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Guide to internal models

European Central Bank (ECB)

List of abbreviations

Abbreviations	Meaning
AVA	Additional Valuation Adjustment
BT	Back-testing
BB	Banking Book
BT	Back test
CA	Competent Authority
CCF	Credit Conversion Factor
CIU	Collective investment undertaking
CP	Consultation Paper
CRCU	Credit Risk Control Unit
CRD IV	Capital Requirements Directive
CRR	Capital Requirements Regulation
CVA	Credit Value Adjustment
DQF	Data Quality Framework
EE	Expected Exposure
EAD	Exposure At Default
EBA	European Banking Authority
EL_{BE}	Best Estimate of Expected Losses
EPE	Expected Positive Exposure
ETC	Early Termination Clauses
GL	Guidelines
G-SIIs	Global Systemically Important Institutions

Abbreviations	Meaning
HQLA	High Quality Liquid Assets
IMA	Internal Model Approach
IMM	Internal Model Method
IRB	Internal Rating-Based Approach
IRC	Incremental Risk Charge
JST	Joint Supervisory Teams
LGD	Loss Given Default
MoC	Margin of Conservatism
MPOR	Margin Period of Risk
OFR	Own Funds Requirements
O-SIIs	Other Systemically Important Institutions
PD	Probability of Default
PPU	Permanent Partial Use
RDS	Reference Data Set
RNIM	Risks Not In the Model
RR	Recovery Rates
RTS	Regulatory Technical Standards
sVaR	Stressed Value at Risk
TB	Trading Book
TRIM	Targeted Review of Internal Models
VaR	Value at Risk
PV	Permanent Value

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Introduction

In November 2018 and July 2019 the ECB published a review of the Guide to internal models regarding the general and risk-type-specific chapters respectively, which aims at ensuring a common and consistent approach of the applicable regulations on internal models

Introduction

In February 2017, the ECB issued a **Guide to the Targeted Review of Internal Models (TRIM)** addressed to the management of significant institutions, which sets out its view on the appropriate supervisory practices and spells out how the ECB intends to interpret the relevant EU law on internal models and on general model governance topics. The Guide to the TRIM covers four main chapters: general topics, credit risk, market risk, and counterparty credit risk.

The TRIM carried out by the ECB is aimed at enhancing the credibility and confirming the adequacy of approved Pillar I internal models (for credit, market and counterparty credit risks) permitted for use by significant institutions when calculating own funds requirements. In this regard, the TRIM will encompass two aspects: i) compliance with regulatory requirements related to internal models, through an assessment based, among others, on the CRR, CRD IV, EBA RTS and guidelines (GL), etc.; ii) 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 this context, the ECB published in November 2018 an **update of the first chapter on general aspects of the Guide to internal models[1]**, which contains principles for the following non-model-specific topics. Further, in July 2019, the ECB also issue an **update of the risk-type-specific chapter of the Guide to internal models**, which covers credit risk, market risk and counterparty credit risk and aims at ensuring a common and consistent approach to the most relevant aspects of the applicable regulations on internal models for banks directly supervised by the ECB.In particular, this Guide (as a whole) aims at:

  - Spelling 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.
  - Ensuring a **harmonised interpretation** and application of the existing legal framework.
  - Ensuring close **alignment with upcoming changes** in the regulation on internal models.

This **Technical Note** includes an analysis of the ECB's Guide to internal models.

(1) The section on overarching principles for internal models covers all Pillar 1 internal models regarding credit risk, market risk and CCR (unless stated otherwise), whereas all subsequent sections only cover credit risk Pillar 1 models. All other models, including operational risk models, Pillar 2 and managerial models are not included in the scope of this Guide.

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Executive summary

This Guide to the internal models provides guidance on the following aspects: general topics, credit risk, market risk, and counterparty credit risk

Executive summary

Scope	Regulatory context	Next steps
• **Significant institutions** supervised by the ECB	• CRR and CRD IV • EBA/RTS/2018/04 - GL on estimation of IRB parameters[1] • EBA/RTS/2016/03 - Final RTS on assessment methodology for IRB • EBA/RTS/2016/07 - Final RTS on assessment methodology for IMA • EBA/GL/2012/3 - GL on the Incremental Default and Migration Risk Charge	• The TRIM project will finalise **in the course of 2019** and it will continue with a review of models for low-default portfolios

Main content

General topics

This section aims to inform institutions on the principles for the general topics (i.e. non-model specific), covering the following areas: overarching principles for internal models, roll-out and permanent partial use, internal governance, internal validation, internal audit, model use, management of model changes to the IRB approach, and third party involvement.

Credit risk	**Market risk**	**Counterparty credit risk**
This section covers the following areas regarding the IRB approach requirements for credit risk: data maintenance, use of data, PD, LGD, CCF, model-related MoC, review of estimates, and calculation of maturity for non-retail exposures.	This section covers the following areas: scope of the internal model approach (IMA), regulatory back-testing of VaR models, internal validation of market risk models, methodology for VaR and sVaR, methodology for incremental risk charge (IRC) models focusing on default risk, and risks not in the model.	This section covers the following areas: trade coverage, margin period of risk and cash flows, collateral modelling, modelling of initial margin, maturity, granularity, number of time steps and scenarios, calibration frequency and stress calibration, validation, effective expected positive exposure, and alpha parameter.

(1) Along with the Guidelines on the application of the definition of default (EBA/GL/2016/07), Final RTS on the specification of the nature, severity and duration of an economic downturn (EBA/RTS/2018/04), and Guidelines for the estimation of LGD appropriate for an economic downturn (EBA/GL/2019/03).

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General topics

This Guide includes expectations on the overarching principles for internal models regarding the application level, documentation, the model risk management framework,…

Overarching principles for internal models (1/3)

Overarching principles for internal models

- These principles for internal models are subject to **supervisory approval for the calculation of own funds requirements** for credit, market and counterparty credit risk (Pillar 1 models).

Consolidated vs. subsidiary level

- Institutions should either:
  - Develop **binding group-wide** (i.e. consolidated) **principles and guidelines** relating to the life cycle of internal models (i.e. development, calibration, validation, supervisory approval, implementation in internal processes, application and review of estimates), or
  - Ensure that each relevant entity has an **appropriate and independently audited principles and guidelines** in place with a high degree of consistency between one another.

Documentation

- All internal models should be **documented** to allow a qualified third party to independently understand the methodology, assumptions, limitations and use of the model and to replicate its development and implementation.
- Institutions should therefore define **principles and guidelines** for model documentation[1], and **adequate controls** of the register of its internal models, together with an **inventory of the documentation**, including an annual review, should be in place.

Model risk management framework

- Institutions should have a **model risk management framework** in place that allows them to identify, understand and manage their model risk for internal models across the group.
- This **framework** should comprise: i) a written model risk management policy; ii) a register of the institution's internal models; iii) guidelines on identifying and mitigating any areas where measurement uncertainty and model deficiencies are known to exist, according to their materiality; iv) guidelines and methodologies for the qualitative and/or quantitative assessment and measurement; v) guidelines with respect to the model life cycle; vi) procedures for model risk communication and reporting (internal and external); and vii) definition of roles and responsibilities within the model risk management framework.

(1) The institution should demonstrate how its documentation and the register of its internal models facilitate the internal and external understanding of the models. The register should contain the models owner, approval date, etc.

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**…the management body and senior management,
internal validation,…**

Management body and senior management

- Institutions should clearly **define the roles and responsibilities** of their **management body** and **senior management** with regard to internal models and in relation to each risk type. It should document the roles and responsibilities of each individual in the management body (executive members).

- The institution should assess the appropriateness of **designated committees** of the management body in order to ensure that they provide an adequate support function for **effective decision-making procedures**. It should clearly document the composition, mandate and reporting lines of committees responsible for internal model governance and oversight, as well as the decisions taken. These committees should be chaired by a member of the management body.

- The senior management should either **report directly to the management body** or be responsible for providing it with the **necessary information** to carry out its duties (especially regarding its oversight role).

Internal validation

- All internal models and internal estimates should be subject to an initial validation of new models and material changes and extensions to approved models, and subsequently to an annual, **internal validation**.

- The institution may choose from **3 different organisational arrangements** in terms of effective independence from the model development process[1]:
  - Separation into two different units reporting to different members of the senior management.
  - Separation into two different units reporting to the same member of the senior management.
  - Separate staff within the same unit.

- The institution should ensure that the **staff of the validation function is separate from the staff involved in the model development process** in order to mitigate the risk of conflicts of interest.

- The validation function should be **adequately staffed** following the proportionality principle, including suitable resources and experienced qualified personnel.

(1) The ECB understands that the first option should be implemented by large and complex institutions; the second option is a good practice for institutions that fulfil the requirements specified on the Final RTSs on assessment methodology for IRB and for IMA; and the third option could be suitable for small legal entities which are not classified as G-SIIs or O-SIIs.

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…and the internal audit function

Overarching principles for internal models (3/3)

> **Internal audit**

- The CRR requires internal models to be subject to **regular review by the internal audit** or another comparable independent auditing unit, that needs to be **efficient and effective**.
- The internal audit function should grant an **adequate level of independence** to ensure that: i) there is an effective separation of the internal audit from the staff involved in the operations of the internal models; ii) the internal audit reports directly to the management body; and iii) no undue influence is exerted on the staff responsible of the audit conclusions.
- To enable a **sufficient number and adequate scope of internal model reviews** the internal audit should:
    - Have **adequate resources** and experienced, **qualified personnel**.
    - Be **adequately equipped and managed** in proportion to the nature, size and degree of complexity of the institution's business and organisational structure.
- To ensure that the internal audit reviews have a timely and effective impact, the following are considered to be good practice:
    - **Conclusions, findings and recommendations** should be reported to the audit committee and/or the appropriate management level of the audited areas.
    - Where weaknesses are identified, **action plans and related measures should be approved** by the audit committee and/or the appropriate management level of the audited areas.
    - **Regular** (at least annual) **status reports** should be prepared and the results discussed in the appropriate committees to ensure the timely and proper implementation of follow-up actions.

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**The Guide also specifies several aspects regarding the roll-out and the PPU
of internal models, including the application of the IRB approach
by asset class, the governance of the roll-out plan,…**

Roll-out and PPU (1/2)

Roll-out and PPU

- The CRR and the Final RTS on assessment methodology for IRB have established several GL and criteria for application, and monitoring as well as the assessment methodology for IRB approach. In this regard, the ECB has set expectations on this issue.

Application of the IRB approach

- Institutions **must implement the IRB approach for all exposures**, unless they have received the permission of the competent authority to permanently use the standardised approach on some exposure classes or some types of exposures.
- The **criteria used to define the application** and sequential implementation of the IRB approach include: i) **quantitative** aspects (e.g. the materiality and risk profile of the exposures and internal thresholds/ratios), and ii) **qualitative** aspects (e.g. importance of the exposure classes).
- Institutions with permission to use the IRB approach are expected to reach a **50% minimum IRB coverage ratio**, and the **time frame** for the initially approved roll-out plan should generally **not exceed 5 years**.
- Institutions are expected to provide the **competent authority with full transparency and regular communications** regarding this treatment, which should include information on all subsidiaries and all portfolios (together with clear exposure assignment criteria).
- **Decisions of the institutions on the application and sequential implementation** of the IRB approach should be triggered by internal criteria, with the main purpose of enhancing risk management and risk sensitivity.

Governance of the roll-out plan

- All material aspects of the **rating and estimation processes shall be approved by the institution's management body** or a designated committee thereof and senior management. As the roll-out plan determines the intended application of the IRB approach and its sequential implementation, it should be approved by the institution's senior management and management body.
- It is expected that the status and progress of the sequential implementation of the IRB approach should be a regular **agenda item** for the **management body** or designated committee. The status of the roll-out plan should be reported at least annually and include the exact scope of application, the planned dates of approval, or use, etc.
- Institutions should have a **framework or policy** for the governance of their roll-out plan.

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**… changes to the roll-out plan, and monitoring of
compliance with the PPU provisions**

**Roll-out
and PPU
(continue)**

- The CRR and the Final Draft RTS on assessment methodology for IRB have established several GL and criteria for application, monitoring and assessment of the IRB approach. In this regard, the ECB has set expectations on this issue.

**Changes to the
roll-out plan**

- Institutions are required to **follow the roll-out plan approved by the competent authorities**, and when a change in the plan is necessary, these **changes may be approved and assessed against these conditions** on the basis of the documentation provided by the institution regarding the rationale for the change, the materiality of the portfolios affected and governance arrangements for the change.

- Institutions should pay attention to the following:

  - **Resource constraints and re-prioritisation** may affect their operational capability to develop and maintain rating systems.

  - General **uncertainty caused by potential changes to the IRB regulatory requirements** should not be considered a valid reason for changing the roll-out plan (or for delaying its implementation).

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**Monitoring
of PPU
compliance**

- Institutions need to ensure on an ongoing basis that **exposures under PPU fall within the categories listed in the CRR**. In particular, institutions should **implement**:

  - **Measures and triggers** for a re-assessment of the suitability for PPU of PPU-authorised exposure classes or types of exposures.

  - A **reporting process** monitoring the materiality of the exposure classes or types of exposures in PPU over time.

  - **Processes and guidelines** to assess whether further exposure classes or types of exposures may become eligible for PPU.

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General topics

Regarding internal governance, the Guide include provisions in relation to the materiality of rating systems, decision-making responsibilities, internal reporting…

--- Internal governance (1/2) ---

Internal governance

- Internal governance principles have been organised along the following lines: i) the materiality of rating systems; ii) the management body and senior management (i.e. decision-making responsibilities, internal reporting and understanding of the rating systems); and iii) responsibilities of the Credit Risk Control Unit (CRCU).

Materiality of rating systems

- Whether a rating system is material depends on **quantitative criteria** (e.g. share of total EAD and RW exposure amount covered by the material rating systems) and **qualitative criteria** (e.g. complexity of the rating models).

- Institutions should assess and **determine the materiality of their rating systems** and communicate it to the CAs. The same requirements apply to all rating systems throughout the model life cycle, but additional requirements may apply to material rating systems (internal reporting and internal validation).

Decision-making responsibilities

- Material aspects of all rating and estimation processes must be approved by the institution's **management body** or a committee designated by it, as well as by **senior management**. In this regard, it is expected that the approval process includes the documentation of the approvals.

- The institutions should define which **policies** should be approved by the management body and senior management[1], and should have a policy in place which defines material changes or exceptions.

Internal reporting

- To ensure consistent oversight of the functioning of the rating systems, the CRR requires **internal reporting on their performance**.

- Institutions should determine the **level of detail of the information and data** to be presented to senior management and the management body, and the **frequency** of the reporting (at least annually). These reports should include 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. At least annually, they should receive an aggregated overview of the validation results for each rating system.

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(1) These policies should cover, in particular, risk management policies that could have material impact in the institution's rating systems and risk estimates, and the risk of a third-provider for model-related tasks ceasing to operate (in relation to IT infrastructure and contingency planning).

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…the understanding of the rating systems, the CRCU and the review of estimates

Internal governance (2/2)

Understanding the rating systems

- The **management body** must possess a **general understanding** of the rating systems and **senior management** must have a **good understanding** of the rating systems design and operations.
- Institutions should be able to provide **evidence of the processes** they use, and the format and content of these processes should match the roles and responsibilities of the management body and senior management.
- The **format** and **content of these processes** (e.g. workshops, seminars or dedicated training on IRB models) should match the roles and responsibilities of the management body and senior management.

CRCU

- To ensure that the CRCU is **independent from the personnel and management functions** responsible for originating and renewing exposures, institutions should clearly determine which **individuals and/or teams make up the credit risk control function** and which personnel and/or units are responsible for originating and renewing exposures, and why they are independent from one another.
- Institutions should have a **clear written mandate for their CRCU** which clarifies its roles and responsibilities. Furthermore, the CRCU is responsible for **ensuring the satisfactory performance** of the **rating systems and their ongoing maintenance**. The CRCU may provide the **validation function**, with the necessary input for the validation of internal estimates; and should address any deficiencies identified by the validation function.

Review of estimates

- In accordance with the CRR, **risk estimates should be reviewed** when new information comes to light but at least on an annual basis.
- The ECB considers it good practice to do it on the basis of: i) the **ongoing monitoring** performed by the CRCU, and ii) the **annual validation** of internal estimates performed by the validation function.

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The Guide includes provisions regarding the internal validation function, specifying the validation level and responsibilities, the content and frequency of the validation process…

Internal validation (1/2)

Internal validation

- The internal validation function, which encompasses the personnel responsible for performing the validation, should perform a consistent and meaningful assessment of the **performance of internal rating** and **risk estimation systems**.

Validation level and responsibilities

- **Internal validation** should be performed at all **relevant levels**. In particular, institutions should pay attention to the following:
    - If the institution has approval for a rating system on a **consolidated bases only**, the validation of that rating system should be performed at least at consolidated level.
    - If the institution has approval for a rating system on a **consolidated basis** as well as on a **sub-consolidated and/or individual basis**, the validation of that rating system should be performed at the consolidated as well as on the sub-consolidated and/or individual levels.
- In order to **ensure consistency in validation activities across the different levels**, the group validation function can provide support to validation functions at lower levels (sub-consolidated or individual level)[1].

Content and frequency

- The **validation policy** should involve proven procedures and methods which adequately validate the accuracy, robustness and stability of their estimation of all relevant risk parameters.
- The **validation process** should assess the performance of the rating systems by means of qualitative and quantitative methods, in particular with regard to the ranking of borrowers by creditworthiness (ranking power) and risk parameter estimation (calibration appropriateness).
- The **content of the validation processes** should be consistent across rating systems and through time, in order to be able to meaningfully and consistently assess the performance of the rating systems. Further, it should include quantitative analyses, which should include thresholds, set up for certain tests such as back-testing; discriminatory power; analyses of overrides; or stability analyses of the internal ratings and risk parameters over time.
- A meaningful validation of the rating systems requires not only an **initial validation** but also **assessment on regular basis**. These assessments should be carried out **annually**.

(1) However, responsibility for the validation tasks should be retained at the level at which the rating system is approved (sub-consolidated and/or individual level)

General topics

**…as well as the reporting and follow-up
of the internal validation function**

--- **Internal validation (2/2)** ---

**Reporting
and follow-up**

- Institutions should ensure that **senior management and the management body are informed** about the conclusions and recommendations of the validation results as set out in the rating systems' validation reports, and in particular about any exceeded thresholds and deficiencies identified.
- Institutions should be able to demonstrate that, on the basis of the validation results and recommendations, **measures are initiated to remedy** identified deficiencies of the rating systems (e.g. model change, recalibration). This process should involve people with the appropriate level of seniority and responsibility from both the CRCU and the validation function.
- An **escalation process up to management body** level should be in place in the event of conflicts between the validation function, the CRCU and/or business units.
- Institutions should have adequate processes in place for **tracking the status of the measures** adopted to remedy deficiencies.
- Further, they should always **notify the CA** in the event of changes to their validation methodology and/or process.

Detail
General topics

**The Guide specifies that the internal audit should review
the rating system and its operations at least annually**

— **Internal audit** —

Internal audit

- Pursuant to the existing regulatory requirements under the CRR, the internal audit or another comparable independent unit shall review the **institution's rating systems and its operations at least annually**.

Scope and frequency

- The internal audit should carry out a **general risk assessment** of all aspects of the rating systems for the purpose of drawing up the appropriate internal audit work plan.
- For the purpose of the **general risk assessment**, the internal audit should develop its own opinion on the areas of rating systems to be reviewed but can take into consideration the analysis performed by the internal validation function where appropriate. This assessment should include, at least, the **opinion of the internal audit unit** on:
  - The development and performance of the rating system.
  - The use of the models
  - the process for the materiality classification, the impact assessment and the compliance with regulatory requirements of all changes to the rating systems
  - The quality of data used for the quantification of risk parameters
  - The integrity of the rating assignment process
  - The validation function, in particular with regard to its independence from the CRCU
  - The process for calculating own funds requirements
- The **procedures** and results of the general risk assessment, the **annual work plan**, the **auditing techniques** and **guidelines** and the subsequent production of the internal audit reports should be properly **documented** and **approved by the management body**.
- For **extensions and changes to the IRB approach**, institutions must submit, among other things, reports of their independent review or validation.

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General topics

Regarding the model use, this Guide specifies the role of internal ratings and default and loss estimates in the risk management and credit approval, in the internal capital assessment and allocation, in the corporate governance functions,…

─── **Model use (1/2)** ───

Model use

- The ECB acknowledges that the degree of use of internal ratings and default and loss estimates in the institution's risk management is **more extensive** for PD/internal ratings than for LGD/loss estimates and conversion factors. The IRB risk parameters can be used in an adjusted form or indirectly through risk measures stemming from rating systems, when justified and documented.

Risk management, credit approval

- Institutions should use internal ratings and default and loss estimates in: i) the **approval, restructuring and renewal of credit facilities**; ii) their **lending policies**, including exposure limits and mitigation techniques; and iii) the **monitoring process** of obligors and exposures.
- In addition, institutions should take into account the internal ratings and default loss estimates in: i) **pricing of transactions**; ii) **early warning systems**; iii) collection and **recovery policies** and processes; iv) **credit risk adjustments**; and v) **allocation or delegation of competence** for the approval process. If an institution is not using the internal ratings in one or several of those areas, it should be able to properly justify its rationale.

Internal capital assessment and allocation

- Internal ratings and the default and loss estimates produced by the rating systems play an important role in the assessment, calculation and allocation of institutions' **internal capital under the framework of the ICAAP** (RW exposure amounts can also be used as an additional driver). This role should be reflected within the institutions' internal policies and procedures on internal capital assessment and allocation.

Corporate governance functions

- Institutions should use internal ratings and default and loss estimates in their **internal reporting** and **portfolio credit risk monitoring** procedures.
- The ECB considers that institutions comply with the above if they establish the following: i) **institution's internal reporting**, i.e. a structured reporting system on risk measured by their IRB risk parameters; and ii) **portfolio credit risk monitoring**, where the CRCU performs descriptive analyses of portfolio riskiness.

**…as well as in the assignment
of exposures to grades or pools**

Model use (2/2)

Assignment of exposures to grades or pools

- The CRR requires institutions to **assign and continue with assigning each exposure** in the range of application of a rating system to a **rating grade or pool of this rating system**, and to review those assignments at least annually.

- The ECB observes that institutions' portfolios occasionally show a certain proportion of **non-rated exposures and/or outdated ratings**. The ECB considers that this should be properly investigated, justified, documented and monitored.

- Regarding the root causes, **non-rated exposures** are temporary exceptions to the 'ordinary' rating assignment process and should therefore be investigated, documented and justified in detail; while **outdated ratings** include both ratings that have not been updated within the 12-month period following the last rating date and ratings based on outdated information.

- Further, regarding the materiality, institutions should implement specific policies and procedures to identify these **non-rated exposures and outdated ratings** and **monitor their materiality** (in terms of number, EAD, and RW exposure amounts).

- All exposures within the range of application of an IRB rating system must eventually be rated and are **not expected to be treated under the SA**, unless they have received the permission of the CA to be permanently treated under the SA. Non-rated exposures and outdated ratings present a risk of potential underestimation of own funds requirements. To mitigate that risk, institutions should comply with certain guidance (e.g. they should have internal policies establishing a process to monitor non-rated exposures).

- Moreover, relative to the **analysis of overrides**[1], the rating of retail exposures is less likely to be affected by an override process given the high degree of standardisation of information processing – including in qualitative terms – and the small margins of discretion in the evaluation. In this regard, institutions should **document** those situations, **retain the quantitative and qualitative information** concerning each phase of the rating process, **analyse the performance** of those exposures whose assignments have been overridden, and **identify specific criteria** for assessing whether or not the number of and justifications for overrides indicate significant weaknesses in the rating system

(1) Instances where human judgement may override the inputs or outputs of the assignment process and the personnel responsible for approving these overrides.

Detail
General topics

Moreover, the management of model changes is covered through guidance on change policy, notification and classification of changes; impact assessment; and on re-rating process

Management of changes to the IRB

Management of changes to the IRB

- Changes to a rating system's range of application or to a rating system itself are subject to **approval by the CAs** if assessed as material, or to ex ante or ex post notification if non-material. In addition, institutions are encouraged to share their policy with the CA and inform about any implemented modifications to it.

Change policy, notification and classification

- Institutions should establish a policy related to changes to the IRB Approach ('**change policy**'), which includes the responsibilities, definitions, methods, metrics, significance levels and procedures to identify, monitor and for implementing changes.

- To facilitate the process for submitting the documentation, the institution is expected to use a **standardised template** for notifying ex ante and ex post non-material changes/extensions and for submitting applications for material model changes/extensions.

- Institutions are 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. Further, several unrelated changes/extensions should not be combined to produce one change of lower materiality (e.g. two different model changes that affect RW exposure amounts in opposite ways).

Impact assessment

- The impact assessment process should consist of a **quantitative assessment** (focused on the impact of the model change or extension on risk-weighted exposure amounts) and a **qualitative assessment** (based on certain specifications set in the Commission Delegated Regulation 529/2014 on the IRB and AMA).

- Regarding the **user acceptance test**, institutions should assess and document the impact of a material changes on the use of the parameters and ensure that the related internal policies remain relevant.

Re-rating process

- Institutions are expected to cover the **re-rating process** (i.e. calculation of their own funds requirements on the basis of this approved extension or change from the date specified in the new permission) in their change policy, and the process should be immediate.

- The re-rating process for model changes/extensions that are classified as non-material may take up to **1 year** from the date of implementation.

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Finally, this Guide also specifies the third party involvement in IRB models, focusing on internal functions and tasks

Third party involvement

Third party involvement

- For the purposes of this Guide, outsourcing in the context of IRB models refers to the **involvement of third parties in any IRB-related tasks**, including data provisioning and the use of external data[1].
- All outsourcing arrangements for IRB-related tasks should be subject to a **formal and comprehensive contract** or similar documented agreement in accordance with the proportionality principle.
- The outsourcing agreements should provide for: i) the agreed terms do not impede the institution in **performing its validation activities**; ii) the agreed terms do not impede the **necessary communication** between the institution and the CAs in performing their supervisory duties; and iii) the agreed terms should ensure that the provider gives the institution access to **relevant information**.

Internal functions and tasks

- **Internal validation and internal audit tasks**. If an institution plans to delegate certain internal validation or internal audit tasks to a third party that would perform them outside the EU, it should discuss this plan with the CA in advance.
- **Use of external credit risk parameters/ratings**. When using these parameters as a component of their rating systems, institutions should take internal information into account, and demonstrate good knowledge of the work performed by the third party in producing the estimates.
- **Model development and maintenance**. If an institution plans to delegate such tasks to a third party located outside the EU, it is encouraged to discuss this with the CA in advance.
- **Use of pool models**. Institutions using pool models shall remain responsible for the integrity of its rating systems. Where a third party is involved in the tasks of developing a rating system and risk estimation for an institution, the institution should verify that the validation activities are not performed by that third party.
- **In-house knowledge**. Institutions should retain adequate in-house knowledge and core competence when they are responsible for the outsourced tasks and functions.
- **Independent monitoring of third-party performance**. The institution should monitor the performance of third parties and have appropriate processes. This practice reinforces the fact that the institutions are the ultimate users of the rating systems and thus have the ultimate responsibility for their operations.

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(1) Further, the delegation of IRB-related tasks to different legal entities within the same group (internal outsourcing) is also considered as outsourcing and hence is subject to these expectations.

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Regarding credit risk, this Guide provides transparency on how the ECB understands a number of topics related to internal models used for the IRB approach, including data maintenance,…

Data maintenance – IRB approach (1/2)

Data maintenance for the IRB approach

- The Guide sets out the principles regarding the following elements for the management of IRB data: i) IT systems: infrastructure and implementation testing; ii) policies, roles and responsibilities in data processing and data quality management; and iii) components of the data quality management framework.

IT systems

- **Infrastructure**. Sound and robust IT infrastructures play an essential role in supporting the institution's rating systems. Institutions should document and keep an updated register of all current and past versions of some elements of a rating system[1], such as the model's data flow; the relevant sources of data and the global map of IT systems and databases; the relevant functional/technical specification of IT systems and databases; and the audit trail procedures for critical IT systems and databases.

- **Implementation testing**. Institutions should have in place a consistent process for testing the relevant IRB systems and applications upon first implementation and on an ongoing basis. This IT-testing process should be clearly defined and documented in an organisation-wide policy and procedure. Furthermore, the policy should consider all potential events that should trigger a testing procedure and their impact on the tests to be conducted, such as software releases or material IT-related changes; regulatory changes; model methodology changes and the extension of the range of application of a rating system.

Policies, roles and responsibilities

- For institutions to be able to comply with the requirement to collect and store all relevant data, policies and rules on data management should be defined at group level for **data processing** and **data quality management**.

- As for **data processing**, general guidelines and rules should be clearly formalised with regard to manual interventions within the data processing; and all data transfers should be formally agreed upon by data providers and data users to ensure timeliness and accountability. Further, to ensure the **integrity** of the data processes, the policies and rules on **data management** should clearly set out the relevant data governance arrangements and specify the different roles and responsibilities assigned to data management (e.g. business owners should ensure that data are correctly entered and updated).

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1) Further, the institutions should keep the register of all rating systems, including all current and past versions of rating systems, updated for a period of at least 3 years and, whenever necessary, an extended period beyond that.

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Making things happen

Detail
Credit risk

…which covers the infrastructure and the implementation testing of IT systems; the policies, roles and responsibilities in data processing and data quality management

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Data maintenance – IRB approach (2/2)

Data quality management framework

- Institutions should establish and implement an effective **data quality management framework** that is formalised in a set of policies and procedures. This framework should be applicable to all data used in IRB-related processes, and should encompass the following components to be effective:

  - **Governance principles**. The data quality management framework should be: i) approved by the institution's management body or a designated committee thereof and senior management; ii) distributed throughout the organisation; iii) regularly assessed in order to verify its adequacy, and be updated and improved whenever necessary; and iv) be regularly reviewed by an independent audit unit.

  - **Scope**. It should cover all relevant data quality dimensions such as completeness, accuracy and consistency, among others; as well as the whole data life cycle, from data entry to reporting, and encompass both historical data and current application databases.

  - **Data quality standards**. Institutions should establish data quality standards that set the objectives and overall scope of the data quality management process. These standards should be defined for all data inputs into the model and at each stage of the data life cycle.

  - **Data quality controls**. Data quality should be measured in an integrated and systematic way. Indicators and their corresponding tolerance levels and thresholds should be set in order to monitor compliance with the standards established and should be combined with visual systems and dashboards for monitoring and reporting purposes. Furthermore, indicators should be supported by effective and sufficient data quality checks and controls throughout the data life cycle.

  - **Remediation of data quality issues**. A process for the identification and remediation of data quality deficiencies should be in place in order to constantly improve data quality and promote compliance[1].

  - **Data quality reporting**. A formal reporting process on the quality of risk data should be in place to improve the quality of data and enabling an assessment of the potential impact of data quality in own fund requirements calculations. It should include: i) comprehensive overview of the performance of the model; ii) findings and recommendations to address detected weaknesses; and iii) evidence that the recommendations have been adequately addressed and properly implemented.

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1) Data quality assessments should be carried out independently and recommendations should be issued with an indication of their priority, based on the materiality of the incidents identified.

Detail
Credit risk

Furthermore, this Guide provides instructions on the use of external data that can be used to complement internal data, use of external bureau scores or rating that may consider all relevant information,…

Use of data (1/3)

Use of data

- The Guide also covers the following aspects: i) use of external data; ii) use of external bureau scores or external ratings as input variables in the rating process; iii) use of pooled data; iv) use of purchased rating systems or models (pool models); v) consistency in the definition of default; and vi) use of human judgement.

Use of external data

- As set out in the CRR, data-related requirements apply to all data: **internal**, **external** or **pooled**.

- For the purposes of risk differentiation, risk quantification and review of estimates institutions should assess whether **external data can be used to complement internal data** when they consider they do not have sufficient available internal data. However, they should avoid **bias** or **double-counting effects**[1].

- If an institution uses statistical models and other mechanical methods to assign exposures to obligors or facilities grades or pools, the data used to build the model must be **representative of the population** of the institution's actual obligors or facilities. Moreover, it must have in place a process for **vetting data inputs** to the model, which should include an assessment of the data's accuracy, completeness and appropriateness.

- Furthermore, if an institution **cannot provide sufficient proof that the external data are representative**, it may still use external data if it shows (by quantitative analysis and/or qualitative argumentation) that the information gained from the use of the external data outweighs any drawbacks stemming from the deficiencies identified and an **appropriate margin of conservatism (MoC)** is applied[2].

Use of external bureau scores or ratings

- In order to mitigate the risk that an internal model may not consider all relevant information if using external credit bureau scores as input variables in the rating process, institutions shall comply with the following principles: i) the external scores or ratings and/or data are **regularly updated or refreshed**, ii) they understand the **structure and nature** of external scores or ratings and their **key drivers**, iii) **validation requirements are similar** to those applied to other internal and external input variables, iv) they ensure that all relevant internal information regarding the **creditworthiness of the obligor** is taken into account with sufficient weighting in the internal rating, v) there is **no bias or double-counting effect**, and v) the institution remains **responsible for the performance of the model**.

1) To avoid this risk, institutions should develop the necessary processes to identify common obligors within these databases and ensure that each common obligor is only taken into account once in the calculation of one-year default rates.

2) They should provide evidence that the model does not deteriorate when including external data.

**…the use of pooled data and the use of
purchased rating systems or models,…**

Use of data (2/3)

**Use of
pooled data**

- According with this Guide, 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**.

- Further, where institutions use **data that are pooled** across institutions the rating systems and criteria of other institutions in the pool must be similar to its own. To comply with this requirement an institution should: i) ensure that there is a **common definition** of the key drivers and processes; and ii) ensure that **policies and procedures** considered for **human judgement**, including overrides, can be applied in a comparable and similar manner across all participating institutions.

**Use of
purchased
rating systems
or models**

- Institutions should ensure that all relevant internal information for model development and parameter calibration is taken into account. In particular, **long-run averages** (LRAs) **of default rates**, **LGD** and **CCFs** based only on internal data should always be computed and considered for calibration.

- In addition, to ensure the **integrity of internal models** when institutions make use of pool models, institutions should follow the following principles:

  - If **PD estimates** are calculated using pooled data, institutions should verify that the data used for risk quantification meet the data requirements for default rate calculation, or that the data are adjusted accordingly.

  - Where several institutions use a **common pool model**, each should ensure that its rating process is aligned and all input risk drivers are defined in the same way. They should also ensure that all assessments of the qualitative components are performed in a **comparable manner**.

  - If a pool model is used for the estimation of PD and LGD parameters, the model-relevant parts of the process for **managing distressed obligors** of the participating institutions should be aligned.

  - Institutions should ensure that all **relevant internal information** with respect to the creditworthiness of an obligor should be taken into account.

  - Each institution should **remain responsible** of the rating model's performance on its own portfolio.

1) In order to comply with the provision of the CRR which sets out that the requirements to use an IRB approach, including own estimates and CCFs, apply also where an institution has implemented a rating system, or model used within a rating system, that it has purchased from a third-party vendor.

…the consistency in the definition of default regarding the use of external data, and the application of human judgement in the assignment of exposures to grades or pools

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Use of data (3/3)

Consistency in the definition of default

- Institutions that use **external data** that are not in themselves consistent with the definition of default must make appropriate adjustments to achieve broad equivalence with the definition of default. If there are differences between the definition of default applied in the external or pooled data and the institution's own definition of default, the institution should **assess the differences** and **describe the adjustments made to the risk estimates**, in order to achieve the required level of consistency with the internal definition of default. It should also include an **appropriate MoC** to account for the adjustments included.

- These **adjustments** should be appropriately documented and justified, in particular by providing reasonable assurance that they do not undermine the validity of the approach for the purposes of risk differentiation and risk quantification.

Use of human judgement

- Institutions should ensure that, when human judgement is used in the assignment of exposures to grades or pools, there is a framework in place that establishes clear and **detailed guidelines** and **procedures** on the **application of human judgement** (e.g. through the use of pre-defined questionnaires). The use of human judgement should be documented in a way that ensures the rating assignment can be understood and replicated by a third party.

- Further, **overrides should be limited** to information relevant to the obligor's creditworthiness, if this is not captured well by the pre-defined components of the model. Within a rating assignment process, the use of pre-defined risk drivers in the form of **qualitative model inputs** should be distinguished from overrides

- In accordance with the CRR, the results of the **statistical model** must be complemented by human judgement, especially by taking into account all information not included in the model.

- For the purposes of quantifying the risk parameters to be associated to grades or pools, estimates must not be based purely on **judgemental considerations**. To this end, where human judgement is used to a greater extent because of the low number of available internal observations, institutions should apply a higher MoC to their estimates to account for additional uncertainty.

Detail
Credit risk

The ECB provides expectations on PD-models, in particular in relation to the structure of PD models and PD risk quantification. For other aspects, the Guide includes references to the EBA GL on PD and LGD

PD parameter (1/7)

Probability of default (PD)

- The Guide sets out the structure of PD models (including risk differentiation, grade assignment dynamics, use of ratings of third parties, and use of shadow rating models) and PD risk quantification (including calculation of observed average default rates, calibration to the LRA default rate, calibration to the LRA default rate, weighting for retail exposures, PD quantification based on mapping to external grades, and specific requirements for direct PD estimates).

Structure of PD models

- Institutions should take appropriate measures against model misspecification with regard to **overfitting**, especially where default data for the development of the model are scarce. Further, the PD models should perform adequately on economically significant and material sub-ranges of application in order to provide a meaningful assessment of obligor and transaction characteristics, a meaningful differentiation of risk and accurate and consistent quantitative estimates of risk[1].

- Moreover, where an institution uses **multiple rating systems**, the rationale for assigning an obligor or a transaction to a rating system must be documented and applied in a manner that appropriately reflects the level of risk

- Regarding **risk differentiation**, the Guide sets out the following principles:

  o **Principles for all model types**.

    ▪ Institutions should ensure a **meaningful differentiation of risk** which takes into account: i) distribution of obligors or facilities; ii) homogeneity of obligors or facilities assigned to the same grade or pool; and iii) different levels of risk across obligors or facilities assigned to different grades or pools to which a different PD is applied.

    ▪ To ensure that the **PD model performs adequately**, institutions should: i) define metrics (considering both their evolution over time and specific reference dates) with well-specified targets; and ii) ensure that the tools used to assess risk differentiation are sound and adequate considering the available data.

1) The Guide provides a non-exhaustive list of drivers for PD models covering exposures to SMEs, for PD models covering retail exposures, for PD models covering retail exposures secured by real estate, for PD models covering exposures to financial institutions, and for PD models covering exposures to large corporates.

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In particular, the Guide sets out principles on risk differentiation for all models, specific for grades and pools, and specific for direct estimates…

PD parameter (2/7)

Structure of PD models

- Regarding **risk differentiation**, the Guide sets out the following principles (continue):

  o **Principles specific for grades and pools**. A grade or pool is understood by the ECB as the subset of obligors or facilities to which the same PD is applied for the calculation of regulatory capital requirements, irrespective of how this PD has been assigned (e.g. through the use of masterscales). In this regard, the following requirements are established:

    ▪ **Distribution of obligors or facilities across grades or pools**. The number of grades and pools should be adequate to achieve meaningful risk differentiation and quantification of the PD at the grade or pool level.

    ▪ **Homogeneity within grades**. The structure of rating systems must ensure the homogeneity of obligors or facilities assigned to the same grade or pool.

    ▪ **Risk differentiation across grades or pools**. Institutions should ensure that there are no significant overlaps in the distribution of the default risk between grades or pools. This should be ensured through a meaningful differentiation of the default rates of each grade.

  o **Principles specific for direct estimates**. In order to use direct PD estimates for the calculation of own funds requirements, institutions should consider the CRR (i.e. where an institution uses direct estimates of risk parameters for individual obligors or exposures these may be seen as estimates assigned to grades on a continuous rating scale), as well as the EBA GL on IRB parameters (i.e. institutions should demonstrate that the theoretical assumptions of the probability model underlying the estimation methodology are met to a sufficient extent in practice and that the long-run average default rate is retained).

**…the requirements regarding the grade assignment dynamics
and the use of ratings of third parties…**

PD parameter (3/7)

> **Structure of PD models**

- As regards the **grade assignment dynamics**, the Guide sets out that institutions should follow the EBA GL on IRB parameters. Further, the rating/grade/pool assignment process should also adequately anticipate and reflect risk over a time horizon longer than a year and take into account plausible changes in economic conditions. Although the time horizon used in PD estimation is one year, the rating/grade/pool assignment process should also adequately anticipate and reflect risk over a longer time horizon and take into account plausible changes in economic conditions. In order to achieve this objective:

  - **All relevant information** should be included in the rating/grade/pool assignment process.
  - A horizon of **two to three years** is considered to be appropriate for most portfolios.
  - In accounting for plausible changes in economic conditions, the institution should consider at least **past observed default patterns**.
  - The model should perform under different **economic conditions**.

- Regarding the **use of ratings of third parties**, institutions should have a clear policy specifying the conditions under which the rating of a third party which has a contractual or organisational relationship with an obligor of the institution (third-party support) may be taken into account in the risk assessment of that obligor. Furthermore, the following aspects are also specified:

  - **Requirements for the eligibility of unfunded credit protection**. Institutions may recognise the guarantee by applying the RW of the guarantor under the standardised approach to the covered part of the exposure, provided that no own estimates of LGD and CCFs are used (F-IRB).
  - **Substitution effects arising from CRM in the ratings assigned**. Institutions should verify that obligors guaranteed by a third party do not carry a significantly different level of risk from those in the same rating grade without such a guarantee, and that no separate calibration segment is required.
  - **Rating transfer across different rating systems**. Institutions should ensure that the mapping between rating scales is performed in such a way that the final PD estimate (including MoC) assigned to the guaranteed exposure amount is not better than the final PD estimate (including MoC) being transferred from a third party.

…as well as regarding the requirements on the use of shadow rating models

PD parameter (4/7)

Structure of PD models

- Regarding the **use of shadow rating models** (SRM)[1], institutions should justify and document the rationale for the use (and the continued use) of the SRM, instead of the internal default prediction model, and also document the alternative approaches that have been considered. Further, institutions should:
  - Adjust the **ratings used as targets for their SRM** if they do not solely embed default risk (including the documentation of such adjustments).
  - When using the SRM external ratings, **do not use them as risk drivers** in addition to target variables.
  - Ensure that they **understand the impact of any differences** between several information sources and establish adequate procedures to ensure that these differences are adequately addressed.
  - Analyse and provide **evidence of the representativeness** of the data used for model development, according with the EBA GL on IRB parameters.

1) i.e. an internal rating approach that selects and weighs the risk drivers to be used for risk differentiation purposes by identifying the main factors that explain external ratings provided by an external credit assessment institution or similar organisation, rather than internal directly observed defaults.

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**Furthermore, the Guide also provides details on PD risk quantification regarding
the calculation of observed default rates which are aligned with
those provisions set out in the EBA GL on IRB parameters…**

PD parameter (5/7)

**PD Risk
quantification**

- According to the CRR, for exposures to corporates, institutions, central governments and central banks and for equity exposures, institutions must **estimate PDs by obligor grade from the LRA of one-year default rates**; and for retail exposures, they must estimate PDs by obligor/facility grade or pool from LRAs of one-year default rates.

- As regards the **calculation of observed default rates**, institutions should follow the EBA GL on IRB parameters, also considering the following:

  o For retail exposures and when the definition of default is applied at facility level, the calculation of the observed average default rate set in the EBA GL on IRB parameters can be applied at **facility level**; and **exposures for which there is no commitment** (considering on-balance sheet exposures, off-balance sheet items and unadvised limits) at reference date **should be excluded** from the calculation of the default rate. Conversely, if there is an exposure at default (EAD) estimate, then these exposures should be included in the calculation of the default rate.

  o The **overlapping one-year time windows approach** should be preferably be used when the analysis performed by the institution reveals any of the following:

    ▪ The proportion of short-term and terminated contracts and/or the respective distribution of default rates **is not stable over time**.

    ▪ The observed average default rate using this approach is **significantly different** from the observed average default rate using non-overlapping one-year time windows.

    ▪ There is a **significant variation** between the observed average default rates calculated using non-overlapping one-year time windows on different reference calculation dates within a year.

  o Institutions should estimate PDs taking their **own internal data** into consideration. In cases where institutions use external or pooled data series, they should also ensure that the average observed default rates from external data or from the external part of the pooled data are calculated separately from, and compared with, those based on internal data[1].

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1) This comparison should be made at the levels at which the default rate is to be calculated.

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**…the calibration to the LRA default rate,
and the weighting for retail exposures…**

PD parameter (6/7)

PD Risk quantification

- Regarding the **calibration to the LRA default rate**, institutions should follow EBA GL on IRB parameters[1].
  - For the purpose of assessing the **representativeness of the historical observation period** used for the likely range of variability of one-year default rates, institutions should consider the following:
    - Where the **scarcity of internal exposures** and/or **defaults** might unduly influence the variability of internally observed default rates, institutions should assess whether external or pooled default rate series can be used to identify the relevant historical observation period for the likely range of variability of one-year default rates (i.e. those relevant for the specific portfolio in terms of geographical composition, sectoral distribution and other risk drivers).
    - When taking into account the existence of **one-year default rates relating to bad years** as reflected by economic indicators, institutions should ensure that such indicators are relevant for the portfolio at least in the terms of geographical composition, sectoral distribution and other risk drivers relevant to the portfolio.
  - Institutions should ensure that there are **no systematic deviations** when comparing the estimated PDs with the LRA default rate of the grades, i.e. the direction of divergences should be random.
- Regarding the **weighting for retail exposures**, an institution may consider that the more recent data are a better predictor of loss rates and may give more importance to recent historical data if the following apply:
  - There is a significant improvement in the predictive power when using the more recent data. To this end, it should be evidenced by comparing the estimated PDs for each grade with the realised default rates covering as long a period as possible.
  - **Older data are considered as non-representative** due to specific policy or business changes, but not in order to reflect current trends in default rates related to macroeconomic conditions.
  - The **weighting approach is used in a consistent manner** over time and any change in the applied weights of historical data is appropriately justified.

1) If an institution makes adjustments to the observed average default rates in order to obtain LRA default rates under paragraph 85(b) of the EBA GL on PD and LGD, these adjustments should be based on (external) default rates, or if no appropriate default rates are available, on other observed indicators relevant for the type of exposures considered.

Detail
Credit risk

**…the PD quantification based on mapping to external grades,
as well as specific requirements for direct PD estimates**

PD parameter (7/7)

> **PD Risk quantification**

- As regards the **PD quantification based on mapping to external grades**, the CRR sets out that mappings must be based on a comparison of internal rating criteria with the criteria used by the external organisations and on a comparison of the internal and external ratings of any common obligors. In order to comply with this requirement, institutions should follow the following:
  - They should ensure the **quality of the mapping** between internal and external rating scales is consistent and provides for an adequate level of predictive ability.
  - When mapping internal to external grades, they should document and analyse **any differences**.
  - The use of common obligors as a basis for the mapping should take into account their **representativeness for the application portfolio**.
  - They should adjust the external rating scale if the **rating scale** does not solely embed **default risk**.
  - When mapping internal grades to external grades and using the default rates of the external grades provided by the organisation, if the latter has a **material number of entities for which it no longer provides a rating** (withdrawn rating), the institution should take this into account.
- Regarding the **specific requirements for direct PD estimates**, institutions should follow the EBA GL on IRB parameters. To assess whether the theoretical assumptions of the probability model underlying the estimation methodology are satisfied to a sufficient extent in practice, institutions should:
  - Ensure **good risk differentiation properties** across the full PD range of the rating system.
  - Have an adequate concept in place specifying the **calibration function currently implemented**.
  - Ensure that any transformation of the scores resulting from the probability model applied during the calibration does **not change the ranking of the obligors/facilities**.
  - Ensure there is a **relevant number of observations** across the whole range of score-inferred PDs.
  - Ensure there are no excessive concentrations of exposures or obligors within the PD range.
  - Understand grades as **sub-ranges of PD values** that represent sufficiently narrow ranges of PD values and contains a sufficient number of observations.

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Regarding the LGD, the Guide specifies several aspects regarding the realised LGD, including the reference dataset, the calculation of the realised LGD…

--- LGD parameter (1/6) ---

Loss Given Default (LGD)

- The Guide gives details regarding the realised LGD (including the reference dataset, calculation of realised LGD, and treatment of multiple defaults), the LGD structure, the risk quantification (including observed average LGD, long-run average, downturn LGD), and estimation of EL_{BE} and LGD in-default.

Realised LGD

- Regarding the **reference dataset**, institutions should ensure that LGD estimations are accurate and are not underestimated as a result of different external and internal recovery processes. Thus, they should place greater importance on comparisons of internal recovery processes with the recovery processes underlying the external data, in cases where a high weight is assigned to external data. If institutions use information derived from the **market price of defaulted financial instruments** to supplement their internal loss or recovery experience data, they should verify whether the development sample is representative of the application portfolio and ensure that losses derived from market prices should be increased to reflect indirect costs.

- As regards the **calculation of realised LGD[1]**, institutions should consider the EBA GL on IRB parameters. Further, institutions should:

   o Have in place **sufficiently detailed policies** and **procedures** to ensure that the realised LGD is calculated consistently and accurately, including the implementation of the definition of economic loss (including sufficiently detailed documentation to allow third parties to replicate the calculation of realised LGD).

   o Calculate the realised LGD at **facility level for each default**. However, it could be calculated at a more aggregated level (e.g. several facilities of the same or different types secured by the same collateral) if certain conditions are met, such as, there is evidence that recovery at aggregated level is legally enforceable, or the counting unit used for the purposes of risk quantification is at this aggregated level.

1) In this regard, all principles on the calculation of realised LGD should be applied for the estimation of LGD on non-defaulted exposures and for the estimation of LGD in-default and EL_{BE} on defaulted exposures, unless mentioned otherwise.

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…as well as the treatment of multiple default where institutions should mainly follow the provisions set out in the EBA GL on IRB parameters

───────────────── **LGD parameter (2/6)** ─────────────────

Realised LGD

- As regards the **calculation of realised LGD** (continue):
  - Institutions should calculate realised LGD, by following the EBA GL on IRB parameters and they should pay particular attention to the following:
    - **Outstanding amount at default** includes any part of the exposure that has been forgiven or written off before or at the date of default. This amount is equal to the accounting value gross of credit risk adjustment (i.e. provisions) and also includes interest and fees capitalised in the institution's income statement before the moment of default but not those after the moment of default.. Institutions should ensure that the exposure used for CCF estimation where additional drawings after default are discounted with the same discount factor as applied for LGD, is consistent with the denominator of the LGD.
    - **Economic loss**[1] is calculated under the IRB parameters. This also applies in the specific case of facilities that return to non-defaulted status, where losses arising from payment delays are expected to be accounted for as well as the "artificial cash flow" envisaged.
    - When recoveries are not directly observed but calculated on the basis of the difference between exposure values at two consecutive dates or derived, even partially, from some other treatment, **all assumptions should be duly justified and clearly documented** in order to adequately replicate the recovery flows that occur during the recovery process.
- Regarding the **treatment of multiple defaults**, institutions should consider the EBA GL on IRB parameters, and also follow the following aspects: i) with regard to defaults recognised on a single facility, a **period of** default longer than 9 months could be envisaged when is appropriate for the specific type of exposures and reflects the economic meaning of the default experience; ii) time considered between two defaults is conditional upon the existence and length of probation periods; and iii) in the particular case of an institution opening new facilities to replace previously defaulted facilities as part of restructuring or for technical reasons, it should be able to make or trace a connection between them.

1) The economic loss also includes material discounts and refers to all losses incurred through forgiveness or write-off. Where institutions open new facilities to replace previously defaulted facilities as part of restructuring or for technical reasons, the economic loss should include the decrease in the degree of financial obligation arising from changes in the contractual conditions.

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Furthermore, it also details the LGD structure establishing, among others that LGD estimates must be based on material drivers of risk, or that a meaningful assessment of obligor and transaction characteristics should be provided

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LGD parameter (3/6)

> **LGD structure**

- The Guide sets out the following observations in order to comply with the requirements regarding the structure of LGD models as provided in the CRR:
  - o **LGD estimates must be based on material drivers of risk**. To comply with this requirement, institutions should identify and analyse potential risk drivers listed under the EBA GL on IRB parameters. When selecting the risk drivers, institutions should take into consideration any changes in product mix or characteristics between the reference and default dates.
  - o Institutions' rating systems must provide for a **meaningful assessment of obligor and transaction characteristics**, a meaningful differentiation of risk and accurate/consistent quantitative estimates of risk (i.e. the model performs adequately in terms of discriminatory and predictive powers).
  - o The **number of grades and pools** must be adequate for a meaningful risk differentiation and for the quantification of the LGD at the grade or pool level. To this end, institutions should ensure:
    - ▪ An adequate distribution of facilities across grades or pools in the datasets used for development and (initial and regular) validation.
    - ▪ Sufficient homogeneity of the risk within each grade or pool by providing empirical evidence that the grade-level LGD is adequate for all facilities in that grade.
    - ▪ Sufficient heterogeneity of the risk across grades or pools by providing empirical evidence that the average realised LGD is different across consecutive grades or pools, for subsets for which there is a meaningful order.
  - o Where an institution uses **direct estimates of risk parameters**, these may be seen as estimates assigned to grades on a continuous rating scale.
  - o To mitigate the risk when institutions split the facilities into different components (i.e. a meaningful differentiation of risk is not achieved), institutions should ensure that **no bias is introduced** in the risk differentiation when combining the different components in order to obtain the final LGD estimate at facility level.

Detail
Credit risk

It also specifies the requirements to be followed by institutions on the observed average LGD, the treatment of incomplete recovery processes and the recovery processes where collateral has been repossessed and not yet sold

LGD parameter (4/6)

LGD Risk quantification

- As regards the **observed average LGD**, institutions should follow the EBA GL on IRB parameters and also consider the following principles:

    o Institutions may establish a **minimum period of time** during which the **default should be observed** in order for it to be considered in the calculation of the observed average LGD. This minimum period should be adequately justified and institutions should ensure that all relevant information regarding defaults observed for a shorter period is considered in the LGD estimates. In any case this period **should not be longer than 12 months**.

    o The specification of the **'time-to-workout'** should be supported by evidence of the observed pace of recoveries and be consistent with the nature of the products concerned, the type of exposures and the operational recovery process. In order to clearly document the studies that support the formulation of this period, institutions should consider certain aspects (e.g. the specific moment after the date of default at which nearly nil evolution of the average cumulative recovery rates is observed, or the period of time after the date of default where the cumulative percentage of closed/recovered exposures flattens).

- Regarding the **treatment of incomplete recovery processes**, institutions should analyse their incomplete recovery processes and extract the information relevant for LGD estimation under the GL on IRB parameters. In addition, institutions should consider several aspects (e.g. justify and document their methodology for the treatment of incomplete recovery processes, or assess the sensitivity of the treatment with respect to the main assumptions).

- Relative to the **recovery processes where collateral has been repossessed and not yet sold**, there is a risk that the value of repossession might not adequately reflect the value of the repossessed collateral. To mitigate this risk, institutions should estimate haircuts to the value of the collateral following the EBA GL on IRB parameters, and they also should compare the estimated haircuts with the available observations regarding the repossession and subsequent sale of similar types of collateral; and assess the impact on the LRA LGD of the inclusion of the repossessed collateral by performing sensitivity analyses based on the application of different haircuts to the value of the collateral (at least by applying haircut of 100% to cases where collateral has been repossessed but not yet sold).

Detail
Credit risk

Regarding the LRA LGD, institutions should follow the EBA GL on IRB parameters as well as certain instructions provided on its calculation, and the use of external or pooled data

--- **LGD parameter (5/6)** ---

LGD Risk quantification

- Regarding the **long-run average LGD** (by facility grade or pool), institutions should estimate LGDs under the EBA GL on IRB parameters. When performing this estimation, institutions should consider the following:

  o Institutions should calculate the LRA LGD as an **arithmetic average of realised LGDs over a historical observation period** weighted by a number of defaults.

  o When **calibration segments** are used for the purpose of LGD estimations, institutions are expected to base their decision on a sound rationale, in particular on quantitative evidence. Institutions should also calculate the LRA LGD at a more granular level than the calibration segment. They should also ensure that there are no systematic deviations when comparing the estimated LGDs with the LRA of realised LGDs at this more granular level.

  o Where the **LGD is the result of a combination of different components** (e.g. secured and unsecured components), for example institutions should perform separate test for the LGD applied to the performing portfolio and the LGD in-default.

  o For **retail exposures**, institutions may consider the **more recent data to be a better predictor of loss rates** and may give more importance to this data if: i) there is a significant improvement in predictive power when using the more recent data with respect to the predictive power resulting from the use of an arithmetic average; ii) the oldest data are considered as non-representative; and iii) the weighting approach is consistent over time and any change is appropriately justified.

  o When institutions use **external or pooled data** to complement their own loss or recovery experience, they should ensure that LRA LGDs derived from external or pooled data are also calculated separately from those based on internal data.

  o The population of exposures represented in the data used for estimation, the lending standards used when the data were generated and other relevant characteristics **must be comparable** with those of the institution's exposures and standards. When institutions perform adjustments to their LGD estimates due to changes to the structure of the portfolio that are expected to happen in the foreseeable future, they should consider certain principles (e.g. the adjustment should be based on a comparison of the data used in risk quantification with the institution's application portfolio).

Detail
Credit risk

**Finally, the LGD also sets out provisions on the LGD downturn
as well as on the estimation of EL$_{BE}$ and LGD in-default**

LGD parameter (6/6)

LGD Risk quantification

- As regards the **downturn LGD** and in order to obtain LGD estimates that are appropriate for an economic downturn in accordance with the CRR, institutions are expected to:
  - Characterise an **economic downturn** in accordance with the Final RTS on the specification of the nature, severity and duration of an economic downturn[1].
  - Derive **LGD estimates which are appropriate for the downturn conditions** specified, in accordance with the EBA GL for the estimation of LGD appropriate for an economic downturn[2].

Estimation of EL$_{BE}$ and LGD in-default

- In accordance with the CRR, for the specific case of **exposures already in default** institutions must use the sum of their best estimate of expected loss for each exposure, given current economic circumstances and exposure status and their estimate of the increased loss rate caused by possible additional unexpected losses during the recovery period. To this end, institutions should estimate EL$_{BE}$ and LGD in-default under the EBA GL on IRB parameters. In this process, institutions should follow the following:
  - Institutions should take into consideration the **economic conditions expected over the period of the recovery process**, and in particular reflect downturn conditions in the EL$_{BE}$ if and only if current economic conditions are in a downturn or a downturn is expected over the period of the recovery process. This can be done either by adding the relevant macroeconomic and economic factors as drivers of the EL$_{BE}$ model, or alternatively through an adjustment to the LRA.
  - **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. In particular, the following should be taken into consideration:
    - The use of a **constant value** for unexpected losses for all defaulted exposures **is not risk sensitive**, and therefore where institutions use it, they should justify it.
    - **LGD in-default estimates** are generally expected to be **higher than EL$_{BE}$ estimates** and only equal for duly justified individual exposures, which are expected to be very limited.

**Regarding the CCF, the Guide specifies several aspects regarding
the commitments, unadvised limits and scope, realised CCFs…**

Credit conversion factor (CCF) – (1/2)

Credit Conversion Factor (CCF)

- The Guide sets out provisions regarding the commitments, unadvised limits and scope of application; the realised CCFs; the CCF structure, as well as the CCF risk quantification.

Commitments, unadvised limits and scope

- Under the CRR, institutions must use **own estimates of CCFs** for the retail exposure class, and for corporate, institutional, central government and central bank exposure classes if they received permission. In both cases, the scope of CCF modelling is limited to the off-balance sheet items.

- The exposure value for the items listed the CRR must be calculated as the committed but undrawn amount multiplied by a CCF. To calculate the **exposure value**, institutions should consider several aspects (e.g. they 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).

- Further, as set out in the CRR, institutions not using their own estimates of CCFs for **non-retail exposures** are permitted to apply a **0% CCF**, under certain conditions. To apply a 0% CCF, 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 a deterioration in the obligor's credit quality is detected.

Realised CCFs

- Institutions must **calculate the realised CCF at facility level for each default**. In cases where realised LGD is calculated at a more aggregated level, CCF estimation can be performed at facility level or at the LGD aggregation level. In this case, for retail exposures where institutions use the definition of default at facility level they should apply full contagion of default across aggregated facilities; ensure consistency between estimation and application of the parameters; and ensure that no bias results from the aggregation of facilities by validation of the estimates (PD, LGD, CCF) also at the more aggregated level.

- Institutions must compute **realised CCF**. In this regard, they should: i) calculate realised CCF as the ratio of the difference between the EAD and the exposure at the reference date in the numerator, and the difference between the limit at reference date and the exposure at reference date in the denominator; ii) ensure that the definition of exposure equals the one used for LGD estimation; and iii) for each reference date and in cases where the same facility defaults more than once during the observation period, consider as date of default relevant for CCF purposes the date of the first default.

Credit risk

**…the CCF structure, as well as
the CCF risk quantification**

Credit conversion factor (CCF) – (2/2)

**CCF
structure**

- To comply with the **requirements for the structure of the CCF models** established in the CRR, and particularly when considering the risk drivers, institutions should: i) demonstrate a detailed understanding of the impact on CCF estimates of changes in customer product mix or characteristics between reference and default dates and the materiality of that impact; ii) analyse the risk drivers considering information not only at the reference date (up to 12 months prior to default) but also before that date whenever relevant; and iii) ensure the models reflect the institution's policies and strategies regarding account monitoring.

**CCF risk
quantification**

- The **exposure value for undrawn commitments** is calculated as the committed but undrawn amount multiplied by a CCF. Institutions should also calculate the LRA CCF at a level more granular than calibration segment that is appropriate for the application of the model, namely using individual CCF values if estimation is discrete or sub-ranges of CCF values if estimation is continuous.

- Institutions are required to **calculate the default weighted LRA CCF** separately for each facility grade or pool. To comply with this requirement, institutions should: i) ensure that the historical observation period is as broad as possible and contains data from different periods characterised by different economic circumstances; ii) calculate the observed average CCF for each facility grade or pool on all defaults observed in the historical observation period; iii) when the historical observation period is considered to be representative of the LRA, the average realised CCFs should be computed as the arithmetic average of the yearly averages of realised CCFs in that period; iv) adjust their CCF when the historical observation period is not considered to be representative of the LRA; and v) ensure that their estimation process is pertinent / accurate where CCF estimates for specific facility grades or pools are low or 0 before the MoC is applied.

- For retail exposures, an institution may consider that the more recent data are a **better predictor of drawdowns** and may give more importance to recent historical data if there is a significant improvement in predictive power, and the oldest data are considered as non-representative, and the weighting approach is used consistently.

- In order to ensure a **meaningful assessment of transaction characteristics**, institutions should ensure that their CCF model is robust and provides estimates that are effectively protected against undesirable issues caused by region of instability and/or that their estimates are adjusted adequately, among others.

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**Furthermore, the Guide covers the model-related MoC, the review
of estimates and the calculation for non-retail exposures**

— Other aspects —

Model-related MoC

- According to the EBA GL on IRB parameters, to reflect the **dispersion of the statistical estimators**, institutions should adopt the following approach: i) for PD, estimate a MoC to account for statistical uncertainty/sampling error affecting the LRA estimate at grade/pool level, and ii) for LGD and CCF, estimate a MoC to account for statistical uncertainty/sampling error affecting the final estimates.

Review of estimates

- Institutions must review their estimates whenever new information comes to light but at least on an **annual basis**.

- Further, they should follow certain **principles** (e.g. for PD models and regarding the analysis of the predictive power, the analysis should be performed at grade level and institutions should use a range of metrics to assess predictive ability; for LGD models that result from a combination of different components, the back-testing analysis should be run at both component and facility level; or institutions should consider in their frameworks for the review of estimates the availability of data for different exposure types, taking into account the specificities of the model architecture, including the existing and potential risk drivers).

- In the case of material models where the assignment of the grade is based on a statistical model, the framework should also include 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**. This analysis should be conducted on a **three-yearly basis**, or more often, depending on the materiality of the model.

- When the number of default observations is low, institutions should **analyse individual defaults**, and for grade and pool assignments institutions must document those situations in which human judgement may override the inputs or outputs of the assignment process.

Maturity for non-retail exposures

- Under the CRR, institutions should calculate the **maturity parameter (M)** using the **expiry date of a facility**, and should not use the repayment date of a current drawn amount.

- To ensure that the calculation of the maturity parameter is correct and to avoid any possible errors, institutions should adequately **justify** and **document any exemptions** from the **one-year maturity floor**.

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**The Guide provides information on scope of the internal model regarding
the delimitation of the regulatory trading book, treatment of banking book positions…**

Scope of the IMA (1/2)

**Scope of
the IMA**

- This Guide covers the delimitation of regulatory trading book (TB), treatment of banking book (BB) positions, partial use of models, exclusion from the scope of application of the IMA of positions in the regulatory trading book, treatment of specific positions and aggregation requirements.

**Delimitation
of the
regulatory TB**

- Institutions should have a **policy** describing which instruments are included in the **regulatory TB** and how they are identified. This policy should also encompass rules for moving instruments between TB and BB. Positions that are classified as "held for trading" for accounting purposes are presumed to be included in the regulatory TB, otherwise the institutions should be able to list and justify the excluded positions.

- Institutions should be able to identify and list the **net short risk positions** for equity risk or credit risk in the regulatory BB at the request to the CA. They should also identify **all internal hedges** and have a **policy** explaining the treatment of internal hedges in terms of calculation of own funds requirements for market risk. Additionally, institutions should be able to identify **internal transactions** within the TB.

- **Eligible** CVA hedges in the TB should be included in the scope of calculation of own funds requirements only for general risk (not for specific risk).

- Institutions should be able to **identify the TB or BB classification** and to indicate to what extent the corresponding positions are included within the scope of the **IMA**.

**Treatment of
BB positions**

- Institutions may consistently **exclude all BB FX positions** from the internal model, subject to supervisory approval (i.e. demonstrating that IMA without BB FX positions covers a significant share of the positions of the FX risk category). When excluded, the BB FX positions should be subject to stand-alone (not netted with regulatory trading book FX positions) own funds requirement calculated according to the SA.

- Institutions that have the **approval to use IMA for FX risk** should be able to estimate the difference between the own funds requirements calculated under the SA and under the IMA for FX positions.

- Commodities positions in the BB, when existing, should not to be systematically excluded from the scope of application of the internal model.

Detail
Market risk

…partial use models, exclusions from the application of the IMA of positions in the regulatory TB, treatment of specific positions, and aggregation requirements

---

Scope of the IMA (2/2)

Partial use models

- Portfolios for which the bulk of the risks fall **outside the scope of the risk categories of the internal model** may be carved out from the scope of application of the internal model if the overall own funds requirement for market risk after the carve-out than they would have been if the carve-out had not been performed. The requirement for the carved-out portfolios should be determined under the **SA**.

- Portfolios for which the bulk of the risks fall **within the scope of the model approval** should be included in the internal model for calculation of the requirements (for the risk categories within the scope of the IMA).

Exclusions from IMA positions in TB

- Institutions should monitor the **exclusion of TB positions (whole or for certain risks)** from internal models. The risk of these positions should be calculated by SA. Institutions should be able to prove that those positions or risks excluded from the scope of the IMA for regulatory purposes are adequately risk managed and do not pursue a regulatory capital arbitrage.

- **Systematic exclusions** of positions or risks that would in principle fall within the scope based on the application of a materiality criterion at transaction level **are not acceptable**.

Treatment of specific positions

- The Guide establishes specific treatments for the following positions:
  - **Own debt exposures**. Institutions having approval for general and/or specific risk of debt instruments should include their own creditworthiness as an individual risk factor in the specific risk component of VaR and sVaR and in the IRC. These exposures should be defined depending on the level of consolidation of model approval (consolidated, sub-consolidated or solo).
  - **Positions in defaulted debt**. Institutions should identify all defaulted debt positions in the regulatory TB, which shall be included in the IMA or in RNIM framework (depending on materiality).
  - **CIUs**. Institutions should have in place a procedure to identify for each CIU if a daily look-through is possible, if the general criteria of the CRR are fulfilled, etc. The outcome of this procedure should be documented and updated at least annually.

Aggregation requirements

- Institutions should be able to provide the list of legal entities that contribute to **market risk own funds requirements** under IMA, specifying the **scope** of application[1] and **risk** categories with permission granted.

- If an institution has an integrated risk management system and IMA approval at the consolidated level, individual **positions of subsidiaries can be netted** against each other.

MS Management Solutions
Making things happen   (1)   Individual, sub-consolidated and consolidated.

Detail
Market risk

Regarding the regulatory back-testing of VaR models several aspects are specified related to the historical period and definition of business days…

Scope of application of the regulatory back-testing (1/2)

Scope of application of regulatory BT

- The **scope of application** of regulatory BT should be clearly documented. The changes in value of all the positions included in the scope of calculation of the VaR (and only those) should be considered in the calculation of the P&L (hypothetical and actual) used to perform the back-testing.

- If the institution is authorized to apply the **IMA for FX and Commodities risk positions** and the BB positions in these risk categories are included in the Internal Model scope, these positions should be considered in the back-testing.

- Positions excluded from the calculation of the own funds requirements for market risk should be excluded from the scope of application of the back-testing.

- **Eligible hedges** that are included in the calculation of own funds requirements for **CVA risk must not be included in the calculation of the own funds requirements for specific risk** whilst if the own funds requirements for general risk of these eligible hedges are calculated using the VaR model, the change in value of those positions that are attributable to general risk should be included in the P&L (actual and the hypothetical). **Non-eligible hedges** for regulatory CVA should also be included in the P&L.

Historical period and definition of business days

- The addend to the multiplication factors must depend on the number of overshootings for the **most recent 250 business days**. In this regard, institutions should define **local business days** and **global business days**. The actual and hypothetical P&L used for back-testing should always be the P&L between two consecutive global business days, and should be compared with the related one-day VaR forecast based on the composition of the portfolio on the first of those global business days.

- Regarding the global business days, if there are **two or more important trading locations**, the institution should choose one reference location and is allowed to add additional global business days based on local business days of the other important trading locations.

- Institutions should be able to **justify** any non-business days and **unchanged** risk positions are a necessary but not sufficient condition to demonstrate adequately that a particular day constitutes a non-business day.

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Detail
Market risk

… calculation of actual and hypothetical P&L, and counting and analysis of overshootings

--- **Scope of application of the regulatory back-testing (2/2)** ---

Calculation of actual P&L

- The **actual P&L** should be as close as possible to the **economic daily P&L of the institution** and should include the P&L stemming from intraday activities, excluding fees, commissions and net interest income. It is calculated for positions in the TB and BB which are under the scope of the IMA[1].
- All **valuation adjustments** (methodology, frequencies, calculation process, etc.) should be clearly documented. Credit, debt, and additional valuation adjustments (AVAs) **are excluded** from the actual P&L.

- -

Hypothetical P&L

- The hypothetical P&L is calculated based on **unchanged positions**. 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. Certain P&L elements, such as CVAs, commissions, etc., are **excluded**.

- -

Counting of overshootings

- The back-testing addend is based on the **higher number of overshootings** under hypothetical and actual changes in the value of the portfolio. For each global business day, the VaR forecast is compared with actual and hypothetical P&L for the subsequent business day. If overshooting has been notified due to errors at calculating P&L or VaR, institutions may, after consent of CA, withdraw **overshooting notification**.

- -

Analysis of overshootings

- For every back-testing overshooting at global level, a **detailed analysis** should be performed by the institution. The analysis should cover the following: **portfolio analysis** (identification of positions responsible for overshooting), **market analysis** (identification, description and analysis of market moves contributing to the overshooting), and **analysis of internal model** (identification of possible weaknesses).

(1) The change in value of all market risk parameters (even those that are not modelled in the VaR) should be taken into account.

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**The Guide also covers the internal back-testing of VaR models as well as
the methodology for VaR and sVaR, including data inputs,…**

Internal back-testing of VaR models and Methodology VaR and SVaR

**Internal
back-testing
of VaR models**

- Regarding the **supplementary test requirement** and 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** at more granular levels than the top-of-house level.
  - For both **regulatory** and **internal back-testing**, the institution should comply with the requirements described above regarding the regulatory back-testing of VaR models.
- Further, institutions should conduct **validation exercises on hypothetical portfolios**. The 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 or trading strategies).
  - Institutions are expected to have a **policy** in place that governs the **overall process for defining hypothetical portfolios** and which should cover portfolio's definition, execution, reporting and analysis.

**Methodology
for VaR
and sVaR**

- Institutions are expected to demonstrate the **appropriateness of assumptions** on the distribution of risk factors included in the VaR and sVaR models, based on observable data. When using Monte Carlo simulations, institutions 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.
  - Institutions 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.
  - The returns should be calculated on the basis of **one single holding period** for all risk factors. Institutions should demonstrate that the day of the week used to calculate sVaR not lead to material bias.
  - Institutions should be able to provide an **inventory of all open validation findings**.

Data inputs

- For the calculation of the VaR institutions should use an **historical observation period of at least 1 year** except where a shorter observation period is justified[1].
- Institutions should have a **process to check the quality** of the time series at least quarterly[1].

(1) Institutions 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.

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…proxies, beta approximation and regression;
risk factors and pricing functions

─── **Methodology VaR and SVaR** ───

Proxies, beta approximation and regression

- 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** (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.
- 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).
- Institutions 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 and define a **clear process for deriving and validating a proxy**. Any proxy should be validated, at least, annually.
- Institutions should be able to provide the results of **tests** for selected sub-portfolios, business days and selected material proxies (e.g. hypothetical P&L used for regulatory back-testing, etc.).

- -

Risk factors

- The model should capture a **sufficient number of risk factors** in the VaR/sVaR. To this end, institutions should be able to provide an inventory of all the market data inputs of the economic P&L and the risk factors used for both the VaR and the sVaR models.
- Institutions are expected to be able to provide the results of **several tests** (e.g. the hypothetical P&L used for regulatory back-testing, etc.) for selected sub-portfolios, business days and selected missing risk factors.

- -

Pricing functions

- Institutions should produce and update at least annually an inventory of the VaR/sVaR pricing methods. This inventory should enable supervisor to have a **clear mapping between** pricing methods used in **VaR/sVaR** and pricing methods used for the **daily economic P&L**. The existing differences should be subject to validation (performed at least initially when a pricing method is introduced in the VaR calculation.
- The inventory should be reviewed at least **annually** by a **unit independent** of the one that produces it.

Market risk

Furthermore, the Guide specifies aspects regarding IRC models focusing on default risk, including data inputs, distributions and assumptions; ratings, probabilities default and recovery rates;…

——————— **IRC models focusing on default risk** ———————

IRC models focusing on default risk

- Institutions 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). If not, institutions should calculate daily the IRC during 15 consecutive business days (including three reporting dates). If this is not possible, it can be performed in a test environment replicating the calculation of the regulatory IRC.

  - Institutions are expected to calculate a confidence interval of IRC estimation with a **confidence level of 95%**. To compute IRC amounts, institutions are expected to use at least one migration matrix for sovereigns (when relevant) and one migration matrix for other types of issuers.

Data inputs, distributions, assumptions

- The same data quality requirements indicated for VaR and sVaR are applied in the IRC models. The ECB considers each institution to check the quality of the time series used quarterly.
- Regarding distribution and correlation assumptions, institutions are expected to justify the types of systematic risk factors and, for each type, the number included in the credit quality diffusion model, the correlation structure and its calibration for the set of factors used.

  - Institutions are expected to use at least two types of systematic risk factors. If the institution uses one type, it should be able to demonstrate that it leads to conservative IRC at least annually.
  - At the start of the TRIM on-site investigations, institutions 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%, 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%, 60%, 70%, 80%[1].
  - Institutions are expected to demonstrate the relevance of the **copula assumptions** by implementing quantitative analysis.

Ratings, probabilities default and recovery rates

- Institutions should have in place the following aspects regarding **documentation requirements**:

  - The methodology and process documents for the determination of PD and recovery rates (RR), including documentation on the fallback approaches applied.
  - Validation documents verifying the robustness of the related assumptions.
  - A hierarchy of preferred sources for the determination of PDs and RRs applied for each issuer/instrument within the scope of the IRC.

(1)   All other inputs into institutions' IRC models remain unchanged.

Market risk

…and connected issuers/obligors.
The Guide also covers risks not in the model (RNIM)

IRC models focusing on default risk and Risks not in the model (RNIM)

Ratings, probabilities default and recovery rates

- **Validation requirements**. Institutions 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). Moreover, they should demonstrate that the PD estimates are justified (all PDs should be higher than zero), and provide specific and convincing justification if they are using RR higher than those specified in the Guide[1].

- **Consistency requirements**. Institutions should be able to justify deviation in the consistency of the hierarchy and should be able to demonstrate that cherry-picking can be excluded.

- **Requirements for PD fallback values**. For positions where a reliable PD assignment may not be possible due to a lack of adequate data, a fallback solution may be applied.

- **Requirements for the calculation of losses based on RR**. The RR, calculated as the difference between the current market value of the position and expected market value subsequent to default, should be between 0 and 100%.

Connected issuers/ obligors

- Institutions are expected to **document** and **justify the treatment** in the IRC model of issuers/obligors falling into the same group of connected clients, by considering this event 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). Institutions must also validate that its modelling approach for correlations is appropriate for its portfolio.

Risks not in the model (RNIM)

- 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), such as insufficient or not reliable data, immaterial risk, etc. In this regard, a RNIM framework should cover at least:

  - **Identification**. Institutions should identify any market risk which is not captured by the model and be able to justify why they are not included. This process includes product approval process, back-testing, etc.
  - **Measurement**. The potential impact of the RNIM on the VaR and sVaR and/or IRC should be estimated under the assumption that there is no diversification effect (i.e. on a stand-alone basis).
  - **Risk management and implementation**. Institutions are expected to monitor and measure the RNIM, at least quarterly or less frequently[2] and report the outcomes to the committee responsible. Material RNIM should only be included in VaR/sVaR/IRC calculation when adequate modelling can be ensured.

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(1) RR higher than: 25% for subordinated debt; 55% for senior unsecured debt; 88.75% for senior secured debt; 75% for any product.
(2) if institutions can justify this on the basis of immaterial RNIM

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Detail
Counterparty credit risk

The Guide provides information on trade coverage regarding practices for IMM transactions, assessment criteria for supervisors and principles for ECB banking supervision; on margin period of risk and cash flows regarding practices…

Trade coverage and margin period of risk and cash flows

Trade coverage

- For the purposes of the trade coverage, Internal Model Method (IMM) transactions are those for which the institution has the approval to use the IMM to estimate the related exposure.
- Further, the trade coverage is related to 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.

Practices[1]

- For IMM transactions where related exposure is not fully simulated, **different types of treatment** have been observed: i) some parameters necessary for the pricing function are not stochastically diffused; ii) the pricing function in the IMM is numerically approximated compared with the pricing function used in benchmarking systems; iii) transactions are treated under an alternative exposure calculation under IMM; v) transactions are carved out from the IMM to a non-IMM approach.

Assessment criteria

- **Supervisors** should assess several items (e.g. pricing function, effects of using pricing approximation, etc.).
- The Guide also sets **principles for ECB banking supervision** on this regard (e.g. institutions should comply with the ECB Guide on options and discretions, etc.).

Margin period of risk and cash flows

- The modelling of the **margin period of risk (MPOR)** includes the following aspects: treatment of margin call- and trade-related cash flows (CFs) and interpolation techniques.

Practices

- Regarding the MPOR, **several practices** have been observed (e.g. most institutions consider that no margin call may occur during the MPOR; modelling of trade-related CFs is performed depending on the institution; institutions consider their default management process (DMP) only partially, etc..

Assessment criteria

- **Supervisors** should assess the quality of margin call-and trade-related CF modelling with regard to the DMP as well as the impact of interpolation/extrapolation techniques used to estimate the netting set PV.
- The Guide also sets **Principles for ECB banking supervision** regarding the modelling of margin call-and trade-related CFs within the MPOR.

(1) 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.

Management Solutions Making things happen

Detail
Counterparty credit risk

**…and assessment criteria for supervisors and principles
for ECB banking supervision. Regarding collateral modelling and
modelling of initial margin, the Guide specifies only the practices observed**

Collateral modelling and modelling of initial margin

Collateral modelling

- The **modelling of cash** and **non-cash collateral** is defined as the potential value changes from the time when the last margin call occurred to the end of the MPOR.

Practices

- The **TRIM centre of competence** observed some practices regarding the use of full simulation/haircut approach, large differences related to assumptions on future collateral, the use of various modelling approaches with regard to the handling of the margin agreement currency in the IMM, etc.

Principles for ECB banking supervision

- The Guide also set **Principles for ECB banking supervision** regarding the collateral modelling (e.g. the treatment of non-cash margin collateral is expected to be consistent with the modelling of securities underlying OTC or SFT transactions, provided the SFTs are in the IMM perimeter, etc.).

Modelling of initial margin

- The **initial margin (IM)** is used in central clearing and currently carries over to bilateral OTC agreements and it depends on the risk profile of the future netting set in terms of levels and volatility of simulated market risk factors. The Guide covers several practices observed as well as **principles for ECB banking supervision**.

Practices

- Regarding the IM, **several practices** have been observed:
  - 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)).
  - For exposures subject to IM that are within the IMM perimeter, most institutions i) have a straightforward modelling where the **IM is simply kept constant** over time, and ii) set the **level of the IM at t0** in the modelling.

Principles for ECB banking supervision

- The Guide also set **Principles for ECB banking supervision** regarding the modelling of initial margin (e.g. 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. etc.).

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Detail
Counterparty credit risk

**For both maturity and granularity, time steps and scenarios the Guide
covers the practices observed as well as the assessment criteria
for supervisors and principles for ECB banking supervision**

Maturity and granularity, time steps and scenarios

Maturity

- The estimation of the **parameter M** considered in the calculation of the risk weight for counterparties uses the IRB and towards it the institution has an IMM exposure.

Practices

- Regarding the M parameter, **several practices** have been observed: i) institutions establish an effective floor for M set at one year, ii) only some institutions apply this floor broadly whereas others tend to reduce it, iii) in the case of daily re-margining, few institutions allow an M of one business day, iv) mandatory early termination clauses (ETCs), and in some cases optional ETCs, are taken into account to shorten the transaction maturities leading to lower M values.

Assessment criteria

- Supervisors should assess the **consistent application** of maturity under the CRR. 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.
- The Guide also sets **principles for ECB banking supervision** on this regard (e.g. internal analyses by the institutions should justify choices of values of M shorter than 5 business days for netting sets, etc.).

Granularity, time steps and scenarios

- It covers the chosen **time grid for future exposure** calculation and the number of scenarios generated. Specifically: i) the number and density of time grid points have impacts on the accuracy of EE profiles; ii) the number of scenarios and the type of random number generator determine numerical accuracy of calculations.

Practices

- Regarding these aspects, **several practices** have been observed: i) high variety in the number of time grid points and most institutions use only static grid points, ii) different number of scenarios, which determine the numerical accuracy of the calculations.

Assessment criteria

- **Supervisors investigation teams** should check whether the number of grid points used is sufficient and whether they are appropriately distributed along the time horizon, as well as the number of scenarios.
- The Guide also sets **principles for ECB banking supervision** on this regard.

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Detail
Counterparty credit risk

Regarding calibration and validation, the Guide covers the practices observed and the assessment criteria for supervisors and principles for ECB banking supervision

Calibration and validation

Calibration

- The calibration is relevant both for **regulatory Pillar 1 reporting** and for **internal risk management** in the light of the use test requirements set by the CRR. To compute own funds requirements, institutions should use two different calibrations: one based on current market data and one based on a stress period.

Practices

- In this regard, **two main practices** have been observed: i) a wide use of historic calibration with recalibration frequencies from daily to yearly; ii) the identification of a stress period and the corresponding stress calibration is performed at legal entity level and/or only at group level.

Assessment criteria

- **Supervisors** should assess whether possible differences with respect to calibration frequencies for regulatory and internal purposes are justified. In the case of single determination of the relevant stress period and calibration only at group level, the suitability analysis of this calibration should be assessed.
- The Guide also set **principles for ECB banking supervision** on this regard (e.g. 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.

Validation

- The validation framework set up by institutions should assess the **performance** of the IMM exposure model, in particular trough back-testing methodologies, the validation of pricing functions and further checks on various modelling assumptions.

Practices

- Regarding validation, **several practices** have been observed: i) most institutions have various teams within them that contribute to validation, ii) back-testing still seems to be the activity to which most attention is given, etc.

Assessment criteria

- The Guide also set **principles for ECB banking supervision** regarding validation (e.g. back-testing is expected to be performed at least one a year, back-testing on a risk factor and real-life portfolio level is expected to be mandatory, etc.).

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Detail
Counterparty credit risk

**Finally, for both effective expected positive exposure (EPE) the Guide
specifies the practices observed and the assessment criteria
for supervisors and principles for ECB banking supervision**

EPE and Alpha parameter

EPE
- If the Δt_k weights are always expressed in units of one year, also for cases where the duration of the longest-lasting transaction in a netting set (T) is either greater or lower than one year, then the EEPE is underestimated for the netting sets where T < 1 year,

Practices
- Different practices can be followed and capital underestimations can happen **if T is less than 1 year**.

Assessment criteria
- The Guide also sets **principles for ECB banking supervision** regarding normalisation of weights. In this regard, the sum of Δt_k weights should be equal to 1.

Alpha parameter
- 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. It is the only parameter that can be increased explicitly to account for model deficiencies (besides capital buffers).

Practices
- Regarding the alpha parameter, it has been observed that 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.

Assessment criteria
- **Supervisors** should consider that, among others:
  - It is intended that alpha parameter will be increased to cope with identified deficiencies under the CRR.
  - Consistent treatment of alpha should be applied across the ECB's Banking Supervision.
  - The amount of an alpha increase above the floor values is justified by an impact analysis.

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Next steps

The TRIM project will finalise in the course of 2019 and it will continue with a focus on reviewing models for low-default portfolios

— **Next steps** —

- The execution of the TRIM project will continue with a focus on **reviewing models for low-default portfolios** (which include, for example, exposures to mid-sized/large corporates or financial institutions).

- Furthermore, the objective of the TRIM is to finalise all on-site activities in the **course of 2019**. Further updates on TRIM will be shared with the industry in due course, through the regular communication processes that have been established.