



EUROPEAN CENTRAL BANK  
BANKING SUPERVISION

## ECB Guide on assessment methodology (EGAM)

Assessment methodology for the IMM and A-CVA

For any future reference,  
please use the [most recent version](#).

BANKENTOEZICHT

December 2017

BANKTILLSYN BANKU UZRAUDZĪBA

BANKŲ PRIEŽIŪRA NADZÓR BANKOWY

VIGILANZA BANCARIA

BANKFELÜGYELET

BANKING SUPERVISION

SUPERVISION BANCAIRE BANČNI NADZOR

MAOIRSEACHT AR BHAINCÉIREACHT NADZOR BANAKA

**BANKING SUPERVISION**

PANGANDUSJÄRELEVALVE

SUPERVISÃO BANCÁRIA

BANKOVNI DOHLED

БАНКОВ НАДЗОР

BANKTILLSYN

BANKENAUF SICHT

ΤΡΑΠΕΖΙΚΗ ΕΠΟΠΤΕΙΑ PANKKIVALVONTA

SUPRAVEGHERE BANCARĂ BANKOVÝ DOHL'AD

SUPERVIŽJONI BANKARJA

**SUPERVISIÓN BANCARIA**

**BANKING SUPERVISION**

SUPERVISÃO BANCÁRIA

BANKENAUF SICHT

# Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>Available regulatory technical standards on assessment methodology</b>	<b>5</b>
2.1	EBA RTS on assessment methodologies	5
2.2	RTS on A-CVA/IMM	7
<b>3</b>	<b>Rationale</b>	<b>8</b>
3.1	General provisions	8
3.2	Governance of the validation function	9
3.3	Governance of risk control and collateral management	9
3.4	Use test	9
3.5	Design, operations and documentation	10
3.6	Exposure quantification	10
3.7	Validation techniques	12
3.8	Stress testing	12
3.9	Data maintenance and processes	12
3.10	A-CVA specifics	12
<b>4</b>	<b>ECB Guide for the assessment methodology of the internal model method and advanced CVA capital charge</b>	<b>14</b>
	Chapter 1 General provisions	14
	Chapter 2 Sequential implementation of IMM across different transaction types	20
	Chapter 3 Organisation and governance of model validation	22
	Chapter 4 Internal governance, risk control, collateral management and audit	28
	Chapter 5 IMM use test	34
	Chapter 6 Documentation and design	37
	Chapter 7 Exposure quantification	42
	Section 1 General	42

Section 2 Risk factor models	44
Section 3 Pricing functions, exposure grid and number of scenarios	48
Section 4 Master netting and margining agreements and exposure aggregation	50
Section 5 Calibration	52
Section 6 Margined trading and SFT requirements	55
Section 7 Wrong Way Risk	61
Chapter 8 Validation techniques	62
Chapter 9 Stress testing	68
Chapter 10 Data Maintenance and IT processes	71
Chapter 11 Specifics for A-CVA	77
<b>List of used abbreviations</b>	<b>82</b>

# 1 Introduction

Counterparty credit risk (CCR) is the risk arising from the possibility that the counterparty to derivative transactions or repurchase/lending agreements may default while these transactions still have a positive value for the bank (i.e. are “in-the-money”). Since the global financial crisis, it can be considered as one of the key financial risks an institution faces, as it can not only cause the failure of one institution but also pose significant systemic risk. As a result, regulators recognised the need for more prudential supervision of CCR based on the conservative own funds requirements in the Basel III package.

Assessment methodologies describe the depth or level of detail required when investigating internal model components to assess their degree of compliance with regulation. They also include high level techniques, such as interviews, to be applied in order to obtain the information necessary for supervisory decisions. The most important area in which to apply assessment methodologies is on-site inspections.

The Capital Requirements Regulation (EU) No 575/2013 (CRR)<sup>1</sup> requires model approval for new models of any risk type and for material model extensions and changes to credit, operational, and market risk internal models. The ECB Guide on materiality assessment (EGMA) provides the ECB’s interpretation of the applicable rules for material model extensions and changes in the CCR area.

The EBA has been mandated to develop regulatory technical standards (RTS) to be adopted by the European Commission for the assessment methodology for competent authorities of financial institutions for IRB (credit risk), AMA (operational risk), and IMA (market risk) models.

In the field of CCR, for both the internal model method (IMM) and the advanced method for credit valuation adjustment risk (A-CVA), the adoption of similar RTS regarding the assessment methodology is not mandated by the current text of the CRR. However, it should be borne in mind that the EBA may regulate this subject by adopting either respective guidelines on a general basis in the EBA regulation or RTS based on any future EU legislation.

This document introduces the European Central Bank (ECB) Guide on assessment methodology (EGAM) for the IMM and A-CVA. The EGAM will be applied in the context of any CCR-related internal model investigation (before or after approval) and the ongoing monitoring of approved internal models and indicates to supervisors how the ECB intends to investigate compliance with the existing legal framework when performing these tasks. The EGAM also provides optional guidance to significant institutions on the self-assessment of their IMM and A-CVA models.

---

<sup>1</sup> Regulation (EU) No 575/2013 of 26 June 2013 with Corrigenda as of 30 November 2013; the “CRR” (Capital Requirements Regulation).

Articles 283 and 383 of the CRR 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 ECB's supervisory expectations by clarifying the methodologies it uses to assess CCR model components within model investigations when assessing whether institutions meet those requirements.

The EGAM should not be construed as going beyond the current applicable EU and national law and therefore is not intended to replace, overrule or affect applicable EU and national law.

The guide is intended to be applied in its entirety. Applying only parts is likely to distort the coherence of the assessment process and should be avoided as far as possible. The assessment methodologies presented in the EGAM should not be understood to be exhaustive. Depending on the materiality of specific findings identified during an investigation, additional assessment methodologies may have to be applied by the assessment team.

The remainder of this document is organised as follows: Section 2 explains the building blocks of the EGAM and compares it with the RTS for IRB, the structure of which has been broadly kept for this guide, while most standards for A-CVA models are based on the RTS for IMA. Section 3 sets out the rationale behind the EGAM. Finally Section 4 presents the EGAM itself.

## 2 Available regulatory technical standards on assessment methodology

This section lists the available CRR provisions and RTS on assessment methodologies, since the EGAM is based on the structure of these RTS. The goal of this section is to provide some background on the EGAM in Section 4. It is not essential to read this section in order to understand the EGAM itself.

Note that all the RTS mentioned below are mandated by respective CRR provisions. There is no mandate for an assessment methodology for the IMM and A-CVA in the CRR. Therefore, no further RTS on this subject can be expected until there is a change in the CRR: it is more likely that a future EBA guideline might address this subject. In that case, the EGAM would be adapted accordingly. Clearly if and to the extent that future EU regulation requires an RTS on CCR assessment methodology, the EGAM would be replaced by those rules.

### 2.1 EBA RTS on assessment methodologies

This subsection provides a short overview of the available EBA RTS on assessment methodologies for credit and market risk.

#### 2.1.1 IRB credit risk assessment methodology

The final EBA Draft RTS, “IRB RTS” (Regulatory Technical Standards on the specification of the assessment methodology for competent authorities regarding compliance of an institution with the requirements to use the IRB Approach in accordance with Articles 144(2), 173(3) and 180(3)(b) of Regulation (EU) No 575/2013) was developed on 21 July 2016 and submitted to the European Commission for adoption.

The table below provides an overview on the alignment between the IRB-RTS (second column) and the EGAM (fourth column):

No	Chapter in IRB RTS	No	Chapter in EGAM	Comment
1.	General rules for the assessment methodology	1.	General provisions	Similar
2.	Assessment methodology of roll-out plans and permanent partial use of Standardised Approach	2.	Sequential implementation of IMM across different transaction types	IMM equivalent used
3.	Assessment methodology of the function of validation of internal estimates and of the internal governance and oversight of an institution	3.	Organisation and governance of the validation function	Split, to avoid a lengthy structure with too many cross-references
		4.	Internal governance, risk control, collateral management and audit	
4.	Assessment methodology of the use test and experience test	5.	IMM use test	Similar
5.	Assessment methodology for Assignment of exposures to grades or pools			No CCR equivalent
6.	Assessment methodology for definition of default			No CCR equivalent
7.	Assessment methodology for rating systems design, operational details and documentation	6.	Documentation and design	Similar for documentation, "extrapolated" for correlation structures; no sections as it is shorter for IMM;
8.	Assessment methodology for risk quantification	7.	Exposure quantification	IMM equivalent; split into sections as in the IRB RTS; most detailed part
9.	Assessment methodology for assignment of exposures to exposure classes	8.	Validation techniques	There is no IMM equivalent for the assignments; but validation approaches are usually very complex and need their own assessment methodology
10.	Assessment methodology for stress test used in assessment of capital adequacy	9.	Stress testing	Note that stressed exposures for Pillar 1 purposes are in Chapter 7
11.	Assessment methodology of own funds requirements			No equivalent: IMM is restricted to exposures, A-CVA carries most over from MR assessment methodology
12.	Assessment methodology of data maintenance	10.	Data maintenance and IT processes	Similar; also including IT performance
13.	Assessment methodology of internal models for equity exposures	11.	Specifics for A-CVA	Many A-CVA items are covered by the IMM parts of the EGAM and by the EBA RTS on materiality assessment for IMA; therefore, only a few items require separate mention in an own chapter of the EGAM
14.	Assessment methodology for management of changes to rating systems			No own section in EGAM as this is treated in the EGMA
15.	Final provision			Omitted for EGAM (as for EGMA)

Section 4 of the EGAM uses parts of these classifications for IMM and A-CVA and follows the general structure of that RTS.

### 2.1.2 IMA market risk assessment methodology

This is a final draft EBA RTS (Regulatory Technical Standards on the assessment methodology for market risk internal models and significant share under Article 363(4)(b) and (c) of Regulation (EU) No 575/2013; the "IMA RTS") as of 22 November 2016 and submitted to the Commission for adoption.

It covers all specific and general market risk topics and the various asset classes, IRC and S-VaR, but no CVA.<sup>2</sup>

## 2.2 RTS on A-CVA/IMM

Other than the above-mentioned RTS, in the area of A-CVA and IMM, the European Commission has adopted Commission Delegated Regulation (EU) No 526/2014 of 12 March 2014 supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards for determining proxy spread and limited smaller portfolios for credit valuation adjustment risk.

---

<sup>2</sup> CVA is only to be mentioned if back-testing overshooting due to specific CVA risk occurs (for P&L definitions) and as potential sources of specific risk in CVA hedges.



## 3 Rationale

This section explains the rationale behind the suggested ECB Guide for the assessment methodology for IMM and A-CVA models as presented in Section 4. This section intends to give the reader a better understanding of the standards with the focus on the IMM. Regarding A-CVA, only some specifics not covered elsewhere will be discussed (see Chapter 11 Specifics for A-CVA).

Differences to the IRB RTS (where comparable to the EGAM) are only explained where the rationale behind those differences may not immediately be apparent.

No special attention is given to EGAM issues that follow the available RTS on assessment methodology (e.g. documentation and IT requirements).

The numbering of sub-sections follows the chapter structure of the EGAM. The sub-section number is equal to the chapter number of the EGAM, e.g. Sub-section 3.1 covers Chapter 1 and Sub-section 3.2 covers Chapter 2.

### 3.1 General provisions

The EGAM aims to provide the ECB's interpretation of methods, techniques, etc. for assessing compliance with CRR provisions dealing with the usage of A-CVA and IMM models.

Furthermore, the assessment methodologies as presented in the EGAM should not be understood to be exhaustive. Depending on the materiality of specific findings identified during an investigation, additional assessment methodologies may have to be applied by the assessment team.

#### Sequential implementation of the IMM

The assessment methodology is based on the following guidance regarding options for national discretion in the document “ECB Guide on options and discretions available in Union law” (EGOD), Section II, Chapter 3(8): ([https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ecb\\_guide\\_options\\_discretions.en.pdf](https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ecb_guide_options_discretions.en.pdf)):

- The initial coverage at time of approval must comprise vanilla interest rate and foreign exchange derivatives and must cover 50% of both the RWA (as calculated with exposures based on the chosen non-IMM method in accordance with Article 271(1) of the CRR) and the number of trades (i.e. legal transactions, no single legs);
- A coverage of more than 65% in both RWA (based on either IMM or non-IMM methods, depending on the trade) and more than 70% in terms of the number

of trades (legal transactions, no single legs) relative to total counterparty credit risk (CCR) is achieved within 3 years;

- If a larger than 35% (RWA) or 30% (number of trades) portion remains outside IMM after the three-year period, the credit institution would be expected to prove that either the remaining transaction types cannot be modelled due to missing calibration data, or that the standardised approach (STA) exposures used are sufficiently conservative.

Chapter 2 Sequential implementation of IMM across different transaction types clarifies the conditions for a permanent partial use in paragraph 8 in terms of data availability by taking also considerations on costs and operational capabilities into account.

## 3.2 Governance of the validation function

For IRB, there is an implicit requirement for Significant Institutions to operate a validation function separate from their risk control unit, because Article 131 of Directive 2013/36/EU (CRD IV) requires competent authorities to verify that the institution is not a globally or otherwise systemically important institution if there is no separate validation unit and only staff are separated.

Since the CRR does not require the validation function to be separate from the risk control unit in the CCR area, such a strict requirement is omitted here.

## 3.3 Governance of risk control and collateral management

The split in Chapter 4 Internal governance, risk control, collateral management and audit follows the split in Article 287(1) of the CRR into items (a) for a risk control unit and (b) for a collateral management unit and also includes the internal audit process as mentioned in Article 288 of the CRR: note that unlike the IRB ITS there is no dedicated section on internal reporting in the CCR part of the CRR.

## 3.4 Use test

The EGAM contains enhanced checks regarding the use test compared to IRB, e.g. due to Articles 289(5) and 289(6) of the CRR. There are CCR peculiarities in the EGAM due to margined trading and the time structure of CCR limits. It is important that the demonstration of model use before approval (for IRB: “experience test”) is also clarified for model extensions because of the current lack of clear rules (or harmonisation).

## 3.5 Design, operations and documentation

There is no clear design prescription for the IMM compared to IRB in the CRR. Article 284(1)(a) of the CRR gives a hint for modelling in terms of classes of market data (often referred to as “asset classes” in an IMM context), for which different stochastic processes usually exist in an IMM. The EGAM thus broadly follows the IRB RTS.

## 3.6 Exposure quantification

### 3.6.1 General

The general part refers to both unmargined and margined exposure values. There is no reference to the institution’s own alpha calculation (Article 284(9) to (13) of the CRR) in line with the EGOD Section II, Chapter 3, item 9.

### 3.6.2 Risk factor models for market data

Both simulated and non-simulated (constant or time-dependent) risk factors are covered.

For historically calibrated stochastic risk factors, the ECB will compare historical time series of observations of a driver with simulations of that driver on a qualitative basis to ensure that basic mistakes (e.g. a modelled volatility is much higher than an observed one) are detected prior to any sophisticated statistical analysis.

As some banks use non-standard random number generators (e.g. Quasi MC), where the quality of random numbers (i.e. their homogeneity) depends on the number of dimensions used, a specific check of random generators is included as part of the assessment.

### 3.6.3 Pricing functions and exposure grid

The ECB does not expect market and used transaction attributes (such as multiple barriers for exotic options) to coincide in full and that every detail reflects pricing as carried out in the front office system or for accounting purposes. However, any approximation applied for either trade attributes or market data feed pricing (e.g. implied volatilities), or regarding the structure of the pricing routine (Taylor approximation, etc.), must be sufficiently conservative in terms of exposure calculation.

The ECB will compare prices of the risk system for the IMM with front office or accounting records (most likely the front office system in practice) on a transaction rather than a netting set level. This approach avoids offsetting overstated with

understated valuations inside large netting sets. This is also part of validation, which is covered in Section 3 Pricing functions, exposure grid and number of scenarios.

#### 3.6.4 Legal agreements and exposure aggregation

The calculation steps to obtain the exposure value are evident (merged in this section), therefore this section focusses on the complete implementation of legal agreements especially in terms of the various margin parameters and mechanisms.

This section also includes CCR-specific issues for the choice of the maturity (M) parameter, when IRB is used for the respective counterpart.

#### 3.6.5 Calibration

This section covers both the stressed and the standard calibration of the IMM and covers both historical calibration (time series analysis) and calibration using market-implied data.

#### 3.6.6 Margined trading

The section addresses all modelling issues related to margined trading: the length of the Margin Period of Risk (MPOR), trade-related cash flows within MPOR and modelling collateral value changes during the MPOR. The cash flow issue during the MPOR is linked to the default management process for controlling cash flows after a – potentially sudden – default.

Due to the fact that SFTs are very often margined and that methodologies to model value changes in the securities leg may overlap with those modelling value changes (volatility adjustments) in margin collateral, this product category is also included in the section.

As a special remark on the effect of the minimum transfer amount (MTA) at the beginning of the MPOR, when determining the collateral balance valid for this MPOR as mentioned in paragraph 46. (2): it depends on the full history of netting set value changes and margin calls up to the beginning of this MPOR. The ECB expects modelling of the effect of the minimum transfer amount to be done in a conservative way for those cases where an institution does not model the collateral balance continuously throughout the time axis until maturity of the longest transaction in the netting set (as this would essentially require daily grid points).

#### 3.6.7 Wrong way risk

The section covers both specific and general wrong way risk (WWR).

## 3.7 Validation techniques

The section deals with methodologies, tools and techniques for validation, as the governance is already covered in Chapter 3 Organisation and governance of model validation.

For netting sets, the back-testing entails back-testing at the level of both exposures and of values. While only floored exposure distributions underlie the calculation of expected exposure, the value back-testing – e.g. using a non-floored and thus full value distribution – can reveal issues with regard to predictions that might also become relevant at the exposure level; for example, when the general level of values is increased significantly above zero, triggered by a maturing transaction that had had a hedge effect.

Above and beyond pure back-testing, plausibility checks and sensitivity analyses of some pre-set model parameters<sup>3</sup> (and some model assumptions) are expected.

## 3.8 Stress testing

Besides the stressed exposures that are part of Chapter 7 Exposure quantification of the EGAM and that contribute to regulatory capital requirements under the CRR, the IMM-specific stress tests also deal with general WWR (contributing to CRD requirements for economic capital).

## 3.9 Data maintenance and processes

This chapter broadly follows the structure of the IRB RTS.

## 3.10 A-CVA specifics

Except where institutions are applying for permission to set M equal to 1 according to Article 162(2)(i) of the CRR, the A-CVA does not require any kind of approval<sup>4</sup> (with respective constraints for the supervision of model changes in the EGMA). The focus of the EGAM is not restricted to the A-CVA assessment methodology alone; it merely tries to avoid duplications or overlaps with the assessment methodology for IMM (also in the EGAM) and IMA. The reason is that regardless of the specific approval status of A-CVA, competent authorities can always review the complete status of the model and all aspects of its implementation when updating the multiplier in Article 383(5)(c) of the CRR.

---

<sup>3</sup> Pre-set or expert-set parameters are not subject of the regular (historic or implied) calibration and are usually valid for longer (more than one quarter).

<sup>4</sup> It is automatically required if there is IMM approval according to Article 283 of the CRR and approval for modelling specific risk of debt instruments according to Article 363(1) of the CRR.

Note that currently neither a use test nor quantitative validation (back-testing) is required for A-CVA, so there is also no assessment methodology described here.

The only items specific to A-CVA are:

- compliance with the EBA RTS on A-CVA, which includes:
  - the modelling of proxy spreads (partially);
  - the selection of market-implied LGD;
  - the thresholds for number and size of qualifying portfolios;
- the selection of the A-CVA stress period for credit spreads;
- the capital calculation for A-CVA including the multiplier and stressed A-CVA;
- the specific assessments to check for the M equal to 1 permission.

## 4 ECB Guide for the assessment methodology of the internal model method and advanced CVA capital charge

Articles 283 and 383 of the CRR require the ECB to grant institutions permission to use internal models for counterparty credit risk (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 ECB's supervisory expectations by clarifying the methodologies it uses to assess CCR model components within model investigations when assessing whether institutions meet those requirements.

The EGAM should not be construed as going beyond the current applicable EU and national law and therefore is not intended to replace, overrule or affect applicable EU and national law.

The guide is intended to be applied in its entirety. Applying only parts is likely to distort the coherence of the assessment process and should be avoided as far as possible.

For model assessments with a targeted scope, e.g. a model change/extension or ongoing model monitoring of peculiar elements of the IMM, the assessment need apply only those elements of the EGAM that are relevant for understanding the context and the relevant model parts.

### Chapter 1 General provisions

#### 1. Definitions

- (1) The term “assessment methodology” refers to the methodology and measures for obtaining a sufficient level of information as a basis for supervisory decisions – especially for approvals of internal models, their material extensions and material changes – regardless of whether this information is received during on-site or off-site internal model investigations, supervisory meetings on model issues, documentation requests or any other inquiry into the model for another purpose in the scope of ECB's supervisory activities.
- (2) The following additional definitions are used in the text below:

- (a) The term “ $t_0$ ” is the first date of the simulation time grid in the IMM and the reporting date for which the effective expected positive exposure (effective EPE) is calculated in Article 284(5) of the CRR<sup>5</sup>: it is thus equal to the “current date” referenced in the same Article.
- (b) “SFTs” are securities financing transactions as defined in Article 3(11) of Regulation 2365/2015; covering repurchase agreements, margin lending and borrowing agreements as well as securities and commodities lending and borrowing agreements (thus including all products covered by Article 272(25)(a) and (b) of the CRR).
- (c) “Benchmarking systems” refers to the respective front office pricing functions, pricing functions of accounting systems or to other benchmarks to which front office prices are frequently compared (at least quarterly as for CCR purposes). Corresponding front office values refer to values after independent price verification (see Article 4(70) of the CRR), which also holds for the other benchmark above, if used; values produced by any of the sources mentioned here refer to values without any valuation adjustments (such as CVA) beyond the default-free value.
- (d) “Representative sub-portfolios” refer to representative counterparts or netting sets for which the following two conditions hold:
  - (i) such sub-portfolios need to be representative regarding the characteristics: transaction type, underlying risk factors, margined or unmargined agreements, short or long positions as well as netting set structure;
  - (ii) the institution needs to demonstrate to supervisors that the chosen sub-portfolios are sufficiently representative as described in (i) above and meaningful regarding the purpose for which the portfolio has been selected<sup>6</sup>.
- (e) “Management body” is primarily defined in Article 3(7) of the CRD IV<sup>7</sup> and refers here to the single management board in a one-tier system or to the role of the management and supervisory boards in a two-tier corporate governance system (this concept needs to be interpreted from a functional perspective and refers to the management body in both its supervisory (Article 3(8) of CRD IV) and management functions);
- (f) “Senior management” means senior management in accordance with Article 3(9) of the CRD IV;

<sup>5</sup> Regulation (EU) No 575/2013 of 26 June 2013 with Corrigenda as of 30 November 2013; the “CRR” (Capital Requirements Regulation).

<sup>6</sup> E.g. when investigating interest rate processes, consider only a sub-portfolio of interest rate transactions, when investigating the impact of cash flows within the MPOR, consider only a sub-portfolio of margined netting sets.

<sup>7</sup> Directive 2013/36/EU of 26 June 2013.



- (g) “Risk factor” refers to all parameters used for the revaluation in the IMM, i.e. beside stochastically diffused risk factors it also includes all other parameters that are derived from market data (deterministic or constant inputs) or based on expert judgment;<sup>8</sup>
- (h) “Not systematically underestimated” refers to (potentially) approximatively or incompletely modelled exposure levels equal to or above what “true modelling” is expected to yield, thus resulting in most cases in a “conservative” exposure level for structural reasons.<sup>9</sup>

## 2. Scope of application and methods applied

- (1) The EGAM lays down criteria that are applied by the ECB for assessing the compliance of an institution with regard to the requirements for using the Internal Model Method (IMM) according to Articles 283 to 294 of the CRR. In particular, this refers to the following:
  - (a) in principle all parts of the EGAM will be applied in the course of the assessment of an initial application for the IMM;
  - (b) where an institution requests permission to extend the IMM sequentially in accordance with Article 283(3) of the CRR, it is expected to apply only those parts of the EGAM that are relevant to the scope of such a request;
  - (c) in the course of assessing changes to the IMM, all parts of the EGAM relevant to the scope of the model change will be applied;
  - (d) where an institution requests permission to revert to the use of less sophisticated approaches in accordance with Article 273 of the CRR, Chapter 2 Sequential implementation of IMM across different transaction types on the sequential implementation of IMM and the conditions for permanent partial use will be applied.
- (2) The EGAM also refers to the assessment of compliance of an institution for using the Advanced Method for the Credit Valuation Adjustment Risk (A-CVA) as referred to in Articles 381 to 383 and 386 of the CRR for two purposes:
  - (a) upon demonstration by the institution, permission may be given to set M equal to 1 according to Article 162(2)(i) of the CRR;
  - (b) the appropriateness of the multiplication factor for calculating the capital charge according to Article 383(5)(c) of the CRR will be verified;

<sup>8</sup> The term “Risk factors” also covers parameters that are derived from market data and that are indirect inputs into pricing functions (e.g. the pricing function requires discount factors, but the IMM simulates interest rates or the IMM stochastic modelling requires mean reversion parameters – to simulate interest rates – whereas the pricing function only requires interest rates).

<sup>9</sup> An example of such causes are parameters underlying stochastic processes that lead to high exposure levels and value-increasing model switches.

In all other cases, where the A-CVA is affected by a model approval, change or extension, either item 1 applies for the assessment of the exposure calculation underlying the A-CVA, or the IMA RTS<sup>10</sup> is used for the assessment of the market risk model component of A-CVA.

- (3) In performing the assessment referred to in the first two items, the methodologies defined in each chapter of the EGAM will be applied by the ECB. To the extent appropriate, additional methodologies will also be applied according to the nature, size and degree of complexity of the institution's business and organisational structure and covering other relevant CRR provisions not explicitly mentioned here. Additional methodologies for the assessment could be applied in the following cases:
- (a) the materiality of sub-portfolios, respectively transaction types that are affected by the various stochastic processes and the various margining schemes;
  - (b) the complexity of stochastic processes underlying exposure distributions and their calibration;
  - (c) the complexity of margining schemes and closeout netting contracts the institution has agreed with counterparties and their representation in the model;
  - (d) the appropriateness of quantitative and qualitative exposure validation;
  - (e) the methodology for deriving proxy credit spreads for the use and calibration of the A-CVA.

Wherever applicable, the findings of earlier external audits should be included in the assessment, in particular previous supervisory on-site investigations of the IMM.

- (4) For the assessment of the calculation of own funds requirements for a given exposure value in accordance with Article 271 of the CRR, the IRB RTS on IRB assessment methodology applies.<sup>11</sup>

### **3. Quality and auditability of documentation**

- (1) With respect to the quality and auditability of the documentation on the models or aspects of them referred to in paragraphs 2. (1). and 2. (2), and further specified in the relevant parts of this guide, the ECB will verify that the documentation is sufficiently detailed and accurate to allow for the examination of these models by third parties. This includes in particular, checking that:

---

<sup>10</sup> Regulatory Technical Standards on the assessment methodology for market risk internal models and significant share under Article 363(4)(b) and (c) of the CRR) of the CRR.

<sup>11</sup> Regulatory Technical Standards On the specification of the assessment methodology for competent authorities regarding compliance of an institution with the requirements to use the IRB Approach in accordance with Articles 144(2), 173(3) and 180(3)(b) of the CRR.

- (a) the documentation has been approved at the appropriate management level of the institution;
  - (b) the institution has policies in place outlining specific standards to ensure a high quality of internal documentation and that there is specific accountability for ensuring that the documentation maintained is complete, consistent, accurate, updated, approved and secure;
  - (c) each item of documentation contains at least the following information: type of document; author; reviewer; authorising agent and owner; dates of development and approval; version number; and a history of changes to the document;
  - (d) the institution adequately documents its policies, procedures and methodologies related to the application of the IMM and A-CVA approaches as referred to in this guide.
- (2) Assessing the auditability of the documentation referred to in the first sub-paragraph entails verifying in particular that:
- (a) the documentation of the models' design is sufficiently detailed to allow third parties to understand the reasoning and procedures underlying their development;
  - (b) the documentation of the models is sufficiently detailed to allow third parties to understand how the models operate, their limitations and key assumptions, and to replicate the model development.

#### **4. Third party involvement**

- (1) The delegation of tasks, activities or functions related to the design, implementation and validation of internal models by an institution to a third party does not exempt an institution from complying with the provisions of Articles 283 to 294 of the CRR and Article 383 of the CRR. Moreover, it should not prevent or otherwise inhibit the application of the methodology referred to in this guide for the purpose of assessing the institution's compliance.
- (2) For the purpose of the first sub-paragraph, the ECB will verify in particular that:
- (a) the senior management and the management body, or the committee designated by it, are actively involved in the supervision of and decision-making on any tasks, activities or functions delegated to a third party and of any IT risk management tool solutions obtained from third parties;
  - (b) there is sufficient in-house knowledge and understanding of the tasks, activities or functions that are outsourced or delegated to third parties and of the structure of any data and methodologies obtained from a third party;

- (c) continuity of the outsourced functions or processes is ensured, including by means of appropriate contingency planning;
  - (d) neither internal audit nor any other kind of control over the outsourced tasks, activities and functions by the institution are limited or inhibited by the outsourcing;
  - (e) the ECB has been given the opportunity to access all relevant information including, where applicable, by initiating on-site inspections at the third party's premises.
- (3) Furthermore, where a third party is involved in the development of any risk methodologies subject to this guide, it will be verified that neither initial nor ongoing validation activities with regard to those risk methodologies are performed by that third party. However, the third party may provide the institution with the information necessary for those validation activities.
- (4) The assessment of items described in sub-paragraphs (1) to (3) will entail:
- (a) a review of the agreements with the third party and other relevant documents which specify the tasks of the third party;
  - (b) a review of the written statements or interviews with the staff and senior management, or the management body, or the committee of the institution designated by the management body, or the third party to whom the task, activity or function is delegated.
- (5) For the purpose of applying sub-paragraphs (1) to (3), it may also be necessary to review all or part of other relevant documents of the institution or of the third party.

## **5. Temporary non-compliance with the requirements for the IMM**

For the purposes of Article 283(6) of the CRR, and where the institution does not satisfactorily demonstrate the immateriality of non-compliance, as referred to in point (b) of Article 283(6) of the CRR, the ECB will review the plan to restore timely compliance as referred to in Article 283(6)(a) of the CRR and will in particular:

- (1) review the institution's plan to return to compliance, in particular by assessing whether the planned actions are sufficient and the timeline is reasonable taking into account the materiality of the non-compliance, the scope of the work required to return to compliance and the available resources;
- (2) regularly monitor progress on the implementation of the plan;
- (3) verify the institution's compliance with the relevant requirements after the implementation of the plan by applying this guide in line with the scope of the previous non-compliance.

## Chapter 2

### Sequential implementation of IMM across different transaction types

#### 6. General

- (1) In order to assess compliance of an institution with the requirements on the implementation of the IMM in accordance with Articles 283(3) of the CRR and Chapter 2, Section 3(8) of the ECB Guide on options and discretions available in Union law (EGOD)<sup>12</sup>, the ECB will verify in particular the following:
  - (a) the institution's initial IMM scope and coverage and its plan for sequential implementation according to paragraph 7;
  - (b) that non-IMM methods under Article 273(1) of the CRR are only applied where transactions are eligible for permanent exemption from the IMM (permanent partial use) according to paragraph 8.
- (2) For the purposes of sub-paragraph (1) the ECB will:
  - (a) review the institution's relevant internal policies and procedures, including the calculation methods for the coverage ratios to comply with the EGOD;
  - (b) review the roles and responsibilities of the units and management bodies involved in the assignment of particular exposures to the IMM or any of the non-IMM methods;
  - (c) review the minutes of the institution's internal bodies, including the senior management;
  - (d) review the findings of the internal audit or of other control functions of the institution;
  - (e) review the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;
  - (f) obtain written statements or interview the staff and senior management of the institution.
- (3) For the purposes of sub-paragraph (1), that also means, that the ECB will, to the extent appropriate:
  - (a) check the correctness of the process of identifying transactions and assigning them to either the IMM or any of the non-IMM methods by performing the assessments described in paragraphs 61 to 63;

---

<sup>12</sup> ECB Guide on options and discretions available in Union law (March 2016), Section II(8) ([https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ecb\\_guide\\_options\\_discretions.en.pdf](https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ecb_guide_options_discretions.en.pdf)).

- (b) conduct sample testing of transaction assignments and review documents related to the characteristics of derivative transactions and SFTs;
- (c) review other relevant documents of the institution.

## 7. Implementation of the IMM

- (1) In assessing the initial IMM coverage and the institution's plan for sequential implementation of the IMM as referred to in paragraph 6. (1) (a), the ECB will verify that:
  - (a) the initial coverage of the IMM is compliant with the conditions specified in accordance with the valid national discretion as defined for Article 283(3) of the CRR in Chapter 2, Section 3(8) of the EGOD;
  - (b) the content of the plan covers at least the following:
    - (i) the specification of transaction types;
    - (ii) the planned dates of application of the IMM with regard to each type of transaction;
    - (iii) the information on the current total exposure values, total number of transactions<sup>13</sup> and risk-weighted exposure amounts calculated according to the approach currently applied for each transaction type;
  - (c) the plan comprises all CCR exposures of the institution, or any parent undertaking, and its subsidiaries, unless they fall under a permanent exemption according to paragraph 8;
  - (d) the planned implementation is performed in accordance with the valid national discretion as defined by the ECB for Article 283(3) of the CRR in the EGOD;
  - (e) the sequence and timing of the implementation of the IMM are specified on the basis of the real capabilities of the institution, i.e. compliance with the requirements in Article 292 of the CRR is feasible, are not being used selectively for the purpose of achieving reduced own funds requirements (that is, there is no obvious "cherry-picking"), and are appropriate to the nature and scale of the institution's activities;
  - (f) the sequence ensures that the transaction types related to the institution's core business are given priority.
- (2) Changes to the implementation plan according to items (1) (d) (1) (e) and 1. (f) are only possible if at least one of the following conditions is met:

---

<sup>13</sup> The different legs of a trade are to be considered as one single transaction.

- (a) there are significant changes in the business environment and in particular changes in strategy, mergers and acquisitions;
  - (b) at least one of the conditions referred to in item (1) was not considered adequately in the plan initially approved for the institution's sequential implementation of the IMM.
- (3) If the institution fails to meet its original plan for sequential implementation of the IMM, Article 283(6)(a) of the CRR also applies: the institution's plan for a timely return to the initial roll-out plan will be checked. In case a return to the original roll-out plan is not possible, an updated plan for sequential implementation provided by the institution will have to be verified by the ECB in accordance with Article 283(6)(a) of the CRR.

## **8. Conditions for permanent partial use**

- (1) For the purpose of assessing the institution's compliance with the conditions for permanent partial use of any of the non-IMM methods mentioned in Article 273(1) of the CRR, and in relation to the applicable national discretion as defined by ECB for Article 283(3) of the CRR in the EGOD, the ECB will assess in particular that:
- (a) the rationale for excluding certain transactions or transaction types permanently from the IMM does not lead to a bias reducing the overall CCR RWA;
  - (b) the cost to the institution of including transactions under letter (a) above in the IMM, in particular where the availability of external data on risk factors for transactions is limited, is assessed by the institution in relation to its scale;
- (2) the institution's operational capacity to include transactions under letter (a) above is assessed by the institution in relation to the nature and scale of its activity.
- (3) It needs to be verified that an institution implements procedures for regular monitoring of the compliance with the applicable option for national discretion as defined by the ECB for Article 283(3) of the CRR.

## **Chapter 3**

### **Organisation and governance of model validation**

#### **9. General**

- (1) In order to assess whether an institution is complying with the requirements on the organisation and internal governance regarding its validation, as referred to

in Articles 287(2), 292(6), 293(1)(a)-(c) and 293(3)-(6) of the CRR, the ECB will verify the robustness of the arrangements, mechanisms and processes for validating the exposure methodology, including the appropriateness of the personnel responsible for the performance of the validation ('validation function' in the sequel), in particular:

- (a) the independence of the validation function, as referred to in Article 287(2)(d) and 293(1)(c) of the CRR and in accordance with paragraph 10;
- (b) the completeness of the validation process, also in terms of frequency, in accordance with paragraph 11;
- (c) the adequacy of the validation methods and procedures, in accordance with paragraph 12 and Chapter 8 Validation techniques of the EGAM;
- (d) the soundness of the reporting process and the process for addressing the validation conclusions and recommendations in accordance with paragraph 13.

(2) For the purposes of sub-paragraph (1), the ECB will:

- (a) review the roles and responsibilities of staff involved in model validation including the internal model approval;
- (b) review the institution's relevant internal policies, procedures and validation manuals;
- (c) review the minutes of the institution's internal bodies, including the management body, or other committees;
- (d) review the annual validation work plan;
- (e) review the process of categorisation of findings and the relevant recommendations in accordance with their materiality;
- (f) review validation reports in terms of:
  - (i) conclusions, findings, recommendations and their consistency;
  - (ii) action plans and follow up for recommendations including their management approval, potential escalations, and any decisions taken on the basis of those reports;
- (g) obtain written statements or interview the staff and management of the institution;
- (h) review other relevant documents of the institution.



## 10. Independence of the validation function

- (1) In assessing the independence of the validation function as referred to in paragraph 9. (1) (a), the ECB will verify that the organisational and operational structure clearly separates activities that are not compatible with each other, i.e. they are performed by different staff members such that conflicts of interest are avoided. In particular, this means that:
  - (a) the validation function is independent from the personnel and management function responsible for trading derivatives and SFTs and reports directly to senior management;
  - (b) the remuneration of the staff and senior managers responsible for any part of the model validation is not linked to the performance of the tasks related to model development;
  - (c) there is effective separation between the validation function and the staff responsible for the model design and development;
  - (d) the validation function provides an effective challenge of model development by looking sufficiently deeply into the methodological aspects and by performing an appropriate own assessment of modelling hypotheses;
  - (e) furthermore, it needs to be verified that:
    - (i) the validation function has at its disposal adequate resources, including experienced and qualified personnel to perform its tasks;
    - (ii) there is a decision-making process in place to ensure that the conclusions, findings and recommendations of the validation function are properly taken into account by the management of the institution;
    - (iii) no undue influence is exercised over the validation function and its conclusions;
    - (iv) all necessary corrective measures are decided at the appropriate management level and via the designated committees, and are implemented in a timely manner;
    - (v) internal audit regularly explicitly assesses the fulfilment of the conditions referred to in (i) to (iv) above.
- (2) In performing the overall assessment of the independence of the validation function, particular attention will be paid to whether the institution's organisational choices are appropriate to the nature, size, scale and complexity of the risks inherent in its business model.

## **11. Frequency and completeness of the model validation process**

- (1) In assessing the completeness of the model validation process as referred to in paragraph 9. (1) (b), the ECB will verify that the institution has defined and documented a complete validation process, in particular for all stochastic processes applied, all legal margin contracts agreed and the different areas of validation referred to in Chapter 8 Validation techniques. In terms of frequency, it is expected that the validation process is applied according to an adequate and regular cycle following the annual work plan. The frequency for back-testing should be at least yearly.
- (2) In performing the assessment regarding the completeness of the validation process as referred to in item 1, the ECB will verify that the validation function:
  - (a) critically reviews all the aspects of specification of the exposure modelling, including the data collection and data cleansing procedures, the choices of the methodology and model structure, in particular regarding stochastic processes, calibration techniques and the representation of margining mechanisms;
  - (b) ensures a comprehensive view on all the findings, problems, weaknesses and limits of the exposure model and an ongoing interaction of all staff contributing to validation tasks;
  - (c) verifies the adequacy of the implementation of the exposure model in IT systems;
  - (d) verifies the performance and the stability of the model outcome;
  - (e) verifies that all model changes and extensions as well as their materiality are in line with the ECB guide on “Materiality assessment for IMM and A-CVA model extensions and changes” and, in particular, that it consistently follows up on its own conclusions and recommendations.
- (3) Where there are applications for permission to use the IMM or any material changes or extensions to the IMM, it needs to be verified that the institution performs the validation referred to in sub-paragraph (2) before the IMM is used for own funds calculation and internal purposes.

## **12. Adequacy of the validation methods and procedures**

In assessing the adequacy of the validation methods and procedures as referred to in paragraph 9. (1) (c), the ECB will verify that validation methods and procedures allow for a consistent and meaningful assessment of the performance of the IMM as required by Article 294 of the CRR, and especially that:

- (a) the validation methods and procedures are of adequate quality for assessing the accuracy and consistency of the IMM and appropriate to the nature, degree of complexity and scope of the IMM;

- (b) if validation is set up by location or legal entity, that methods and procedures are consistent across sites or, if not, that any inconsistencies are justified;
- (c) the validation methods clearly state the validation objectives, standards and limitations, including a description of all validation tests and datasets, as well as regular data cleansing, data sources and reference time periods, both with regard to current and stress calibration according to Article 292(2) of the CRR;
- (d) the validation methods, the data sets used for validation and the respective data cleansing are applied consistently over time.

### **13. Soundness of the reporting process and the process for addressing validation conclusions, findings and recommendations**

- (1) In assessing the soundness of the reporting process and the process for addressing the validation conclusions, findings and recommendations, as referred to in paragraph 9. (1) (d), the ECB will verify, in particular, that:
  - (a) the validation reports identify and describe or reference the validation methods and techniques used, the tests performed, the reference dataset used and the respective data cleansing processes, and fully and clearly describe the results of these tests, the conclusions, the findings with their materiality and the relevant recommendations;
  - (b) the conclusions and recommendations of the validation reports are directly communicated to the senior management and either to the management body of the institution or to the committee designated by it;
  - (c) the conclusions and recommendations of the validation report directly influence the further design of the institution's IMM and the decision-making process for further model cycles;
  - (d) the validation report is signed-off at a sufficiently senior management level with authority to trigger remedial action.
- (2) In order to ensure that the precise conclusions as described in sub-paragraph (1) above are drawn from validation results, it is further expected that:
  - (a) the institution has defined clear quantitative and qualitative thresholds when the exposure model is considered to have low performance. This definition needs to include at least:
    - (i) a statistical component in line with paragraph 52. (1) (c) below, where the outcome is such that the institution is not able to justify low exposure model performance;

- (ii) an expert-based component also including model users, such as credit officers, and qualitative aspects of the model's performance;
  - (b) the institution draws separate conclusions on each model component, e.g. exposure simulation and collateral modelling, before any general conclusions are drawn.
- (3) In order to ensure that validation reports are clear and comprehensive as mentioned in sub-paragraph (1) (a), the ECB will verify that:
  - (a) the scope of the items covered in validation reports, the team responsible for preparing them and the dates on which a model has been investigated are clearly described;
  - (b) validation results are presented such that they can be understood with the level of knowledge as required below by paragraph 15. (1) (d) for management;
  - (c) the underlying validation techniques and methodologies are either directly included in the report or readily available using references in the report;
  - (d) in case of low model performance on any model component, the report provides, to the extent possible, reasons why these model components demonstrate low performance;
- (4) In order to ensure that the results of validation reports are used in further cycles of the model development, the ECB will verify that:
  - (a) the validation report contains well-defined recommendations that are discussed with those responsible for model development and give clear guidance on how to improve the quality of the model if some model components demonstrate low performance;
  - (b) the report contains a schedule ideally agreed with the model development department on when to address observed shortcomings (based on the materiality of the effective EPE and RWA) and who is responsible for which task;
  - (c) the institution implements the recommendations of the validation reports according to the document fixing schedule;
  - (d) the institution has validated whether the model's performance has improved following the implementation of earlier validation recommendations.

## Chapter 4

### Internal governance, risk control, collateral management and audit

#### 14. General

- (1) In order to assess whether an institution is in compliance with the requirements on internal governance, including requirements on senior management and the management body, internal reporting, counterparty risk control, collateral management and internal audit units, as referred to in Articles 286, 287, 288, 292 and 293 of the CRR, the ECB will verify its internal governance with regard to:
  - (a) the role of senior management and the management body, in accordance with paragraph 15;
  - (b) the CCR control unit and its reporting, in accordance with paragraph 16;
  - (c) the collateral management unit and its reporting, in accordance with paragraph 17;
  - (d) the internal auditing process, in accordance with paragraph 18.
- (2) For the purposes of sub-paragraph (1), the ECB will:
  - (a) review the institution's relevant internal policies and procedures;
  - (b) review the minutes of the institution's internal bodies, including the management body, or other committees;
  - (c) review the exposure reports relating to both regulatory and internal risk including overdraft reports, as well as any conclusions and decisions taken on the basis of those reports;
  - (d) review the collateral management reports especially in terms of disputes;
  - (e) review the internal audit reports and the conclusions and recommendations they contain;
  - (f) obtain written statements or interview the staff and senior management of the institution;
  - (g) review other relevant documents of the institution.

#### 15. Senior management and management body

- (1) In assessing the soundness of the institution's internal governance regarding management as referred to in paragraph 14. (1) (a), the ECB will verify that:

- (a) the decision-making process of the institution for CCR, including its hierarchy, reporting lines and levels of responsibility, is clearly laid down in the institution's internal documentation and consistently reflected in the minutes of its internal bodies;
  - (b) the management body or the committee designated by it approves all material aspects of the IMM and provides the appropriate organisational structure for its sound implementation by way of a formal decision, which comprises:
    - (i) guaranteeing sufficient resources (staffing of the development and validation teams, etc.);
    - (ii) ensuring the adequacy of the governance arrangements (among other things, the positioning in the organisational chart);
  - (c) the management body or the committee designated by it approves all relevant policies related to the implementation of the IMM, including the policies related to the IT infrastructure and contingency planning;
  - (d) the senior management of the institution has a good understanding of the IMM as well as of its design and production processes, including the requirements for the IMM as laid down in Article 292 of the CRR and the institution's approach to meeting these requirements and being aware of model limitations according to Article 286(4) of the CRR;
  - (e) the senior management of the institution notifies the management body, or the committee designated by it, of any material changes to or exceptions from established policies and processes that materially impact the operation of the IMM;
  - (f) the senior management of the institution undertakes relevant measures if weaknesses in the IMM are identified by the CCR control, the independent validation function or the internal audit, which means in particular having a governance framework in place within the institution:
    - (i) to identify, classify (according to the EGMA and manage model changes and extensions, and;
    - (ii) to plan phases in the life cycle of the IMM;
  - (g) the management responsible for enforcing reductions in the institution's transactions reviews reports prepared by the independent CCR control according to Article 293(1)(d) of the CRR on a daily basis.
- (2) For the purposes of verifying that the requirements referred to in item (1) (b) are met, the ECB will verify whether the institution's senior management and the management body or the committee designated by it have approved at least the following:

- (a) the risk management strategies and policies on the IMM, including all material aspects of data supply and calibration processes;
- (b) the organisational structure of the collateral management and CCR control units, including the tasks and set-up of validation and internal audit;
- (c) the specification of the acceptable level of CCR.

## **16. CCR control unit**

- (1) For the assessment of the CCR control unit, referred to in paragraph 14. (1) (b) in addition to the elements mentioned in paragraph 14. (2), the ECB will review, in particular:
  - (a) the roles and responsibilities of staff and senior management of the CCR control unit;
  - (b) the relevant reports submitted by the CCR control unit to the senior management or to its designated committee.
- (2) In assessing the internal governance and oversight of the institution in relation to the CCR control unit as referred to in sub-paragraph (1), it will be verified in particular whether the CCR control unit is separate and independent from the units responsible for trading derivatives and SFTs. In the course of this assessment, the ECB will verify in particular that:
  - (a) the CCR control unit is part of the structure in the institution's organisational chart;
  - (b) neither the staff nor the senior management responsible for the CCR control unit are responsible for trading derivative transactions or SFTs;
  - (c) the managers of the CCR control unit and of units responsible for trading derivative transactions or SFTs have different reporting lines at the level of the management body of the institution or its designated committee;
  - (d) the remuneration of the staff and senior management responsible for the CCR control unit is independent from the performance of the tasks related to trading derivatives or SFTs.
- (3) In assessing the internal governance and oversight of the institution in relation to the CCR control unit as referred to in sub-paragraph (1), the ECB will verify in particular that the CCR control unit is adequate, proportional and functional. In the course of this assessment it needs to be verified in particular that:
  - (a) the staffing of the CCR control unit is appropriate to the nature, size and degree of complexity of the institution's business and organisational structure, and in particular to the complexity of the IMM and its implementation, where staff need to be experienced and qualified to undertake all relevant activities;

- (b) the CCR control unit is responsible for the design or selection, implementation and oversight, and the performance of the IMM and the tasks referred to in Article 287(2) of the CRR;
  - (c) the CCR control unit regularly informs the senior management about the performance of the IMM, any areas for improvement, and the status of efforts to improve previously identified deficiencies.
- (4) In assessing the adequacy of the internal reporting of the CCR control unit as referred to in sub-paragraph (1) (b), the ECB will verify in particular that
- (a) reporting according to Article 286(5) to (7) of the CRR includes time profiles of counterparty exposures aggregated across netting sets
  - (b) the reporting under (a) also makes use of the exposure measure as defined for internal risk management purposes for transactions not covered by the IMM,
  - (c) breaches of risk limits and the usage of the credit lines according to Article 286(6) and (7) of the CRR are shown;
  - (d) counterparties with the largest exposures and those with limit breaches are highlighted, and the reporting is appropriate for the nature, size, and degree of complexity of the institution's business and organisational structure;
  - (e) the form of reporting corresponds to the significance and type of the information, taking into account the institution's organisational structure;
  - (f) the reporting includes stress tests in accordance with Article 290 of the CRR;
  - (g) the reporting includes WWR in accordance with Article 291(6) of the CRR;
  - (h) the reporting identifies any difficulties or anomalies with regard to market data supply and calibration, if deemed to have a significant impact;
  - (i) the institution's reporting facilitates senior management's monitoring of the CCR in the overall portfolio of transactions covered both by the IMM and any non-IMM exposure method under Article 273(1) of the CRR.

## **17. Collateral management unit**

- (1) For the assessment of the collateral management unit, referred to in paragraph 14. (1) (c) in addition to the elements mentioned in paragraph 14. (2), the ECB will review, in particular:
- (a) the roles and responsibilities of all staff and senior management of the collateral management unit;



- (b) the relevant reports submitted by the collateral management unit to an appropriate level of management or to its designated committee.
- (2) In assessing the internal governance and oversight of the institution in relation to the collateral management unit, as referred to in sub-paragraph (1), the ECB will verify in particular that:
- (a) the collateral management unit is appropriate for the nature, size and degree of complexity of the institution's business, and in particular to the complexity of the legal agreement types for derivative and SFT margining;
  - (b) the collateral management unit has adequate resources, and experienced and qualified staff to undertake all relevant activities in accordance with Article 287(4) of the CRR;
  - (c) for the reporting of independent amounts as mentioned in point (a) of Article 287(3) of the CRR, this reporting requirement applies only if this amount is specified in contracts similarly to an initial margin,<sup>14</sup> i.e. when a certain level of available collateral corresponds to the independent amount;
  - (d) the collateral management unit works closely with the legal department and has sufficient access to legal databases;
  - (e) either the legal department or any other dedicated function involved updates legal databases in a timely manner following any contractual change and upon entering new contracts.
- (3) In assessing the adequacy of the internal reporting of the collateral management unit as referred to in paragraph 17. (1) (b), the ECB will verify in particular that:
- (a) the collateral management unit regularly informs senior management about the performance of margining including the status of disputes, areas for improvement, and the status of efforts to improve previously identified deficiencies; this includes passing dispute reports on to units responsible for transaction pricing;
  - (b) the reporting fulfils the requirements of Article 287(3)(d) and (f) of the CRR, and for point (e) there are case-by-case reports on concentrations of collateral above pre-defined thresholds, whether by type of collateral (for non-EUR cash collateral) or by issuer for non-cash collateral;
  - (c) the reporting frequency is adapted in the event of serious and material disputes;
  - (d) the institution's reporting facilitates the management body's or designated committee's monitoring of the margining.

---

<sup>14</sup> For some independent amount (IA) agreements, the IA merely acts like a negative threshold (only as a parameter that governs margin calls, i.e. it does not correspond to a certain level of physical collateral).

## 18. Internal audit

- (1) For the assessment of the internal audit function responsible for the processes referred to in paragraph 14. (1) (d), in addition to the elements mentioned in paragraph 14. (2), the ECB will review:
  - (a) the roles and responsibilities of staff involved in the internal audit;
  - (b) the adequacy and appropriateness of the annual internal audit work plan;
  - (c) the auditing manuals, the work programmes, the findings and the recommendations included in the audit reports;
  - (d) the action plan of each relevant recommendation, also in terms of its follow-up, as approved by the appropriate management level.
- (2) In assessing the internal governance and oversight of the institution in relation to the internal audit as referred to in sub-paragraph (1), the ECB will verify in particular that:
  - (a) at least once a year the internal audit reviews the operations of the CCR control unit, limit and credit line approval process and internal validation function, also in terms of compliance with the requirements for the institution's IMM as defined in CRR Part 3 Title II Chapter 6 Section 6;
  - (b) the review referred to above in (a) helps identifying areas in the annual work plan where a detailed review of adherence is necessary;
  - (c) the resources of the internal audit unit are adequate for and proportionate to the tasks assigned to it.
- (3) In the course of the assessment of sub-paragraph (2) (c), the ECB will verify in particular that:
  - (a) the internal audit function provides sufficient information to senior management and the management body of the institution on the compliance of the IMM with all applicable requirements;
  - (b) the internal audit function is appropriately staffed taking into account the nature, size and degree of complexity of the institution's business and organisational structure, and in particular the complexity of the IMM and its implementation, and has experienced and qualified staff to undertake all relevant activities;
  - (c) the internal audit function is not involved in any aspect of the IMM modelling or its operation that is the subject of the reviews that the internal audit or other comparable independent auditing unit carry out in accordance with sub-paragraph (2) (a);

- (d) the internal audit function is independent from the personnel and management function responsible for trading derivative transactions or SFTs and reports directly to senior management;
- (e) the remuneration of the staff and senior management responsible for the internal audit function is independent from the performance of the tasks related to trading derivative transactions or SFTs.

## Chapter 5

### IMM use test

#### 19. General

- (1) In order to assess whether an institution is compliant with the requirements on the use of the IMM, as referred to in Article 289 of the CRR, the ECB will verify, in particular, that:
  - (a) the distribution of exposures generated by the model used to calculate effective EPE plays an essential role in all of the following areas, in accordance with Article 289(1) of the CRR:
    - (i) day-to-day CCR management, decision-making and credit approval (see paragraph 20);
    - (ii) the internal capital allocation process (see paragraph 21);
    - (iii) the corporate governance functions (see paragraph 22);
  - (b) data and exposures considered by the institution for the calculation of own funds and those used for internal purposes are consistent and, where discrepancies exist, these are fully documented and reasonable;
  - (c) an exposure model broadly in line with the requirements set out in CRR Part 3 Title II Chapter 6 Section 6 has been used by the institution for at least one year before receiving the permission to use IMM, in accordance with Article 289(2) of the CRR (see paragraph 23).
- (2) For the purpose of sub-paragraph (1), the ECB will:
  - (a) review the institution's relevant internal policies and procedures;
  - (b) review the minutes of the institution's internal bodies, including the management body, or other committees involved in the governance of CCR management;
  - (c) review the documented credit line delegation schemes and credit management manuals;

- (d) review the institution's analysis of the counterparty credit line approvals in context of WWR and stress tests;
  - (e) review the documented regular CCR reporting, its underlying systems and processes and their performance regarding daily production in line with Article 289(5) of the CRR;
  - (f) review the documentation on the calculation of the institution's internal capital and the distribution of the internal capital to risk types, subsidiaries and portfolios in the CCR context;
  - (g) review the findings of the internal audit or of other control functions of the institution including the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;
  - (h) obtain written statements or interview the staff and senior management of the institution.
- (3) For the purpose of sub-paragraph (1), ECB may also, to the extent appropriate, review:
- (a) the default management process, especially for margined trading;
  - (b) the CCR budgetary planning manuals and reports;
  - (c) other relevant documents of the institution.

## **20. Use test in risk management, decision-making and credit approval process**

- (1) In assessing whether the distribution of exposures generated by the model used for the calculation of own funds requirements plays a substantial role in the institution's CCR management (line consumption), credit approval and decision-making processes, as referred to in paragraph 19. (1) (a) (i), the ECB will verify in particular that:
- (a) IMM exposures are in particular taken into account by the institution when
    - (i) making a decision on the approval, rejection and renewal of CCR limits and transactions;
    - (ii) setting the CCR profile of the institution, whether this is done by the management body or by any other internal committee designated by it;
    - (iii) determining the policies, including the exposure limits, their time structure and mitigation techniques;
    - (iv) measurement of the usage of credit lines according to Article 289(3) of the CRR along the limit time structure;

- (v) allocating or delegating competence for the credit approval process by the management board to internal committees, senior management and staff;
  - (vi) assessing the payment performance of obligors, especially in margined trading and related disputes;
  - (vii) producing the CCR management reporting.
- (2) In the course of the assessment referred to in sub-paragraph (1), and where the institution applies such practices, the ECB will evaluate whether the IMM has been taken into account, in particular, for:
- (a) measuring, monitoring and controlling of exposures throughout the life of all contracts in the netting set, thus also beyond the one-year horizon, in accordance with Article 289(6) of the CRR;
  - (b) determining and implementing the default management process and the extent to which it is taken into account in modelling, especially for margined trading;
  - (c) monitoring WWR;
  - (d) implementing stress test analysis.

## **21. Use test in the internal capital allocation**

In assessing whether the distribution of exposures generated by the model used to calculate effective EPE plays an essential role in the institution's internal capital allocation as referred to in paragraph 19. (1).(a) (ii), the ECB will evaluate whether this distribution has been used, in particular, to:

- (1) assess the amount of internal capital of the institution in accordance with Article 73 of the CRD IV;
- (2) allocate the internal capital across risk types, subsidiaries and portfolios.

## **22. Use test in corporate governance functions**

(1) In assessing whether the distribution of exposures generated by the model used to calculate effective EPE and used for the calculation of own funds requirements plays an essential role in the institution's corporate governance functions, as referred to paragraph 19. (1) (a) (iii), the ECB will evaluate whether the IMM exposures are taken into account, in particular, for:

- (a) the institution's internal reporting;
- (b) the CCR monitoring.

- (2) In the course of the assessment referred to in sub-paragraph (1), and where the institution applies such practices, it is also necessary to evaluate whether the IMM is taken into account, in particular, in the internal audit planning.

### **23. Demonstration of model use prior to approval**

- (1) In assessing whether an exposure model which is broadly in line with the requirements set out in CRR Part 3 Title II Chapter 6 Section 6, has been used by the institution for internal purposes for at least one year before receiving permission to use the IMM for the purpose of the own funds requirements calculation according to Article 289(2) of the CRR, the ECB will verify in particular that:
  - (a) internally modelled exposure distributions that are later on used for effective EPE calculations have been used for at least the last year<sup>15</sup> in the internal risk measurement and management processes as referred to in paragraph 20. (1);
  - (b) adequate documentation of the effective operation of the exposure modelling is available for at least the last year, in particular with regard to limit monitoring, internal validation and internal audit reports.
- (2) The assessment referred to in item 1 also applies to extensions of the use of the IMM<sup>16</sup>.

## **Chapter 6**

### **Documentation and design**

### **24. General**

- (1) In order to assess whether an institution is in compliance with the requirements on the design, management and documentation of the IMM, the ECB will verify in particular the following:
  - (a) the adequacy of the documentation on the design, operational details of and rationale for the IMM, as referred to in Articles 286(1) and 288(a) of the CRR, according to the provisions of paragraph 25;
  - (b) the adequacy of the structure and design of the risk factor dependencies within IMM for forecasting various types of market values, as referred to in Article 284(1)(a) of the CRR, according to the provisions of paragraph 26.

---

<sup>15</sup> The model used during that year may have been subject to changes provided that such changes are not classified as "material" as defined in the ECB Guide on Materiality Assessment (EGMA).

<sup>16</sup> Model extensions as defined in Annex I of the EGMA.

- (2) For the purposes of sub-paragraph (1), the ECB will:
- (a) review the institution's relevant internal policies;
  - (b) review the institution's technical documentation on the methodology and processes for the IMM's development;
  - (c) review and challenge the assumptions of IMM development manuals, methodologies and processes;
  - (d) review the minutes of the institution's internal bodies responsible for approving this institution's IMM, including the management body or other committees;
  - (e) review the reports on the performance of the IMM and the recommendations of the CCR unit, validation function, internal audit function or any other control function of the institution;
  - (f) review the progress reports on the institution's effort to correct shortfalls and mitigate risks detected during monitoring, validations and audits of the IMM;
  - (g) obtain written statements or interview the staff and senior management of the institution.
- (3) For the purposes of sub-paragraph (1), ECB may also, to the extent appropriate:
- (a) request and analyse data and test cases used in the process of developing the IMM;
  - (b) conduct its own estimations or replicate the institution's for a sub-set of risk factors;
  - (c) request additional documentation or analysis substantiating the methodological choices and the results obtained;
  - (d) review the functional documentation of relevant IT systems;
  - (e) review other relevant documents of the institution.

## **25. Documentation**

- (1) In assessing the documentation on the design, operational details of and rationale for the IMM as referred to in paragraph 24. (1) (a), the ECB will verify the presence of the elements in sub-paragraphs (2) and (3).
- (2) The completeness of the documentation must be established, which requires a review of coverage of the following areas:

- (a) the adequacy of the IMM and its components in relation to the portfolio characteristics, including verifying that:
  - (i) the purpose of the IMM is clearly outlined in the model documentation (also in terms of Pillar 2 use);
  - (ii) the documentation includes description of the scope of application of the IMM, specifying the types of covered and non-covered transactions included, both in a qualitative and in a quantitative manner, and the type of outputs, including which reporting they will be included in;
  - (iii) the documentation includes an explanation of how the IMM results are taken into account in the processes of granting and monitoring credit, as defined in Article 289 of the CRR on the use test;
- (b) the description of market data sources and cleansing practices, including the verification that:
  - (i) it contains detailed information on all data used for the model's development, including precise definitions of its content and its source, format, coding and, where applicable, exclusions;
  - (ii) any data cleansing procedures are described, including procedures for data exclusions, outlier detection and treatment, and data adaptations, as well as explicit justification for their use, and evaluation of their impact;
- (c) the process for calibrating the parameters used for generating exposure distributions, including verifying that:
  - (i) all related processes, algorithms and variable transformations are noted in detail;
  - (ii) criteria for the stability and adequacy of the calibrated parameters are listed;
  - (iii) all risk factor-specific parameters that are not set by experts are covered;
- (d) the rationale for any parameters set by experts for generating exposure distributions, including a reference to the validation of sensitivities and materiality;
- (e) the rationale for methodological choices including expert judgement, verifying that the documentation includes:
  - (i) the role of expert judgement in the process of the IMM's development, including a detailed description of the consultation process with business experts on the design of the IMM to the extent applicable;



- (ii) an explanation on how the institution addresses – by way of expert judgement and adjustments – qualitative elements that may affect the performance of the IMM, in particular the unsatisfactory quality of the data, the lack of simulated risk-factors and the use of either fixed or deterministic parameters set by experts inside stochastic processes;
  - (iii) the procedure for the design of the final model, including potential adjustments (or caps/floors) based on expert judgement on the parameters resulting from calibration;
- (f) the technical and mathematical specification of the stochastic models, verifying that the documentation includes:
- (i) the final model structure, specification and input components including type and format of selected variables;
  - (ii) tools used to develop the model;
- (g) a description of the stochastic processes beyond the mathematical specification, including rationales for the choice of risk factors to be modelled using stochastic, deterministic but time dependent, and constant approaches, the distribution assumptions associated with the processes and the chosen multi-dimensional dependency structure, as well as analysis of the appropriateness of these choices;
- (h) a description of the characteristics of the simulation, including the time grid chosen to evaluate the market values at future points in time, analyses of the appropriateness of the chosen time grid, approximations such as Brownian bridges used between time grid points, the number of simulations chosen, the stability and convergence of the simulation results and an simulation error analysis;
- (i) the stochastic models' and pricing function weaknesses, limitations and possible mitigating factors thereof, verifying that the documentation includes:
- (i) an estimate on model risk, and/or;
  - (ii) a respective reference to validation reports;
- (j) the specification of valuation models to price all IMM-approved transactions as of the valuation date and all future exposure grid points, or references to documentation outside the IMM, verifying that the documentation includes for each transaction type:
- (i) a listing and description of all required static data (such as maturities, strike prices, or fixing dates) including the required formats;
  - (ii) a listing and description of the market data required as input, such as spot prices, foreign exchange rates, interest rates, or implied volatilities, together with a description of required conventions (such

as day count and compounding conventions for interest rates, quotation type for foreign exchange against which reference currency);

- (k) the implementation of stochastic and valuation models into the IT environment and a description of the system architecture and data flows, verifying that the documentation includes:
  - (i) specification of the process to be followed when a new or modified model is moved into the production environment;
  - (ii) the results of the tests on the implementation of the IMM in the IT systems, including confirmation that the model implemented in the production system is the same as the one described in the documentation and is operating as intended.
- (3) The procedures for gathering and storing information on the IMM's development and maintenance entailing a review of coverage of the following areas:
  - (a) the parties involved (model developers, software engineers, validation, etc.) and their responsibilities;
  - (b) whether the documents and information are updated frequently enough;
  - (c) an overview or framework document on all IMM-related documentation with sufficient documentary links or references.

## **26. Model design**

- (1) In assessing the model design as referred to in paragraph 24. (1) (b) (market factor dependencies), the ECB will verify:
  - (a) whether the model's general logic exhibits a convincing explanation and whether its outputs lie in line with intuition;
  - (b) the institution's analysis of alternative assumptions or approaches to the chosen model design to the extent that they are available;
  - (c) the institution's methodology for model development, which should inter alia encompass tests to challenge hypotheses, quantify their potential impact (sensitivities), and gauge the model's performance after changes;
  - (d) whether the institution fully understands the model's capabilities and limitations, in particular that the institution:
    - (i) describes which of the model's limitations are related to the model inputs, uncertain assumptions, the processing component of the model, or the way the model output is produced;

- (ii) identifies situations in which the model may perform below expectations or become inadequate as well as assessing the materiality of model weaknesses and possible mitigating factors;
- (iii) also sufficiently understands model components purchased externally (vendor models) to the extent applicable, and subjects these components to sufficient scrutiny.

## Chapter 7

### Exposure quantification

#### Section 1

#### General

#### 27. General

- (1) In order to assess an institution's compliance with the requirements on the calculation of exposure values, as referred to in Article 284 of the CRR, the ECB will verify the institution's:
  - (a) compliance with the requirements for the estimation of future exposure distributions based on changes in market values as referred to in Article 284(1)(a) of the CRR, as further laid out in Section 2 Risk factor models ;
  - (b) compliance with the requirements for calculating exposure values as referred to in Article 284(4), (5) and (6) of the CRR for calculating the value of a netting set using transaction price routines at appropriate time grid points, as further laid out in Section 3 Pricing functions, exposure grid and number of scenarios;
  - (c) compliance with the requirements for legal agreements as referred to in Article 272(4) and Article 297 of the CRR and the exposure aggregation per netting set as referred to in Article 284(1)(b) of the CRR and the subsequent calculation of the exposure value as referred to in Article 284(5) to (7), or, alternatively, according to Article 284(8), and as referred to in Article 162(2) of the CRR for the maturity calculation, as further laid out in Section 4 Master netting and margining agreements and exposure aggregation;
  - (d) compliance with the requirements for the calculation of the IMM exposure value and maturity using current market data and a stress calibration (only for the exposure value, not for the maturity) as referred to in Articles 162(2) and (3) and 284(5) of the CRR, as further laid out in Section 5 Calibration ;

- (e) compliance with the requirements for margined trading as referred to in Article 285 and for eligible collateral as referred to in Articles 197, 198 and 299(2)(c) and (d) of the CRR, as further laid out in Section 6 Margined trading and SFT requirements;
  - (f) compliance with the requirements specific to transaction-specific WWR as referred to in Article 291 of the CRR, as further laid out in Section 7 Wrong Way Risk .
- (2) For the purposes of sub-paragraph (1), the ECB will:
- (a) review the institution's relevant internal policies;
  - (b) review the institution's technical documentation on estimation methodologies and processes;
  - (c) review the model development manuals, methodologies and processes;
  - (d) review the minutes of the institution's internal bodies, including the management body, model committee, or other committees;
  - (e) review the reports on IMM performance and the recommendations by the CCR control unit, validation function, internal audit function or any other control function of the institution;
  - (f) assess progress reports on the effort of the institution to correct shortfalls and mitigate risks detected during audits, validations and monitoring;
  - (g) obtain written statements or interview the staff and the senior management of the institution.
- (3) For the purposes of sub-paragraph (1), the ECB may also, to the extent appropriate:
- (a) request additional documentation or analysis substantiating the institution's methodological choices and the results obtained;
  - (b) conduct its own estimations of exposures or replicate the institution's estimations of exposures using calibration data supplied by the institution;
  - (c) request and analyse the data used in the process of exposure generation;
  - (d) review the functional documentation of the relevant IT systems to the extent not already carried out for Chapter 10 Data Maintenance and IT processes;
  - (e) review other relevant documents of the institution.

## Section 2

### Risk factor models

#### **28. Risk factors selection and dependence structure**

In order to assess the structure of the IMM in accordance with paragraph 24. (1) (b), the ECB will verify the appropriateness of the following:

- (1) The selection of risk factors for the purpose of estimating exposure in the IMM, both in terms of simulated and non-simulated risk factors (i.e. those kept constant or deterministic, with non-stochastic moves), in particular by assessing:
  - (a) the selection process across all transaction types and netting sets, taking into account the required market data and transaction attributes for the pricing routines. The coverage by the simulated risk factors should be sufficiently granular, i.e. the characteristics of risk factors used need to be in line with the pricing routines used (see also paragraph 54) and need to reflect the how the risk materialises in practice;
  - (b) the methods to detect new, potentially relevant risk factors;
  - (c) the criteria for deciding whether to simulate certain risk factors in the IMM or keep them deterministic or constant, e.g. by assessing the materiality of simplifications regarding the generation of exposures such as effective EPE.
- (2) The dependence structure between the risk factors, which includes:
  - (a) an assessment of the modelling technique used for dependence structures (i.e. linear correlation or other types via copulas), specific aspects of its calibration and their respective rationales;
  - (b) in case a correlation matrix is required to model the dependence structure, an assessment of the correction technique used to ensure that the final correlation matrix is positive semi-definite, including the assessment of its impact on the exposures;
  - (c) intra-risk correlations or dependencies within one risk factor category, such as interest rate tenors and dependencies between interest rate curves;
  - (d) inter-risk correlations or dependencies between relevant risk factor categories, such as interest rates, credit spreads, foreign exchange rates or equities.

## 29. Simulated risk factors

- (1) In order to assess whether simulated risk factors adequately meet the requirements of the pricing functions or stochastic processes they are used for, the ECB will:
  - (a) verify, for the choice of the stochastic process, that the risk factors, which are simulated inside IMM, are mapped to adequate stochastic processes. This includes particularly assessing:
    - (i) whether the simulated behaviour of risk factors is sufficiently in line with historical observations;
    - (ii) whether the way parameters are calibrated fits the chosen stochastic approach;
  - (b) verify, for the stochastic processes themselves that:
    - (i) the mathematical structure of the chosen stochastic process is appropriate and consistent – this includes among other things assessing whether the documentation is mathematically correct and detailed enough for competent investigators to understand the rationale for selecting this kind of stochastic process, its components, the underlying assumptions, its calibration and the influence of possible uncertainties;
    - (ii) the solutions of the chosen projection model (e.g. a system of stochastic differential equations) are:
      - correct and stable under perturbations<sup>17</sup> and uncertainties of the parameters and the initial values;
      - calculated with a numerically stable and accurate method – this concerns the modelling choices regarding, e.g. the time discretisation method and time step sizes, other discretisations and transformations, and the implemented calibration method (which might involve optimisation routines, iterative solvers and/or analytic approximations), as well as aspects such as the random number generator and variance reduction techniques;
    - (iii) in this regard it is necessary to either mathematically verify the correctness and stability of the solution or to check that a sufficiently detailed derivation is part of the documentation including all necessary steps for arriving at the solution.
- (2) To the extent necessary for the purposes of sub-paragraph (1) (a) (i), ECB will assess the adequacy of caps or floors used in the stochastic processes. This

---

<sup>17</sup> This holds to the extent that stability is to be expected, e.g. not necessarily in cases where there are option barriers.

includes assessing how caps/floors for the risk factor distribution are set, e.g. by expert judgement or based on historical observations.

- (3) The ECB will assess how the solutions of sub-paragraph (1) (b) (ii) are linked with the random numbers and paths of simulated risk factors as a function of time.
  - (a) In this regard, ECB will review, among other things, whether the institution uses an additional process (e.g. a jump process) as superposition and whether the choice of such an additional process<sup>18</sup> and its parameters is appropriate;
  - (b) The ECB will review the quality of the random number generator used by assessing among others the appropriateness of:
    - (i) its period, i.e. the number of calls until the random number sequence starts to repeat itself, and;
    - (ii) the distribution choice with regard to the dimensionality of the problem as given by the number of risk factors that are simulated simultaneously and the homogeneity;<sup>19</sup>
  - (c) For the purpose of (b); the ECB may either:
    - (i) review available scientific papers and reviews of the chosen random number generator, or;
    - (ii) require the credit institution to demonstrate a reasonable and appropriate behaviour of the chosen random number generator.

### 30. Non-simulated risk factors

In order to verify that non-simulated risk factors deliver the characteristics needed for pricing at future grid points, the ECB will assess the following:

- (1) When there are risk factors kept constant for the use of pricing the transactions at future time steps, the ECB will assess:
  - (a) that the level/value assigned to these risk factors is appropriate;
  - (b) how this level was derived, e.g. by expert judgement or based on historical data observed;
  - (c) that the constant level is adequate for direct use in a pricing function, if applicable;

---

<sup>18</sup> For example, a jump process.

<sup>19</sup> This is meant in the sense of "low discrepancy".

- (d) that it is appropriate to consider a constant value for the risk factor within a deterministic function or stochastic process for another risk factor.
- (2) For risk factors subject to a deterministic movement in time, the ECB will verify, that:
- (a) the risk factors are mapped to an adequate deterministic function, e.g. in terms of observed historical development;
  - (b) where directly used in a pricing function, that the deterministic movement is adequate for pricing purposes at future time steps;
  - (c) where such a risk factor is used as an input parameter to derive another risk factor's distribution, that the deterministic movement sufficiently meets the requirements of the stochastic process it feeds into.
- (3) If applicable for the purposes of sub-paragraph (2) (a), the ECB will assess the adequacy of caps or floors used in the deterministic functions. This includes determining how these caps/floors are set, e.g. by expert judgement or based on historical observations.

### **31. Data requirements for risk factors used within the IMM**

- (1) In assessing the overall requirements for the estimation of future exposure distributions based on changes of market values as referred to in paragraph 27.
- (1) (a), the ECB will verify:
- (a) the completeness of quantitative data underlying the calibration of the IMM, assessing in particular:
    - (i) the sufficient length of time series where historical market data underlie the calibration;
    - (ii) the origin in sufficiently liquid markets, or the consistency with relevant market information (e.g. the market values of similar positions), where market-implied data underlie the calibration;
  - (b) the adequate use of market data proxies (if relevant);
  - (c) the justification and documentation of all data cleansing, such as the deletion of observations deemed outliers, e.g. due to technical issues at the data provider, the treatment of bank holidays in certain jurisdictions, and the reasoning justifying the view that these specific choices do not bias the risk quantification.
- (2) For the purposes of sub-paragraph (1), the representativeness and quality of the data feeds used needs to be assessed in conjunction with the evaluation of the IT processes and maintenance of market data according to Chapter 10 Data Maintenance and IT processes.



## Section 3

### Pricing functions, exposure grid and number of scenarios

#### **32. Pricing of trades**

In order to assess the correctness of the pricing of the trades in the IMM, the ECB will verify that:

- (1) The pricing functions used for the purposes of effective EPE calculation are internally validated by the institution. The pricing functions implemented should, among other things, account for all intermediate cash flows and cash flows at maturity date.
- (2) Potential pricing approximations shall not lead to significantly biased exposure profiles. The institution is expected to provide evidence that these approximations are adequate and in particular account sufficiently for non-linearity, if relevant.
- (3) The institution compares the initial values calculated with the risk system that calculates the effective EPE at transaction level with the values from a benchmarking system for a fixed valuation date ( $t_0$ ) on a regular basis. In more detail, the ECB will assess that:
  - (a) the institution has implemented appropriate thresholds for acceptable value differences between benchmarking systems and effective EPE risk engine pricing;
  - (b) these thresholds are defined and verified at transaction level applying at least the thresholds defined by paragraph 17 in the TRIM Guide for CCR are applied;
  - (c) at least transactions exceeding the thresholds referred to under (b) are carved out and allocated to one of the exposure methods in Chapter 6, Section 3 to Section 5, of the CRR;
  - (d) in case deviations are below the thresholds referred to under (b), it is verified that an institution:
    - (i) monitors large deviations observed – if these deviations have a significant impact on the effective EPE of the bank's total portfolio or certain netting sets, they have to be analysed and remedied (e.g. by adjusting the pricing function or using consistent market data at  $t_0$ );
    - (ii) appropriately takes into account such pricing deviations in the modelling of the transaction's time profile of values, i.e. adjustments of the value time-profile should consider the characteristics of the respective transactions without leading to a systemic underestimation of the resulting EE time profiles;

- (e) if trades from margined netting sets are not subject to the mandatory carve out from the effective EPE risk engine as referred to under (c), the netting benefit is calculated in a reliable manner and added to all concerned netting sets along the whole time axis.

### **33. Attributes of trades and pricing approximations**

In order to assess the correct representation of trades and the pricing of the trades in the IMM, the ECB will verify, in addition to the completeness and correctness check of trades and static data in Chapter 10 Data Maintenance and IT processes, that:

- (1) Trades are correctly represented; especially that the correct cash flow schedule is generated or applied to the trades.
- (2) Any approximations for market data used for pricing, if applicable, are appropriate for the risk factors, which are impacted by these market data approximations.
- (3) Any attribute missing either in the pricing function itself or in the data delivery, such as a double or second barrier, does not lead systematically to an underestimation of exposure (taking into account all potential long and short positions in the netting set).
- (4) Any approximation of the pricing function is applied in a way that does not lead systematically to an underestimation of exposure (taking into account all potential long and short positions in the netting set), which is validated over the full horizon until final maturity of the transaction.

### **34. Choice of grid points**

In order to assess the quality of the implemented simulation grid points for both margined and un-margined trading, the ECB will verify that:

- (1) The result of the institution's effective EPE calculations is reasonably close to the result a much denser, e.g. daily, simulation grid, would have yielded – the impact of a denser grid may also be calculated on representative sub-portfolios if agreed with the supervisor.
- (2) The simulation grid points are implemented such that:
  - (a) for dynamic simulation of grid points, they occur just before and at the moment of the exchange of cash flows and the dynamic grid point setting is carried out such that at least the cash flows most material to the calculation of effective EPE as well as RWA are covered;
  - (b) for fixed simulation grid points, they are fixed to cover the general cash flow profile of a bank appropriately, and if meaningful with different sets of grid points for margined and un-margined netting sets;

(c) they adequately capture the dynamics of the EE profile in general, even after the one-year horizon.

(3) The institution checks adherence to items (1) and (2) above on a regular basis.

### **35. Choice of number of scenarios**

In order to assess the appropriateness of the number of scenarios implemented for both stressed and current effective EPE calculation, the ECB will verify that the institution checks on a regular basis that:

- (1) The chosen number of scenarios ensures a reasonable convergence of the expected risk measures, e.g. stressed and current effective EPE, at bank level as well as at netting set level;
- (2) In case a percentile-based potential future exposure is used for risk management purposes, the number of scenarios chosen for this purpose leads to a reasonably low numerical error, too.

### **36. Balance of different requirements in this section**

When assessing the appropriateness of the choices in the current section, the relationship between the number of scenarios, the granularity of time steps and the complexity of the pricing functions will be taken into account by considering the following:

- (1) Due to the need to calculate the market value of the trades/netting sets at each time step, a higher density of the grid could lead to fewer scenarios or to less sophisticated pricing functions or vice versa. When expecting banks to raise the minimum number of scenarios, this might lead to an unwanted simplification of the IMM-implemented pricing models and/or to a less dense grid.
- (2) A similar correlation may exist when demanding greater consistency between front office/accounting and IMM pricing: The complexity of the banks' pricing functions can also limit the number of scenarios chosen due to a similar trade-off.

## Section 4

### Master netting and margining agreements and exposure aggregation

### **37. Implementation of legal agreements' attributes**

Besides the verification of completeness and correctness of data for legal agreements and the assignment of trades to them, which is explained in Chapter 10 Data Maintenance and IT processes, the ECB will verify that:

- (1) The implementation of the margin algorithm and the meaning of its parameters, such as minimum transfer amount, threshold, independent amount and initial margin, match the contractual specifications of the respective margin agreement or are modelled in a conservative manner.
- (2) Differences between attributes of contract types (e.g. for bilateral versus central clearing, ISDA versus non-ISDA, derivatives versus SFTs) are reflected in the implementation to the extent that they are material for the calculation of the exposure value.

### **38. Exposure aggregation**

In order to assess the correctness of the exposure aggregation steps, i.e. the steps of the calculation of the exposure value based on the simulated exposure distribution, and ultimately to calculate RWA, the ECB will verify that:

- (1) Trades for which the institution did not receive permission from the competent authority to apply the IMM are still modelled via an approach recorded either in Section 3, 4 or 5 of Chapter 6, Title II, Part three of the CRR. More specifically, the ECB will verify that:
  - (a) for these trades, no diversification and offsetting or netting benefits result from trades for which IMM approval has been given by the competent authority;
  - (b) there is no double counting of collateral where additional, synthetic netting sets are created to cover trades for which no IMM approval has been obtained.
- (2) The institution has tested the correctness of all exposure aggregation steps from single trade exposures to the effective EPE and exposure value at netting set level and the institution has documented those tests in a satisfactory manner.
- (3) The institution correctly takes into account the requirement of Article 284(3) of the CRR and does not, for example, apply the higher of the effective EPE determined using current market data and determined using stressed market data or the maximum exposure value or RWA per counterparty.
- (4) The institution applies the correct formula for determining the maturity parameter M mentioned in Article 162 of the CRR. More specifically, in cases where the IRB approach is used, the ECB will verify that:
  - (a) in cases where the foundation IRB approach applies, M is set at 0.5 year for repurchase transactions or securities or commodities lending or borrowing and at 2.5 years for all other transactions;
  - (b) in cases where the advanced IRB approach applies:

- (i) M is capped at 5 years, except in the cases specified in Article 384(1) of the CRR (for M used for the calculation of own funds requirements for CVA risk under the standardised method) where M is capped at the longest contractual remaining maturity in the netting set;
- (ii) M is determined at netting set level and not at trade level;
- (iii) the exposure values in the M calculation under Article 162(2)(g) of the CRR are discounted using the risk-free interest rate discount curve;
- (iv) the exposures in the M calculation under Article 162(2)(g) of the CRR are the effective EE up to the one year horizon and the EE after the one year horizon.

## Section 5 Calibration

### 39. General

- (1) In order to assess the correctness of the calibration of the institution's stochastic model, the ECB will assess whether:
  - (2) the institution uses both a calibration based on current market data and a calibration based on market data from a period of stress;
  - (3) the calibrations for both the current period and the period of stress are based on data after the quality checks as described in paragraph 61;
  - (4) the institution can handle significant market data changes (e.g. regime changes) using the underlying calibration process implemented, e.g. the model calibration should be able to adapt to increasing interest rate levels when the current interest rate levels are relatively low;
  - (5) the calibration is both numerically stable and sensitive to tail events;
  - (6) the calibration is sufficiently automated to prevent dependence on manual tasks and related operational risks, and the respective algorithms are described, tested and documented;
  - (7) the institution calibrates current and stressed effective EPE in a consistent manner, as referred to in Article 292(4) of the CRR.

### 40. Calibration based on market data from current time period

- (1) In order to assess the correctness of the calibration using current market data for the institution's IMM, as referred to in paragraph 39 (2), the ECB will assess whether:

- (a) the institution has a sound reasoning for the length of the calibration period if it applies historic calibration (at least 3 years for effective EPE);
  - (b) the institution recalibrates its model parameters at least quarterly in accordance with Article 292(2) of the CRR, and more frequently to properly reflect market conditions<sup>20</sup>, for the daily internal reporting requirements according to Article 289 of the CRR;
  - (c) the calibration for regulatory reporting uses market data as of the regulatory valuation date, and that for internal risk management market data as of the current reporting date.
- (2) In order to assess the calibration frequency for internal risk measurement purposes, the ECB will assess:
- (a) whether the future exposure distribution used for internal risk measurement in accordance with Article 289(1) of the CRR within the day-to-day CCR management process is recalibrated with a frequency consistent with the internal reporting needs and equal to or more frequent than the recalibration for regulatory reporting,
  - (b) that the needs mentioned above in (a) depend on the structure of netting sets and their sensitivity to changing volatilities and correlations resulting in the following frequencies:
    - (i) if counterparty portfolios that are material in terms of effective EPE and RWA depend strongly on changing volatilities and correlations, a daily or weekly calibration frequency seems appropriate;
    - (ii) otherwise monthly or a less frequent (e.g. quarterly) calibration could be used; provided that the institution justifies its choice.

#### **41. Stress calibration**

- (1) In order to assess the correctness of the stress calibration of the institution's model as referred to in paragraph 39 (2), it is necessary to assess that:
- (a) the stress period selection is representative of the credit default spreads associated with the institution's main counterparties, whose credit default spreads need to exhibit a significantly increased level;
  - (b) the institution assesses the adequacy of the chosen period for the stressed calibration at least quarterly in line with Article 292(3) of the CRR;
  - (c) if only a single stress period is applied within a banking group where the capital requirement calculation is required on legal entity level<sup>21</sup> as well,

<sup>20</sup> This applies in case of a significant change in markets.

<sup>21</sup> This is sometimes also referred to as "solo level".

the institution assesses the suitability of the uniform stress period for the computation on legal entity level;<sup>22</sup>

- (d) for the most material netting sets, the institution should monitor and explain the differences between the effective EPE calculated with the stressed calibration and the effective EPE calculated with the current calibration;
  - (e) the stress calibration date, in case market-implied data are used, needs to be representative of the market data levels and volatilities from the stress period under Article 292(2) of the CRR;
- (2) In order to assess the consistency of current and stress calibration as referred to in paragraph 39 (7), the ECB will verify that the modelling assumptions and choices made in the context of the current calibration are also appropriate in the context of the calculation of effective EPE based on market data from a period of stress. In this regard at least the following items will be assessed:
- (a) When assessing the risk factor models, the ECB will verify, as appropriate, that the following items are also sufficient for the stressed calibration:
    - (i) the potential change in the risk factor set according to paragraph 28 (1) (a), and the corresponding decision on whether to simulate, keep deterministic or constant those risk factors in the IMM described in paragraph 28 (2) <sup>23</sup>; this also includes the assessment of the impact on the stressed effective EPE;
    - (ii) the dependence structure between risk factors as described in paragraph 28 (2).;
    - (iii) the simulated behaviour of the risk factors is line with historical observations, also for the stressed period as described in paragraph 29 (1) (a) (i);
    - (iv) the interaction between simulated risk factors and stochastic processes as described in paragraph 29 (1) (b), in particular concerning the stability of the projection model's solutions under perturbation of initial values and parameters;
    - (v) the appropriateness of the level and its derivation for constant risk factors as described in paragraph 30 (1).;
    - (vi) the appropriateness of the treatment of deterministic risk factors as described in paragraph 30 (2).;

---

<sup>22</sup> A group function could take over responsibility for demonstrating the suitability of the group-wide stress period for each legal entity, if the relevant data is available for that group function.

<sup>23</sup> This might lead to a "reclassification" of a risk factor concerning its modelability in accordance with data availability during the stress period.

- (vii) the data requirements as described in paragraph 31 are also met for the stress calibration. If adjustments have to be made, e.g. due to insufficient data availability, it is verified that these adjustments are justified by the institution; particular care needs to be taken in the assessment of proxies, for example, as these may differ for the stress period.
- (b) When assessing the pricing routines implemented to revalue trades in the IMM, ECB verifies, as appropriate, that the following items are also sufficient for the stress calibration:
  - (i) the requirements for pricing trades appropriately, as described in paragraph 32 (1). and (2);
  - (ii) in case approximations are used in the pricing functions (see paragraph 33 (3). and (4).), that the exposures are not systematically underestimated, also in the context of the stress calibration;
  - (iii) there are no unintended jumps or distortions in the calculated exposures, in particular in conjunction with the requirements of this Section on deciding how to model certain risk factors according to 0 of this Chapter;
- (c) When assessing collateral modelling, in case own estimates of volatility adjustments are used, the ECB verifies, as appropriate, that these estimates are also based on the stress period.

## Section 6

### Margined trading and SFT requirements

#### **42. Length of MPOR**

In order to assess whether the institution has correctly set the MPOR per margin agreement, the ECB will verify that:

- (1) The institution has implemented the minimum MPOR in line with Article 285(2) of the CRR.
- (2) The institution has implemented processes such that for netting sets that exceed 5,000 trades, or have illiquid collateral, or OTC derivative transactions that cannot easily be replaced, that:
  - (a) these netting sets are identified in a reliable way;
  - (b) the definitions of illiquid collateral and transactions not easily replaceable under stressed market conditions are documented;



- (c) the MPOR for these netting sets is increased to at least 20 business days in line with Article 285(3) of the CRR.
- (3) The institution has implemented processes and definitions to identify trades and securities that are concentrated with a particular counterparty and whether it would be able to replace those trades and securities in the event of counterparty default, in accordance with Article 285(3) of the CRR, such that:
- (a) these trades and securities are identified in a reliable way;
  - (b) the institution has documented criteria for defining the concentration of trades or securities with one counterparty;
  - (c) the institution has at least implemented monitoring that defines the steps to be taken in case such a concentration is identified and the trades or securities are not replaceable.
- (4) The institution has implemented processes for legal agreements subject to margin disputes such that:
- (a) these legal agreements are identified in a reliable way;
  - (b) the length of the disputes is always recorded;
  - (c) the MPOR for these legal agreements is at least doubled for two subsequent quarters if the disputes meet the requirements as set in Article 285(4) of the CRR.
- (5) The institution correctly increases the MPOR for legal agreements to which margining is not applied at least daily, in accordance with Article 285(5) of the CRR.

#### **43. Modelling of cash flows within the MPOR**

- (1) Definitions:
- (a) Trade-related cash flows are intermediate trade cash flows, such as swap coupons, or cash settlements upon maturity.
  - (b) Margin-related cash flows cover settlements for both variation margin and initial margin.
- (2) In case margin modelling is done according to Article 285(1) of the CRR where the model properly captures the effects of margining when estimating EE, i.e. points (a) and (b) in Article 285(1) of the CRR do not apply, the ECB will verify that:
- (a) the institution has clearly defined the MPOR regarding the following possible events: (i) trade related cash flows, (ii) margin-related cash flows and (iii) default of a counterparty;

- (b) the institution has designed the margin collateral modelling according to paragraph 45.
- (3) In more detail, the ECB will verify that:
- (a) the institution has clearly defined when both the margin call and the effective margin payment related to the margin exchange at the beginning of the MPOR, as defined in Article 272(9) of the CRR, occur;
  - (b) the institution has clearly defined assumptions on when exactly the counterparty defaults within the MPOR;
  - (c) the institution has clearly defined which cash flows it expects to pay and receive during the MPOR – the modelling should be consistent with the chosen default time in item (b) and should reflect the default management process as it is applied by the institution (see also paragraph 44);
  - (d) the institution's modelling assumptions regarding payments of cash flows with respect to a grace period during MPOR, if applicable in the legal agreement, are clearly defined and in line with the legal agreements and the past experience of the bank, if applicable;
  - (e) the institution's ability to net outgoing trade-related cash flows with cash flows related to margin calls that would occur if the counterpart was not in default, in order to set off exposure spikes according to (g) below, to the extent that the legal agreement allows for that is reflected in the model;
  - (f) the institution either models only its own margin-related cash flow payments or excludes further margin payments following those defined in Article 272(9) of the CRR at the beginning of the MPOR and provides a rationale for doing so;
  - (g) the institution explains to what extent the chosen time grid and its specific modelling make spikes visible implicitly (e.g. through interpolation) or explicitly (e.g. through grid point setting) and how these spikes are input into the calculation of expected exposure considering the default management process mentioned above in (c).

#### **44. Default management processes**

- (1) The default management process (DMP) includes all actions and communication to be performed by and between front office, back office (settlements), legal department, credit department, the collateral management department and risk management/control or any other relevant unit upon default of a counterparty. In particular, it covers a description of actions to be taken around, during and immediately after a default.
- (2) In order to assess whether the institution takes its default management process into account correctly when modelling cash flows within the MPOR if margined

trading is modelled directly according to Article 285(1) of the CRR when estimating EE, the ECB will verify that:

- (a) The institution's ability to stop outgoing cash flows after notification of the counterparty's default or at a pre-defined time after such a notification is correctly reflected in its exposure calculation.
- (b) The default management process has been thoroughly analysed by the institution regarding:
  - (i) the flow of information and alerts between the credit department, front office, back office, collateral management, legal department and senior management upon a default notification, taking into account:
    - cases where critical counterparts are already under strict observation before the default;
    - cases where defaults happen unexpectedly;
    - cases where outstanding margin payments are also related to a dispute launched before or during a default;
  - (ii) the availability of action plans upon default, especially regarding payment controls;
  - (iii) the availability of written process descriptions of default management that also include rules for cases where key staff are absent or temporarily unavailable.

#### **45. Margin collateral modelling**

In order to assess whether the institution has correctly modelled its current and future simulated margin collateral according to Article 285(6) or (7) of the CRR, the ECB will verify that:

- (1) The institution takes into account all relevant margin features of the respective contract.
- (2) The institution has justified its assumptions regarding the date on which the collateral balance for the MPOR (for calculating EE(t) at end of MPOR) is no longer affected by margin-related cash flows (i.e. it is "frozen").
- (3) The institution has justified assumptions regarding the collateral composition of future margin calls in terms of non-cash collateral versus cash collateral and currencies used.
- (4) In case that collateral is simulated:

- (a) the simulation properly addresses all the interest rate, foreign exchange and specific risks of the margin collateral, if relevant;
  - (b) the institution uses sufficiently granular asset buckets for modelling that are based on well-defined characteristics of the assets, e.g. ratings if the collateral consists in assets.
- (5) If the collateral is not simulated, the volatility adjustments (i.e. haircuts) to the collateral are applied according to Articles 223 to 227 of the CRR and account appropriately for foreign exchange risk in case of currency mismatches, applying the definitions in paragraph 34 in the TRIM Guide for CCR.
- (6) If collateral is simulated or own estimates of volatility adjustments are used to derive haircuts, then the ECB assesses whether:
- (a) the treatment of non-cash margin collateral is consistent with the modelling of securities underlying the OTC or, if applicable, SFT positions;
  - (b) if a certain type of security is fully simulated<sup>24</sup> (or if an own estimate of volatility adjustment is applied) for the securities leg of an SFT, then it is also fully simulated (or an own estimate of volatility adjustment is applied) if occurring as margin collateral;
  - (c) deviations from (a) and (b), i.e. an inconsistent treatment, are:
    - (i) justified by an institution;
    - (ii) not material in terms of quantitative impact
    - (iii) do not lead to a systematic underestimation of exposures.
- (7) Reductions of exposure value due to clauses in collateral agreements that require receipt of collateral when the credit quality of the counterparty deteriorates are excluded in modelling in line with Article 285(8) of the CRR, using complete listings of respective legal agreements provided by the institution.

#### 46. Exposure modelling

In order to assess whether the institution models exposures appropriately if margined trading is modelled directly according to the first paragraph of Article 285 of the CRR (without points a and b) when estimating EE, the ECB will verify that:

- (1) When modelling the netting set value, if the simulation grid points for full revaluation do not cover all the required exposure time points, but an exposure estimation is deemed necessary for additional time points, the interpolation technique applied is:

---

<sup>24</sup> "Full simulation" means here that margin collateral is modelled jointly with the OTC derivatives and SFT exposure.

- (a) conceptually and mathematically sound;
  - (b) validated for sample netting sets where the additional exposure estimation is done with a dense or daily primary grid applying full revaluation.
- (2) The minimum transfer amount enters the calculation of the collateral balance at the beginning of MPOR in a conservative way, if the collateral balance is not modelled throughout the full exposure time axis.

#### **47. Specific requirements for securities financing transactions**

- (1) In order to assess whether the institution has correctly modelled the current and future value of the securities leg of an SFT, the ECB will verify that:
- (a) the institution has justified assumptions regarding the security composition of the underlying transactions in terms of eligible security types, in case this composition can change during the transaction lifetime, and used currencies;
  - (b) the simulation of securities properly addresses all the specific risks (such as credit spreads) of the asset over the horizon of the transaction;
  - (c) the simulation takes intermediate cash flows such as bond coupon payments into account to the extent such exchanges are part of the agreement;
  - (d) the institution has defined sufficiently granular buckets for the security types based on well-defined characteristics of the securities, e.g. ratings, that enter the modelling;
  - (e) the maturity assigned to open term SFTs for purposes of effective EPE calculation according to Article 284(6) of the CRR is economically justified and validated.
- (2) When assessing the requirements for margined trading, the ECB will verify if the institution has correctly taken into account the characteristics of margin agreements for SFTs within the IMM. This means to verify in particular that:
- (a) margining requirements specific for SFTs, such as keeping contractual ratios between cash and securities leg, have been taken into account in paragraph 37;
  - (b) the institution has justified assumptions regarding the future composition of SFTs' margin collateral, which is in line with the respective margin agreements;
  - (c) the effect of changing values of securities legs and in general changing values due to foreign exchange rate changes is included in the margin modelling, and regulatory volatility adjustments according to Articles 220

and 221, or Articles 224 to 226 of the CRR are only applied in exceptional cases.

## Section 7 Wrong Way Risk

### **48. General wrong way risk**

In order to assess whether the institution correctly identifies its general wrong way risk (GWWR) as referenced in Article 291(3) of the CRR, the ECB will verify that:

- (1) the institution has implemented a process for identifying GWWR (in particular stress tests and scenario analyses, but also additional qualitative assessment);
- (2) the institution monitors and regularly reports to senior management and the appropriate committee of the management body (in line with Article 291(6) of the CRR) GWWR by category (product, region, industry, other) relevant to the business and on actions taken to manage GWWR;
- (3) the institution has designed stress scenarios to stress risk factors that are adversely correlated with the counterparty's creditworthiness. It also investigates the possibility of changed relationships between risk factors in stressed markets and is able to give evidence on the choice of scenarios;
- (4) the institution has identified the drivers of the GWWR.

### **49. Specific wrong way risk**

(1) In order to assess whether the institution correctly identifies and manages its Specific Wrong Way Risk (SWWR), the ECB will verify that:

- (a) the institution has implemented processes in order to identify and address SWWR as set out in Article 291(4) of the CRR, distinguishing cases where:
  - (i) there is a legal connection between the counterparty and the issuer of the underlying OTC derivative or SFT transaction;
  - (ii) there is no legal connection between the counterparty and the issuer of the underlying of the OTC derivative or SFT transaction, but there is still evidence of a positive correlation between the counterparty's PD and the future exposure;
- (b) the institution monitors and controls cases of SWWR throughout the life of the transaction;

- (c) the institution's own funds requirements with respect to SWWR meet the requirements set out in Article 291(5) of the CRR, where the jump-to-default under Article 291(5)(e) of the CRR, in particular, needs to be justified by a reference to the pricing function document as mentioned in paragraph 25. (2) (j) above and the jump size needs to be explained in the light of the pricing function;
- (d) regular reports on transactions bearing SWWR as well as regular reports on actions taken to manage it are provided to senior management in line with Article 291(6) of the CRR.

## Chapter 8

### Validation techniques

#### 50. General

- (1) In order to assess compliance of an institution with the validation requirements as referred to in Article 294 of the CRR, the ECB will assess the following:
  - (a) compliance with the requirements for back-testing, in accordance with Article 294(1)(a) to (c), and (h) to (k) of the CRR as further laid out in paragraphs 51 to 53;
  - (b) compliance with the requirements for the validation of pricing models as referred to in Article 294(1)(e) and (l) of the CRR as further laid out in paragraph 54;
  - (c) adequacy of any other performance assessment concerning Article 294(1)(f) and (g) of the CRR as further laid out in paragraph 55;
  - (d) compliance with the requirements for the validation processes of the exposure model as referred to in Article 294(1)(d) and (m) to (o), Article 294(3) of the CRR and as further laid out in Chapter 3 Organisation and governance of model validation of the EGAM.
- (2) For the purposes of sub-paragraph (1), the ECB will:
  - (a) review the institution's relevant internal policies and procedures;
  - (b) review the minutes of the institution's internal bodies, including the management body or other committees;
  - (c) review the findings and shortcomings identified by internal audit or of other control functions of the institution;
  - (d) review the progress reports on the effort of the institution to correct shortfalls and mitigate risks detected during audits;

- (e) obtain written statements or interview the staff and senior management of the institution.
- (3) If a more granular assessment<sup>25</sup> of one of the items (a) to (d) of sub-paragraph (1) is needed, the ECB may:
- (a) conduct sample testing and review documents related to the characteristics of a legal agreement and to the origination and maintenance of the exposures;
  - (b) review the functional documentation of the relevant IT systems or perform its own tests on the institution's data;
  - (c) review other relevant documents of the institution;
  - (d) conduct test calculations (within reason).

#### **51. Levels of back-testing and the choice of sample portfolios**

- (1) In order to assess whether the institution performs its back-testing on adequate levels and representative samples and whether it is able to drill down into its back-testing analyses, the ECB will verify:
- (a) that the institution has at least the following back-testing levels:
    - (i) the institution's relevant single risk factors<sup>26</sup>;
    - (ii) the institution's main real-life portfolios<sup>27</sup>;
    - (iii) securities underlying SFTs (except where SFTs do not fall within the IMM scope) and securities used as margin collateral (except where the value changes of such margin collateral are modelled via regulatory volatility adjustments in accordance with Article 224 of the CRR);
  - (b) that, if applicable for the institution and assuming the respective back-testing level is in place, hypothetical portfolios include:
    - (i) representative individual trades with reasonable rollover assumptions for maturing short-term transactions, or;
    - (ii) transactions with significant value changes due only to the passing of time;

---

<sup>25</sup> An example where a more granular assessment is needed is a specific area where a finding needs to be proven.

<sup>26</sup> Note that the overall set of risk factors should include all underlyings/drivers that are integrated into the IMM exposure model (regardless of whether risk factors are diffused or not), as defined in paragraph 12(g).

<sup>27</sup> Note that the CRR uses the term "actual portfolios" in Article 294(1)(h).



- (c) that on each back-testing level predictions, realisations and statistical tests are performed explicitly on that level.
- (2) For the purpose of sub-paragraph (1), the ECB will verify that the institution has demonstrated the following when defining its back-testing sample:
- (a) the representativeness of the risk factor back-testing samples if not all risk factors used for modelling are covered;
  - (b) the representativeness of the back-testing samples compared to the full portfolio of the institution; in the setting of both real life and hypothetical portfolios;
  - (c) the suitability of the back-testing samples for assessing the appropriateness of the risk factor movements and other relevant parameters of the risk factors such as drift, volatilities and the term structure of a modelled curve;
  - (d) the suitability of the back-testing samples for accounting for dependencies in joint risk factor movements, in particular with respect to both intra and inter correlations between risk factors of different asset classes;
  - (e) the suitability of the back-testing samples for assessing the quality of modelling for legal agreements both with and without margining.
- (3) In addition to the general requirement to demonstrate representativeness of back-testing samples, institutions are expected to calculate and provide coverage indicators, at least at the risk factor and real-life portfolio level. To check whether these indicators allow for an assessment of the back-testing coverage, the ECB will verify that:
- (a) the institution is able to provide detailed information about the numbers that are inputs for the nominator and denominator for the respective coverage ratios;
  - (b) coverage ratios have been calculated considering various weighting schemes (e.g. also applying sensitivities or an exposure metric as weights in addition to the number-based<sup>28</sup> indicators);
  - (c) on a risk factor level, numbers are available by asset class and overall, if applicable;<sup>29</sup>
    - (i) to give an example, the coverage ratio at risk factor level for the EQ asset class could be defined as follows (with “#” denoting “number of”) :

$$\text{Coverage Ratio}^{EQ} = \frac{\# \text{ backtested EQ risk factors}}{\# \text{ all IMM relevant EQ risk factors}};$$

<sup>28</sup> This means for example the number of risk factors or the number of portfolios that are covered.

<sup>29</sup> Note, for instance, that under a sensitivity-based approach, coverage ratios per asset class have to be taken.

- (ii) the overall number-based coverage ratio is given by the number of all back-tested risk factors divided by all risk factors relevant for IMM (in the sense of paragraph 51 (1) (a) (i));
- (d) on a real-life portfolio (RLP) level, an EaD-based ratio could be defined as follows:
 
$$\text{Coverage Ratio}^{RLP} = \frac{\text{IMM EaD of all backtested RLPs}}{\text{EaD of all IMM netting sets}};$$
- (e) the institution treats unusual cases like a split contractual IMM netting set (e.g. due to SWWR or carve outs), when trades/netting sets expire shortly after the back-testing date, etc. in a well-documented way;
- (f) whenever ratios are less than [50%], a reasonable explanation is given;
- (g) either coverage ratios are part of the regular back-testing report or the institution is able to provide and track coverage ratios.

## 52. Methodology for back-testing

- (1) In order to assess whether the institution has implemented a sound back-testing methodology, the ECB will verify that:
  - (a) the institution back-tests different relevant risk measures including PV<sup>30</sup> at trade level, PV of netting sets<sup>31</sup> as well as exposure at netting set level taking into account the collateral balance and margin mechanism.<sup>32</sup> In cases where no full distribution back-testing is applied, the ECB will assess whether the chosen set of quantiles is sufficiently dense to account for an appropriate assessment of the distribution shape of the respective value (e.g. market risk factor value, PV or exposure);
  - (b) both the metrics used for the internal risk measurement (PFE) and those used for regulatory purposes (EE) are analysed;
  - (c) the institution has defined clear quality assignments (e.g. red, amber, green) to the back-testing exercise, which are based on test statistics and additional qualitative assessments;
  - (d) if observation periods overlap, the institution takes the autocorrelation between forecasts in the back-testing sample into account when defining the test statistics and thereupon assigns a quality assignment (e.g. red, amber, green);
  - (e) the institution has implemented validation techniques that, in addition to movements of the risk factors, also back-test other relevant parameters

<sup>30</sup> PVs can be either positive or negative.

<sup>31</sup> Sum of trade PVs, which can result in a positive or in a negative netting set PV.

<sup>32</sup> For unmargined netting sets, the collateral is zero.

such as drift, volatilities and the term structure of a modelled curve. If back-testing of such parameters is not possible, institutions are expected to set up a separate validation to assess their adequacy;

- (f) if real or hypothetical trades or portfolios are back-tested, the institution compares predicted prices or exposures with at least one of the following:
    - (i) actually realised prices or exposures derived from benchmarking systems (where the realised values are to be taken after the independent price verification process but before any valuation adjustments);
    - (ii) prices or exposures that are calculated using the IMM with market conditions as of the realisation date;
  - (g) In case only option (ii) is applied, the ECB will strengthen the assessment of the adequacy of IMM pricing functions.
- (2) When assessing the back-testing for real-life portfolios, the ECB will verify how the institution calculates realisations and predictions for those portfolios. Special attention will be paid to assumptions on the portfolio composition over the observation period (e.g. certain closed-out or new transactions affecting the realisation may not have been taken into account in the prediction).
- (3) In the context of margined exposures, in addition to sub-paragraph (1) the ECB will verify that the institution applies reasonable and meaningful back-testing techniques that aim at the validation of net exposure values, i.e. taking the collateral balance into account. If direct back-testing of margined net exposures is not possible, institutions are expected to have a separate validation of the margining process and of the collateral value changes during the MPOR (cf. also paragraph 55).

### **53. Time horizons for exposure back-testing**

- (1) In order to assess whether the institution has implemented adequate time horizons for its exposure back-testing framework, the ECB will verify that:
- (a) the institution back-tests its exposures out to at least one year for all netting sets where the longest transaction maturity equals or exceeds one year with additional back-testing for shorter horizons such as one week, one month and three months;
  - (b) the institution uses also validation techniques to assess the quality of its exposure profiles beyond the one-year time horizon, where applicable – this includes:
    - (i) an assessment of the long-term stability of simulated market data and exposure paths;

- (ii) a comparison of the simulated long-term behaviour of market data with historical charts;
- (c) for margin agreements, the institution back-tests its exposure with different time horizons in addition to time horizons that reflect the typical MPOR of 10 working days for OTC derivatives and 5 working days for SFTs.

#### **54. Validation of pricing functions**

- (1) In order to verify whether the institution has implemented processes to validate the quality of the pricing functions used in the exposure model for the calculation of capital requirements beyond the expectations of paragraph 32. (3) above, the ECB will verify that:
  - (a) the institution has established adequate validation methods to account for the non-linearity of option pricing models with respect to market risk factors, in accordance with Article 294(1)(e) of the CRR;
  - (b) the institution has implemented processes for periodically assessing the quality of its IMM pricing functions, e.g. by comparing their output to values from benchmarking systems (after the independent price verification process but before any valuation adjustments), using market data and values as of the valuation date  $t_0$  – furthermore, potential differences or discrepancies are expected to be analysed;
  - (c) such comparisons are part of the framework of the validation function.

#### **55. Other performance assessments**

In order to verify that the institution applies further quantitative validation, the ECB verifies whether:

- (1) sensitivity analyses, plausibility checks or related analyses are performed for all parameters of the stochastic models or pricing functions that are either proxied, expert-set or updated less than every three months – special attention is expected to be paid to any constellations where an increased level of uncertainty is suspected;
- (2) the institution has implemented procedures and policies in order to assess and challenge all kinds of important modelling assumptions, which should at least cover:
  - (a) the choices of stochastic processes used to model market risk factor movements, at least in cases of poor back-testing results;
  - (b) the use of caps and floors for risk factor paths;

- (c) the sensitivity of the exposure to the initial seed of the random generator and the resulting numerical error due to the number of simulated scenarios used;
- (d) the simulation grid point setting, especially its capability to adequately reflect exposure profile characteristics related to maturing transactions and cash flows over the complete lifetime of the netting sets;
- (e) potential interpolation techniques used in the exposure modelling;
- (f) the collateral modelling (collateral composition as well as collateral value) or, in case collateral is not modelled, the adequacy of the implemented collateral volatility adjustments;
- (g) the modelling of initial margin;
- (h) the setting of the MPOR, the respective treatment of cash flows within the MPOR and the margin mechanism.

## Chapter 9

### Stress testing

#### 56. General

- (1) In order to assess the soundness of an institution's stress testing programme in accordance with Article 290 of the CRR, the ECB will verify in particular the following:
  - (a) the adequacy of methods used in designing the stress tests, as referred to in Article 290(2) to (8) of the CRR, as further laid out in paragraph 57;
  - (b) the robustness of organisation of the stress-testing process as referred to in Article 290(5), (6) and (9) of the CRR, as further laid out in paragraph 58;
  - (c) the integration of the stress testing into the risk and capital management processes in particular as referred to in Article 290(10) of the CRR, as further laid out in paragraph 59.
- (2) For the purposes of sub-paragraph (1), the ECB will:
  - (a) review the institution's internal policies, methods and procedures on the design and execution of stress tests;
  - (b) review the institution's outcomes of the stress tests;
  - (c) review the roles and responsibilities of the units and management bodies involved in designing, approving and executing the stress tests;

- (d) review the minutes of the institution's internal bodies, including the management body, or other committees, in particular on the use of the stress test results;
  - (e) review the findings of the internal audit or of other control functions of the institution;
  - (f) review the progress reports on the effort of the institution to correct shortfalls and mitigate risks detected during audits;
  - (g) obtain written statements or interview the staff and senior management of the institution.
- (3) For the purposes of sub-paragraph (1), ECB may also, to the extent appropriate:
- (a) review the functional documentation of the IT systems used for the stress tests;
  - (b) request the institution to perform a computation of the stress tests based on alternative assumptions;
  - (c) perform own stress tests calculation on the institution's data for certain types of exposures;
  - (d) review other relevant documents of the institution.

## **57. Adequacy of methods used in designing the stress tests**

- (1) In assessing the adequacy of methods used in designing the stress tests used by the institution in the assessment of the capital adequacy as referred to in paragraph 56. (1) (a), the ECB will verify in particular that:
- (a) the tests are meaningful, reasonably conservative, and capable of identifying severe and extreme but plausible market environments – the impact of those shall be evaluated on the institution's exposures and total capital requirements for CCR in line with Article 290(7) of the CRR;
  - (b) the scope of the tests corresponds to Article 290(4) of the CRR and contains at least all material counterparts in line with Article 290(9) of the CRR;
  - (c) the methods are consistent with methods used by the institution for the purpose of internal capital allocation stress tests;
  - (d) the documentation of the methodology of stress tests including internal and external data as well as expert judgement input is detailed enough to allow third parties to understand the rationale for the chosen scenarios and replicate the stress test.

- (2) For the purpose of sub-paragraph (1) (a), it is required to verify that the stress tests include at least the following steps:
- (a) the identification of the scenarios including the effect of severe but plausible stressed scenarios; in more detail (see notably Articles 290(5), (6) and (8) of the CRR):
    - (i) scenarios cover the institution's main risk drivers;
    - (ii) historic scenarios are based on identified historical periods in which the current portfolio is unfavourably impacted;
    - (iii) multifactor stress-testing scenarios are applied, addressing at least the following: a) severe economic or market events, b) a significant decrease in broad market liquidity, c) a large financial intermediary liquidating positions;
    - (iv) reverse stress tests;
  - (b) the assessment of the impact of identified scenarios on the institution's own funds, current exposure, effective EPE, RWA and metrics used for internal risk management:
  - (c) the comparison of the stress impact with limits set for internal risk management according to Article 290(3) of the CRR.

#### **58. Robustness of organisation of the stress test process**

In assessing the robustness of the organisation of the stress-testing process used by the institution in the assessment of the capital adequacy as referred to in paragraph 56. (1) (b), the ECB will verify in particular that:

- (1) the stress tests are performed regularly and at least on a quarterly basis to the extent that Article 290(5) of the CRR does not apply, and otherwise at least monthly;
- (2) the roles and responsibilities of the unit or units in charge of the design and execution of the stress test are clearly defined;
- (3) the results of stress tests are approved on an adequate management level and that senior management is informed of the results in a timely manner at least quarterly;
- (4) the IT infrastructure effectively supports the performance of stress tests in terms of flexibility and computational power.

## **59. Integration of the stress tests in the risk and capital management processes**

In assessing the integration of the stress tests with the risk and capital management processes of the institution as referred to in paragraph 56. (1) (c), the ECB will verify in particular that:

- (1) the institution takes into account the results of stress tests in its decision-making process and in particular with regard to risk and capital management, taking into account the interaction with the risk appetite framework and concentration limits;
- (2) the institution takes into account the results of stress tests within the capital management processes so as to consider the forward-looking nature of capital requirements.

## **Chapter 10 Data Maintenance and IT processes**

### **60. General**

- (1) In order to assess the compliance of an institution with the requirements on the integrity of the modelling process as referred to in Article 292(1) of the CRR, in particular data maintenance and IT processes, the ECB will verify in particular the following:
  - (a) the quality of the transaction terms and specifications, market data and legal data, including the data quality management process, as referred to in Article 292(1) of the CRR, as further laid out in paragraph 61;
  - (b) the data documentation and reporting, as referred to in Article 293(1)(g) of the CRR as further laid out in paragraph 62;
  - (c) the relevant IT infrastructure, in accordance with paragraph 63.
- (2) For the purpose of sub-paragraph (1), the ECB will:
  - (a) assess the comprehensiveness of data quality management policies, methods and procedures relevant for the data used in the IMM approach; whereby comprehensiveness means (also concerning the following parts of this section):
    - (i) compliance with internal formal requirements;
    - (ii) the appropriateness of the defined scope and full description of elements involved;



- (iii) that procedures are in place to manage incidents, upgrades (including releases of new versions) and maintenance, audit trails, management of changes and releases;
  - (iv) the inclusion of control and monitoring processes, reporting to senior management and internal governance as stated in paragraph 15. (1);
  - (b) review the relevant data quality reports, as well as their conclusions and recommendations;
  - (c) assess the comprehensiveness of IT infrastructure policies and IT systems management procedures, including the contingency planning policies relevant for the IT systems used for the purpose of the IMM approach;
  - (d) review the minutes of the institution's internal bodies, including its management body, or other committees;
  - (e) review the findings of the internal audit or other control functions of the institution;
  - (f) review the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;
  - (g) obtain written statements or interview the staff and senior management of the institution.
- (3) For the purpose of sub-paragraph (1), any of the following methods may also be applied, as appropriate:
- (a) own tests on the institution's data or the performance by the institution of tests proposed by the ECB, the inspection team or any other staff involved in the assessment;
  - (b) checks of the representation and processing of a sample of transactions and market data in all systems relevant for the model;
  - (c) a review of other relevant documents of the institution.

#### **61. Quality of transaction terms and specifications, market data and legal data**

- (1) In assessing the quality of transaction terms and specifications, market data, and legal data that the institution uses to provide effective support to its CCR measurement and management process, as referred to in paragraph 60. (1) (a), the ECB will verify in particular that:
- (a) the data are available and correctly identified in the CCR system for all relevant aspects of the exposure calculation ("completeness") – in more detail and with particular reference to transaction attributes:

- (i) the institution can demonstrate that all relevant transactions with external counterparties are captured by its IT system for the IMM (e.g. via respective reconciliations with front or back office or accounting) and thus included in the EAD calculation;
  - (ii) the institution can demonstrate that all relevant transaction attributes (static data such as notional amount, cash flow structure, maturity, strike prices or fixing dates) are captured by its IT system for each transaction; in particular, this includes those attributes that are needed to determine whether the trade can be processed within the IMM (i.e. all necessary input is available for full simulation or fall-back approaches) and, moreover, to assign trade parameters referring to underlying risk factors to the appropriate stochastic processes, and to assign the trade type to the appropriate pricing function;
  - (iii) the institution can demonstrate that the IT system captures correctly which transactions are covered by which legal netting agreement, and legal netting agreements are enforceable in all relevant jurisdictions as stated in Article 206(a) of the CRR;
  - (iv) the institution can demonstrate that its IT system reflects correctly the characteristics of a margin or collateral agreement (e.g. the ISDA Credit Support Annex for a Master Netting Agreement) such as the threshold, minimum transfer amount, initial margin and independent amount, as well as all types of asymmetric settings, and also for contracts with central clearing, bilateral derivatives clearing, bilateral clearing of SFT positions or any other legal variant, as they are laid down in written contracts or legal databases, respectively, and that any changes to the legal structure are updated in timely manner in the risk system used to calculate the IMM;
- (b) the data is error-free (“accuracy”), such that especially for market data stale values are identified and either excluded or substituted by data from other source systems, and data formats are aligned to the definitions in their corresponding data dictionaries;
  - (c) a given set of data can be matched across different data sources of the institution (“consistency”) and across different measuring points (e.g. databases or data warehouses) along the data flow, which also includes an integrity check of all relevant interfaces (“integrity”);
  - (d) the data values are up to date (“timeliness”) for use at the regulatory reporting dates, with justified interpolations for market data on bank holidays;
  - (e) the aggregate data are free from any duplication due to transformations or manipulations of source data (“uniqueness”);
  - (f) the data are founded on an adequate system of classification, rigorous enough to compel acceptance (“validity”);

- (g) the history, processing and location of data under consideration can be easily traced (“traceability”).
- (2) In assessing the data quality management process, the ECB will verify that:
- (a) the following are in place:
    - (i) adequate data quality standards that set the objectives and the overall scope of the data quality management process. This refers to, among other things, checking whether external market data providers are still supporting and updating the respective data feeds;
    - (ii) adequate rules in the form of policies, standards and procedures for data collection, storage, migration, actualisation and use;
    - (iii) the continuous updating and improvement the data quality management process;
    - (iv) a set of criteria and procedures for determining compliance with the data quality standards, and in particular the general criteria and process of data reconciliation across and within systems, including data used for accounting and regulatory purposes;
    - (v) adequate processes for internally assessing and constantly improving data quality, including the process of issuing internal recommendations to address problems in areas which need improvement and the process of implementing these recommendations with a priority based on their materiality and, more particularly, the process for addressing material discrepancies coming to light during the data reconciliation process;
  - (b) data collection has a certain degree of independence from the data quality management process, including a separate organisational structure and staff, where applicable.

## **62. Data documentation and reporting**

- (1) In assessing data documentation, which the institution uses to provide effective support to its CCR measurement and management process, the ECB will evaluate in particular the following:
- (a) the specification of the set of databases and, in particular:
    - (i) the global map of databases involved in the calculation systems used for the purpose of the IMM approach;
    - (ii) the relevant sources of data;
    - (iii) the relevant processes for data extraction and transformation and the criteria used;

- (iv) the relevant functional specification of databases, including their size, date of construction, data dictionaries including the content of the fields and of the different values inserted in the fields, with clear definitions of data items;
  - (v) the relevant technical specification of databases, including the type of database, tables, database management system, database architecture; and data models given in any standard data modelling notation;
  - (vi) the relevant work-flows and procedures relating to data collection and data storage;
- (b) the data management policy and allocation of responsibilities, including users' profiles and data owners;
  - (c) the transparency, accessibility and consistency of the controls implemented in the data management framework.
- (2) In assessing data reporting as referred to in paragraph 60. (1) (b), the ECB will verify that the data reporting:
- (a) specifies the scope of reports or reviews, the findings and, where applicable, the recommendations to address weaknesses or shortfalls detected;
  - (b) is communicated to the senior management and management body of the institution at an adequate frequency and that the level of the recipient of the data reporting is determined in accordance with the institution's organisational structure and the type and significance of the information;
  - (c) is performed regularly and, where appropriate, on an *ad hoc* basis;
  - (d) provides adequate evidence that the recommendations are sufficiently addressed and properly implemented by the institution.

### **63. IT infrastructure**

- (1) In assessing the architecture of the IT systems of relevance to the institution's CCR management systems and to the application of the IMM approach, the ECB will evaluate in particular the following:
- (a) All relevant objects in the IT systems architecture, including the relevant applications, their interfaces and interactions, which implies:
    - (i) assessing the overall degree of automation;
    - (ii) verifying that any manual procedures in the upstream systems are performed under the four eyes principle;

- (b) a data flow diagram showing a map of the key applications, databases and IT components involved in the application of the IMM approach and related to CCR and limit management systems;
  - (c) the assignment of IT systems owners;
  - (d) the capacity, scalability and efficiency of IT systems;
  - (e) the manuals for the IT systems and databases.
- (2) In assessing the soundness, safety and security of the IT infrastructure that is of relevance to the institution's CCR management and to the application of the IMM, the ECB will verify that:
- (a) the IT infrastructure is deemed sound, on the basis that it can support the ordinary and extraordinary processes of an institution in a timely, automatic and flexible manner. This refers at least to:
    - (i) a potential future exposure calculation that can be performed in a timely manner overnight, i.e. the process finishes before the trading desks open;
    - (ii) an implemented policy for dealing with situations in which the overnight potential future exposure calculations fail to be completed in a timely manner;
    - (iii) the ability of the institution to perform *ad hoc* analyses;
  - (b) the IT infrastructure is deemed safe, on the basis that the risk of suspension of its abilities ("failures"), the risk of loss of data and the risk of incorrect evaluations ("faults") are appropriately addressed;
  - (c) the IT infrastructure is deemed secure, on the basis that it is adequately protected against theft, fraud, manipulation or sabotage of data or systems by malicious insiders or outsiders – this comprises the check that access rights for users, testers, management and audit are set appropriately;
- (3) In assessing the robustness of the IT infrastructure that is of relevance to the institution's CCR management and to the application of the IMM, the ECB will verify that:
- (a) the procedures to back up the IT systems, data and documentation are implemented and tested on a periodic basis;
  - (b) continuity action plans are implemented for critical IT systems (e.g. the limit management systems);
  - (c) the recovery procedures for IT systems in the event of failure are defined and tested on a regular basis;
  - (d) the management of IT systems users is compliant with the institution's relevant policies and procedures;

- (e) audit trails are implemented for critical IT systems;
  - (f) the management of changes of IT systems is adequate and the monitoring of changes covers all IT systems.
- (4) In assessing whether the IT infrastructure of relevance to the institution's CCR management and to the application of the IMM is reviewed both regularly and on an ad hoc basis, the ECB will verify that:
- (a) regular monitoring and *ad hoc* reviews result in findings and, where appropriate, in recommendations to address any weaknesses or shortfalls detected;
  - (b) the findings and the recommendations referred to in (a) are communicated to the senior management and management body of the institution;
  - (c) there is adequate evidence that the recommendations are sufficiently addressed and properly implemented by the institution.

## Chapter 11

### Specifics for A-CVA

#### 64. General

- (1) In order to assess the compliance of an institution with the requirements on quantifying the calculation of the capital charge for the advanced credit valuation adjustment (A-CVA), as referred to in Article 383 of the CRR, the ECB will, in particular, verify the institution's:
- (a) compliance with the requirements as referred to in Regulation (EU) No 526/2014 (regulatory technical standards for determining proxy spread and limited smaller portfolios for credit valuation adjustment risk) under Article 383(7) of the CRR, the "RTS on CVA", as further laid out in paragraph 65;
  - (b) compliance with the own funds requirement calculation for the A-CVA as referred to in Articles 383 and 386 of the CRR and, if applicable, the calculation of the own funds requirement for CCR using the M parameter according to 162(2) of the CRR, as further laid out in paragraph 66.
- (2) For the purposes of sub-paragraph (1), the ECB will:
- (a) review the institution's relevant internal policies;
  - (b) review the institution's technical documentation of estimation methodology and process;
  - (c) review and challenge the model development manuals, methodologies and processes;

- (d) review the minutes of the institution's internal bodies, including the management body, model committee, or other committees;
  - (e) review the reports on the A-CVA capital requirements over time and the recommendations by the organisational unit calculating CVA, validation function, internal audit function or any other control function of the institution;
  - (f) assess progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits, validations and monitoring;
  - (g) obtain written statements or interview the staff and the senior management of the institution.
- (3) For the purposes of sub-paragraph (1), the ECB may also:
- (a) request the provision of additional documentation or analysis substantiating the institution's methodological choices and the results obtained;
  - (b) conduct supervisory estimations or replicate the institution's estimations of the A-CVA capital requirement using the relevant data supplied by the institution;
  - (c) request and analyse the credit spread data used in the process of calculating the A-CVA capital requirement;
  - (d) review the functional documentation on the relevant IT systems to the extent not done for Chapter 10 Data Maintenance and IT processes;
  - (e) review other relevant documents of the institution.

## **65. Compliance with the RTS on CVA**

- (1) In order to verify that the institution has implemented a proxy spread methodology for counterparties for which no CDS spread is available, following the requirements of the RTS on A-CVA, the ECB will verify in line with Article 1 of the RTS on CVA that:
- (a) the institution has a sound policy that defines 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 in both cases including at least the following dimensions:
    - (i) rating;
    - (ii) region (Europe, North America, Asia, and the rest of the world);
    - (iii) industry (public sector, financials, and others);

- (c) the proxy spreads exhibit a stochastic behaviour comparable to that of liquid CDS spreads and the composition of their underlying CDS baskets (or single name proxies) is stable over time;
  - (d) if the institution uses single name proxies, it has a sound policy on when it applies a single name proxy rather than a bucket level proxy, which still complies with the requirement under (b);
  - (e) the institution ensures a high coverage of the counterparty-specific ratings (either based on external or internal information) on which the selection of proxy credit spreads is based and the assignment of fall-back ratings does not jeopardize the reliability of the proxy credit spread selection process;
  - (f) the institution's methodology captures basis risk between:
    - (i) counterparties that are mapped to the same bucket under (b);
    - (ii) any individual counterparty spread, either a liquidly traded single name CDS spread for the individual counterparty or a proxy curve assigned to the individual counterparty, and the spreads of index CDS hedges;
  - (g) the institution has implemented a methodology for validating the quality of the proxy spreads – his methodology should at least assess whether the volatility of the proxy spread is conservatively calibrated.
- (2) In order to verify that the institution has identified the appropriate market LGD that is compliant with Article 2 of the RTS on A-CVA, the ECB will verify 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 in item (a), e.g. in the institution's pricing routines for credit derivatives.
- (3) In order to verify that the institution applies A-CVA to qualifying portfolios according to Article 3 of the RTS on A-CVA, the ECB will verify that:
- (a) the institution's calculations are reported and actions to be taken in the event of a breach of any of the thresholds have 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 A-CVA or on any other system reconciled with the risk engine that calculates the IMM exposures underlying A-CVA on at least a quarterly basis.



## 66. Own funds requirement calculation for A-CVA

- (1) In order to verify that the institution correctly selects its stress period for the stressed VaR calculation according to Article 383(5)(b) of the CRR, the ECB will verify that:
  - (a) the institution has a defined, documented and validated methodology to select 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;
  - (b) 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.
- (2) In order to verify that the institution correctly calculates its own funds requirement for A-CVA according to Articles 383(5)(c), (d) and 383(6) of the CRR using eligible hedges according to Article 386 of the CRR, the ECB will verify that:
  - (a) the methodology for complying with Articles 383(5)(c), (d) and 383(6) of the CRR is correctly implemented in the risk system and exposures rejected for the A-CVA according to Article 383(6) of the CRR are input for the S-CVA calculation under Article 384 of the CRR;
  - (b) eligible hedges used to lower the own funds requirement in accordance with Article 386 of the CRR:
    - (i) fulfil the eligibility criteria in terms of their contractual specifications;
    - (ii) are only entered at 50% of their notional amount if belonging to index CDS, where the basis between the individual counterparty spread to be hedged and the index hedge is not reflected to the satisfaction of ECB;
    - (iii) are executed with external counterparties only;
    - (iv) do not provide any single name over-hedging;
    - (v) are not used for any other purpose, as described in Article 386(3) of the CRR, and this is supported by respective measures implemented in the systems used for CVA risk and credit risk mitigation.
- (3) In order to verify that the institution meets the requirements for the permission to use M equal to 1 in Article 162(2)(i) of the CRR to the extent that this provision applies to the institution in question, the ECB will verify that:
  - (a) for each of the counterparties subject to the permission there is a single name CDS credit spreads time series available on which the credit spread modelling is based;

- (b) the model appropriately reflects the stochastic behaviour of the single name time series;
- (c) the institution demonstrates that part of the volatility of liquid single name CDS credit spreads can be attributed to rating migrations.

#### List of used abbreviations

<b>A-CVA</b>	advanced credit valuation adjustment
<b>CCR</b>	counterparty credit risk
<b>CDS</b>	credit default swap
<b>CRR</b>	Capital Requirement Regulation - Regulation (EU) No 575/2013
<b>CVA</b>	credit valuation adjustment
<b>EBA</b>	European Banking Association
<b>EE</b>	expected exposure
<b>EGAM</b>	ECB Guide on assessment methodology for CCR
<b>EGMA</b>	ECB Guide on the materiality assessment (for CCR model change and extensions)
<b>EGOD</b>	ECB Guide on options and discretions available in Union law
<b>GWWR</b>	general wrong way risk
<b>IMA</b>	internal models approach for market risk
<b>IMI</b>	internal model investigation
<b>IMM</b>	internal model method for counterparty credit risk
<b>IRB</b>	Internal Rating Based approach for credit risk
<b>LGD</b>	loss given default
<b>M</b>	maturity parameter of IRB
<b>MPOR</b>	margin period of risk
<b>OTCD</b>	over-the-counter derivatives
<b>PD</b>	probability of default
<b>RTS</b>	regulatory technical standards
<b>RWA</b>	risk weighted assets
<b>SFT</b>	securities financing transaction (repo-lending trades)
<b>SSM</b>	Single Supervisory Mechanism
<b>SWWR</b>	specific wrong way risk