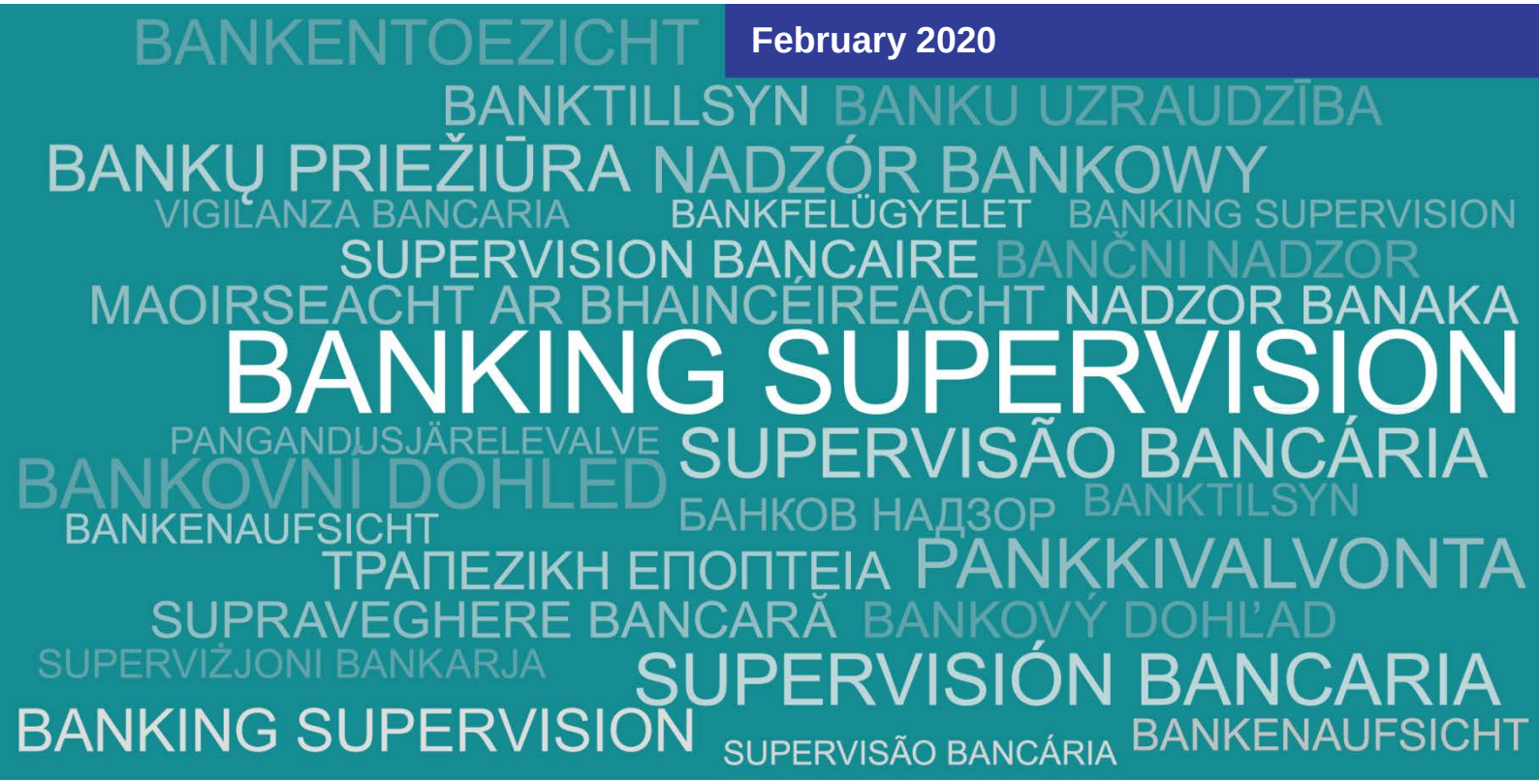
EUROPEAN CENTRAL BANK

BANKING SUPERVISION

ECB Guide on assessment methodology (EGAM)

Assessment methodology for the internal model method for calculating exposure to counterparty credit risk and the advanced method for own funds requirements for credit valuation adjustment risk



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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 (CRR)[1] 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[2] (EGMA) provides the ECB's understanding of the applicable rules for material model extensions and changes in the field of CCR.

The European Banking Authority (EBA) has been mandated to develop regulatory technical standards (RTS) to be adopted by the European Commission for the assessment methodology that competent authorities are to apply when assessing a financial institution's compliance with the requirements to use an internal ratings-based (IRB) approach for credit risk, an advanced measurement approach for operational risk and an internal model approach (IMA) for market risk.

In the field of CCR, for both the internal model method (IMM) and the advanced method for own funds requirements for credit valuation adjustment risk (hereinafter referred to as the "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 ECB Guide on assessment methodology (EGAM) for the IMM and the A-CVA. The EGAM is to be applied in the context of any CCR-related internal model investigation (IMI) – before or after approval – and the ongoing monitoring of approved internal models, and outlines for supervisors how the ECB

1 Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (OJ L 176, 27.6.2013, p. 1), as amended by Regulation (EU) 2019/876 of the European Parliament and of the Council of 20 May 2019.

2 See EGMA – Materiality assessment for IMM and A-CVA model extensions and changes.

intends to investigate compliance with the existing legal framework when performing these tasks. It also provides optional guidance to significant institutions on the self-assessment of their IMM and A-CVA models.

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 currently applicable EU and national law and is therefore not intended to replace, overrule or affect applicable EU and national law.

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

The remainder of this document is structured as follows: Section 2 explains the building blocks of the EGAM and compares it with the RTS on assessment methodology for IRB approach, the structure of which has been broadly kept for the EGAM, 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 RTS on assessment methodology

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

Note that the RTS mentioned below for credit risk and market risk are mandated by the 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 IRB approach assessment methodology

The EBA's Final Draft 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 (hereinafter referred to as "IRB RTS") were published on 21 July 2016 and submitted to the European Commission for adoption.

Table 1

Overview of 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 and partial implementation of the 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 model validation	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 methodologies	There is no IMM equivalent for the assignments; however, 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: the IMM is restricted to exposures; the 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 the 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 a separate chapter of the EGAM
14.	Assessment methodology for management of changes to rating systems			No separate section in the EGAM as this is covered in the EGMA
15.	Final provision			Omitted in the EGAM (as in the EGMA)

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

2.2 IMA assessment methodology

The EBA Final Draft RTS on the specification of the assessment methodology for competent authorities regarding compliance of an institution with the requirements to use internal models for market risk and assessment of significant share under points (b) and (c) of Article 363(4) of Regulation (EU) No 575/2013 (hereinafter referred to

as the “IMA RTS”) were published on 22 November 2016 and submitted to the European Commission for adoption.

The RTS cover all specific and general market risk topics, as well as the various asset classes, incremental risk charge and stressed value at risk, but not the A-CVA.[3]

[3] CVA is only to be mentioned if back-testing overshooting occurs as a result of specific CVA risk (for P&L definitions) and as a potential source of specific risk (in CVA hedges).

3 Rationale

This section explains the rationale behind the ECB Guide on assessment methodology for the IMM and A-CVA models, as presented in Section 4, with a particular focus on the IMM. With regard to the A-CVA, only some specifics not covered elsewhere will be discussed (see Chapter 11).

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

Those parts of the EGAM that follow the available RTS on assessment methodologies are not explained in detail (e.g. documentation and IT requirements).

The numbering of the subsections follows the chapter structure of the EGAM. The subsection number is equal to the chapter number in the EGAM, e.g. Subsection 3.1 covers Chapter 1 and Subsection 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 the A-CVA and IMM.

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

3.2 Sequential and partial implementation of the IMM across different transaction types

The assessment methodology is based on Section II, Chapter 3, paragraph 8 of the ECB Guide on options and discretions available in Union Law (EGOD).[4] The ECB takes into account whether:

- the initial coverage at time of approval comprises "plain vanilla" interest rate and foreign exchange derivatives and covers 50% of both the risk-weighted assets (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);

[4] See ECB Guide on options and discretions available in Union law.

- a coverage of more than 65% in terms of 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 CCR is achieved within three 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 owing to missing calibration data, or that the exposures under non-IMM methods are sufficiently conservative.

Chapter 2 clarifies the conditions for increasing IMM coverage under paragraph 8 in terms of data availability by also considering the institution's costs and operational capabilities.

3.3 Organisation and governance of model validation

Article 131 of the Capital Requirements Directive (CRD IV)[5] requires competent authorities to verify that the institution is not globally or otherwise systemically important for cases where there is no separate validation unit and only a separation of staff. Therefore, with the IRB approach there is an implicit requirement for significant institutions to ensure that model validation is organisationally separate from the risk control unit. With regard to CCR, there is no such strict requirement.

In addition to the independence of model validation from the risk control unit, this chapter of the EGAM also deals with the frequency, completeness and adequacy of the validation process, as well as the soundness of reporting validation conclusions, findings and recommendations.

3.4 Internal governance, risk control, collateral management and audit

The split in Chapter 4 follows the split in Article 287(1) of the CRR into items for (a) a risk control unit, and (b) a collateral management unit. This chapter also covers the internal auditing process referred to in Article 288 of the CRR: note that, unlike in the IRB ITS, there is no dedicated section on internal reporting in the CCR part of the CRR.

[5] Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC (OJ L 176, 27.6.2013, p. 338).

3.5 Use test

Compared with the IRB RTS, the EGAM contains enhanced checks regarding the use test, e.g. owing to Articles 289(5) and 289(6) of the CRR. In terms of CCR, there are peculiarities in the EGAM relating to margined trading and the time structure of CCR limits. It is important to clarify that the requirement for institutions to demonstrate that they use the model before approval ("experience test" in the IRB RTS) also applies to model extensions because of the current lack of clear rules (or harmonisation).

3.6 Documentation and design

In contrast to the IRB RTS, there is no clear design prescription for the IMM 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 there are usually different stochastic processes in an IMM. The EGAM thus broadly follows the IRB RTS.

3.7 Exposure quantification

3.7.1 General

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

3.7.2 Risk factor models for market data

This section covers both simulated and non-simulated (constant or time-dependent) risk factors.

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

As some banks use non-standard random number generators (e.g. Quasi-Monte Carlo), 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.

3.7.3 Pricing functions, exposure grid and number of scenarios

The ECB does not expect market data input or transaction attributes (such as multiple barriers for exotic options) to coincide fully with those used for pricing, as carried out in the front office system or for accounting purposes. However, any approximation applied to either transaction attributes or market data feed pricing (e.g. implied volatilities), or in terms of 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) at a transaction rather than a netting set level. This approach avoids offsetting overstated valuations with understated valuations within large netting sets. This is also part of validation, which is covered in Section 3.

3.7.4 Master netting and margining agreements and exposure aggregation

The steps for calculating the exposure value are evident (merged in this section). Therefore, this section focuses 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 the IRB approach is used for the respective counterparty.

3.7.5 Calibration

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

3.7.6 Margined trading and requirements for securities financing transactions

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

Given that securities financing transactions (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 this section.

With regard to the effect of the minimum transfer amount (MTA) when determining the collateral balance valid at the beginning of the MPOR, note the following (see paragraph 47(2)): this balance depends on the full history of netting set value changes and margin calls up to the beginning of the MPOR. The ECB expects modelling of the effect of the MTA to be done in a conservative way for those cases in which 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).

3.7.7 Wrong-way risk

This section covers both specific wrong-way risk (SWWR) and general wrong-way risk (GWWR).

3.8 Validation methodologies

This chapter deals with validation methodologies and tools, as the organisation and governance of model validation is already covered in Chapter 3.

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

In addition to pure back-testing, the ECB expects plausibility checks and sensitivity analyses of some expert-set model parameters[6] (and some model assumptions).

3.9 Stress testing

Besides the stressed exposures that are part of Chapter 7 of the EGAM and that contribute to regulatory capital requirements under the CRR, specific stress tests are required for the IMM (contributing to CRD IV requirements for economic capital).

3.10 Data maintenance and IT processes

This chapter broadly follows the structure of the IRB RTS.

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[6] Parameters set by experts are not subject to the regular (historic or implied) calibration and are usually valid for longer (more than one quarter).

3.11 Specifics for the A-CVA

Except where institutions are applying for permission to set M equal to 1 in accordance with Article 162(2)(i) of the CRR, the A-CVA does not require any kind of approval[7] (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 the IMM (also in the EGAM) and IMA. The reason is that, regardless of the specific approval status of the A-CVA, competent authorities can always review the complete status of the model and all aspects of its implementation when updating the multiplier in accordance with Article 383(5)(c) of the CRR.

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

The only items specific to the A-CVA are:

- compliance with the EBA's RTS on CVA[8] – where "CVA" stands for credit valuation adjustment – which include:
  - modelling of proxy spreads (partially);
  - selection of market-implied loss given default (LGD);
  - thresholds for number and size of qualifying portfolios;
- selection of the A-CVA stress period for credit spreads;
- calculation of the own funds requirement for CVA risk, including the multiplier and stressed A-CVA;
- specific assessments to check for the M equal to 1 permission.

7 It is automatically required if there is IMM approval in accordance with Article 283 of the CRR and approval for modelling specific risk of debt instruments in accordance with Article 363(1) of the CRR.

8 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 (OJ L 148, 20.5.2014, p. 17).

4 ECB Guide on the assessment methodology for the internal model method for calculating exposure to counterparty credit risk and the advanced method for own funds requirements for credit valuation adjustment risk

With regard to counterparty credit risk (CCR), Article 283 of the Capital Requirements Regulation (CRR)[9] requires the ECB to grant institutions permission to use internal models, namely the internal model method (IMM) for calculating exposure value, provided they meet the requirements set out in the corresponding sections of the CRR. Article 383 of the CRR deals with the advanced method for calculating the own funds requirement for credit valuation adjustment risk (hereinafter referred to as the "A-CVA") that institutions must apply if they have approval to use the IMM for the specific risk of debt instruments in accordance with Article 363(1)(d) of the CRR.

Based on the currently applicable EU and national law, the ECB Guide on the assessment methodology (EGAM) for the IMM and A-CVA 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 currently applicable EU and national law and is therefore not intended to replace, overrule or affect applicable EU and national law.

The EGAM is intended to be applied in its entirety. Applying it only in part 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 to those elements of the EGAM that are relevant for understanding the context and the relevant model parts.

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9 Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (OJ L 176, 27.6.2013, p. 1), as amended by Regulation (EU) 2019/876 of the European Parliament and of the Council of 20 May 2019.

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 – in particular for approvals of internal models, their material extensions and material changes – regardless of whether this information is received in the context of on-site or off-site internal model investigations (IMI), supervisory meetings on model issues, documentation requests or any other enquiry into the model for another purpose in the scope of ECB’s supervisory activities.

2. The following additional terms are used in the text below.

   (a) “t_0” – this refers to 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. It is thus equal to the “current date” referred to in the same Article.

   (b) “Securities financing transactions” (SFTs) – this term covers repurchase agreements, margin lending and borrowing agreements, as well as securities and commodities lending and borrowing agreements. It thus encompasses all products covered by Article 272(25)(a) and (b) of the CRR).

   (c) “Benchmarking systems” – this refers to the respective front office pricing functions, pricing functions of accounting systems or other benchmarks with which front office prices are frequently compared (at least quarterly, as for CCR purposes). Values taken from such benchmarking systems are values after independent price verification (see Article 4(70) of the CRR) without any valuation adjustments beyond the default-free value (such as the CVA).

   (d) “Representative sub-portfolios” – this refers to representative counterparties or netting sets to which the following two conditions apply:

      (i) such sub-portfolios need to be representative regarding at least the following characteristics: transaction type and their “moneyness”, underlying risk factors, the ratio of the value of short positions to the value of long positions, margined agreement types, and the ratio of margined to un-margined netting sets;

      (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.[10]

(e) "Management body" – this is primarily defined in Article 3(7) and (8) of the Capital Requirements Directive (CRD IV)[11] and for the purposes of this guide it refers to the single management body in a one-tier system or to the role of the management and supervisory function of the management body in a two-tier corporate structure (this concept needs to be interpreted from a functional perspective and refers to the management body in both its supervisory (see Article 3(8) of the CRD IV) and management functions).

(f) "Senior management" – this refers to senior management in accordance with Article 3(9) of the CRD IV.

(g) "Systematically underestimated exposures" – this expression means a progressive, aggressive or non-conservative modelling of exposures in almost all cases compared with a precise treatment without approximations, which may refer to almost all cases of:

(i) simulated scenarios;

(ii) portfolio configurations;

(iii) market conditions at t_0;

(iv) market conditions during the period used for calibration.

This holds to the extent that "almost all cases" can be anticipated from past experience or historic time series. Otherwise, this expression refers to an a priori estimation, for example resulting from a mathematical consideration. Example: a model implementation approximates the true value of a bought vanilla call option inside a netting set by its intrinsic value (the value if exercised). Since the true value is always more than the intrinsic value before exercising the option, this modelling would lead to too low a transaction value and thus to too low a netting set value; hence, in this specific example, "almost all cases" even changes to "always".

If the expression is used in the context of the netting set value, it means that modelling/pricing leads, in almost all cases, to too low an overall netting set value, i.e. after applying the netting rules. If it is used in the context of single transaction values, it means that transactions with a positive value have, in almost all cases, too low a value and that

[10] For example, when investigating interest rate processes, consider only a sub-portfolio of interest rate transactions and when investigating the impact of cash flows within the margin period of risk (MPOR), consider only a sub-portfolio of margined netting sets.

[11] Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC (OJ L 176, 27.6.2013, p. 338).

transactions with a negative value (if they are also inside a netting set) have, in almost all cases, too high an absolute value compared with a precise treatment.

(h) "Pricing function" – this refers to a dedicated implementation of a pricing model, taking into account:

(i) the input data used in that particular implementation (e.g. the input market data needed, day-count conventions, etc.);

(ii) the parametrisation of the implemented pricing model, including the method for its calibration;

(iii) the numerical method used (e.g. binomial tree, finite difference, Monte Carlo, etc.).

(i) "Pricing model" – this refers to the quantitative, mathematical model (e.g. a Black 76 swaption) that is used to determine the market value of a transaction for a given (current or future) date and specified market conditions/scenarios.

(j) "Fully simulated exposure" – this means that, for each of the simulated market data paths with a joint dependency structure at the predefined grid points, a full revaluation of the transactions is performed. All material risk drivers of the valuation routine are simulated and the pricing function is not approximated compared with the benchmarking system.

(k) "Trade-related cash flows" – these are intermediate (cash) flows related to transactions in the netting set, such as swap coupons or cash settlements upon maturity.

(l) "Margin-related cash flows" – these cash flows or the delivery of physical collateral cover settlements for both variation margin and initial margin calls.

(m) "Default management process (DMP)" – this process refers to all legal and operational actions performed by the institution upon counterparty default before the institution stops paying margin call and trade-related cash flows to the defaulted counterparty.

2. Scope of application and methods applied

1. The EGAM lays down criteria that are applied by the ECB when assessing an institution's compliance with the requirements for using the IMM under Articles 283 to 294 of the CRR. In particular, this refers to the following:

(a) in principle, all parts of the EGAM are applied in the course of the assessment of an initial application to use the IMM;

(b) if an institution requests permission to extend the IMM sequentially in accordance with Article 283(3) of the CRR, the expectation is that only those parts of the EGAM are applied that are relevant to the scope of such a request;

(c) when assessing changes to the IMM, all parts of the EGAM relevant to the scope of the model change are applied.

2. The EGAM also refers to the assessment of an institution's compliance with the requirements for using the A-CVA, as referred to in Articles 381 to 383 and Article 386 of the CRR, for two purposes:

(a) to grant permission, upon the institution's demonstration of compliance to set the maturity parameter (M) equal to 1 in accordance with Article 162(2)(i) of the CRR;

(b) to verify the appropriateness of the multiplication factor for calculating the own funds requirement referred to in Article 383(5)(c) of the CRR (see also paragraph 65(4)).

In all other cases, where the A-CVA is affected by a model approval, change or extension, either sub-paragraph (1) applies when assessing the IMM exposure calculation underlying the A-CVA or the IMA RTS[12] are used for assessing the market risk model component of the A-CVA.

3. In performing the assessment referred to in sub-paragraphs (2) and (3), the methodologies defined in each chapter of the EGAM are applied by the ECB. To the extent appropriate, additional assessment methodologies are also applied depending on 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 may also 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 that the institution has agreed with counterparties, and their representation in the model;

(d) the appropriateness of quantitative and qualitative validation activities regarding the CCR exposure model;

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[12] EBA Final Draft Regulatory Technical Standards on the specification of the assessment methodology for competent authorities regarding compliance of an institution with the requirements to use internal models for market risk and assessment of significant share under Article 363(4)(b) and (c) of Regulation (EU) No 575/2013.

(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[13] apply.

3. Quality and auditability of documentation

1. With regard to the quality and auditability of the documentation on the models or aspects of them, the ECB verifies 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:

   (a) the documentation has been approved at the appropriate management level of the institution;

   (b) the institution has policies in place outlining specific standards for ensuring that internal documentation is of a high quality 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 any changes to the document;

   (d) the institution adequately documents its policies, procedures and methodologies related to the application of the IMM and A-CVA, as referred to in this guide.

2. Assessing the auditability of the documentation referred to in sub-paragraph (1) 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 model is sufficiently detailed to allow third parties to understand how the model operates, the methodologies applied therein and their limitations and key assumptions, i.e. the third party should be able to replicate the risk measure calculated with the model.

[13] EBA Final Draft 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.

3. 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 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 purposes of assessing the institution's compliance.

2. For the purposes of sub-paragraph (1), the ECB verifies, in particular, that:

   (a) 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, as well as 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, as well as 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 tasks, activities and functions outsourced 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, the ECB verifies 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) entails:

   (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 from or interviews with the staff and senior management, or the management body, or the committee designated by it, or the third party to whom the task, activity or function is delegated.

5. For the purposes 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 using 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 Article 283(6)(b) of the CRR, the ECB reviews the plan to restore timely compliance as referred to in Article 283(6)(a) of the CRR and, in particular:

1. reviews the institution's plan to return to compliance by assessing in particular 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 monitors progress on the implementation of the plan;

3. verifies 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 and partial implementation of the IMM across different transaction types

6. General

1. In order to assess an institution's compliance with the requirements on the implementation of the IMM in accordance with Article 283(3) of the CRR and Section II, Chapter 3, paragraph 9 of the ECB Guide on options and discretions available in Union Law (EGOD)[14], the ECB verifies, in particular:

   (a) the institution's initial or current IMM scope and its plan for sequential implementation in accordance with paragraph 7;

   (b) how the institution justifies and monitors transactions treated with a non-IMM method under Articles 273(1), 221 or 223 of the CRR for permanent or temporary exemption from the IMM in accordance with paragraph 8.

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

   (a) reviews the institution's relevant internal policies and procedures, including the calculation methods for the IMM coverage ratios, to ensure compliance with the EGOD;

[14] See ECB Guide on options and discretions available in Union law.

(b) reviews 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) reviews the meeting minutes of the institution's internal bodies, including senior management;

(d) reviews the findings of the institution's internal audit or other control functions;

(e) reviews the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;

(f) obtains written statements from or interviews the staff and senior management of the institution.

3. For the purposes of sub-paragraph (1), that also means that the ECB, to the extent appropriate:

(a) checks the correctness of the process for identifying transactions and assigning them to either the IMM or any of the non-IMM methods by performing the assessments described in paragraphs 62 to 64;

(b) conducts sample testing of transaction assignments and reviews documents related to the characteristics of derivative transactions and SFTs;

(c) reviews other relevant documents of the institution.

7. Implementation of the IMM

1. When assessing the initial or current IMM coverage and the institution's plan for sequential implementation of the IMM, as referred to in paragraph 6(1)(a), the ECB verifies that:

(a) the initial or current coverage of the IMM is compliant with the conditions specified in Article 283(3) of the CRR, as further explained in Section II, Chapter 3, paragraph 9 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) information on the current total exposure values, total number of transactions[15] and risk-weighted exposure amounts calculated in line with 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 in accordance with paragraph 8;

(d) the planned implementation is compliant with the conditions specified in Article 283(3) of the CRR, as further explained in Section II, Chapter 3, paragraph 9 of 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 purposes of achieving reduced own funds requirements (i.e. there is no "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 in accordance with sub-paragraphs (1)(d), (1)(e) and (1)(f) are only possible if at least one of the following conditions is met:

(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 sub-paragraph (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 is checked. If a return to the original roll-out plan is not possible, an updated plan for sequential implementation provided by the institution is verified by the ECB in accordance with Article 283(6)(a) of the CRR.

8. Conditions for treating transactions permanently or temporarily outside the IMM

1. For the purposes of assessing an institution's compliance with the conditions for treating transactions permanently outside the IMM and using any of the non-IMM methods mentioned in Articles 273(1), 221 or 223 of the CRR, and in

[15] The different legs of a trade are to be considered as one single transaction.

relation to the applicable national discretion as defined by ECB for Article 283(3) of the CRR in Section II, Chapter 3, paragraph 9 of the EGOD, the ECB verifies, 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 risk-weighted assets (RWA);

(b) the cost to the institution of including transactions under sub-paragraph (1)(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 size;

(c) the institution's operational capacity to include transactions under sub-paragraph (1)(a) above in the IMM is assessed by the institution in relation to the nature and scale of its activity.

2. The ECB verifies that an institution has procedures in place for regularly monitoring compliance with the applicable option for national discretion as defined by the ECB for Article 283(3) of the CRR in Section II, Chapter 3, paragraph 9 of the EGOD, taking into account that some transactions might be carved out from the IMM also on a temporary basis, which would have an impact on the coverage ratio between monitoring dates.

3. In the case of frequent temporary carve-outs from the IMM, the ECB investigates the root causes.

Chapter 3
Organisation and governance of model validation

9. General

(a) In order to assess whether an institution is complying with the requirements for the organisation and internal governance of its model validation, as referred to in Articles 287(2), 292(6), 293(1)(a)-(c) and (i), 293(3)-(6), as well as Article 294 of the CRR, the ECB verifies the robustness of the arrangements, mechanisms and processes for validating the CCR exposure model, including the appropriateness of the staff responsible for performing validation tasks (hereinafter referred to as the "validation function"; see also paragraph 59 in the chapter on the CCR in the ECB Guide to Internal Models), in particular:

(b) the independence of the validation function, as referred to in Articles 287(2)(d) and 293(1)(c) of the CRR and in accordance with paragraph 10;

(c) the completeness of the validation process, also in terms of frequency, in accordance with paragraph 11;

(d) the adequacy of the validation methodology and processes, in accordance with paragraph 12 and Chapter 8;

(e) the soundness of the reporting process and the process for addressing validation conclusions in accordance with paragraph 13.

4. For the purposes of sub-paragraph (1), the ECB:

(a) reviews the roles and responsibilities of staff involved in model validation, including the internal model approval;

(b) reviews the institution's relevant internal policies, procedures and validation manuals;

(c) reviews the meeting minutes of the institution's internal bodies, including the management body or other committees;

(d) reviews the annual validation work plan;

(e) reviews the process for categorising findings and the relevant recommendations in accordance with their materiality;

(f) reviews 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) obtains written statements or interviews the staff and management of the institution;

(h) reviews other relevant documents of the institution.

10. Independence of the validation function

1. When assessing the independence of the validation function, as referred to in paragraph 9(1)(a), the ECB verifies that the organisational and operational structure clearly separates activities that are not compatible with each other, i.e. that they are performed by different staff members such that conflicts of interest are avoided. In particular, this means the following.

(a) The validation function should be independent from the personnel and management function responsible for originating, renewing or trading derivatives and SFTs and report directly to senior management.

(b) The remuneration of staff and senior managers responsible for any part of the model validation should not be linked to the performance of the tasks related to model development.

(c) There should be effective separation of the validation function from the staff responsible for the model design and development. For cases where certain parts of the validation framework, e.g. back-testing or the benchmarking of IMM pricing functions, are conducted by staff also responsible for model design and development, the ECB verifies that:

(i) model validation regularly, independently and effectively challenges the underlying methodological aspects of the respective validation task, comprising scope, data samples, tools/statistical tests (including, if applicable, test statistics and thresholds[16] in use), etc.;

(ii) model validation reviews the assessment of the outcomes of the analysis (e.g. the evaluation of back-testing traffic lights or pricing deficiencies detected in the benchmarking) and the judgement regarding respective remediation measures, potentially requiring further analyses of and/or changes to any actions involved;

(d) The validation function should perform its own proper assessment of modelling hypotheses;

(e) Furthermore, it needs to be verified that:

(i) the validation function has adequate resources at its disposal, including experienced and qualified staff to perform its tasks;

(ii) no undue influence is exercised over the validation function and its conclusions;

(iii) internal audit regularly explicitly assesses the fulfilment of the conditions referred to in points (i) and (ii) of sub-paragraph (1)(e).

2. When performing the overall assessment of the independence of the validation function, the ECB pays particular attention 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. When assessing the completeness of the model validation process, as referred to in paragraph 9(1)(b), the ECB verifies that the institution has defined and documented a validation framework that covers at least the key modelling assumptions mentioned below. In terms of frequency, it is expected that the

[16] This refers, for example, to thresholds used for back-testing traffic lights or fort he benchmarking of pricing functions.

validation process be applied according to an adequate and regular cycle following the annual work plan. Back-testing should be performed at least on an annual basis.

2. When performing the assessment of the completeness of the validation process, as referred to in sub-paragraph (1), the ECB verifies that the validation function:

   (a) critically reviews all the aspects of specification of the CCR exposure model, the choice of methodology and model structure, particularly with regard to the key modelling assumptions as outlined in paragraph 56(2);

   (b) challenges the adequacy of the implementation of the CCR exposure model in IT systems, including the data collection and data cleansing procedures;

   (c) ensures the performance and stability of the model outcome;

   (d) checks that all model changes and extensions, as well as their materiality, are in line with the ECB Guide on materiality assessment[17] (EGMA) and, in particular, that it consistently follows up on its own conclusions and recommendations;

   (e) ensures a comprehensive view of all the findings, problems, weaknesses and limits of the CCR exposure model, as well as ongoing interaction within the validation function.

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 methodologies and processes

When assessing the adequacy of the validation methodologies and processes, as referred to in paragraph 9(1)(c), the ECB verifies that these validation methodologies and processes ensure model integrity and allow for a consistent and meaningful assessment of the performance of the CCR exposure model as required by Article 292(6) in conjunction with Article 294 of the CRR, and especially that:

   (a) the validation methodologies and processes 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) the validation methodologies clearly state the validation objectives, standards and potential limitations, including a description of all validation

[17] See EGMA – Materiality assessment for IMM and A-CVA model extensions and changes.

tests and corresponding datasets (based on data sources and reference time periods and the regular data cleansing);

(c) if validation is set up by location or legal entity, the methodologies and processes are consistent across sites and with the group or, if not, that differences are justified;

(d) the validation methodologies, the corresponding datasets and the respective data cleansing are applied consistently over time.

13. Soundness of the reporting process and the process for addressing validation conclusions

1. When assessing the soundness of the reporting process and the process for addressing validation conclusions, as referred to in paragraph 9(1)(d), the ECB verifies, in particular, the following.

   (a) The validation reports identify and describe or reference the validation methodologies used, the tests performed, the corresponding datasets and the respective data cleansing procedures. Moreover, they fully and clearly describe the results of these tests, the conclusions, in particular the findings along with their severity, and the relevant recommendations.

   (b) The validation conclusions, i.e. findings and recommendations, are reported directly to senior management and either to the management body of the institution or the committee designated by it. Furthermore, it is expected that there be a decision-making process in place to ensure that the validation conclusions are properly taken into account by the management of the institution.

   (c) The validation conclusions directly influence the further design of the institution's IMM and the decision-making process for further model cycles. In this regard, all necessary corrective measures should be decided at the appropriate management level and via the designated committees, and implemented in a timely manner.

   (d) The validation report is signed-off at a sufficiently senior management level with the authority to trigger remedial action.

2. In order to ensure that precise conclusions, as described in sub-paragraph (1) above, are drawn from validation results, the institution is also expected to:

   (a) have defined clear quantitative and qualitative thresholds for the event that the CCR exposure model is considered to have low performance, including at least:

      (i) a statistical component in accordance with paragraph 53(1)(f) below;

(ii) an expert-based component that also includes model users, such as credit officers, and qualitative aspects of the model's performance;

(b) draw separate conclusions on each model component, e.g. risk factor simulation or collateral modelling, before drawing any general conclusions.

3. In order to ensure that validation reports are clear and comprehensive, as mentioned in sub-paragraph (1)(a), the ECB verifies 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 in such a way that they can be understood with the level of knowledge required of management, as stated below in paragraph 15(1)(d);

(c) in the event that any model component has low performance, the report provides reasons for this to the extent possible.

4. In order to ensure that the results of validation reports are used in further cycles of the model development, the ECB verifies that:

(a) the shortcomings described in the validation report lead to well-defined recommendations on model components that are considered to have low performance; ideally these recommendations should be discussed with those responsible for model development;

(b) the validation report contains or refers to a schedule ideally agreed with model development, showing 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 documented fixing schedule;

(d) the institution has validated whether the model's performance has improved following the implementation of earlier recommendations made by the validation function;

(e) as part of the process for identifying and remedying unacceptable model performance, the institution has drawn up a comprehensive overview of all validation conclusions, in particular ongoing and closed findings, weaknesses and limits of the CCR exposure model (see paragraph 11(2)(e)).

Chapter 4
Internal governance, risk control, collateral management and audit

14. General

1. In order to assess whether an institution is compliant with the requirements for internal governance, including those for senior management and the management body, internal reporting, counterparty risk control, collateral management and internal audit units, as also referred to in Articles 286, 287, 288, 292 and 293 of the CRR, the ECB verifies the institution's internal governance in terms of:

   (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:

   (a) reviews the institution's relevant internal policies and procedures;

   (b) reviews the meeting minutes of the institution's internal bodies, including the management body or other committees;

   (c) reviews the exposure reports relating to both regulatory and internal risk, including overdraft reports and any conclusions and decisions taken on the basis of those reports;

   (d) reviews the collateral management reports, particularly in terms of disputes;

   (e) reviews the internal audit reports and the conclusions and recommendations they contain;

   (f) obtains written statements from or interviews the staff and senior management of the institution;

   (g) reviews other relevant documents of the institution.

15. Senior management and management body

1. When assessing the soundness of the institution's internal governance in terms of management, as referred to in paragraph 14(1)(a), the ECB verifies that:

   (a) the institution's decision-making process 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 meeting 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, including:

      (i) guaranteeing sufficient resources (staff for 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 institution's senior management has a good understanding of the IMM and 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 those requirements, and that it is aware of the specified model limitations under Article 286(4) of the CRR;

   (e) the institution's senior management notifies the management body, or the committee designated by it, of any material changes or exceptions to established policies and processes that have a material impact on the operation of the IMM;

   (f) the institution's senior management undertakes relevant measures if weaknesses in the IMM are identified by the CCR control unit, the independent validation function or internal audit, which means, in particular, having a governance framework in place within the institution:

      (i) to identify, classify (in accordance with the EGMA) and manage model changes and extensions;

      (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 unit in accordance with Article 293(1)(d) of the CRR on a daily basis, taking into account Articles 287(1)(a) and (2).

2. For the purposes of verifying that the requirements referred to in sub-paragraph (1)(b) are met, the ECB verifies 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 the validation function 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, as referred to in paragraph 14(1)(b), in addition to the elements mentioned in paragraph 14(2), the ECB reviews, in particular:

   (a) the roles and responsibilities of staff and senior management in the CCR control unit;

   (b) the relevant reports submitted by the CCR control unit to senior management or to its designated committee.

2. When assessing the internal governance and oversight of the institution in relation to the CCR control unit, as referred to in sub-paragraph (1), it is 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 verifies, 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 derivatives or SFTs;

   (c) the managers of the CCR control unit and of the units responsible for trading derivatives 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 of the performance of the tasks related to trading derivatives or SFTs.

3. When 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 verifies, 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, for which 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 under Article 287(1)(a) and (2) of the CRR.[18]

(c) the CCR control unit regularly informs senior management about the performance of the IMM, any areas for improvement and the status of efforts to improve previously identified deficiencies.

4. When assessing the adequacy of the internal reporting of the CCR control unit, as referred to in sub-paragraph (1)(b), the ECB verifies, in particular, that:

(a) reporting pursuant to Article 286(5) to (7) of the CRR includes time profiles of counterparty exposures aggregated across netting sets;

(b) the reporting referred to in sub-paragraph (4)(a) also makes use of the exposure measure as defined for internal risk management or for transactions not covered by the IMM;

(c) breaches of risk limits and the usage of the credit lines under Article 286(6) and (7) of the CRR are reported;

(d) counterparties with the largest exposures and those with limit breaches are highlighted, and that the reporting is appropriate to 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 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 covers wrong-way risk (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;

[18] This applies unless (parts of) the initial or ongoing validation of the model (are) is conducted by staff not belonging to the CCR control unit, but, for instance, to a separate validation unit.

(i) the institution's reporting facilitates senior management's monitoring of 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, as referred to in paragraph 14(1)(c), in addition to the elements mentioned in paragraph 14(2), the ECB reviews, in particular:

   (a) the roles and responsibilities of all staff and senior management in 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. When assessing the institution's internal governance and oversight in relation to the collateral management unit, as referred to in sub-paragraph (1), the ECB verifies, in particular, that:

   (a) the collateral management unit is appropriate to the nature, size and degree of complexity of the institution's business, and, in particular, to the complexity of the types of legal agreement for derivative and securities financing transaction (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 Article 287(3)(a) of the CRR, that reporting requirement applies only if the independent amount is specified in contracts, i.e. when a certain level of available collateral corresponds to the independent amount similar to the initial margin (IM);[19]

   (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 or agreement of new contracts.

3. When assessing the adequacy of the internal reporting of the collateral management unit, as referred to in paragraph 17(1)(b), the ECB verifies, in particular, that:

[19] For some independent amount agreements, the independent amount merely acts as a negative threshold (only as a parameter that governs margin calls, i.e. it does not correspond to a certain level of physical collateral, i.e. this type of independent amount does not need to be reported.

(a) the collateral management unit regularly informs senior management about the performance of its 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 under Article 287(3)(d) and (f) of the CRR, and that for Article 287(3)(e) there are case-by-case reports on concentrations of collateral above predefined thresholds, whether by type of collateral (for non-euro 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 processes.

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 reviews:

   (a) the roles and responsibilities of staff involved in internal audit;

   (b) the adequacy and appropriateness of the annual internal audit work plan;

   (c) the auditing manuals and work programmes, as well as the findings and 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. When assessing the internal governance and oversight of the institution in relation to internal audit, as referred to in sub-paragraph (1), the ECB verifies, in particular, that:

   (a) at least once a year, internal audit reviews the operations of the CCR control unit, the limit and credit line approval process and the internal validation function, also in terms of compliance with the requirements for the institution's IMM, as defined in Part 3, Title II, Chapter 6, Section 6 of the CRR;

   (b) the review referred to in sub-paragraph (2)(a) helps to identify areas in the annual work plan where there needs to be a detailed review of adherence thereto;

   (c) the resources of the internal audit unit are adequate for and proportionate to the tasks assigned to it.

3. In the course of assessing compliance with sub-paragraph (2)(c), the ECB verifies, in particular, that:

   (a) the internal audit function provides sufficient information to the 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 that it 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 forms the subject of the reviews carried out by the internal audit function or any other comparable independent auditing unit in accordance with sub-paragraph (2)(a);

   (d) the internal audit function is independent from the staff and management function responsible for trading derivatives 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 derivatives 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 verifies, 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, that these are documented and reasonable;

(c) the institution has used an exposure model broadly in line with the requirements set out in Part 3, Title II, Chapter 6, Section 6 of the CRR for at least one year before being granted permission to use the IMM, in accordance with Article 289(2) of the CRR (see paragraph 23).

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

(a) reviews the institution's relevant internal policies and procedures;

(b) reviews the meeting minutes of the institution's internal bodies, including the management body or other committees involved in the governance of CCR management;

(c) reviews the documented credit line delegation schemes and credit management manuals;

(d) reviews the institution's analysis of the counterparty credit line approvals in the context of WWR and stress tests in accordance with Articles 291 and 290 of the CRR;

(e) reviews the documented regular CCR reporting, its underlying systems and processes and their performance in terms of daily production under Article 289(5) of the CRR;

(f) reviews 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 context of CCR;

(g) reviews the findings of the institution's internal audit or other control functions, including the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;

(h) obtains written statements from or interviews the staff and senior management of the institution.

3. For the purposes of sub-paragraph (1), the ECB may also, to the extent appropriate, review:

(a) the DMP, particularly 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. When 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 verifies, in particular, that:

    (a) the institution takes into account IMM exposures, in particular when:

        (i) making a decision on the approval, rejection and renewal of CCR limits and transactions;

        (ii) setting its desired CCR profile[20], 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) measuring the usage of credit lines pursuant 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 evaluates whether the IMM has been taken into account, in particular, for:

    (a) measuring, monitoring and controlling 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) monitoring WWR in accordance with Article 291 of the CRR;

    (c) implementing stress test analysis in accordance with Article 290 of the CRR.

[20] The CCR profile is the risk profile for risk factors that affect exposures based on the current portfolio/netting sets.

21. Use test in the internal capital allocation

When 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 evaluates whether this distribution has been used, in particular, to:

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

   (a) the institution's internal reporting;

   (b) 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. When assessing whether an exposure model, which is broadly in line with the requirements set out in Part 3, Title II, Chapter 6, Section 6 of the CRR, has been used by the institution for internal purposes for at least one year before being granted permission to use the IMM to calculate own funds requirements in accordance with Article 289(2) of the CRR, also taking into account Article 283, the ECB verifies, in particular, that:

   (a) internally modelled exposure distributions that are later used in effective EPE calculations have been used for at least the last year[21] in the internal risk measurement and management processes, as referred to in paragraph 20(1), for initial IMM approval and material extensions of the IMM;

[21] The model used during that year can have been subject to change, provided that any change is not classified as "material" in accordance with the EGMA. In such cases, it is possible for the use test periods to overlap for different model changes.

(b) adequate documentation on 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 sub-paragraph (1) also applies to extensions of the use of the IMM.[22]

Chapter 6
Documentation and design

24. General

1. In order to assess whether an institution is compliant with the requirements for the design, management and documentation of the IMM, the ECB verifies, in particular, the following:

   (a) the adequacy of the documentation on the design and operational details of the IMM, as well as the rationale for it, as referred to in Articles 286(1) and 288(a) of the CRR, in accordance with paragraph 25;

   (b) the adequacy of the structure and design of the IMM, in accordance with paragraph 26.

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

   (a) reviews the institution's relevant internal policies;

   (b) reviews the institution's technical documentation on the methodology and processes for the IMM's development;

   (c) reviews and challenges the assumptions used in IMM development manuals, methodologies and processes;

   (d) reviews the meeting minutes of the institution's internal bodies responsible for approving its IMM, including the management body or other committees;

   (e) reviews the reports on the performance of the IMM and the recommendations of the CCR control unit, validation function, internal audit function or any other control function of the institution;

   (f) reviews the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during monitoring, validations and audits of the IMM;

[22] Model extensions as defined in Annex I of the EGMA.

(g) obtains written statements from or interviews the staff and senior management of the institution.

3. For the purposes of sub-paragraph (1), the ECB may also, to the extent appropriate:

(a) request and analyse data and test cases used in the process of developing the IMM;

(b) make its own estimations or replicate the institution's for a subset 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. When assessing the documentation on the design and operational details of the IMM, as well as the rationale for it, referred to in paragraph 24(1)(a), the ECB verifies that sub-paragraphs (2) and (3) apply.

2. The documentation needs to be complete, requiring 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 a description of the scope of application of the IMM, specifying the types of covered and non-covered transactions included, in both a qualitative and 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 verifying 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 an 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 of 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 in stochastic processes as set by experts;

(iii) the procedure for the design of the final model, including potential adjustments (or caps/floors) based on expert judgement regarding 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:

(i) the choice of risk factors to be modelled using stochastic, deterministic but time-dependent, and constant approaches;

(ii) the distribution assumptions associated with the processes;

(iii) the chosen multi-dimensional dependency structure, as well as an 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 a simulation error analysis;

(i) the stochastic models' and pricing function's weaknesses, limitations and possible mitigating factors thereof, verifying that the documentation includes:

(i) an estimate of model risk;

(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 in the IT environment and a description of the system architecture and dataflows, 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 assessment of the procedures for gathering and storing information on the IMM's development and maintenance should entail a review of the coverage of the following areas:

   (a) the parties involved (model developers, software engineers, validation function, etc.) and their responsibilities;

   (b) whether the documents and information are updated sufficiently frequently;

   (c) an overview or framework document detailing all IMM-related documentation with sufficient documentary links or references.

26. Model design

When assessing the model design, as referred to in paragraph 24(1)(b), in particular, risk factor modelling and dependency structures, the ECB verifies:

   (a) whether the model's general logic exhibits a convincing explanation and whether its outputs are in line with general expectations;

   (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, among other things, 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 verifies the institution's:

   (a) compliance with the requirements for estimating future exposure distributions based on changes in market values, as referred to in Article 284(1)(a) of the CRR (see Section 2);

   (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 (see Section 3);

   (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, pursuant to Article 284(8) and as referred to in Article 162(2) of the CRR for the maturity calculation (see Section 4);

   (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 Article 162(2) and (3) and Article 284(5) of the CRR (see Section 5);

   (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 (see Section 6);

   (f) compliance with the requirements specific to transaction-specific WWR, as referred to in Article 291 of the CRR (see Section 7).

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

   (a) reviews the institution's relevant internal policies;

   (b) reviews the institution's technical documentation on estimation methodologies and processes;

(c) reviews the model development manuals, methodologies and processes;

(d) reviews the meeting minutes of the institution's internal bodies, including the management body, model committee or other committees;

(e) reviews 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) assesses progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits, validations and monitoring;

(g) obtains written statements from or interviews the staff and 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) make 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 exposure generation process;

(d) review the functional documentation of the relevant IT systems to the extent not already carried out for Chapter 10;

(e) review other relevant documents of the institution.

Section 2
Risk factor models

28. Risk factor selection and dependence structure

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

1. The selection of risk factors for the purposes 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 of the simulated risk factors should be sufficiently granular, i.e. the characteristics of the risk factors used need to

be in line with the pricing routines used (see also paragraph 55) and reflect how the risk materialises in practice.

(b) The methods for detecting 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) if 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 an assessment of its numerical impact;

(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:

(a) verifies, for the choice of stochastic process, that the risk factors, which are simulated in the IMM, are mapped to adequate stochastic processes – in particular, this includes assessing:

(i) whether the simulated behaviour of risk factors is sufficiently in line with historical observations;

(ii) whether the way in which parameters are calibrated is appropriate for the chosen stochastic approach;

(b) verifies, for the stochastic processes themselves, that:

(i) the mathematical structure of the chosen stochastic process is appropriate and consistent – this includes assessing whether the documentation is mathematically correct and detailed enough for competent investigators to understand the rationale for selecting that

particular 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 when subject to perturbations[23] and uncertainties regarding 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.[24]

2. To the extent necessary for the purposes of sub-paragraph (1)(a)(i), the ECB assesses the adequacy of the caps or floors used in the stochastic processes. This includes assessing how the caps/floors for the risk factor distribution are set, e.g. by expert judgement or based on historical observations.

3. The ECB assesses how the solutions under sub-paragraph (1)(b)(ii) are linked to the random numbers and paths of simulated risk factors as a function of time.

(a) In this regard, the ECB reviews, among other things, whether the institution uses an additional process (e.g. a jump process) as a superposition and whether the choice of such an additional process and its parameters is appropriate;

(b) The ECB reviews the quality of the random number generator used by assessing, among other things, the appropriateness of:

(i) its period, i.e. the number of calls until the random number sequence starts to repeat itself;

(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;[25]

(c) For the purposes of sub-paragraph (3)(b), the ECB may:

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[23] This applies to the extent that stability is to be expected, e.g. not necessarily in cases where there are option barriers.

[24] 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.

[25] This is meant in the sense of “low discrepancy”.

(i) review available scientific papers and reviews of the chosen random number generator;

(ii) require the credit institution to demonstrate that the behaviour of the chosen random number generator is reasonable and appropriate.

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 assesses the following:

1. when there are risk factors kept constant in order to price transactions at future points in time, the ECB assesses:

   (a) whether the level/value assigned to these risk factors is appropriate;

   (b) how this level has been derived, e.g. by expert judgement or based on historical observations;

   (c) whether the constant level is adequate for direct use in a pricing function, if applicable;

   (d) whether 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 verifies that:

   (a) the risk factors are mapped to an adequate deterministic function, e.g. in terms of historical observations;

   (b) where directly used in a pricing function, the deterministic movement is adequate for pricing purposes at future points in time;

   (c) where such a risk factor is used as an input parameter to derive another risk factor's distribution, 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 assesses the adequacy of the 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 in the IMM

1. When assessing the overall requirements for the estimation of future exposure distributions based on changes in market values, as referred to in paragraph 27(1)(a), the ECB verifies:

(a) the completeness of the quantitative data underlying the calibration of the IMM, assessing in particular:

(i) whether the length of time series is sufficient in cases where historical market data underlie the calibration;

(ii) whether the data originate from sufficiently liquid markets or are consistent with relevant market information (e.g. the market values of similar positions), in cases 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 to be outliers, e.g. owing to technical issues at the data provider, the treatment of bank holidays in certain jurisdictions and the reasons 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 need to be assessed in conjunction with the evaluation of the IT processes and maintenance of market data in accordance with Chapter 10.

Section 3
Pricing functions, exposure grid and number of scenarios

32. Pricing of transactions

In order to assess the correctness of the pricing of the transactions in the IMM, the ECB verifies the following.

1. The pricing functions used to calculate effective EPE are to be validated internally by the institution, as described in paragraph 55. Among other things, the pricing functions implemented should account for all intermediate cash flows and cash flows at maturity date.

2. Pricing approximations should not result in significantly biased exposure profiles. In particular, they should not lead to a systematic underestimation of exposures. 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 should compare the t_0 values calculated with the risk system used to determine the effective EPE at the transaction level with the values from a benchmarking system for a fixed valuation date (t_0) on a regular basis. More specifically, the ECB assesses:

(a) whether the institution has implemented an appropriate methodology (e.g. thresholds on transaction price differences) for determining acceptable value differences between benchmarking systems and effective EPE risk engine pricing;

(b) whether that methodology can be applied and verified at the transaction level;

(c) the extent to which transactions, in cases where an unacceptable difference is identified in accordance with sub-paragraphs (3)(a) and (3)(b), are either carved out and allocated to one of the non-IMM exposure methods under the CRR, or treated by another comparably conservative action, or are remediated in due course after an internal escalation process;

(d) whether, in the case of deviations identified in accordance with sub-paragraphs (3)(a) and (3)(b), an institution:

(i) monitors and reports any 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 should be analysed and remediated (e.g. by adjusting the pricing function or using consistent market data at t_0);

(ii) appropriately takes into account such persistent pricing deviations in the modelling of the transaction's time profile of values, i.e. adjustments to the value time profile should consider the characteristics of the respective transactions without leading to a systematic underestimation of the resulting expected exposure (EE) time profiles;

(e) whether, in cases where transactions from margined netting sets are not subject to a carve-out from the effective EPE risk engine, as referred to under sub-paragraph (3)(c), the netting benefit of keeping them in the IMM is considered by the methodology in a reliable manner that prevents unjustified netting benefits from leading to a systematic underestimation of the exposure, e.g. by adding it to all affected netting sets along the whole time axis (or in a more sophisticated way taking into account maturing transactions).

33. Attributes of transactions and pricing approximations

In order to assess the correct representation of transactions and the pricing of the transactions in the IMM, the ECB verifies, in addition to the completeness and correctness of transactions and static data in accordance with Chapter 10, that:

1. transactions are represented correctly and, in particular, that the correct cash flow schedule is generated or applied to the transactions;

2. any approximations of market data used for pricing, if applicable, are appropriate for the risk factors that are impacted by these market data approximations;

3. any attribute that has been omitted 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 to a systematic underestimation of the exposure (taking into account all potential long and short positions in the netting set), which applies 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 verifies that:

1. the result of the institution's effective EPE calculations is reasonably close to the result that 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 in such a way that:

   (a) for the dynamic simulation of grid points, they occur just before and at the point in time of the exchange of cash flows and that the dynamic grid point setting is carried out such that at least the cash flows most material to the calculation of effective EPE and RWA are covered;

   (b) for the fixed simulation of 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 compliance with sub-paragraphs (1) and (2) above on a regular basis.

35. Choice of the number of scenarios

In order to assess the appropriateness of the number of scenarios implemented for calculating both stressed and current effective EPE, the ECB verifies 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 both the bank and netting set level;

2. in cases where a percentile-based potential future exposure is used for risk management purposes, the number of scenarios chosen for this purpose also results in a reasonably low numerical error.

36. Balance of different requirements in this section

When assessing the appropriateness of the choices in this section, the relationship between the number of scenarios, the granularity of the time steps and the complexity of the pricing functions is taken into account by considering the following.

1. Owing to the need to calculate the market value of the transactions/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. Expecting banks to raise the number of scenarios might lead to an unwanted simplification of the IMM-implemented pricing models and/or to a less dense grid.

2. There may be a similar correlation when demanding greater consistency between front office/accounting and IMM pricing: the complexity of banks' pricing functions can also limit the number of scenarios chosen owing to a similar trade-off.

37. Use of alternative exposure calculation

In order to assess the appropriateness of the application of alternative exposure calculations affecting the proportion of transactions for which the institution does not perform a full simulation, the ECB verifies that:

1. the institution has justified that the sole reason for using the alternative exposure calculation is that the integration of the affected transactions into the full simulation would significantly extend the simulation time, thus generating the risk that the risk reporting would not be completed in one day;

2. the institution has included available pricing functions for all affected transactions in the scope of the IMM governance and framework, and uses these pricing functions for the justification mentioned under sub-paragraph (1);

3. the methodology for the exposure calculation ensures the integrity of the modelling process pursuant to Article 292 of the CRR by complying with the following modelling standards:

    (a) the methodology is sufficiently integrated into the IMM by using the methodology for the dependence structure (e.g. unique correlations, under Article 284(1)(a) of the CRR requiring joint changes);

(b) the methodology generates time-dependent exposures as required by Article 284(4) of the CRR;

(c) the methodology reflects transaction terms as required by Article 292(1)(a) of the CRR, in particular by appropriately taking into account potential cash flows within the margin period of risk (MPOR), as also required under Article 289(5) of the CRR;

4. the institution:

(a) monitors and reports the materiality of alternative exposure calculations with regard to the IMM by calculating the market value-weighted percentage of transactions that are affected;

(b) ensures that this percentage does not exceed a predefined threshold of the percentage under sub-paragraph (4)(a) in order to restrict its impact on the overall model integrity.

Section 4
Master netting and margining agreements and exposure aggregation

38. Implementation of legal agreements' attributes

In addition to verifying the completeness and correctness of data for legal agreements and the assignment of transactions to them, which is explained in Chapter 10, the ECB verifies that:

1. the implementation of the margin algorithm and the meaning of its parameters, such as minimum transfer amount (MTA), threshold, independent amount and IM, match the contractual specifications of the respective margin agreement or are modelled in a conservative manner;

2. differences between the attributes of contract types (e.g. for bilateral versus central clearing, International Swaps and Derivatives Association (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.

39. Exposure aggregation

In order to assess the correctness of the exposure aggregation steps, i.e. the steps in the calculation of the exposure value based on the simulated exposure distribution, and ultimately to calculate RWA, the ECB verifies the following.

1. Transactions for which the institution has not received permission from the competent authority to apply the IMM are still dealt with using any of the non-IMM methods referred to in the CRR. More specifically, the ECB verifies that:

(a) for such transactions, no diversification, offsetting or netting benefits result from transactions for which IMM approval has been granted by the competent authority;

(b) there is no double-counting of collateral in cases where additional, synthetic netting sets are created to cover transactions for which no IMM approval has been obtained or which are carved out for any other reason.

2. The institution has tested the correctness of all exposure aggregation steps from single transaction exposures to the effective EPE and exposure value at the netting set level, and the institution has documented those tests in a satisfactory manner.

3. The institution correctly takes into account the requirement under 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 verifies that:

(a) in cases where the foundation IRB approach applies, M is set at 0.5 years 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 five years, except in the cases specified in Article 384(1) of the CRR (for M used for the calculation of the own funds requirement 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 the netting set level and not at the transaction level (if applicable);

(iii) the exposure values in the calculation of M under Article 162(2)(g) of the CRR are discounted using the risk-free interest rate discount curve;

(iv) the exposures in the calculation of M under Article 162(2)(g) of the CRR are the effective EPE up to the one-year horizon and the EE after the one-year horizon;

(v) the calculation of M takes only mandatory early termination clauses into account.

Section 5
Calibration

40. General

In order to assess the correctness of the calibration of the institution's stochastic model, the ECB assesses whether:

(a) the institution uses both a calibration based on current market data and a calibration based on market data from a period of stress;

(b) the calibrations for both the current period and the period of stress are based on data after performance of the quality checks described in paragraph 62;

(c) 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;

(d) the calibration is both numerically stable and sensitive to tail events;

(e) the calibration is sufficiently automated to prevent dependence on manual tasks and related operational risks, and whether the respective algorithms have been described, tested and documented;

(f) the institution calibrates current and stressed effective EPE in a consistent manner, as referred to in Article 292(4) of the CRR.

41. Calibration based on market date 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 40(a), the ECB assesses whether:

(a) the institution has a sound reasoning for the length of the calibration period if it applies historic calibration (at least three 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,[26] for the daily internal reporting requirements pursuant to Article 289 of the CRR;

(c) the calibration for regulatory reporting uses market data as of the regulatory valuation date, and whether internal risk management uses

[26] This applies in case of a significant change in markets.

market data as of the current reporting date (e.g. for the calculation of the current line usage).

2. In order to assess the calibration frequency for internal risk measurement purposes, the ECB assesses whether:

   (a) 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) the needs mentioned above in sub-paragraph (2)(a) depend on the structure of the netting sets and their sensitivity to changing volatilities and correlations resulting in the following frequencies:

      (i) daily or weekly if counterparty portfolios that are material in terms of effective EPE and RWA depend heavily on changing volatilities and correlations;

      (ii) monthly or less frequently (e.g. quarterly) provided that the institution can justify its choice.

42. Stress calibration

1. In order to assess the correctness of the stress calibration of the institution's model, as referred to in paragraph 40(a), the ECB needs to assess whether:

   (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 stress calibration at least quarterly, in line with Article 292(3) of the CRR;

   (c) in cases where only a single stress period is applied within a banking group where the capital requirement calculation is also required at the legal entity level[27], the institution assesses the suitability of the uniform stress period for the calibration at the legal entity level;[28]

   (d) for the most material netting sets, the institution is aware of the main drivers of the differences between the effective EPE calculated with the stress calibration and the effective EPE calculated with the current calibration;

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[27] This is also sometimes referred to as "solo level".

[28] A group function could assume responsibility for demonstrating the suitability of the group-wide stress period for each legal entity, if the relevant data are available for that group function.

(e) the stress calibration date, in cases where market-implied data are used, is representative of the market data levels and volatilities from the stress period pursuant to Article 292(2) of the CRR;

2. In order to assess the consistency of the current and the stress calibration, as referred to in paragraph 40(f), the ECB verifies 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, it assesses at least the following items:

(a) When assessing the risk factor models, the ECB verifies, as appropriate, that the following items are also sufficient for the stress calibration.

(i) The potential change in the risk factor set in accordance with paragraph 28(1)(a) and the corresponding decision on whether to simulate, keep deterministic or keep constant those risk factors in the IMM described in paragraph 28(2);[29] 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 alignment between the simulated behaviour (or simulated patterns) of the risk factors and 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), particularly in terms of the stability of the projection model's solutions when initial values and parameters are perturbed.

(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).

(vii) Compliance with the data requirements for the stress calibration, as described in paragraph 31. If adjustments have to be made, e.g. owing 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 transactions in the IMM, the ECB verifies, as appropriate, that the following items are also sufficient for the stress calibration:

[29] This might lead to a "reclassification" of a risk factor in terms of its modelability in accordance with data availability during the stress period.

(i) the requirements for pricing transactions appropriately, as described in paragraph 32(1) and (32)(2);

(ii) in cases where approximations are used in the pricing functions (see paragraph 33(3) and (33)(4)), the exposures are not systematically underestimated;

(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;

(c) When assessing collateral modelling, in cases where own estimates of volatility adjustments are used, the ECB verifies that these estimates do not result in volatility adjustments being significantly lower than the volatilities observed during the stress period.

Section 6
Margined trading and SFT requirements

43. Length of the MPOR

In order to assess whether the institution has set the MPOR for each margin agreement correctly, the ECB verifies that:

1. the institution has implemented the minimum MPOR in line with Article 285(2) of the CRR;

2. for netting sets that exceed 5,000 trades, or that contain illiquid collateral or over-the-counter (OTC) derivatives that cannot easily be replaced, the institution has implemented processes such that:

   (a) the definitions of illiquid collateral and trades that cannot be easily replaced under stressed market conditions are documented;

   (b) these netting sets are identified in a reliable way;

   (c) the MPOR for these netting sets is increased to at least 20 business days pursuant to Article 285(3) of the CRR;

3. the institution has implemented processes and definitions for identifying transactions and securities that are concentrated with a particular counterparty and whether it would be able to replace those transactions and securities in the event of counterparty default, in accordance with Article 285(3) of the CRR, such that:

   (a) the institution has documented criteria for defining the concentration of transactions or securities with one counterparty;

   (b) these transactions and securities are identified in a reliable way;

(c) the institution has at least implemented monitoring that defines the steps to be taken if such a concentration is identified and the transactions 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 set out 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.

44. Modelling of cash flows within the MPOR

1. In cases where margin modelling is done in accordance with Article 285(1) of the CRR where the model properly captures the effects of margining when estimating EE, i.e. points (a) and (b) of Article 285(1) of the CRR do not apply, the ECB verifies that:

   (a) the institution has clearly defined the MPOR for 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 in accordance with paragraph 46.

2. More specifically, the ECB verifies 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 sub-paragraph (2)(b) and should reflect the DMP to the extent it is defined and applied by the institution (see also paragraph 45);

   (d) the institution's modelling assumptions regarding payments of cash flows with respect to a grace period during the MPOR, if applicable in the legal

agreement, are clearly defined and in line with the legal agreements and the past experience of the institution;

(e) the institution's ability to net outgoing trade-related cash flows with cash flows related to margin calls that would occur if the counterparty was not in default, in order to set off exposure spikes in accordance with sub-paragraph (2)(g), 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 as 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 DMP under sub-paragraph (2)(c).

45. DMP

1. In order to assess whether the institution has defined a DMP framework that also takes into account the requirements of Article 286(2)(b) of the CRR, the ECB verifies that:

   (a) the institution has appropriately documented the DMP and that this documentation also includes rules for cases where a key staff member is absent or temporarily unavailable;

   (b) the institution has thoroughly analysed the DMP, in particular with regard to the procedural aspects listed in sub-paragraph (2).

2. In order to assess whether the institution has an effective and reliable DMP that can be used to model cash flows within the MPOR if margined trading is modelled directly in accordance with Article 285(1) of the CRR, the ECB verifies that the following has been reflected appropriately in the exposure calculation:

   (a) the institution's ability to stop outgoing cash flows after notification of the counterparty's default or at a predefined time after such a notification;

   (b) 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:

      (i) cases where critical counterparties are already under strict observation before a default;

      (ii) cases where defaults happen unexpectedly;

(iii) cases where outstanding margin payments are also related to a dispute launched before or during a default;

(c) the availability of action plans upon counterparty default, especially regarding payment controls;

(d) the impact assessment of potential deviations of the modelling of trade-related and margin-related cash flows, as assessed in paragraph 44, from the effective DMP in place.

46. Modelling of margin collateral

In order to assess whether the institution has modelled its current and future simulated margin collateral correctly in accordance with Article 285(6) or (7) of the CRR, the ECB verifies 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 the end of the MPOR) is no longer affected by margin-related cash flows (i.e. it is "frozen");

3. the institution has justified its assumptions regarding the collateral composition of future margin calls in terms of non-cash collateral versus cash collateral and currencies used;

4. if the institution jointly models collateral with the exposure in its exposure value calculations:

   (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 asset characteristics (e.g. ratings);

5. if the collateral is not jointly modelled, the volatility adjustments to the collateral are applied in accordance with Articles 223 to 227 of the CRR; in cases where the definition of currency mismatches provided in the chapter on the CRR in the ECB Guide to Internal Models is used in order to account appropriately for foreign exchange risk, either by using the volatility adjustments or simulated foreign exchange rates at future grid points, the ECB verifies that this risk is properly captured against the reporting currency of the institution and that exposures are not systematically underestimated by the chosen approach;

6. if the collateral is jointly modelled or own estimates of volatility adjustments are used:

   (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 modelled in the IMM (or if an own estimate of volatility adjustment is applied) for the securities leg of an SFT, it is also jointly modelled (or an own estimate of volatility adjustment is applied) if being used as margin collateral;

(c) deviations from sub-paragraphs (6)(a) and (6)(b), i.e. inconsistent treatment, are;

(i) justified by the institution;

(ii) not material in terms of quantitative impact;

(iii) do not lead to a systematic underestimation of exposures;

7. reductions in exposure value owing to clauses in collateral agreements that require receipt of collateral when the credit quality of the counterparty deteriorates are excluded in modelling pursuant to Article 285(8) of the CRR, using complete listings of respective legal agreements provided by the institution.

47. Modelling of margined exposures

In order to assess whether the institution models exposures appropriately in cases where margined trading is modelled directly in accordance with Article 285(1) of the CRR (excluding points (a) and (b)) when estimating EE, the ECB verifies the following.

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:

(a) conceptually and mathematically sound;

(b) validated for representative sub-portfolios where the additional exposure is estimated with a dense or daily time grid applying full revaluation.

2. The margining mechanism implemented in the IMM corresponds to the contractual margin arrangements. If this mechanism is approximated, it is verified that this does not result in a systematic underestimation of exposures. In particular, it is verified that:

(a) contractual haircuts for non-cash collateral or cash collateral in certain currencies are taken into account;

(b) the MTA enters the calculation of the collateral balance at the beginning of the MPOR in a conservative manner if the collateral balance is not modelled throughout the full exposure time axis.

3. If the IM is modelled dynamically within the IMM, it should appropriately reflect the contractual margining arrangements (e.g. with regard to forward variability and maturing transactions) for the respective netting set and be fully integrated into the risk management framework. In particular, the ECB verifies that:

   (a) the scope of transactions subject to the IM model as represented in the IMM is consistent with the transaction subject to the IM agreement;[30]

   (b) all material risk factors as defined in the contractual IM model[31] are also modelled in the IMM;

   (c) the results of IM estimates using the IMM are regularly validated and benchmarked against the IM calculated for collateral management; in particular, that the level of the modelled IM at t_0 is benchmarked on a regular basis against the respective actual IM at t_0;

   (d) the IMM implementation of the contractual IM model, as well as the procedures and processes around it are clearly documented;

   (e) for example, if an institution uses the ISDA SIMM model and intends to mimic this model closely in its IMM:

      (i) the mapping of transactions to product classes is consistent and conservative, and is justified in the IMM, in particular for cases where a transaction falls within more than one product class;

      (ii) the calculations, aggregations and parameters used in the IMM are in line with the ISDA SIMM methodology and are up to date;

      (iii) the calculation or approximation of sensitivities is sufficiently consistent with the ISDA SIMM definition.

   (f) if a dynamic contractual IM is modelled constantly in the IMM, the corresponding validation item, as referred to in paragraph 56(2)(f), is appropriate.

48. Specific requirements for SFTs

1. In order to assess whether the institution has modelled the current and future value of the securities leg of an SFT correctly, the ECB verifies that:

   (a) the institution has justified its assumptions regarding the security composition of the underlying transactions in terms of eligible security types, in case that composition changes during the transaction lifetime, and regarding the currencies used;

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30 This takes into account cases where the standardised method for the bilateral IM ("schedule method") is used in collateral management in line with the contract.

31 This applies to the extent that these risk factors are disclosed.

(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 into account intermediate cash flows, such as bond coupon payments, to the extent that 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) used for the modelling;

(e) the maturity assigned to open term SFTs for the purposes of calculating effective EPE in accordance with Article 284(6) of the CRR is economically justified and validated.

2. When assessing the requirements for margined trading, the ECB verifies whether the institution has correctly taken into account the characteristics of margin agreements for SFTs within the IMM. In particular, this means verifying that:

(a) specific margining requirements for SFTs, such as adhering to contractual ratios between the cash and securities legs, have been taken into account in paragraph 38;

(b) the institution has justified its assumptions regarding the future composition of SFTs' margin collateral, in line with the respective margin agreements;

(c) the effect of changing the values of securities legs and in general changing values owing to foreign exchange rate changes is included in the margin modelling, and that regulatory volatility adjustments pursuant to Articles 220 and 221, or Articles 224 to 226 of the CRR are only applied in exceptional cases.

Section 7
Wrong-way risk

49. General wrong-way risk

In order to assess whether the institution identifies its general wrong-way risk (GWWR) correctly, as referred to in Article 291(1)(a) and (3) of the CRR, the ECB verifies that:

1. the institution has implemented a process for identifying GWWR (in particular stress tests and scenario analyses, but also additional qualitative assessments);

2. the institution monitors GWWR by category (product, region, industry, other) as relevant to the business and regularly reports on it and any action taken to manage it to senior management and the appropriate committee of the management body pursuant to Article 291(6) of the CRR;

3. the institution has designed stress scenarios for risk factors that are adversely correlated with the counterparty's creditworthiness and that it also looks at potential changes in the relationships between risk factors in stressed markets and is able to justify its choice of scenarios;

4. the institution has identified the drivers of GWWR.

50. Specific wrong-way risk

1. In order to assess whether the institution identifies and manages its specific wrong-way risk (SWWR) correctly, the ECB verifies that:

   (a) the institution has implemented processes for identifying and addressing SWWR, as set out in Article 291(1)(b), (2), (4) and (5) of the CRR, distinguishing between cases where:

      (i) there is a legal connection between the counterparty and the issuer of the underlying of the 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 probability of default and its future exposure;

   (b) the institution monitors and controls cases of SWWR throughout the life of the transaction;

   (c) the institution's own funds requirement in terms of 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), and the jump size needs to be explained in the light of the pricing function;

   (d) the institution regularly reports to senior management and the appropriate committee of the management body on both transactions bearing SWWR and any action taken to manage it, pursuant to Article 291(6) of the CRR;

   (e) the institution treats all transactions where SWWR has been identified in accordance with Article 291(2), (4), (5) and (6) of the CRR, irrespective of whether the IMM or any non-IMM method is used, also taking into account the second sub-paragraph of Article 273(8) of the CRR.

Chapter 8
Validation methodologies

51. General

1. In order to assess an institution's compliance with the validation requirements, as referred to in Articles 292(6)(a), 293(1)(b) and (c), (3) and (6), and 294 of the CRR, the ECB assesses:

   (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 52 to 54;

   (b) compliance with the requirements for the validation of pricing functions, in accordance with Article 294(1)(e) and (l) of the CRR, as further laid out in paragraph 55;

   (c) the adequacy of any other performance assessment pursuant to Article 294(1)(f) and (g) of the CRR, as further laid out in paragraph 56;

   (d) compliance with the requirements for the validation processes of the CCR exposure model pursuant to Article 294(1)(d) and (m) to (o) and Article 294(3) of the CRR, as further laid out in Chapter 3.

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

   (a) reviews the institution's relevant internal policies and procedures;

   (b) reviews the meeting minutes of the institution's internal bodies, including the management body or other committees;

   (c) reviews the findings and shortcomings identified by internal audit or by other control functions of the institution;

   (d) reviews the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;

   (e) obtains written statements from or interviews the staff and senior management of the institution.

3. If a more granular assessment[32] of one of sub-paragraphs (1)(a) to (1)(d) 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;

[32] An example of where a more granular assessment is needed is a specific area in which a finding needs to be justified.

(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.

52. 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 is able to appropriately drill down into its back-testing analyses, the ECB verifies that:

   (a) the institution performs back-testing on the following levels:

      (i) single risk factors;

      (ii) single transactions, including SFTs if they are within the scope of the IMM;

      (iii) actual and/or hypothetical portfolios;

   (b) for each back-testing level, predictions, realisations and statistical tests are performed explicitly on that level.

2. For the purposes of sub-paragraph (1), the ECB verifies that the institution has demonstrated the following when defining its back-testing sample:

   (a) the representativeness of the risk factor back-testing samples if they do not cover all risk factors modelled stochastically;

   (b) the suitability of the back-testing samples for assessing the appropriateness of the risk factor movements, in particular risk factors that are only implicitly diffused (e.g. when linking a single name to a simulated index), or of the term structure of a modelled curve;

   (c) the suitability of the back-testing samples for accounting for dependencies in joint risk factor movements, in particular with regard to both intra- and intercorrelations between risk factors of different asset classes;

   (d) the representativeness of the back-testing samples compared with the full portfolio of the institution, both in terms of single transactions and actual and/or hypothetical portfolios;

   (e) that hypothetical portfolios (if used for back-testing) include representative individual transactions with reasonable rollover assumptions[33] for maturing

[33] Keeping, for example, the transaction type, desired range of moneyness, desired range of maturities, etc. when rolling over.

transactions and sample transactions with significant value changes owing only to the passing of time;

(f) the representativeness of the back-testing samples if the institution uses an alternative method for calculating the exposure (see paragraph 36);

(g) the suitability of the back-testing samples for assessing the quality of modelling for legal agreements, both with and without margining.

3. The ECB also verifies that institutions ensure a comprehensive coverage of their back-testing framework by calculating back-testing coverage ratios (i.e. shares of back-tested risk factors or portfolios), at least at the risk factor and, if applicable, the actual portfolio level. To check whether these coverage ratios allow for a meaningful assessment of the back-testing coverage, the ECB verifies that:

(a) the institution is able to provide detailed information on the numbers that are inputs for the nominator and denominator for the respective coverage ratios;

(b) coverage ratios have been calculated taking into account various weighting schemes (e.g. also applying sensitivities or an exposure metric as weights in addition to the number-based[34] approach);

(c) at the risk factor level, numbers are available by asset class and overall, if applicable,[35] for example:

(i) the overall number-based coverage ratio at the risk factor level is given by the number of all back-tested risk factors divided by the full set of IMM relevant risk factors;[36]

(ii) the number-based coverage ratio at the risk factor level for the equity (EQ in the equation below) asset class could be defined as follows (with "#" denoting "number of") :

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

(d) at the actual portfolio (AP) level, an exposure at default (EAD in the equation below, means the same as exposure value) based ratio could be defined, for example, as follows:

$$Coverage\ ratio^{AP} = \frac{IMM\ EAD\ of\ all\ backtested\ APs}{EAD\ of\ all\ IMM\ netting\ sets};$$

[34] This means, for example, the number of risk factors or the number of portfolios that are covered.

[35] Note, for instance, that under a sensitivity-based approach, coverage ratios per asset class are sufficient.

[36] Note that, in this sense, the set of IMM relevant risk factors should include all stochastic risk factors that are integrated into the IMM exposure model (not differentiating between whether they are directly or implicitly diffused).

(e) the institution is able to provide a reasonable explanation for the level of the respective coverage ratio;

(f) coverage ratios are part of the regular back-testing reports in order to ensure that the back-testing scope is transparent.

53. Methodology for back-testing

1. In order to assess whether the institution has implemented a sound back-testing methodology, the ECB verifies the following.

(a) The institution back-tests different relevant risk measures, including the market value[37] at the transaction level, the market value of netting sets[38] and the exposure[39] at the netting set level.

(b) In cases where no full distribution back-testing is applied, the chosen set of quantiles is appropriate for assessing the distribution shape of the respective value (e.g. risk factor value, market value or exposure). Both the metric used for the internal risk measurement (potential future exposure) and the metric used for regulatory purposes (EE) are analysed, either as part of the chosen quantiles or in addition to the full distribution back-testing.

(c) If back-testing relies only on IMM pricing functions for both the predictions and the realisations of actual or hypothetical transactions/portfolios (i.e. realised prices derived from benchmarking systems are not taken into account), the institution has strengthened its validation/review of IMM pricing functions in order to ensure their adequacy.

(d) The institution provides explanations on how it determines realisations and predictions for back-testing purposes. In particular, in the case of predictions, the ECB tracks the institution's forward[40] and/or backward-looking[41] approach and, if applicable, modifications to the actual IMM run. In terms of realisations, the ECB verifies whether the institution uses realised prices derived from benchmarking systems or whether

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37 Market values can be either positive or negative.

38 This means the sum of all transaction market values within that netting set. This sum can be positive or negative.

39 Exposure should always take into account the collateral balance and margin mechanism. In the case of unmargined netting sets, the collateral is zero. Exposure is understood as an inherently non-negative value.

40 "Forward-looking" would mean storing all predictions calculated using the IMM in the past (IMM model as it was set up and calibrated at each prediction date in the past, taking the model methodology as it was back then, in particular its design and the corresponding calibration window) and comparing the simulated distribution of values for a given time horizon with the observed realisation after the corresponding time period has passed.

41 "Backward-looking" implies recalculating ex post distributions using the IMM model as it is in the current production, but calibrating parameters on the basis of respective past segments of risk factor time series. Predictions are then compared with the observed realisation, also based on stored time series.

realisations are calculated using the IMM pricing functions with market data as of the realisation date.

(e) In the case of actual portfolio back-testing, the institution ensures consistent pairs of predictions and realisations, i.e. assumptions concerning the changes of 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).

(f) The institution defines clear quality assignments (e.g. “red, amber, green”) for back-testing purposes, which are based on test statistics and potentially on additional qualitative assessments.

(g) If back-testing samples contain forecasts over fully or partially overlapping observation periods,[42] the institution takes into account the resulting dependencies when defining the test statistics/thresholds.

2. In the context of margined netting sets, in addition to sub-paragraph (1), the ECB verifies that the institution applies reasonable and meaningful back-testing methodologies aimed at validating exposure values, i.e. taking the collateral balance into account. If it is not feasible to directly back-test the exposure of margined netting sets, the ECB assesses whether the institution conducts a separate validation of the margining process, the collateral value changes and the netting set market value changes over the relevant time horizons (see also paragraph 56).

54. Time horizons for back-testing

1. In order to assess whether the institution has implemented adequate time horizons for its back-testing framework, the ECB verifies the following.

(a) The institution performs back-testing out to at least one year, with additional shorter horizons such as one week, one month and three months. If back-testing is not feasible for long time horizons owing to low sample sizes, other methodologies may be used to prove the adequacy of the model;

(b) For margin agreements, the institution back-tests its exposure, in addition to the time horizons mentioned above, over periods that reflect the typical[43] MPOR for OTC derivatives and SFTs in accordance with Article 285 of the CRR.

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[42] For instance, distinct variables over the same forecasting period are tested simultaneously, or tests are built on a single variable observation period and different successive, but overlapping, observation periods.

[43] “Typical” should be interpreted here as the material MPOR horizons that are implemented in the system, e.g. when the MPOR is conservatively set to 20 days for all OTC derivatives, this horizon should be used instead of the ten-day floor value.

2. Furthermore, the ECB verifies that the institution also uses validation methodologies to assess the quality of its risk measures beyond the one-year time horizon, in particular, including:

   (a) an assessment of the long-term stability[44] of simulated market data paths and exposure profiles;

   (b) a comparison of the simulated long-term behaviour of market data with historical charts.

55. Validation of IMM pricing functions

1. In order to verify whether the institution has implemented processes for validating the quality of the IMM pricing functions, beyond the expectations of paragraph 32(3), the ECB verifies the following.

   (a) The institution has established adequate validation methods to account for the non-linearity of option pricing models in terms of 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 by comparing their output with values from benchmarking systems (after the independent price verification process but before any valuation adjustments), using market values as of t_0. In this regard, the validation framework should involve reviewing the process for identifying significant price differences and include a full analysis of those differences and their root causes, together with a review of the action taken to address model inaccuracies, such as price corrections for t_0 and for future grid points.

   (c) The institution validates whether deviations from a full simulation are documented and justified, whether the effect of using approximated pricing functions (instead of those from any reliable benchmarking system) is not significant and whether for all approximated pricing functions the value changes owing to risk factors occurring in the IMM simulated paths are reliable compared with value changes from non-approximated pricing functions for the same transaction types.

56. Other performance assessments

In order to verify that the institution applies further quantitative validation, the ECB verifies the following.

[44] "Long-term stability" in this context means that, for a constant portfolio and constant market conditions, the model output (e.g. market data paths or exposure profiles) should not change dramatically.

1. Sensitivity analyses, plausibility checks or related analyses are performed for all parameters of the stochastic processes or parameters of the IMM pricing functions that are either proxied, set by experts or updated less than every three months. Special attention is expected to be paid to cases where an increased level of uncertainty is suspected (e.g. when parameters are determined on scarce data or when certain modelling choices are known as accepted model weaknesses).

2. The institution has implemented procedures and policies in order to assess and challenge all kinds of key modelling assumption, which should cover at least:

   (a) the choice of stochastic processes used to model market risk factor movements, including all relevant parameters such as drift, volatilities and the term structure of a modelled curve (at least in cases of poor back-testing results);

   (b) the use of boundaries such as caps and floors for risk factor paths;

   (c) the sensitivity of the exposure to the initial seed of the random number generator and the resulting numerical error owing to the number of simulated scenarios used (numerical Monte Carlo error of the expected EPE as a result of a limited sample of scenarios);

   (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 modelling features regarding margining, i.e. the setting of the MPOR (including the respective treatment of cash flows), the agreement-dependent variation margin and IM mechanisms;

   (g) collateral modelling, especially the composition of collateral and collateral value changes over time;

   (h) the methodology for determining the relevant stress period in accordance with Article 292(3) of the CRR and the corresponding stress calibration.

3. The institution has implemented processes for periodically benchmarking both the collateral balance and the IM, as modelled in the IMM, using values as of t_0. In this regard, the validation framework should include a full analysis of any material differences detected and their root causes, and a review of the action taken to address such model inaccuracies.

4. If the institution uses any alternative method for calculating exposures (see paragraph 36), the validation function has ensured that the respective methods are applied in a way that does not result in a systematic underestimation of exposures compared with the full simulation for the affected transactions. Additionally, the validation function's assessment should take into account the

netting benefits when using any type of alternative method for calculating exposures in the IMM.

Chapter 9
Stress testing

57. 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 verifies, in particular, the following:

   (a) the adequacy of the methods used for designing the stress tests, as referred to in Article 290(2) to (8) of the CRR, as further laid out in paragraph 58;

   (b) the robustness of the 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 59;

   (c) the integration of the stress tests 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 60.

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

   (a) reviews the institution's internal policies, methods and procedures regarding the design and execution of stress tests;

   (b) reviews the institution's outcomes of the stress tests;

   (c) reviews the roles and responsibilities of the units and management bodies involved in designing, approving and executing the stress tests;

   (d) reviews the meeting 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) reviews the findings of the institution's internal audit or other control functions;

   (f) reviews the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;

   (g) obtains written statements from or interviews the staff and senior management of the institution.

3. For the purposes of sub-paragraph (1), the 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 compute the stress tests on the basis of alternative assumptions;

   (c) perform its own stress tests on the institution's data for certain types of exposure;

   (d) review other relevant documents of the institution.

58. Adequacy of the methods used for designing the stress tests

1. When assessing the adequacy of the methods used for designing the stress tests used by the institution to assess its capital adequacy, as referred to in paragraph 57(1)(a), the ECB verifies, in particular, that:

   (a) the tests are meaningful, reasonably conservative and capable of identifying severe and extreme, but plausible, market environments, the impact of which is evaluated on the basis of the institution's exposures and total capital requirements for CCR, as referred to in Article 290(7) of the CRR;

   (b) the scope of the tests is in accordance with Article 290(4) of the CRR and covers at least all material counterparties, as referred to in Article 290(9) of the CRR;

   (c) the methods are consistent with methods used by the institution for the purposes of internal capital allocation stress tests;

   (d) the documentation on the stress-testing methodology, including internal and external data, as well as expert judgement input, is sufficiently detailed for third parties to understand the rationale for the chosen scenarios and to replicate the stress test.

2. For the purposes of sub-paragraph (1)(a), the ECB verifies that the stress tests include at least the following steps:

   (a) identification of the scenarios, including the effect of severe, but plausible, stressed scenarios; more specifically (see notably Articles 290(5), (6) and (8) of the CRR):

      (i) scenarios covering the institution's main risk drivers;

      (ii) historical scenarios based on specific historical periods that have an unfavourable impact on the current portfolio;

(iii) multifactor stress-testing scenarios, 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) 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) comparison of the stress impact with limits set for internal risk management in accordance with Article 290(3) of the CRR.

59. Robustness of the organisation of the stress-testing process

When assessing the robustness of the organisation of the stress-testing process used by the institution to assess its capital adequacy, as referred to in paragraph 57(1)(b), the ECB verifies, 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 at 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.

60. Integration of the stress tests into the risk and capital management processes

When assessing the integration of the stress tests into the institution's risk and capital management processes, as referred to in paragraph 57(1)(c), the ECB verifies, in particular, that:

1. the institution takes into account the results of stress tests in its decision-making process and, in particular, its 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 in the capital management processes in order to consider the forward-looking nature of capital requirements.

Chapter 10
Data maintenance and IT processes

61. General

1. In order to assess an institution's compliance 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 verifies, 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 62;

   (b) the data documentation and reporting, as referred to in Article 293(1)(g) of the CRR, as further laid out in paragraph 63;

   (c) the relevant IT infrastructure, in accordance with paragraph 64.

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

   (a) assesses the comprehensiveness of data quality management policies, methods and procedures relevant for the data used in the IMM approach, with comprehensiveness meaning (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 the elements involved;

      (iii) that procedures are in place for managing incidents, upgrades (including releases of new versions) and maintenance, audit trails, 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) reviews the relevant data quality reports, as well as their conclusions and recommendations;

   (c) assesses the comprehensiveness of IT infrastructure policies and IT systems management procedures, including the contingency planning policies relevant for the IT systems used for the IMM approach;

(d) reviews the meeting minutes of the institution's internal bodies, including its management body or other committees;

(e) reviews the findings of the institution's internal audit or other control functions;

(f) reviews the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits;

(g) obtains written statements from or interviews the staff and senior management of the institution.

3. For the purposes 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 institution's performance 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.

62. Quality of transaction terms and specifications, market data and legal data

1. When 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 61(1)(a), the ECB verifies, in particular, that:

(a) the data are available and correctly identified in the CCR system for all relevant aspects of the exposure calculation ("completeness") – more specifically 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 the front or back office or accounting) and thus included in the exposure value 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 transaction can be processed using the IMM (i.e. all necessary input is available for full simulation or fall-back approaches) and, moreover, to assign transaction parameters referring to underlying risk factors to the appropriate stochastic

processes, and to assign the transaction type to the appropriate pricing function;

(iii) the institution can demonstrate that the IT system correctly captures which transactions are covered by which legal netting agreement, and that 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 correctly reflects the characteristics of a margin or collateral agreement (e.g. the ISDA Credit Support Annex for a Master Netting Agreement), such as the threshold, MTA, IM and independent amount, as well as all types of asymmetric setting, 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 are error-free (“accuracy”), such that, especially for market data, stale values are identified and either excluded or substituted by data from other source systems, data formats are aligned with the definitions in their corresponding data dictionaries, irrespective of whether monitoring and resolution processes are in place, as foreseen in paragraph 62(2)(a)(v);

(c) a given set of data can be matched across the institution’s various data sources (“consistency”) and across different measuring points (e.g. databases or data warehouses) along the dataflow, which also includes an integrity check of all relevant interfaces (“integrity”);

(d) the data values are up to date (“timeliness”) for use on the regulatory reporting dates, with justified interpolations for market data on bank holidays;

(e) the aggregate data are free from any duplication resulting from transformations or manipulations of source data (“uniqueness”);

(f) the data are based on an adequate system of classification, sufficiently rigorous to compel acceptance (“validity”);

(g) the history, processing and location of data under consideration can be easily traced (“traceability”).

2. When assessing the data quality management process, the ECB verifies 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, among other things, to 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, updating and use;

(iii) the continuous updating and improvement of the data quality management process;

(iv) a set of criteria and procedures for determining compliance with the data quality standards, and, in particular, with 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 a process for issuing internal recommendations to address problems in areas for improvement and a process for implementing such recommendations prioritised according to materiality and, more particularly, a process for addressing material discrepancies identified during the data reconciliation process;

(b) the data collection process has a certain degree of independence from the data quality management process, including a separate organisational structure and staff, where applicable.

63. Data documentation and reporting

1. When assessing data documentation that the institution uses to provide effective support to its CCR measurement and management process, the ECB evaluates, 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 purposes of the IMM approach;

(ii) the relevant data sources;

(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 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 workflows 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. When assessing data reporting, as referred to in paragraph 61(1)(b), the ECB verifies that the data reporting:

(a) specifies the scope of reports or reviews, the findings and, where applicable, the recommendations to address any weaknesses or shortfalls detected;

(b) is communicated to senior management and the 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 institution has sufficiently addressed and properly implemented the recommendations.

64. IT infrastructure

1. When 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 evaluates, in particular, the following:

(a) all relevant objects in the IT system 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 dataflow 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 system owners;

(d) the capacity, scalability and efficiency of IT systems;

(e) the manuals for the IT systems and databases.

2. When 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 verifies that:

(a) the IT infrastructure is deemed sound, on the basis that it can support the institution's ordinary and extraordinary processes 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) a policy implemented for dealing with situations in which the overnight potential future exposure calculations fail to be completed in a timely manner;

(iii) the institution's ability 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. When 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 verifies that:

(a) the procedures for backing 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 system 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 to IT systems is adequate and the monitoring of changes covers all IT systems.

4. When 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 verifies 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 recommendations referred to in sub-paragraph (4)(a) are communicated to senior management and the management body of the institution;

(c) there is adequate evidence that the institution has sufficiently addressed and properly implemented the recommendations.

Chapter 11
Specifics for the A-CVA

65. General

1. In order to assess an institution's compliance with the requirements on calculating the own funds requirement for CVA risk, as referred to in Article 383 of the CRR, the ECB, in particular, verifies the institution's:

   (a) compliance with the requirements, as referred to in Commission Delegated Regulation (EU) No 526/2014[45], under Article 383(7) of the CRR, hereinafter referred to as the "RTS on CVA", as further laid out in paragraph 66;

   (b) compliance with the own funds requirement calculation for CVA risk, 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 in accordance with 162(2) of the CRR, as further laid out in paragraph 67.

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

   (a) reviews the institution's relevant internal policies;

   (b) reviews the institution's technical documentation on the estimation methodology and process;

   (c) reviews and challenges the model development manuals, methodologies and processes;

   (d) reviews the meeting minutes of the institution's internal bodies, including the management body, model committee or other committees;

   (e) reviews the reports on the A-CVA over time and the recommendations by the organisational unit calculating the CVA, the validation function, the internal audit function or any other control function of the institution;

[45] 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 (OJ L 148, 20.5.2014, p. 17) – note that this RTS does not deal with any assessment methodology.

(f) assesses the progress reports on the institution's efforts to correct shortfalls and mitigate risks detected during audits, validations and monitoring;

(g) obtains written statements from or interviews the staff and 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 own funds requirement using the relevant data supplied by the institution;

(c) request and analyse the credit spread data used in the process of calculating the own funds requirement;

(d) review the functional documentation on the relevant IT systems to the extent not done for Chapter 10;

(e) review other relevant documents of the institution.

4. Based on the assessment conducted for the purposes of sub-paragraph (1), the ECB may reassess the appropriateness of the multiplication factor used in the A-CVA in accordance with Article 383(5)(c) of the CRR by taking into account the criteria laid out in the IMA RTS.

66. 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 credit default swap (CDS) spread is available, following the requirements of the RTS on CVA, the ECB verifies in accordance with Article 1 of the RTS on CVA that:

(a) the institution has a sound policy defining when a CDS is considered liquid or illiquid;

(b) the institution has modelled its proxy spreads using either a regression approach or a bucketing approach, and that both approaches include at least the following dimensions:

(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 with that of liquid CDS spreads and that 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 sub-paragraph (1)(b);

(e) the institution ensures a high coverage of the counterparty-specific ratings (based either on external or internal information) on which the selection of proxy credit spreads is based and that the assignment of fall-back ratings does not jeopardise 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 sub-paragraph (1)(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 – this methodology should assess at least whether the volatility of the proxy spread is conservatively calibrated.

2. In order to verify that the institution has identified the appropriate market loss given default (LGD) pursuant to Article 2 of the RTS on CVA, the ECB verifies that:

(a) the institution uses updated and maintained data feeds to extract market credit spreads and assigned LGDs;

(b) the identified market LGD is also used when determining default probabilities from the credit spreads in sub-paragraph (2)(a), e.g. in the institution's pricing functions for credit derivatives.

3. In order to verify that the institution applies the A-CVA when qualifying portfolios in accordance with Article 3 of the RTS on CVA, the ECB verifies that:

(a) the institution's calculations are reported and that any action to be taken in the event of a breach of any of the thresholds has been defined;

(b) the respective reports on the number and size of transactions are based on either the risk system that calculates the IMM exposures underlying the A-CVA or on any other system reconciled with the risk engine that calculates the IMM exposures underlying the A-CVA on at least a quarterly basis.

67. Own funds requirement calculation for CVA risk

1. In order to verify that the institution correctly selects its stress period for the stressed value at risk (VaR) calculation in accordance with Article 383(5)(b) of the CRR, the ECB verifies that:

   (a) the institution has a defined, documented and validated the methodology for selecting the most severe one-year time window regarding credit spread levels within the three-year period used as the basis for deriving the data for the stressed exposure calculation;

   (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 CVA risk, in accordance with Article 383(5)(c) to (d) and Article 383(6) of the CRR using eligible hedges in accordance with Article 386 of the CRR, the ECB verifies that:

   (a) the methodology for complying with Article 383(5)(c) to (d) and Article 383(6) of the CRR is correctly implemented in the risk system and that exposures rejected for the A-CVA in accordance with Article 383(6) of the CRR are input for the standardised CVA risk calculation under Article 384 of the CRR;

   (b) eligible hedges used to reduce 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 they belong 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 calculating CVA risk and credit risk mitigation.

3. In order to verify that the institution meets the requirements for being granted 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 verifies that the internal model for specific risk associated with traded debt instruments contains rating migrations. To verify, this the ECB assesses whether:

   (a) for each of the counterparties subject to the permission there is a single name CDS spread time series available on which the credit spread

modelling is based or whether the counterparty is properly mapped to a proxy spread if no liquid CDS spread time series is available;

(b) the model appropriately reflects the stochastic behaviour of the single name time series;[46]

(c) the institution demonstrates that:

(i) part of the volatility of liquid single name CDS credit spreads can be attributed to rating migrations;

(ii) part of the volatility of the proxy spread can be attributed to the occurrence of rating migrations of the counterparties assigned to the proxy spread buckets.

[46] This is relevant to the extent that the assessment of the market risk model does not yet cover respective single name credit spreads.

5 Technical terms

A-CVA	advanced credit valuation adjustment
CCR	counterparty credit risk
CVA	credit valuation adjustment
DMP	default management process
EE	expected exposure
EGAM	ECB Guide on assessment methodology
EGMA	ECB Guide on materiality assessment (for CCR model changes and extensions)
EGOD	ECB Guide on options and discretions available in Union law
EPE	expected positive exposure
GWWR	general wrong-way risk
IMA	internal model approach (for market risk)
IMM	internal model method
ISDA	International Swaps and Derivatives Association
M	maturity parameter (as used in the IRB context)
MPOR	margin period of risk
SWWR	specific wrong-way risk
WWR	wrong-way risk

For further abbreviations, please consult the ECB glossary.

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