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EUROPEAN CENTRAL BANK

BANKING SUPERVISION

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February 2017

Information on the current version (February 2017) of the guide to the Targeted Review of Internal Models (TRIM)

Dear Members of the Management Body,

As announced in the invitation you have received on 6 February 2017 for the conference on the Targeted Review of Internal Models (TRIM) organised by the ECB on 28 February 2017, we are pleased to share with you the current version (February 2017) of the guide to TRIM.

This guide sets out the ECB's view on the appropriate supervisory practices. It further spells out how the ECB intends to interpret the relevant EU law on internal models for credit, market and counterparty credit risks and on general model governance topics. The aim pursued by the guide is to ensure a harmonised interpretation and application of the existing legal framework as well as also ensuring close alignment with upcoming changes in the regulation on internal models.

The guide to TRIM will be presented to the institutions in scope for TRIM during the conference on 28 February 2017 and will be made public consecutively via the ECB Banking Superivsion website. Until this publication, this version shall not be shared with any other third party. We also invite you to provide feedback on this version of the guide to TRIM in order to identify where further clarifications or reconsiderations of the defined principles could be helpful. To that extent, you will find attached feedback templates for each chapter, including some instructions.

We kindly ask you to send back these feedback templates to TRIM_PMO@ecb.europa.eu **by Thursday, 13 April 2017**.

In particular, with regard to paragraph 18 in the chapter of the guide on counterparty credit risk, concerned institutions are invited to propose examples of quantitative impact studies to estimate model risk for cases where approximations or fall-backs are applied to transactions within (non-split) netting sets subject to the IMM, since such impacts would be the base for an increase of the alpha parameter.

This version of the guide will be refined during the coming months based on the feedback received by the institutions through this process and also taking into account the outcomes of the on-site assessments performed during the TRIM on-site investigations, the results of horizontal analyses on peer groups and the latest regulatory developments. Before finalisation of the guide, a formal public consultation will be launched for each risk type.

Yours sincerely,

[signed]

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Director General - DG Microprudential Supervision IV

EUROPEAN CENTRAL BANK

BANKING SUPERVISION

Guide for the Targeted Review of Internal Models (TRIM)

February 2017

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Foreword

The Targeted Review of Internal Models (TRIM) is aimed at enhancing the credibility and confirming the adequacy and appropriateness of approved Pillar I internal models permitted for use by significant institutions when calculating own funds requirements. As a major objective, TRIM focuses on the **reduction of unwarranted variability in risk-weighted assets (RWA)** driven by inappropriate modelling which takes advantage of the freedom granted by the current regulation.

TRIM will encompass two aspects:

- compliance with regulatory requirements related to internal models, through an assessment based on the Capital Requirements Regulation[1] (CRR), the Capital Requirements Directive[2] (CRD IV), relevant Commission Delegated Regulations and Commission Implementing Regulations, regulatory technical standards (RTS), European Banking Authority (EBA) guidelines, and the approved European Central Bank (ECB) Banking Supervision manuals and guidelines – thereby fulfilling the obligations of ECB Banking Supervision to ensure equal treatment of credit institutions and the supervisory assessment and approval of internal models;

- the reduction of unwarranted variability in RWA as it relates to internal model outcomes, taking into account the results of benchmarking, delivering interpretations of the CRR and addressing current gaps in interpretation of regulations relating to internal models, in situations where significant modelling issues contributing to unwarranted variability have been identified.

During the preparatory phase, the ECB and the national competent authorities (NCAs), through the centres of competence (CCs) and the Harmonisation Board, have been working on the definition of topics requiring a harmonised approach to reduce unwarranted RWA variability, and, in relation to those topics, on the development of this guide to define best-practice approaches to credit risk, market risk, counterparty credit risk and general issues related to model governance. The guide is also closely aligned with upcoming changes in the regulations on internal models, such as those referred to in the Fundamental Review of the Trading Book (FRTB)[3] and the proposed EBA Guidelines on probability of default (PD) and loss given default (LGD)[4].

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1 Regulation (EU) 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).

2 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 (OJ L 176, 27.6.2013, p. 338).

3 Document “Minimum capital requirements for market risk” issued by the Basel Committee on Banking Supervision (BCBS) in January 2016. http://www.bis.org/bcbs/publ/d352.pdf

4 EBA Consultation paper on Guidelines on PD estimation LGD estimation and the treatment of defaulted exposures, 14 November 2016.

The guide sets out the ECB's view on the appropriate supervisory practices and how the relevant EU law should be applied in a particular area.

The TRIM on-site investigations will be used to explore the range of practices for which targeted topics requiring harmonisation should be implemented, and to identify potential shortcomings as against the best practices defined in this guide. Horizontal analyses will start on peer groups in parallel to the missions as part of the continuous dialogue between the heads of missions and the centres of competence.

This version of the guide will be further refined during the course of the project, based on several sources of information, namely:

- feedback received from the institutions concerned after a conference scheduled for 28 February 2017 which will open a period for submission of written comments;
- the outcomes of the on-site assessments performed during the TRIM on-site investigations;
- horizontal analyses performed by the CCs on peer groups;
- the latest regulatory developments.

Before finalisation of the guide, a public consultation will be launched for each risk type. At the conclusion of the TRIM project, the final Guide will be published on the ECB's Banking Supervision website.

General topics

1 Scope of the guide for general topics

1. The purpose of this chapter of the guide is to inform institutions of the principles for the general (i.e. non-model specific) topics selected for harmonisation under TRIM, relating in particular to the Internal Ratings Based (IRB approach).

2. In accordance with the requirements set out in the Regulation (EU) No 575/2013 (CRR), the European Banking Authority (EBA) has prepared technical standards (Final Draft Regulatory Technical Standards on Assessment Methodology (Final Draft RTS on assessment methodology for IRB))[5] that specify how competent authorities should assess compliance with the IRB framework. Although at the date this document is distributed the technical standards have not yet been adopted by the European Commission, the document incorporates the principles stated in them.

3. A reference must also be made to the recent developments in the **Basel IRB framework**[6], which will lead to a revision of that framework and the treatment of credit valuation adjustments under the CRR. Nevertheless, the principles underlying this revision were taken into consideration where relevant, in order to provide institutions with a complete overview.

4. The centre of competence for general topics gathered information about banks' practices regarding credit risk in a comprehensive questionnaire launched on 1 July 2016, covering 11 general topics[7]. The answers and documentation collected through the survey and through on-site visits have been incorporated in this Guide.

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5 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 (EBA/RTS/2016/03)
See also: 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 points (b) and (c) of Article 363(4) of Regulation (EU) No 575/2013 (EBA/RTS/2016/07)
Note that there is no RTS on assessment methodology mandated for counterparty credit risk (CCR).

6 The BCBS consultative document on Reducing variation in credit risk-weighted assets - constraints on the use of internal model approaches.

7 Assignment of exposures to exposure classes and Default definition are out of the scope of this document

2 Overarching principles for internal models

Relevant regulatory references

Legal Background	Date of issue	Articles	Section
CRD	26/06/2013	3(1)	7, 9, 11
CRR	30/11/2013 (Corrigendum)	175, 185, 189, 190, 191,288, 292, 293, 368	
Final Draft RTS on assessment methodology for IRB	21/07/2016	3, 9, 10, 12, 13, 14, 16, 17, 30, 32	
Final Draft RTS on assessment methodology for IMA and significant shares	22/11/2016	7-34	
Other references	**Date of issue**	**Article**	**Section**
SREP Guidelines[8]	19/12/2014	235	

5. Unlike the other topics of this document that relate to the IRB approach, the overarching principles for internal models are intended to cover all internal models but operational risk models.

2.1 Application of consolidated vs. subsidiary level guidelines

6. To have a holistic understanding of risks and risk measurement, it is expected that institutions will either develop group-wide principles and guidelines relating to the development and maintenance of internal models[9], or ensure that each relevant entity has an appropriate, independently audited framework in place.

   (a) Where an institution has group-wide policies and guidelines, a consistent and well-integrated level of application is expected.

   (b) Where different principles and standards exist between the subsidiary and the group, the institution should have plans or processes to review and benchmark the appropriateness of its local principles and standards. This includes the development of controls to mitigate gaps in practice and any associated risk.

   (c) Group permission for entities to use a “comply or explain” approach (e.g. to allow for national differences in regulation or practice if this is well justified) should be clearly defined in group-level policies.

8 Guidelines on common procedures and methodologies for the supervisory review and evaluation process (SREP) (EBA/GL/2014/13).

9 In the case of credit risk, read “internal models” as “rating systems” hereinafter.

2.2 Measurement of model risk across the internal models of the group[10]

7. An institution should have a model risk management framework in place that allows it to identify, understand and manage its model risk[11] as it relates to internal models across the group. This framework should include the following.

   (a) A model inventory that allows a holistic understanding of their application and usage.

   (b) Guidelines on identifying and mitigating the areas where measurement uncertainty and model deficiencies are known. In particular the elements that relate to qualitative aspects of model risk (such as model misuse or implementation error) should be considered. This methodology should be applied consistently to the internal models across the group (e.g. within subsidiaries or regions).

   (c) Definitions of roles and responsibilities.

   (d) Definition of policies, measurement procedures and reporting.

2.3 Identification of management body and senior management

8. Institutions should be able to clearly identify and differentiate the roles and responsibilities of their management body and senior management in their governance structures as defined in Article 3(1) sub-paragraphs (7) and (9) of the Directive 2013/36/EU (CRD IV). This evidence should be shown with regard to internal models and in relation to each risk type. The internal documentation of the institution should clearly state which individuals and/or bodies constitute the management body and the senior management.

9. The term “management body” could for instance refer to the single board, in a one-tier system, or to the role of the management and supervisory boards in a two-tier corporate governance system. Note that this concept should be interpreted in a functional perspective and should refer to the management body in both its supervisory[12] and management functions. The institution should document the roles and responsibilities of each individual in the management body.

10. The institution should assess the appropriateness of designated committees from the management body in order to ensure effective decision-making procedures. This holds in particular for decisions which concern the material aspects of the internal modelling. The institution should clearly document the

[10] This document focuses on internal models, but institutions are expected to implement an effective model risk management framework for all models.

[11] Similarly to any other risk category.

[12] As defined in Article 3(1) sub-paragraph (8) of the CRD IV.

composition, mandate and reporting lines of committees responsible for internal model governance and oversight, as well as the decisions they take. These committees should be mandated by the management body and generally chaired by a management body member.

11. The institution should also be able to identify which individuals constitute its senior management. In addition to the specifications of Article 3(1) sub-paragraph (9) of the CRD IV, senior management should be a level below the management body in the hierarchical structure of the institution and should report directly to the management body, providing it with the necessary information to carry out its duties, especially with regard to its oversight role. The senior management's decision-making procedures relating to all aspects of internal modelling should be clearly documented.

2.4 Documentation of internal models

12. All internal models should be documented in such a way that a third party would be able to understand the methodology, assumptions, limitations and use of the model.

    (a) Institutions should have a concept of what constitutes a model; this concept should be documented/fall under model governance. Identified models should be inventoried in a manner that facilitates a holistic understanding of their application and use.

    (b) The thoroughness of model governance should be proportionate to the materiality of the model. However, it is expected that all models that are used for business decisions should be properly documented.

13. The scope of the required documentation (e.g. areas to be covered) for each type of model should be properly defined. Areas to be covered include the technical aspects of the model (methodology and assumptions), instructions for model users and performance/validation (including the results of implementation testing).

2.5 General principles for internal validation

2.5.1 Organisation and staff of the internal validation function

14. All internal models and internal estimates should be subject to a thorough and consistent internal validation (initially and then on an annual basis). The main role of the internal validation function should be to ensure that the quality of the internal models is adequate and that they comply with the relevant requirements.

15. The institution may choose from three different organisational options in terms of independence from the risk control unit (*proportionality principle*)[13]:

    (a) separation into two different units reporting to different members of the senior management;

    (b) separation into two different units reporting to the same member of the senior management;

    (c) separate staff within the same unit.

16. The first two options are possible for all banks classified as significant institutions (SIs). When using the second option (two different units reporting to the same member of senior management), the institution should ensure that the additional requirements specified in Article 10(3) of the Final Draft RTS on assessment methodology for IRB and Article 22(1)(e) of the Final Draft RTS on assessment methodology for IMA and significant shares are fulfilled.[14] They should also ensure, in particular, that the internal audit regularly assesses the fulfilment of these additional requirements.

17. The third option is only possible for SIs which are not classified as Globally significant institutions (G-SIIs) or other systemically important institutions (O-SIIs).[15] When using the third option, institutions should ensure that the additional requirements specified in Article 10(4) of the Final Draft RTS on assessment methodology for IRB and Article 22(2) of the Final Draft RTS on assessment methodology for IMA and significant shares are fulfilled,[16] and especially that the internal audit regularly assesses the fulfilment of these additional requirements.

18. If two different units validate their internal models alternatively[17], the independence requirement is not considered to be fulfilled (under any of the above-mentioned options).

19. The internal validation function should be adequately staffed following the proportionality principle. It should have suitable resources and experienced, qualified personnel (who have appropriate quantitative and qualitative knowledge) to perform all related activities.

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13 The appropriateness of the three options for SIs will be re-assessed after the completion of the GT on-site reviews.

14 This also holds for counterparty credit risk.

15 SIs not considered as O-SIIs with effect from 30 June 2016 are those not included in the list available here.

16 This also holds for CCR.

17 For example, Unit A develops model X and validates model Y, Unit B develops model Y and validates model X.

2.6 General principles for internal audit

2.6.1 Organisation, staff and reporting of the internal audit

20. In order to allow an objective assessment, the internal audit function should be granted an adequate level of independence from the reviewed processes and units to ensure that:

    (a) there is effective separation between the staff performing the internal audit function and the staff involved in the operation of the internal models: internal validation, risk control unit and the relevant business area;

    (b) the internal audit reports directly to the management body;

    (c) no undue influence is exerted on the staff responsible for the audit conclusions.

21. Furthermore, the corresponding unit(s) should be located at an appropriate level in the institution's organisation.

22. A review should take place as to whether the internal audit:

    (a) has adequate resources and experienced, qualified personnel (with the appropriate quantitative and qualitative knowledge) to undertake all relevant activities;

    (b) is adequately equipped and managed in proportion to the nature, size and degree of complexity of the institution's business and organisational structure.

23. Where weaknesses are identified, the internal audit should ensure that there is an adequate decision-making process in place.

    (a) Conclusions, findings and recommendations should be reported to the senior management of the institution.

    (b) Action plans and related measures should be approved by the appropriate management level of the audited areas (the management body, the bank's senior management or its audit committee, depending on the corporate governance model). Depending on the severity of the audit findings, the internal audit function may report to a higher or lower management level.

    (c) The internal audit should ensure that corrective measures are implemented in a timely manner by the audited areas. Regular (at least annual) status reports should be prepared and the results should be discussed in the appropriate committees to ensure the timely and proper implementation of the follow-up actions.

3 Roll-out and PPU

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	148, 149, 150	
Final Draft RTS on assessment methodology for IRB	21/07/2016	1, 6, 7, 8	
Other references	**Date of issue**	**Article**	**Section**
EBA Consultation paper 2014/10[18]	26/06/2014	Entire paper and responses received and published were considered	

3.1 Application of the IRB approach

24. The IRB approach should be applied by asset class.[19] For example, once a bank receives the authorisation to use the IRB approach for an asset class, it is expected to extend it across all material exposures within that asset class. It is proposed that, at consolidated level, the minimum coverage per asset class to which the IRB approach is applied would be 50% of exposures at initial application of the IRB approach, with a target ratio of 80% by the end of the implementation period.[20]

25. As a consequence of Article 148(3), this proposal would overrule any related local regulatory constraint for SIs.

26. The criteria used to determine the application and/or roll-out of the IRB approach to the proposed asset classes should be clearly documented and agreed with the competent authority. The criteria are expected to reflect, at a minimum, the time frame for the roll-out plan (not expected to exceed five years), the materiality and risk profile of the exposures (it is expected that SIs adopt the IRB approach for all their core asset classes), the amount and quality of the data available to develop a rating system, and the operational capability and cost of developing the system.

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18 Consultation Paper "Draft regulatory technical standards on the sequential implementation of the IRB Approach and permanent partial use under the Standardised Approach under Articles 148(6), 150(3) and 152(5) of Regulation (EU) No 575/2013 (CRR)" (EBA/CP/2014/10).

19 For the purpose of implementing the IRB approach, the asset classes are: sovereigns, banks, corporates (except the types of exposures listed thereafter), corporates – specialised lending (SL), corporates – purchased receivables, Qualifying revolving retail exposures (QRRE), residential real estate RRE, other retail, retail – purchased receivables.

20 The following exposures should be excluded from the calculation of the coverage ratio: equity exposures for which the CRR envisages (PPU under certain circumstances, EU Sovereigns in PPU and other PPU exposures as stated in CRR Article 150(1) sub-paragraphs (e), (f), (g), (h), (i) and (j).

3.2 Governance of the roll-out plan for the IRB approach

27. It is expected that the status and progress of the IRB roll-out will be an agenda item for the management body or designated committee. The reporting frequency for the roll-out plan should be proportionate to the materiality of the portfolios that are still in roll-out, and in any case no less than annually. At a minimum this reporting should include the exact scope of application (exposure class), the planned dates of approval and/or use, exposure at default (EAD) and risk-weighted asset (RWA) of the exposures.

28. Institutions are expected to have a framework or policy for the governance of their roll-out plan that includes the following:

    (a) the persons or committees responsible for approving the roll-out plan and any changes to it;

    (b) the frequency of reporting on the roll-out plan to the management body (or designated committee) and to the competent authority;

    (c) the criteria used for changes to the roll-out plan (see also Section 3.3, below);

    (d) the controls to assess compliance with the roll-out plan, for example second line of defence attestation or internal audit review.

3.3 Changes to the roll-out plan for the IRB approach

29. Article 7(3) of the Final Draft RTS on assessment methodology for IRB lists the criteria whereby competent authorities may approve any changes to the sequence and time period of the plan. It is expected that any change to the roll-out plan will be internally assessed against these criteria, with documentation produced regarding the rationale for the change, the materiality of the portfolios affected, and governance arrangements for the change (e.g. which unit will approve it).

30. Further expectations are provided below.

    (a) Resource constraints and re-prioritisation may affect the operational capability to develop and maintain rating systems. Institutions should look to minimise disruptions to the roll-out plan as a result of such factors, taking appropriate mitigation or contingency actions to demonstrate compliance with the CRR requirements.

    (b) General uncertainty caused by potential changes to the IRB regulatory requirements (e.g. consultation papers) should not be considered a valid reason for changing the roll-out plan (in particular for delaying its development). If such regulatory changes become policy, an institution can then reflect the impact of this policy in their plans by submitting a revised roll-out plan for approval.

3.4 Monitoring of PPU compliance

31. Institutions should have a procedure and policy in place to ensure compliance with the requirements for permanent partial use (PPU) as listed in Article 150 of the CRR, to ensure that PPU is applied appropriately. In particular, institutions should develop the following.

    (a) A reporting process to state the materiality (in terms of RWA and EAD) of the exposure classes or types of exposures in PPU. It is expected that such reporting will consider the way in which the materiality has changed over time.

    (b) Measures and triggers for a re-assessment of the suitability for PPU of PPU-authorised classes or types of exposure. Examples of measures that could be used include the number of obligors, EAD, proportion of group EAD, and average risk weight.

    (c) Some processes and guidelines to assess whether further exposure types may be suitable for PPU, e.g. a business in run-off and/or planned to be discontinued.

4 Internal governance

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	175, 187, 189, 190,	
Final Draft RTS on assessment methodology for IRB	21/07/2016	14, 15, 16, 33	
Other references	**Date of issue**	**Article**	**Section**
Basel Committee on Banking Supervision (BCBS) 328[21]	08/07/2015		Principles 1, 2, 3, 4, 5, 6

32. The principles on internal governance have been organised along the following lines:

    (a) the management body and senior management:

        (i) decision-making responsibilities (Section 4.1);

        (ii) internal reporting (Section 4.2);

        (iii) understanding of the rating systems (Section 4.3);

[21] Guidelines: Corporate governance principles for banks.

(b) composition and independence of the credit risk control unit (CRCU) (Section 4.4);

(c) governance of rating system information (Section 4.5).

4.1 Decision-making responsibilities

33. In accordance with Article 189(1) of the CRR, material aspects of the rating and estimation processes should be approved by the institution's management body or a designated committee thereof, as well as by senior management. Alongside this, Article 14(b) of the Final Draft RTS on assessment methodology for IRB specifies which policies are considered as part of these material aspects and therefore should be approved at both levels.

34. It is expected that institutions document the approval of these IRB provisions as a form of evidence. Such information should be made available for review on demand by the institution’s internal audit unit or its competent authority. The institution should define which policies should be approved at both levels and this should be clear in the respective mandates. At a minimum, risk management policies that could have a material impact on the institution’s rating systems and risk estimates should be considered. These policies should cover, in particular, the risk of a third-provider for model-related tasks ceasing to operate (in relation to IT infrastructure and contingency planning, as per article 14(b)(ii) of the Final Draft RTS on assessment methodology for IRB).

35. In accordance with Article 189(2)(a) of the CRR, institutions should be capable of demonstrating which material changes or exceptions from established policies, that will materially impact the operations of their rating systems, are communicated to the management body, and how. To this extent, the institution should define guidelines for assessing the materiality of these changes or exceptions, which may include the use of quantitative and/or qualitative criteria. The use of expert judgement within the classification process should be clearly justified and documented.

4.2 Internal reporting

36. Reports on the performance of the rating systems should be provided to the management body and senior management on a regular basis (no less than yearly), with information regarding the materiality of each rating system, its perceived strengths and limitations, and its current status in the light of validation and/or audit actions. Article 15 of the Final Draft RTS on assessment methodology for IRB establishes the elements to be included as part of the institution’s internal reporting. Proportionality should be applied in deciding the level of detail of the information and data to be presented to the senior management and management body, and the frequency of the reporting. Institutions should be able to demonstrate the adequacy of both. Reports to the

management body are expected to be more concise than reports to senior management; they should however include the necessary information for sound and appropriate decision-making.

37. Regarding the frequency of reporting, as senior management is expected to support the management body in its oversight role, institutions are expected to provide senior management with at least the same or more frequent reporting and, in general, more detailed and comprehensive information. In particular, risk profiles and the comparison of realised and expected default rates should be reported to senior management more frequently than annually. At least annually, both the senior management and management body should receive an aggregated overview of the validation results for every rating system.

4.3 Understanding the rating systems

38. Institutions should be able to provide evidence of the processes they use to improve and maintain the management body and senior management's understanding of the rating systems, including those implemented after receiving permission to use the IRB approach.

39. This documentation should be able to associate the form and content of the process (for example workshops, seminars or dedicated training on IRB models) with the responsibilities of, or decisions made by, the management body and senior management, in particular those related to the model approval process. Especially for the management body, an adequate balance between collective and individual knowledge should be ensured. In the case of third party involvement (see chapter 10), the institution should maintain adequate internal knowledge of the outsourced tasks.

40. As reporting or monitoring can be considered as part of the management body and senior management's knowledge process, it is expected that these will not be the only means for ensuring an adequate understanding of the rating systems by these parties.

41. One outcome of an effective internal understanding of the rating system is an objective debate on, and the ability to challenge, the rating systems at management body level. Evidence of such debates should be clearly stated in the minutes of management body meetings that raise such a challenge, as the management body should be able to discuss the outcomes, use, strengths and limitations of the IRB models.

4.4 The CRCU

42. Institutions should clearly define which individuals and/or teams make up the CRCU and explain to what extent it is independent of the personnel and management functions responsible for originating and renewing exposures.

43. Institutions are expected to be able to clearly identify which personnel and/or units are responsible for originating and renewing exposures. In particular, the institution should be able to distinguish between direct responsibility (underwriting) and indirect responsibility (for example lending strategy), and how this is reflected in the independence of their CRCU function.

44. Institutions should have a clear written mandate for their CRCU which clarifies the roles and responsibilities of this unit, in particular how the areas of responsibility described under Article 190(2) of the CRR are ensured. Institutions should be able to demonstrate which business units are responsible for the performance of the tasks allocated to the CRCU and how the CRCU is able to perform its tasks without undue influence from the business units, and that all tasks related to the origination or renewing of exposures are performed by different units.

4.5 Governance of the documentation on internal models

45. The institution should be able to demonstrate how its documentation and the register of rating systems facilitate internal and external understanding of the rating system and the decisions that have been made.

46. Adequate controls should be in place surrounding the register of their IRB models as well as an inventory of the documentation. This includes a policy for document management that clearly states the roles and responsibilities involved when approving documents, as well as how changes in documentation are implemented and communicated internally. In addition, the bank should have a policy regarding the adequate archiving and maintenance of information, access permissions and the assessment of the completeness and consistency of information.

47. Documentation should be kept up to date and the institution should keep documents for an appropriate period of time, taking into account legal or regulatory retention periods.

48. Alongside the items listed in Article 33 of the Final Draft RTS on assessment methodology for IRB regarding the contents of the register of rating systems, institutions should have access to “top down” views of the rating system models that succinctly present key information on each model, for example its materiality, approval date, validation status and current performance. Such “model ID cards” should be updated on a regular basis and have a role in the reporting of the rating system.

5 Internal Audit

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	191	
Final Draft RTS on assessment methodology for IRB	21/07/2016	17	
Other references	**Date of issue**	**Article**	**Section**
BCBS 328	08/07/2015	43, 139, 140, 141, 142, 143	
EBA Guidelines on Internal Governance (GL 44)	27/09/2011	II. 3. 35	
		III. D. 29.1, 3, 4, 5, 6	

5.1 Scope and frequency of the review of the rating systems

49. Pursuant to the existing regulatory requirements, the internal audit or another comparable independent auditing unit should review the rating system and its operations at least annually. The areas for review should include compliance with all applicable requirements.

50. As a result, it is expected that, on an annual basis, the institution will carry out a general risk assessment of all aspects of the rating systems in order to define the appropriate internal audit work plan. When an area shows signs of increased risk (including, but not limited to, new processes, warnings from data quality reports or internal validation reports, or new exposures in the range of application of a rating system, etc.), it should be subject to a thorough new review ("deep dive"). For other areas where no significant change has occurred the internal audit may keep its opinion unchanged.

51. The outcome of this annual risk assessment is expected to be properly documented. This assessment should include at least the opinion of the internal audit unit or any other comparable independent auditing unit on the following aspects[22].

    (a) The development[23], performance[24] and use of the rating systems. The use assessment should show that the rating systems play an essential role in the most basic areas of risk management (credit decisions, competences for the credit approval process, lending policies, risk monitoring and reporting) and in the internal capital allocation.

[22] The internal audit opinion may rely on analysis performed by the internal validation unit, except for those aspects related to the internal validation function and governance

[23] The scope should include the initial validation tasks described in the internal validation principles.

[24] The scope should include the annual/regular basic tasks described in the internal validation principles.

(b) The changes to any material aspects of the model.

(c) The quality of the data used for the quantification of risk parameters and the integrity of the rating assignment process.

(d) The internal validation function, challenging the scope and suitability of the tasks and outputs performed.

(e) The process for calculating own funds requirements.

52. The procedures for the general assessment and prioritisation, the annual work plan, the different auditing techniques and guidelines, and the subsequent production of the internal audit reports are expected to be properly documented.

6 Internal Validation

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	144	1 (c)
		174	
		185	(b)
Final Draft RTS on assessment methodology for IRB	21/07/2016	10	1 (a), (b), 2 (a)
		13	(b)
		14	(b), (d)
		11	1 (b), 2 (c)
		12	(a), (c), (d), (e)
		39	(a)
		30	3 (b)
Other references	**Date of issue**	**Article**	**Section**
BCBS Newsletter No4[25]	01/2005		
BCBS Regulatory consistency assessment programme (RCAP)[26]	04/2016		

53. In the context of rating systems, the term “validation” encompasses a range of processes and activities that contribute to an assessment of whether ratings adequately differentiate risk, and whether estimates of risk components (such as probability of default (PD), loss given default (LGD) and credit conversion factor (CCF)) appropriately characterise the relevant aspects of risk.

[25] Update on work of the Accord Implementation Group related to validation under the Basel II Framework.

[26] BCBS Regulatory Consistency Assessment Programme (RCAP) – Analysis of risk-weighted assets for credit risk in the banking book.

54. The main role of the internal validation function is to ensure an adequate quality of the rating systems and their compliance with the relevant requirements. The term “validation function” encompasses the personnel responsible for the performance of the validation as well as the arrangements, mechanics and processes used in the validation of rating systems.

6.1 Validation level

55. In general, the internal validation should be performed at all relevant levels. If the institution only has approval for a rating system at group level, validation should be performed at least at group level. If the institution has approval for a rating system at more than one level (group level and sub-consolidated or individual level), validation should be performed at all of these levels.

6.2 Content and frequency of tasks of the internal validation function

56. Validation policy:

    (a) Institutions should have internal validation policies involving proven procedures and methods which adequately validate the accuracy, robustness and stability of their estimation of all relevant risk parameters.

57. Validation process and content:

    (a) The validation process and content are expected to be consistent across rating systems. However, it is not expected that institutions develop a unique validation process, as the relevant tests may differ from one rating system to another (e.g. corporate vs. retail rating systems). The analyses and tests depicted in this section should be considered as good practice requirements; however, the implementation of all of them does not necessarily mean that the validation requirements have been fulfilled, nor should it prevent the institution from developing additional tests when deemed relevant.

    (b) The institution’s internal validation process should evaluate the performance of the rating system applied under the IRB approach appropriately, logically and consistently, with regard to the ranking of borrowers by creditworthiness (ranking quality) and parameter estimation (calibration quality). The performance assessment should be based on the risk database and not on an intermediate extraction. Therefore, the institution should ensure that the validation unit has its own access to the relevant databases.

    (c) The institution should ensure that any statistical tests or confidence intervals used by the bank are appropriate from a methodological point of view (or sufficiently conservative).

(d) Analyses and tests that should be performed at least **on an annual basis** are:

(i) Back-testing, as per Article 185(b) of the CRR

(ii) Discriminatory power

- This should relate to at least the levels of the overall model as well as to the individual risk factors and possible subsets including, for example, scorecards and modules.

(iii) Analyses of representativeness

- The data set used to build the model should be representative of the current obligors or positions (Article 174(c) of the CRR). This should include the following checks.
  - To ensure that the range of application of the model is in line with the one approved, in accordance with Article 143(3) of the CRR, the comparison of obligor characteristics should be made for PD models, and the comparison of facility types and characteristics should be made for LGD models. This analysis should also include an assessment of the definition of default used to calibrate the model over time.
  - Monitoring of the register of the modifications undertaken in the definition of default, with a view to ensuring that no changes have been made that would be applicable to obligors or facilities in the range of application of the model.
  - Analysis of lending standards or work-out procedures, external market and economic conditions, and other relevant characteristics surrounding the model development process.
- Where an institution uses data that are pooled across institutions, the analyses should also cover the requirements of Article 179(2) sub-paragraphs (a) and (b) of the CRR.

(iv) Analyses of overrides

- Overrides should not only be monitored but also assessed as part of the validation process (Article 172(3) of the CRR). See also chapter 7.

(v) Stability analyses

- The stability of the internal ratings and risk parameters over time should be checked. Excessive or unexpected variability should be justified.

- The stability of the model design should be checked. As an example, the institution is expected to analyse the differences between the original weights of the risk drivers (development sample) and the weights estimated from a different sample (longer or more recent historical sample).

(vi) Evaluation of input data

- This should ensure all of the following:
  - that the data treatment process is reliable and well-founded;
  - that the necessary information is available and up to date for the majority of the application portfolio's obligors and facilities by tracking the age of model input data, especially in the case of financial statements;
  - that all defaults that occurred in the institution within the scope of application of the model are correctly identified and fully documented and registered in the appropriate and intended IT systems;
  - that the number and reasons for technical defaults are tracked.

(vii) Other quantitative analyses:

- the institution should analyse cases where back-testing or other analyses reveal abnormalities, if applicable by means of other quantitative methods.

(viii) Qualitative analyses, for example:

- qualitative assessments of the assumptions and expert-based estimates and the integrity of the rating assignment process;
- assessment of the use of the models and their correct application in practice (see also chapter 7);
- assessment of legal or macroeconomic changes that may impact the risk parameters.

(e) Additional tests that should be performed **on a periodic basis** are:

(i) Benchmarking analyses:

- the bank should carry out comparisons with representative, comparable, external up-to-date data sources, and in particular with low-default-portfolios (Article 185(c) of the CRR).

(ii) Data cleansing analyses

(f) Additional tests should be performed at least **at initial validation** (and if applicable after material model changes).

(i) Replication of the model development phase, challenging model design, assumptions and methodology. A stepwise initial validation process involving interaction with the model development function at every step of the development phase does not guarantee an effective challenge.

(ii) Quality assurance of the computer code.

(iii) This should include at least the following:

- that the implementation of the model in the respective IT system is compliant and reproduces exactly the documented model under review;
- that the description of the data sources and the variables and risk factors used for development purposes are properly documented;
- that the information used for model review purposes is provided in order to easily detect all differences in the latest datasets used for model development.

58. The duration from the start (reference date of data) to the end (approval of the validation results) of the yearly validation should not be more than one year.

59. The unit(s) in charge of performing the validation tasks should be neither the CRCU nor any other development unit, except for institutions making use of the third organisational option for independence (see Section 2.5.1)[27].

60. Thresholds should be implemented as triggers for further investigation. Such investigation should justify deviations from the specific thresholds.

61. Thresholds should be set up for at least the following tests:

(a) back-testing;

(b) discriminatory power;

(c) analyses of representativeness;

(d) analyses of overrides;

(e) stability tests;

(f) benchmarking analysis.

[27] The appropriateness of the three options for SIs will be re-assessed after the completion of the GT on-site reviews.

6.3 Reporting (including treatment and processing of deficiencies)

62. Reporting:

    (a) the institution is expected to take the validation results properly into account throughout the model's lifecycle;

    (b) the institution's senior management should be informed of the results and/or performance, as well as of the exceeded thresholds.

63. Validation measures and results should be verifiable by third party experts (e.g. the internal audit and supervisors). This also includes the preparation of the validation data.

64. Validation results should also be aggregated and compared with all of the institution's rating systems. A summary report with an aggregated view of the results of all rating systems is expected to be produced.

65. Institutions should show that the validation results and recommendations affect the rating systems appropriately (e.g. model change, recalibration, etc.).

66. Banks should have adequate processes in place for tracking the action plan and monitoring the status of the findings. In particular, responsibilities should be clearly specified.

67. Institutions should have a committee to discuss the results of both model development and model validation activities. In addition, a process for escalation up to management board level should be in place in the event of conflicts between the validation and development units.

68. Banks should always notify the competent authority in the event of changes to their validation methodology and/or processes regarding annex 1 part 2 section 1 (material model change) or section 2 (ex ante notification) of Commission Delegated Regulation (EU) No 529/2014 (Regulatory Technical Standards (RTS) on model change)[28].

[28] Commission Delegated Regulation (EU) No 529/2014 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 assessing the materiality of extensions and changes of the Internal Ratings Based Approach and the Advanced Measurement Approach (OJ L 148, 20.5.2014, p.36).

7 Model use

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	144	1 (b)
		172	3
		179	1
Final Draft RTS on assessment methodology for IRB	21/07/2016	18, 19, 20, 21	
		23	1 (a)
		24	2 (a, b, c, d, e)
		42	1 (c)
Other references	**Date of issue**	**Article**	**Section**
BCBS Newsletter No 9[29]	18/09/2006	Principles: 1, 2, 3, 4	

Use test requirement

69. As a general principle, the degree of use of internal ratings and risk parameters in credit processes is expected to be more extensive for PD than for LGD and CCF. Moreover, these parameters can be used in an adjusted form or indirectly through relevant risk measures/indicators stemming from the rating systems, provided that this is fully justified and properly documented. For example, institutions may use adjusted or transformed IRB parameters removing certain constraints (e.g. downturn effect, conservative add-on, floor) or adjusting the time horizon.

70. The use of risk parameters and their integration into internal policies and procedures is intended to continuously improve their accuracy and reliability. The conditions for an effective and beneficial feedback loop include a good understanding of the model, its assumptions and constraints and an adequate level of interaction between users, CRCU and internal validation.

7.1 Risk management, credit approval and decision-making process

71. Banks' internal policies and procedures are expected to require the use of internal ratings or risk parameters in the following areas:

    (a) Approval and rejection of credit facilities

        (i) Institutions are expected to integrate the internal ratings into the overall credit granting and renewal process. Related policies should

[29] The IRB Use Test: Background and Implementation.

be calibrated on the basis of, at least, rating classes or groups of rating classes or PDs.

(ii) For this integration to be beneficial, staff involved in the credit granting and renewal process are expected to have sufficient knowledge of the rating systems, including their strengths and weaknesses. This could consist of having appropriate training programmes for the staff involved in the processes where ratings should be used.

(iii) In any case, the assignment or update of ratings should be a prerequisite for the assessments underlying the granting and reviewing of credit lines.

(b) Lending policies including exposure limits and mitigation techniques

(i) Lending policies should include specific references to the use of internal rating systems and the related parameters (for instance, use of a grid of parameters in the decision-making process). These parameters should serve as an indicator of riskiness (e.g. in terms of expected loss, etc.). They may be differentiated by banks' portfolios (e.g. retail/non-retail) and by facility type.

(c) Allocation or delegation of competence for the approval process

(i) Along with the materiality of credit lines, the credit approval delegation of competences for credit approval should take risk estimates into account either through one or several IRB parameters or through expected loss (for example, an increase of some expected loss (EL) -driven measures above a pre-defined threshold should typically trigger an escalation process).

(ii) The allocation and delegation process is expected to include a degree of proportionality, taking into account portfolio risk and facility types.

72. In addition, banks' internal policies and procedures are expected to require the use of the internal ratings or risk parameters in the five areas shown below. If an institution is not using the internal ratings or risk parameters in one or several of those areas, it should be able to properly justify its rationale.

(a) Pricing of transactions

(i) Ratings and risk estimates are expected to play a role in the pricing of transactions, in particular for non-retail exposures.

(ii) The methodology underlying pricing should be documented and the use of risk-adjusted performance indicators (e.g. return on risk-adjusted capital (RORAC)) or adjusted IRB parameters should be considered as good practice for pricing estimation.

(b) Early warning systems

(i) Early warning systems are expected to be applied to the whole bank's portfolio and to be tailored to its specific sub-portfolios (with at least a distinction between retail and non-retail).

(ii) PD/ratings dynamics (i.e. downgrades) and other indicators linked to other risk measures (e.g. expected loss, loan-to-value, overdraft) are expected to be taken into account in the bank's early warning system: whenever an anomaly is detected, a specific exposure management process should be triggered. This process should be adjusted depending on the persistency and intensity of the warning. It can also be designed according to other variables such as exposure size or facility type.

(c) Collection and recovery policies and processes

(i) Regarding the collection process, banks are expected to have in place recovery processes which are triggered in advance of the exposure's default (e.g. early collection calls) and based – among other indicators – on the internal ratings or risk parameters (e.g. PD and/or exposure size).

(ii) The non-performing loans (NPL) management department is expected to have in place a tool that takes into consideration, inter alia, the LGD/ expected loss best estimate (ELBE) values, as well as the set-aside provisions. This information can be useful in the case of asset disposals and/or securitisation.

(d) Credit risk adjustments

(i) Collective provisioning both for performing exposures and for defaulted assets (or share of defaulted assets) is expected to be based on IRB parameters, although specific adjustments might be needed to comply with accounting standards.

(ii) With regard to specific provisioning, expert judgement outcomes are expected to be consistent with the expected loss resulting from the use of internal IRB parameters (ELBE). The bank should justify any significant deviations.

(e) Internal capital allocation

(i) Banks are expected to make use of IRB parameters, including adjusted ones, to calculate their internal capital under the ICAAP framework (RWA could also be used as an additional driver).

(ii) Adjustments to IRB parameters should be thoroughly justified and explained in banks' internal documentation.

73. Breaches or overruling cases of internal policies and procedures (especially the ones mentioned in (a), (b) and (c) of paragraph 71 above) should be properly documented and monitored regularly.

7.2 Corporate governance functions

74. Banks' internal policies and procedures are also expected to require the use of internal ratings or risk parameters in the following areas:

    (a) Institutions' internal reporting

        (i) Banks are expected to have a structured reporting system on risk measured by the IRB risk parameters. This reporting framework should contain information about frequency, recipients and contents (if possible broken down by segment, portfolio and product).

        (ii) The reports should be accompanied by comments and explanations of the numbers provided and by qualitative assessments, to enable recipients to fully understand the potential underlying risks.

    (b) Portfolio credit risk monitoring

        (i) The credit risk control unit usually performs descriptive analyses of portfolio riskiness (distribution of exposures among rating classes, average probability of default, expected losses): these tests should be progressively refined to include the analytical insights derived from the information on ratings.[30]

        (ii) Reporting to senior management should provide a concise but complete overview of the relevant variables so that the evolution of credit risk can be monitored. Those in charge of the monitoring process for individual positions should be promptly provided with adequate information on the development of counterparties' credit risk as expressed by ratings, so that the relevant information can be easily integrated into the process and trigger appropriate actions.

[30] For example: highlighting, in aggregate terms, the volume of credits whose rating has worsened by more than one class ("double downgrade"), rating stability, the speed and frequency of rating modifications, the incidence of defaults, the relationship between "upgrade" and "downgrade" at the portfolio level in a given period of time, changes in rating by line of business, market segment, type of credit line.

7.3 Assignment of exposures to grades and pools

7.3.1 Non-rated exposures and outdated ratings

75. As general principles:

76. Exposures within a range of application of an IRB rating system (neither in roll-out nor PPU) are not expected to be treated under the standardised approach.

77. Banks' portfolios will likely include a certain proportion of non-rated exposures and/or outdated ratings. However, if such exposures or ratings are either absent or present to an excessive degree, this should be properly justified and documented.

78. The prudential treatment adopted to manage non-rated and outdated ratings should envisage a penalty system that impacts the IRB parameters.

    (a) Materiality

        (i) Institutions are expected to implement specific policies and/or procedures to define non-rated exposures and outdated ratings and to monitor their materiality (in terms of number, EAD and RWA). A formal check should be carried out on these issues (at least yearly) and reported to management. These items should also be reviewed periodically by the internal validation and/or the internal audit unit.

    (b) Root causes

        (i) Non-rated exposures should usually be considered as exceptions to the "ordinary" rating assignment process and therefore investigated, documented and justified in detail (e.g. foreign companies presenting a financial statement prepared in accordance to different accounting standards, erroneous mapping of positions under PPU, etc.)

        (ii) In the case of outdated ratings, with regard to the corporate IRB class the rating should be fed with financial information taken from balance sheets dating back no more than two years. However, any qualitative information should be updated annually. With regard to the retail class, outdated ratings are expected to be even more immaterial

    (c) Prudential treatment

        (i) Banks are expected to have internal policies defining management and prudential processes, designed to monitor and manage non-rated exposures and outdated ratings. In particular, banks should be able to prove that their procedures allow for a conservative measure of risk (e.g. a time-dependent downgrading applied to outdated ratings).

(ii) The calibration of the prudential treatment is expected to be validated at least annually (statistical evidence of conservativeness).

7.3.2 Analysis of overrides

79. The term “overrides” refers here to instances where human judgement results in deviation from the inputs or outputs of rating systems.

80. As a general principle, the rating of retail exposures should only be marginally affected by an override process due to the high standardisation of information processing – including in qualitative terms – and the small margins of discretion in the evaluation.

(a) Documented policies

(i) Banks should have documented policies for overrides in place which should:

- include clear and exhaustive justifications for triggering the override process on the basis of pertinent and significant information for an accurate assessment of the counterparty’s creditworthiness;
- define the maximum extent of overrides (in terms of, for example, maximum number of notches up/down); banks should aim to be more restrictive with positive overrides than with negative ones.

(b) Analysis of performance

(i) Banks should carry out the following procedures.

- Performance analysis of models, in order to assess if the judgemental adjustments of model outcomes improve their discriminatory power. These observations, valid for the final output of the internal system, may be extended to all its components (modules). It might be particularly useful to measure the performance and impact of the “pre-override” and “post-override” stages.
- Other analyses, including the assessment of the distribution of overrides by override root cause, i.e. if there is a situation that systematically triggers an adjustment.

(c) Collection of information

(i) Banks should retain the quantitative and qualitative information concerning each phase of the rating attribution process. In particular, all decisions taken throughout the process – including provisional ratings – should be recorded (including digital ones), as should the

reasons for any override. The information should be proportionate to the severity and extent of the override.

(d) Triggers for redevelopment or recalibration

(i) Banks should identify specific criteria for assessing whether or not the number of and justifications for overrides indicate significant weaknesses of the rating model and whether this is a reason to take ad-hoc action (e.g. a model change). In general, situations where there are too many overrides could be a strong indicator of weaknesses in the model (i.e. systematic and material adjustments can be the consequence of a misspecification of the model). This depends on the type of model: for low default models where there are few statistical data, the human judgment component is expected to be more relevant.

8 Management of model changes

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	143	3, 4
		145	3
Final Draft RTS on assessment methodology for IRB	21/07/2016	22	1 (a, b)
		86, 87	
RTS on model changes (EU 529/2014)	12/03/2014	2, 3, 4, 5, 8, Annex 1	

81. Changes to a rating system's range of application or to a rating system itself are subject to approval by the competent authorities if assessed as material, or to ex ante or ex post notification if non-material. A policy related to rating system changes should be in place and should have a minimum content requirement including detailed criteria that ensure that the classification of changes is consistent and that any arbitrage in that regard is avoided.

8.1 Documentation

82. According to Article 86 of Final Draft RTS on assessment methodology for IRB, each institution is expected to have a dedicated "change policy" in place, i.e. a policy related to changes/extensions of rating systems and their range of application and to the internal models approach to equity exposures, where applicable. This change policy should include provisions relating to the operationalisation of the requirements of Commission Delegated Regulation (EU) No 529/2014. The change policy should include:

(a) "Responsibilities, reporting lines and procedures for the internal approval of changes, taking into account the institution's organisational characteristics and approach specificities"[31]; the change policy should define at least the unit(s) responsible for the assessment and the classification of the model changes or extensions, as well as the unit responsible for confirming and countersigning the classification.

(b) Definitions, methods and, where applicable, metrics and significance levels for the impact assessment, threshold calculation and the classification of changes; in particular, the quantitative/qualitative criteria referred to in Commission Delegated Regulation (EU) No 529/2014. In addition, as required in Annex 1, Part 2, Section 1 of the Regulation and to ensure consistency, the following should be observed.

  (i) The institution should specify metrics and significance levels that define the significance/materiality of changes in the distribution across rating grades produced by the changes to the rating methodology (paragraph 2(d)(ii)); these metrics and significance levels should be complementary to those of Articles 4(2) and (3), and Article 5(2) of the same Regulation.

  (ii) The institution should specify metrics and significance levels that define the significance/materiality of rating migrations produced by the changes in the rating system's assumptions on the impact of economic conditions (paragraph 2(c)).

  (iii) The institution should specify metrics and significance levels that define the significance/materiality of changes in the rank ordering of clients/exposures (paragraph 2(d)(i)).

  (iv) In its change policy, the institution should define which changes in the methodology for estimating PDs, LGDs (including best estimate of expected loss), and conversion factors are considered as fundamental in the sense of paragraph 2(f) of Section 1 (as opposed to the changes referred to in paragraph 2(h) of Section 2).

  (v) The institution's change policy should include a definition of "the institution's judgement of the accuracy and consistency of the estimation of the relevant risk parameters, the rating processes or the performance of their rating systems" (paragraph 4 of Section 1).

(c) Procedures to identify and monitor changes, and to notify and apply for permission to the competent authorities with respect to such changes. In particular, SIs should establish an end-to-end process from identification to notification/application and describe how they perform the activities at each step.

[31] Article 87 of Final Draft RTS on assessment methodology for IRB.

(d) Procedures for the implementation of changes, including their documentation; in particular, the re-rating process should be defined (if no other document is already in place).

8.2 Notification

83. The institution is expected to use a harmonised “template”, ensuring consistency and completeness in the notification process. The template should include:

(a) a description of the extension or change, its rationale and objective;

(b) the implementation date;

(c) the scope of application affected by the model extension or change, with volume characteristics;

(d) technical and process document(s);

(e) reports of the institution’s independent review or validation;

(f) confirmation that the extension or change has been approved by the competent bodies through the institution’s approval processes and the date of approval;

(g) where applicable, the quantitative impact of the change or extension on the risk-weighted exposure amounts or the own funds requirements;

(h) records of the institution’s current and previous version number of internal models which are subject to approval;

(i) descriptions on which management level and/or committee the model notification was approved by.

8.3 Classification

84. The institution is expected to have processes in place which specify, in detail, that the classification of a model change/extension is adequate and consistent with the classification of other changes/extensions. The institution should ensure that arbitrage is avoided. In particular, in line with Article 3(3) of Commission Delegated Regulation (EU) No 529/2014, one material extension or change should not be split into several changes or extensions of lower materiality. The opposite also applies: several changes/extensions should not be combined to produce one change of lower materiality. Similarly, an extension or change that requires notification before its implementation (ex ante) should not be split into several changes/extensions or combined into one that is notified after implementation (ex post).

85. In accordance with Article 3(4) of Commission Delegated Regulation (EU) No 529/2014, in case of doubt institutions should assign an extension/change to the category of the highest potential materiality.

86. To ensure the accuracy of the impact assessment and the correctness and consistency of the resulting classification, the institution is expected to establish a four-eyes principle; the minimum requirement is that the assessment and the classification are confirmed by a unit independent from the one responsible for the assessment and the classification of the model change/extension.

8.4 Responsibilities

87. It should be ensured that the units responsible for managing model changes or extensions possess the necessary expert knowledge to assess concrete model changes or extensions as well as an overall perspective on them. Therefore, it is possible that responsibilities will depend on the specific subject of the model change or extension.

8.5 Impact assessment

88. The impact assessment should fulfil the requirements of Commission Delegated Regulation (EU) 529/2014; it should consist of a quantitative and a qualitative assessment.

89. The quantitative assessment focuses on the impact of the model change or extension on risk-weighted exposure amounts. Before and after the change the institution should calculate the difference in these amounts for credit and dilution risk associated with the range of application of the internal rating system.

90. This quantitative assessment is based on the specifications of Article 4(2) and (3) and Article 5(2) of Commission Delegated Regulation (EU) No 529/2014. The institution should use transparent definitions and internal procedures.

    (a) The institution should document the relevant reference date on which the calculations are based. In accordance with Article 3(2)(a) of Commission Delegated Regulation (EU) No 529/2014, the institution should use the most recent data available. The time between the reference date and the date of notification should not exceed nine months. If the time between the reference date and the date of notification exceeds six months, the institution should explain the reasons for the difference.

    (b) The institution should give a precise definition of the range of application of the rating system applied in the calculations according to Article 4(1)(c) and 5(1) sub-paragraph (a)(iii), and ensure that the range of application of the rating system is directly related to the change to the IRB approach. The institution should describe the basic properties of the population of

clients/exposures in the range of application of the rating system (number of observations/exposures, minimum/maximum exposure, mean/median exposure, first/third quartile).

(c) The institution is expected to perform a precise impact assessment (all exposures of the relevant range of application) for retail rating systems.

(d) If the institution applies Article 3(2)(b) of Commission Delegated Regulation (EU) No 529/2014 and performs an impact assessment based on the re-rating of a representative sample of the population (only possible for non-retail rating systems), this sample and its relation to the population should be described in detail (respective number of observations/exposures, minimum/maximum exposure, mean/median exposure, first/third quartile). The representativeness of the sample should be documented.

(e) If the institution applies Article 3(2)(b) of Commission Delegated Regulation (EU) No 529/2014 and performs an impact assessment based on other reliable inference methodologies, these methods should be described in detail and their reliability corroborated by qualitative and quantitative means.

91. The qualitative assessment is based on the specifications of Article 4(1)(a) and (b) and Article 5(1)(a) sub-paragraphs (i) and (ii), which refer to the Annexes of Commission Delegated Regulation (EU) No 529/2014. The institution should thoroughly examine each of these criteria. In addition, as reported in the change policy, to ensure consistency SIs should examine the metrics and significance levels for the impact assessment and threshold calculation (as reported above for principle regarding “Documentation”).

92. If a criterion specified in the Annexes of Commission Delegated Regulation (EU) No 529/2014 may be applicable a priori (and within reason) to a model change or an extension and the institution’s assessment concludes that this particular criterion is not fulfilled, the institution should document this conclusion in the notification.

8.5.1 User acceptance test

93. In general, banks are expected to assess and document the impact of a material model change on the use of the parameters and ensure that the related internal policies and procedures for the areas described in paragraph 7.1 remain relevant.

94. In the context of rating systems which contain qualitative inputs and/or any expert judgement component, the exposures of the representative sample referred to in point (d) of paragraph 90 above should be fully re-rated under the new rating system, for example ensuring adherence to the entire rating

assignment process. The feedback received from users on the new rating system and the rating results is expected to be analysed and documented.

95. Model changes/extensions that are classified as non-material do not generally require the preparation of a use test sample, unless there is evidence of a potential impact on the use of the parameters.

8.5.2 Re-rating process

96. Institutions are expected to cover the re-rating process in their relevant policy.

97. Re-rating refers to the computation of a rating using the changed/extended rating system and the assignment of this new rating to an exposure previously rated using the previous model.

98. In the context of model changes/extensions that are classified as material, the policy should ensure that the rating transfer (re-rating process) is immediate, i.e. all former ratings should be replaced by ratings calculated using the changed/extended model at the date of approval – if the conceptual design allows this (e.g. for a rating system that is exclusively based on behavioural scoring). If this is not possible (e.g. if the rating assignment requires manual input and human judgement) then the policy should ensure that:

    (a) the ratings of the sample used for the impact assessment are transferred to the production environment at the date of approval of the model change/extension, unless new material information is available for those exposures;

    (b) the remaining clients/exposures/facilities are rated using the new system within a short time following the date of approval, and in any case within six months.

99. The re-rating process for model changes/extensions that are classified as non-material may take up to one year from the date of implementation.

8.5.3 Experience test

100. In the case of extension/roll-out, the institution should comply with the experience test requirement. To ensure that all requirements are in line with CRR Article 145(1) and Chapter 4 of the Final Draft RTS on assessment methodology for IRB, it is expected that a unit independent from the units responsible for developing/using the internal rating system will evaluate the experience test.

9 Data quality

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	144	1 (d)
		176	
		190.4	
Final Draft RTS on assessment methodology for IRB	21/07/2016	75, 76, 77, 78	
Other references	**Date of issue**	**Article**	**Section**
BCBS 239[32]	01/01/2016	Principles 1-11	

101. The objective of the Guide on data quality is to ensure that institutions deploy adequate processes and control mechanisms to ensure the quality of data (which comprises its completeness, accuracy, consistency, timeliness, uniqueness, validity and traceability). This applies throughout the IRB process, from data entry to reporting, and to both calibration and current exposure databases. This framework should ensure reliable risk information that enables an accurate assessment of a bank's risk profile and drives sound decision-making within the institution and by external stakeholders, including competent authorities.

9.1 Data quality management process

102. In order to ensure the quality of the data used for the IRB approach, institutions should establish and implement an effective data quality framework.

9.1.1 Overarching governance principles for the data quality framework

103. The general principles for the data quality framework (DQF) are that:

(a) the DQF is reviewed and approved by the bank's board and senior management;

(b) the DQF is fully documented;

(c) the DQF is distributed throughout the organisation (comprehensive coverage);

(d) the DQF is subject to high standards of independent validation;

[32] BCBS paper on Principles for effective risk data aggregation and risk reporting, January 2013.

(e) the DQF is subject to continuous review, in order to update and improve the data quality management process.

9.1.2 Scope and components of the data quality framework

104. With regard to the scope of the DQF:

(a) the DQF is applied to internal, external and pooled data;

(b) the DQF covers all relevant data quality dimensions: completeness, accuracy, consistency, timeliness, uniqueness, validity, availability and traceability;

(c) the DQF ensures that there is an effective (data quality) control framework in place throughout the IRB process, from data entry to reporting.

9.1.3 Components of the DQF

105. The components of the DQF include data quality standards that set the objectives and overall scope of the data quality management process. The data quality standards should cover at least the following data quality dimensions:

(a) completeness (values are present in the attributes that require them);

(b) accuracy (data is substantively error-free);

(c) consistency (a given set of data can be matched across different data sources of the institution);

(d) timeliness (data values are up to date);

(e) uniqueness (aggregate data are free from any duplication from filters or other transformations of source data);

(f) validity (data are founded on an adequate and rigorous classification system);

(g) availability/accessibility (data are made available to the relevant parties);

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

9.1.4 Organisation-wide rules

106. Data processing procedures (collection, storage, validation, migration, actualisation and use) should be properly defined at institution level.

9.1.5 Overall criteria and key quality indicators

107. Data quality compliance should be measured in an integrated and systematic way. The measurement system and the frequency of its application should be clearly formalised.

108. The tolerance level and related thresholds should be defined for at least the quantitative indicators and should be combined with visual systems (e.g. Red/amber/green (RAG) traffic-light system) and dashboards for monitoring and reporting purposes.

9.1.6 Indicators

109. Indicators should be supported by effective and sufficient data quality checks and controls throughout the IRB process (i.e. an effective control framework should be in place), from data entry to reporting, and for both current exposure as well as calibration datasets. These should include reconciliation across and within systems, including between accounting and internal ratings-based data. This control framework should ensure sound controls and related procedures, especially for manual processes.

9.1.7 Internal assessment process

110. The objective is to constantly improve data quality in order to ensure compliance with the data quality framework.

111. The assessment should be carried out by an independent unit whose recommendations should be issued with an indication of their priority. All data quality issues identified should be recorded and monitored by an independent data quality unit. For each of the data quality issues, an owner – responsible for resolving the issue – should be appointed and an action plan for dealing with the issue should be scheduled on the basis of its materiality. Remediation timelines should depend on the severity and impact of the issue and the implementation timelines required to resolve it.

112. Data quality issues are expected to be resolved, rather than mitigated, by taking a prudent approach.

9.1.8 Data quality report

113. A data quality report for a specific rating system should include:

    (a) the scope of the report or review, which should provide an overview of the performance of the model in terms of data quality, including external data;

(b) the findings and, where applicable, recommendations to address detected weaknesses or shortfalls;

(c) adequate evidence that the recommendations have been adequately addressed and properly implemented.

114. The report should give sufficient coverage of the quality of data at all stages of the IRB lifecycle, from data entry to reporting, and of both current exposure and calibration datasets. Reports should be submitted to the management body or designated committee and senior management on a regular basis.

9.1.9 Roles and responsibilities

115. The roles of the different units and internal bodies involved in the data quality management process, specifically relating to the IRB process, should be defined in such a way as to ensure an adequate degree of independence of the data handling process from the data quality management process. Institutions should have a dedicated independent unit with an overall view and responsibility for the management of data quality.

9.2 IT: Implementation testing, infrastructure and roles

9.2.1 Infrastructure

116. The institutions should fully document:

(a) the global map of databases involved in the IRB process;

(b) the relevant sources of data;

(c) the relevant processes of data extraction and transformation and the criteria used in this regard;

(d) the relevant functional specification of databases, including their size, date of construction and data dictionaries, specifying the content of the fields and of the different values inserted in them, with clear definitions of data items;

(e) 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;

(f) the relevant workflows and procedures relating to data collection and storage.

9.2.2 Implementation testing

117. Institutions should perform regular IT implementation tests, from the data entry to the reporting stage.

118. The overall approach for IT testing should be clearly defined and formalised in an organisation-wide policy/procedure. The policy should clearly state triggering events which should include the following: software releases or IT-related changes, regulatory changes, model methodological changes, new data scope.

119. Tests should be performed periodically and documented. They should include the following:

    (a) unit/component/module tests;

    (b) integration tests (units and between systems);

    (c) system tests (this includes functionality, performance – in normal and stress scenarios – and security and portability tests);

    (d) user acceptance testing (functional testing);

    (e) regression testing.

120. All of these tests and their results should be documented and the unit responsible should be clearly labelled.

9.2.3 Roles and responsibilities of the data owner

121. Data ownership and data quality roles and responsibilities, for both the business area and the IT unit, should be clearly established and documented throughout the entire IRB lifecycle (including all IT systems used). For example:

    (a) the responsibilities of business area owners include ensuring data are correctly entered, kept current and aligned with the data definitions, and ensuring that data aggregation capabilities and reporting practices are consistent with the institution's policies;

    (b) IT owners should be responsible for supporting the operation of the systems for data collection, processing, transformation and storage during the entire lifecycle of the data.

122. Different business area and IT owners could be appointed throughout the IRB data lifecycle but business area and IT owners should be appointed to each data source, IT system and process step (i.e. data points). Adequate controls should be in place throughout the lifecycle of the data and for all aspects of the technology infrastructure.

10 Third party involvement

Relevant regulatory references

Legal Background	Date of issue	Article	Section
CRR	30/11/2013	144.1	
		179.2	2
		190.4	3-4
Final Draft RTS on assessment methodology for IRB	21/07/2016	4	1-5
Other references	**Date of issue**	**Article**	**Section**
Committee on European Banking Supervision (CEBS) Guidelines on outsourcing	14/12/2006	(part) 2	(guidelines) 2-3, 6-9, 11

10.1 Preliminary principles: contract requirements

10.1.1 Global outsourcing policy

123. Each institution should have a global policy for outsourcing and third-party involvement in accordance with the CEBS Guidelines on outsourcing (14 December 2006) and bearing in mind other specific national rules and legislation.

124. The special case of delegating tasks, activities or functions related to the design, implementation and validation of the institution's IRB rating systems falls within the scope of, and should be explicitly set out in, this policy.

10.1.2 Contract requirements

125. All arrangements should be subject to a formal and comprehensive contract. In particular, the operational activity that is to be delegated should be clearly defined. The contract should include the following criteria.

(a) Require the provider to protect confidential information.

(b) Require the provider to give full and timely access to competent authorities for all information required (e.g. all the models' development details where an external rating system is used).

(c) Require the third party to provide support and make itself available to participate in interviews with the competent authority.

(d) Require the provider to give the institution access to relevant information in order to maintain sufficient in-house knowledge. The delivery of training and workshops is considered good practice (see also paragraph 10.2.5).

(e) Contain provisions allowing the institution to cancel the contract by notice of dismissal or extraordinary notice of cancellation, if required by the supervisory authority.

(f) Specify requirements concerning the minimum performance of the service and conditions, and triggers for requesting a change and a delivery time.

(g) Include a provision requiring periodic external audits and the availability of the report to the institution and competent authority.

(h) Consider the institution's need to perform its validation activities (requiring third-party assistance or to provide access to external data if necessary).

(i) Include a notice period before any service interruption by the provider. External providers should be contractually obliged to provide a prudent warning notice for any significant changes in the service provided (including ceasing to provide the service).

10.2 Outsourced functions and tasks

10.2.1 Internal validation and internal audit tasks

126. Although institutions are allowed to delegate some of their tasks, activities and functions to a third party, this should be done in accordance with all existing requirements and with the Guide (in particular principles related to internal validation and the internal audit, for general topics). If an institution plans to delegate such tasks to a third party located outside the EU, it is encouraged to consult its Joint Supervisory Team (JST) in advance.

127. Responsibility for the delegated tasks should be retained by the bank (Guideline 2 of CEBS Guidelines on outsourcing and Article 4 of the Final Draft RTS on assessment methodology for IRB).

128. The following practices should be observed:

(a) reports should carry the logo and name of the bank;

(b) reports should be approved by senior management or the management body responsible for the function within the bank;

(c) the institution should assess the quality/performance of the outsourced tasks;

(d) the independence requirements stated in paragraph 2.5.1 and paragraph 2.6.1apply.

10.2.2 Use of external credit risk parameters/ratings

129. Although institutions are allowed to use external credit risk parameters as a component of their rating systems, they should ensure that these are developed in accordance with all existing regulatory requirements and with credit risk and counterparty credit risk principle. The following practices should be observed.

(a) The parameters used should be adjusted to internal information.

(b) The institution should demonstrate good knowledge of the work previously performed by the third party in producing the estimates for these parameters. In particular, the institution should demonstrate a good understanding of the data cleansing process, assumptions used, methodological choices and subsequent limitations. It should also know and monitor the performance of the systems involved and have clear triggers for requesting a model change.

10.2.3 Model development

130. Although institutions are allowed to delegate the development of internal models, this should be done in accordance with all existing requirements (CRR Section 6), the guide and institutions' internal guidelines and policies. If an institution plans to delegate such tasks to a third party located outside the EU, it is encouraged to consult its JST in advance.

131. Institutions, as the ultimate model owners and users, are expected to do the following:

(a) maintain an appropriate level of in-house knowledge (see paragraph 10.2.5);

(b) have a robust contingency plan in place (see paragraph 10.2.6).

10.2.4 Use of pool models

132. The principles defined in this guide for credit risk (8) and (9) apply.

133. The Institution should be able to independently trigger a procedure, if pooled rating system deficiencies at institution level are identified, regardless of the performance of the rating system at the level of the other participating institutions. This procedure could trigger model changes at pool level or other appropriate adjustments.

10.2.5 In-house knowledge

134. If they are to be responsible for the outsourced tasks and functions, institutions should retain adequate in-house knowledge and core competence. This will enable them to take direct control of an outsourced activity in extremis (contingency planning), provided the institution has access to all relevant information. The best practices to ensure that this in-house knowledge is retained include mandatory training at all levels (not only at management level) and access to all relevant information.

135. The following practices are deemed appropriate to maintain in-house knowledge and are expected to be observed by all entities with third-party outsourcing of IRB-related tasks:

    (a) the terms of the contract include transparency requirements;

    (b) transparency is a legal requirement;

    (c) the institution has full access to all relevant information regarding internal model-related topics;

    (d) the institution receives regular reports;

    (e) on request, the institution can be provided with specific reports;

    (f) on request, the third party can provide support and attend an interview with the competent authorities;

    (g) the institution is capable of making or proposing changes to the models;

    (h) the institution has a specific model change policy in place for models developed by third-parties.

10.2.6 Independent monitoring of third-party performance

136. The institution is expected to independently monitor the performance of third parties and have appropriate process in place in this regard. This practice reinforces the fact that the institution should take responsibility for the provider's outcomes.

137. The following are expected as good practices with regard to monitoring third-party provision of external data.

    (a) Similar validations should be performed as would be the case if the data or service were provided in-house. Data quality checks should be automatised (IT/Batch processes) when possible, and technical issues as well as reasonableness and consistency should be considered.

    (b) Historical differences in the data provided should trigger inquiries if justified, or if there has been an error.

(c) Where external data are used, their representativeness, appropriateness and consistency with regard to the institution should be assessed.

(d) Cross-checks should be carried out between different databases (when available) or between different providers. This is considered good practice as it is a sign of consistency and robustness.

(e) Service Level Agreements (SLAs)/contract agreements should include the required specific key performance indicators (KPIs) and performance metrics.

(f) It should be recognised that the data quality of the information provided cannot be determined by its predictive power or by the performance of the model itself.

138. The following are expected as good practices with regard to monitoring third party IRB-related tasks:

(a) It is considered good practice to apply the same standards of validation/audit to external tasks as to those performed in house.

(b) Validation and monitoring should be performed on a regular basis, not only for initial approval.

(c) SLAs/contract agreements should include the specific KPIs and performance metrics the required service should include.

(d) The designation of specific bodies with clear responsibilities regarding the monitoring of external IRB activities (such as a monitoring committee) is also considered good practice.

10.2.7 Contingency plan

139. A contingency plan refers to the course of action designed for responding quickly and effectively in the event of a service interruption.

140. For any task or function performed by a third party, the institution should have an effective contingency plan in place that assumes that the institution:

(a) has developed a contingency plan policy that provides the necessary guidance to take the proper course of action when needed;

(b) has identified preventive controls such as regular assessment of the probability of the third party defaulting on its obligations, and regular assessment of the availability of the providers;

(c) ensures plan testing if relevant;

(d) ensures plan maintenance: reviewing the relevance of the plan on an annual basis.

141. The banks should adjust their contingency plans in accordance with their size and needs. In particular, the following would be expected as good practice:

(a) checking whether external services could be provided in-house in case the institution has sufficient knowledge and capacity;

(b) having a replacement system in a shadow environment to guarantee service continuity;

(c) carrying out an assessment of the third party and its capacity to continue to provide the service; this should include an assessment as to whether other third parties could “fill the gap” and provide the same service.

11 Glossary

BCBS	Basel Committee on Banking Supervision
CCF	Credit Conversion Factor
CCR	Counterparty Credit Risk
CEBS	Committee on European Banking Supervision
CRCU	Credit risk control unit
CRD IV	Directive 2013/36/EU
CRR	Regulation (EU) No 575/2013
DQF	Data quality framework
EAD	Exposure at default
EBA	European Banking Authority
EL	Expected Loss
ELBE	Expected loss best estimate
Final Draft RTS on assessment methodology for IRB	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
Final Draft RTS on assessment methodology for IMA and significant shares	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
GL	Guidelines
G-SIIs	Globally significant institutions
IRB	Internal Ratings Based
JST	Joint Supervisory Team
KPIs	Key performance indicators
LGD	Loss Given Default
NPL	Non-performing loans
O-SIIs	Other systemically important institutions
PD	Probability of Default
PPU	Permanent partial use
QRRE	Qualifying revolving retail exposures
RAG	Red/amber/green
RORAC	Return on risk-adjusted capital
RRE	Residential real estate

RTS	Regulatory Technical Standards
RWA	Risk- weighted asset
SIs	Significant institutions
SL	Specialised lending
SLAs	Service level agreements
TRIM	Targeted Review of Internal Models

Credit risk

1 Scope of the guide for credit risk

1. The purpose of this chapter of the guide is to inform institutions of the principles regarding the internal ratings-based (IRB) approach requirements for the topics selected for harmonisation under TRIM. This guide could be subject to changes to take into consideration information to be collected during the TRIM on-site missions.

2. It is important to clarify also that this is not an exhaustive list of principles regarding compliance with the requirements of the IRB approach, as the TRIM on-site missions may identify additional areas of investigation.

3. In accordance with the requirements set out in the CRR, the EBA has prepared technical standards (Final Draft Regulatory Technical Standards on Assessment Methodology)[33] (EBA RTS on AM) specifying how competent authorities should assess compliance with the IRB approach framework. Although those technical standards have not yet been adopted by the European Commission, the guide incorporates the principles stated in them. It should also be mentioned that the EBA is preparing a number of guidelines consequent upon the CRR in a Consultation Paper on Guidelines on PD and LGD estimation and the treatment of defaulted exposures[34] (EBA CP on GLs). Although the this guide has attempted to accommodate these developments, the document may require revision in due course once the binding technical standards required by the CRR, as well as the EBA Guidelines on PD estimation, LGD estimation and the treatment of defaulted exposures, are in place.

4. A reference must also be made to recent proposals by the **Basel Committee on Banking Supervision (BCBS) to adjust the IRB approach framework**[35], which is likely to lead to a revision of that framework under the CRR. The principles underlying the proposals were taken into consideration as relevant, in order to provide institutions with a complete overview on the IRB approach requirements for the topics selected under TRIM.

5. Finally, it is important to note that the guide focuses, as its primary target, on portfolios characterised by a large number of defaults, i.e. retails and corporate

[33] 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, 21 July 2016.

[34] EBA Consultation paper on Guidelines on PD estimation LGD estimation and the treatment of defaulted exposures, 14 November 2016.

[35] BCBS Consultative document on reducing variation in credit risk-weighted assets – constraints on the use of internal model approaches, March 2016.

SME portfolios. Application of the guide to low default portfolios may need to take into account particular characteristics of those portfolios.

2 Data requirements

6. The relevant regulatory references related to the topic presented in this chapter are:

   (a) Articles 170, 171(1)(a) and 179(1)(a), (c) and (d) of the **CRR**;

   (b) Articles 45, 48, 50, and 56 of the **EBA RTS on AM**;

   (c) Paragraphs 20, 21, and 126 of the **EBA CP on GLs**.

7. Institutions are expected to establish a complete framework which assesses the quality of the data considered for use in the modelling and risk quantification process including:

   (a) Its completeness and appropriateness;

   (b) The soundness of the process for vetting data inputs (especially with regard to missing data, outliers and categorical data);

   (c) The representativeness of modelling data.

   This framework should be in line with paragraphs 8 to 14 below.

8. Regarding general data requirements, institutions are expected to have in place a framework in line with paragraphs 20 and 21 of the EBA CP on GLs. The same applies as regards the estimation of credit conversion factors (CCFs).

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20. For the purpose of Article 76 of Commission Delegated Regulation xxx/xxxx [RTS on IRB assessment methodology] institutions should specify internal policies, standards and procedures for data collection, storage, migration, actualisation and use, with such characteristics so as to ensure regular updating and correcting of the data where necessary.

21. The process for vetting data which includes an assessment of the accuracy, completeness and appropriateness of the data, as required by Article 40 of Commission Delegated Regulation xxx/xxxx [RTS on IRB assessment methodology] should include in particular all of the following:

    (a) the assessment of reliability and quality of the internal and external data sources and the range of data obtained from those sources, as well as the time period the sources cover;

    (b) the data merging, where the model is fed with data from multiple data sources;

(c) the rationale and scale of data exclusions broken down by reason for exclusion, using statistics of the share of total data covered by each exclusion, where certain data were excluded from the model development sample;

(d) the procedures for dealing with erroneous and missing data and treatment of outliers and categorical data, and the procedures for ensuring that, where there has been a change in the type of categorization, this did not lead to decreased data quality or structural breaks in the data;

(e) the data transformation, including the standardization and other functional transformations and the procedures for ensuring the appropriateness of those transformations in terms of the risk of model overfitting.

9. For the purposes of estimation of loss(es) given default (LGD) and in line with section 6.2.1 of the EBA CP on GLs, institutions should use a reference data set (RDS) covering all of the following.

   (a) All defaults identified during the historical observation period specified in paragraph 63 of the EBA CP on GLs.

   (b) All necessary data for calculating realised LGDs in accordance with paragraphs 112 to 126 of the EBA CP on GLs. In particular, the date of default and time in default are to be included in the RDS.

   (c) Any potential risk drivers that can be used to group the defaulted exposures in meaningful ways, including their values at the date of default and within at least the year before default, where available.

2.1 Use of external data

10. The optimal approach is to use internal data for the estimation of risk parameters, but if external data are used, the same requirements with regard to representativeness are applicable vis-à-vis the bank's portfolio or subset of the portfolio for which the external data is used. Proving representativeness in these cases is generally more difficult as internal data are scarce. Where the institution cannot sufficiently prove the representativeness of the external data, it should show (by quantitative analysis and/or qualitative argumentation) that the information gained from the use of the external data outweighs the drawbacks stemming from any deficiencies identified. In particular, the institution should provide evidence that the model's performance does not deteriorate when including information derived from the external data, and that the parameter estimates are not biased. The institution should conduct quantitative and qualitative validation analysis specifically designed to assess these issues.

2.2 Use of external bureau scores

11. Regarding the use of external credit bureau scores or ratings as input variables in the rating process, close attention should be paid to situations in which externally sourced scores are the main (or one of the main) driver(s) of the overall internal rating, since they bear strong similarities to situations in which external models are used. Key principles in the use of external data such as credit bureau scores are listed below.

    (a) The credit bureau scores and/or data should be regularly updated or refreshed, especially where credit bureau information is dynamic and is used not only for the application rating but also for the on-going behavioural rating.

    (b) The institution should assess the appropriateness of external scores and/or models for its current portfolio. At a minimum, institutions are expected to understand the structure and nature of external scores and their key drivers. They should also verify regularly that the results of the credit bureau score continue to be appropriate input variables in their credit rating process, for example by reviewing any changes in the credit bureau score methodology.

    (c) Validation requirements are similar to those applied to internal ratings. In particular, the institution should verify regularly the performance and robustness of the credit bureau score.

    (d) Even when the credit bureau score is the main (or one of the main) driver(s) of the rating result, the institution should ensure that all relevant internal information regarding the creditworthiness of the obligor is taken into account in the rating.

    (e) The institution remains responsible for the performance of the model.

2.3 Use of pooled data

12. The use of pooled data is treated similarly to the situation where internal data are combined with data derived from a different (and external) set of obligors or facilities. Therefore, the institution should ensure a common definition of the key drivers and processes.

2.4 Use of pool models[36]

13. In situations where estimates of PD are generated from pooled data, institutions should verify that the data used for risk quantification meet the data requirements for default rate calculation as specified in section 3.2 below, or are adjusted accordingly. Where several institutions use a common rating methodology, each one should ensure that its rating process is aligned to the extent that all input risk drivers are defined in the same way across all participating institutions and all assessments of qualitative components of the rating model are performed in a comparable manner. In the case of a pooled project for the estimation of LGD parameters, the workout processes should also be aligned, and differences in methodology taken into account.

14. Each institution remains responsible for the performance of the rating model on its own portfolio, and should ensure that all relevant internal information with respect to the creditworthiness of an obligor is taken into account and the rating is updated with new information in a timely manner. Validation of the pool model, including testing of discriminatory power and predictive power, should be applied by each institution on its own portfolio.

3 Probability of default (PD)

3.1 Structure of PD-models

15. The relevant regulatory references related to the topic presented in this section are:

    (a) Articles 161(3), 169(3), 170(1)(a) to (f), 170(2), 170(3)(a) to (c), 170(4), 172(1)(a) and (d), 173(1)(b), 174(c), 178, 179(1)(a), 180(1)(a) and (g), and 180(2)(a) and (g) of the **CRR**;

    (b) Articles 34 to 38 of the **EBA RTS on AM**;

    (c) Paragraphs 68 to 74, 75 to 79, 84 to 86, and 88(c) of the **EBA CP on GLs**.

3.1.1 Drivers for risk differentiation

16. With reference to Article 179(1)(a) of the CRR, estimates should be based on the material drivers of the risk parameters mentioned. The relevant risk drivers

[36] It may occur that institutions not only pool their data, but develop a shared or common rating model based on these pooled data which is then applied by each participating institution to its portfolio(s). Institutions which pool data may work together very closely, disclosing to each other more information than simply publicly available external data, and even sharing the same rating and validation processes. The practice of pooling data can, at one extreme, be similar to the use of external data and, at the other, be more analogous to the sharing of data between two units in the same institution.

can be taken into consideration in several ways: (i) when assigning exposures to different rating systems, (ii) at a rating system level when assigning exposures to different models, (iii) as explanatory variables in models, and (iv) as drivers in the process for the assignment of PDs to grades or pools.

17. Institutions are expected to provide detailed explanations supporting their determination of the ranges of application of rating systems. In particular, institutions are expected to demonstrate that their models also perform adequately (in terms of discriminatory power and predictive power) on economically significant (and operationally consistent) sub-ranges of application of the rating systems. The sub-ranges are identified by partitioning the full range of application on the basis of potential drivers for risk differentiation, taking into consideration at least the drivers mentioned below:

    (a) for rating systems covering exposures to small and medium enterprises (SMEs): country, industry (e.g. *Nomenclature statistique des activités économiques dans la Communauté Européene* (NACE) code section classification A to U), size of obligor (define bucket of total assets), past delinquency (e.g. obligors with delinquency events, i.e. days past due, in the last 12 months);

    (b) for rating systems covering retail exposures: client type (e.g. high net worth/private banking, other individuals, self-employed, SMEs), product type (e.g. consumer credit, credit card, other), region (e.g. Nomenclature of territorial units for statistics (NUTS) 1, 2 or 3 as defined by Eurostat), past delinquency (e.g. obligors with delinquency events, i.e. days past due, in the last 12 months), maturity (e.g. original or remaining maturity);

    (c) for rating systems covering retail exposures secured by real estate: region (e.g. NUTS 1, 2 or 3 as defined by Eurostat), type of real estate (e.g. residential, commercial, other), past delinquency (e.g. obligors with delinquency events, i.e. days past due, in the last 12 months), maturity (e.g. original or remaining maturity).

    In cases where the model does not perform adequately within a sub-range of application, the institution should take appropriate action (e.g. by considering the inclusion of additional risk drivers).

18. Institutions should ensure that there are no overlaps in the range of application of different models and that each obligor or facility to which the IRB approach should be applied can clearly be assigned to one particular rating system.

19. The documentation on each rating system should clearly describe its range of application (and subdivisions into different models) and also include an explanation of the risk drivers which the institution has considered, but decided not to use.

3.1.2 Risk differentiation

20. With reference to Articles 36 to 38 of the EBA RTS on AM, a meaningful risk differentiation should be ensured which takes into account (i) the distribution of obligors and exposures in the grades or pools, (ii) the tools and metrics used to assess risk differentiation, and (iii) the homogeneity of obligors or exposures assigned to the same grade or pool.

Distribution of obligors and exposures in the grades or pools

21. Institutions are expected to ensure that the number of grades and pools is adequate for a meaningful risk differentiation and a quantification of the loss characteristics at the grade or pool level. In particular, institutions are expected to demonstrate the reasonableness of the criteria applied when determining the number of grades or pools and the proportion of exposures and obligors assigned to each.

22. Institutions are expected to ensure that the concentration of numbers of exposures or obligors is not excessive in any grade or pool. Any significant concentrations should be supported by convincing empirical evidence of the homogeneity of risk of those exposures or obligors.

23. Institutions are expected to ensure that a single grade or pool does not have too few exposures or obligors, unless supported by convincing empirical evidence of the adequacy of the grouping of those exposures.

Risk differentiation across grades or pools

24. Performance of the PD model in terms of risk differentiation should be defined by the institution by reference to clearly established fixed targets and tolerances for defined metrics and tools as well as actions to rectify deviations from these targets or tolerances. Separate targets and tolerances may be defined for the initial development and the ongoing performance.

25. Institutions should ensure that the tools used to assess risk differentiation are sound and adequate considering the available data, and are also evidenced by records of the time series of realised default rates or loss rates for grades or pools under different economic conditions.

Homogeneity of obligors and exposures assigned to a grade or pool

26. The exposures or obligors assigned to a particular grade or pool should be homogeneous in terms of the similarity of the obligors and transaction loss characteristics (i.e. similarity in underlying risk).

3.1.3 Use of direct PD estimates

27. Regarding the use of direct PD estimates, institutions are expected to have in place a framework in line with paragraphs 84 to 86 and 88(c) of the EBA CP on GLs as set out below:

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84. In order to use direct PD estimates for the calculation of capital requirements in accordance with Article 169 (3) of Regulation (EU) No 575/2013, institutions should demonstrate that the theoretical assumptions of the probability model underlying the estimation methodology are satisfied to a sufficient extent in practice.

85. When using the approach of using direct PD estimates for the calculation of capital requirements in accordance with Article 169 (3) of Regulation (EU) No 575/2013, institutions may apply either of the following methods:

    (a) calculate the long-run averages of one-year default rates required in Article 180 (1) point (a), (2) point (a) of Regulation (EU) No 575/2013) at a level other than obligor grade that is appropriate for the application of the probability model;

    (b) instead of explicitly calculating default rates, they aggregate all relevant default and non-default information implicitly for the estimation of a model whose outcomes can be proven to be obligor PDs with sufficient certainty.

86. Whichever of the methods referred to in paragraph 85 an institution uses, all requirements for the long-run averages of one-year default rates should then apply to the long-run averages of one-year default rates calculated explicitly at the respective level, or, mutatis mutandis, to the implicit incorporation of long-run one-year default information in the model estimation. In particular, all data and representativeness requirements, including those in accordance with Article 174 point (c) of Regulation (EU) No 575/2013, have to be met, and the default definition in accordance with Article 178 of Regulation (EU) No 575/2013 has to be used at the level at which the long-run one-year default information is incorporated for PD estimation purposes. Under no circumstances can the use of continuous PDs or any default rates smoothening be performed in order to overcome lack of data, low discriminatory capacity or any other deficiencies in the rating or PD estimation process, or in order to reduce the capital requirements.

88. Where scoring models are used, institutions should ensure that:

(…)

    (c) where Article 180(2) point (g) or Article 180(1) point (g) of Regulation (EU) No 575/2013 apply, that PD estimates are adequate for grades which were derived as a simple average of individual PD estimates, by applying calibration tests to this estimates on the basis of one-year-default rates representative of the likely range of variability.

3.1.4 Rating philosophy

28. Regarding rating philosophy, institutions are expected to have in place a framework in line with paragraphs 75 to 78 of the EBA CP on GLs:

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75. Depending on the methods and drivers used to assign exposures to risk grades or pools, changes in the portfolio's default rate caused by changes in economic conditions will be reflected through a combination of:

    (a) migrations across risk grades;

    (b) changes in the yearly default rates of each grade.

76. Where the rating assignment process is highly sensitive to the economic conditions, grades assignment will change significantly, while default rates of each grade will remain relatively stable. In contrast, when the assignment is less sensitive to the economic conditions, the yearly default rates per grade component will capture the cyclicality of the global default rate.

77. Institutions should analyse the appropriateness of the philosophy underlying the grade or pool assignment in terms of how institutions assign exposures, obligors or facilities to 'risk buckets' according to appropriate risk drivers.

78. Institutions should decide the philosophy underlying the grade or pool assignment, and specifically the risk drivers. However,

    (a) the choice of rating philosophy should be applied consistently over time;

    (b) Institutions should assess whether the method used to quantify the risk parameter is adequate for the philosophy underlying the grade or pool assignment and understand the characteristics and dynamics, of the ratings and of the risk parameter estimates that result from the method used.

    (c) Institutions should assess the adequacy of the resulting characteristics and dynamics, of the ratings and risk parameter estimates that result from the method used, with regard to their different uses and should understand their impact on the dynamics and volatility of capital requirements.

    (d) The rating philosophy must also be taken into account for back testing purposes. Sensitive philosophies tend to estimate PDs which are better predictors of each year's DR. On the other hand, more insensitive philosophies tend to estimate PDs which are closer to the average PD across the different states of the economy, but that differ from observed DRs in years where the state of the economy is above or below its average. Deviations between observed default rates and the average will hence be more frequent in rating system less sensitive to the cycle. On the contrary, migrations among grades will be more frequent in rating system more sensitive to the cycle. These patterns have to be taken into account when analysing back-testing results. They shall also be accounted for in benchmarking analysis.

3.1.5 Recognition of Parent/Group Support

29. Regarding the recognition of parent/group support, institutions are expected to have in place a framework in line with paragraphs 68 to 74 of the EBA CP on GLs:

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68. Institutions should have clear policies specifying the triggers resulting from the contractual relation between a third counterparty ('connected client') and the considered obligor that lead to each of the following outcomes:

    (a) triggers resulting in the rating of that connected client being transferred to a considered obligor due to CRM substitution ('rating transfer'), according to Article 161(3) of Regulation (EU) No 575/2013;

    (b) triggers resulting in a rating of a connected client being taken into account either as indication for an override of the individual PD estimate of the considered obligor;

    (c) triggers resulting in a rating of a connected client serving as input to the PD-model ('a support').

69. In the course of establishing the policies referred to in the previous sub-paragraph, institutions should take into account paragraphs 70 to 74.

70. In order for an internal or external rating of connected clients to be incorporated into a statistical model, the rating should comply with all of the following:

    (a) it should fulfil all the requirements for relevant risk drivers laid down in section 5.5.1;

    (b) the weighting in the statistical model should be purely statistically based;

    (c) institutions should ensure that other relevant obligor and transaction risk characteristics are properly reflected in the model in accordance with Article 170(1) point (a) and Article 170(3) point (a) of Regulation (EU) No 575/2013 and that no material biases are introduced by a high weighting of the internal or external rating information.

71. An internal IRB rating for a connected client may be incorporated in the non-statistical part of the PD model or through the use of overrides, if not already incorporated in the statistical part.

72. A rating transfer should not change the assignment of exposures to exposure classes, rating systems or models, but should only affect the assignment to grades or pools. Rating transfers should be set up in such a way that any changes to a rating of a connected obligor which is material information on the obligor or exposure with regard to Article 173(1) point (b) of Regulation (EU) No 575/2013 is reflected in all influenced ratings in a timely manner.

73. An institution's policy should prevent inappropriate double counting of a contractual relation to a connected client or group of connected clients.

74. The possible support of one obligor to another should be seen as diminishing the free financial strength of the supporting obligor, including the strength to repay all obligations to the institution in full without recourse, irrespective of the rating transfer method chosen. This should be reflected in the rating of the supporting obligor.

3.2 Calculation of default rate and PD long-run average

30. The relevant regulatory references related to the topic presented in this section are:

    (a) Articles 4(1)(78), 144(1)(a), 179(1)(b), 180(1)(a) and (h), and 180(2)(a) and (e) of the **CRR**;

    (b) Articles 49(3) and (4) of the **EBA RTS on AM**;

    (c) Paragraphs 48 to 63 of the **EBA CP on GLs**.

31. Regarding the calculation of the one-year default rate, institutions are expected to have in place a framework in line with paragraphs 48 to 52 of the EBA CP on GLs:

48. For the purpose of calculating the one-year default rate as referred to in Article 4(1) point (78) of Regulation (EU) No 575/2013, both of the following should apply:

    (a) the denominator should consist of the number of non-defaulted obligors observed at the beginning of the one-year observation period with any credit obligation. In this context a credit obligation refers to any amount of principal, interest and fees as well as to any off-balance sheet items including guarantees.

    (b) the numerator should include all obligors considered in the denominator with at least one default event during the one-year observation period.

49. Where the one-year-default-rate is calculated by rating grade or pool the denominator should refer to all obligors assigned to a rating grade or pool at the beginning of the observation period, taking into account overrides, but excluding any substitution effects due to credit risk mitigation, as well as any ex-post conservative adjustments.

50. Institutions should calculate the one-year default rate also for the subset of obligors that did not have a rating at the start of the relevant observation period but were in the range of application of the model under consideration, even if these obligors were assigned to a rating grade or pool in a conservative manner for the purpose of calculation of capital requirements ('missing ratings'). Obligors whose ratings are based on missing or partly missing information or where the rating is outdated but still deemed valid by the institution should not be considered as missing ratings.

51. For the avoidance of doubt with regard to paragraphs 48 to 50 an obligor has to be included into the denominator, and numerator as well, if relevant, also in case of a migration to a different rating grade, pool or rating model, rating system or approach to calculation of capital requirements within the observation period or where the corresponding credit obligations were sold during the observation period. Institutions should analyse whether such migrations bias the default rate and if so reflect this in an appropriate adjustment and consider such bias in their determination of an appropriate margin of conservatism.

52. In cases where there is a significant proportion of customers carrying multiple facilities within a considered Retail rating system and the institution identifies defaults at the level of an individual credit facility institutions should ensure that the estimates are not biased due to the multiple facilities.

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32. Regarding the long-run average default rate, institutions are expected to have in place a framework in line with paragraphs 59 to 63 of the EBA CP on GLs:

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59. For the purpose of determining the historical observation period referred to in Article 180(1)(h) and 180(2)(e) of Regulation (EU) No 575/2013, additional observations to the most recent 5 years, at the time of model calibration, should be considered as relevant when these observations are representative of the likely range of variability of default rates of that type of exposures as referred to in Article 49(3) of Commission Delegated Regulation xxx/xxxx [RTS on IRB assessment methodology].

60. When the historical observation period as referred to in paragraph 59 is representative of the likely range of variability of default rates, then the long-run average default rate should be computed as the observed average of the one-year default rates in that period.

61. For the purpose of assessing the representativeness of [the] historical observation period as referred to in paragraph 59 for the likely range of variability of one-year-default rates, institutions should take into account all of the following:

    (a) the variability of all observed one-year-default rates;

    (b) the existence or lack of one-year default rates relating to downturn periods as reflected by economic indicators that are relevant for the considered type of exposure within the historical observation period;

(c) significant changes in the economic, legal or business environment within the historical observation period.

62. In case the historical observation period is not representative of the likely range of variability of one year default rates in order to comply with Article 49(4) of Commission Delegated Regulation xxx/xxxx [RTS on IRB assessment methodology] the average of observed one year default rates should be adjusted in order to estimate a long-run average default rate, in particular where no downturn period is included in the historical observation period.

63. In case that the long-run average default rate does not equal the average of all observed one year default rates, institutions should compare their adjusted long-run average default rates to the maximum between:

(a) the observed average of the one-year default rates of the most recent 5 years and

(b) the observed average of all available one-year default rates

and where the adjusted long-run average default rate is lower than that maximum institutions should justify the direction and magnitude of the adjustment, including the adequacy of the considered margin of conservatism, where applicable.

3.2.1 Weighting for retail exposures

33. Notwithstanding paragraph 32 above, as regards PD estimation requirements in relation to retail exposures as set out in Article 180(2)(e) of the CRR, where the institution does not give equal importance to all historical data used, it is expected to be able to demonstrate that the use of a simple average would not comply with the predictive power metrics. Moreover, it is expected that the weighting approach is used in a consistent manner over time.

4 Loss Given Default (LGD)

4.1 Realised LGD

34. The relevant regulatory references related to the topic presented in this section are:

(a) Articles 4(1)(55), 5(2), 144(1)(e), 174(c), 175(1) and (4)(a), 176(4) and (5), 179(1)(a), (c), (d) and sub-paragraph 2, 181(1)(a), (i), (j), (2)(b) and sub-paragraph 2, 182(3), 185(a), and 191 of the **CRR**;

(b) Articles 3(1), (2)(d) and (3), 11(2)(a), 17(1)(a), 30(1)(a), 31, 32, 39(a), 40(2)(a) and (b), 45(1)(a), (c) and (d), 45(2)(a) and (b), 50, 51(b), (c), (d) and (g), and 52(b) and (c) of the **EBA RTS on AM**;

(c) Paragraphs 90, 91, 111, 114, 115, 122, 124, 125 and 128 of the **EBA CP on GLs**.

4.1.1 Reference data set

35. In line with paragraph 91 of the EBA CP on GLs, the modelling of LGD should be based on loss or recovery experience. This experience can be derived from external data as long as they meet the requirements applicable to internal data, as presented in section 2 above. This means that institutions are not expected to use any realised LGD inferred from market prices.

4.1.2 Realised LGD

36. Institutions are expected to have in place sufficiently detailed policies and procedures to ensure that a consistent and accurate approach is adopted to calculate the realised LGD. These policies and procedures should include (i) sufficiently detailed documentation in order to allow third parties to replicate the calculation of realised LGD, and (ii) a review of the calculation process by the institution's internal audit or other control function.

37. Institutions are expected to calculate the realised LGD at facility level for each default. The definition of default should be identical to the one used for the purposes of PD estimation and any deviation should be justified.

38. Institutions are expected to calculate realised LGD as the ratio of losses to the observed exposure at default (EAD). The EAD definition should be identical to the one used for CCF estimation. In particular, treatment of post-default drawings should be identical for the EAD used in both the LGD and CCF estimations.

39. In line with paragraph 114 of the EBA CP on GLs and where, relating to a default event, any part of an exposure has been forgiven or written off before or at the date of default and the amount forgiven or written off is not included in the outstanding obligation at the moment of default, that amount is expected to be added to the outstanding obligation at the moment of default included in the denominator of the realised LGD. The amount of the exposure that was forgiven or written off is also expected to be added to the realised losses (numerator).

4.1.3 Treatment of multiple defaults

40. Regarding the treatment of multiple defaults, and in line with paragraph 90 of the EBA CP on GLs:

90. For the purpose of LGD estimation institutions should consider an exposure that after the return to non-defaulted status is classified as defaulted again as having been constantly defaulted from the first moment when the default occurred if the time between the moment of the return of the exposure to non-defaulted status and the subsequent classification as default is shorter than 1 year in any case. Institutions may specify a longer period than one year for the purpose of considering two subsequent defaults as one for the purpose of LGD estimation, if this is adequate to the specific type of exposures and reflects the economic meaning of the default experience.

41. In the particular case of restructured facilities, institutions are expected to be able to make or trace a connection between the restructured facility and the facility (or facilities) previously advanced, which it restructures.

4.1.4 Discounting rate

42. Regarding the discount rate to be used for the calculation of economic loss, and in line with paragraph 122 of the EBA CP on GLs:

122. For the purpose of the calculation of economic loss, in accordance with point (2) of Article 5 of Regulation (EU) No 575/2013, institutions should discount all recoveries and costs, including capitalised late fees and interest and additional drawings after the moment of default using an annual discounting rate composed of a primary interbank offered rate applicable at the moment of default increased by [5%-points] add-on. For this purpose the primary interbank offered rate should be considered the 1-year EURIBOR or a comparable interest rate in a currency of the exposure.

Where an institution's practices are not aligned with this approach, institutions are expected to estimate the impact of aligning them.

43. Notwithstanding paragraph 42, and in line with paragraph 115 of the EBA CP on GLs:

115. (…) in the case of exposures that return to non-defaulted status institutions should calculate economic loss as for all other defaulted exposures with the only difference that additional recovery cash flow is added to the calculation at the date of the return to non-defaulted status in the amount that was outstanding at the date of the return to non-defaulted status. This additional recovery cash should not be discounted.

4.1.5 Direct and indirect costs

44. Institutions are expected to define direct costs in line with paragraph 124 of the EBA CP on GLs:

> 124. Direct costs should include the costs of outsourced collection services, legal costs, the cost of hedges and insurances and all other costs directly attributable to the collection on a specific exposure. Institutions should consider all direct costs as material.

45. Institutions are expected to define indirect costs in line with paragraph 125 of the EBA CP on GLs:

> 125. Indirect costs should include all costs stemming from the running of the institution's recovery processes, overall costs of outsourced collection services, and all other costs related to the collection on defaulted exposures that cannot be directly attributed to collection on a specific exposure. Institutions should include in their estimation of indirect costs an appropriate percentage of other ongoing costs such as institution's overheads related to the recovery processes, unless they can demonstrate that these costs are immaterial.

4.2 LGD structure

46. The relevant regulatory references related to the topic presented in this section are:

    (a) Articles 143(3) sub-paragraph 2, 144(1)(a), (f) and (h), 170(3)(b), (c) and (4), 174(d), 175(1) and (4)(b), 185(a), (b) and (c), and 190(1) of the **CRR**;

    (b) Articles 11(1) and (2)(c), 12(a) and (f), 16(3)(c), 32(2)(b) and (5)(b), 34(a), 35, 41(a), 43, and 51(i) of the **EBA RTS on AM**;

    (c) Paragraphs 139, 142, and 143 of the **EBA CP on GLs**.

4.2.1 Drivers for risk differentiation

47. Institutions are expected to provide detailed explanations supporting their choices of methods to determine the range of application of rating systems. In particular, they are expected to demonstrate that their models also perform adequately (in terms of discriminatory power and predictive power) on economically significant (and operationally consistent) sub-ranges of application of the rating systems.

48. When selecting the risk drivers, institutions are expected to comply with paragraphs 142 and 143 of the EBA CP on GLs:

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142. Institutions should identify and analyse potential risk drivers that are relevant to its specific circumstances and to the specific characteristics of the type of exposures covered by the rating system. Potential risk drivers analysed by institutions should include in particular the following:

    (a) Transaction-related risk characteristics, including type of product, type of collateral, geographical location of the collateral, unfunded credit protection, seniority, Loan-to-Value ratio (LTV), exposure size, seasoning, and recovery procedures;

    (b) Obligor-related risk characteristics, including, where applicable, size, capital structure, geographic region, industrial sector, and line of business;

    (c) Institution-related factors, including internal organisation and internal governance, relevant events such as mergers, and existence of specific entities within the group dedicated to recoveries such as ‘bad credit institutions’;

    (d) External factors, including interest rates, legal framework and other factors influencing expected length of the recovery process.

143. Institutions should analyse the risk drivers not only at the moment of default but also at least within a year before default. Institutions should use a reference date for a risk driver that is representative of the realisations of the risk driver within a year before default. When choosing the appropriate reference date for a risk driver institutions should take into account its volatility over time.

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49. If the institution splits the facilities into different components (for example, secured and unsecured), the allocation of flows to these components should be adequately documented and implemented in a consistent way. Institutions should ensure that no bias is introduced in the risk differentiation when combining the different components.

4.2.2 Treatment of recovery processes with no loss or positive outcome

50. Realised LGD may be zero when recoveries offset the direct or indirect costs associated with collecting on the default and the effects of discounting. Particular attention should, nevertheless, be given to zero-loss exposures, since they may reveal some issues with the calculation of realised losses – for example, costs not being adequately allocated to recovery processes, or inadequate treatment of write-offs.

51. In line with paragraph 139 of the EBA CP on GLs and where institutions observe that they realised profit on their observations of defaults the realised LGD on these observations is expected to be equal to 0 for the purpose of calculation of the observed average LGD and of estimation of the long-run average LGD.

52. Where LGD estimates for specific facility grades or pools are low or even zero (in exceptional cases), institutions should demonstrate that their estimation process is pertinent and accurate. Institutions should demonstrate that these outcomes are carefully monitored and scrutinised to make sure that no (systematic) errors or distortions are made.

4.3 Risk quantification

53. The relevant regulatory references related to the topic presented in this section are:

    (a) Articles181(1)(a), (b), (e), (f) and (2) sub-paragraph 2 of the **CRR**;

    (b) Articles 50(c) and 51(a) to (f) and (i) of the **EBA RTS on AM**;

    (c) Paragraphs 132, 135 to 138, and 156 of the **EBA CP on GLs**.

4.3.1 Observed average LGD

54. Institutions are expected to calculate the observed average LGD in line with paragraph 135 of the EBA CP on GLs:

> 135. Institutions should calculate the observed average LGD for each facility grade or pool and at the level of portfolio covered by the LGD model taking into account realised LGDs on all defaults observed in the historical observation period related to closed recovery processes in accordance with paragraphs 136 and 137 [of the EBA CP on GL] without including any expected future recoveries. The observed average LGD should be weighted by the number of defaults included in the calculation.

55. Institutions are expected to define closed recovery processes in line with paragraph 136 of the EBA CP on GLs:

136. Institutions should clearly specify in their internal policies the moment of closing the recovery processes. All recovery process that have been closed should be treated as such for the purpose of the calculation of the observed average LGD. The observations where the institution does not expect to take any further recovery actions should be recognised as closed recovery processes without undue delay.

4.3.2 Treatment of incomplete recovery processes and recovery processes where collateral has been repossessed and not yet sold

56. Regarding the treatment of incomplete recovery processes, the assumptions underlying the expected future costs and recoveries, as well as the adjustment to the observed average LGD, should be proportionate, taking into consideration that LGD estimates should be based on a sufficient number of facilities for which there are realised recoveries[37]. This should be in line with paragraphs 57 and 58 below.

57. The objective of the maximum length of the recovery process is to avoid institutions giving consideration to overly optimistic recoveries from open exposures that are already at a very advanced stage of the recovery process. For the purposes of LGD estimation (and validation), long recovery processes are expected to be considered as closed in line with paragraph 137 of the EBA CP on GLs:

[37] Taking into consideration that LGD estimates should be based mainly on realised recoveries.

137. Institutions should define the maximum period of the recovery process for a given type of exposures from the moment of default that reflects the expected period of time observed on the closed recovery processes during which the institution realises the most of the recoveries, without taking into account the outlier observations with significantly longer recovery processes. The maximum period of the recovery processes should be specified in such a way that ensures sufficient data for the estimation of the recoveries within this period for the incomplete recovery processes. The length of the maximum period of the recovery processes may be different for different types of exposures. This specification of the maximum period of the recovery process should be clearly documented and supported by evidence of the observed recovery patterns, and should be coherent with the nature of the transactions and the type of exposures. All exposures that remain in defaulted status for a period of time longer than the maximum period of the recovery process specified for this type of exposures should be treated as closed recovery process for the purpose of calculation of the observed average LGD, considering only the recoveries realised so far."

58. Institutions should analyse the incomplete recovery processes and extract the information relevant for LGD estimation. It is expected that assumptions/adjustments are in line with paragraph 138 of the EBA CP on GLs:

138. Institutions should obtain the long-run average LGD by adjusting the observed average LGD taking into account the information related to incomplete recovery processes and the estimated future costs and recoveries on these exposures in accordance with the following conditions:

(a) where the time from the moment of default until the moment of estimation is longer than the maximum period of the recovery process specified for this type of exposures institutions:

i) should take into account all actually observed recoveries realized before or after the maximum period of the recovery process;

ii) should not estimate any future recoveries.

(b) where the time from the moment of default until the moment of estimation is shorter than the maximum period of the recovery process specified for this type of exposures they may estimate future recoveries both those stemming from the realisation of the existing collaterals and those to be realised without the use of collaterals;

(c) for the purpose of estimation of the future costs and recoveries institutions should analyse the costs and recoveries realised on these exposures until the moment of estimation in comparison to the average costs and recoveries realised during [a] similar period of time on similar exposures; for this purpose institutions should analyse the recovery patterns observed on both closed and incomplete recovery processes taking into account only factually observed costs and recoveries;

(d) the assumptions that underlying the expected future costs and recoveries as well as the adjustment to the observed average LGD should be:

  i) proven accurate through backtesting;

  ii) based on a reasonable economic rationale;

  iii) proportionate, taking into consideration that LGD estimates should be based on the long-run average LGD that reflects the average LGDs weighted by the number of defaults using all defaults observed during an historical observation period.

(e) in estimating the future recoveries institutions should take into account the potential bias stemming from incomplete recovery processes being characterised by longer average recovery processes and lower average recoveries in comparison to closed recovery processes;

(f) in estimating the future recoveries stemming from the realisation of the existing collaterals institutions should take into account the legal certainty of the collateral and realistic assumptions regarding the possibility of its realisation;

(g) the adjustment of observed average LGD may be estimated at the level of individual exposure, at the level of grade or pool or at the level of portfolio covered by the LGD model;

(h) any uncertainty related to the estimation of the future recoveries on incomplete recovery processes should be reflected in appropriate MoC applied in accordance with section 4.4.

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59. In specific cases where the institution has taken possession of the collateral and has not yet sold it, and the collateral repossessed can be considered as cash-equivalent (high quality liquid assets (HQLA) at Level 1, as defined in Article 10 of Commission Delegated Regulation on the liquidity coverage requirement[38]), the market value of the collateral at the time of the repossession can be taken into account directly as a realised recovery. In all other cases, there is considered to be significant uncertainty as to whether the value of repossession adequately reflects the value of the repossessed collateral, and the expected recovery flows taken into account should be in line with paragraph 152 of the EBA CP on GLs:

[38] Commission Delegated Regulation (EU) 2015/61 of 10 October 2014 to supplement Regulation (EU) No 575/2013 of the European Parliament and the Council with regard to liquidity coverage requirement for Credit Institutions (OJ L 11, 17.1.2015, p. 1).

152. Institutions should consider whether the value of repossession adequately reflects the value of the repossessed collateral, consistently with any established internal requirements for collateral management, legal certainty and risk management. In the case there is significant uncertainty whether the value of repossession adequately reflects the value of the repossessed collateral, institutions should apply an appropriate haircut to this value and include in the calculation of economic loss a recovery as a value of repossession after the haircut. Institutions should estimate this haircut taking into account all of the following conditions:

(a) the haircut should reflect the possible errors in the valuation of the collateral at the moment of repossession taking into account the type of the valuation available at the moment of repossession, the date it was performed and the liquidity of the market for this type of asset;

(b) the haircut should be estimated with the assumption that the institution intends to sell the repossessed collateral to an independent third party and should reflect the potential price that could be achieved from such sale, the costs of the sale and the discounting effect to the moment of repossession taking into account the liquidity of the market for this type of assets;

(c) where there are observations available regarding the repossessions and subsequent sales of similar types of collaterals the estimation of the haircut should be based on these observations and regularly backtested; for this purpose institutions should take into account all of the following:

i) difference between the value of repossession and the sale price;

ii) any income and costs related to this asset that were observed between the date of repossession and the moment of the sale;

iii) discounting effects;

iv) whether the institution repossessed the collateral with the intension of immediate sale or whether another strategy was adopted.

(d) where the historical observations regarding the repossessions and subsequent sales of similar types of collaterals are not available the estimation of the haircut should be based on a case-by-case assessment, including the analysis of the current market and economic conditions;

(e) the less data an institution has on the previous repossessions and the less liquid is the market for the given type of assets the more uncertainty is attached to the resulting estimates, which should be adequately reflected in MoC in accordance with section 4.4 [of the EBA CP on GLs].

4.3.3 Long-run average

60. Institutions should obtain the long-run average LGD by facility grade or pool, by adjusting the observed average LGD and taking into account the information related to incomplete recovery processes and the estimated future costs and recoveries on these exposures (paragraph 138 of the EBA CP on GLs). The default weighted average referred to in Article 181(1)(a) of the CRR is the facility default weighted average.

61. Where direct LGD estimates are used for the calculation of capital requirements in accordance with Article 169(3) of the CRR, institutions are expected to calculate the long-run average LGD at a level (other than facility grade or pool) appropriate for the application of the model.

    This is particularly the case where the continuous LGD is the result of a combination of different components (for example, secured and unsecured components). In this case the long-run average expectations should be applied at the level of each of the components. Institutions should ensure that no bias is introduced in the estimation when combining the different components.

62. When using a different weighting in accordance with Article 181(2) of the CRR, institutions are expected to have in place a framework in line with paragraph 132 of the EBA CP on GLs:

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132. Where institutions do not give equal importance to all historical data for retail exposures in accordance with Article 181(2) of Regulation (EU) No 575/2013 they should be able to demonstrate in a documented manner that the use of higher weights to more recent data is justified by better prediction of loss rates. In particular where a zero or very small weights are applied to specific periods this should be duly justified or lead to more conservative estimates.

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63. Regarding the length of the historical observation period, institutions are expected to have in place a framework in line with paragraph 128 of the EBA CP on GLs:

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128. The historical observation period should be as broad as possible and should contain data from various periods with differing economic circumstances. For this purpose institutions should at a minimum select a historical observation period in such a way that:

(a) the length of the historical observation period, i.e. the timespan between the oldest default considered in the RDS and the moment of the LGD estimation, covers at least the minimum length specified in Article 181(1)(j) of Regulation (EU) No 575/2013 for exposures to corporates, institutions, central governments and central banks and, for retail exposure, the period specified in Article 181(2) subparagraph 2 of that Regulation and, where applicable, Commission Delegated Regulation adopting technical standards laid down in Article 181(3)(b) of that Regulation;

(b) it ensures that the estimation sample includes a sufficient number of closed recovery processes in order to provide robust LGD estimates;

(c) it is composed of consecutive periods and includes the most recent periods before the moment of LGD estimation;

(d) all available internal data is considered 'relevant', as referred to in Articles 181(1)(j) and 181(2) subparagraph 2 of Regulation (EU) No 575/2013 and is included in the historical observation period.

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64. Regarding adjustment to the long-run average, institutions are expected to have in place a framework in line with paragraph 111 of the EBA CP on GLs and paragraph 65 below:

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111. (…) Where historical data is not sufficiently representative of a current portfolio institutions should provide, to the extent possible, appropriate adjustments. In addition to these appropriate adjustments institutions should increase the margin of conservatism applied to their LGD estimates (…).

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65. The following principles apply to the adjustments referred to in paragraph 64 above.

    (a) The adjustment should be based on a comparison of the risk characteristics of the exposures considered in the reference data set (RDS) with the risk characteristics of the institution's current portfolio of performing exposures. In many circumstances (for example where a type of product has been discontinued by the institution), the addition of these characteristics as risk drivers for LGD estimation is the most simple and effective way of dealing with issues of non-representativeness.

    (b) In the event of changes in lending or recovery policies, only conservative adjustments are permitted until the institution is able to provide evidence concerning the impact of the new policies. Such evidence should be based on the inclusion in the RDS of recent periods since the change of policy.

(c) All economic and market conditions experienced in the past and reflected in historical observations should be considered by institutions as part of foreseeable economic and market conditions (paragraph 108 of the EBA CP on GLs).

4.3.4 Downturn LGD

66. In order to carry out an LGD estimation that is appropriate for an economic downturn (DT LGD), institutions are expected to have in place a framework in line with paragraphs 67 to 69 below. Additionally, institutions are expected to compare their estimates with a reference value calculated according to paragraph 70 below.

67. Institutions are expected to characterise an economic downturn in terms of economic and credit indicators. This should be done on the basis of the observed evolution of such economic and credit indicators over a historical period. When analysing historical series in order to characterise a downturn period, institutions should take the following into consideration.

    (a) The length of the historical dataset of economic indicators should be at least the most recent 20 years.

    (b) As a minimum, and where relevant, institutions should consider (for all exposure types) indicators (analysed separately) such as GDP growth, unemployment rates, interest rates, inflation rates, system-wide default rates and credit losses, complemented with internal series (i.e. default rates, losses) where available. Additional indicators should be considered for the following types of exposure:

        (i) exposures to “corporate and retail SME” – sectoral/industry indexes;

        (ii) exposures to “residential real estate” – house prices, region-specific indexes;

        (iii) exposures to “other retail” – consumer leverage ratio[39] or similar information.

    (c) The specified downturn period should be a minimum of one year, although longer periods are acceptable in order to account for cases where the historical data show longer stress periods for some indicators, or where the peaks or troughs of different economic indicators are not reached simultaneously but are nonetheless the effect of one single overall downturn. In such cases, the downturn period should be long enough to reflect the continued stressed situation.

[39] The consumer leverage ratio can be calculated as the ratio of total household debt to disposable personal income.

68. Consequently, the specified downturn conditions should be evidenced by elevated levels of realised LGD including treatment for incomplete recovery processes (according to paragraph 56 above) at portfolio level, or at the relevant sub-range of application, driven by stressed levels of the relevant economic indicators (as specified in paragraph 67 above).

69. Institutions should then derive LGD estimates which are appropriate for the downturn conditions specified, following the principles set out in paragraphs 67 and 68 above. Any lag between the beginning of the downturn period and the date of the impact on the realised LGDs must be taken into account. This means that even where high levels of realised LGD are not experienced simultaneously with the stress in economic indicators, but are still the result of such stress, they are to be considered as the LGD estimates appropriate for the economic downturn.

70. In assessing their DT LGD estimates, institutions are expected to compare the DT LGD estimates derived in accordance with paragraph 69 above with a reference value derived according to the following steps.

    (a) First, institutions should identify, from the most recent 20 years, the two individual years with the highest observed losses considering the defaults observed in those years.

        Given the current circumstances (adverse economic conditions experienced in many countries since 2008), the most recent 20 years can be replaced with the most recent 10 years for estimations made during 2017. Thereafter, this period should be increased by one year each year until the period of 20 years is reached, provided representativeness requirements are met. Institutions should be able to provide evidence that the period considered actually contains years which include adverse economic conditions.

        To identify the two individual years referred to above, institutions are expected (i) to group all defaults within the RDS and corresponding exposures and losses by the year in which the default occurred, and obtain the ratio of total losses to total exposure, and (ii) to select the two individual years with the highest ratio of total losses to total exposure. This analysis should consider years for which the maximum length of recovery process has been observed.

    (b) Second, institutions should calculate reference values as the average realised LGD from those two individual years (see paragraph 70(a) above), for each facility grade or pool which they use. The only exception is where, according to the institution's methodology, the LGD estimates result from combining different components (for example, secured and

unsecured); in this case, the reference values should be calculated at the level of each of the components and the comparison made at this level[40].

Where DT LGD estimates (by facility grade or pool) or, if applicable, estimates of model components (including margin of conservatism) obtained by the institution are lower than those resulting from the reference value described above, the institution should be able to provide evidence that its DT LGD methodology is aligned with the target of elevated LGDs driven by economic conditions (as specified in paragraph 68 above).

The reference value referred to in this paragraph should not be considered as a valid methodological option. Institutions are expected to develop internal methodologies compliant with paragraphs 67 to 69 above.

71. Where an institution does not have a data series with the length described above, or cannot provide evidence that the available data include adverse economic conditions, the approach described above should be used with the available data series and an add-on or margin of conservatism (MoC) should be applied, taking into consideration the economic environment observed for the data available (i.e. the better the observed economic environment, the higher the add-on or MoC should be).

4.4 Calculation of EL_{BE} and LGD in-default

72. The relevant regulatory references related to the topic presented in this section are:

    (a) Articles 179(1)(c), 181(1)(a), (h), (j) and (2) sub-paragraph 2, and 185(a) to (c) of the **CRR**;

    (b) Articles 11(3)(a), 46(d), 50, 51(c), and 54 of the **EBA RTS on AM**;

    (c) Paragraphs 159 to 164, 168 to 171, 173 to 175, 177, 180, 181, and 184 of the **EBA CP on GLs**.

[40] Examples are set out below:

(a) Where the institution uses secured as against unsecured components, it may be necessary (depending on the specificities of the model) to at least establish a comparison between the observed values for defaults occurring during those two individual years and those actually used by the institution for their DT LGD estimates of (i) collateral haircuts and (ii) average realised LGD as regards the uncollateralised component.

(b) Where the institution uses cure probabilities as well as LGDs for “cured” and “not cured” as components of the model, the realisation of each of these three components during the two individual years should be compared with the DT LGD estimates actually being used by the institution.

Where the estimates for a particular component are made on the basis of grade or pool, the reference value for that component should be computed and compared for each grade or pool. Where the uncollateralised LGD is estimated by grades, a reference value should be obtained, and a comparison made for each grade.

73. Regarding the update of expected loss best estimate (EL_{BE}) and LGD in-default, institutions are expected to have in place a framework in line with paragraph 160 of the EBA CP on GLs:

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160. Institutions should take into consideration all relevant post-default information in their EL_{BE} and LGD in-default estimates in a timely manner. In particular, where events from the recovery process invalidate the recovery expected by the most recent EL_{BE} estimation, institutions should update immediately their EL_{BE} and LGD in-default estimates.

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74. For the purposes of EL_{BE} and LGD in-default estimation, institutions are expected to use the same reference data set as used for LGD estimation, complemented to account for any relevant information observed during the recovery process and at each reference date (paragraph 163 of the EBA CP on GLs).

75. Regarding the update of EL_{BE} and LGD in-default estimates, institutions are expected to have in place a framework in line with paragraph 164 of the EBA CP on GLs:

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164. For the purposes of EL_{BE} and LGD in-default estimation, institutions should set the reference dates that can be used to group defaulted exposures in a significant manner in terms of the recovery pattern observed. For the purposes of setting the reference dates institutions should use only closed recovery processes and those recovery processes that are treated as closed in accordance with paragraph 137 [of the EBA CP on GLs] and factually observed costs and recoveries from incomplete recovery processes.

4.4.1 Clarification of EL_{BE}

76. In line with the applicable prudential requirements, the EL_{BE} should represent a best estimate of expected loss given current economic circumstances and exposure status, therefore sensitive to the current economic conditions rather than based on long-run average economic conditions. Nevertheless, the EL_{BE} may:

    (a) be based on historical data (e.g. on a recoveries reference data set) and adjusted, where necessary, for conditions expected over the period of the recovery process;

    (b) reflect downturn conditions, where current economic conditions are in a downturn or a downturn is expected over the period of the recovery process.

77. The computation of the EL_{BE} should reflect economic losses and take into account the information on the time in default and recoveries already realised, where an institution consider these as material risk drivers. Throughout the time in default, both the occurrence and non-occurrence of specific recovery events could influence the EL_{BE} estimation. In this context, it is expected that recent operational information from the ongoing recovery process, including, where relevant, time since default, is input into the EL_{BE} estimation of each exposure. This means, in particular, that institutions should take into consideration all relevant post-default information for the purposes of EL_{BE} estimation. For example, where an institution considers time in default as a material risk driver, the EL_{BE} estimation should take into account the outstanding exposure as at that reference date (i.e. time in default) rather than as at the time of default, as well as direct and indirect costs assigned to the credit obligation after that point, and expected recoveries, including appropriate discounting effects up to the reference date.

78. Institutions may use specific credit risk adjustments as EL_{BE} estimates where the accounting model used for the purposes of determining credit risk adjustments satisfies (or can be adjusted to satisfy) the requirements for own-LGD estimates (paragraph 177 of the EBA CP on GLs).

79. In any case, institutions are expected to demonstrate that EL_{BE} estimates are adequately back-tested.

4.4.2 Clarification of LGD in-default

80. LGD in-default can be estimated directly, or as the sum of EL_{BE} and an add-on capturing the unexpected loss, related to the exposures in default, that may occur during the recovery period. Regardless of the approach, and in line with paragraph 184 of the EBA CP on GLs:

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184. (…) institutions should document separately all of the following:

(a) the break-down of the LGD in-default into its components: the EL_{BE} and the add-on;

(b) the break-down of the add-on into its components:

i) the downturn conditions component calibrated on the downturn adjustment to the long-run average LGD as specified in paragraph 180,

ii) the MoC component, referred to in section 4.4,

iii) and any component covering for potential additional unexpected losses during the recovery period referred to in Article 181 (1)(h) of Regulation (EU) No 575/2013.

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81. The use of a constant charge for unexpected losses for all defaulted exposures is not risk sensitive, and therefore is generally not acceptable. Where an institution does use a constant charge, it is expected to justify this. In particular, it should demonstrate that the specific constant charge is an adequate estimate of possible additional unexpected losses during the remaining recovery period, i.e. between the date for which estimates are being applied and the final closure of the recovery process.

82. LGD in-default estimates are generally expected to be higher than EL_{BE} estimates. If, in individual and exceptional cases, the LGD in-default equals the EL_{BE} the relevant institution will be expected to provide a justification.

83. Institutions are expected to analyse the deviations between LGD in-default and LGD estimates in line with paragraph 161 of the EBA CP on GLs:

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161. Institutions should assess and duly justify situations where there are systematic deviations of the LGD in-default estimates just after the date of default from the LGD estimates just before the date of default at the facility grade or pool, which are not stemming from the use of risk drivers that are applicable from the date of default onwards.

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5 Credit conversion factor (CCF)

84. The relevant regulatory references related to the topic presented in this section are Articles 166(1) to (8)(a), (b), (c) and (d), and Articles 166(10) and 162(3)(b) of the **CRR**.

5.1 Cancellable commitments

85. In accordance with Articles 166(8)(a) and (c) of the CRR, institutions not using their own estimates of conversion factors for non-retail exposures are permitted to apply a 0% conversion factor, under certain conditions.

86. For these purposes, “commitment” are expected to be interpreted as any contractual arrangement that has been offered by the institution and accepted by the obligor to extend credit, purchase assets or issue credit substitutes. “Cancellable commitment” are expected to be interpreted as any such arrangement that can be cancelled by the institution if the obligor fails to meet conditions set out in the facility documentation, including conditions that must be met by the obligor prior to any initial or subsequent drawdown under the arrangement.

87. In order to comply with the provisions of Article 166(8)(a) and (c) of the CRR, institutions should have in place internal control systems that allow them to monitor the obligor's financial condition and to act in the event that deterioration in the credit quality of the obligor is detected. For this reason, institutions are expected to demonstrate that the 99th percentile of the observed conversion factor in all defaulted exposures of a particular type observed during the previous year is equal to, or less than, zero (using the approach for computation of observed conversion factors for e.g. retail exposures). This analysis should be performed on an annual basis.

5.2 Start date of a commitment and unadvised limits

88. Institutions should treat a facility as an exposure from the earliest date at which the facility is recorded in the institution's systems in a way that would allow the obligor to make a drawing. An unadvised limit is any credit limit determined by the institution (i) that is above the limit the obligor has been informed of by the institution, and (ii) according to which additional drawings are technically possible, at least temporarily.

89. This higher (unadvised) credit limit may be disregarded if its availability is subject to a further credit assessment by the institution, as long as this additional assessment includes a re-rating or a confirmation of the rating of the obligor.

5.3 Estimation of conversion factors

Scope of application

90. In relation to non-retail exposures, an institution's own estimates of conversion factors can only be used for the items listed in Article 166(8) of the CRR[41]. The treatment of off-balance-sheet items other than those mentioned in Articles 166(1) to (8) of the CRR is specified in Article 166(10), according to which the exposure value should be a percentage of an off-balance-sheet item's value, based on the classification of off-balance-sheet items established in Annex I of the CRR.

91. Additionally, it is considered that the term "credit lines" in Article 166(8) of the CRR refers solely to those undrawn commitments that can be unconditionally drawn by the counterparty of the institution at any time, i.e. without the requirement that a specified event has occurred prior to drawing. In particular, this interpretation excludes guarantees provided by the institution, since these can only be drawn by the counterparty once a specified event has occurred,

[41] Please refer to EBA Single Rulebook Q&A 2014_1263.

e.g. guarantees for payment of credit facilities can only be drawn once a credit event has occurred (such as insolvency or outstanding payment(s) past due). Therefore the term “credit lines” in Article 166(8) of the CRR is specifically considered not to extend to longer-term letters of credit arising from the movement of goods. This is notwithstanding the fact that Article 166(8)(b) of the CRR permits own estimates of conversion factors for short-term letters of credit arising from the movement of goods (generally of less than one year, in line with Article 162(3)(b) sub-paragraph 2 of the CRR), since they are separately mentioned in that Article 166(8)(b).

Estimation by facility type

92. Realised conversion factors should be calculated at facility level.

93. Institutions are expected to demonstrate a detailed understanding of the impact of changes in customer product mix on conversion factor estimates and that the impact is immaterial or has been effectively addressed within the institution’s estimation process. This is because changes in exposure characteristics or “product profile transformations” (e.g. a revolving loan that has been converted into a term loan or vice versa) which commonly occur between reference and default dates have a high potential for introducing substantial arbitrariness and downward bias into the estimates of conversion factors by institutions.

Estimation approach

94. The EAD for undrawn commitments is calculated as the committed but undrawn amount multiplied by a CCF. CCFs can also be derived from direct estimates of total facility EAD.

95. A well-known issue in estimating CCFs is the region of instability associated with facilities close to being fully drawn at the relevant reference date. Institutions are expected to ensure that their CCF estimates are effectively protected from the potential effects of this region of instability.

96. The RDS should not be capped at the principal amount outstanding or at facility limits. The RDS should include accrued interest, other due payments and limit excesses.

97. Institutions should analyse the risk drivers not only at twelve months prior to default (the “fixed horizon approach”) but also within the year before default (the “cohort approach”). When choosing the appropriate reference date for a risk driver, institutions should take into account its volatility over time.

98. In order to address the estimation of CCFs appropriate for an economic downturn, institutions are expected to apply the methodology for characterising an economic downturn, as described in paragraph 67 above. As a result, the specified downturn conditions should be evidenced by elevated levels of

realised CCFs. Any lag between the beginning of the downturn period and the date of the impact on the realised CCFs must be taken into account. This means that where high levels of realised CCFs are not experienced simultaneously with the stress in economic indicators, but nevertheless result from it, these high CCFs are to be considered as the CCFs appropriate for the economic downturn.

6 Model-related margin of conservatism

99. The relevant regulatory references related to the topic presented in this section are:

    (a) Article 179(1)(f) of the **CRR**;

    (b) Article 47 of the **EBA RTS on AM**;

    (c) Paragraphs 23 to 35 of the **EBA CP on GLs**.

100. Institutions are expected to have in place a MoC framework in line with the EBA CP on GLs 23 to 35. This principle is also applicable to the estimation of CCFs.

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23. In relation to the requirement that institutions should add a margin of conservatism ('MoC') that is related to the expected range of estimation errors as required by Article 179(1) point (f) of Regulation (EU) No 575/2013 and Article 180 (1) point (e), institutions should implement a framework, that consists of the phases specified in sections 4.4.1 to 4.4.4.

4.4.1 Identification of deficiencies

24. Institutions should have a robust process for identifying all deficiencies, including data errors and any uncertainties that lead to estimation errors, and for classifying them in the following categories:

    (a) Category A: Expected range of estimation errors due to data deficiencies;

    (b) Category B: Expected range of estimation errors due to diminished representativeness of historical observations;

    (c) Category C: General estimation errors including errors stemming from methodological deficiencies;

    (d) Category D: Other uncertainties.

25. For the purposes of applying the MoC during the phases of model development, estimation and calibration institutions should consider:

    (a) for the errors classified under Category A as referred to in paragraph 24 at least the following triggers:

i) missing or materially changed default triggers in historical observations;

ii) missing estimated date of default, leading to late default detection;

iii) missing or outdated rating information used for the purpose of calculation of default rate per grade or pool;

iv) missing or inaccurate information on the source of cash flows;

v) missing, inaccurate or outdated data on risk drivers and rating criteria;

vi) missing or inaccurate data for the calculation of economic loss;

(b) for the errors classified under Category B as referred to in paragraph 24, at least the following triggers:

i) diminished representativeness of the historical observations due to the changes in the definition of default;

ii) diminished representativeness of the historical observations due to the use of external data;

iii) diminished representativeness of the historical observations due to changed underwriting standards or recovery policies;

iv) diminished representativeness of the historical observations to the current portfolio in terms of the distribution of risk drivers;

(c) for the errors classified under Category C as referred to in paragraph 24, methodological errors not yet rectified, including:

i) the rank order estimation error;

ii) estimation error in the calibration;

(d) for the errors classified under Category D as referred to in paragraph 24, at least the following triggers:

i) changes in the legal environment not covered by the errors included under Category B referred to in paragraph 24;

ii) changes in the relevant processes not covered by the errors included under Category B referred to in paragraph 24;

iii) estimation error in the long-run averages due to necessary adjustments to comply with Article 179(1)(d), Article 49(3) to (5) and Article 53 of Commission Delegated Regulation xxx/xxxx [RTS on IRB assessment methodology].

4.4.2 Quantification of estimation errors

26. In order to overcome estimation errors in PD and LGD estimates stemming from the categories of deficiencies A, B or D, institutions should apply adequate methodologies for correcting the identified errors ('appropriate adjustment'). Institutions should ensure that the appropriate adjustment results in a more accurate estimate of the risk parameter, where this adjustment can have both positive and negative effect on the risk parameter.

27. Where such appropriate adjustments are used institutions should apply a MoC to account for the additional estimation error associated with these adjustments. The MoC related to the economic adjustment should be proportionate to the impact of the adjustment on the risk parameter.

28. Institutions should also apply a MoC to address any errors that have not been corrected via appropriate adjustment and any identified uncertainties. Institutions should ensure that the impact of the MoC does not ever result in lowering PDs or LGDs.

29. Institutions should assess the MoC at the level it is identified but they should reflect and report it with respect to the final risk parameter estimate used for own funds requirements.

30. Any occurrence of any of the triggers referred to in paragraph 25 should result in the application of a MoC. Where more than one trigger occurs, a higher aggregate MoC should be applied. The MoC related to each trigger should be proportionate to the estimation error in the estimated parameter that results from the identified deficiency. Institutions should quantify the estimation error that results from the identified deficiency in order to justify the level of MoC. Institutions should quantify the appropriate adjustment and MoC as defined in paragraphs 26 to 29 at least for every calibration segment.

31. Institutions should provide for a customable IT implementation solution, which ensures that MoC can be implemented in a timely manner.

32. Institutions should consider the overall impact of the identified deficiencies and the resulting MoC on the soundness of the model and ensure that capital requirements are not distorted due to the necessity for excessive adjustments.

4.4.3 Monitoring

33. Institutions should regularly monitor the levels of the appropriate adjustments and MoC. The adoption of a MoC by institutions should not replace the need to address the causes of errors or uncertainties and to correct the models to ensure their full compliance with the requirements of the Regulation (EU) No 575/2013. Following its assessment, institutions should develop a plan to rectify the data and methodological deficiencies and reduce the estimation errors within a reasonable timeline, taking into consideration the materiality of the estimation error and the materiality of the rating system.

34. When reviewing the levels of MoC institutions should ensure all of the following:

    (a) that the MoC stemming from Category A, B and D as referred to in paragraph 24 is reduced over time;

(b) that the MoC stemming from Categories C as referred to in paragraph 24 is eliminated after the error is rectified in all parts of the rating system that were affected.

4.4.4 Documentation

35. For each rating system, the MoC applied should be documented in the relevant model documentation and methodology manuals. The documentation should at least contain:

(a) a complete list of all potential and identified deficiencies and the potentially affected model components or risk parameters;

(b) a description of the methods used to apply appropriate adjustments to rectify the data and methodological errors, where relevant;

(c) a description of the methods of addressing the deficiencies, including errors and uncertainties, via the application of an MoC;

(d) the category under which these errors and uncertainties are classified, as referred to in paragraph 24.

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101. The conservatism framework established by institutions should provide a strong incentive to remove the source(s) of uncertainty and/or deficiencies by pursuing the most accurate models. Institutions are expected, over time, to correct data and model deficiencies in order to reduce the MoC to the extent possible. However, they should always account for general estimation errors in the model by applying a MoC above zero.

7 Review of estimates

102. The relevant regulatory references related to the topic presented in this section are:

(a) Article 179(1)(c) of the **CRR**;

(b) Article 46 of the **EBA RTS on AM**;

(c) Paragraphs 200 to 205 of the **EBA CP on GLs**.

103. Regarding the review of estimates, institutions are expected to have in place a framework in line with paragraphs 200 to 205 of the EBA CP on GLs. This principle also applies to the estimation of CCFs.

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200. For the purpose of performing annual reviews of estimates in accordance with Article 179(1)(c) of Regulation (EU) No 575/2013 institutions should have a framework in place which includes at least the following elements:

(a) a minimum scope of analyses to be performed, including predefined metrics chosen by the institution to test model performance and its predictive power;

(b) predefined standards, including predefined thresholds and significance levels for the relevant metrics;

(c) predefined actions to be taken in case of adverse results in any of the analyses.

201. For the purpose of paragraph 200(c), institutions should investigate and decide on the adequate steps in order to remediate identified deficiencies. This may require in particular re-development of the model, re-estimation of risk parameters or re-estimation of any model components.

202. The analyses referred to in paragraph 200(a) should at least comprise the following elements:

(a) a representativeness analysis in order to identify potential differences between the reference dataset used to estimate the risk parameter and the current portfolio to which the estimates are applied; this analysis should include the following analyses of any changes in the portfolio or any structural breaks:

i) along relevant risk drivers and segmentation drivers used in the rating system;

ii) due to changes in the underwriting, recovery or default identification process as well as relevant technical advances;

iii) (due to changes in the scope of application of the model;

iv) due to structural changes in market and economic conditions.

Where institutions identify significant deficiencies in terms of the representativeness of the dataset used to estimate risk parameters or where the model's discriminatory power, as referred to in point (b), is deteriorating, they should perform the representativeness analysis as described in the first subparagraph also for the dataset used in model development.

(b) analysis of the performance of the model and its stability over time; this analysis should:

i) identify any potential deterioration of the model performance (in particular discriminatory power) through the comparison of its performance at the time of the development against its performance on each subsequent observation period of the extended data set as well as against the predefined thresholds; in particular should this analysis be performed on relevant subsets, for instance with and without delinquency days;

ii) be performed with regard to the whole application portfolio, without any data adjustments or exclusions; for comparison purposes, the performance at the time of development must be obtained also for the whole portfolio, prior to any data adjustments or exclusions;

iii) be performed according to metrics and standards defined by the institution in accordance with paragraph 200 and applied consistently over time.

(c) analysis of the predictive power of the model, including at least:

i) an analysis of whether the inclusion of the most recent data in the dataset used to estimate risk parameters leads to materially different risk estimates and in particular:

- for PD, whether including the most recent data leads to a significant change in the long-run average default rate; this analysis should take into account the appropriate redefinition of the period of likely range of variability of default rates and of the mix of good and bad years, if necessary;
- for LGD, whether including the most recent data leads to a significant change in the long-run average LGD or downturn LGD;

ii) a backtesting analysis, which should include a comparison of the estimates used for the calculation of own funds requirements against observed outcomes for each grade or pool

203. Institutions should specify conditions when the analyses referred to in paragraph 202 should be performed more frequently than annually. These conditions should include the specification of events that trigger the analyses such as major changes in the risk profile, credit policies or relevant IT systems.

204. For the purpose of performing the tasks referred to in Article 190(2) of Regulation (EU) No 575/2013 institutions should define a regular cycle for full review of the rating systems, taking into consideration their materiality, covering all aspects in development, estimation of risk parameters and, where applicable, of model components. This review should include a review of the selection of the existing and potential risk drivers and assess their significance based on the predefined standards. The review should also include an assessment of the modelling approach, its conceptual soundness, fulfilment of modelling assumptions and alternative approaches. Where the results of this review recommend changes to model design, a respective re-development of the model should be carried out.

205. For the purpose of the review specified in paragraphs 200 to 204 institutions should use consistent rules for data adjustments and exclusions and ensure that any difference in these processes between the relevant datasets is justified and does not distort the results of the analysis.

The analysis referred to in paragraph 202(c)(i) of the EBA CP on GLs should also address, for CCFs, whether including the most recent data leads to a significant change in the long-run average CCF or downturn CCF.

The back-testing analysis referred to in paragraph 202(c)(ii) of the EBA CP on GLs should also, for LGD models that result from a combination of different components (for example, secured and unsecured components), be run both at component and at facility level.

104. In the case of material models where the assignment of the grade is based on a statistical model and the portfolio is not sufficiently granular (i.e. where slight changes in the ranking of the obligors could lead to significant changes in the

risk-weighted assets in that portfolio, for example, due to single-name concentrations, concentrations of the risk parameters in grades or pools, etc.), the framework referred to in paragraph 103 should also include – at least on a triennial basis, but more often depending on the materiality of the model – an analysis of whether the inclusion of the most recent data in the RDS used for model development would lead to materially different model outcomes. The analysis should consider, in particular, whether the discriminatory power of the PD, LGD or CCF models would be materially increased when re-estimating the model parameters based on the updated RDS.

8 Calculation of maturity for non-retail exposures

105. The relevant regulatory references related to the topic presented in this section are:

    (a) Articles 162(2)(f) and 162(3) of the **CRR**;

    (b) Article 73(d)(i) and (ii) of the **EBA RTS on AM**.

106. For the purposes of Article 162(2)(f) of the CRR, institutions are expected to calculate the maturity parameter (M) using the expiry date of a facility, and should not use the repayment date of a current drawn amount.

107. For the purposes of Article 162(3) of the CRR, institutions are expected to adequately justify and document any exemptions from the one-year maturity floor.

9 Glossary

BCBS	Basel Committee on Banking Supervision
CCF	Credit conversion factor
CP on GLs	Consultation paper on the Guidelines on PD estimation, LGD estimation and treatment of defaulted exposures
CRR	Capital Requirements Regulation
DR	Default rate
DT	Downturn
EAD	Exposure(s) at default
EBA	European Banking Authority
EBA RTS on AM	EBA Final Draft Regulatory Technical Standards on assessment methodology
EL_{BE}	Expected loss best estimate
GDP	Gross domestic product
IRB	Internal ratings-based
LGD	Loss(es) given default
MoC	Margin of conservatism
NUTS	Nomenclature of territorial units for statistics
PD	Probability of default

RDS	Reference data set
RTS	Regulatory Technical Standards
SME	Small and medium-sized enterprises
TRIM	Targeted review of internal models

Market risk

1 Scope of the guide for market risk

1. The purpose of this chapter of the guide is to inform institutions of the principles regarding a number of topics selected for market risk under TRIM. These topics were selected taking into account the current requirements of the CRR as well as the principles of the expected revision to the market risk framework within the CRR arising from recent developments in the **Basel market risk framework**. This enabled the targeting of modelling choices that will still be allowed in the revised framework (e.g. calculation of actual and hypothetical P&L, risk factors in VaR and stressed VaR or default risk of the incremental risk charge (IRC)).

2. In addition, in accordance with the requirements set out in the CRR, the EBA has drafted a Regulatory Technical Standard that specifies how competent authorities should assess internal models for market risk[42]. The **guide** accommodates these developments where possible.

3. It should also be highlighted that this document does not cover all the topics that will be subject to review during the on-site investigations (e.g. model governance, internal validation).

2 Scope of the internal model approach

4. The relevant regulatory references related to the topic presented in this chapter are:

   (a) Articles 4(86), 104, 106, 325, 348, 349, 350, 352, 362, 363, 364, 367(2)(b), 373, and 386 of the CRR;

   (b) EBA Guidelines on the Incremental Default and Migration Risk Charge (IRC) (EBA/GL/2012/3).

2.1 Delimitation of the regulatory trading book

5. In accordance with Article 104 of the CRR, banks should have a policy describing which instruments are included in the regulatory trading book and how they are identified. This policy should also encompass rules for moving instruments between the regulatory trading book and the regulatory banking book.

[42] Final draft RTS on the IMA assessment methodology and significant shares (EBA/RTS/2016/07).

6. According to Article 4(86) of the CRR, “trading book” means all positions in financial instruments and commodities held by an institution either with trading intent, or in order to hedge positions held with trading intent. Banks should be able to list all positions that are classified as held for trading for accounting purposes and which are not included in the regulatory trading book. In addition, they should also be able to justify these exclusions.

7. Banks should be able to identify and list the net short risk positions for equity risk or credit risk in the regulatory banking book at the request of the competent authority[43].

8. Banks should be able to identify[44] all internal hedges (as defined in Article 106 of the CRR) and have a policy explaining the treatment of internal hedges in terms of calculations of own funds requirements for market risk. This policy should distinguish between:

   (a) hedges of a banking book credit risk exposure or counterparty credit risk exposure using an internal risk transfer with the trading book;

   (b) hedges of a banking book equity risk exposure using a hedging instrument purchased from the market through the trading book;

   (c) hedges of a banking book interest rate risk exposure using an internal risk transfer with the trading book;

   (d) eligible hedges that are included in the credit valuation adjustment capital charge.

   Additionally, banks should be able to identify internal transactions within the trading book[45] and show that these transactions in principle do not contribute to the IMA calculated risk numbers on trading book level.

9. In accordance with Article 386 of the CRR, eligible credit valuation adjustment hedges in the trading book should be included in the scope of calculation of own funds requirements for general risk (they might be included in the VaR or treated through the Risk Not in VaR framework – see Chapter 7). In addition, other (i.e. non-eligible) credit valuation adjustment hedges in the trading book should be included in the calculation of own funds requirements for market risk (i.e. general and specific risk).

10. If back-to-back transactions are excluded banks should be able to provide respective documentation and demonstrate that there are no residual risks stemming from these transactions.

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[43] CDS (credit default swaps) held by banks for banking book hedging purposes that are fair valued instruments hedging loans accounted for in accrued shall be identified as net short positions for credit risk.

[44] Identify means to be able to spot out these trades from among its transactions. It is not required that the bank is able to segregate them in dedicated portfolios on which to carry out specific analysis.

[45] E.g. between two trading units within the trading book.

11. In particular, banks should be able to identify the trading book or banking book classification and specify the market values, differentiated according to trading book and banking book, for the following types of instruments which are presumed to be in the trading book:

    (a) instruments in the correlation trading portfolio;

    (b) instruments giving rise to a net short credit or equity position in the banking book;

    (c) instruments resulting from underwriting commitments;

    (d) instruments held as accounting trading assets or liabilities (“held for trading” assets and liabilities);

    (e) instruments resulting from market-making activities;

    (f) listed equities;

    (g) equity investments in a fund, including but not limited to hedge funds, for which the bank can look through the fund daily or can obtain daily liquid prices for its equity investment in the fund;

    (h) trading-related repo-style transactions;

    (i) options including bifurcated embedded derivatives from instruments issued out of the banking book that relate to credit or equity risk.

    If the current classification deviates from the presumed classification, banks should be able to justify this in light of the definition of the trading book of Article 4(86) of the CRR.

12. Banks should be able to identify the trading book or banking book classification and specify the market values, differentiated according to trading book and banking book, for the following types of instruments which are presumed not to be in the trading book:

    (a) unlisted equities;

    (b) instruments designated for securitisation warehousing;

    (c) real estate holdings;

    (d) retail and SME credit;

    (e) other types of credit;

    (f) equity investments in a fund, including but not limited to hedge funds, that do not fulfil the conditions of paragraph 11;

    (g) derivative instruments that have the above instrument types as underlying assets;

(h) instruments held for the purpose of hedging a particular risk of a position in the types of instrument above.

If the current classification deviates from the presumed classification, banks should be able to justify this in light of the definition of the trading book of Article 4(86) of the CRR.

13. In addition, for each category listed in paragraphs 11 and 12, banks should be able to indicate whether the corresponding positions are included within the scope of the Internal Model Approach (IMA).

2.2 Treatment of banking book positions

14. For banks that have approval to use the IMA for foreign exchange risk, the modelling of banking book foreign exchange (FX) positions in the internal model may be challenging due to different trade booking systems and different market data processes for the banking book compared with the trading book. Subject to supervisory approval, banks may consistently exclude all banking book FX positions from the internal model.

15. For both existing and new permissions to model FX risk, these exclusions are subject to supervisory approval and banks should ensure that the scope of the permission still covers a significant share of the positions of the foreign exchange risk (in accordance with Article 363(2) of the CRR). If no supervisory approval is granted, the banking book FX exclusions should be treated in the same way as those for trading book positions (see Section 2.4).

16. When excluded from the internal model, the banking book FX positions should be subject to stand-alone own funds requirements (OFR) calculated according to the standardised approach. When calculating this add-on, banking book positions should not be netted with trading book FX positions excluded from the IMA and treated under the standardised approach.

17. Banks should have well-documented processes for the methodology for calculating overall net foreign exchange positions (ONFEP) according to Article 352 of the CRR. In particular, the intermediate steps (e.g. before and after netting, treatment of intragroup deals) followed for calculating the ONFEP from the subsidiaries' solo level to the group level should be clearly defined. If a bank makes use of Article 352(2) of the CRR, it should document in detail which structural positions and hedges are covered by the exception and how they are covered, including detail on the materiality of each of them.

18. Banks that have the approval to use IMA for FX risk should be able, at the request of supervisors, to estimate the difference between the OFR calculated under the standardised approach and the OFR calculated under the IMA for FX

positions of the banking book which are excluded from the scope of application of the IMA[46].

19. If the bank has permission to use the IMA for commodities risk, commodities positions in the banking book are presumed not to be excluded from the scope of application of the internal model. Commodity positions are not expected to be widespread throughout the banking book (in contrast to FX positions).

2.3 Partial use models

20. Banks that have permission to use the internal model for calculating market risk own funds requirements for only one or more of the risk categories according to Article 363(1) of the CRR ("partial use") should exclude certain risks or positions from the scope of the internal model approval. In this case, the own funds requirements for the risk categories outside the scope of the internal model should be calculated according to the standardised approach.

21. Portfolios for which the bulk of the risks[47] fall outside the scope of the model approval may be completely carved out from the regulatory internal model if the overall own funds requirements under the carve-out are higher than under the previous approach[48]. Banks should notify the competent authority about the exclusion via an ex-ante notification. Nevertheless, a bank should adequately risk manage these portfolios. The own funds requirements for the carved-out portfolios should be determined according to the standardised approach (including the risk categories for which internal model approval had been granted). In this case, banks should ensure that the internal model still covers a significant share of the positions of the related risk categories (in accordance with Article 363(2) of the CRR).

22. Portfolios for which the bulk of the risks fall within the scope of the model approval should be included in the regulatory internal model for the calculation of own funds requirements (for the risk categories within the scope of the IMA). In any case, the own funds requirements for the risks not included in the scope of permission for the IMA should be determined according to the standardised approach.

23. According to Article 362 of the CRR, the general risk of debt instruments should refer to interest rate risk. Similarly, the general risk of equity instruments refers to the change in value of indexes. Banks having the approval only for general risk of equity or debt instruments (in accordance with Article 363 of the CRR)

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46 Structural forex positions excluded from the scope of the calculation of the own funds requirements for market risk according to Article 352(2) of the CRR should also not be included.

47 A typical example would be a portfolio of equity options for a bank that has no permission to model equity risk (only position risk of debt instruments modelled).

48 This should be considered as an option given to partial use banks to smooth the transition to FRTB trading desk view.

may use a different definition of general risk[49] if they are able to demonstrate that it leads to higher risk-weighted assets[50].

2.4 Exclusion from the scope of application of the IMA of positions in the regulatory trading book

24. For each institution or undertaking that is included in the scope of supervisory approval for the internal model at the consolidated or sub-consolidated levels, banks should monitor the exclusion of trading book positions or of certain risks of trading book positions from the internal model[51].

25. If the bank excludes positions (including any banking book positions) or risks that would in principle fall within the scope of supervisory approval for the internal model, the bank should determine the own funds requirements for the excluded positions according to the standardised approach. Additionally, banks should be able to justify the exclusions and demonstrate that they are appropriately treated under the standardised approach.

26. For banks with approval to use the IMA, instruments on underlyings such as temperature, weather derivatives and mortality or exotic derivatives should be included in principle in the scope of the IMA (where the “exotic” risks might be treated under the “Risks Not in the Model” framework where necessary) unless they can demonstrate that the standardised approach can appropriately capture the risks (see paragraph 25).

27. In any case, banks should be able to demonstrate that those positions or risks excluded from the scope of the internal models for regulatory purposes are adequately risk managed.

28. Systematic exclusions of positions or risks that would in principle fall within the scope of supervisory approval for the internal model based on the application of a materiality criterion at transaction level (e.g. notional amount lower than a certain EUR amount) are not acceptable. Banks must be able to provide documentation for excluded back-to-back transactions (i.e. transactions exactly matched with a third-party transaction) and to demonstrate that there are no residual market risks stemming from these transactions. Unlike other excluded positions, these back-to-back transactions do not need to be included in the standardised approach. However, potential P&L generated by these back-to-back transactions should be considered in the back-testing (for the P&L components that are not excluded from the actual or hypothetical P&Ls).

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[49] For example, by including credit spread risk in the interest rate general risk.

[50] Using a different definition and extending the risk coverage of the IMA should be considered as an option, not an obligation, given to partial use banks, to smooth the transition to FRTB trading desk full risk view.

[51] These exclusions are assumed to be an exceptional case.

2.5 Treatment of specific positions

Own debt exposures

29. Banks having approval for general and/or specific risk of debt instruments are expected to include their own creditworthiness[52] as an individual risk factor in the specific risk component of the VaR and sVaR and in the incremental risk charge (IRC). In any case, general interest rate risk for own debt instruments should be accommodated in the model if the bank has the respective approval.

30. In line with the EBA Guidelines on the IRC (EBA/GL/2012/3), banks are expected to model only the migration risk of those long or short positions in the institution's own debt which may arise from trading or market-making activity in its own-debt issuances, or from trading protection in the institution's own name (e.g. via an index). Banks are not expected to model the default risk of positions in their own debt in the IRC model.

31. Own debt exposures to be included should be defined depending on the level of consolidation of the model approval:

    (a) consolidated or group level (Figure 1): all intragroup exposures are expected to be considered as own debt positions;

    (b) sub-consolidated level (Figure 2): all exposures among subsidiaries at the sub-consolidated level, the sub-consolidated level itself and the parent levels are expected to be considered as own debt positions;

    (c) solo level (Figure 3): only exposures to the solo level itself and to the parent levels of consolidation are expected to be considered as own debt positions.

    Figures 1, 2 and 3 illustrate an example of each case respectively.

[52] This refers exclusively to position risk taken against debt issued by the institution or derivatives referencing that debt and does not refer to debt value adjustments.

Figure 1

Own debt positions (blue background) at the consolidated level

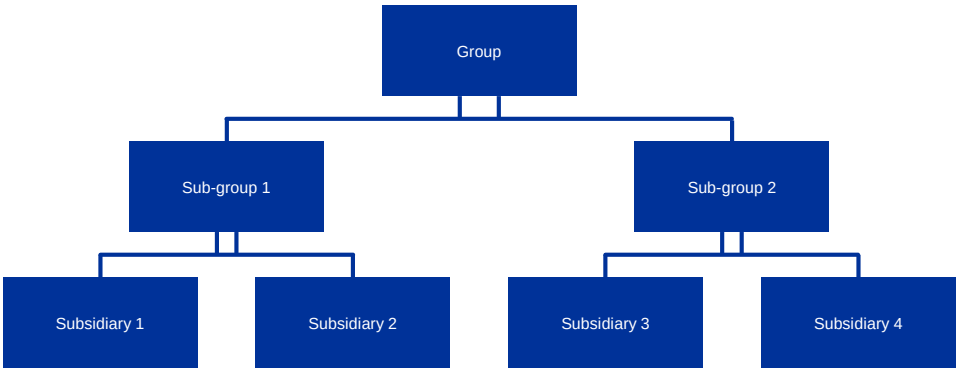


Figure 2

Own debt positions (blue background) at the sub-consolidated level of Sub-group 1

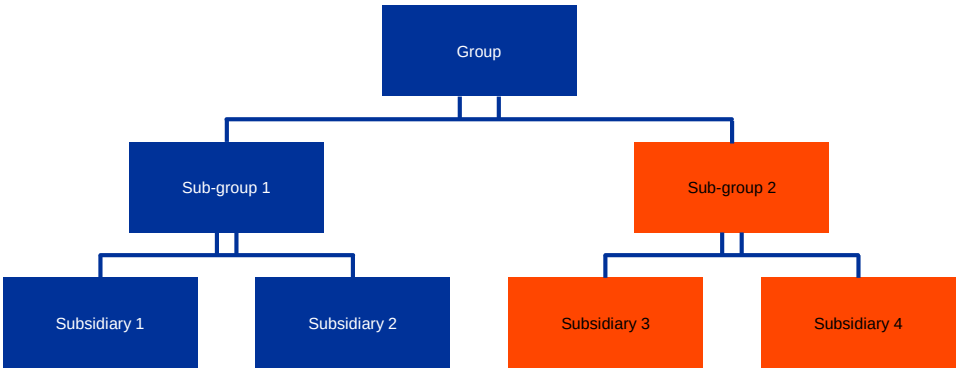
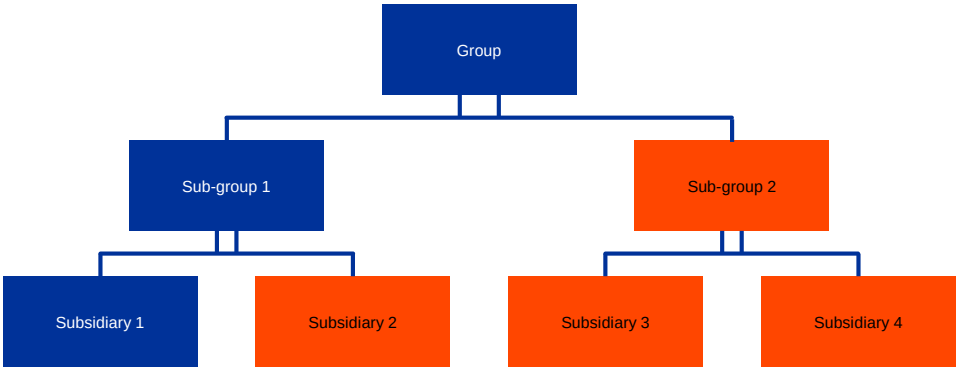


Figure 3

Own debt positions (blue background) at the solo level of Subsidiary 1



Positions in defaulted debt

32. When requested, banks should be able to identify all positions in defaulted debt that are in the regulatory trading book, with the following information:

    (a) market value of the exposure;

    (b) Boolean variable indicating if they are included in the VaR/sVaR;

    (c) Boolean variable indicating if they are included in the IRC.

33. Positions in defaulted debt should be included in the scope of the internal model approach or in the risks not in the model framework.

34. In modelling the risk of price changes of positions in defaulted debt in the IRC, banks are expected to apply a specific calibration of the recovery rates which is appropriate for positions in defaulted debt. If a credit institution does not have the capacity to model price changes of positions in defaulted debt in the IRC (e.g. owing to IT limitations), it is expected to apply a stressed price of the positions in defaulted debt that is proven to be adequately conservative given the quantile and holding period of the IRC.

35. In modelling any losses arising from positions in defaulted debt, institutions are expected to consider default as being an absorbing state. That is, no migration from default to non-default states is expected to be included in the modelling.

CIUs

36. This section refers to all equity investments that banks may have in a collective investment undertaking[53] (CIU) (including exchange-traded funds (ETFs), equity investments in hedge funds, etc.) as well as derivative instruments that have these instrument types as underlying assets.

37. Banks should have in place a procedure to identify for each CIU:

    (a) if daily look-through is possible;

    (b) if the general criteria as defined in Article 349 of the CRR are fulfilled;

    (c) if the CIU is subject to any type of risk for which the institution has received approval (general and specific risk for debt instruments and equity, FX risk also included in the banking book, commodities risk also included in the banking book)[54];

[53] As defined in Article 4(1)(7) of the CRR.

[54] This identification should be done based on the mandate of the CIU. If the mandate of the CIU allows the investment in underlyings subject to a certain risk category, the CIU is considered to be subject to that risk category regardless of the actual investments at any given moment in time.

(d) where daily look-through is not possible and Article 350(2) of the CRR is applied, if the conditions of that article are met; institutions should define a methodology to assess the correlation between the CIU and the index in accordance with Article 350(2) of the CRR;

(e) if, solely where daily look-through is not possible, a daily liquid price can be obtained for the CIU. Institutions should define a methodology to assess the liquidity in this case.

38. The outcome of the procedure described above should be documented and updated periodically, at least annually for existing positions and immediately for new positions or at the request of the competent authorities.

39. If the underlyings of the CIU are not subject to specific risk, banks may adopt the internal model approach for their own funds requirements for general risk when at least one of the following conditions is met:

(a) if daily look-through is possible;

(b) in accordance with Articles 364(2)(a) and 350(2) of the CRR, if the purpose of the CIU's mandate is to replicate the composition and performance of an externally generated index or fixed basket of equities or debt securities and a minimum correlation coefficient between daily returns on the CIU and the index or basket it tracks of 0.9 can be clearly established over a minimum period of six months. In this case, banks may include the CIU under the scope of the VaR and sVaR by incorporating positions representing the externally generated index or fixed basket of equities or debt securities;

(c) if a daily liquid price for the CIU is available. In this case, banks may include the CIU under the scope of the VaR and sVaR as a single risk factor.

If none of these conditions are satisfied, the CIU should not be included in the scope of the IMA.

40. If the CIU is subject to specific risk for debt instruments and the bank is authorised to use the internal model approach for specific risk for debt instruments, the following applies.

(a) In accordance with Articles 364(2)(a) and 350(1) of the CRR, if the application of the daily look-through approach is possible, banks may include the underlying positions of the CIU within the scope of the internal model (VaR, sVaR and IRC) and be subject to the general requirements for computing own funds requirements using internal models.

(b) In accordance with Articles 364(2)(a) and 350(2) of the CRR, if the purpose of the CIU's mandate is to replicate the composition and performance of an externally generated index or fixed basket of equities or debt securities and a minimum correlation coefficient between daily returns

on the CIU and the index or basket it tracks of 0.9 can be clearly established over a minimum period of six months, banks may include the CIU under the scope of the model (VaR,sVaR and IRC) by incorporating positions representing the externally generated index or fixed basket of equities or debt securities in the IMA.

(c) If the daily look-through approach is not possible but a daily liquid price for the CIU is available, institutions may include the CIU within the scope of the internal model (VaR or sVaR) to account for the general risk of debt instruments. In this case, the specific risk of the debt instruments of the CIU should be taken into account as an add-on based on the standardised approach for the specific risk of debt instruments (according to Articles 348 and 350(3) of the CRR). Institutions should have a policy in place describing the calculation of such add-ons.

(d) If none of the previous cases is satisfied, both general and specific risk should be covered by the standardised approach and the CIU should not be included in the scope of the internal model.

41. If the CIU is subject to specific risk for equity instruments and the bank is authorised to use the internal model approach for specific risk for equity instruments, the following applies.

(a) If the bank models specific risk of equity instruments in the IRC, the treatment described in paragraph 40 should be applied[55].

(b) If the bank does not model specific risk of equity instruments in the IRC, the bank may apply the internal model approach for the equity risk of the CIU subject to the conditions described in paragraph 39.

42. In all cases, the actual FX positions (including gold) of the CIU should be taken into account in accordance with Article 367(2)(b) of the CRR.

2.6 Aggregation requirements

43. Banks are expected to be able to provide the list of legal entities that contribute to the market risk own funds requirements under the IMA. In each case, banks should be able to specify whether the internal model is used at the solo and/or sub-consolidated level. In addition, they should be able to provide information on how each legal entity is included in the IT infrastructure of the risk engine and whether limitations exist for the legal entity.

44. If the quality of the risk numbers at the consolidated level suffers from limitations of the risk calculations at the entity level (e.g. due to system limitations) a bank should include these entities in the model-based own funds

[55] Where specific risk for debt instruments is replaced by specific risk for equity instruments and general risk for debt instruments is replaced by general risk for equity instruments.

requirements by applying a simple sum. The simple sum aggregation should also apply if the bank cannot ensure integrated and harmonised risk management across all entities.

45. If an institution has an integrated risk management system and IMA approval at the consolidated level, which allows for the calculation of single VaR, sVaR and IRC figures for the group, then individual positions of subsidiaries can be netted against each other and diversification between group entities can be taken into account, as long as the conditions in Article 325 of the CRR are met.

46. Institutions without approval at consolidated level may use positions in one institution or undertaking to offset positions in another institution or undertaking for the purpose of calculating net positions and own funds requirements on a consolidated basis provided that approval according to Article 325 of the CRR has been granted. In this case, banks should document how the offsetting of positions is performed and decide either to consistently include or consistently exclude intragroup positions from the calculation of own funds requirements for market risk at consolidated level.

47. For institutions without approval at consolidated level:

    (a) if the bank has a solo IMA approval at the parent level and at the level of each subsidiary, then the bank should aggregate individual VaR (or respectively sVaR, IRC) using a simple sum to calculate VaR (or respectively sVaR, IRC) at the consolidated level. For example, in the case of three subsidiaries:

    $$VaR_{group} = VaR_{parent} + VaR_{sub_1} + VaR_{sub_2} + VaR_{sub_3}$$

    $$sVaR_{group} = sVaR_{parent} + sVaR_{sub_1} + sVaR_{sub_2} + sVaR_{sub_3}$$

    $$IRC_{group} = IRC_{parent} + IRC_{sub_1} + IRC_{sub_2} + IRC_{sub_3}$$

    (b) if a bank has a solo IMA approval at the parent level and at the level of one subsidiary but not at the level of the other subsidiaries, then the bank should aggregate capital charges (CC) using a simple sum so as to calculate capital charges at the consolidated level. For example, in the case of three subsidiaries:

    $$CC_{group} = CC_{parent}(IMA) + CC_{sub_1}(IMA) + CC_{sub_2}(SA) + CC_{sub_3}(SA)$$

48. The aggregation of certain risks or risk categories may be performed, in accordance with Article 367(3) of the CRR, by the use of empirical correlations[56] only if the institution's approach for measuring correlations is based on observable data. If this cannot be ensured, an institution should use the simple sum aggregation of stand-alone risk numbers for certain risks or risk categories. In addition, banks should be able to calculate, at the request of the supervisors,

[56] For the purpose of this **Guide**, "empirical" correlations mean correlations that can be observed in reliable historical market data.

the stand-alone VaR and sVaR corresponding to each of the following risk classes[57]: interest rate risk, equity risk, commodity risk, foreign exchange risk and credit spread risk.

3 Regulatory back-testing of VaR models

The relevant regulatory references related to the topic presented in this chapter are Articles 106(3), 352(2), 366, and 386 of the CRR.

3.1 Scope of application of the regulatory back-testing

49. The scope of application should be clearly documented.

50. The changes in value of all the positions included (and only those) in the scope of calculation of the VaR should be considered in the calculation of the P&L (hypothetical and actual) used to perform the back-testing. The following paragraphs present specific cases.

51. If the bank is authorised to apply the internal model approach for positions in its banking book (foreign exchange and/or commodities risk), the bank should include these positions in the back-testing and should clearly document how the actual and hypothetical P&L of these positions are calculated.

52. Regarding positions in the banking book included in the IMA, only the changes in value of market data pertaining to FX risk and commodity risk should be taken into account in the calculation of the actual and hypothetical P&L. In addition, the same market data should be used to calculate the P&L of banking book and trading book positions.

53. All positions taken to hedge against the adverse effect of the exchange rate of the bank's ratios which may, subject to permission, be excluded from the calculation of the own funds requirements for market risk (Article 352(2) of the CRR) are also excluded from the scope of application of the back-testing.

54. Internal or external credit derivative hedges for non-trading book credit risk exposure or counterparty risk exposure that are excluded from the trading book for the purposes of calculating capital requirements, in accordance with Article 106(3) of the CRR, are excluded from the scope of calculation of the actual and hypothetical P&L.

55. According to Article 386(3) of the CRR, eligible hedges that are included in the calculation of own funds requirements for credit valuation adjustment risk should not be included in the calculation of the own funds requirements for specific risk. Therefore, the change in value of these positions attributable to

[57] If this is not possible, the calculation should be based on the approved risk categories.

specific risk is not included in either the actual or the hypothetical P&L. However, if the own funds requirements for general risk of these eligible hedges are calculated with the VaR model (see paragraph 9), the change in value of these positions attributable to general risk is included in the actual and in the hypothetical P&L.

56. Hedges that are not eligible for regulatory credit valuation adjustment are included in the VaR calculation, as well as in the scope of calculation of the hypothetical and actual P&L for back-testing.

3.2 Historical period used to perform back-testing and definition of business days

57. According to Article 366(2) of the CRR, the addend should depend on the number of overshootings for the most recent 250 business days.

58. For the purpose of the previous paragraph, institutions should define and document local and global business days according to the following guidance.

59. If the institution has the possibility to conduct trading on a given day in a given location, this constitutes a local business day for the institution, in that location, therefore requiring P&L calculation, VaR calculation and market risk monitoring and reporting. Banks should justify non-business days. Unchanged risk positions are a necessary but not sufficient condition to demonstrate the adequate determination of non-business days.

60. Global business days are defined at the consolidated level (or for a national sub-group at the sub-consolidated level). For the purpose of defining global business days the institution should take its most important trading location ("reference location"). Global business days should include at least the local business days of the reference location. When there are two or more reference locations (of approximately the same size), the bank chooses one reference location and is allowed to add additional global business days based on the local business days of the other major reference locations. In such a case, the rationale underlying this choice should be documented.

61. For every global business day P&L calculation, VaR calculation and market risk monitoring and reporting is required[58]. If P&L calculation is conducted on non-business days, these should not be used for the purposes of regulatory back-testing, i.e. the P&L used for back-testing is the P&L between two global business days and should be compared with the VaR for a one-day holding period.

[58] All positions of trading units in the location with local non-business days should be included in the calculation of the consolidated figures.

62. Banks should have a policy/procedure describing how they calculate the actual and hypothetical P&L. For example, they should at least explain:

    (a) how the actual P&L is calculated and, in particular, the differences between the economic[59] and actual P&L;

    (b) the fees and commissions excluded from the actual P&L;

    (c) the valuation adjustments not updated every day and whether or not they are included in the P&L time series.

3.3 Calculation of actual P&L

General rules

63. In order to promote the use test of back-testing and avoid any supplementary and burdensome computations for banks, the actual P&L should be as close as possible to the economic daily P&L of the bank.

64. Actual P&L should include the profit and loss stemming from intraday activities, excluding fees, commissions and net interest income. The methods and definitions used to apply this exclusion should be clearly documented.

65. Net interest income[60] can be defined as the interest cash flow related component of the passage of time on the value of the portfolio (i.e. positions remain unchanged, market data remain unchanged and the date is moved from t to t+1). It measures the paid or received interest cash flows and the interest cash flow related effect on the fair value[61]. In the calculation of the net interest income refinancing costs can be considered. The deduction of this effect from the actual P&L can be restricted to the portfolios for which it is material.

66. The actual P&L is calculated for positions in the trading book and banking book which are under the scope of the IMA. The change in value of all market risk parameters (even those that are not modelled in the VaR) should be taken into account in the actual P&L.

67. The same pricing methods (i.e. same pricing configurations and model parametrisations) as those used to compute the daily economic P&L should be used.

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59 As defined in the glossary.

60 Banks will be required to provide additional information on their definition of net interest income in order to give a more precise guidance if needed.

61 For example, if a bond coupon is received and the fair value of the bond drops by the coupon amount, the net interest income is zero.

Valuation adjustments

68. All valuation adjustments (methodology, frequencies, calculation process, etc.) should be clearly documented by banks.

69. Credit valuation adjustments and debt valuation adjustments are excluded from the actual P&L[62].

70. Additional valuation adjustments (AVA)[63] that are calculated to obtain the prudent value of the positions in the trading book are excluded from the actual P&L.

71. All other valuation adjustments should be included in the actual P&L, even if they are not computed on a daily basis[64].

72. Change in value of valuation adjustments that are not computed daily should be taken into account in the actual P&L of the business day on which the adjustment has been calculated. Any kind of smoothing or distributing of such change in value of fair value adjustments is not allowed.

73. Actual P&L should not take into account the changes in value generated by the default of a counterparty, under the condition that the bank demonstrates that they are related only to counterparty credit risk and that the corresponding losses are taken into account in the bank's counterparty credit risk framework. However, losses due to the default of a bond or other fixed income security should be included.

3.4 Calculation of hypothetical P&L

74. The hypothetical P&L is the change in value of the portfolio that is calculated based on unchanged positions. Hence the P&L generated by the intraday trading and by the new positions over the past day is not taken into account.

75. Any other profit and loss element, such as credit valuation adjustments, debt valuation adjustments or any other valuation adjustments, fees, commissions or net interest income, are not included in the hypothetical P&L[65].

76. Only the changes in value of the market risk parameters of the risk categories included in the scope of the model permission should be considered. For example, if the bank is authorised to use an internal model for general interest

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62 In accordance with Article 40(5)(d) of the final draft RTS on the IMA assessment methodology and significant shares (EBA/RTS/2016/07).

63 As set out in Commission Delegated Regulation (EU) 2016/101 of 26 October 2015 supplementing Regulation (EU) No 575/2013 of the European Parliament and of the Council with regard to regulatory technical standards for prudent valuation under Article 105(14) (OJ L 21, 28.1.2016).

64 This refers at least to the valuation adjustments listed in Article 105(10) of the CRR with the exception of the unearned credit spreads which are excluded according to paragraph 69.

65 In accordance with Article 40(4)(d) of the final draft RTS on the IMA assessment methodology and significant shares (EBA/RTS/2016/07).

rates risk only, the hypothetical P&L should include the changes in value of market parameters pertaining to general interest rate risk only.

77. The pricing methods and model parametrisations should be the same as those used to compute the daily economic P&L.

78. The time decay effect (theta effect) might not be considered in either the VaR or in the hypothetical P&L in a consistent manner. However, banks might choose to model time decay in their VaR model (and thus also in the hypothetical P&L) to better align the model to the inherent risks of the trading strategies (e.g. a material inherent risk of a straddle option may be the effect on P&L stemming from time decay without change of the market data).

3.5 Counting of overshootings

79. According to Article 366(3) of the CRR, the back-testing addend is based on the higher of the number of overshootings under hypothetical and actual changes in the value of the portfolio.

80. For each global business day, the VaR forecast (based on the composition of the portfolio at time t, the forecast is calculated for one-day change of the risk factors) is compared with actual and hypothetical P&L for the subsequent business day. The date of the subsequent day can differ from the next day due to weekends and non-business days.

81. However, if an overshooting has been notified due to errors in the calculation of the P&L or VaR the bank may, subject to the consent of the competent authority, withdraw the overshooting notification (this includes overshootings caused by IT issues or data issues). Consent should be granted if the explanation given by the bank is clear and complete. If the erroneous calculations leading to overshooting notifications are recurrent, the bank should present a remediation plan.

82. Admissible reasons for withdrawing an overshooting notification are, for example:

    (a) errors in the calculation of the actual or hypothetical P&L due to IT issues or wrong parameters;

    (b) errors in the scope of calculation of the actual or hypothetical P&L;

    (c) false bookings (wrong positions included in the scope of the model);

    (d) delayed reserve releases;

    (e) temporary transmission problems between different business locations.

83. Inadmissible reasons for withdrawing an overshooting notification are, for example:

(a) differences in pricing functions between risk management (the VaR engine) and the front office;

(b) the transferal of whole portfolios causing deviations from mark to market due to traded volumes;

(c) the overshooting corresponds to a small difference between VaR and P&L;

(d) the model deficiency that caused the overshooting having already been addressed (there is no backward adjustment of overshootings);

(e) unexpected market movements.

84. If either the P&L or the VaR is not available or is impossible to compute within t+5 business days[66], it should be counted as an overshooting.

85. It is expected that the VaR numbers used for back-testing are available no later than t+2 business days. If there are frequent delays in the VaR computation, the bank should be able to justify these delays.

3.6 Analysis of overshootings

86. For every back-testing overshooting at global level, a detailed analysis should be performed by the bank. The analysis should be conducted in a structured way proportional to the respective overshooting and should in principle cover the following steps:

(a) identification of the set of positions responsible for the overshooting (portfolio analysis);

(b) identification, description and analysis of the market moves contributing to the overshooting (market analysis);

(c) identification of possible weaknesses in the internal model in the light of the previous two steps (analysis of the internal model).

More precisely, the topics listed below should be analysed.

Portfolio analysis

87. The analysis of the back-testing overshooting starts with a detailed description of the trading portfolio for which the one-day VaR forecast calculated had been exceeded by the one-day change in the portfolio's value. If the overshooting had been notified for the actual P&L, the intraday changes in the portfolio affecting the actual change should also be analysed.

[66] Where the VaR amounts are calculated on the basis of the positions at the end of business day t.

88. The back-testing analysis should be performed not only at the overall portfolio level, but also on lower portfolio levels, to identify the main positions that caused the overshooting. If respective sub-portfolios can be identified, they should be mentioned and analysed.

Market analysis

89. The analysis of the market describes the market moves contributing to the cause of the overshooting and explains them based on observable market parameters (e.g. asset prices, indices, interest rates, FX rates, implied correlations and volatilities). To assess the significance of the market moves, the market data, including those that are risk factors in the VaR, are analysed in a historical context. The significance of the change in market data which are risk factors in the VaR that contributed to the P&L is tested against the historical 99% confidence interval of risk factor changes. Changes in the correlations structure between the risk factors are also analysed. In addition the analysis includes the economic reasons for the market moves, as far as possible.

Analysis of the internal model

90. Based on the previous two steps, the suitability of the internal model is assessed. Where positions contributing to the back-testing overshooting can be identified, the appropriateness of the model for these particular positions is assessed. In addition, the reliability of the VaR calculation and of the actual and hypothetical changes in the portfolio is evaluated. The analysis of the internal model should focus on:

    (a) the appropriateness of risk factors used;

    (b) the modelling of risk factors;

    (c) the suitability of the processes for calculating VaR, hypothetical P&L and actual P&L.

4 Internal back-testing of VaR models

The relevant regulatory reference related to the topic presented in this chapter is Article 369 of the CRR.

4.1 Supplementary test requirements

Requirements in terms of granularity of internal back-testing

91. According to Article 369(1)(b) of the CRR, in addition to the regulatory back-testing programmes, institutions should carry out their own internal model validation tests, including back-testing, in relation to the risks and the structure of their portfolios. Therefore, institutions are expected to perform separate back-testing at least on hypothetical P&L (i.e. counting and analysis of overshootings under hypothetical P&L) at more granular levels than the top-of-house level.

    (a) At a minimum:

        (i) internal back-testing should be performed at the level immediately below the top-of-house level;

        (ii) internal back-testing should be performed for each portfolio that is subject to a separate VaR limit.

    (b) If possible: banks should analogously apply the criteria established in Appendix A of the FRTB to their current portfolio structure in the trading book and identify the level in their portfolio hierarchy that would most likely satisfy the requirements for the trading desks; all portfolios at this level that are, to a large extent, within the scope of the internal model, should be separately back-tested.

Requirements for additional tests to be performed at the level of the whole portfolio as well as at the sub-levels as defined in paragraph 91

92. For both regulatory and internal back-testing, the institution should comply with the requirements described in Chapter 3, especially regarding the calculation of hypothetical P&L, and the counting of overshootings.

93. On request, banks should be able to provide, for a sample of transactions or portfolios, detailed decompositions of economical, actual and hypothetical P&L into their elements.

94. For each level below the top-of-house level where internal back-testing is performed, the institution should be able to provide:

    (a) a complete economic P&L, hypothetical P&L and VaR time series of at least one year but preferably three years;

    (b) an analysis of all overshootings including an explanation of the hypothetical P&L and an assessment of the model adequacy.

95. For the top-of-house level only, the institution should be able to provide in the regular internal validation tests:

(a) a complete economic P&L, hypothetical P&L, actual P&L and VaR time series of at least one year but preferably three years;

(b) the number of overshootings over at least the last year or preferably over the last three years, where available, in the VaR at the percentile 99% as well as:

(i) the averaged frequency of these overshootings (i.e. $-P\&L_{t+1} > VaR_t$ where $VaR_t > 0$ by convention);

(ii) the Loss Overshooting Ratio (LOR) defined by

$LOR = \frac{-P\&L_{t+1} - VaR_t}{VaR_t}$, where $-P\&L_{t+1} > VaR_t$;

(c) the results of statistical tests on the overshootings, at least the Kupiec (1995)[67] and Christoffersen (1998) [68] tests;

(d) the daily time series over at least the last year indicating the p-values[69] corresponding to the actual P&L and the hypothetical P&L in the daily simulated forecast of P&Ls used in the VaR engine[70] (for example, the VaR at confidence level of 99% corresponds to the p-value of 0.01).

4.2 Validation on hypothetical portfolios

96. As set out in Article 369(1)(c) of the CRR, banks should conduct validation exercises on hypothetical portfolios in order to test that the model is able to account for particular structural features[71]. These hypothetical portfolios should have targeted compositions so that the VaR model can be tested at a level that enables the identification and isolation of specific behaviours (e.g. specific business lines, features and/or trading strategies).

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67 Kupiec, Paul H. (1995). Techniques for verifying the accuracy of risk measurement models, *Journal of Derivatives*, 3 (2), 73–84.

68 Christoffersen, Peter (1998). Evaluating interval forecasts. *International Economic Review*, 39 (4), 841-862.

69 If a bank has a model based on a mixture of approaches, report the percentile of the most material one.

70 Given a vector of simulated P&Ls (used to estimate the VaR) sorted in ascending order, $x_1, \dots, x_n$, the p-value, $p(x)$, corresponding to a given P&L, x, should be obtained in the following way:

$$p(x) = \begin{cases} \frac{x_{k+1}-x}{x_{k+1}-x_k} \cdot p_k + \frac{x-x_k}{x_{k+1}-x_k} \cdot p_{k+1} & if\ x_k \le x \le x_{k+1}\ for\ k = 1, \dots n-1 \\ \frac{\left(\frac{p_1}{1-p_1}\right)^{\frac{x}{x_1}}}{1+\left(\frac{p_1}{1-p_1}\right)^{\frac{x}{x_1}}} & if\ x < x_1 \\ \frac{\left(\frac{p_n}{1-p_n}\right)^{\frac{x}{x_n}}}{1+\left(\frac{p_n}{1-p_n}\right)^{\frac{x}{x_n}}} & if\ x > x_n \end{cases} \quad \text{where } p_k = \frac{k}{n+1}.$$

71 These portfolios should not be limited to portfolios defined in the benchmarking exercises for market risk conducted by the EBA or the BCBS. Participation in such benchmarking exercises is thus not sufficient to meet the requirements of this section.

97. Such hypothetical portfolios should be built in line with the business model of the bank. For example, banks do not need to include products that are not covered by trader mandates or to test specific features which are not relevant for their positions. Consequently, banks are required to review the hypothetical portfolios in the event of any change in their business model or trading practices.

98. The number of hypothetical portfolios should be commensurate with the importance and the complexity of the trading activity of the bank.

99. The requirement of Article 369(1)(c) of the CRR can be fulfilled by performing back-testing on hypothetical portfolios. If banks set up back-testing on a very granular level and if they can demonstrate that the requirements of paragraph 96 are fulfilled, this could be considered as sufficient to fulfil this requirement as well.

100. The general framework for the back-testing of hypothetical portfolios should not differ from the framework for regulatory VaR back-testing as defined in Chapter 3 (e.g. the same valuation methods should be used to compute the P&L used for the regulatory back-testing and the P&L used for back-testing on hypothetical portfolios). However, only back-testing based on hypothetical P&L is expected.

101. In addition:

    (a) back-testing periods for hypothetical portfolios should cover at least the period used to calibrate the current VaR;

    (b) banks have the possibility to keep the portfolio static or to keep the features of the hypothetical portfolios over time (i.e. to keep the specific behaviours for which the hypothetical portfolio was selected as mentioned in paragraph 96 to back-test them over time);

    (c) the comparison should be carried out using the daily hypothetical P&L and the one-day VaR.

102. Banks are expected to have a policy in place that governs the overall process for defining hypothetical portfolios, conducting analysis of hypothetical portfolio outcomes and following up on the results of the exercise. This framework should cover at least the following tasks:

    (a) **Portfolio definition**:

        (i) Banks should have a process in place to identify and define hypothetical portfolios.

        (ii) The relevant trading units should be involved in the definition of these hypothetical portfolios.

    (b) **Execution**: Banks should have a process in place to execute back-testing on hypothetical portfolios at least annually.

(c) **Reporting**: Banks should have a process in place to ensure that the results for hypothetical portfolios are reported to the management body authorised to make decisions relating to internal models. This reporting can be part of the yearly validation report.

(d) **Analysis**: Banks should have a process in place to analyse the performance of the model based on the back-testing results, covering:

(i) identification of the market moves and parameters causing the overshootings;

(ii) compilation of a statement on the ability of the model to capture the risk of the hypothetical portfolios;

(iii) verification that insights gained by the analysis of hypothetical portfolio back-testing are reflected in the VaR model.

5 Methodology for VaR and stressed VaR

The relevant regulatory references related to the topic presented in this chapter are:

(a) Articles 365 and 367 of the CRR;

(b) EBA Guidelines on Stressed VaR (EBA/GL/2012/2).

5.1 General requirements

103. When using specific assumptions about the distributions of the risk factors included in the VaR and sVaR models, banks are expected to demonstrate the appropriateness of these assumptions based on observable data[72]. In the case of non-convincing justification or of missing validation, banks should compare the VaR and sVaR amounts calculated using their models with those calculated under another appropriate model using different distributions assumptions.

104. When using Monte Carlo simulations, banks are expected to be able to demonstrate that the number of simulations used to compute the VaR and sVaR is sufficient for producing precise and stable VaR and sVaR numbers.

105. Banks may apply different methodologies to calculate returns used to calibrate the VaR and stressed VaR models (absolute, relative or mixed approach) for different risk factors. However, for a given risk factor, when a specific methodology is used in the VaR, the same methodology is expected to be used for the same risk factor in the sVaR. Banks are expected to explain deviations

[72] In case banks are applying historical returns in their model the requirement refers to the choice of specific methodology to determine the returns (e.g. use of relative or absolute returns).

from this requirement on the basis of the regime changes occurring between the VaR and stressed VaR periods.

106. It is expected that the returns are calculated on the basis of one single holding period (e.g. one day or ten days) for all risk factors[73]. If the bank uses different holding periods for different risk factors (e.g. daily returns for some risk factors and weekly returns for other risk factors), the bank should not apply diversification between these different risk factors.

107. In order to demonstrate that the day of the week when the sVaR amounts are calculated does not lead to material bias, as required by the EBA Guidelines on Stressed VaR (EBA/GL/2012/2) part C, paragraph 10-3, the bank should be able to show that the sVaR on the day chosen is not significantly lower than the sVaR on the other days (e.g. by using sensitivities).

108. At the request of the supervisors, if the demonstration required in the preceding paragraph is not considered to be sufficiently convincing, banks should re-calculate the sVaR for 15 consecutive business days (including three reporting days). If it is not possible to perform this calculation in the production environment, it can be performed in a test environment replicating the calculation of the regulatory sVaR.

109. On request, banks should be able to provide an inventory of all open validation findings in relation to the VaR/sVaR calculation, including, for each of them, a description of the finding, the envisaged remedial action and a target date for the finding's closure. In addition, banks should retain closed validation findings for up to at least one year after the closure date and should be able to provide a description of the remedial action implemented.

5.2 Data inputs

Length of the time series used to calibrate VaR and stressed VaR

110. According to Article 365(1)(d) of the CRR, for the calculation of the VaR banks should use an historical observation period of at least one year except where a shorter observation period is justified by a significant upsurge in price volatility. It would be acceptable if banks simplified this requirement by taking returns referring to 250 consecutive business days[74].

[73] Uniformly using a one-day holding period in VaR and a ten-day holding period in stressed VaR might be permissible if adequately justified by a bank.

[74] The observation period corresponds to the timeframe between the first day of calculation of returns and the last day of calculation of returns. When a bank uses 10-day returns, the minimum observation period is 250 business days but the timeframe between the first day of calculation of the first 10-day return and the end date of the last 10-day return is 260 days.

111. If the bank uses an observation period (e.g. by applying a weighting scheme) for which the average time lag[75] is less than the average time lag for a one year equally weighted observation period (i.e. 125.5 days for 250 business days), the bank should use whichever is the highest result when calculating:

    (a) the VaR amount calculated with an equally weighted observation period of at least one year,

    (b) the VaR amount calculated with the weighted observation period[76].

    This comparison should be performed at least monthly. A bank should apply the calibration method leading to the highest VaR until the next comparison.

112. For the regulatory back-testing, the higher of the two metrics mentioned in paragraph 111 will be used. However, if the bank uses a VaR based on the metric leading to an average time lag lower than 125.5 for its risk management only, it is expected that the bank also performs internal back-testing of the VaR amounts based on the model calibrated to this period.

113. With respect to the requirement in Article 365(2) of the CRR to calibrate the sVaR from a continuous 12-month period, it would be acceptable if banks simplified this requirement by taking returns referring to 250 consecutive business days[77].

114. The bank should use one single observation period (i.e. the same starting date and ending date, and consequently the same length of observation period) for all risk factors modelled in the VaR or sVaR.

115. Consequently, if a new instrument (e.g. single stock or credit index series) is issued, the time series corresponding to this instrument should not be used on its own (at least the missing portion should be filled by a proxy) for the calibration of the VaR/sVaR models until the length of the time series reaches the length of the observation period used by the bank. In this case, the risk factor is considered to be proxied and the requirements for proxies will apply (see Section 5.3).

116. For banks using a simulation approach (either historical or Monte Carlo), the VaR (or sVaR respectively) is expected not to be lower than the weighted average of the P&Ls of the two scenarios surrounding the 99th percentile as defined below.

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[75] Given any weighting scheme, $\{w_t\}_{t=1,2,\ldots}$, where t is the lag in number of business days between the computation date and the historical date, the average time lag using the most recent n observations is defined as

$$average\ time\ lag(n,w) = \frac{\sum_{i=1}^{n} i \cdot w_i}{\sum_{i=1}^{n} w_i}$$

This definition can be extended to equally weighted schemes by taking $w_i = 1$ for all dates.

[76] In accordance with Articles 38(1) and 38(2) of the final draft RTS on the IMA assessment methodology and significant shares (EBA/RTS/2016/07).

[77] See Footnote 33.

Consider the vector of simulated P&L for VaR (or sVaR respectively) estimation ($P\&L_1$ to $P\&L_n$) ordered by ascending order[78]. It is assumed that the 99th percentile loss of this distribution is between $-\mathrm{P\&L}_{\mathrm{Int}\left(\frac{n+1}{100}\right)}$ and $-\mathrm{P\&L}_{\mathrm{Int}\left(\frac{n+1}{100}\right)+1}$, and not lower than:

$$\left(\frac{n+1}{100} - Int\left(\frac{n+1}{100}\right)\right) \cdot \left(-P\&L_{Int\left(\frac{n+1}{100}\right)+1}\right) + \left(Int\left(\frac{n+1}{100}\right) - \frac{n+1}{100} + 1\right) \cdot \left(-P\&L_{Int\left(\frac{n+1}{100}\right)}\right)$$

Where $\mathrm{Int}\left(\frac{n+1}{100}\right)$ is the highest integer below $\frac{n+1}{100}$.

Example:

For n=250, the VaR (or sVaR) should not be lower than
0.51 x (-P&L L_3)+0.49 ×(-P&L_2)

For n=260, the VaR (or sVaR) should not be lower than
0.61 x (-P& L_3)+0.39 ×(-P&L_2)

Data quality

117. For each risk factor time series used to calibrate the shocks of the VaR model, the bank should have a process in place to check the quality of the time series at least quarterly. In particular, at the request of the supervisors and when discussing the inventory referred to in paragraph 130, banks are expected to be able to explain the differences between the data used to calibrate the VaR and the data used for the daily economic P&L calculation.

118. During the quality checks on the time series, banks should, at least, identify for each risk factor time series:

    (a) the number of days for which data points were initially missing and then filled using a particular methodology (e.g. interpolation and extrapolation)[79];

    (b) the number of days for which data points were initially available and were replaced using a particular methodology (e.g. interpolation and extrapolation);

    (c) the number of days with no daily changes;

    (d) the maximum number of consecutive days with no daily change.

119. Banks are not expected to introduce material or large numbers of manual changes into the time series. They are expected to maintain up-to-date documentation describing the list of tasks that are potentially subject to manual adjustments. This documentation should contain the following.

[78] $P\&L_1$ is the lowest P&L (or the highest loss).

[79] No missing points are expected for the final time series of shocks used to calibrate the model.

(a) A description of the methodology followed to introduce the adjustment. The description should be detailed enough so for any staff member of the unit in charge to be able to produce the same outcome.

(b) A description of the processes in place to ensure the appropriate implementation of the manual process according to the documentation.

120. Specific justification should be given for the use of time series including less than 24 points per year before any data cleaning/treatment or more than 20 consecutive business days with missing data or no daily changes.

121. A methodology for the replacement of missing data should be defined and documented. In particular, banks should analyse how the replacement of missing data affects the volatilities and correlations of the IMA, especially in the case of automatic and systematic replacement of missing data points with the value of the same data on the previous day. Filtering of data or exclusions of outliers should not be performed unless the bank can demonstrate that the excluded data points correspond to erroneous or stale data and do not represent the real market volatility of the risk factors. The bank is required to keep track of any exclusion made in the time series used to calculate VaR/sVaR.

122. In particular, automatic and systematic filtering of data leading to exclusions of high or low returns, without further analysis, is not acceptable.

5.3 Proxies, beta approximation and regressions

123. For the purpose of this **Guide**, when market data that are used as input in the pricing model to compute the economic P&L for an IMA position are replaced by other market data[80] (or a weighted average of market data) for the purpose of determining the time series used to calibrate the VaR or sVaR for that position, the market data are considered as proxied in the calculation of the VaR or sVaR respectively. When the directly observable price of an instrument is taken for the economic P&L whereas the VaR model is using other market data that would lead to an equivalent price, this should not be considered as proxies[81].

124. In case of approval for specific risk, the use of each single stock (when available) as a risk factor in the VaR is considered to be the most appropriate method for modelling specific risk for equity instruments. Similarly, the direct use of idiosyncratic market data (when available) (e.g. the idiosyncratic part of the spread of each bond or each single-name credit default swap) as a risk

[80] If market data used for pricing and VaR calculation only differ in the source (for example, P&L pricing uses internal data sources and VaR calculations are based on Bloomberg data), the data used for risk calculation should not be considered as a proxy.

[81] Examples: a) if the VaR/sVaR is computed based on zero coupon rates whereas the economic P&L is computed by market instrument (yield) rates, zero coupon rates should not be considered as proxies; b) If a price-based economic P&L is used (e.g. listed options) and the VaR uses a model-based P&L, market data used on this pricing model should not by definition be considered a proxy.

factor is considered to be the best practice for modelling specific risk for debt instruments.

However, the use of beta approximations or regressions could be accepted if they are documented and regularly validated (i.e. they lead to good model performance). Banks with approval for specific risk should be able to demonstrate that the idiosyncratic volatility of equity or debt instruments with specific risk is correctly taken into account in the VaR and sVaR models.

125. Banks should be able to provide at least quarterly the percentage of time series of risk factors that are proxied for the calibration of the VaR and stressed VaR models:

$$\frac{Number\ of\ marked\ data\ inputs\ which\ are\ proxied\ for\ the\ VaR\ calculation}{Number\ of\ marked\ data\ inputs\ which\ are\ proxied for\ the\ VaR\ calculation + Number\ of\ market\ data\ inputs\ directly\ modelled\ for\ the\ VaR\ calculation}$$

$$\frac{Number\ of\ marked\ data\ inputs\ which\ are\ proxied for\ the\ sVaR\ calculation}{Number\ of\ marked\ data\ inputs\ which\ are\ proxied for\ the\ sVaR\ calculation + Number\ of\ market\ data\ inputs\ directly\ modelled\ for\ the\ sVaR\ calculation}$$

126. Banks should have a policy in place that defines a clear process for deriving and validating a proxy for VaR and sVaR. The policy should further define a set of controls (e.g. statistical analysis, comparison with alternative proxies) that should be performed to ensure the appropriateness of proxies.

127. Where sufficient market data is available, banks should perform analyses that show that the proxy market data are highly correlated with the market data used for economic P&L and that they show a similar level of volatility for VaR and sVaR.

In particular, for instruments with specific interest rate risk and specific equity risk, banks with approval for specific risk should demonstrate that the use of a proxy enables the idiosyncratic risk to be appropriately captured.

128. Any proxy should be validated for VaR and sVaR at least annually.

129. Upon request and depending on the results of the analysis of the appropriateness of the proxies, banks should be able to provide the results of the following test for selected sub-portfolios, business days and selected material proxies:

(a) the hypothetical P&L used for regulatory back-testing;

(b) the hypothetical P&L calculated on the same unchanged positions but replacing, for the positions for which proxies are used in the VaR, the market data with the market data of their proxies;

(c) the hypothetical P&L calculated on the same unchanged positions but replacing, for the positions for which proxies are used in the stressed VaR, the market data with the market data of their proxies.

5.4 Risk factors in the model

130. According to Article 367(1)(b) of the CRR, the model should capture a sufficient number of risk factors in the VaR/sVaR, depending on the level of activity of the institution in the respective markets. Where market data is incorporated into the institution's pricing model but not into the risk measurement model, the institution should be able to justify such an omission to the satisfaction of the competent authority.

    Therefore, banks should be able to provide an inventory of all the market data inputs of the economic P&L and the risk factors used in the models. This inventory should enable comprehensive mapping between the market data used to calculate the economic P&L and those included in the VaR model. The inventory should contain at least the following information:

    (a) a list of the market data inputs used in the calculation of the bank's economic P&L[82];

    (b) for each market data input, it should also be indicated:

        (i) whether the market data input is directly modelled in the VaR engine (i.e. whether it is a risk factor of the model and involves no use of a proxy);

        (ii) whether the market data input is proxied in the VaR calculation;

        (iii) whether the market data input is not modelled in the VaR engine;

        (iv) where relevant, how the market data input is proxied in the VaR calculation (e.g. by one market data input or several market data inputs).

    A similar inventory should be available for the sVaR model.

131. Identical underlyings should always be mapped to the same risk factor.

132. Upon request and depending on the results of the analysis of the appropriateness of the risk factors, banks are expected to be able to provide the results of the following test for selected sub-portfolios, business days and selected missing risk factors:

    (a) the hypothetical P&L used for regulatory back-testing as defined in Section 3.4 above;

    (b) the P&L calculated assuming simultaneously:

        (i) unchanged positions and omitting the changes in value of the missing risk factors of the VaR;

[82] E.g. inputs in banks' pricing models for economic P&L.

(ii) use of the pricing method and model parametrisation used to compute the economic P&L[83].

This test should enable the detection of missing risk factors.

5.5 Pricing functions/methods in the model

133. Banks should be able to produce and update on a regular basis (at least annually) an inventory of the VaR/sVaR pricing methods. This inventory should enable the supervisor to have a clear mapping between pricing functions/methods used in VaR/sVaR and pricing functions/methods used for the daily economic P&L. It should encompass the following information at the relevant level of granularity:

(a) the pricing functions/methods and pricing functions/methods parametrisation (e.g. number of Monte Carlo simulations) used to calculate the daily economic P&L;

(b) the scope of instrument types covered by each pricing function/method used to calculate the daily economic P&L;

(c) the number of individual positions as well as the total amount of outstanding notional and market value covered by each pricing function/method used to calculate the daily economic P&L;

(d) corresponding pricing functions/methods as well as the pricing functions/methods parametrisation (e.g. the number of Monte Carlo simulations) used in the VaR engine;

(e) a self-assessment by the bank, including a scorecard indicator (green, amber, red[84]) of the appropriateness of VaR pricing methods (VaR engine pricing vs daily economic P&L pricing).

The criteria for assessing the above scorecard indicator should be described in an internal policy.

134. This inventory should be reviewed at least annually by a unit independent of the one that produces it (e.g. the internal audit function or internal validation function). This review does not need to challenge or validate these pricing functions but should rather check the quality, reliability and comprehensiveness of the information provided in the inventory.

135. The differences in the pricing functions/methods used for the calculation of the VaR compared with the ones used for the calculation of the economic P&L

[83] This should be identical to the pricing function used to calculate hypothetical P&L according to paragraph 77.

[84] Green: fully appropriate, amber: acceptable, red: weakness detected.

should be subject to validation[85]. The validation should include any simplifications of pricing functions/methods introduced for VaR purposes (e.g. reduced number of parameters or simulations). The validation should be performed at least initially when a pricing method is introduced in the VaR calculation that is not identical to the one for economic P&L purposes and should assess the impact of the use of different pricing methods. Additionally, a regular validation should be performed in order to check that this impact remains low. The scorecard indicator mentioned above should be based on the findings from this (initial and regular) validation. For the pricing functions/methods that are deemed inadequate according to the bank's assessment (red indicator), banks should develop a work plan to mitigate the risk or improve their quality.

136. Upon request and depending on the results of the analysis of the appropriateness of the pricing functions, banks are expected to be able to provide the results of the following test for selected sub-portfolios, business days and selected pricing methods:

    (a) the hypothetical P&L used for regulatory back-testing as defined in Section 3.4 above;

    (b) the P&L, calculated on the same unchanged positions, by using the pricing methods used to compute the VaR numbers and the market data used for the hypothetical P&L.

    This aim of this test is to assess the impact on the level of VaR/sVaR using different pricing functions only.

6 Methodology for IRC models focusing on default risk[86]

The relevant regulatory references related to the topic presented in this chapter are:

(a) Articles 4(1)(39), 153(1), 374, 375, and 376 of the CRR;

(b) EBA Guidelines on the Incremental Default and the Migration Risk Charge (IRC): (EBA/GL/2012/3).

6.1 General requirements

137. In order to demonstrate that the day of the week when the IRC amounts are calculated does not lead to material bias as required by the EBA Guidelines on

[85] The validation of pricing functions used for economic P&L purposes is expected to be regularly performed by a bank and thus is the basis for this additional requirement.

[86] For the purpose of this document default risk in IRC means the risk charge calculated with the bank's IRC methodology and on the bank's current IRC portfolio but without taking the effect of rating migrations into account.

IRC (EBA/GL/2012/3) part F, paragraph 29, the bank should be able to show that the IRC on the chosen day is not systematically lower than if it were calculated on another day (e.g. by using sensitivities or jump-to-default).

138. At the request of supervisors, if the demonstration required in the preceding paragraph is not considered to be sufficiently convincing, banks should calculate daily the IRC during 15 consecutive business days (including three reporting dates). If it is not possible to perform this calculation in the production environment, it can be performed in a test environment replicating the calculation of the regulatory IRC.

139. If a bank uses a constant level of risk assumption and liquidity horizons shorter than one year, it should be able to calculate the impact of the use of a constant risk assumption position with a single liquidity horizon of one year on the IRC and the default risk in the IRC amounts.

140. Banks are expected to be able to demonstrate that the number of simulations used in their model to compute the IRC is sufficient to ensure precise and stable IRC amounts[87].

141. In particular, banks are expected to calculate a confidence interval of IRC estimation with a confidence level of 95%.

142. To compute IRC amounts, banks are expected to use at least one migration matrix for sovereigns (when relevant) and one migration matrix for other types of issuers. If the bank uses only one matrix, it should be able to demonstrate that it leads to conservative IRC amounts[88].

143. On request, banks should be able to provide an inventory of all open validation findings in relation to the IRC, including a description of the finding, the envisaged remedial action and a target date for the finding's closure. In addition, banks should retain closed validation findings up to at least one year after the closure date and should be able to provide a description of the remedial action implemented.

6.2 Data inputs

144. The same data quality requirements indicated in paragraphs 118 to 119 and 121 to 122 apply for the calibration of IRC/the default risk in the IRC models.

[87] The impact on the default risk in IRC should also be provided upon request.

[88] The impact on the default risk in IRC should also be provided upon request.

6.3 Distribution and correlation assumptions

145. According to Article 376(3)(a) of the CRR, as part of the independent review and validation of its IRC model, an institution should prove that its modelling approach for correlations and price changes is appropriate for its portfolio, including the choice and weights of its systematic risk factors. In particular, banks are expected to justify the types (for example, region, industry, etc.) and, for each type, the number of systematic factors included in the credit quality diffusion model, as well as the correlation structure and its calibration for the whole set of factors used.

146. Banks are expected to use at least two types of systematic risk factors. If the bank uses one type, it should be able to demonstrate that it leads to conservative IRC[89] at least annually in the validation report and at the request of the supervisor.

147. Any assumption for correlation estimation/modelling made by the bank should be supported by observable market data (e.g. credit default swap, equities data or rating migrations data) and duly justified by a quantitative analysis. In addition, as part of their regular validation process, banks are expected to analyse the level of correlation between issuers that is derived from their IRC model. Banks should be able to provide these correlations, differentiated according to their factor model (issuer falling into the same bucket, i.e. the same systematic factors, and falling into different buckets).

148. Banks that do not calibrate the correlations of their IRC model to market data but use internal ratings-based (IRB) correlations instead should demonstrate their appropriateness in relation to their portfolio. In such a case, correlations as defined in Article 153(1) of the CRR should be used.

149. If the length of the observation period used for the calibration of the correlations is shorter than ten years, the bank is expected to be able to quantify the impact of using a time series of 10 years[90] to calibrate correlations on the IRC and the default risk in the IRC.

150. In addition, banks should perform, at least annually in the validation process and at the request of the supervisor, sensitivity analyses/impact assessments if the IRC and the default risk in the IRC are calculated when the asset correlations structure in the model[91] is shifted up or down by a fixed value or set to generic values, as follows:

89 The impact on the default risk in IRC should also be provided upon request.

90 By using proxies if and where necessary.

91 The latent variables of the model that are determining the correlation of migration and default events of the issuers.

(a) all weights of issuers to their respective systematic factors[92] by +10% in absolute value (not going beyond 100%)[93];

(b) all weights of issuers to their respective systematic factors by -10% in absolute value (not going below 0%);

(c) all weights of issuers to their respective systematic factors set to 0;

(d) all weights of issuers to their respective systematic factors set to 1;

(e) all correlations between systematic factors set to 100% (weights of issuers to their respective systematic factors unchanged);

(f) all correlations between systematic factors set to 0% (weights of issuers to their respective systematic factors unchanged).

151. At the start of the TRIM on-site investigations, banks should be able to calculate the IRC and the default risk in the IRC amounts based on a one-factor Merton Model and one flat correlation with different correlation assumptions: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%. All other inputs into banks' IRC models remain unchanged.

152. Banks are expected to demonstrate the relevance of the copula assumptions implementing quantitative analysis, comparing:

(a) the IRC and the default risk in the IRC amounts calculated using the approved model;

(b) the IRC and the default risk in the IRC amounts calculated using Student-t with 8 degrees of freedom;

(c) if possible, the IRC and the default risk in the IRC amounts calculated using Student-t where the degrees of freedom have been calibrated to market data.

153. For all the above-mentioned analysis, banks should store the underlying detailed data that would enable supervisors to check the relevance of the analysis.

[92] If the asset value Ai of an obligor i is written as follows in a factor model: $A_i = \sqrt{\rho_i}\, X_i + \sqrt{1-\rho_i}\, \xi_i$ where Xi is driven by systemic contributions and ξi the idiosyncratic noise term), the weights of the issuers to their respective systematic factors corresponds to $\sqrt{\rho_i}$.

[93] Reducing the idiosyncratic weight accordingly.

6.4 Ratings, probabilities of default and recovery rate assumptions

Documentation requirements

154. Banks should have in place:

(a) methodology and process documents for the determination of probabilities of default (PD) and recovery rates (RR), including documentation on the fallback approaches applied;

(b) validation documents verifying the robustness of the related assumptions;

(c) a hierarchy of preferred sources for the determination of PDs and RRs applied for each issuer/instrument within the scope of the IRC.

155. On request, banks should be able to produce a complete list of positions of the IRC model with the respective ratings and PDs of the issuers and RRs for the positions. If RRs and/or PDs have been adjusted in comparison with the pure automatic process-driven setting (e.g. by manual intervention or deviation from the automated usual process), banks should maintain a complete list of adjusted PDs and RRs and provide the rationale for the adjustment in each case.

Validation requirements

156. As part of their validation, banks should assess the sensitivity of the IRC and the default risk in the IRC (own funds requirements with respect to the RRs applied and PDs at least annually). In particular, the following analysis should be performed:

(a) banks should assess the quantitative impact, in terms of the IRC and the default risk in the IRC, of a simultaneous 10% (absolute) up and down shift (not going beyond 0% or above 100%) of the RR used in the portfolio. For models using stochastic RR, banks are expected to incorporate this impact by adjusting the mean of the RR distribution;

(b) for models using stochastic RR, banks should assess the quantitative impact on IRC and default risk in the IRC for a simultaneous 30% (relative) up and down shift of the standard deviation of recovery rates;

(c) banks should be able to provide the quantitative impact on IRC and default risk in the IRC of applying a floor of 0.03% for the PDs used in the IRC calculation;

(d) banks should be able to provide the quantitative impact on IRC and the default risk in the IRC for:

(i) a simultaneous 10% relative up shift of all PDs;

(ii) a simultaneous 10% relative down shift;

(iii) Aa simultaneous 1bp absolute up shift;

(iv) a simultaneous 1bp absolute down shift[94].

The change in PD should be compensated for by proportionally increasing/decreasing all the migration probabilities belonging to the same initial rating class to maintain the cumulative 100% migration and default probability.[95]

In all cases, banks should analyse the difference in detail and justify their calibrated parameters. This assessment should encompass analysis of how the most important issuers and groups of issuers are affected by the altered sources.

157. Banks should demonstrate, based on observable data, that the PD estimates[96] are justified. In this respect, all PDs should be higher than zero[97].

158. Banks should provide specific and convincing justification if they are using recovery rates that are higher than:

(a) 25% for subordinated debt;

(b) 45% for senior unsecured debt;

(c) 65% for senior secured debt;

(d) 85% for any product.

This also applies to positions under the fallback approach for the loss given default (i.e. for which no sources are available).

Consistency requirements

159. The hierarchy of preferred sources for PD and RR should be consistently applied in the IRC calculation. Banks should be able to justify deviation in the consistency of the hierarchy and should be able to demonstrate that cherry-picking can be excluded.

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94 Not going below zero.

95 Given an initial set of migration probabilities, $p_1, \ldots, p_n$, where p_n corresponds to the PD, the probabilities p_i for $i = 1, \ldots, n-1$ should be adjusted by $p_i' = p_i \cdot \left(1 + \frac{p_n - p_n'}{1 - p_n}\right)$ where p_n' corresponds to the modified PD.

96 Same requirements apply to the rating agency data.

97 In accordance with Article 65(3) of the final draft RTS on the IMA assessment methodology and significant shares (EBA/RTS/2016/07).

Requirements for PD fallback values

160. For positions where a reliable PD assignment may not be possible due to a lack of adequate data (e.g. if neither internal nor external ratings nor liquid credit spread time series are available) a fallback solution may be applied. The PD assigned to each of these positions should not be less than the highest of the following two:

(a) the PD equivalent to the worst investment grade rating (in terms of the rating agency grade "BBB", or "Baa" for Moody's);

(b) the equally weighted[98] average PD[99] of the issuers included in the IRC calculation which are not subject to the fall-back approach.

Banks using internal rating approaches for the PD assignment should map the external ratings above to their internal rating scales.

161. Banks should, at least annually (and on request), assess the materiality of the positions subject to this fallback PD assignment in the IRC model by:

(a) comparing the jump-to-default (by using the average of the RR in the case of a stochastic recovery rate) of the positions subject to the fallback with the jump-to-default of all positions subject to the IRC;

(b) calculating the marginal IRC and the default risk in the IRC contributions of these positions:

$$\frac{IRC(full\ scope) - IRC(non-fallback\ for\ PD)}{IRC(full\ scope)}$$

$$\frac{Default\ risk\ in\ the\ IRC(full\ scope)\ - Default\ risk\ in\ the\ IRC\ (non-fallback\ for\ PD)}{Default\ risk\ in\ the\ IRC(full\ scope)}$$

162. If the marginal IRC thus calculated is larger than 10%, the bank should investigate whether additional data sources are available to reduce the portion of issuers subject to the fallback PD assignment. If the marginal IRC is above 10% for four consecutive weeks banks should apply a more prudent assignment than the one according to paragraph 160. Banks should assess the sensitivity of the IRC amounts to a one grade higher and a one grade lower than the one in the fallback PD assignment (compared with the PD assigned according to paragraph 160)[100] and choose the most prudent one. The application of the prudent PD shall remain in place until the marginal IRC as calculated above are below 10% for four consecutive weeks.

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98 All issuers have the same weights.

99 PD may be derived from the rating of the issuer by applying the rating matrix of the model.

100 When the average PD is used as a fallback approach, banks should analogously apply this requirement (i.e. identify the rating grade that is closest to the average PD and shift up and down starting from this rating grade).

Requirements for the calculation of losses based on recovery rates

163. The losses following the default of an issuer should be calculated as the difference between the current market value of the position and the expected market value subsequent to default.

164. The recovery rate should reflect the type of product, collateralisation and seniority of the position.

165. The recovery rates should be between 0 and 100%.

6.5 Treatment of groups of connected issuers/obligors

166. Institutions are expected to document and justify the treatment in the IRC model of issuers/obligors falling into the same group of connected clients according to the definition in Article 4(1)(39) of the CRR.

167. Institutions are expected to model issuers/obligors falling into the same group of connected clients as a single risk (i.e. in an asset value model, this means as a single asset value but it does not mean that they default simultaneously). The default or migration of each sub-group of issuers or issuances with the same internal or external rating grade for obligors(s) within a group of connected clients is expected to occur simultaneously in the IRC model unless it is demonstrated that another treatment is more appropriate in accordance with the provisions of Article 4(1)(39) of the CRR.

7 Risks Not In the Model

The relevant regulatory references related to the topic presented in this chapter are Articles 367 and 369 of the CRR.

168. According to Article 367(1) of the CRR, the VaR model should capture accurately all material price risks. In addition, according to Article 369(1), institutions should have processes in place to ensure that all their market risk internal models have been adequately validated by suitably qualified parties independent of the development process to ensure that they are conceptually sound and adequately capture all material risks. This chapter aims to better define how to fulfil these CRR requirements.

169. Several reasons can lead to the non-consideration of some risks related to positions within the approved risk categories in the internal model approach (VaR, sVaR or IRC), for example:

    (a) data are not sufficient or not reliable;

    (b) data are sufficient but the risk is considered as not material;

(c) the risk cannot be adequately modelled in the model[101] (e.g. basis risk between two different classes of shares).

170. Banks are expected to have a policy in place that governs the overall process for identifying the risks that are not covered in the internal model (VaR, sVaR or IRC), including a definition of the different tasks and responsibilities and the frequency of their execution (the Risks Not In the Model framework). The Risks Not In the Model (RNIM) framework should cover at least the tasks listed in paragraphs 7.1 to 7.3.

7.1 Identification

171. Banks should identify any market risk which is not captured by the model and be able to justify why they are not included. In particular, and at minimum, the following processes should be established:

(a) the new product approval process, where the bank should analyse whether the inherent market risks of the new products and related trading strategies can be adequately captured by the model;

(b) the back-testing process, where the bank should analyse the back-testing on adequate portfolio levels to identify risks not in the model;

(c) expansion and reorientation of the trading business, as expanding a certain business could lead to risks not in the model becoming significant, or to market risks not currently covered in the RNIM process; the bank should make the effort to identify such a risk as soon as possible (i.e. should not solely rely on the monitoring of current risks not in the model, even though that is likely to support such identification);

(d) limitations in the model production process or the systems used that affect the model calculation, for example the bank's inability to download certain data;

(e) market data processes for the risk factors where market data display insufficient quality;

(f) regular validation exercises for both the pricing model and the risk measurement model where at least deviations between pricing and risk measurement are identified (e.g. risk factors that are used for the valuation of a product but not for risk measurement).

[101] This does not refer to the definition of modellable or non-modellable risk factors of the FRTB.

7.2 Measurement

172. Banks should measure the risks not in the model in an appropriate way. The potential impact on the VaR and sVaR and/or IRC should be estimated under the assumption that there is no diversification effect, which means that the risks not in the VaR, sVaR or IRC respectively should be estimated on a stand-alone basis.

173. Where possible, the measurement of risks not in the model should make use of observable market data even if the data quality is not sufficient to model these risks in the VaR, sVaR and/or IRC (for example, when risk management has no regular access to market data that are available to the institution, or when available market data do not enable modelling of a risk not in the model but can be used to quantify the risk not in the model on a stand-alone basis).

    When quantifying by using sensitivities, the shocks applied to quantify risks not in the model should be based on the same period as the one for the shocks of other risk factors.

    In the case of scarce data to calibrate these shocks, the bank should use a stressed calibration. It is acceptable for this stress calibration to rely to some extent on expert judgment.

174. The quantification of risks not in the VaR approximation should aim to reflect a loss at a 99% confidence level and a holding period of ten days or a more conservative loss. Similarly, the quantification of risks not in the sVaR should reflect a loss at a confidence level of 99% and a holding period of ten days, and be calibrated to historical data from the stressed period used to calibrate the stressed VaR model. The quantification of a risk not in the IRC should reflect a loss at a 99.9% confidence interval over a time horizon of one year.

7.3 Risk management and implementation

175. Banks are expected to monitor and measure the risks not in the model, at least quarterly or less frequently if banks can justify this on the basis of immaterial RNIM and report the outcomes to a committee or persons that is/are responsible for deciding on the management of these risks (e.g. quantification, limitation, reporting frequency, etc.).

176. Banks should ensure that the risks modelled in VaR, sVaR and IRC are sufficient to ensure a risk-sensitive measure.

    (a) Banks should determine a threshold system at their own discretion above which material risks not in the model must be covered in Pillar 1 regulatory capital. In any case, a risk not in the model should be considered as

material[102] if the stand-alone quantification corresponds to more than 5% of the amount computed by the model[103] (VaR or IRC) without taking this risk into account, and any material risk not in the model should be included in the models affected (modelling or increasing the VaR by way of an add-on).

(b) Banks should also calculate the cumulative effect of all risks not in VaR[104] or IRC by adding up the amount of each risk not in VaR or IRC respectively, without taking any diversification effect into account. If the cumulative impact of the risks not in the model is higher than 10% of the amount computed by the model[105] (VaR or IRC) without taking this risk into account, the bank should propose a remediation plan or show that the effect is not material when diversification is taken into account.

177. With reference to paragraph 176, the inclusion in the VaR/sVaR/IRC calculation of material risks not in the model should only be performed when adequate modelling can be ensured; otherwise, add-ons to the VaR/sVaR/IRC or regulatory capital should be determined.

178. If a risk not in the model is included in the Pillar 1 own funds requirements as an add-on to the VaR and sVaR based on a simplified methodology (equivalent to a confidence level of 99% and one-day holding period), the corresponding contribution to the VaR and sVaR might be added in the VaR amounts used to perform regulatory back-testing. However, banks should be able to provide time series with and without the add-on. The add-on should be updated at least quarterly.

179. The RNIM methodology should be covered in the regular validation process and updated if necessary.

180. On request, banks should be able to provide an inventory of all known model deficiencies that go beyond the RNIM framework (e.g. process or data issues) including a description of the deficiency, assessment of the severity (including potential risk management actions) and, if applicable, remedial actions and the envisaged remediation date.

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[102] The comparison with the threshold should be done only for the VaR and IRC. Any risk considered as material for the VaR should be considered as material for stressed VaR.

[103] The comparison should be done at the end of the quarter by comparing the quantification of the RNIM at the end of the quarter with the 60-day average of the VaR or 12-week average of the IRC amount of the preceding quarter.

[104] The comparison with the threshold should be done only for the VaR and IRC. Any risk considered as material for the VaR should be considered as material for stressed VaR.

[105] The comparison should be done at the end of the quarter by comparing the quantification of the RNIM at the end of the quarter with the 60-day average of the VaR or 12-week average of the IRC amount of the preceding quarter.

8 Glossary

A **position** is understood to be a risk position. Holding securities or entering into transaction contracts entails having a position. When defining a position, neither hedging nor netting should be considered.

Hypothetical profit and loss (P&L) refers to the daily hypothetical changes in value, as defined in Article 366(3) of the Capital Requirements Regulation (CRR)[106]

Actual P&L refers to the daily actual changes in value, as defined in Article 366(3) of the CRR.

Economic P&L refers to the daily P&L calculated on the basis of end-of-day mark-to-market or mark-to-model (depending on the instruments) values of the books and records of the bank. It is generally calculated using front office systems (position data, pricing models, valuation methods, pricing parameters, end-of-day market data, etc.).

FRTB ("Fundamental Review of the Trading Book") refers to the document "Minimum capital requirements for market risk"[107] issued by the Basel Committee on Banking Supervision (BCBS) in January 2016.

Final draft Regulatory Technical Standards (RTS) on the internal model approach (IMA) assessment methodology and significant shares refers to the document published by the European Banking Authority (EBA/RTS/2016/07)[108] in November 2016.

[106] 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).

[107] http://www.bis.org/bcbs/publ/d352.pdf

[108] http://www.eba.europa.eu/-/eba-publishes-final-standards-on-assessment-methodology-to-validate-market-risk-models

Counterparty credit risk

1 Scope of the guide for counterparty credit risk

1. The purpose of this chapter of the guide is to inform institutions on the principles defined for the Internal Model Method (IMM[109], as referred to in Part 3, Title II, Chapter 6, Section 6 of the Capital Requirements Regulation (CRR)[110]) requirements for the topics selected for harmonisation under TRIM. It is important to clarify that this is not an exhaustive list of principles regarding compliance with IMM requirements. The outcome and subsequent analysis of TRIM-related on-site investigations in 2017 and 2018 could also identify additional areas for harmonisation.

2. It is important to note that this guide could be revised on the basis of the additional information collected during the TRIM project.

3. The following sections are structured according to areas of harmonisation as identified by the TRIM centre of competence (CC) for CCR. For each item:

   (a) reference is made to CRR to the extent the subject is covered;

   (b) a summary of observed practices and their variability is given;

   (c) assessment criteria for supervisors are given if applicable;

   (d) principles are expressed, which often include a degree of interpretation of the CRR;

   (e) special preparations for institutions that will be subject to TRIM-related on-site investigations are described for some of the following sections.

2 Trade coverage

4. For the purposes of this section, “IMM transactions” are transactions for which the institution has approval to use the IMM to estimate the related exposure.

5. This section refers to both transactions for which the institution has no approval to use the IMM, and IMM transactions for which related exposure is not fully

[109] Note that the advanced method for the CVA capital requirement is not in scope here.

[110] 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).

simulated in the IMM[111] or which are carved out from the IMM to a non-IMM method.

6. The section also addresses the valuation of transactions within the IMM system compared with front office or accounting systems and the consequences of the potential creation of synthetic netting sets.

2.1 Relevant regulatory references

7. Regulatory requirements can be found in:

   (a) Article 283(1) of the CRR and Article 283(3) of the CRR (sequential implementation of the IMM), further specified for Banking Supervision in Section II, Chapter 3, Paragraph 8 of the *ECB Guide on options and discretions available in Union law*.

   (b) Article 284(1) of the CRR, which requires calculating the exposure value at netting set level for those transactions where the institution has the permission to use the IMM in accordance with Article 283(1) of the CRR.

   (c) Article 273(6), according to which for all methods in Part 3, Title II, Chapter 6 sections 3 to 6 of the CRR, the exposure value for a given counterparty should be calculated as the sum of exposure values calculated for each netting set with that counterparty.

8. The CRR does not explicitly establish a requirement regarding how to handle netting sets in cases where transactions which the institution has general approval to treat with the IMM need to be carved out from the IMM to a non-IMM method for any reason.

2.2 Practices

9. For IMM transactions where related exposure is not fully simulated, five different types of treatment have been observed.

   (a) Exposure is simulated but some (material) parameters necessary for the pricing function are not diffused.

   (b) Exposure is simulated but the pricing function in the IMM is numerically approximated compared to the pricing function used for the same transaction in front office or accounting systems.

[111] "Fully simulated" in this context means: for each of the simulated market data paths at the pre-defined 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 numerically approximated with respect to any benchmark.

(c) Transactions are treated under a (hereinafter) fall-back solution. A fixed-exposure time profile built from two components is assigned to a given transaction:

(i) the t_0-value of the transaction, which is kept constant over the whole lifetime of the trade;

(ii) a pre-calibrated add-on time profile, which aims to account for the estimated exposure shape of the transaction over time.

Simulated exposure scenarios related to the transaction are kept constant and equal to the fixed exposure time profile. Transactions are aggregated (per time grid point) together with simulated values from the other transactions in the IMM belonging to the same netting set.

(d) Transactions are treated under a further variant of the fall-back solution. Add-on profiles are stochastic but independent of IMM risk factor simulation. Netting is then performed as in point (c) above.

(e) transactions are carved out from the IMM to a non-IMM approach, for example because market data for revaluation are not available, or a new product process has to be followed first, or differences in front office or accounting values are too high (with heterogeneous threshold levels) etc.

10. When carving out IMM transactions to a non-IMM method, institutions create synthetic netting sets either by netting agreement or by counterparty.

11. The various approximations and fall-back solutions are related to different product types and different risk factor availabilities.

2.3 Assessment criteria for supervisors

12. Supervisors should assess the following items:

(a) pricing functions used to calculate the effective expected positive exposure (EPE) should be internally validated by the institution and account for all trade-related intermediate cash flows and cash flows at maturity date of the transaction; this refers in particular to paragraph 18;

(b) institutions should prove that the effects of using pricing approximations and fall-back solutions for the estimation of the exposure profiles are adequate and in particular that they account sufficiently for non-linearity and do not lead systematically to an underestimation of exposure;

(c) institutions compare the values of pricing functions used for revaluation in the IMM with values from front office or accounting systems on a regular basis.

2.4 Principles for ECB banking supervision

13. With regard to the coverage of the IMM, institutions should comply with Section II Chapter 3 Paragraph 8 of the *ECB Guide on options and discretions available in Union law*.

14. Transactions for which there is no permission to apply the IMM according to Article 283(1) of the CRR should be covered by one of the exposure methods described in Part 3, Title II, Chapter 6, Sections 3, 4 or 5 of the CRR.

15. For cases where, for a given legally enforceable netting agreement as defined in Part 3, Title II, Chapter 6, Section 7 of the CRR, one part of the transactions is treated under the method described in Section 6 (IMM) and another part is covered by one of the methods described in Sections 3, 4 or 5 (i.e. not all transactions of the netting set associated with the contractual netting agreement are treated under the IMM), different (synthetic) netting sets, one per method, should be created. Hence, one synthetic netting set covers all the transactions under IMM and the others cover all the transactions under the non-IMM methods.

16. Synthetic netting sets created for the purposes described in paragraph 15 should cover only transactions under the same contractual netting agreement, i.e. Article 273(6) of the CRR (netting set-specific application of any CCR method) is applied also for synthetic netting sets.

17. Institutions compare the values of pricing functions used for revaluation in the IMM with values from front office or accounting systems on a regular basis. A mandatory carve-out to one of the methods described in Part 3, Title II, Chapter 6, Sections 3, 4 or 5 of the CRR and the creation of synthetic netting sets is expected for transactions:

    (a) where the difference between the IMM values and the respective front office or accounting values exceeds [10%] of the front office or accounting value;

    (b) where the absolute value of the price is above [10%] of the notional amount.

    For all transactions that are not carved out from the IMM, institutions are expected to take price differences into account in the modelling of the expected exposure (EE) time-profile, i.e. at t_0 and at all future grid points, provided the IMM value at t_0 is below the front office or accounting system value.

18. Institutions are expected to validate that:

    (a) the effect of using numerically approximated pricing functions is not significant with regard to expected exposures at the netting set level;

    (b) for all numerically approximated pricing functions, the sensitivities of risk factor changes occurring in IMM path simulations are reliable compared

with non-approximative pricing functions (from any reliable benchmarking library) for the same transaction type;

(c) the use of pre-calibrated expected present value (PV) time profiles within IMM netting sets (fall-back solutions) is clearly justified compared with (approximative) pricing functions that react to risk factor changes:

(i) such profiles are applied in a way that does not lead systematically to an underestimation regarding the effect of the netting set on effective EPE;

(ii) additionally, the netting benefits (numerical impact) when using such time profiles should be assessed within the regular internal validation by comparing the fall-back solutions with a carve-out into a separate synthetic netting set.

3 Margin period of risk and cash flows

19. This refers to the modelling of the margin period of risk (MPOR) including the following aspects: treatment of margin call- and trade-related cash flows (CFs) and interpolation techniques (note that the modelling of collateral is addressed in section 4).

3.1 Relevant regulatory references

20. Regarding MPOR and CF modelling in the CRR we have:

(a) the definition of MPOR is stated in Article 272(9) of the CRR: "'*margin period of risk' means the time period from the most recent exchange of collateral covering a netting set of transactions with a defaulting counterparty until the transactions are closed out and the resulting market risk is re-hedged*";

(b) floors to be applied to the length of the MPOR are specified in Article 285(2) to (5) of the CRR;

(c) no other MPOR modelling requirement is envisaged by the CRR; this applies in particular to the treatment of cash flows and default time-setting within the MPOR.

3.2 Practices

21. The following practices have been observed:

(a) Most institutions consider that no margin call, either paid or received, may occur during the MPOR.

(b) Modelling of trade-related CFs is performed in various ways depending on the institution. As a result, modelling choices may result in observing more or fewer “spikes” (cash-flow induced, non-stochastic expected exposure changes) on the expected exposure profile, depending on the chosen CF modelling approach. This leads to variability in the estimated effective EPE.

(c) Institutions take their default management process (DMP) only partially into account, where the DMP describes all legal and operational actions that happen upon counterparty default before the institution stops paying variation margin and trade-related CFs to the defaulted counterpart.

(d) MPOR modelling may require the estimation of netting set PV at time points that do not belong to the simulation time grid. Institutions perform PV estimations at such time points in significantly different ways, involving various interpolation/extrapolation techniques, notably the use of Brownian bridges.

3.3 Assessment criteria for supervisors

22. Supervisors should assess the quality of margin call- and trade-related CF modelling with regard to the DMP. In the event that assumptions are considered to be simplistic, a quantitative assessment of the materiality of their impact is needed.

23. The impact of interpolation/extrapolation techniques used to estimate the netting set PV (instead of full estimation based on revaluation at additional grid points) should be assessed.

3.4 Principles for ECB banking supervision

24. Regarding the modelling of margin call- and trade-related CFs within the MPOR, Article 272(9) of the CRR is interpreted as meaning that none of these CFs is received from the counterparty after the beginning of the MPOR. Non-payment of CFs to the defaulting counterparty may be assumed to the extent that this assumption is consistent with the DMP. A non-conservative assumption showing discrepancies with the DMP could be accepted if it is shown that its quantitative impact on final effective EPE is not material.

25. Spikes resulting from CFs modelled as being paid during the MPOR are expected to be considered, where the following two options are possible.

(a) Spikes are included as a full part of the simulated expected exposure profiles and enter effective EPE.

(b) The effective EPE is calculated under the assumption that no margin call- and trade-related CFs occur during the MPOR and an add-on is calculated

to be added to effective EPE before multiplication by alpha. The add-on is defined as a one-year weighted average of all modelled spikes. The expected spike exposure for a given time point t_i is weighted with the "spike width", where the spike width caused by a single CF is given by the length of the MPOR minus the number of business days within MPOR, where the institution stops paying trade-related CFs in line with its DMP. If the settlement date of the CF generating the spike cannot be precisely identified, the spike width is set as being equal to the full length of the MPOR:

(i) Formally,

$$add-on = \sum_{i=1}^{1year} EE(t_i)^{spike} \cdot \Delta t_i,$$

with Δt_i denoting the spike width.

(ii) If the longest-lasting transaction in the netting set, noted *T*, is above or equal to one year, then Δt_i is expressed in units of a year. If *T* is below one year, e.g. 0.5y, then Δt_i is expressed as a fraction of *T* (in other words, the Δt_i are rescaled by 1/*T*, in this example by 1/*T* = 2).

26. If margin call- or trade-related CFs are ignored in the effective EPE and this is not justified by the DMP, the alpha factor may be increased depending on the estimated impact.

27. MPOR modelling may require the estimation of netting set PV at time points that do not belong to the simulation time grid. Interpolation/extrapolation techniques used by the institutions to perform such estimations are expected to be justified through studies showing that impacts on effective EPE, compared with full simulation, are not material.

28. In the context of the TRIM on-site investigations, institutions are expected to perform impact calculations of variants (a) and (b) of paragraph 25, at least for representative sub-portfolios in the sense of paragraph (d) of the Glossary.

4 Collateral modelling

29. This section deals with the modelling of cash and non-cash collateral, i.e. its potential value changes from the time when the last margin call occurred to the end of the MPOR. Initial margin modelling is addressed in section 5.

4.1 Relevant regulatory references

30. The relevant regulatory references related to the topic presented in this section are the following.

(a) Article 285(1), (6) and (7) of the CRR, which clarifies the modelling approaches under which the effects of margining can be recognised in the exposure value calculation. However, the CRR does not determine whether institutions should model margin collateral jointly with over-the-counter (OTC) derivatives and securities financing transactions (SFT) exposure ("full simulation" approach), or if they should adopt a modelling approach based on volatility adjustments ("haircut" approach).

(b) For the volatility adjustments used to calculate the haircut Title II, Chapter 4, Articles 223 to 226 of the CRR set out the criteria that should be applied, with Article 224 of the CRR applying to supervisory volatility adjustments and Article 225 to own estimates.

4.2 Practices

31. The CC observed the following practices:

(a) some institutions use the full simulation approach and some use the haircut approach;

(b) assumptions on future collateral composition (i.e. the breakdown between cash collateral and different types of non-cash collateral) over time show large differences among institutions;

(c) various modelling approaches with regard to the handling of the margin agreement currency in the IMM have been observed;

(d) not all institutions perform a proper assessment of the modelled collateral balance at t_0 with respect to the known existing collateral balance[112] at t_0;

(e) in cases where a contractual margined netting set includes both IMM and non-IMM transactions and the institution splits transactions into synthetic netting sets in accordance with paragraph 15, the assignment of the real collateral balance at t_0 to one synthetic netting set or the other is performed in significantly different ways;

(f) in cases where SFTs are modelled in the IMM, the modelling of securities of the non-cash margin collateral is not always consistent with the modelling of the security leg of SFTs.

4.3 Principles for ECB banking supervision

32. The treatment of non-cash margin collateral is expected to be consistent with the modelling of securities underlying OTC or SFT transactions, provided the

[112] Hereinafter referred to as "real collateral balance"

SFTs are in the IMM perimeter. In particular, if a certain type of security is fully simulated (respectively, if an internal haircut is applied) in the security leg of a SFT, then it should also be fully simulated (respectively, if an internal haircut is applied) if occurring as margin collateral.

33. The assumptions with respect to the future composition of collateral over the lifetime of the netting set are expected to reflect the contractual arrangements in terms of eligible margin collateral or at least the current composition of margin collateral. As an example, if the t_0 composition of margin collateral for a netting set is mainly USD bonds, this should be reflected in assumptions for future margin calls, which therefore should not be assumed as EUR cash.

34. Potential foreign exchange risk arising from the margin agreement currency (when the margin agreement currency is different from the reporting currency) is expected to be taken into account in the modelling using the simulated foreign exchange rate at the end of the MPOR. The collateral currency thus should remain the margin agreement currency throughout the MPOR.

35. When the collateral balance at t_0 is "model estimated" (i.e. when the t_0 collateral balance is estimated as a function of the calculated netting set value as of t_0 (using IMM pricing functions) and using modelled features of the margin agreement, and is not set equal to the real collateral balance), the resulting modelled collateral balance is expected to be benchmarked against the real collateral balance at t_0 on a regular basis. In this case:

    (a) validated but still relevant differences between "model estimated" and real t_0 collateral balances are expected to be taken into account in the modelling of future time grid points so that exposure at default (EAD) is not systematically underestimated;

    (b) a full analysis of these differences is expected to be performed at least annually in order to detect and correct, when needed, the most significant discrepancies.

36. When a contractual margin agreement contains both transactions treated under the IMM and under a non-IMM method and therefore the contractual netting set is split into different synthetic netting sets, then the real margin collateral is expected to be assigned to the synthetic netting sets in a way that reflects the exposure weights. The institution is expected to justify that the full assignment of collateral to only one synthetic netting set (if this is done) does not systematically result in an underestimation of the resulting net exposures, e.g. because of over-collateralisation or double counting of collateral.

5 Modelling of initial margin

37. The initial margin (IM) is already used in central clearing and currently carries over to bilateral OTC agreements. The modelling issue with respect to the CCR is that the IM depends on the risk profile of the future netting set in terms of

levels and volatility of simulated market risk factors and on transactions still alive, i.e. it is a variable agreement parameter.

5.1 Relevant regulatory references

38. Article 285(1) of the CRR applies for modelling, where the EE captures the effects of margining. However, no specific requirement related to initial margin modelling within the IMM framework can be found in the regulation.

5.2 Practices

39. The following practices have been observed:

    (a) Some institutions keep some of their exposures subject to IM out of the IMM perimeter (e.g. exchange-traded derivatives, exposures towards central counterparties (CCPs)), therefore the IM itself is kept outside the IMM.

    (b) For exposures subject to IM that are within the IMM perimeter, most institutions have a straightforward modelling where the IM is simply kept constant over time. More advanced approaches (dynamic modelling) have also been observed.

    (c) For exposures subject to IM that are within the IMM perimeter, most institutions set the level of the IM at t_0 in the modelling at an amount equal to the real IM at t_0.

5.3 Principles for ECB banking supervision

40. For exposures subject to IM that are within the IMM perimeter, institutions are expected to have an IM modelling reflecting contractual arrangements for the respective netting set. In particular, if contractual arrangements provide that the IM reflects forward variability of netting set values, the IMM modelling of the IM is expected to take this feature into account unless the institutions demonstrate that keeping the IM constant over time does not systematically underestimate exposure.

41. The level of IM at t_0 in the modelling is expected to be benchmarked on a regular basis against the real IMs at t_0. Differences are expected to be taken into account in the modelling (e.g. by some corrective exposure level add-on). Moreover, a full analysis of the differences is expected to be performed annually so as to detect the most important discrepancies and enhance the modelling, if needed.

42. In the context of the TRIM on-site investigations, linstitutions are expected to assess the materiality of IM modelling and provide the following measures at a clearly defined valuation date:

    (a) number of transactions subject to a margin agreement with IM (first with a CCP, second bilaterally), number of all margined transactions, and number of all CCR transactions;

    (b) number of agreements subject to IM (first with a CCP, second bilaterally), number of all margined agreements, and number of all CCR netting agreements;

    (c) EAD of netting sets subject to IM (first with a CCP, second bilaterally), EAD of all margined netting sets, and EAD of all CCR netting sets;

    (d) Risk-weighted assets (RWA) of netting sets subject to IM (first with a CCP, second bilaterally), RWA of all margined netting sets, and RWA of all CCR netting sets.

43. In the context of the TRIM on-site investigations, beyond the current impact of IM modelling, institutions are also expected to:

    (a) assess the expected increase in the number of transaction resulting from the new IM requirement according to Article 11(3) of Regulation (EU) No 648/2012 (European Market Infrastructure Regulation (EMIR))[113],[114] in 2017 and 2018;

    (b) assess the assumed impacts using the metrics of paragraph 42;

    (c) plan the implementation of the respective modelling.

6 Maturity

44. This section refers to the estimation of the parameter M used in the calculation of the risk weight for counterparties using the internal ratings-based (IRB) approach and towards which the institution has an IMM exposure.

45. It also refers to the treatment of contingent maturities, especially in cases of early termination clauses (ETCs, also called break clauses) for derivatives and SFTs, and to different CRR interpretations.

[113] Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories (OJ L 201, 27.7.2012, p. 1)

[114] Paragraph 15 of Article 11(3) of EMIR mandates ESAs to provide draft RTS on IM; the final draft can be found here.

6.1 Relevant regulatory references

46. The relevant regulatory reference is Article 162 of the CRR.

6.2 Practices

47. The following practices have been observed:

    (a) institutions usually apply Article 162(2)(g) of the CRR, thus establishing an effective floor for M set at one year;

    (b) only some institutions apply this floor broadly; the others tend to reduce it, applying the relevant paragraphs in the event that the longest maturity in the netting set is either below or above one year;

    (c) in the case of daily re-margining, few institutions apply Article 162(3) of the CRR, either with a floor equal to the relevant MPOR or without any floor, thus also allowing an M of one business day (for exceptional cases);

    (d) mandatory ETCs, and in some cases optional ETCs, are taken into account to shorten the transaction maturities leading to lower M values.

6.3 Assessment criteria for supervisors

48. Regarding CCR exposures, the consistent application of Article 162 of the CRR should be assessed. The calculation of M is not related to any exposure methodology but requires an analysis of transaction maturities and, if applicable, ETCs for all transactions inside the netting set.

6.4 Principles for ECB banking supervision

49. Article 162 of the CRR is interpreted in the following way, and a corresponding treatment is expected under the SSM:

    (a) Article 162(2)(b) of the CRR applies for non-margined derivatives not covered under the IMM, while point (c) covers margined derivatives not in the IMM;

    (b) Article 162(2)(d) of the CRR applies for SFTs not covered under the IMM;

    (c) Article 162(2)(g) of the CRR applies for all non-margined derivatives and SFTs under the IMM if the maturity of the longest-dated contract in the netting set is greater than one year;

    (d) Article 162(2)(i) of the CRR applies only for netting sets covered by the IMM where the maturity of the longest-dated contract occurring in the

netting set is greater than one year. If Article 162(2)(i) of the CRR applies, then Article 162(2)(g) of the CRR does not apply.

50. The CRR is silent on open term repos or in general on SFTs without an explicitly fixed maturity. The following expectations are expressed:

    (a) It is expected that in such cases the transaction maturity is given by the higher of:

        (i) the average lifetime of the respective transaction types in the last two years with the same or comparable counterparts;

        (ii) 5 business days, provided the institution has the right to terminate the transaction.

    (b) If the institution does not have the right to terminate the transaction, the longest past lifetime of transactions with the same or comparable counterparts should be taken, subject to a 5-year cap.

51. For derivatives with ETCs:

    (a) it is accepted that mandatory ETCs can be used for the calculation of M instead of the contractual maturity;

    (b) it is expected that non-mandatory ETCs are not used for the calculation of M.

52. Internal analyses by the institutions should justify choices of values of M shorter than 5 business days for netting sets consisting only of SFTs, and shorter than 10 business days for all other netting sets, including derivative instruments listed in Annex II of the CRR.

7 Granularity, number of time steps and scenarios

53. This section refers to the chosen time grid for future exposure calculation and the number of scenarios generated. Specifically:

    (a) the number and density of time grid points have impacts on the accuracy of EE profiles and thus also on the accuracy of the effective EPE;

    (b) the number of scenarios and the type of random number generator determine the numerical accuracy of the calculations and thus the statistical error of expected exposures.

7.1 Relevant regulatory references

54. Article 284(4) of the CRR provides for time grid points $t_i, i = 1,2,3$ ... at which EE must be calculated. The output, $EE(t_i)$, enters the effective EPE calculations

(Article 284(5) and (6) of the CRR); however, there is no specific requirement as to how to set these t_i values. Since the modelling should reflect transaction terms, notional amounts, maturity etc. as required by Article 292(1)(a) and (b) of the CRR, the density and location of grid points should capture intermediate and final transaction-related cash flows that influence the shape of the exposure profile. There is no explicit regulation on the number of scenarios.

7.2 Practices

55. The following has been observed.

    (a) A high variety in the number of time grid points. Most institutions use only static grid points. Few institutions match part of trade-related cash flows (including final payment at maturity) to dynamic grid points (in addition to static ones) that are specific for each netting set.

    (b) Different numbers of scenarios have been observed across institutions, where the resulting numerical errors of the exposure values are estimated at different levels of accuracy and within different validation frameworks.

7.3 Assessment criteria for supervisors

56. Supervisory investigation teams should check whether the number of grid points used is sufficient and whether the grid points are appropriately distributed along the time horizon to ensure a precise and stable calculation of effective EPE. For instance, the effective EPE value should be very close to the one calculated with daily grid points up to one year. An assessment should also be carried out as to whether the grid points used beyond the one-year horizon adequately capture the shape of the expected exposure profile over time.

57. Regarding the number of scenarios, whether this number ensures a reasonable convergence of effective EPE values (e.g. in terms of statistical error) both on netting set and counterparty levels should also be assessed.

7.4 Principles for ECB banking supervision

58. If the effective EPE calculated with very dense (up to daily, thus catching all relevant cash flows) grid points is more than 10% above the effective EPE as calculated by the institution using its standard set of grid points for all (summed) counterparties or representative sub-portfolios in the sense of paragraph (d) of the Glossary, the alpha factor referred to in Articles 284(4) and 293(2) of the CRR should be increased by at least 0.1.[115]

[115] If the difference is more than 20%, alpha should be increased by at least 0.2, etc.

59. It is expected that the estimation and monitoring of the statistical error on effective EPE will be part of the regular validation programme as referred to in Articles 293(1)(c) and 294(1)(d) of the CRR. If the statistical error (standard deviation) is more than 10% of effective EPE for all counterparties (summed) or for representative sub-portfolios in the sense of paragraph (d) of the Glossary, the alpha factor referred to in Articles 284(4) and 293(2) of the CRR should be increased by at least 0.1.[116]

8 Calibration frequency and stress calibration

60. The calibration frequency is relevant both for regulatory Pillar 1 reporting and for internal risk management (line consumptions etc.) in the light of the use test requirements set by the CRR:

    (a) for Pillar 1 purposes, a more frequent calibration as required by Article 292(2) of the CRR may be done for quality purposes, but for supervisors only the quarterly reported numbers are visible;

    (b) for internal risk management purposes, the calibration frequency also affects the quality of exposure numbers used for the institution's day-to-day risk management process.

61. To compute own funds requirements for CCR, institutions should use two different calibrations: one based on current market data and one based on a stress period.

8.1 Relevant regulatory references

62. The relevant regulatory references related to the topic presented in this section are as follows.

    (a) Article 292(2) of the CRR requires at least quarterly updates of data for historical calibration (which corresponds to the quarterly regulatory Pillar 1 reporting);

    (b) Article 284(3)(b) of the CRR requires institutions to compute effective EPE using a stress calibration. Article 292(2) and (3) of the CRR provides the requirements for the stress period determination.

63. The CRR is vague as to the level of a banking group at which the stress calibration has to be performed for solo capital requirement calculations, if the IMM covers different legal entities of a banking group.

[116] If the error is more than 20%, alpha should be increased by at least 0.2, etc.

8.2 Practices

64. Observations:

    (a) a wide use of historic calibration with recalibration frequencies from daily to yearly was observed;

    (b) the identification of a stress period and the corresponding stress calibration is performed at legal entity level and/or only at group level.

8.3 Assessment criteria for supervisors

65. An assessment should be carried out as to whether (possible) differences with respect to calibration frequencies for regulatory and internal purposes are justified.

66. In the case of single determination of the relevant stress period and the corresponding stress calibration only at group level, the suitability analysis of this calibration for the different legal entities should be assessed (in the context of solo capital requirement computations).

8.4 Principles for ECB banking supervision

67. Article 289(1) of the CRR is interpreted as implying that the exposure distribution used for internal risk measurement in the day-to-day CCR management process should be sufficiently up to date for daily line consumption calculations. This implies a [daily] revaluation of current exposure and at least [monthly] re-calibrations of the stochastic parameters and correlations.

68. If a single stress period is determined at group level for the different legal entities which have approval to use the IMM for solo capital requirement calculations, each legal entity is expected to assess the suitability of this single stress period for its own IMM perimeter.

9 Validation

69. This section refers to the validation framework set up by institutions to assess the performance of the IMM exposure model, in particular back-testing (BT) methodologies, the validation of pricing functions and further checks on various modelling assumptions.

9.1 Relevant regulatory references

70. Validation is addressed in Article 293(1)(b), (c) and (i), and Article 293(3) to (6), as well as in Article 294 of the CRR. The requirements set out are predominantly dedicated to BT, including for instance BT time horizons, the choice of BT portfolios and risk measures to be back-tested.

9.2 Practices

71. The CC observed the following practices.

    (a) In most cases, various teams within the institution contribute to validation; one institution has model development and model validation in the same unit, with some staff only being responsible for validation tasks.

    (b) Looking at validation frameworks in general, BT still seems to be the activity to which most attention is given, compared with work regarding the validation of stochastic processes, pricing functions or margining. Further validation on all kinds of modelling assumptions is not systemically in place.

    (c) Frequencies of validation, especially for BT, differ greatly between the institutions but also depend on the kind (e.g. statistical measure or prediction horizon) and level of analysis. BT is mainly conducted on a quarterly basis but within a range that goes from weekly to every 1.5 years.

    (d) While BT at the risk factor and real-life portfolio level is common practice, further analysis at the level of real or hypothetical trades and of hypothetical portfolios is not conducted in every institution. Moreover, the absolute and relative numbers of back-tested risk factors, trades and portfolios vary strongly. It was observed that BT coverage ratios were estimated using very different approaches and definitions of these ratios.

    (e) Some institutions build BT samples with forecasts on fully overlapping time periods (e.g. distinct variables over the same forecasting period are tested simultaneously) or partly overlapping time periods (e.g. tests built on a single variable and different successive but overlapping observation periods). It was observed that only some of the institutions account for these dependencies by adapting the respective BT test statistic.

    (f) While a couple of institutions use the IMM internal pricing functions to compute BT realisations, most take realised values from either front office or accounting systems.

    (g) Concerning the risk measures and metrics used in the BT approaches, it was observed that some of the institutions only perform BT on the PV at portfolio level, while others extend the analysis to exposure metrics such as EE or potential future exposure (PFE), or even EPE. With respect to

margined trading, meaningful BT techniques to assess the net exposure (taking into account the collateral balance and margin mechanism) are not yet common practice.

(h) All institutions have established a benchmarking of IMM pricing functions on an ongoing basis. Furthermore, it was observed that some institutions use benchmark prices before the independent price verification process (IPV).

9.3 Principles for ECB banking supervision

72. Various units, or at least independent sub-teams within one unit (cf. Art. 293 (1)(c) of the CRR), should contribute to the overall assessment of the model's soundness and appropriateness. Given that validation activities are carried out by different units using different kinds of analyses, a comprehensive view of the problems, weaknesses and limits of the exposure model and an ongoing interaction of all units/staff contributing to the validation function is expected.

73. The validation framework is expected to be complete; various types of analyses should be included in a regular validation schedule. In particular, a check on all kinds of modelling assumptions is expected to be a mandatory part of the overall assessment. This refers to, at least, the validation of the grid point setting, the chosen stochastic processes in the event of poor BT results, the monitoring of the Monte Carlo error of effective EPE (see paragraph 59), an assessment of expert set parameters and boundaries in use (such as caps and floors for risk factor paths) and modelling features regarding the MPOR setting.

74. Back-testing is expected to be performed at least once a year.

75. Back-testing on a risk factor and real-life portfolio level is expected to be mandatory. Note that BT on a given level means that predictions, realisations and statistical tests should be performed explicitly on that level.

76. Securities as part of SFTs for cases where SFTs are part of the IMM perimeter, and securities used as margin collateral, are expected to be a mandatory part of the BT framework whenever institutions model these securities using internal haircuts according to Article 225 of the CRR or via a full simulation approach (cf. also paragraph 29).

77. BT samples should be representative and allow for a meaningful assessment of the complete IMM exposure model. In order to set up a coverage indicator, institutions are expected to calculate and provide BT coverage ratios on all levels (risk factors, trades and portfolios). In particular, and if applicable:

    (a) institutions should take into account different weighting schemes like sensitivities and exposure metrics;

(b) at risk factor level, in addition to the full risk factor set[117], numbers should also be provided by asset class;

(c) whenever ratios are less than [50%], institutions are expected to provide an explanation.

78. When BT samples contain forecasts on fully or partially overlapping time periods, the statistical tests used for BT are expected to be adapted accordingly (compared with a standard version meant for the case of non-overlapping forecasts) to account for dependencies in the sample and therefore serve as a proper indicator of the model performance.

79. When back-testing real trades or portfolios, the institution should compare its predicted prices or exposures with both of the following:

(a) actually realised prices or exposures, deriving from front office or accounting systems;

(b) calculated prices or exposures generated by feeding market movements as of the realisation date into the IMM.

80. For BT of hypothetical trades or portfolios, the determination of both prediction and realisation using the IMM is regarded to be sufficient.

81. Institutions are expected to back-test different relevant risk measures including PV and exposure. If direct BT of margined net exposures (netting set exposure minus collateral balance) is not possible, institutions are expected to have a separate validation of the margining process and of collateral during the MPOR.

82. The values computed using IMM pricing functions are expected to be benchmarked on an ongoing basis (see paragraph 18). The comparison should be conducted with values from front office or accounting systems. A full analysis of the differences should be performed regularly so as to detect and correct, when needed, the most significant discrepancies.

10 Effective expected positive exposure

83. This section refers to the normalisation of weights Δt_k that are used in the calculation formula for effective EPE.

10.1 Relevant regulatory references

84. The calculation formula for effective EPE occurs in Article 284(6) of the CRR.

[117] Note that the set of risk factors should include all underlying risk factors/drivers that are integrated into the IMM exposure model (not differentiating whether risk factors are diffused or not).

85. In this respect, there is an issue with the CRR in its current form. If the Δt_k weights are always expressed in units of one year, both for cases where the duration of the longest lasting transaction in a netting set (T) is greater or lower than one year, then the effective EPE is underestimated for the netting sets where $T < 1$ year, i.e.:

$$\sum_{k=1}^{min\{1\ year, maturity\}} \Delta t_k < 1, \qquad if\ T < 1 year$$

Note that the current CRR formula lacks a ratio "1/T" before the sum (which would rescale the weights and normalise effective EPE).

10.2 Practices

86. Different practices and capital underestimations are possible if T is less than one year.

10.3 Principles for ECB banking supervision

87. Article 284(6) of the CRR is interpreted so that the sum of the weights is equal to one:

$$\sum_{k=1}^{min\{1\ year, maturity\}} \Delta t_k = 1$$

using the CRR notation, i.e. if Δt_k are originally expressed in units of a year but the longest maturity of the netting set is less than one year (e.g. T = 0.5 years), then all Δt_k weights should be rescaled (enlarged) with $1/T > 1$ (in this example by $1/T = 2$).

11 Alpha parameter

88. The alpha multiplier is intended by the CRR to capture extra risk arising from the fact that exposures are correlated with credit drivers and potentially lack accuracy, and to address general model deficiencies. Alpha is the only parameter that can be increased explicitly to account for model deficiencies (besides capital buffers). While it always requires supervisory approval, or is even set as a supervisory measure, it can also be proactively proposed by institutions to remedy self-identified model deficiencies and limitations.

11.1 Relevant regulatory references

89. This section refers to Article 284(4) of the CRR. Article 293(2) links the level to alpha (if higher than the floor value of 1.4 for the non-modelled and 1.2 for the

modelled[118] multiplier according to Article 284(4) and (9) of the CRR) to the extent that the institution meets the requirements for the risk management system as set out in Article 293(1) of the CRR. Article 293(1) refers in particular to overall validation, adequate processes, integration into the day-to-day risk management process and limit utilisation (use test), documentation and independent reviews.

11.2 Practices

90. It was observed that only one country within the scope of the SSM made use of the possibility to increase alpha (pre-SSM) to higher values than the floor of 1.4 in the event of model deficiencies.

11.3 Supervisory actions

91. It is intended that the alpha parameter will be increased to cope with identified deficiencies regarding the requirements set out in Article 293(1) of the CRR that are acknowledged by the ECB for either an interim or an undefined period. This holds in particular for model deficiencies, which probably, or demonstrably, lead to an underestimation of effective EPE as defined in Articles 284 (5) and (6) of the CRR and Article 285 of the CRR for margined trading, and identified deficiencies in the validation framework. Consistent treatment of alpha should be applied across the ECB's Banking Supervision. It should be noted that:

    (a) both supervisory alpha increases related to an interim period and those related to an undefined period require supervisory decisions as part of a condition or obligation.

    (b) if alpha is increased for an interim period, the length of the interim period must be specified in the decision.

92. It is intended that the amount of an alpha increase above the floor values referred to in Article 284(4) and (9) of the CRR (respectively, alpha = 1.4 and alpha = 1.2 or above) is justified to the extent possible by an impact analysis, which is detailed below.

    (a) The analysis assesses the impact on effective EPE as calculated without the identified model deficiency.

    (b) As it is obvious by definition that the standard configuration of the IMM contains this deficiency, an impact calculation based only on a subset of the relevant portfolio is accepted for this purpose. This calculation can be

[118] According to Article 284(9) of the CRR, competent authorities may permit institutions to use their own estimates of alpha, but these should not be lower than 1.2. Currently, only one institution supervised by the ECB models the alpha multiplier.

performed in a well-defined developer area for representative (in the sense of paragraph (d) of the Glossary) sub-portfolios.

(c) Some (non-exhaustive) examples on how identified model deficiencies can increase alpha are discussed in this document, see for example paragraphs 26, 58 and 59.

(d) If no impact and no proxy impact calculation are possible, the ECB estimates the amount of the alpha increase in a conservative way.

(e) Increases are applied in multiplies of one decimal point. For example, if Article 284(4) (alpha = 1.4) applies, alpha becomes at least 1.5 if an increase is deemed necessary.

93. If there is evidence that the final alpha parameter after applying an alpha increase could become higher than 2.0, the ECB proposes to apply one of the standardised exposure methods in Part Three, Title II, Chapter 6 of the CRR as described in Section 3 or 5 for all CCR exposures, i.e. the ECB will withdraw the model approval for the IMM.

12 Glossary

Throughout this document, the following terms are used and the following definitions are applied.

(a) **"t_0"** is the first date of the simulation time grid in the IMM and the reporting date for which the effective expected positive exposure (EPE) is calculated. It is thus equal to the "current date" referred to in Article 284(5) of the CRR.

(b) "**SFTs**" are securities financing transactions. 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) When the term "**front office or accounting systems**" is used in the context of pricing functions, it refers to the respective front office or to the accounting systems' pricing functions. Corresponding front office values refer to values after independent price verification (see Article 4(70) of the CRR); values produced by accounting systems refer to values without any valuation adjustments beyond the default-free value (e.g. CVA).

(d) When the term "**representative sub-portfolios**" is used, it refers to representative counterparts or netting sets for which the following two conditions hold:

(i) such sub-portfolios should be representative in terms of transaction types, underlying risk factors, margined/un-margined netting sets, short/long positions and the netting set structure;

(ii) the institution should demonstrate to supervisors that the chosen sub-portfolios are sufficiently representative in terms of item i).