Executive Summary

In the light of the recent publication of the finalised Basel 3 review by the Basel Committee on Banking Supervision (BCBS), the authors analyse the effects of the incoming FRTB regulation on the CVA risk framework. As explained in the article, the Basel Committee in 2015 started an important review of the CVA risk framework which has been finalized in December 2017 with the publication of the new Basel 3 standards. In July 2020, BCBS published the revised version of CVA risk framework after November 2019 consultation. The regulator is proposing a new sensitivity-based CVA risk charge with the intention of being much more consistent with the FRTB standardised approach. The paper is also a chance for the authors to explore the shortcomings and the challenges implied in the newly proposed CVA regulation, especially with respect to the concurrent financial risk frameworks.
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The Credit Value Adjustment (CVA) is the adjustment to the fair value of derivative instruments in order to take into account the downgrade of the counterparty quality. The need of collecting capital also for CVA purposes has been formalized by the Basel Committee on Banking Supervision (BCBS) only after the 2008 financial crisis, with the Basel 2.5 and Basel 3 regulations.

In particular, the Basel Committee started an important review of the CVA risk framework in 2015 that has been finalised and formalised in December 2017 with the new Basel 3 standards (see [3]) and suggested a new approach for CVA capital charge that is more consistent with the revised approach for market risk (FRTB).

The paper is organized as follows: in the first part we briefly describe the Basel 3 regulation for CVA Capital Charge currently in use. In the second part we introduce to the main steps of the CVA risk revision performed by BCBS until the formalization of the new standards in the Basel 3 framework. In the third part we present the new Basel 3 CVA risk in detail, focusing on its comparison with the revised market risk (FRTB) and its potential implications on the banks risk frameworks; the fourth part is a brief detour on the last revision of ECB Guide on Assessment Methodology (EGAM) with a particular focus on specification regarding current A-CVA framework; the final part is left for conclusions.

This paper is the revised version of the one published in January 2018: we have updated the sessions on the basis of the Basel committee revision of July 2020 [11]. In order to avoid misunderstanding, in the paper we refer to CVA meaning regulatory CVA.


With the introduction of Basel 3 at the end of 2010 a bank is obliged to add capital charge to cover the risk of mark-to-market losses in the expected counterparty risk of OTC derivatives (see [2]). Depending on the bank’s approved method of calculating the capital charges for CCR and specific interest rate risk (VaR), there are two approaches for the CVA capital charge computation (a synthetpicture is reported in Figure 1).

1.1 Advanced CVA

If the bank can use approved internal models for both CCR and VaR, the Advanced CVA capital charge can be applied. It consists in modelling the impacts due to the changes in the credit spreads of counterparties of OTC derivatives using the internal bank model for VaR computation. If the bank is applying the full repricing VaR model, then the CVA charge is obtained through the following formula:

\[ CVA = (LGD_{mkt}) \sum_{i=1}^{T} [A \cdot B] \]

where:

- \( LGD_{mkt} \) is the loss given default of the counterparty based on the spread of the counterparty market instrument.
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FIGURE 1: The table summarizes the current Basel 3 criteria to adopt the Advanced or the Standardised CVA capital charge. For the Standardised, a single formula is given by the BCBS and it is reported above.

\[
K = 2.33 \cdot \sqrt{h} \cdot \left[ \sum_{i=1}^{T} \left( 0.5 \cdot w_i \cdot \left( M_i + EAD_{tot} - M_i^{hedg} + B_i \right) \right) - \sum_{j=1}^{T} \left( w_j \cdot M_j + B_{tot} \right) \right] + \sum_{j=1}^{T} \left( 0.75 \cdot w_i \cdot \left( M_j + EAD_{tot} - M_j^{hedg} + B_j \right) \right)
\]

1.2 Standardised CVA

The Standardised CVA approach is used when a bank does not have the approval for the internal models on VaR, CCR or both of them. In such a case the BCBS provides a single formula to compute the portfolio CVA capital charge. As it is possible to see in Figure 1, the main drivers of the formula are:

\[
A = \max \left[ 0; \exp \left( - \frac{s_i t_i - 1}{LGD_{mkt}} \right) - \exp \left( - \frac{s_i t_i}{LGD_{mkt}} \right) \right]
\]

with the credit spread of the counterparty \( s_i \) as main driver.

\[
B = \frac{EE_{i-1} D_{i-1} + EE_{i} D_{i}}{2}
\]

with \( D_i \) the default risk-free discount factor at time \( t_i \).

The alternative to the full repricing is the VaR model based on Credit Spread sensitivity. If the banks is adopting bumps on specific tenors, then the regulatory credit spread is given by:

\[
CS_{01} = 0.0001 \cdot t_i \exp \left( - \frac{s_i t_i}{LGD_{mkt}} \right) \frac{EE_{i-1} D_{i-1} - EE_{i+1} D_{i+1}}{2}
\]

while if the bank is choosing for a parallel shift the regulatory credit spread formulation changes as follows:

\[
CS_{01} = 0.0001 \sum_{i=1}^{T} \left[ t_i \exp \left( - \frac{s_i t_i}{LGD_{mkt}} \right) - t_{i-1} \exp \left( - \frac{s_i t_{i-1}}{LGD_{mkt}} \right) \right] \left( \frac{EE_{i-1} D_{i-1} + EE_{i} D_{i}}{2} \right)
\]

As for the Market Risk in Basel 2.5, the total CVA risk capital charge is given by the sum of both general and specific credit spread risk, including the stressed VaR charge and excluding the IRC.
In both *Advanced* and *Standardised* CVA capital charge, only the **eligible hedges** used for mitigating CVA risk can be included in the charge computation (and excluded in the Market Risk one): single-name CDS, contingent single-name CDS, CRDI (with some restrictions), each equivalent hedging instrument reflecting the counterparty directly.

### 2. CVA Review Proposals

Both *Advanced* and *Standardised* approaches described above capture the variability of regulatory CVA depending *only* on credit spreads, without considering the exposure variability due to the daily changes of other (market) risk factors: this is one of the most relevant drawbacks of the current CVA capital charge computation and, as a consequence, one of the main drivers of the revision indeed. This section briefly highlights the main steps of the review process, starting from the first proposal in 2015 until the finalisation of the framework in the recent Basel 3 formulation (July 2020).

#### 2.1 2015: First Proposal

In the first consultative paper published by BCBS in July 2015 [8] it is quite clear the attempt of the regulator to increase convergence between the CVA risk framework and the revised market risk framework. The Basel Committee explained the main rationales behind this choice that we can briefly summarise as follows:

- All the relevant risk factors (including the market ones) need to be taken into account for CVA capital charge purposes; the relevance is given by the fact that movements in such risk factors can affect the future value of the exposures.
- The future exposure shall be computed with a market implied calibration of the parameters within a risk-neutral approach: this way shall guarantee the calculation to be compliant with the accounting principles.
- The reviewed approach has to be aligned with the new market risk regulation (FRTB): in particular for non-internal model calculation there should be a *more risk-sensitive* approach.

In the paper the BCBS suggested two different frameworks in order to cover all the types of banks:

1. **FRTB-CVA framework**: banks have to meet several conditions in order to be allowed to implement such an approach; it entails two different methods: the internal model (IMA-CVA) and the standardised model (SA-CVA).
2. **Basic CVA framework**: for all the banks that cannot match the conditions for the FRTB-CVA approach.

Focusing on SA-CVA described in the paper, it is an adaptation of the FRTB Sensitivity-based Method (FRTB-SBM) to the regulatory CVA capital charge calculation. Indeed the only differences we spot in SA-CVA with respect to FRTB-SBM are:

- The reduction in granularity of market risk factors for most cases;
- The absence of default risk and gamma risk calculation;
- The creation of a specific risk class (*counterparty credit spreads*) that inherits the bucketing features of CSR (non-securitisation);
- The use of a more conservative risk aggregation;
- The use of a multiplier ($m_{\text{CVA}}$).

Another important point that distinguish the SA-CVA proposal to the FRTB-SBM is the fact that banks need to meet three main eligibility criteria in order to be authorised to apply it, even if it is a *standardised* method:
1. The ability to calculate CVA sensitivities;
2. A robust methodology to approximate the credit spread for illiquid counterparties;\footnote{For illiquid counterparties the Committee means those counterparties that do not have credit spreads traded in the market.}
3. The existence of a dedicated CVA risk management function.

As in the FRTB-SBM the frequency of the capital charge calculation in accordance with the SA-CVA is at least monthly (and on demand). The BCBS also defines the eligible hedges for SA-CVA: only the transactions used for the purpose of mitigating CVA risk can be considered as eligible. The instruments that cannot be included in the FRTB-IMA cannot be eligible for CVA hedging purposes (e.g. securitisation products). The non-eligible CVA hedges will be treated as trading book instruments and then charged via FRTB rules.

2.2 2016: Constraints on the Internal Models

In March 2016 the BCBS issued a consultative paper highlighting some constraints in the use of internal model approaches for both market and counterparty credit risks \footnote{Practitioners and mass media are referring to the new standards also with the name of Basel 4.}. This consultation involved also the revision of CVA risk framework. In particular in the summary of the proposal (paragraph 2.1 in [7]) the Committee clearly states:

«[...] Furthermore, in July 2015 the Committee issued a consultative document on credit valuation adjustment risk (CVA risk) that included three methods: the internal models approach (IMA-CVA), the standardised approach (SA-CVA) and the basic approach (BA-CVA). The Committee has decided to eliminate from the proposed framework the IMA-CVA. The proposal for CVA risk continues to include the SA-CVA and the BA-CVA. In finalising its reform agenda this year the Committee will consider the calibration of these remaining approaches.»

Given the constraints on the use of internal model approaches highlighted by BCBS in 2016, all the efforts of the revision are focused now on the SA-CVA, the most refined method a bank can adopt to regulatory CVA capital charge computation.

2.3 2017: Basel 3 Finalisation

In December 2017 the Basel Committee issued the new Basel 3 standards [3], finalising a series of post-crisis reforms announced in 2010\footnote{Practitioners and mass media are referring to the new standards also with the name of Basel 4.}. In a nutshell, the finalisation of Basel 3 regulatory framework by the Committee has the main goals to restore credibility in the calculation of RWAs and to improve the comparability of capital ratios among banks by:

- Enhancing the robustness and risk sensitivity of the standardised approaches for market risk, credit risk and operational risk;
- Establishing some constraints on the use of internal model approaches;
- Complementing the risk-weighted capital ratio with a finalised leverage ratio and a robust capital floor.

2.4 2020: Targeted Revision to the CVA Risk Framework

A few updated on Basel III standard publication in December 2017 can be considered relevant on the last version of July 2020 [11]:

1. Reduced risk weights: delta risk weights in interest rate, foreign exchange and in the counterparty credit spread and reference credit spread risk classes for high yield and non-rated sovereigns were reduced. In addition, also for BA-CVA, risk weight for high yield and non-rated sovereigns, including exposures to central banks and multilateral development banks
were reduced. Lastly, the vega risk weights in the SA-CVA will be capped at 100%. The aim of BCBS is to align the CVA risk framework with the revised market risk framework.

2. **New index buckets and revised aggregation formula**: the revised market risk framework introduced new index buckets, where banks could, under certain conditions, calculate capital requirements using credit and equity indices directly instead of looking through to the underlying constituents. BCSD introduced the same new buckets in the:

- Counterparty credit spread risk class;
- Reference credit spread risk class;
- Equity risk class of the SA-CVA.

The Committee has also revised the formula for aggregating capital requirements across buckets in the CVA risk framework in order to better align it to the market risk framework.

3. **Alterations to the Scope of CVA Risk Capital Requirements**: the scope of portfolios subject to CVA risk capital requirements has been modified excluding some SFTs when the risk arising from such trades is not material and excluding certain client-cleared derivatives. Furthermore, the floor for the margin period of risk for some centrally-cleared client derivatives has been reduced. The goal of BCBS is to align the CVA requirement to the Counterparty risk framework and provide incentive to centrally clear OTC derivatives.

4. **A Revised Overall Calibration of the CVA Risk Framework**: the aggregate multiplier $m_{cva}$ has been reduced from 1.25 to 1 for banks using the SA-CVA. In order to keep SA-CVA and BA-CVA a new scalar $D_{BA,CVA} = 0.65$ for BA-CVA approach has been introduced. The implementation date of the revision has been delayed of one year from January 2022 to January 2023 due to COVID-19 impact.

In the following section we will deepen the analysis of the new CVA risk framework with particular attention on the analogies and the divergences with respect to the revised market risk framework.

### 3. 2020 Basel 3: CVA Risk Framework

The Committee has revised the regulatory CVA framework taking into account all the drawbacks of the current approaches and confirming the convergence towards the standard models for market and counterparty credit risks. At high level the final revision moves in three complementary directions:

1. **Enhance risk sensitivity**: the fact that both the Advanced and Standardised methods for CVA capital charge calculations do not cover the exposure component entails a relevant shortcoming in the current framework; the exposure component is related to the prices of the transactions in the CVA capital charge application scope and these prices move with respect to the changes in underlying market risk factors; the revised CVA framework takes into account the exposure component together with its associated hedges, becoming more sensitivity-based indeed.

2. **Strengthen robustness**: in line with the 2016 consultative paper [7], the revised CVA framework removes the use of the internal model approach (IMA-CVA) and paves the way for three alternatives in CVA capital charge computation:

   - The Standardised Approach (SA-CVA);
   - The Basic Approach (BA-CVA);
   - A simple multiplier of CCR charge in case the bank has an aggregated notional amount of non-centrally cleared derivatives less than or equal to €100 billions.

3. **Improve consistency**: both the SA-CVA and Basic approaches have been designed and calibrated to be consistent with the revised market risk framework.
In what follows we analyse in details the two approaches to calculate CVA capital charge and the implications related to their implementation in the banks risk framework. Before deepening in the analysis, we highlight some points of attention that can be useful drivers:

- The convergence of new SA-CVA with the FRTB-SBM and, more in general, towards a more risk-sensitivity framework;
- The presence of eligibility criteria and supervisory approval in order to apply the SA-CVA;
- The establishment of a materiality threshold that can allow banks to approximate their CVA capital charge to their CCR capital charge.

With regard to all the details related to CVA hedges and eligibility criteria we suggest to refer to the BCBS paper [4] directly.

3.1 Standardised Approach for CVA: SA-CVA

General Principles

We can confirm that also this final version of the SA-CVA is an adaptation of the FRTB-SBM and a refinement of the 2015 first proposal. Thus comparing this final SA-CVA to the FRTB-SBM we can highlight once more the following major differences:

- The reduction in granularity of market risk factors for most cases;
- The creation of a specific risk class (counterparty credit spreads) that inherits the bucketing features of CSR (non-securitisation);
- The absence of default risk and curvature risk calculation;
- The use of a more conservative risk aggregation and a multiplier \( m_{CVA} \) to counterbalance the absence of default and curvature risks calculation;
- The need of supervisory approval to be applied.

The minimum criteria for the SA-CVA eligibility are two:

1. The ability for the bank to model exposure and calculate (at least monthly) CVA and CVA sensitivities to the relevant market risk factors;
2. The presence in the bank of a CVA desk responsible for CVA risk management and hedging.

Of course regulatory CVA is the base for the calculation of the CVA capital charge and such a calculation must be performed by the bank for each counterparty having at least one covered position. A key point for supervisory approval in the use of CVA-SA is the bank’s adherence to the following principles:

- CVA must be calculated at counterparty level as the expectation of future losses resulting from the default of the counterparty assuming the bank itself is default-free.
- CVA calculation must be based on at least three fundamental inputs:
  - The **term structure of market-implied PD** that has to be estimated from credit spreads observed in the market\(^4\);
  - The **market-consensus ELGD** that has to be the same used for calculating risk-neutral default probabilities from credit spreads\(^5\);
  - The **path of discounted future exposure** that has to be produced by pricing all the derivative transactions related to the counterparty on simulated paths of relevant market risk factors\(^6\).

\(^4\)The Committee is quite precise also in defining the requirements in case of illiquid counterparties.
\(^5\)Unless the bank is able to demonstrate that the seniority of the derivative exposure is different from the seniority of the senior unsecured bonds.
\(^6\)To be discounted using risk-free interest rate curves.
• CVA calculation must be consistent with Accounting CVA as well, in particular:
  - The paths of discounted future exposure has to be obtained via exposure models used for calculating the accounting CVA, adjusted to regulatory requirements in case of needs;
  - The model calibration process, market and transaction data must be the same as those used for accounting purposes.

• The generation of market risk factor paths (underlying the exposure models) shall meet specific requirements indeed:
  - Drifts of risk factors must be consistent with a risk-neutral probability measure;
  - The volatilities and the correlations of market risk factors must be calibrated to market data (if no sufficient data exists in a given market, historical calibration is allowed);
  - The distribution of modelled risk factors must account for the possible non-normality of the exposure distribution (e.g. “fat-tails”).

• CVA calculation must take into consideration the level of dependency between exposure and counterparty credit quality.

• CVA calculation must take into account mitigant effect deriving from margining and collateral requirements.

Supervisory approval is also subject to:

• The appropriateness of bank methodology in simulating all the relevant risk factors across an adequate numbers of paths and set of future time-points;

• The adequacy of risk management processes in the control and governance of CVA risk;

• The adequacy of IT infrastructure processes in the market data management.

As in the first proposal, the BCBS also defines the eligible hedges for SA-CVA: only the transactions used for the purpose of mitigating CVA risk can be considered as eligible. Eligibility can be extended to hedges of both the counterparty credit spread and the exposure component of CVA risk. The instruments that cannot be included in the FRTB-IMA cannot be eligible for CVA hedging purposes (e.g. securitisation products).

Calculations

Banks that are eligible to adopt the SA-CVA must calculate the CVA capital charge at least monthly and on demand (as in FRTB-SBM). The SA-CVA uses as input the sensitivity of regulatory CVA to both counterparty credit spreads and market risk factors underlying transactions prices. Sensitivity computation must be performed in accordance with the FRTB-SBM standards indeed. In particular the main general principles regarding the calculation and the aggregation principles are reported below:

• Six risk asset classes are identified as relevant: Interest Rate (IR), Foreign Exchange (FX), Counterparty Credit Spreads, Reference Credit Spread\(^7\), Equity, Commodity.

• The overall CVA capital requirement is calculated as the sum of the capital requirements for delta and vega risks calculated for the entire CVA book (including also eligible hedges).

• The capital requirement for delta risk is given by the sum of the delta capital requirements for all the six risk asset classes.

• The capital requirement for vega risk is given by the sum of the vega capital requirements for five risk asset classes (the counterparty credit spreads are excluded from vega sensitivity computation).

\(^7\)Credit spreads that drive the exposure
• The sensitivities are defined as the ratio between the change of the quantity (due to a change in the risk factor value) and the size of the change; in line with FRTB-SBM, the Committee provides specific definitions of buckets, risk factors, sensitivities, risk weights and correlations for each risk asset class.

• Despite shifts are defined in line with FRTB-SBM, the Committee allows bank to use smaller values of risk factors shifts in case it is more consistent with internal risk management calculations.

• Regarding vega risk, volatility shifts must be applied to both volatilities used for generating risk factor paths and volatilities used for pricing options; CVA vega sensitivities are considered always material by the regulator and thus must be calculated by the bank regardless the presence or not of options in the portfolio.

• Regarding the index hedging instruments, it is mandatory the calculation of the sensitivities to all risk factors upon which the value of the index depends.

Within each risk type the bank has to compute sensitivity of the aggregate CVA \( s^{CVA}_k \) and the sensitivity of all eligible hedges in the CVA book to each risk factor \( k \) \( s^{Hdg}_k \). The procedure is completely consistent with the FRTB-SBM one (with some differences in the final aggregation formula) and holds for both delta and vega sensitivity.

For each risk factor \( k \) the net sensitivities have to be weighted by the corresponding risk weight \( RW_k \) (given by the regulator as for FRTB-SBM):

\[
WS^{CVA}_k = RW_k s^{CVA}_k \quad (6)
\]

\[
WS^{Hdg}_k = RW_k s^{Hdg}_k \quad (7)
\]

Then the net weighted sensitivity of the CVA book to risk factor \( k \) is given by:

\[
WS_k = WS^{CVA}_k - WS^{Hdg}_k \quad (8)
\]

The formula in (8) is set out under the convention that the CVA is negative, it intends to recognise the risk reducing effect of hedging. If CVA loss had been expressed as a negative value, the minus sign would have been replaced by a plus sign.

The weighted sensitivities must be aggregated into a capital charge \( K_b \) within each bucket \( b \) following the Variance-Covariance approach that we have already seen in the FRTB-SBM framework; the formula is slightly different from the one presented at first in 2015 proposal, with the presence of the \( R \) parameter only in the second component of the equation and a different formulation of this second component itself:

\[
K_b = \sqrt{[C] + R \cdot [D]} \quad (9)
\]

where:

• \( R = 0.01 \) is the hedging disallowance parameter that prevents the possibility of perfect hedging of CVA risk;

• \( C \) is the component related to CVA sensitivities and is defined as follows:

\[
C = \sum_{k \in b} WS^2_k + \sum_{k \in b} \sum_{l \in b, l \neq k} \rho_{kl} WS_k WS_l \quad (10)
\]

• \( D \) is the component related to eligible hedges sensitivities and now is defined as follows:

\[
D = \sum_{k \in b} (WS^{Hdg}_k)^2 \quad (11)
\]

The last step is the aggregation of capital charges across different buckets within each risk type:

\[
K = m_{CVA} \cdot \sqrt{\sum_b K^2_b + \sum_{b \neq c} \sum_{c \neq b} \gamma_{bc} K_b K_c} \quad (12)
\]
where the correlation parameters $\gamma_{bc}$ applicable across buckets are defined by the BCBS itself. From equation (12) it is possible to notice the presence of a specific multiplier for CVA ($m_{CVA}$) that is absent in the corresponding FRTB-SBM formula: this multiplier had a default value of 1.25 in the 2017 proposal, reduced to 1 in the last revision of July 2020 [11]. However, a bank’s relevant supervisor may require a bank to use a higher value of the multiplier if the supervisor determines that the bank’s CVA model risk warrants it (e.g. if the level of model risk for the calculation of CVA sensitivities is too high or the dependence between the bank’s exposure to a counterparty and the counterparty’s credit quality is not appropriately taken into account in its CVA calculations).

Implications and Challenges

The first challenge a bank that want to adopt the SA-CVA has to face is the supervisory approval. In order to get it, the bank must be compliant with the eligibility criteria set by the BCBS in [3] and this could entail not negligible implications in its risk framework.

The first criterion (i.e. the ability for the bank to model exposure and calculate CVA and CVA sensitivities to the relevant market risk factors at least monthly) is for sure the most challenging and has been influenced by the revised market risk framework. Given the strong imprint of the FRTB in the new CVA risk proposal, for our analysis we adopt the same structure we applied in our previous article on the FRTB-SBM [1]: for each phase (Identification, Calculation and Aggregation) we will comment the implications and the challenges entailed by the new CVA risk framework. A summary is presented in Figure 2.

Risk Factors Identification and Classification

As for the Sensitivity-Based Method (SBM) in the FRTB, the capital requirement is given by the sum of the contributions from different risk classes. In particular, for SA-CVA there are six relevant risk types (versus seven risk classes in the market risk framework): credit spreads (counterparty and reference), interest rate, foreign exchange, equity and commodity. Banks that want to adopt the SA-CVA need to consider two main kinds of intervention:

1. The identification of all the relevant risk factors for the calculation. Despite it seems quite easy by a financial point of view, by a technical perspective this intervention implies the ability...
of the bank to properly associate for each financial transactions the related risk factors; it has two level of complexity:

- The ability of the bank risk framework to associate to each derivative transaction the actual risk factors useful for the calculation (ignoring all the non-relevant ones);
- The ability of the bank risk framework to maintain this association consistently with the evolution of the portfolio and the market data.

2. **The proper classification of risk factors in buckets.** In this case, as for FRTB-SBM, specific **metadata** need to be associated to each risk factor for the proper classification.

Here the main challenge for the bank is to improve its data management system in order to:

- Map the set of relevant risk factors with respect to the actual CVA book: **risk factor mapping**;
- Identify all the inter-correlation among market data to the proper definition of risk factors within the engine: **risk factor hierarchy**;
- Handle enriched metadata and properly associate them to risk factors: **risk factor classification**.

Considering the fact that the implementation of FRTB is mandatory for all the banks, we believe that strong synergies can be exploited between the FRTB-SBM and the SA-CVA in this phase. In Figure 3 we have summarised the buckets by risk class for both CVA-SA and FRTB-SBM: as it is possible to see, the CVA-SA bucket structure is completely inherited by the FRTB (even if simplified in some cases). We believe that relevant synergies can be exploited between the FRTB and the SA-CVA implementation: once the bank put in place a logic of risk factor identification and metadata association for the FRTB-SBM, the adaptation of this logic to CVA risk framework is simplified. From this perspective, the challenge of improving data management implied in CVA-SA becomes not critical for banks.

**Sensitivity Calculations**

Most of the calculation rules for SA-CVA are inherited from the FRTB-SBM indeed. In these two phases the main challenges for banks may rise in shifting:

- **From the current Advanced CVA to the SA-CVA**, if a CVA sensitivity engine is not in place yet;
- **From the current Standardised CVA to the SA-CVA**: despite we are talking about two "standardised" approaches, the SA-CVA is much more refined and implies an engine able to capture sensitivities and aggregate them with different logics; in this light we can consider this challenge as the most relevant.

Delta and vega calculation procedures are mainly replicating the FRTB-SBM ones: differently from the market risk regulation, the SA-CVA does not require any curvature computation. If we start assessing the implications of SA-CVA from this perspective, we can confirm they are related to the sensitivity implementation in the FRTB framework and then foresee two potential scenarios for calculation:

1. The bank is already able to calculate sensitivities for its CVA book: in this case the first criterion for SA-CVA eligibility is met; if the engine needs just an adaptation in the shifting application procedure, the bank will not face big challenges in extending the FRTB-SBM logic also for CVA framework; in this specific case we see relevant synergies that can be exploited from FRTB implementation, with the advantage that no efforts for curvature calculation are expected in the SA-CVA.

2. The bank is not able to calculate sensitivities for its CVA book positions: in this case the bank is not matching with the first eligibility criterion for supervisory approval; despite formal criteria, the challenge introduced by SA-CVA in this context is much more relevant since the bank has to implement from scratch (or at least strongly enhance) the revaluation engine in order to
compute CVA sensitivities; some synergies can be exploited from FRTB-SBM implementation indeed, but for sure the additional effort to extend the logic to SA-CVA becomes higher with respect to scenario 1.

As general comment, the sensitivity calculations in SA-CVA poses a challenge to banks in terms of computational performances: given the calculation principles provided by BCBS to get the supervisory approval, calculating the CVA sensitivities to all relevant risk factors in a proper way means to reiterate many times CVA calculations under several sensitivity scenarios. CVA risk calculations (considering the main inputs provided by BCBS and related methodologies) imply a more demanding effort in terms of computation with respect to the market risk one: from this perspective the SA-CVA can be considered more challenging than the FRTB-SBM (and few synergies are exploitable). One remark highlighted also by Bonollo and Castagna [12] is related to the fact that the Basel Committee is imposing specific calculation methodologies for sensitivities: the authors believe that simply bumping the risk factors may not be the most effective way to compute them, given also the fact that more sophisticated methods have been implemented by some banks with good results. They suggested to modify the proposal in order to allow banks to be free to choose the preferred numerical calculation method, with the Basel Committee that should strictly prescribed only the functional mathematical definition of the indicator: in such a way banks could select the optimal strategy to calculate sensitivities and in most cases ease the burden of calculation indeed. It is true that the computational burden can be managed if the frequency of regulatory reporting is monthly (and on demand), but banks should evaluate carefully such an effort since calculations may require several reiteration before providing consistent risk metrics.

Aggregation

The aggregation of sensitivities within a bucket and across buckets is another crucial point in FRTB implementation and this phase may reveal challenges for banks in their ability of data handling. The implications of SA-CVA are not so different: banks that want to adopt the new CVA framework can leverage on FRTB implementation (paying attention on some differences the SA-CVA entails with respect to the FRTB-SBM). All the aggregation rules and the correlation coefficients for SA-CVA are provided by BCBS and follow the FRTB-SBM logic.

To conclude, if we consider the first eligible criterion defined by the BCBS indipendently from the FRTB-SBM requirements, the challenges for banks that want to adopt SA-CVA become relevant (in terms of risk factor identification and classification, sensitivity calculation and aggregation). If instead we assess the implications of this criterion together with the implementations entailed by FRTB-SBM, then significant synergies can be identified and exploited by banks, especially in the data handling and aggregation enhancements. It is quite clear that a basic assumption for the supervisory approval of SA-CVA application is the ability of banks to rely on an adequate IT infrastructure in order to manage metadata and to perform calculation, aggregation and reporting of results in the most compliant and efficient way.

Other Implications of SA-CVA

Challenges for banks that want to adopt the SA-CVA may rise also from the other eligibility criteria and principles.

In particular, a bank should be able to estimate the credit spreads of illiquid counterparties from the quoted credit spreads of its peers using an algorithm that should have at least three variables of measuring: rating, industry and region. These metadata can be retrieved from Front Office systems or market data providers and are useful also for the sensitivity computation and aggregation phase. In case neither historical series of credit spreads from peers are available, then a bank may face a real challenge: the regulator allows the bank to use a robust methodology based on a more fundamental analysis of credit risk in order to find a proxy for illiquid counterparties spreads; the assessment cannot be based on historical PD only, but it has to be related to credit markets as well. In certain

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8Just as example, think about the sensitivity calculation for an index hedging component: as stated by the BCBS, it is mandatory the calculation of the sensitivities to all risk factors upon which the vaule of the index depends; it implies the application of the shift of a risk factor \( k \) to all the index components that depends on this risk factor and the subsequent recalculation of the index value. If the index is the S&P500, reiteration may become challenging.
cases (not really specified by the Committee) the mapping of an illiquid counterparty to a single liquid reference name is allowed: this solution surely reduces the implication of this criterion but the bank that wants to adopt this work-around must justify each single mapping to supervisory authority.

Finally, the BCBS is quite clear in stating that sensitivities that are not used by the bank in its risk management process cannot be considered as reliable. Then in order to adopt the SA-CVA the bank must have also a CVA desk (or a function similar to that) for risk management purposes. Despite this is probably the less challenging implication, it implies additional costs for the bank in case no CVA desk is currently in place.

3.2 Basic Approach for CVA: BA-CVA

Banks that won’t match the eligibility criteria discussed above and won’t be allowed by supervisor authority to use the SA-CVA will fall-back on the basic CVA approach. The BA-CVA calculations can be performed in two ways:

1. Via full version, that recognises counterparty spread hedges and is intended for banks to hedge CVA risk;

2. Via reduced version, that is obtained from the full version with the elimination of hedging recognition.

The reduced version is thought for less sophisticated banks in order to further reduce the burden of implementation.

Various input are needed for the BA-CVA calculation:

<table>
<thead>
<tr>
<th>Risk Type</th>
<th>FRTB-SBM</th>
<th>SA-CVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIRR</td>
<td>• Curve Type: zero curve, inflation or basis</td>
<td>• Curve Type: zero curve, inflation or basis</td>
</tr>
<tr>
<td></td>
<td>• Tenor (vertex for sensitivity granularity)</td>
<td>• Tenor (vertex for sensitivity granularity)</td>
</tr>
<tr>
<td></td>
<td>• Currency for bucket allocation</td>
<td>• Currency for bucket allocation</td>
</tr>
<tr>
<td></td>
<td>• 10 vertices + Inflation + CCS basis</td>
<td>• 5 vertices + Inflation</td>
</tr>
<tr>
<td>CSR (no-securitisation)</td>
<td>• Credit Quality: IG or HY</td>
<td>• Sector: Industry Sector</td>
</tr>
<tr>
<td></td>
<td>• Sector: Industry Sector</td>
<td>• 7 buckets</td>
</tr>
<tr>
<td>Equity</td>
<td>• Market Capitalisation: Large or Small</td>
<td>• Market Capitalisation: Large or Small</td>
</tr>
<tr>
<td></td>
<td>• Region: Advanced or Emerging</td>
<td>• Region: Advanced or Emerging</td>
</tr>
<tr>
<td></td>
<td>• Sector: Industry Sector</td>
<td>• Sector: Industry Sector</td>
</tr>
<tr>
<td></td>
<td>• 11 buckets</td>
<td>• 11 buckets</td>
</tr>
<tr>
<td>Commodity</td>
<td>• Type of commodity: Energy, Metals, Gas, Grains,…</td>
<td>• Type of commodity: Coal, Crude Oil, Electricity, Freight, Metals, Natural Gas, Precious Metals,…</td>
</tr>
<tr>
<td></td>
<td>• 11 buckets</td>
<td>• 11 buckets</td>
</tr>
<tr>
<td>Forex</td>
<td>• Individual currencies</td>
<td>• Individual currencies</td>
</tr>
</tbody>
</table>

FIGURE 3: In the table above there is the comparison between the metadata/bucket structure defined for FRTB purposes and the metadata/bucket structure for SA-CVA. In most of the risk classes the structure is identical. For the Interest Rate risk the granularity of vertices by bucket is reduced. Regarding the Credit Spread Risk, the SA-CVA Counterparty and Reference Credit Spreads have metadata/bucket structures comparable with the CRS (non-sec) in the FRTB-SBM (the only difference is the number of buckets, reduced in both the SA-CVA risk classes).
• $RW_c$ is the risk weight for counterparty $c$ that reflects the volatility of its credit spreads; all risk weights values are given by the regulator on the basis of counterparty sector and credit quality.

• $RW_h$ is the risk weight of single name hedge $h$ that reflects the volatility of the credit spread of the reference name of the hedging instrument; all risk weights values are given by the regulator on the basis of counterparty sector and credit quality.

• $RW_i$ is the risk weight of index hedge $i$; all risk weights values are given by the regulator on the basis of counterparty sector and credit quality.

• $EAD_{NS}$ is the exposure at default of netting set NS obtained according to Basel 3 framework and used for default capital calculations of CCR.

• $M_{NS}$ is the effective maturity for netting set NS.

• $DF_{NS}$ is the supervisory discount factor.

• $\alpha$ is the multiplier used to covert EEPE to EAD\(^9\).

• $\rho$ is the supervisory correlation parameter equal to 0.5.

• $\beta$ is the supervisory parameter used to provide a floor that limits the extent to which hedging can reduce CVA capital charge; it is equal to 0.25.

• $B_{SN}^h$ is the notional of single-name hedge $h$.

• $B_{ind}^i$ is the notional of index hedge $i$.

• $DF_{SN}^h$ is the supervisory discount factor to be applied on $B_{SN}^h$.

• $DF_{ind}^i$ is the supervisory discount factor to be applied on $B_{ind}^i$.

• $M_{SN}^h$ is the remaining maturity of single-name hedge $h$.

• $M_{ind}^i$ is the remaining maturity of index hedge $i$.

• $r_{hc}$ is the supervisory prescribed correlation between the credit spread of counterparty $c$ and the credit spread of a single-name hedge $h$ of counterparty $c$.

### Reduced Version of BA-CVA

The CVA capital charge under the reduced version of the BA-CVA is calculated by summing:

$$K_{reduced} = \sqrt{\left(\rho \sum_c SCVA_c\right)^2 + (1 + \rho^2) \sum_c SCVA_c^2}$$  \hspace{1cm} (13)

where:

• $SCVA$ is the CVA capital requirement that counterparty $c$ would receive if considered on a stand-alone basis and it is given by:

$$SCVA_c = \frac{1}{\alpha} RW_c \sum_c (M_{NS} EAD_{NS} DF_{NS})$$  \hspace{1cm} (14)

• The first term under the square root in equation (13) aggregates the systematic components of CVA risk.

• The second term under the square root in equation (13) aggregates the idiosyncratic components of CVA risk.

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\(^9\)The value of $\alpha$ under the SA-CCR is 1.4.
Full Version of BA-CVA

The full version of BA-CVA implies the calculation of \( K_{\text{reduced}} \) as well and can be summarised as follows:

\[
K_{\text{full}} = K_{\text{reduced}} + (1 - \beta)K_{\text{hedged}}
\]

where:

- \( K_{\text{reduced}} \) is calculated as in equation (13);
- \( K_{\text{hedged}} \) represents the part of capital requirements that recognizes eligible hedges and is calculated as follows:

\[
K_{\text{hedged}} = \left( A + B + \sum c HMA_c \right)^{\frac{1}{2}}
\]

Regarding equation (16):

- \( A = ((\rho \sum (SCVA_c - SNH_c) - IH)^2 \) aggregates the systematic components of CVA risk;
- \( B = (1 + \rho^2) \sum (SCVA_c - SNH_c)^2 \) aggregates the idiosyncratic components of CVA risk;
- \( SNH_c \) is a parameter to recognise CVA risk reduction related to the use of single-name hedges and it is calculated as \( SNH_c = \sum_{h \in c} r_h RW_h M^SN_h B^SN_h D^SN_h \);
- \( IH \) is a parameter to recognise the CVA risk reduction related to the use of index hedges and it is calculated as \( IH_c = \sum RW_i M^ind_i B^ind_i DF^ind_i \);
- \( HMA_c \) aggregates the component of indirect hedges and it is calculated as \( HMA_c = \sum_{h \in c} (1 - r_{h,c}^2) (RW_h M^SN_h B^SN_h D^SN_h)^2 \).

The BA-CVA has been refined with respect to the proposal presented in July 2015, even if it maintains the original logic of calculation and aggregation. We believe there are no relevant implications for a bank in shifting from the current standardised CVA to the proposed basic CVA approach. In both cases the formulae are given by the regulator and it is just a matter of properly put the input for the calculation. For sure the new BA-CVA approach is more refined than the current standardised approach in terms of risk component calculation (i.e. systematic + idiosyncratic + indirect hedges) and the RWs are not based on external ratings anymore, but provided directly by the regulators on the basis of specific metadata (i.e. risk buckets are defined by credit quality and industrial sector, similarly to what happens for FRTB-SBM); although this, we don’t see any particular difficulty for banks in applying the basic formulation proposed by the Committee.

4. EGAM: ECB Guide on Assessment Methodology

ECB introduced on September 2020 the EGAM (ECB Guide on Assessment Methodology), a document which describes the supervisors activity to be applied in the context of any CCR-related internal model investigation (IMI) [15] before or after approval and the ongoing monitoring of approved internal models. Articles 283 and 383 of the CRR (Capital Requirements Regulation) require the ECB to grant institutions permission to use internal models for CCR if they meet the requirements set out in the corresponding chapters of the CRR. Based on the currently applicable EU and national law, the EGAM provides transparency on the methodologies that the ECB uses to assess CCR model components within model investigations when assessing whether institutions meet regulatory requirements.

In the document released by ECB there is also a section which is specifically referred to the current CVA framework, in particular to A-CVA.

Some of the items require compliance with EBA’s RTS on CVA, which include:
• Modelling of proxy spreads in order to verify that the institution has implemented a proxy spread methodology for counterparties for which no credit default swap (CDS) spread is available and the ECB verifies that:

   a) The institution has a sound policy defining when a CDS is considered liquid or illiquid;
   b) The institution has modelled its proxy spreads using either a regression approach or a bucketing approach, and that both approaches include at least the following dimensions: rating, region (Europe, North America, Asia and the rest of the world), industry (public sector, financials and others);
   c) The proxy spreads exhibit a stochastic behaviour comparable with that of liquid CDS spreads and that the composition of their underlying CDS baskets, or samples or single name proxies, is sufficiently stable over time.

• Selection of market-implied loss given default (LGD) in order to verify that the institution has identified the appropriate market LGD and the ECB verifies that:

   a) The institution uses updated and maintained data feeds to extract market credit spreads and assigned LGDs;
   b) The identified market LGD is also used when determining default probabilities from the credit spreads, e.g. in the institution’s pricing functions for credit derivatives.

• Thresholds for number and size of qualifying portfolios in order to verify that the institution applies the A-CVA for qualifying portfolios and the ECB verifies that:

   a) The institution’s calculations are reported and that any action to be taken in the event of a breach of any of the thresholds has been defined;
   b) The respective reports on the number and size of transactions are based on either the risk system that calculates the IMM exposures underlying the A-CVA or on any other system reconciled with the risk engine that calculates the IMM exposures underlying the A-CVA on at least a quarterly basis.

Furthermore, EGAM provide specification on the selection of the stress period for A-CVA approach in order to verify that the institution correctly selects its stress period for the stressed value at risk (VaR) calculation. The ECB verifies that the institution has a defined, documented and validated the methodology for selecting the most severe one-year time window regarding credit spread levels within the three-year period used as the basis for deriving the data for the stressed exposure calculation. Then it is tested if the institution is able to justify ratio values close to one for the stressed VaR to the VaR calculation to the extent that such ratios are observed.

Lastly, the Guide also clarify assessment methodology for calculation of the own funds requirement for CVA risk, including the multiplier and stressed A-CVA, and a specific assessments to check for the M equal to 1 permission.
5. Conclusions

In Figure 4 we have summarised the main differences between the current and the revised CVA risk framework presented by the BCBS in [3]. Challenges and implications in shifting from the current Basel 3 to the SA-CVA are strictly related to the FRTB-SBM implementation: metadata and bucket association, data handling improvement, sensitivity computation and aggregation are for sure the most urgent topics that banks should face in order to adapt their frameworks to the new rules set by the Committee.

The Basel Committee has finalised the CVA risk framework in December in 2017 and subsequently revised it through consultation in November 2019 and finalized the revision in July 2020, while the implementation deadline is shifted from January 1st, 2022 to January 1st, 2023 due to COVID-19. This would allow bank to properly reassess in the current pandemic situation while getting ready for the implementation deadline of the new CVA framework.

Apart from the implications described in the paper, we highlighted also the chance for banks to leverage on several synergies coming from the FRTB implementation in the enhancement of CVA risk framework. Banks should evaluate and assess the costs of implementation carefully since there is a clear tendency started by regulators to standardised capital requirements in order to improve comparability among banks, and to make the computation much more sensitivity-based with respect to the current framework.

Moreover, the finalization of CVA risk review will allow also the finalization of other draft guidelines on CVA (such as the EBA guidelines on the treatment of CVA risk under SREP).
References


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