sensitivities, risk weights and aggregation functions should be the ones specified in art. 325s and 325u of the CRR2 proposal, i.e. FRTB SA framework (exclusively delta risk sensitivities, as defined in art. 325s).

<sup>5</sup> From a mathematical point of view, it can be defined as  $a_1 = \max(|rc_1|, \dots, |rc_6|)$  and

$$a_i = \begin{cases} \max_{|rc_j| < a_{i-1}} (|rc_1|, \dots, |rc_6|) & \text{if } \#\{j: |rc_j| < a_{i-1}, j = 1, \dots, 6\} = 6 - i \\ a_{i-1} & \text{otherwise} \end{cases} \quad \text{for } i = 2, \dots, 6.$$

The levels of the thresholds  $Y\%$  and  $Z\%$  are chosen considering that a less conservative condition in 3i) (i.e.  $Y\% = 50\%$ ) can be counterbalanced by a more stringent condition in 3ii) ( $Z\% = 25\%$ ) and vice versa (i.e.  $Y\% = 60\%$  and  $Z\% = 30\%$ ).

$Y\% = 50\%$  and  $Z\% = 25\%$  (option 1a)

$Y\% = 60\%$  and  $Z\% = 30\%$  (option 1b)

The most material risk driver for each risk category identified above is the one corresponding to the greatest absolute risk weighted sensitivity, i.e.  $\max(|s_1 * RW_1|, \dots, |s_{n_k} * RW_{n_k}|)$ .

29. In addition to the consideration made in paragraph 27, another possible quantitative methodology that is potentially suitable for this purpose involves the use of SA-CCR add-ons for assessing the materiality of each risk category. In particular, institutions can compute SA-CCR add-ons for each risk category of the risk drivers affecting the transaction and compare them against their sum. The first step of the sequence would then read as follows:

“1) Compute the SA-CCR add-ons for each risk category of the risk drivers affecting the transaction  $rc_k$ . (option 2)”

30. This alternative presents the advantage of being coherent with the SA-CCR framework and potentially more suitable for banks that do not use FRTB but do apply SA-CCR, for which computing FRTB SA sensitivities may entail a disproportionate burden. Therefore, the EBA requests feedback about leaving the possibility for banks exempted from using FRTB SA to use SA-CCR add-ons computation in step 1). In the case an institution chooses the SA-CCR add-ons alternative in step 1), this treatment should be the same for all transactions within the scope of SA-CCR framework.

### Approach 3

31. As explained above, a fallback qualitative approach would be needed for cases where approach 2 cannot be applied (for example where sensitivities are not available). This approach being by definition simplistic, it is expected to be more conservative than steps 1 and 2. These goals can be met by simply assessing that all identified risk drivers are deemed material, thus triggering the mapping to the related risk categories.

32. The most material risk driver for each risk category is the one corresponding to the greatest resulting add-on component.

## Supervisory delta formula for interest rate risk category

33. Once the derivative transaction is mapped to risk categories, then institutions make a supervisory delta adjustment to the trade adjusted notional amount, in order to reflect the direction of the transaction and its non-linearity. The direction of the position in the primary risk factor (long/short) and the type of derivative transaction (whether the trade is linear, an option or a CDO tranche) determine the sign and magnitude of the supervisory delta. The supervisory delta formula is already provided in the CRR2 for call and put options:

$$\delta = \text{sign} \cdot N \left( \text{type} \cdot \frac{\ln\left(\frac{P}{K}\right) + 0.5 \cdot \sigma^2 \cdot T}{\sigma \cdot \sqrt{T}} \right)$$

34. The present discussion focuses on adjustments that allow situations of negative interest rates to be reflected without fundamentally changing the formula above. This excludes, in particular, reverting to a normal distribution or using FRTB SA sensitivities, which represent the change in the market value of an instrument as a result of a regulatory pre-defined shift for the corresponding risk driver.

35. Considering also industry experience, acquired as the market had to adjust to negative interest rates, it is proposed to add a  $\lambda$  shift in the regulatory formula, affecting both the price value and the strike value, so that the ratio  $\frac{(P + \lambda)}{(K + \lambda)}$  is moved back into positive territory. In this context,  $\lambda$  represents the presumed lowest possible extent to which interest rates in the respective currency can become negative.

36. The same  $\lambda$  parameter should be used consistently for all interest rate options in the same currency  $i$ ; it is intrinsically dependent on the level of interest rates in a jurisdiction, therefore it is jurisdiction-specific. In addition, the  $\lambda$  parameter should be set as low as possible.

37. Therefore, the supervisory delta formula for call and put options would become, depending on whether they are bought or sold:

Table 2: Adjusted supervisory delta formula for bought/sold call/put options

Supervisory delta	Bought	Sold
Call options	$+N \cdot \left( + \frac{\ln\left(\frac{P_j + \lambda_i}{K_j + \lambda_i}\right) + 0.5 \cdot \sigma_j'^2 \cdot T_j}{\sigma_j' \cdot \sqrt{T_j}} \right)$	$-N \cdot \left( + \frac{\ln\left(\frac{P_j + \lambda_i}{K_j + \lambda_i}\right) + 0.5 \cdot \sigma_j'^2 \cdot T_j}{\sigma_j' \cdot \sqrt{T_j}} \right)$
Put options	$-N \cdot \left( - \frac{\ln\left(\frac{P_j + \lambda_i}{K_j + \lambda_i}\right) + 0.5 \cdot \sigma_j'^2 \cdot T_j}{\sigma_j' \cdot \sqrt{T_j}} \right)$	$+N \cdot \left( - \frac{\ln\left(\frac{P_j + \lambda_i}{K_j + \lambda_i}\right) + 0.5 \cdot \sigma_j'^2 \cdot T_j}{\sigma_j' \cdot \sqrt{T_j}} \right)$

38. In the feedback from the consultation to the Discussion Paper, some respondents suggested that the parameter  $\sigma$  may have to be adjusted, in the sense that it should take into account the bias that the shift  $\lambda$  introduces to the formula for the supervisory delta. On the one hand, the introduction of a shift  $\lambda$  slightly changes the assumptions underpinning the model (i.e.  $P_j + \lambda_i$  is lognormally distributed, instead of  $P_j$ ). On the other hand the need for an adjustment should be assessed with respect to the impact of the distortion introduced, i.e. only in the case where the materiality of the distortion is relevant (see section 5.1 for a more detailed discussion).

39. By nature,  $\lambda$  is expected to change, reflecting movements in interest rates in a jurisdiction, and to progressively reach its lower bound, zero, while interest rates are moving back into positive territory. However, in order to promote consistency in the implementation across the EU, the EBA considers that the regulation should specify criteria for the application of the  $\lambda$  shift.
40. One option would allow banks, via these EBA draft RTS, to reflect available market data for the  $\lambda$  parameter (option 5), i.e. the  $\lambda$  values that are quoted on the relevant markets; In that case, the  $\lambda$  value would be automatically adjusted by the market for the relevant jurisdiction.
41. It is necessary, however, to ensure that available market data for the  $\lambda$  value represents an appropriate displacement for the bank. The displacement must be sufficiently large to move back into positive territory even the lowest spot or forward rate that can be included in the calculation. However, it should not be excessively large, avoiding possible biased results.
42. Example of maximum market values for the  $\lambda$  parameter (retrieved from data provider, as reported in section 5.1) are reported in Table 3 below. These possible values for the  $\lambda$  parameter take into consideration both the current level of interest rates in each jurisdiction, as well as the volatility observed in the market for the same interest rates. These values are the ones that can be presumably used if banks are allowed to reflect the market convention on the  $\lambda$  parameter.

Table 3: Example of maximum market values for the  $\lambda$  parameter (as provided on 31 May 2018 by ICAP\Bloomberg)

Currency	$\lambda$
Euro	3%
GBP	2%
CHF	2%
JPY	1%
SEK	3%
DKK	3%

43. In the feedback received, an alternative solution was proposed: to set  $\lambda_i$  such that a certain threshold on the smallest (i.e. more negative) term between  $P_j + \lambda_i$  and  $K_j + \lambda_i$  is not crossed. In this sense, a possible formula for  $\lambda$  could be:

$$\lambda_i = \max(\text{threshold} - \min(P_j, K_j), 0)$$

- where  $\text{threshold} =$
- 1 bp (option 4a)
  - 0.1% (option 4b)
  - 1% (option 4c)

## Determination of long and short position in a material risk driver

44. The CRR2 provides a definition of long or short position in the primary risk driver. A methodology for the assessment of which definition applies (long or short) in specific cases should be provided.

45. The EBA believes that institutions should build on the same elements (i.e. cash flows and sensitivities) used for the materiality assessment of risk drivers, also in the determination of the direction of the position in that particular risk driver (long or short).

## 4. Draft regulatory technical standards on mapping of derivative transactions to risk categories, on supervisory delta formula for interest rate options and on determination of long or short positions in the Standardised Approach for Counterparty Credit Risk under Article 277(5)(a), Article 277(5)(b), Article 279a(3)(a) and Article 279a(3)(b) of proposed amended Regulation (EU) No 575/2013 (Capital Requirements Regulation 2 - CRR2)

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In between the text of the draft RTS that follows, further explanations on specific aspects of the proposed text are occasionally provided, which either offer examples or provide the rationale behind a provision, or set out specific questions for the consultation process. Where this is the case, this explanatory text appears in a framed text box.



**COMMISSION DELEGATED REGULATION (EU) No .../..**

of **XXX**

[...]

**supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards for the mapping of derivative transactions to risk categories, for the supervisory delta formula for interest rate options and for the determination of long or short positions in the Standardised Approach for Counterparty Credit Risk under Article 277(5) and Article 279a(3)**

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EU) No 575/2013 of 26 June 2013 of the European Parliament and of the Council on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012<sup>6</sup>, and in particular the third subparagraph of Article 277(5) and the third subparagraph of Article 279a(3) thereof,

Whereas:

- (1) The method for identifying derivative transactions with only one material risk driver, pursuant to Article 277(5)(a) of Regulation (EU) No 575/2013, for the purpose of mapping those derivative transactions to the relevant risk category, should be rendered simple for all cases where the primary and only material risk driver of the transaction is immediately discernible from the nature of the transaction. Thus, for example, in the case of interest rate swaps, interest rate futures or floating rate agreements, where the underlyings are in the same currency as the settlement currency, the cash flows of these instruments depend only on the interest rates relating to that currency. As a result, the primary risk driver for such type of transactions is clearly linked with the interest rate curve in the respective currency. Similarly for all other risk categories referred to in Article 277(1) of that Regulation: transactions should be mapped to them on the basis of whether the cash flows of that transaction depend exclusively on any one of these risk drivers. Obviously, with regard to foreign exchange forwards, foreign exchange futures and foreign exchange swaps, instead, given the nature of the transactions where the settlements relate to more than one underlying currencies, the cash flow of such transactions depends primarily on foreign exchange risk driver.

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<sup>6</sup> OJ L 176, 27.6.2013, p. 1.

- (2) Where a transaction has more than one material risk driver, with those material risk drivers referring to different risk categories, the method for identifying transactions with more than one material risk driver and for identifying the most material of those risk drivers pursuant to Article 277(5)(b) should take into account the sensitivities and the volatility of the underlying of the transaction in order to determine the primary risk driver.
- (3) With regard to those transactions, which appear to have more than one material risk driver referring to different risk categories, where it is not possible, even after taking into account sensitivities and the volatility of the underlying of the transaction, to conclude which of the risk drivers are the material ones, institutions should be allowed to allocate the derivative transaction to each of the risk categories corresponding to all the risk drivers of the transaction, given that a simple, general and conservative fallback approach should be provided.
- (4) In accordance with Article 279a(3)(a) of Regulation (EU) No 575/2013, since the adjustment to the formula referred to in Article 279a(1) of that Regulation and the supervisory volatility that is suitable for that adjusted formula need to be in line with international regulatory developments, it is appropriate to apply a treatment similar to that proposed by the Basel Committee on Banking Supervision (BCBS) in “Frequently asked questions on the Basel III standardised approach for measuring counterparty credit risk exposures”<sup>7</sup>.
- (5) Given that, in accordance with Article 279a(3)(a) of Regulation (EU) No 575/2013, the adjustment is required to make the formula compatible with market conditions in which interest rates may be negative, hence it cannot fundamentally change the formula, such an adjustment should be based on the use of a  $\lambda$  shift in the context of the formula provided in Article 279a(1) of that Regulation.
- (6) In order for the  $\lambda$  shift to be adequate to move the interest rate into positive territory, the  $\lambda$  shift should be large enough to allow institutions to calculate the supervisory delta of the transaction in accordance with the formula provided in Article 279a (1). In addition, the  $\lambda$  shift should also be small enough not to introduce unnecessary bias in the outcome of the supervisory delta calculation.
- (7) One of the parameters included in the formula provided in Article 279a (1) of Regulation (EU) No 575/2013, is the supervisory volatility. Distinct values should be provided for that parameter, based on the risk category of the transaction and the nature of the underlying instrument of the option, including for the interest rate risk category. As a result, the supervisory volatility for the adjustment to the formula should be suitable for the formula provided for the interest rate risk category, i.e. coherent with the  $\lambda$  shift.
- (8) The definition of long or short position in a risk driver requires the specification of what objective information concerning a transaction institutions should use to determine whether the transaction is long or short in that risk driver, pursuant to Article 279a(3)(b). While there could be many approaches based on which this could be done, it would be less burdensome for institutions to apply the same methodology used for the identification of material risk drivers also for the determination of the direction of the position as either long or short.
- (9) This Regulation is based on the draft regulatory technical standards submitted by the European Banking Authority to the Commission.

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<sup>7</sup> March 2018 (update of FAQs published in August 2015).

- (10) EBA has conducted open public consultations on the draft regulatory technical standards on which this Regulation is based, analysed the potential related costs and benefits and requested the opinion of the Banking Stakeholder Group established in accordance with Article 37 of Regulation (EU) No 1093/2010<sup>8</sup>,

HAS ADOPTED THIS REGULATION:

## SECTION 1

Method for identifying transactions with only one material risk driver for the purposes of mapping derivative transactions to risk category in accordance with Article 277(5)(a) of Regulation (EU) No 575/2013

### *Article 1*

#### *Method for identifying transactions with only one material risk driver*

1. For the purpose of identifying those transactions with only one material risk driver, for the purposes of Article 277 of Regulation (EU) No 575/2013, institutions shall apply the following steps in sequence:
  - (a) they shall identify all the risk drivers of the transaction by determining the risk factor or risk factors on which the cash flows of the transaction depend. The assessment shall be made with respect to a sufficient number of risk factors, which shall include at least the risk factors referred to in Articles 325m to 325r of Regulation (EU) No 575/2013;
  - (b) where the cash flows of the transaction depend exclusively on one risk driver that belongs to one of the risk categories referred to in points (a), (c), (d), (e) and (f) of Article 277(1) of Regulation (EU) No 575/2013, and where the currency of the underlying of the transaction is the same as the settlement currency of the transaction, institutions shall identify that risk driver as the only material risk driver of the transaction;
  - (c) where the cash flows of the transaction depend exclusively on one risk driver belonging to the risk category referred to in point (b) of Article 277(1) of Regulation (EU) No 575/2013, institutions shall identify the foreign exchange risk driver as the only material risk driver of the transaction.

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<sup>8</sup> Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/78/EC (OJ L 331, 15.12.2010, p. 12).

## SECTION 2

Method for identifying transactions with more than one material risk driver and for identifying the most material of those risk drivers for the purposes of mapping derivative transactions to risk category in accordance with Article 277(5)(b) of Regulation (EU) No 575/2013

### *Article 2*

#### *Method for identifying transactions with more than one material risk driver*

For the purpose of Article 277 of Regulation (EU) No 575/2013, institutions shall identify as transactions with more than one material risk driver all transactions other than those referred to in points (b) and (c) of Article 1.

### *Article 3*

#### *Method for identifying the most material risk driver for those transactions with more than one material risk driver*

1. For the purposes of Article 277 of Regulation (EU) No 575/2013, with regard to the transactions referred to in Article 2, institutions shall determine the most material risk driver by applying either of the following methods:

(a) they shall apply the following steps in sequence:

- (i) they shall consider all the risk drivers of the transaction identified in accordance with the procedure referred to in Article 1(a) to be material risk drivers;
- (ii) for each risk category corresponding to the risk drivers referred to in point (i), they shall consider as the most material risk driver the risk driver corresponding to the highest risk category add-on from among those referred to in Articles 280a to 280f of Regulation (EU) No 575/2013.

(b) they shall apply the following steps in sequence:

- (i) with regard to all the risk drivers identified in accordance with the procedure referred to in Article 1(a), they shall compute the sensitivities of those risk drivers in accordance with Article 325s of Regulation (EU) No 575/2013;
- (ii) they shall multiply the sensitivities computed in accordance with point (i) with the corresponding risk weights referred to in Section 6 Subsection 1 of Regulation (EU) No 575/2013;
- (iii) they shall aggregate the results of the multiplication referred to in point (ii) for each of the risk categories referred to in Article 277(1) of Regulation (EU) No 575/2013 in accordance with the aggregation schemes referred to in Section 6, Subsection 1 of that Regulation;
- (iv) they shall rank the aggregate results referred to in point (iii) from the greatest to the smallest in absolute terms, in order to obtain a monotonically decreasing sequence

of entries, where the entry  $a_1$  is the greatest absolute term,  $a_2$  is the second greatest term and so on;

- (v) for each of the entries referred to in point (iv) in the order resulting from the ranking in that point, they shall verify whether the following condition is met:

$$\frac{\sum_{j=1}^i a_j}{\sum_{k=1}^6 a_k} < Y\%$$

where:

(option 1a)

$$Y\% = 50\%$$

(option 1b)

$$Y\% = 60\%$$

- (vi) they shall consider material those risk drivers corresponding to the risk categories for which the condition of point (v) is met and the first risk category for which that condition is not met;
- (vii) for each of the risk categories corresponding to risk drivers considered not material in accordance with point (vi), they shall verify whether the following condition is met:

$$\frac{a_i}{\sum_{k=1}^6 a_k} \geq Z\%$$

where

(option 1a)

$$Z\% = 25\%$$

(option 1b)

$$Z\% = 30\%$$

- (viii) they shall consider material those risk drivers corresponding to the risk categories for which the condition of point (vii) is met.

#### Explanatory text for consultation purposes

The condition in step (v) ensures that a relative portion of the aggregated sensitivities of a derivative transaction to risk drivers is captured (i.e. risk drivers representing  $Y\%$  or more of the aggregated sensitivities of an instrument are considered material). The condition in step (vii) ensures that risk drivers belonging to a risk category which significantly contributes to the aggregated sensitivities of a derivative transaction are considered material (i.e. risk drivers of any risk category representing  $Z\%$  of the aggregated sensitivities of an instrument are considered material).

The levels of the thresholds  $Y\%$  and  $Z\%$  are chosen considering that a less conservative condition in (v) can be counterbalanced by a more stringent condition in (vii) (i.e. option 1a) and vice versa (i.e. option 1b).

### Question

**Q1. Which one of the options do you think is more appropriate (option 1a :  $Y\%=50\%$  and  $Z\%=25\%$  or option 1b:  $Y\%=60\%$  and  $Z\%=30\%$ )? Please provide the rationale for the chosen option.**

- (ix) for each of the risk categories referred to in points (vi) and (viii), they shall consider as most material risk driver the risk driver corresponding to the highest absolute value of the result of the multiplication referred to in point (ii).

#### (option 2)

2. Where institutions meet either the conditions set out in Article 94(1) of Regulation (EU) No 575/2013 or the conditions set out in Article 325a(1) of that Regulation, they may determine, the most material risk driver by applying the following steps in sequence to all derivative instruments identified in accordance with Article 2:
  - (a) they shall compute the add-ons referred to in Articles 280a to 280f of Regulation (EU) No 575/2013, as applicable, for each risk category referred to in Article 277(1) of Regulation (EU) No 575/2013 and associated to all the risk drivers identified in accordance with Article 1(a);
  - (b) they shall apply points (iv) to (viii) of paragraph 1(b);
  - (c) for each of the risk categories referred to in points (vi) and (viii), they shall consider as most material risk driver the risk driver corresponding to the highest risk category add-on from among those referred to in Articles 280a to 280f of Regulation (EU) No 575/2013.

### Explanatory text for consultation purposes

For the purpose of mapping a derivative transaction, where an institution, in accordance with point (a) of Article 1(1), has identified more than one risk driver belonging to more than one risk category, it is proposed to leave the option to institutions to:

- either go through the quantitative assessment of material risk drivers, thus leading to the mapping of the transaction to the risk category or risk categories corresponding to material risk drivers only;

- or simply consider as material all the risk drivers of the transaction, hence mapping the transaction to all the corresponding risk categories.

The quantitative assessment of risk drivers hinges on FRTB SA sensitivities (set out under the alternative standardised approach in Part Three, Title IV, Chapter 1a of CRR2) for determining the materiality of risk drivers. That approach presents a number of advantages: it is granular, risk-sensitive and easy to implement for banks using FRTB or SIMM.

However in case an institution does not use FRTB (or SIMM), computing FRTB SA sensitivities may represent a hurdle in performing the materiality assessment. According to Article 101a of CRR2, smaller institutions are exempted from using the alternative standardised approach in two cases:

- the size of the institution's on- and off-balance sheet trading-book business is equal to or less than both 5 % of the institution's total assets and EUR 50 million (Article 94 CRR2);
- the size of the institution's on- and off-balance sheet business subject to market risks is equal to or less than both 10 % of the institution's total assets and EUR 500 million (Article 325a CRR2).

In that case, smaller institutions may be allowed to compute SA CCR add-ons for determining the materiality of risk drivers instead of FRTB SA sensitivities. The SA CCR add-ons approach is coherent within the framework and easy to implement, although less granular.

In any case, smaller institutions are expected to hold portfolios of relatively simple derivative transactions, which in most cases will be mapped based on a qualitative allocation under Approach 1 (i.e. Article 1(b) and 1(c)), with only a few transactions to be allocated based on either a materiality assessment (i.e. Article 3(2)) or the proposed simplified approach (i.e. Article 3(1)(a)).

Such alternative would provide more proportionality in the framework. Please note, however, that even without that alternative, proportionality is already provided, since smaller institutions are always free to use the simplified approach instead of performing the quantitative assessment under Article 3(2), should they consider this materiality assessment too burdensome.

## Questions

**Q2. What are your views about the general quantitative approach methodology, which hinges on FRTB SA sensitivities? Please provide examples of cases where computing FRTB SA sensitivities might raise some issues.**

**Q3. Do you have any views on the appropriateness, for smaller institutions, of the alternative SA CCR add-ons approach (paragraph 2) in overcoming the issues (if any) raised by the general FRTB SA sensitivities approach?**

## SECTION 3

The formula to be used for the purposes of Article 279a(3)(a) of Regulation (EU) No 575/2013 and the supervisory volatility that is suitable for that formula

### Article 4

#### *Supervisory delta for options mapped to the interest rate risk category*

1. For the purpose of Article 279 of Regulation (EU) No 575/2013, the formula that institutions shall use to calculate the supervisory delta ( $\delta$ ) of call and put options mapped to the interest rate category shall be the following:

$$\delta = sign \cdot N \left( type \cdot \frac{\ln \left( \frac{(P + \lambda)}{(K + \lambda)} \right) + 0.5 \cdot \sigma^2 \cdot T}{\sigma \cdot \sqrt{T}} \right)$$

where:

$$type = \begin{cases} -1 & \text{where the transaction is a put option} \\ +1 & \text{where the transaction is a call option} \end{cases}$$

$$sign = \begin{cases} -1 & \text{where the transaction is a sold call option or a bought put option} \\ +1 & \text{where the transaction is a sold put option or a bought call option} \end{cases}$$

$N(x)$  = the cumulative distribution function for a standard normal random variable which reflects the probability that a normal random variable with mean zero and variance of one is less than or equal to 'x';

$P$  = the spot or forward price of the underlying instrument of the option;

$K$  = the strike price of the option;

$T$  = the expiry date of the option which is the only future date at which the option may be exercised, expressed in years using the relevant business day convention;

$\lambda$  = the shift adequate, to move both  $P$  and  $K$  into positive territory, determined in accordance with paragraph 2;

$\sigma$  = the supervisory volatility of the option determined in accordance with Article 5.

**(option 3a: applicable at currency level)**

2. For the purposes of paragraph 1, institutions shall calculate the shift ( $\lambda$ ) for any reference currency which includes call and put options as follows:



$$\lambda_i = \max\left(\text{threshold} - \min_j(P_j, K_j), 0\right)$$

where:

$j$  = any call and put option with reference currency  $i$

$i$  = any reference currency which includes call and put options

$P_j$  = the spot or forward price of the underlying instrument of the option  $j$  with reference currency  $i$

$K_j$  = the strike price of the option  $j$  with reference currency  $i$

$\text{threshold} = 0.01\%$  (option 4a)

$\text{threshold} = 0.10\%$  (option 4b)

$\text{threshold} = 1.00\%$  (option 4c).

(option 3b: applicable at transaction level)

- For the purposes of paragraph 1, institutions shall calculate the shift ( $\lambda$ ) for any call and put options as follows:

$$\lambda_j = \max\left(\text{threshold} - \min(P_j, K_j), 0\right)$$

where:

$P_j$  = the spot or forward price of the underlying instrument of the option  $j$  ;

$K_j$  = the strike price of the option  $j$  ;

$\text{threshold} = 0.01\%$  (option 4a)

$\text{threshold} = 0.10\%$  (option 4b)

$\text{threshold} = 1.00\%$  (option 4c).

(option 5 ‘market lambda’ applicable at transaction level)

- For the purpose of paragraph 1, institutions may set the shift ( $\lambda$ ) using values of the shift obtained from market quotes from disclosed, daily verifiable prices of derivative instruments where these are sensitive to the implied volatilities of the relevant risk-free rate.

#### Explanatory text for consultation purposes

It is proposed to set the  $\lambda$  shift such that a certain threshold on the smallest (i.e. more negative) term between  $P + \lambda$  and  $K + \lambda$  is not crossed.

The formula can be applied either at currency level (i.e. setting a single value of the  $\lambda$  shift for each currency, computed taking into account the characteristics of each and every option referencing that currency) or at transaction level (i.e. setting a single value of the  $\lambda$  shift specific for each transaction). Different levels for the threshold can be set.

Finally, institutions could be allowed to use, as an alternative, available market data for the  $\lambda$  parameter (i.e. the  $\lambda$  values that are quoted on the relevant markets), at transaction level only. Given that the use of “market” lambda introduces discretion, the EBA would need sufficient

evidence by respondents that this alternative is needed. Otherwise the EBA would consider removing this alternative, in order to have more harmonised rules across the EU.

**Questions**

**Q4. Do you think the approach outlined here should be applied at currency level (option 3a) or transaction level (option 3b)?**

**Q5. Which one of the three options (option 4a: 1 bp, option 4b: 0.1% or option 4c: 1%) do you think is more appropriate as a threshold? Please provide the rationale for the chosen option.**

**Q6. Please provide examples of cases where the possibility to set the shift  $\lambda$  according to the prevalent market conditions (option 5) might:**

- provide some benefits
- raise some concerns

*Article 5*

*Supervisory volatility suitable for the corrected delta for options mapped to the interest rate risk category*

For the purposes of paragraph 1 of Article 4, the supervisory volatility of the option shall be determined in accordance with Table 1 on the basis of the risk category of the transaction and the nature of the underlying instrument of the option.

Table 1

Risk category	Underlying instrument	Supervisory volatility
Interest rate	All	50%

**Explanatory text for consultation purposes**

In order to counterbalance the effect produced by the shift  $\lambda$ , a correction on the volatility may be assessed to be needed. However, it could be difficult to find a suitable solution that allows overcoming the possible bias introduced by the  $\lambda$  shift. Considering the standardised nature of SA-CCR, it may therefore be more appropriate to apply a constant 50% supervisory volatility.

**Question**

**Q7. Do you consider necessary an adjustment to the supervisory volatility parameter  $\sigma$  as defined in Article 5? In the case an adjustment is considered necessary, how should it be carried out?**

## SECTION 4

Method for determining a short or long position in the primary risk driver or in the most material risk driver in a given risk category to be used for the purposes of Article 279a(3)(b) of Regulation (EU) No 575/2013 risk driver

### *Article 6*

*Method for determining whether a transaction is a long or short position in the primary risk driver or in the most material risk driver in a given risk category*

For the purpose of determining whether a transaction is a long or short position in the primary risk driver or in the most material risk driver in a given risk category, institutions shall apply either of the following:

- (a) they shall compute the sensitivities of those risk drivers in accordance with Article 325s of Regulation (EU) No 575/2013. The transaction shall be considered as a long position in the material risk driver where the corresponding sensitivity is positive and as a short position in the material risk driver where the corresponding sensitivity is negative;
- (b) where institutions apply the approach set out in Article 3(1)(a), they shall determine the transaction as either long or short by assessing the dependence of the structure of cash flows of the transaction on that risk driver or the hedging purpose of the transaction with respect to that risk driver.

#### **Explanatory text for consultation purposes**

The EBA believes that institutions should determine the direction of the position in that particular risk driver (long or short) using the sensitivity of the transaction to that risk driver. However, for proportionality, in the case an institution is not required to compute sensitivities in any other part of the present Regulation, then the institution should be allowed to alternatively use other elements (cash flows, hedging purpose).

#### **Question**

**Q8. Do you think the specified method for determining whether a transaction is a long or short position in a material risk driver is adequate? If not, please provide an explanation.**

### *Article 7*

#### *Entry into force*

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

*For the Commission  
The President*

*[For the Commission  
On behalf of the President*

*[Position]*

## 5. Accompanying documents

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### 5.1. Draft cost- benefit analysis/impact assessment

Article 277(5) of the CRR2 proposal requires the EBA to develop draft RTS to specify the method for identifying the material risk drivers of a derivative transaction for mapping them to risk categories under the standardised approach for counterparty credit risk.

Article 279a(3) of the CRR2 proposal requires the EBA to develop draft RTS to specify the formula that institutions shall use to calculate the supervisory delta of call and put options mapped to the interest rate risk category. The formula should be compatible with market conditions in which interest rates may be negative. EBA should also identify the supervisory volatility that is suitable for that formula as well. Finally, the formula should be in line with international regulatory developments. In addition, the EBA is required to provide a method for determining whether a transaction is a long or short position in the primary risk driver or in the most material risk driver in the given risk category.

As per Article 10(1) of Regulation (EU) No 1093/2010 (EBA Regulation), any regulatory technical standards developed by the EBA shall be accompanied by an Impact Assessment (IA), which analyses ‘the potential related costs and benefits’.

This section presents the cost-benefit analysis of the provisions included in the RTS described in this CP. The analysis provides an overview of identified problems, the proposed options to address those problems and the potential impact of those options.

#### A. Problem identification

In March 2014, the Basel Committee has published its final standard on the standardised approach for measuring counterparty credit risk exposures. The new Standardised Approach for Counterparty Credit Risk (SA-CCR) replaces all non-internal model approaches (i.e. the Current Exposure Method (CEM) and the Standardised Method).

The SA-CCR consists of two components: the replacement cost (RC) and the potential future exposure (PFE). An alpha factor is applied to the sum of these components to calculate the exposure at default (EAD).

#### Mapping of derivative transactions to risk categories

The PFE is calculated differently for each asset class, requiring institutions to first allocate (map) derivative transactions to one or more asset classes.



According to the Basel standards, the designation of a derivative transaction to an asset class is to be made on the basis of its primary risk driver. Most derivative transactions will have one primary risk driver, which is clearly identifiable, so as the transaction will fall into one asset class (also called risk categories). For most complex transactions that may have more than one risk driver, banks must take sensitivities and volatility of the underlying into account for determining the primary risk driver and may allocate the trade to more than one asset class.

Other than these general principles, the Basel standards does not provide any specific methodology for the mapping of transactions to one or more asset classes. Consequently, the CRR2 proposal, which implements the SA-CCR into the EU, requests EBA to specify this method. The lack of a common specification, would give banks the flexibility to decide on their own methodology, resulting in an inconsistent application of SA-CCR across banks. This would create an uneven playing field and unfair competition in EU banking sector, where banks with the same or very similar transactions can have different capital requirements for counterparty credit risk.

### Corrections to supervisory delta

As part of the calculation of PFE, banks need to apply a supervisory delta adjustment to the adjusted notional amount at trade-level to reflect the direction of the transaction (i.e. short or long) and its non-linearity.

For options, the supervisory delta adjustment is based on the Black-Scholes option pricing model. Black-Scholes model is widely used within the options markets and the model's implied volatilities are a standard quoting convention for option prices.<sup>9</sup>

However, the Black-Scholes model assumes that the underlying risk factor is positive. In particular, the supervisory delta formula contains the term  $\ln(P/K)$ , i.e. the natural logarithm of the ratio between the spot or forward price  $P$  of the underlying instrument of the option and the strike price  $K$  of the option. Given that the natural logarithm is only defined for values greater than zero, a negative  $P$  or  $K$  (e.g. negative interest rates) would make the supervisory delta adjustment inoperable.

The recent financial crisis has led many central banks to introduce a negative interest rate policy to ensure price stability and stimulate economic growth (Figure 1). When interest rates are negative, depositors must pay regularly to keep their money with the bank (private or central bank), instead of receiving money on deposits. This is intended as an expansionary monetary policy to stimulate borrowing and lending and, eventually, economic growth.

In June 2014, the European Central Bank (ECB) was the first to introduce a negative interest rate on its deposit facility (-0.1%)<sup>10</sup>. Other central banks have followed, with Danish National Bank setting

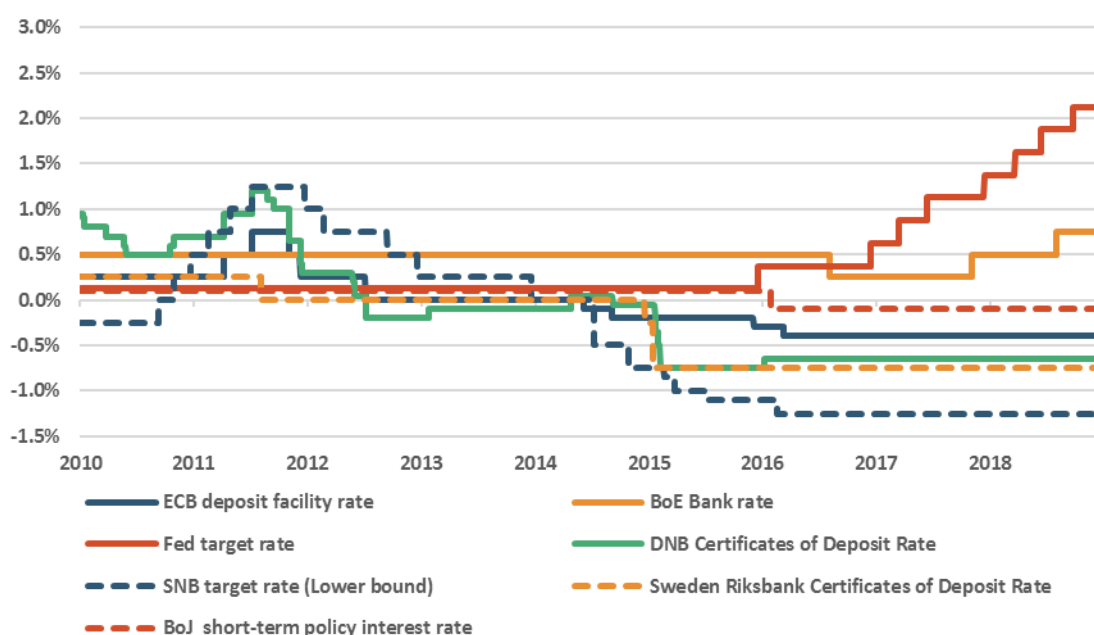
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<sup>9</sup> Other well-known models to price options are the Bachelier normal model, the constant elasticity of variance (CEV) model and the SABR model

<sup>10</sup> [https://www.ecb.europa.eu/press/pr/date/2014/html/pr140605\\_3.en.html](https://www.ecb.europa.eu/press/pr/date/2014/html/pr140605_3.en.html)

a negative rate in July 2012 (certificates of deposit: -0.2%)<sup>11</sup>, the Swiss National Bank (SNB) in December 2014 (deposit rate: -0.25%)<sup>12</sup>, the Swedish Riskbank in February 2015 (repo rate: -0.10%)<sup>13</sup> and the Bank of Japan (BoJ) in January 2016 (deposit rate: -0.1%)<sup>14</sup>. At the same time, the Federal Reserve (fed rate: 0.25%) and the Bank of England (bank rate: 0.5%) have kept interest rates close to zero.

Figure 1: Central banks' interest rates



Source: Bloomberg

Note: Daily data from 1 January 2010 to 31 December 2018.

The negative interest rate policies were effectively transmitted to the money market, with interbank offered rates in various currencies moving to negative territory. The 1-month interbank offered rates for Euro, Swiss Franc, Japanese Yen, Swedish Krona and Danish Krone have been (or still is) negative, while for the British Pound and US Dollar, they have been positive but close to 0% (Figure 2).

<sup>11</sup> <http://www.nationalbanken.dk/en/pressroom/Documents/2012/07/DNN201216563.pdf>

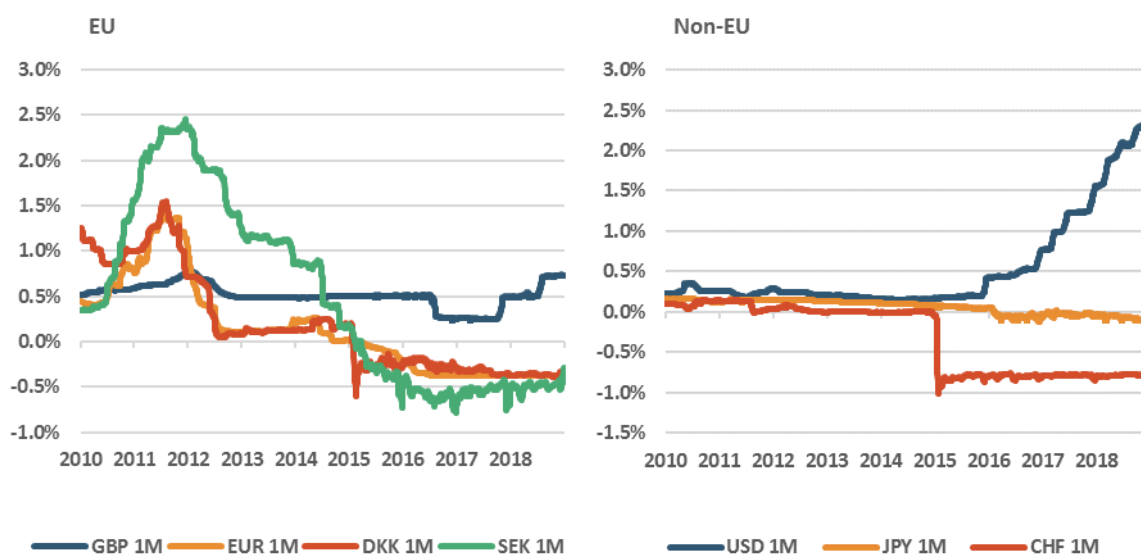
<sup>12</sup> [https://www.snb.ch/en/mmr/reference/pre\\_20141218/source/pre\\_20141218.en.pdf](https://www.snb.ch/en/mmr/reference/pre_20141218/source/pre_20141218.en.pdf)

<sup>13</sup> <http://archive.riksbank.se/en/Web-archiver/Published/Press-Releases/2015/Riksbank-cuts-repo-rate-to-010-per-cent-buys-government-bonds-for-SEK-10-billion/index.html>

<sup>14</sup> [https://www.boj.or.jp/en/announcements/release\\_2016/k160129a.pdf](https://www.boj.or.jp/en/announcements/release_2016/k160129a.pdf)



Figure 2: 1-month interbank Offered Rate<sup>1</sup> for EUR, GBP, CHF, USD, JPY, DKK and SEK



Source: Bloomberg

Note: Daily data from 1 January 2010 to 31 December 2018.

A possible remedy to maintain Black’s model framework in a negative interest rate setting is to replace the spot or forward rate  $P$  with a shifted spot or forward rate  $P + \lambda$ :

$$d(P_t + \lambda) = \sigma(P_t + \lambda)dW_t$$

In this case  $P_t + \lambda$  is drawn from a lognormal distribution (and  $P_t$  is said to follow a displaced or shifted lognormal distribution). In this case, the lowest possible value allowed for  $P_t$  is  $-\lambda$  (rather than zero). In the option pricing equations  $P$  must be replaced by  $P + \lambda$  and  $K$  with  $K + \lambda$  everywhere.<sup>15</sup>The displacement  $\lambda$  must be sufficiently large so as  $P + \lambda$  is positive for the lowest forward rate implied by the current term structure and the logarithm  $\ln\left(\frac{P+\lambda}{K+\lambda}\right)$  is well defined.

However, there is no common methodology exists in setting the exact value of the shift parameter  $\lambda$ . The lack of such specification, would give the option to banks to use their own adjustments/shifts, creating an uneven playing field and unfair competition in EU banking sector, where banks with the same or very similar transactions can have different capital requirements for counterparty credit risk.

## B. Policy objectives

The specific objective of the RTS is to establish a harmonised methodology for:

- identifying the material risk drivers of derivative transactions under the SA-CCR within the EU;

<sup>15</sup> J. Hull and A. White, ‘Interest Rate Models and Negative Rates’ [Online]. Available: <http://www.fincad.com/blog/interest-rate-models-and-negative-rates>



- computing the supervisory delta adjustment applied to options under the SA-CCR when interest rates are negative. Operationally, this would provide institutions with a practical solution for computing the supervisory delta adjustment in a negative interest rate environment.

This would equip all institutions across the EU with a common tool for mapping derivative transactions to risk categories when calculating the PFE and a practical solution for computing the supervisory delta adjustment in a negative interest rate environment.

Generally, the RTS aims to create a level playing field, promote convergence of institutions' practices and enhance comparability of own funds requirements across EU. Overall, the RTS is expected to promote the effective and efficient functioning of the EU banking sector.

### C. Baseline scenario

The baseline scenario aims to describe the current regulatory environment and regulatory developments, as well as the institutions' practices.

In terms of regulatory environment, the baseline assumes the entry into force of the CRR2 proposal, which does not provide any methodology for mapping derivative transactions to risk categories under the SA-CCR or any guidance on how to calculate supervisory delta adjustment for options in a negative interest rate environment.

#### Mapping of derivative transactions to risk categories

The only high-level principles regarding such mapping can be found in the Basel standards, which state that:

- *'When this primary risk driver is clearly identifiable, the transaction will fall into one of the asset classes described above' (paragraph 151)*
- *'For more complex trades that may have more than one risk driver (e.g. multi-asset or hybrid derivatives), banks must take sensitivities and volatility of the underlying into account for determining the primary risk driver' (paragraph 152).*

In terms of institutions' practices, the baseline scenario assumes that no common approach exists regarding the identification of material risk drivers of derivative transactions, given that such a requirement is not present in the current CRR.

#### Corrections to supervisory delta

Basel FAQs on SA-CCR<sup>16</sup> suggests that banks must incorporate a shift in the price value and strike value by adding  $\lambda$ , where  $\lambda$  represents the presumed lowest possible extent to which interest rates in the respective currency can become negative. However, it does not specify the value of  $\lambda$ . It only

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<sup>16</sup> <https://www.bis.org/bcbs/publ/d438.pdf>



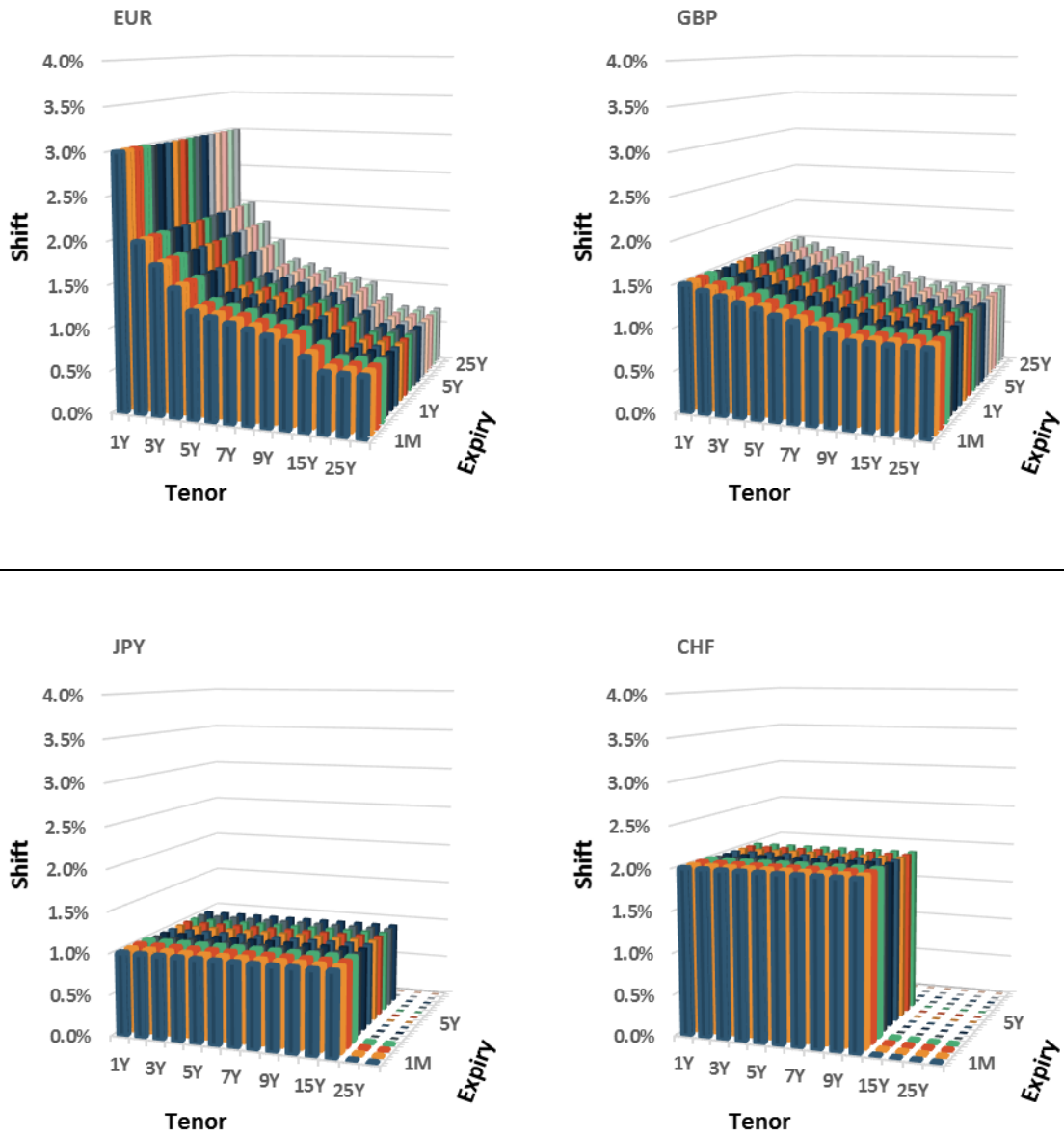
sets high principles stating that: a) the same parameter must be used consistently for all interest rate options in the same currency; b) for each jurisdiction, and for each affected currency  $j$ , the supervisor is encouraged to make a recommendation to banks for an appropriate value of  $\lambda_j$ , with the objective to set it as low as possible; c) banks are permitted to use lower values if it suits their portfolios.

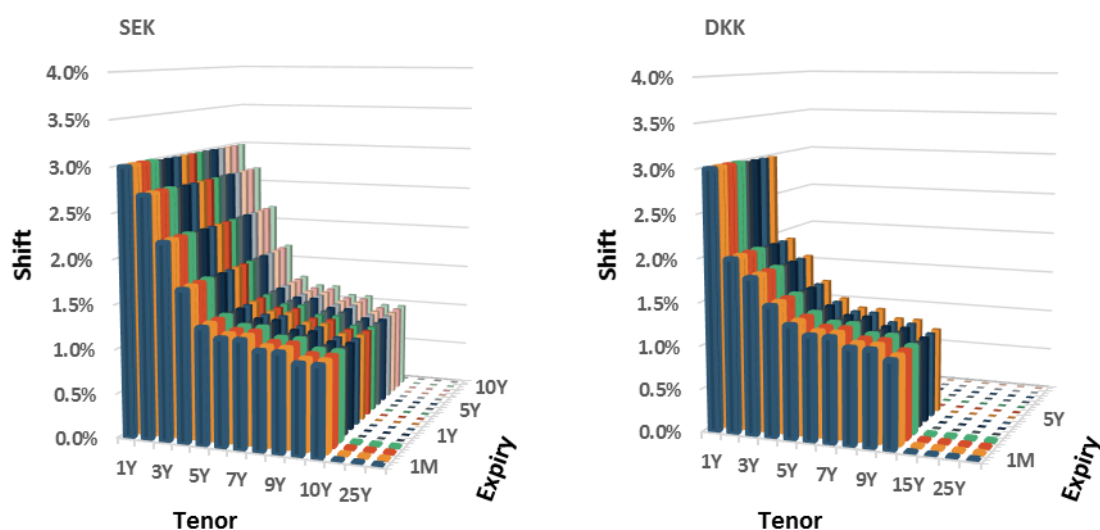
In terms of institutions' practices, the baseline scenario assumes that no common approach exists regarding the calculation of delta for options when interest rates are negative. Given that Black's model is not suitable in a negative interest rate environment, market practitioners have either switched to alternative models that allow for negative values of  $P$ , such as the Bachelier model, or have modified existing models to create the shifted (or displaced) versions of Black's model, CEV model and SABR model. In the latter case, the lowest possible rate for the underlying price equals the shift,  $\lambda$  and the size of the displacement and the corresponding shifted volatilities are published alongside.

Figure 3 shows the shifts applied by brokers to at-the-money swaptions for Euro, British Pound, Japanese Yen, Swiss Franc, Swedish Krona and Danish Krona. The maturity of the options ranges from 1 month to 30 years, while the maturity of the underlying swap ranges from 1 to 30 years.

For all currencies, the shifts varies with the maturity of the underlying swap, with larger shifts applied to shorter maturities. For Euro, the shift ranges from 3% for short-term options (1 year) to 0.7% for longer term options (higher than 20 years). The Danish Krona and Swedish Krona's shifts have similar values as the Euro, ranging from 1% to 3%. For the British Pound, the shift is lower and ranges from 1% to 1.5%. For the Japanese Yen and Swiss Franc, a flat shift is applied irrespective of the maturity, standing at 1% and 2% respectively. The results suggest that there is no common shift and the value depends on the currency and maturity of the underlying swap. This confirms the assumption that the value of the shift may not necessarily be coherent across institutions.

Figure 3: Shifts applied for Shifted Black ATM swaptions





Source: Bloomberg (ICAP)

Note: Data as of 18 February 2019. Expiry refers to the time period between the valuation date and the maturity of the option. Tenor refers to the length of the underlying swap.

#### D. Options considered, Cost-Benefit Analysis and Preferred Options

The following analysis is expected to be reviewed based on the feedback to this CP.

##### Mapping of derivative transactions to risk categories

###### a. Approach 2 methodology

The EBA DP put forward the following four proposals for the methodology to identify material risk drivers:

Option 1: Compare the relative relevance of other sensitivities with that of the primary risk driver.

Option 2: Compare the relative contribution of each sensitivity to the total.

Option 3: Similar to option 1 and 2 but based on risk-weighted sensitivities (i.e. taking into account volatility) instead of simple sensitivities.

Option 4: Based on SA-CCR add-ons. This is Option 2 in the CP.

The following table lists the main pros and cons for each option.

Table 4: Proposals for identifying material risk drivers

Options	Pros	Cons
Option 1	Simple and easy to implement	Does not take into account volatility No mechanical cap to the number of material risk drivers
Option 2	Simple and easy to implement Allows for mechanical cap to the number of material risk drivers	Does not take into account volatility
Option 3	Takes into account volatility Allows for mechanical cap to the number of material risk drivers	More complex than Option 1 and 2
Option 4 (Option 2 in CP)	Coherent with SA-CCR framework Allows for mechanical cap to the number of material risk drivers	More burdensome to implement

The feedback to the DP favored Option 3, i.e. assessing the materiality of risk drivers using an indicator that considers jointly sensitivity and volatility. Given the potential advantages and disadvantages of the four options, both Option 3 and 4 are retained for consultation.

#### b. Risk weights to be used to adjust sensitivities

The EBA has considered two alternative sets of risk weights to adjust sensitivities.

Option 1: Use FRTB risk-weights

Option 2: Use SA-CCR risk weights

Option 1 offers greater risk-sensitivity, as the FRTB risk weights are more granular than the SA-CCR risk weights, while Option 2 promotes a more coherent application within the framework. On the one hand, using FRTB risk weights would be easy to implement for banks using FRTB or SIMM. On the other hand, the use of FRTB risk weights may be potentially difficult for banks that do not use FRTB or SIMM.

Option 1 is retained, given that the alternative method based on SA-CCR add-ons (Option 2 in CP) maintained for consultation provides the same benefits as Option 2.

### c. Aggregation scheme for aggregating risk-weighted sensitivities

The EBA has considered two alternative aggregation schemes to aggregate risk-weighted sensitivities.

Option 1: Aggregation in accordance with the aggregation schemes referred to in Section 6, Subsection 1 of the CRR2 proposal

Option 2: Aggregation as a simple sum of absolute value of risk-weighted sensitivities

Option 1 uses the FRTB aggregation scheme, which takes into account the correlation between risk factors. This scheme is the natural choice given that FRTB risk-weights are used to adjust sensitivities, as it would ensure full consistency with the FRTB framework. It also captures basis risk and diversification. Option 2 provides for a very simple aggregation scheme, but does not account for any offsetting positions or diversification benefits within risk categories.

Option 1 is retained.

### d. Material risk driver assessment methodology

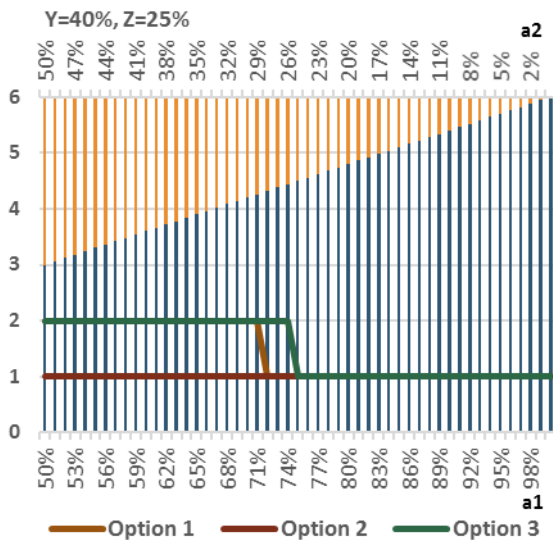
Option 1: Material risk drivers are chosen based on the condition  $\frac{a_i}{a_1} \geq Y\%$

Option 2: Material risk drivers are chosen based on the condition  $\frac{\sum_{j=1}^i a_j}{\sum_{k=1}^6 a_k} < Y\%$

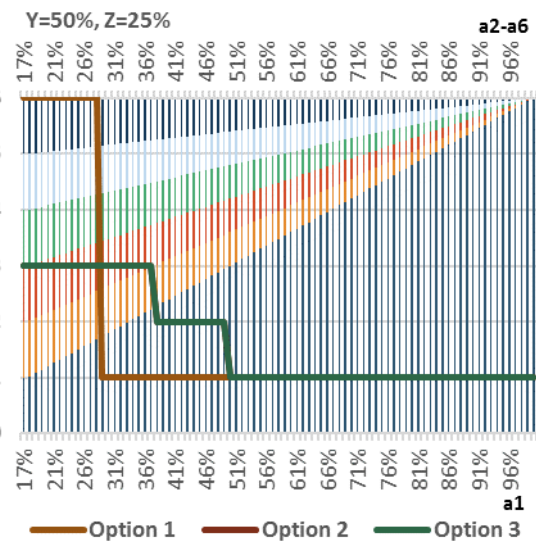
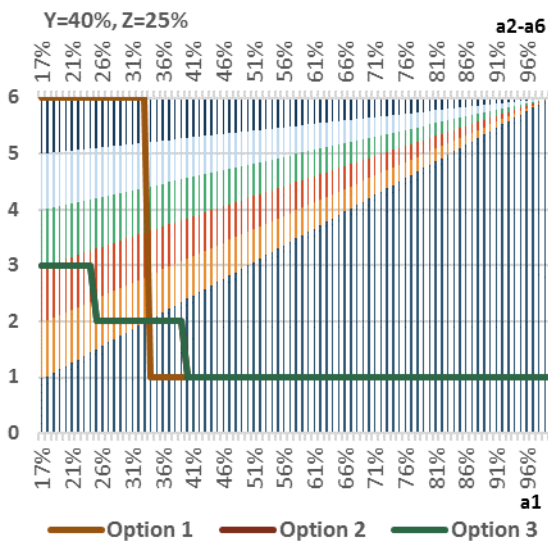
Option 3: Material risk drivers are chosen based on the condition  $\frac{\sum_{j=1}^i a_j}{\sum_{k=1}^6 a_k} < Y\%$ , with a backstop that any risk driver that satisfy the condition  $\frac{a_i}{\sum_{k=1}^6 a_k} \geq Z\%$  is also material (i.e. Option 1a and 1b in CP)

Moreover, various levels have been considered for Y%, between 40%-70% and Z%, between 25%-30%.

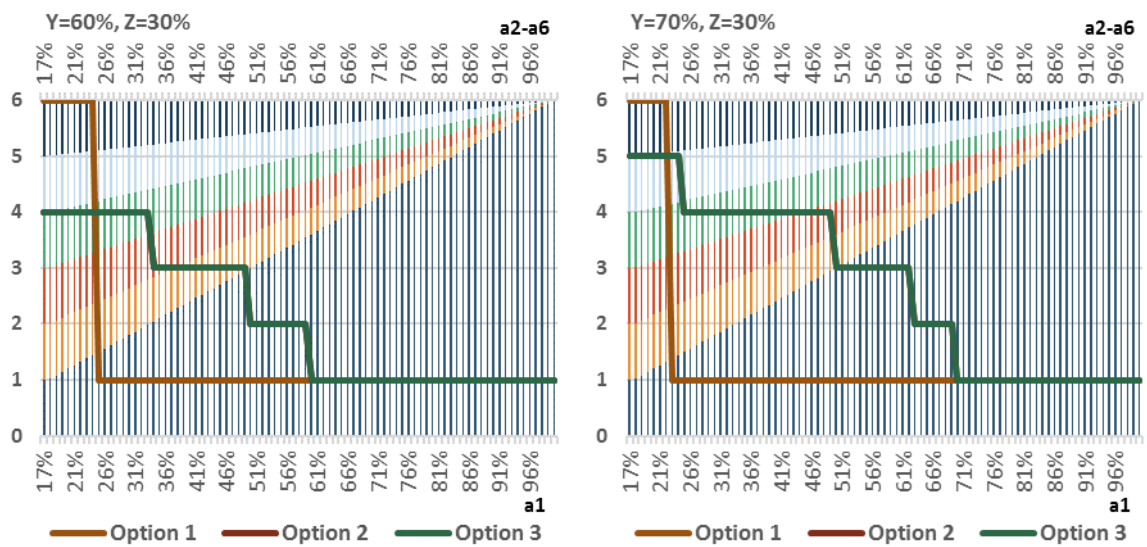
To illustrate the advantages and disadvantages of the alternative options the following theoretical examples are considered. In the first example, a situation in which the risk drivers of a transaction belong to all six risk categories is considered ( Figure 4). The second example considers a situation in which the risk drivers of a transaction belong to just two risk categories (



). Under both examples, the relative importance of the risk categories varies, starting from a situation where all the risk categories have the same importance to a situation where there is one predominant risk category and all the others are residuals. Figure 4 : Example 1 - the risk drivers of a transaction belong to all six risk categories

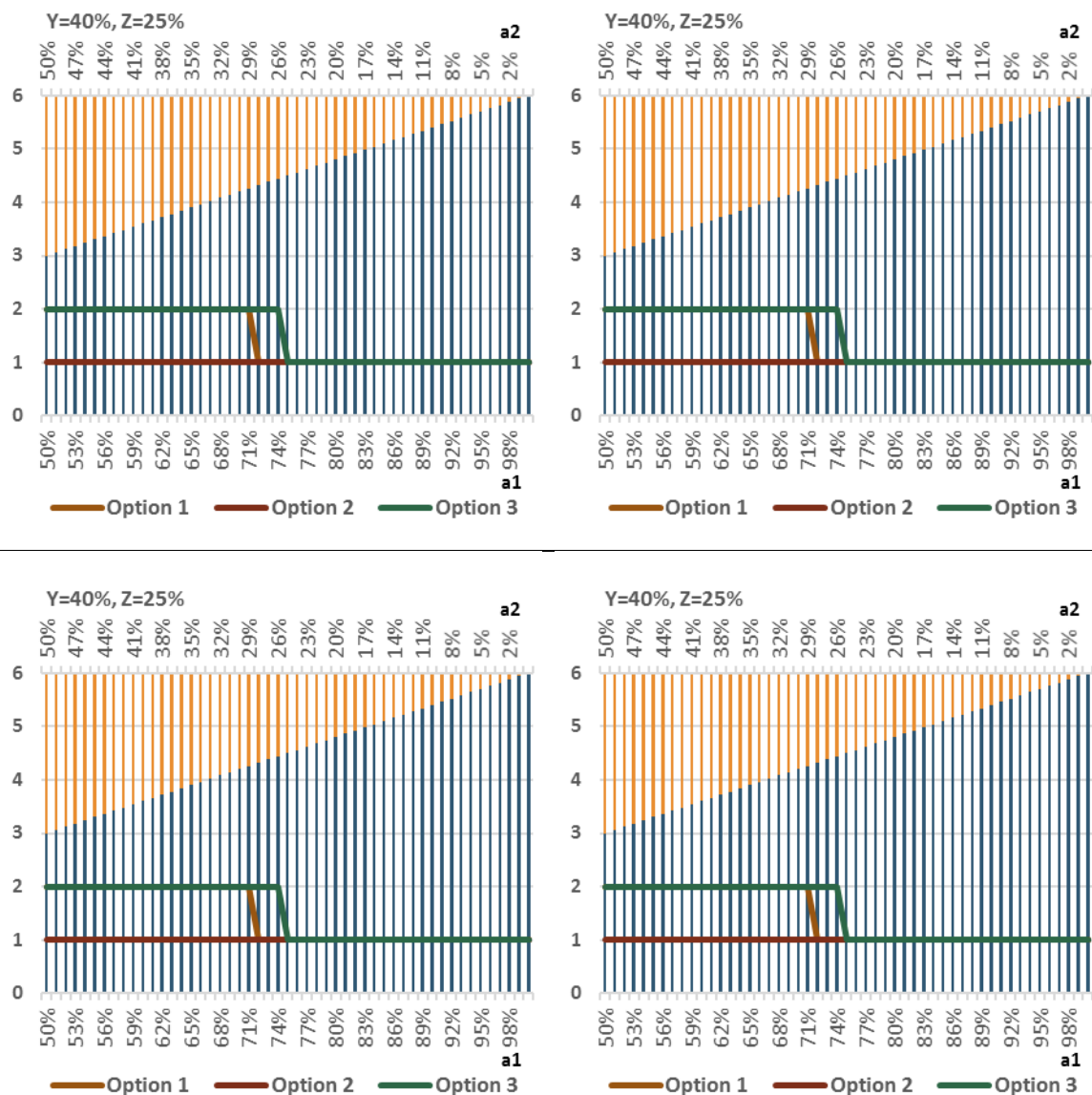






Note: The bar chart shows the relative importance of each risk category to the total, starting from a situation where all risk categories have the same importance (17.6%) to a situation where there is one predominant risk category (100%). Option 2 and Option 3 coincide completely and this is the reason why Option 2 does not appear in the graph.

Figure 5: Example 2 - the risk drivers of a transaction belong to two risk categories



Note: The bar chart shows the relative importance of each risk category to the total, starting from a situation where all risk categories have the same importance (50%) to a situation where there is one predominant risk category (100%).

Option 2 and 3 provides a smoother mapping across categories, as the relative importance of the risk categories varies. In addition, they provide for an implicit cap to the number of risk categories depending on the threshold (e.g. 3 risk categories for Y=50% and 4 risk categories for Y=60%), while under Option 1 all the risk categories are selected, when their importance is very similar. Option 1 and 3 seems to work better in Example 2, as both risk categories are chosen when the importance of the two factors is high and very close to each other.

Based on the aforementioned analysis, Option 3 is retained as it combines the benefits of both Option 1 and 2. Given that the results for the thresholds levels 40% and 50%, and respectively 60% and 70% are similar, only the levels of 50% and 60% are maintained for consultation.

## Corrections to supervisory delta

### a. Value of $\lambda$ shift

Option 1: Based on market convention (Option 5 in CP)

Option 2: Based on the formula  $\max(\text{threshold} - \min(P_j, K_j), 0)$

Option 1 allows institutions to retrieve the value of the shift  $\lambda$  from market quotes for the relevant risk-free rate. A disadvantage of this option is that it entails the risk of setting different values of  $\lambda$  for the same transactions, simply because the institutions may use different market data providers. Moreover, some data providers may not quote shift  $\lambda$  for all different type of transactions.

Option 2 on the other hand, provides for a mechanistic way that ensures that the Delta formula will be workable and that the shift is the same across institutions for the same transactions. It is also aligned with the guidance provided in the Basel FAQs on SA-CCR and with the proposal of Federal Reserve Board, Federal Deposit Insurance Corporation, and the Office of the Comptroller of the Currency's proposal on the SA-CCR. This has the potential to reduce the compliance costs for internationally active institutions, which need to comply with different regulations worldwide and ensure a level playing field.

Both Options 1 and 2 are retained for consultation, with a preference for Option 2.

### b. Threshold amount

Option 1: threshold = 0.01%

Option 2: threshold = 0.1%

Option 3: threshold = 1%

Introducing a shift ( $\lambda$ ) to the formula for the supervisory delta may lead to different results, depending on the value of the shift, i.e. in general

$$\text{sign} \cdot N\left(\text{type} \cdot \frac{\ln\left(\frac{P}{K}\right) + 0.5 \cdot \sigma^2 \cdot T}{\sigma \cdot \sqrt{T}}\right) \neq \text{sign} \cdot N\left(\text{type} \cdot \frac{\ln\left(\frac{P + \lambda}{K + \lambda}\right) + 0.5 \cdot \sigma^2 \cdot T}{\sigma \cdot \sqrt{T}}\right)$$

whenever  $\lambda > 0$ . The only exception is in the case  $P = K$ , i.e. for ATM options.

In order to assess the possible materiality of the difference, the Example 1 from Annex 4a of BCBS document "The standardised approach for measuring counterparty credit risk exposures" is considered. Figure 6 summarises the main calculation steps to compute the Exposure-at-Default (EAD) of the portfolio (composed by one long position in a swap denominated in USD and two short positions in USD-denominated swap and Euro-denominated swaption). The example is slightly modified: in BCBS original example the assumed underlying price (the appropriate forward swap rate) is 6% and the strike price (the swaption's fixed rate) is 5%, while in the example proposed here



the assumed underlying price and the strike price are 6 bp and 5 bp, respectively. As the supervisory delta is the same  $-N\left(-\frac{\ln(6\%/5\%)+0.5\cdot(0.5)^2\cdot 1}{0.5\cdot\sqrt{1}}\right) = -N\left(-\frac{\ln(6\text{ bp}/5\text{ bp})+0.5\cdot(0.5)^2\cdot 1}{0.5\cdot\sqrt{1}}\right)$  even after the modification, the resulting EAD is the same.

Figure 6: Example 1 from Annex 4a – The standardised approach for measuring counterparty credit risk exposures. Underlying price and strike price modified: 5 bp and 6 bp.

Trade	Nature	Residual Maturity	M	S	E	Currency	Notional	Pay Leg	Receive Leg	Mkt Value	Option Type	P	K
1	IRS	10	10	0	10	USD	10,000	fix	fl	30	0		
2	IRS	4	4	0	4	USD	10,000	fl	fix	-20	0		
3	Swaption	1 to 10	11	1	11	EUR	5,000	fl	fix	50	-1	6 bp	5 bp

EAD	alpha	RC	PFE	multiplier	AddOnAgg	DIRj	V	C	SD	d	delta	MF
	1.4	60	347	1	347	78,694	30		8	78,694	1	1
569	1.4	60	347	1	347	-36,254	20		4	36,254	-1	1
	1.4	60	347	1	347	-10,083	50		7	37,428	-0.27	1

Notice that the option is Out-of-the-Money, being a put option with  $P > K$ . Consider then a downside movement of the underlying price, from 6 bp to 1 bp. The option is now In-the-Money, as  $P < K$  (the supervisory delta moves consequently from -0.27 to almost -1.00). Changed PFE and EAD are shown in Figure 7.

Figure 7: Example 1 from Annex 4a. Underlying price and strike price: 1 bp and 6 bp.

Trade	Nature	Residual Maturity	M	S	E	Currency	Notional	Pay Leg	Receive Leg	Mkt Value	Option Type	P	K
1	IRS	10	10	0	10	USD	10,000	fix	fl	30	0		
2	IRS	4	4	0	4	USD	10,000	fl	fix	-20	0		
3	Swaption	1 to 10	11	1	11	EUR	5,000	fl	fix	50	-1	1 bp	5 bp



EAD	alpha	RC	PFE	multiplier	AddOnAgg	DIRj	V	C	SD	d	δ	MF
	1.4	60	483	1	483	78,694	30	-	8	78,694	1	1
761	1.4	60	483	1	483	-36,254	-20	-	4	36,254	-1	1
	1.4	60	483	1	483	37,428	50	-	7	37,428	-1	1

Consider then another downward movement of the underlying price, from 1 bp to -1 bp. The supervisory delta in that case needs to be adjusted with a  $\lambda$  shift.

Compares the results for the three different threshold levels.

Table 5: Example 1 from Annex 4a. Underlying price and strike price: -1 bp and 6 bp for different levels of thresholds

Threshold level	Swaption $\delta$	PFE	EAD
0.01%	-1	483	761
0.1%	-0.75	437	670
1%	-0.45	380	616

For threshold level 0.1% and 1% the supervisory delta is -0.75 and -0.45 respectively (Table 5). However, this appears to be inconsistent, as the option is even more ITM than the example, but the supervisory delta is moving in the opposite direction (towards 0 and not towards -1 as correctly expected). The results also shows how PFE and EAD are significantly dropping instead of remaining substantially unchanged as would have been expected.

This illustrative example shows that setting the threshold as low as possible produces the less distortion. In this way, the objective reported in Basel FAQ<sup>17</sup> to set it as low as possible is also pursued.

However, given that the actual effect depends on many features of the instruments composing the portfolio (e.g. strike price, underlying price, maturity), all three threshold levels are retained for consultation.

### c. Volatility adjustment

<sup>17</sup> <https://www.bis.org/bcbs/publ/d438.pdf>

Option 1: No adjustment to volatility

Option 2: Adjustment to volatility

In order to offset the effect produced by the shift  $\lambda$ , a correction on the volatility is assessed. Consider that one needs to find  $\sigma'$  such that

$$\text{sign} \cdot N\left(\text{type} \cdot \frac{\ln\left(\frac{P}{K}\right) + 0.5 \cdot \sigma^2 \cdot T}{\sigma \cdot \sqrt{T}}\right) = \text{sign} \cdot N\left(\text{type} \cdot \frac{\ln\left(\frac{P+\lambda}{K+\lambda}\right) + 0.5 \cdot \sigma'^2 \cdot T}{\sigma' \cdot \sqrt{T}}\right),$$

resulting after some simplifications in

$$\begin{aligned} & \frac{\ln\left(\frac{P}{K}\right) + 0.5 \cdot \sigma^2 \cdot T}{\sigma \cdot \sqrt{T}} - \frac{\ln\left(\frac{P+\lambda}{K+\lambda}\right) + 0.5 \cdot \sigma'^2 \cdot T}{\sigma' \cdot \sqrt{T}} \\ &= \frac{\ln\left(\frac{P}{K}\right) \cdot \sigma' + 0.5 \cdot \sigma^2 \cdot \sigma' \cdot T - \ln\left(\frac{P+\lambda}{K+\lambda}\right) \cdot \sigma - 0.5 \cdot \sigma'^2 \cdot \sigma \cdot T}{\sigma' \cdot \sigma \cdot \sqrt{T}} = 0. \end{aligned}$$

The generic adjustment function  $f'$  can be found by solving the above equation for  $\sigma'$ .

The solution is

$$\sigma' = \frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma \mp \sqrt{\left(\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma\right)^2 - 2 \cdot \frac{\ln\left(\frac{P+\lambda}{K+\lambda}\right)}{T}}$$

Figure 14 provides further insight on the behaviour of the function  $f'$ . As one can notice from the graph, the adjustment is more “severe” (i.e.  $\sigma'$  is more distant from the value of  $\sigma$ ) the more the parameter  $\lambda$  increases. Moreover, when  $\frac{P}{K} = 1$  the function  $f'$  can assume either value  $\sigma$  or 0,

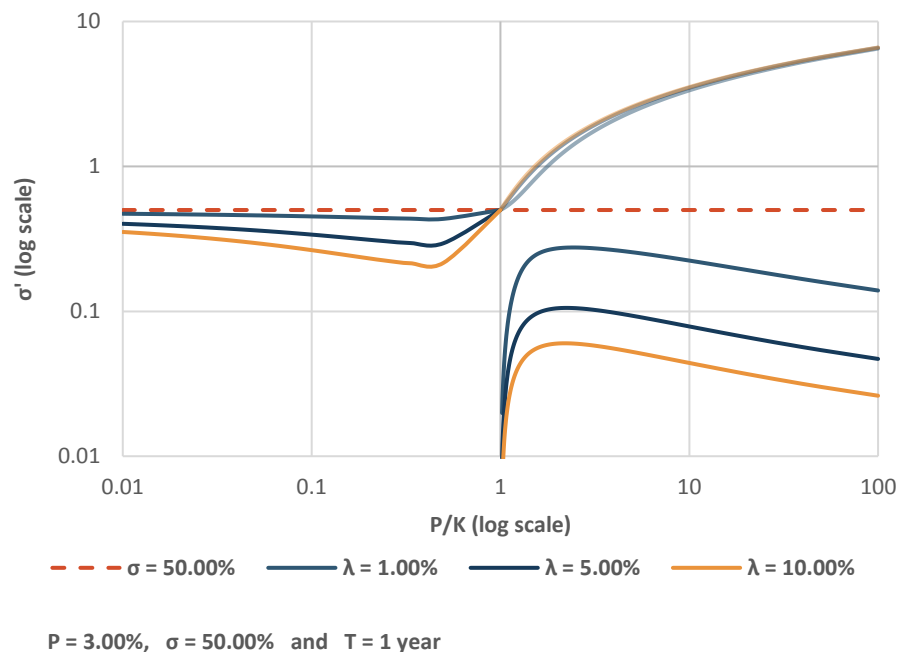
depending if one considers  $\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma - \sqrt{\left(\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} - 0.5 \cdot \sigma\right)^2}$  or  $\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma + \sqrt{\left(\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} - 0.5 \cdot \sigma\right)^2}$ , respectively.

Notice<sup>18</sup> also that that  $\sigma' \in \mathbb{R}$  for any  $P, K, \sigma, T > 0$ .

<sup>18</sup>  $\left(\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma\right)^2 - 2 \cdot \ln\left(\frac{P+\lambda}{K+\lambda}\right)/T \geq 0$  if  $\frac{P}{K} < 1$  as the sum of two positive quantities.

Moreover,  $\left(\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma\right)^2 - 2 \cdot \ln\left(\frac{P+\lambda}{K+\lambda}\right)/T \geq \left(\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma\right)^2 - 2 \cdot \ln\left(\frac{P}{K}\right)/T \geq 0$  if  $\frac{P}{K} \geq 1$ , as  $\left(\frac{\ln\left(\frac{P}{K}\right)}{\sigma \cdot T} + 0.5 \cdot \sigma\right)^2 - 2 \cdot \ln\left(\frac{P}{K}\right)/T = 0$  when  $\ln\left(\frac{P}{K}\right)/T = \sigma^2/2$  and positive otherwise.

Figure 8.: Behaviour of the function  $\sigma' = f'(\frac{P}{K}, \frac{P+\lambda}{K+\lambda}, T, \sigma)$ .

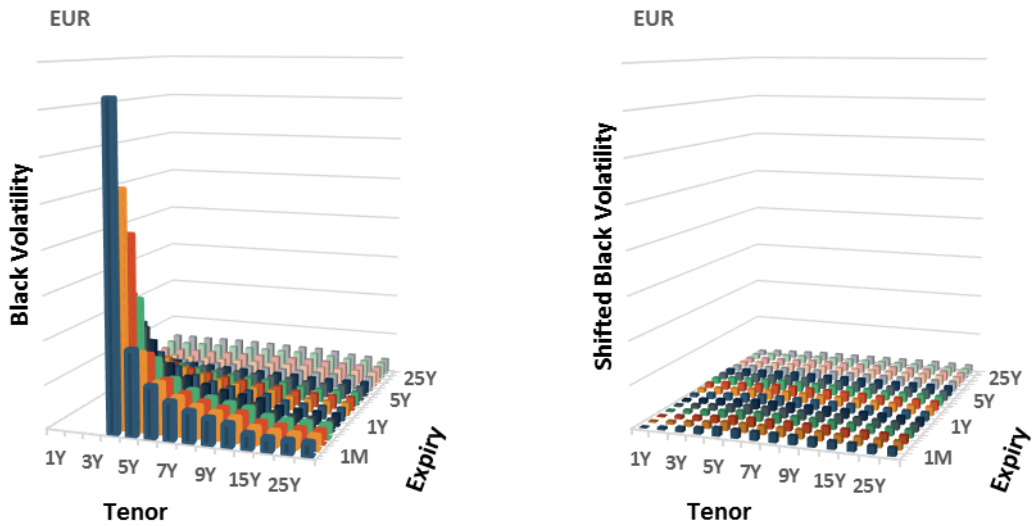


Unfortunately this adjustment is a function of the ratio  $\frac{P}{K}$ , which is precisely the quantity that cannot be computed. One possible solution could be to substitute the function  $\sigma' = f'(\frac{P}{K}, \frac{P+\lambda}{K+\lambda}, T, \sigma)$  with a slightly different function  $\sigma'' = f''(P, K, \lambda, T, \sigma)$ , defined to behave in a specific and precise way, i.e. resembling  $f'$ .

However, it could be difficult to find a function that allows to overcome the possible bias highlighted in Figure 9 - Figure 11 below.

For Euro, a substantial difference between the two volatility surfaces is observed. In the sample of swaptions considered, there is a minimum of 10% difference between the volatilities quoted in terms of Black model and the ones quoted under the Shifted Black model, with an average of just over 40% and a median value of just over 20%.

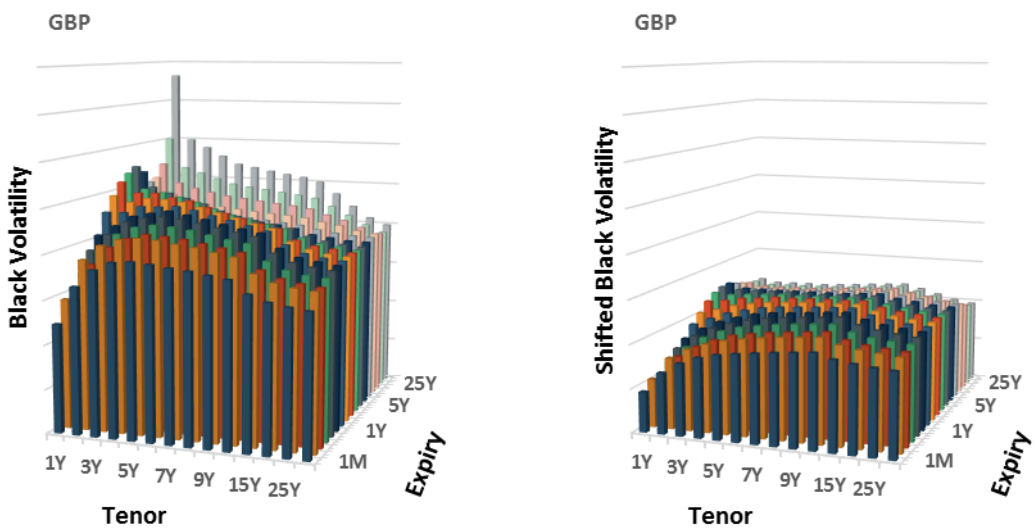
Figure 9: Black’s volatilities and Shifted Black’s volatilities for Euro



Source: Bloomberg (ICAP)

Note: Data as of 18 February 2019. Expiry refers to the time period between the valuation date and the maturity of the option. Tenor refers to the length of the underlying swap.

Figure 10: Black’s volatilities and Shifted Black’s volatilities for GBP



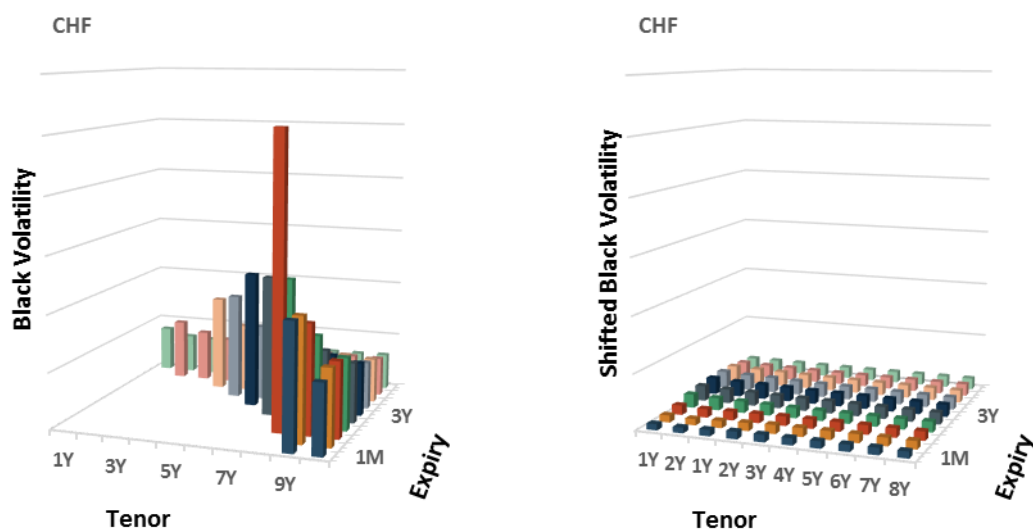
Source: Bloomberg (ICAP)



Note: Data as of 18 February 2019. Expiry refers to the time period between the valuation date and the maturity of the option. Tenor refers to the length of the underlying swap.

For British Pound, the difference between the two volatility surfaces is smaller but still substantial. In the sample considered, there is a minimum of 12% difference with an average of 21% and a median value of 20% (Figure 10).

Figure 11: Black’s volatilities and Shifted Black’s volatilities for CHF



Source: Bloomberg (ICAP)

Note: Data as of 18 February 2019. Expiry refers to the time period between the valuation date and the maturity of the option. Tenor refers to the length of the underlying swap.

For Swiss Franc, the difference between the two volatility surfaces is very pronounced – similar to the one observed for Euro. In the sample considered, there is a minimum of 41% difference with an average of 101% and a median value of over 75% (Figure 11).

Options 1 and 2 are retained for consultation.

## 5.2 Overview of questions for consultation

**Q1.** Which one of the two options do you think is more appropriate as thresholds in Article 3(b) steps (v) and (vii) (option 1a: Y%=50% and Z%=25%, or option 1b: Y%=60% and Z%=30%)? Please provide the rationale for the chosen option.

**Q2.** What are your views about the general quantitative approach methodology, which hinges on FRTB SA sensitivities? Please provide examples of cases where computing FRTB SA sensitivities might raise some issues.

**Q3.** Do you have any views on the appropriateness, for smaller institutions, of the alternative SA CCR add-ons approach (Article 3(2)) in overcoming the issues (if any) raised by the general FRTB SA sensitivities approach?

**Q4.** Do you think the approach outlined here should be applied at currency level (option 3a) or transaction level (option 3b)?

**Q5.** Which one of the three options (option 4a: 1 bp, option 4b: 0.1% or option 4c: 1%) do you think is more appropriate as a threshold? Please provide the rationale for the chosen option.

**Q6.** Please provide examples of cases where the possibility to set the shift  $\lambda$  according to the prevalent market conditions (option 4) might:

- provide some benefits
- raise some concerns

**Q7.** Do you consider necessary an adjustment to the supervisory volatility parameter  $\sigma$  as defined in Article 5? In the case an adjustment is considered necessary, how should it be carried out?

**Q8.** Do you think the specified method for determining whether a transaction is a long or short position in a material risk driver is adequate? If not, please provide an explanation.