Internal Credit Risk Modelling Policy

## Internal Policy on IRB Model Development and Management for Residential Mortgage Portfolios

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### 1. Introduction and Scope

#### 1.1. Purpose

This policy document establishes the principles, requirements, and methodologies for the development, validation, implementation, and ongoing monitoring of Internal Ratings-Based (IRB) models specifically for residential mortgage portfolios. Its primary objective is to ensure that the Bank’s IRB models accurately reflect the credit risk of these exposures, comply with all applicable EU banking regulations and supervisory expectations, and support effective credit risk management and capital adequacy assessment. This policy promotes comparability of risk estimates and maintains appropriate risk sensitivity, reflecting the Bank’s commitment to robust credit risk management.

#### 1.2. Scope and Applicability

This policy applies to all aspects of IRB model development and management for retail exposures secured by residential real estate, as defined under CRR Article 142(1), within the Bank and its EU-supervised entities. This includes, but is not limited to, the estimation of Probability of Default (PD), Loss Given Default (LGD), Loss Given Default in-default (LGD in-default), Expected Loss Best Estimate (ELBE), and Conversion Factors (CCF). The requirements detailed herein are mandatory for all personnel involved in the model lifecycle, including model developers, validators, internal audit, risk control units, and senior management.

#### 1.3. Regulatory Framework

This policy is aligned with and fully integrates the requirements and guidance set forth in:  
\* \*\*Regulation (EU) No 575/2013 (CRR)\*\*, as amended by CRR2 and CRR3.  
\* \*\*Directive 2013/36/EU (CRD)\*\*.  
\* \*\*European Central Bank (ECB) Guide to Internal Models (ECB Guide)\*\*, latest consolidated version (July 2025, Release 4.0).  
\* \*\*EBA Guidelines on PD Estimation, LGD Estimation and the Treatment of Defaulted Exposures (EBA GL on PD and LGD)\*\*, EBA/GL/2017/16.  
\* \*\*EBA Guidelines on the application of the definition of default under Article 178 of Regulation (EU) No 575/2013 (EBA GL on DoD)\*\*, EBA/GL/2016/07.  
\* \*\*Commission Delegated Regulation (EU) No 2022/439\*\* (RTS on IRB Assessment Methodology).  
\* \*\*Commission Delegated Regulation (EU) No 529/2014\*\* (RTS on Materiality of Extensions and Changes of the IRB Approach).  
\* \*\*ECB Regulation (EU) 2018/1845 on the exercise of the discretion under Article 178(2)(d) in relation to the materiality threshold (ECB Reg on Materiality Threshold)\*\*.  
\* \*\*Commission Delegated Regulation (EU) 2021/930\*\* (RTS on Nature, Severity and Duration of an Economic Downturn).  
\* \*\*EBA/EBA-RESPONSE/7934\*\*, specifically noting the absence of publicly available statistics in the residential mortgage sector.  
\* \*\*2021\_5830 Reporting of residential mortgage loans on C80.00\*\*, providing insights on specific reporting considerations for residential mortgages.

### 2. Governance and Oversight of IRB Models

The Bank shall establish a robust governance framework for its IRB models, ensuring clear lines of responsibility, accountability, and independent oversight throughout the model lifecycle, as articulated in the "Overarching principles for internal models" of the ECB Guide.

#### 2.1. Management Body and Senior Management Responsibilities

The Management Body and Senior Management bear ultimate responsibility for the integrity and performance of the Bank's IRB models.  
\* \*\*Approval of Material Aspects:\*\* All material aspects of the rating and estimation processes, including the roll-out plan, material model changes, and key policies (e.g., model risk management, data governance, validation, audit), shall be approved by the Management Body or a designated committee thereof and Senior Management (CRR Article 189(1); ECB Guide, Credit Risk, Section 3.3, para 26).  
\* \*\*Understanding of Rating Systems:\*\* The Management Body shall possess a general understanding, and Senior Management a good understanding, of the rating systems' designs and operations (CRR Article 189(1) and (2)(b); ECB Guide, Credit Risk, Section 3.5, para 37). The Bank shall provide evidence of processes (e.g., ongoing training, workshops) to improve and maintain this understanding.  
\* \*\*Management Reporting:\*\* Senior Management and the Management Body shall receive regular reports on the status and performance of IRB models, including risk profiles, migration across grades, comparison of realised versus expected rates, stress test results, and model deficiencies (CRR Article 189(2) and (3); ECB Guide, Credit Risk, Section 3.4, para 32-36). For material rating systems, reporting frequency and detail shall be higher, including specific metrics relevant to residential mortgages (e.g., LTV distribution, property market trends).  
\* \*\*Application and Notification Quality:\*\* The Management Body and Senior Management are responsible for the quality and timeliness of applications and notifications for new models, changes, or extensions to the Competent Authority (ECB Guide, Credit Risk, Section 3.3, para 30).

#### 2.2. Model Risk Management Framework

The Bank shall implement and maintain a comprehensive model risk management framework designed to identify, understand, and manage model risk for all internal models across the group (ECB Guide, Overarching Principles, Section 4, para 12). This framework shall incorporate:  
\* A written model risk management policy defining what constitutes a model, the Bank's interpretation of model risk (as defined in CRD Article 3(1)(11)), and a description of the framework's components (e.g., model governance, risk control function, validation function, internal audit).  
\* A comprehensive register of all internal models, as described in Section 2.3.  
\* Guidelines for identifying and mitigating measurement uncertainty and model deficiencies, prioritised by materiality, including qualitative aspects such as data deficiencies, model misuse, or implementation errors. This methodology shall be applied consistently across the group (ECB Guide, Overarching Principles, Section 4(c), para 12).  
\* Methodologies for the qualitative and/or quantitative assessment and measurement of model risk. For IRB models, the expected range of estimation errors shall be reflected in the Margin of Conservatism (MoC) (ECB Guide, Overarching Principles, Section 4(d), para 12, fn 17).  
\* Clearly defined roles and responsibilities for all stakeholders involved in the model risk management framework, ensuring appropriate skills, capabilities, and expertise are maintained through training programmes (ECB Guide, Overarching Principles, Section 4(h), para 12).  
\* A regular complexity assessment for each internal model, with ML-based models generally classified as more complex (ECB Guide, Overarching Principles, Section 4, para 13; Section 9.1, para 33-34).

#### 2.3. Documentation Standards

All IRB models, including those for residential mortgage portfolios, and their associated processes shall be meticulously documented throughout their lifecycle (development, calibration, validation, approval, implementation, application, and review of estimates). This documentation must be sufficiently detailed to enable a qualified third party to independently comprehend the methodology, underlying assumptions, inherent limitations, and operational use of the model, as well as to replicate its development and implementation (ECB Guide, Overarching Principles, Section 2, para 4).  
\* \*\*Content:\*\* Documentation shall cover technical specifications, data sourcing and processing, instructions for model users, and performance/validation reports.  
\* \*\*Model Register:\*\* A central, comprehensive register of all internal models shall be maintained. For each model, this register shall include the model owner(s), defined range of application, materiality classification, supervisory approval date, any applicable restrictions on its use, identified key model weaknesses, a record of main changes applied, and versioning information (ECB Guide, Overarching Principles, Section 2, para 6; CRR Article 32 of Commission Delegated Regulation (EU) No 2022/439). This register shall also include models purchased from third-party vendors.  
\* \*\*Maintenance:\*\* Documentation shall be kept up-to-date, with clear policies for approval, change management, archiving, and access permissions, and subject to adequate controls and an annual review (ECB Guide, Overarching Principles, Section 2, para 7-8).

#### 2.4. Internal Validation Function

The internal validation function shall be effectively independent from the model development process and adequately staffed with qualified personnel to effectively challenge internal models.  
\* \*\*Independence:\*\* Organisational arrangements shall ensure effective independence from the model development process (design, development, implementation, and monitoring), with large and complex institutions implementing the most robust options (e.g., separation into different units reporting to different senior management members) (ECB Guide, Overarching Principles, Section 6, para 19-23). The validation function shall have suitable resources and experienced, qualified personnel (with appropriate quantitative and qualitative knowledge) (ECB Guide, Overarching Principles, Section 6, para 24).  
\* \*\*Scope and Frequency:\*\* All internal models and estimates shall be subject to an initial validation (for new models or material changes) and subsequent annual internal validation (ECB Guide, Overarching Principles, Section 6, para 18; EBA GL on PD and LGD, Section 9, para 218). For material rating systems, a "full validation" shall be performed at least once every three years (ECB Guide, Credit Risk, Section 4.3, para 52(g)).  
\* \*\*Policies and Procedures:\*\* Internal validation policies and procedures shall explicitly account for the use of ML techniques in internal models and/or in the validation process itself, effectively challenging complexity, stability, robustness, and the adequacy of explainability techniques (ECB Guide, Overarching Principles, Section 9.3, para 43).

#### 2.5. Internal Audit Function

The internal audit function shall regularly review the Bank's rating systems and their operations with an adequate level of independence from the processes and units reviewed (CRR Article 191; ECB Guide, Overarching Principles, Section 7, para 25).  
\* \*\*Independence:\*\* Internal audit shall be effectively separated from model operations and report directly to the Management Body (ECB Guide, Overarching Principles, Section 7, para 26). It shall have adequate resources and experienced, qualified personnel (ECB Guide, Overarching Principles, Section 7, para 27).  
\* \*\*Scope and Frequency:\*\* An annual general risk assessment shall inform the audit work plan, with thorough audit assignments ("deep dives") for high-risk areas. For highly complex and/or dynamic ML-based models, an increased risk assessment and deep dive are expected (ECB Guide, Overarching Principles, Section 9.4, para 45-46; Credit Risk, Section 5.2, para 62-63). The review shall assess aspects such as model development, performance, use, materiality classification, data quality, integrity of the rating assignment process, and calculation of own funds requirements (ECB Guide, Credit Risk, Section 5.2, para 64).  
\* \*\*Follow-up:\*\* Conclusions, findings, and recommendations shall be reported to the audit committee and/or appropriate management level, with action plans approved and monitored for timely implementation (ECB Guide, Overarching Principles, Section 7, para 28).

#### 2.6. Skills, Capabilities, and Expertise

All key stakeholders (development, validation, audit, users, senior management, Management Body) shall possess sufficient skills, capabilities, and expertise in relation to IRB models, including ML techniques where applicable, commensurate with the Bank's model risk and the duties of each stakeholder (ECB Guide, Overarching Principles, Section 4(h), para 12; Section 9.2.1, para 36-37). Appropriate training programmes shall be devised and regularly reviewed to ensure these skill levels are maintained.

#### 2.7. Third-Party Involvement

For detailed requirements on third-party involvement, including outsourcing, please refer to Section 13 of this policy document.

#### 2.8. Use of Machine Learning (ML) Techniques: Governance Aspects

The use of ML techniques in IRB models shall be viewed as a driver in their complexity and materiality assessments, leading to higher expectations for management reporting and internal validation (ECB Guide, Overarching Principles, Section 9.1, para 34).  
\* \*\*Governance Frameworks:\*\* The Bank's governance frameworks and processes shall explicitly address risks stemming from ML-based models, including data governance, internal validation governance, and management of model changes (ECB Guide, Overarching Principles, Section 9.2, para 35).  
\* \*\*Model Changes:\*\* The change policy (see Section 12) shall explicitly define what constitutes a change for ML-based models, clarifying implications for materiality assessment. Initial adoption of an ML-based approach is generally a material change. Dynamic ML models require robust monitoring processes to prevent automatic implementation of material changes and to recognise model drift (ECB Guide, Overarching Principles, Section 9.2.2, para 38-41).

### 3. Data Standards and Management

High-quality data is fundamental for robust IRB models. The Bank shall implement sound data governance and management practices across the entire data lifecycle.

#### 3.1. Data Governance

Sound data governance practices, aligned with the ECB Guide on effective risk data aggregation and risk reporting and considering standards such as the Digital Operational Resilience Act (DORA) and BCBS 239, shall be in place for all data used as inputs for internal models (ECB Guide, Overarching Principles, Section 3, para 9-10).  
\* \*\*Consistency in Human Judgement:\*\* Where human judgement influences target variable values (e.g., "unlikeliness to pay" flags), a data governance process shall ensure consistency in labelling, clear guidelines, and regular analysis to prevent systematic differences in judgement (ECB Guide, Overarching Principles, Section 3, para 11).

#### 3.2. Data Quality Management Framework

A formalised and effective data quality management framework shall be established and implemented, applicable to all IRB-related data used for residential mortgage portfolios, including internal, external, and pooled data (ECB Guide, Credit Risk, Section 8.4, para 130; EBA GL on PD and LGD, Section 4.2.1, para 15). This framework shall explicitly define and monitor data quality across the following dimensions (ECB Guide, Credit Risk, Section 8.4.3, para 137):  
\* \*\*Completeness:\*\* All required values are present.  
\* \*\*Accuracy:\*\* Data is substantively error-free.  
\* \*\*Consistency:\*\* Data matches across the Bank's different data sources.  
\* \*\*Timeliness:\*\* Data values are up-to-date.  
\* \*\*Uniqueness:\*\* Aggregate data is free from duplication.  
\* \*\*Validity:\*\* Data adheres to an adequate and rigorous classification system.  
\* \*\*Availability/Accessibility:\*\* Data is available to relevant stakeholders.  
\* \*\*Traceability:\*\* Data history, processing, and location can be easily traced.  
The framework shall include consistent criteria and systematic metrics for assessing compliance with these standards, supported by sufficient data quality checks and controls across the entire IRB data chain (ECB Guide, Credit Risk, Section 8.4.4, para 139-140). A process for identification and remediation of data quality deficiencies shall be in place (ECB Guide, Credit Risk, Section 8.4.5, para 141-142), with formal reporting on data quality submitted to Senior Management at least quarterly (ECB Guide, Credit Risk, Section 8.4.6, para 143-145).

#### 3.3. Data Representativeness and Vetting

A robust process for vetting all data inputs into the models shall be in place, encompassing an assessment of data accuracy, completeness, and appropriateness (CRR Article 174(b); ECB Guide, Credit Risk, Section 8.4, para 130).  
\* \*\*General Representativeness:\*\* The Bank shall maintain sound policies, processes, and methods for assessing the representativeness of data used in both model development and calibration (EBA GL on PD and LGD, Section 4.2.2, para 17). This assessment shall consider the model's scope, definition of default, distribution of relevant risk drivers, and lending/recovery policies (EBA GL on PD and LGD, Section 4.2.3, para 21, and Section 4.2.4, para 28).  
\* \*\*Model Development Data:\*\* Data used for model development must be highly representative of the application portfolio to ensure effective risk differentiation. For residential mortgages, this includes analyzing the distribution of risk drivers such as region, property type, LTV, and obligor-specific characteristics. Material differences in key risk characteristics between the development data sample and the application portfolio shall be avoided (EBA GL on PD and LGD, Section 4.2.3, para 20, 25).  
\* \*\*Calibration Data:\*\* Data used for calibration (e.g., historical default rates, LGDs) must strictly reflect the requirements of CRR Article 178 DoD (EBA GL on PD and LGD, Section 4.2.4, para 30). Where insufficient representativeness is identified in calibration data, this shall trigger the introduction of appropriate adjustments and an increased Margin of Conservatism (MoC), rather than data exclusion (EBA GL on PD and LGD, Section 4.2.4, para 34).

#### 3.4. IT Systems and Infrastructure

The Bank shall deploy and maintain sound and robust IT infrastructures that effectively support its rating systems (ECB Guide, Credit Risk, Section 8.1, para 116). This includes comprehensive documentation and an updated register of all current and past versions of the model's data flow, relevant data sources, IT systems, databases, and audit trails for critical systems (ECB Guide, Credit Risk, Section 8.2.1, para 120).

#### 3.5. Definition of Default (DoD)

The Bank's DoD shall strictly adhere to CRR Article 178, encompassing both the 'days past due' (DPD) criterion and the 'unlikeliness to pay' (UTP) criterion (ECB Guide, Credit Risk, Section B, para 147).  
\* \*\*Consistency of Application:\*\* The DoD shall be applied consistently at the obligor level across all exposures to the institution, its parent, or any subsidiaries. Mechanisms for consistent identification of default across the banking group must be in place, with clear monitoring processes for common obligors and defined actions for threshold breaches (CRR Article 178(1); EBA GL on DoD, para 81-82; ECB Guide, Credit Risk, Section 9, para 148-149).  
\* \*\*Days Past Due (DPD) Criterion:\*\* A default is triggered when an obligor is more than 90 consecutive days past due on a material credit obligation (CRR Article 178(1)(b)). Materiality thresholds are €100 for retail exposures (including residential mortgages) and €500 for non-retail, representing more than 1% of the total on-balance sheet exposures to that obligor (ECB Reg on Materiality Threshold; ECB Guide, Credit Risk, Section B, para 147(b)). The DPD count shall be precise, driven by the exact number of days, not proxies like "months in arrears" (ECB Guide, Credit Risk, Section 10, para 154). Technical past due situations may be treated as non-defaults if specific conditions are met and documented (EBA GL on DoD, para 23; ECB Guide, Credit Risk, Section 10, para 161).  
\* \*\*Unlikeliness to Pay (UTP) Criterion:\*\* Default shall be considered to have occurred when the Bank considers the obligor unlikely to pay its credit obligations in full (CRR Article 178(1)(a)). This includes, but is not limited to, distressed restructuring, sale of credit obligations due to credit deterioration, or bankruptcy (CRR Article 178(3); EBA GL on DoD, para 36-40; ECB Guide, Credit Risk, Section 11, para 165-168). The Bank shall define and document additional indications of UTP appropriate for residential mortgage portfolios, reflecting specificities such as significant and sustained deterioration in property value, changes in marketability of collateral, or other factors affecting repayment capacity (EBA GL on DoD, para 58-59; ECB Guide, Credit Risk, Section 11, para 169). External information, where available, shall be incorporated.  
\* \*\*Return to Non-Defaulted Status:\*\* Reclassification requires minimum conditions, including a probation period and material payments by the obligor (EBA GL on DoD, para 71-73; ECB Guide, Credit Risk, Section 12, para 170-173). For distressed restructurings, no past due credit obligations should exist.  
\* \*\*Adjustments for DoD Changes:\*\* Any change to the DoD requires prior CA approval (CRR Article 143(3); Commission Delegated Regulation (EU) No 529/2014, Annex I, Part II, Section 1(3); ECB Guide, Credit Risk, Section 14, para 177). If risk differentiation is impacted, model redevelopment may be necessary. A DoD-related MoC shall be applied for uncertainty caused by data deficiencies or adjustment quantification (ECB Guide, Credit Risk, Section 14, para 180).

### 4. Model Development - General Principles

The model development phase focuses on achieving appropriate risk differentiation within the residential mortgage portfolio.

#### 4.1. Scope of Application of Rating Systems and Segmentation

Residential mortgage portfolios shall be assigned to rating systems that cover exposures with common risk drivers, creditworthiness, and comparable availability of credit-related information (EBA GL on PD and LGD, Section 4.1, para 12).  
\* \*\*Homogeneous Management:\*\* Exposures covered by the same rating system shall be homogeneously managed in terms of risk management, decision-making, and credit approval processes (EBA GL on PD and LGD, Section 4.1, para 13). A common obligor rating scale and a common facility rating scale shall be applied within the rating system.  
\* \*\*Calibration Segments:\*\* The PD and LGD models may comprise various calibration segments. These segments shall be justified and documented, particularly where subsets of exposures exhibit significantly different risk levels (EBA GL on PD and LGD, Section 4.1, para 12, Section 5.3.5, para 97). For residential mortgages, this could include segmentation by region (e.g., NUTS 1, 2 or 3 as defined by Eurostat), property type, or specific product features. For instance, specific attention is paid to LTV ratios, especially those exceeding 80%, reflecting industry-specific reporting considerations (e.g., `2021\_5830 Reporting of residential mortgage loans on C80.00`).

#### 4.2. Risk Drivers Selection and Ageing of Information

Estimates shall be based on material drivers of the risk parameters (CRR Article 179(1)(a)). The selection of risk drivers and rating criteria for residential mortgages shall be based on statistical analysis and consultation with relevant business experts to ensure business rationale and risk contribution (EBA GL on PD and LGD, Section 5.2.2, para 58; ECB Guide, Credit Risk, Section 16.1.1, para 202).  
\* \*\*Specific Risk Drivers for Residential Mortgages:\*\* For PD models, relevant risk drivers shall include, but not be limited to, region, type of real estate (e.g., residential), past delinquency, and maturity (ECB Guide, Credit Risk, Section 16.1.1, para 204(c)). For LGD models, risk drivers should also consider Loan-to-Value (LtV) ratio and geographical location of the collateral (EBA GL on PD and LGD, Section 6.2.1, para 121(a)).  
\* \*\*Ageing of Information:\*\* The decrease in reliability of information over time (e.g., initial property valuation, obligor characteristics at origination) shall be appropriately reflected in PD and LGD estimations. The model or assignment process shall provide for adequate and conservative adjustment for outdated information (EBA GL on PD and LGD, Section 5.2.2, para 59).  
\* \*\*Consistency of Time Horizon:\*\* Risk drivers and rating criteria shall be used consistently with respect to the relevant time horizon in model development, calibration, and application (EBA GL on PD and LGD, Section 5.2.2, para 60).

#### 4.3. Use of Human Judgement in Model Development

Human judgement, where used in model development (e.g., setting assumptions, identifying risk drivers, combining components), shall be appropriately managed and proportionate to the number of relevant available observations (ECB Guide, Credit Risk, Section 15.6, para 195; EBA GL on PD and LGD, Section 4.3, para 35). Such judgement shall be documented and justified, and not be the sole basis for quantifying risk parameters (ECB Guide, Credit Risk, Section 15.6, para 196).

#### 4.4. Climate-related and Environmental (C&E) Risks

The Bank shall assess the materiality of climate-related and environmental (C&E) risks throughout the life cycle of its residential mortgage models. Where C&E risk drivers are identified as relevant and material for residential mortgages (e.g., flood risk, energy efficiency ratings affecting property value), they shall be included in the internal models (ECB Guide, Overarching Principles, Section 8, para 29; Credit Risk, Section 16.1.1, fn 136; Section 17.2.1, fn 170). Institutions without sufficient information on these drivers shall consider a more conservative approach in rating assignments, potentially through overrides (ECB Guide, Credit Risk, Section 6.6.1, fn 77).

### 5. Probability of Default (PD) Model Development and Quantification

#### 5.1. PD Model Structure and Risk Differentiation

The PD model for residential mortgages shall provide a meaningful assessment of obligor characteristics, differentiate risk, and produce accurate and consistent quantitative estimates of PD (CRR Article 144(1)(a)).  
\* \*\*Risk Drivers:\*\* PD estimates shall be based on material drivers of default risk (CRR Article 179(1)(a)). For residential mortgage portfolios, this includes, but is not limited to, obligor characteristics (credit history, income stability, employment status, debt-to-income ratio), transaction characteristics (Loan-to-Value (LTV) ratio, loan seasoning, payment history, original and remaining maturity, interest rate type), and collateral characteristics (type of real estate, geographical region, property valuation method, marketability of collateral) (ECB Guide, Credit Risk, Section 16.1.1, para 204(c); EBA GL on PD and LGD, Section 5.2.2, para 57).  
\* \*\*Overfitting Mitigation:\*\* For statistical models used in assigning exposures to grades or pools, the statistical process for model selection shall include assessing performance on independent datasets (out-of-sample and out-of-time data) to limit the risk of overfitting (ECB Guide, Credit Risk, Section 16.1.1, para 203).  
\* \*\*Sub-Range Performance:\*\* PD models shall perform adequately in terms of risk differentiation on economically significant and material sub-ranges of application, such as distinct geographical regions, property types, or client segments within the residential mortgage portfolio (ECB Guide, Credit Risk, Section 16.1.1, para 204).  
\* \*\*Homogeneity and Heterogeneity:\*\* Grades or pools shall be defined to ensure obligors/facilities assigned to the same grade/pool exhibit reasonably similar default risk (homogeneity) and that meaningful differentiation of default risk across different grades/pools (heterogeneity) is achieved, avoiding significant overlaps in default rate distributions (EBA GL on PD and LGD, Section 5.2.5, para 69; ECB Guide, Credit Risk, Section 16.1.2, para 210-211).  
\* \*\*Grade Assignment Dynamics (Rating Philosophy):\*\* The rating assignment process shall adequately anticipate and reflect risk over a longer time horizon (typically 2-3 years) and account for plausible changes in economic conditions, incorporating all relevant information (EBA GL on PD and LGD, Section 5.2.4, para 66-68; ECB Guide, Credit Risk, Section 16.1.3, para 213).

#### 5.2. Treatment of Third-Party Ratings or Scores

Where external credit bureau scores or external ratings are used as input variables in the rating process for residential mortgages (EBA GL on PD and LGD, Section 5.2.3, para 62-64; ECB Guide, Credit Risk, Section 16.1.4, para 215-219):  
\* \*\*Integration and Weighting:\*\* The Bank shall ensure that all relevant internal information regarding the obligor's creditworthiness is taken into account with sufficient weighting in the internal rating, preventing the internal rating from merely mirroring external scores (ECB Guide, Credit Risk, Section 15.3, para 189(d)).  
\* \*\*Understanding and Validation:\*\* The structure, nature, and key drivers of external scores/ratings must be thoroughly understood and regularly verified for appropriateness, particularly in light of any methodological changes by the third party (ECB Guide, Credit Risk, Section 15.3, para 189(b)).  
\* \*\*Timely Updates:\*\* Ratings incorporating third-party information shall be automatically updated when the third-party rating changes (EBA GL on PD and LGD, Section 5.2.3, para 64; ECB Guide, Credit Risk, Section 16.1.4, para 216).

#### 5.3. Use of Machine Learning (ML) Techniques: Development Aspects

If ML techniques are employed in IRB model development for residential mortgages, the Bank shall adhere to the following principles (ECB Guide, Overarching Principles, Section 9.7, para 57-66):  
\* \*\*Justification of Complexity:\*\* The complexity of ML-based models must be justified by performance increase and enhanced organisational objectives, avoiding unnecessary intricacy (ECB Guide, Overarching Principles, Section 9.7.2, para 60).  
\* \*\*Bias Mitigation:\*\* The methodology for ML component structure and parameter estimation must be justified, considering bias from over-/under-fitting, and hyperparameters determined based on generalisation capacity (ECB Guide, Overarching Principles, Section 9.7.1, para 57). Potential bias from applying ML components to observations included in their training data (e.g., sequential use affecting homogeneity or PD bias) must be assessed (ECB Guide, Overarching Principles, Section 9.7.1, para 58).  
\* \*\*Explainability:\*\* Reliance on explainability techniques and tools is required to support the plausibility and intuitiveness of estimates, assessing individual risk driver contributions globally and for specific predictions (ECB Guide, Overarching Principles, Section 9.7.2, para 62). Explanations derived from ML models shall be robust, accurate, and actionable, with different levels of explainability provided to different stakeholders (ECB Guide, Overarching Principles, Section 9.7.2, para 64-65).  
\* \*\*Replicability:\*\* Documentation of ML components shall allow for replication, including parameters and hyperparameters, and storage of random seeds and observation ordering for training (ECB Guide, Overarching Principles, Section 9.7.1, para 59).

#### 5.4. PD Quantification: One-Year Default Rate and Long-Run Average (LRA)

\* \*\*Calculation of One-Year Default Rate:\*\* The denominator for the one-year default rate shall consist of non-defaulted obligors with any credit obligation at the beginning of the one-year observation period. The numerator shall include all such obligors that had at least one default event during the period (EBA GL on PD and LGD, Section 5.3.2, para 73; ECB Guide, Credit Risk, Section 16.2.2, para 230(d)). Obligors who migrated between grades/pools, rating systems, or whose credit obligations were sold, written off, repaid, or otherwise closed during the observation period, must still be included. Any resulting bias shall be addressed through appropriate adjustments and MoC (EBA GL on PD and LGD, Section 5.3.2, para 76; ECB Guide, Credit Risk, Section 16.2.2, para 230(f)). Each defaulted obligor shall be counted only once (EBA GL on PD and LGD, Section 5.3.2, para 77).  
\* \*\*Observed Average Default Rate:\*\* The observed average default rate shall be calculated for each rating grade/pool, and for the overall model portfolio and any relevant calibration segment (EBA GL on PD and LGD, Section 5.3.3, para 79). For retail exposures (residential mortgages), the observed average may be a weighted average if justified by better loss predictability from recent data; otherwise, an arithmetic average is used (EBA GL on PD and LGD, Section 5.3.3, para 81; ECB Guide, Credit Risk, Section 16.2.2, para 230). The approach (overlapping vs. non-overlapping time windows) shall be justified by documented analysis of potential biases (EBA GL on PD and LGD, Section 5.3.3, para 80; ECB Guide, Credit Risk, Section 16.2.2, para 232).  
\* \*\*Long-Run Average (LRA) Default Rate:\*\* The LRA default rate shall be computed from historical observation periods that are as broad as possible and contain a representative mix of good and bad economic years (EBA GL on PD and LGD, Section 5.3.4, para 82-83; ECB Guide, Credit Risk, Section 16.2.3, para 235-236). The historical observation period shall contain at least the five most recent years and extend to previous relevant years to reflect the likely range of variability (ECB Guide, Credit Risk, Section 16.2.3, para 236(a)). If the historical period is not representative, appropriate adjustments shall be made (EBA GL on PD and LGD, Section 5.3.4, para 85; ECB Guide, Credit Risk, Section 16.2.3, para 235-236). The LRA default rate shall be compared against a reference LRA DR (e.g., from January 2008 to December 2018 for EU exposures) at calibration segment level, with deviations justified or leading to revision (ECB Guide, Credit Risk, Section 16.2.3, para 237-238).

#### 5.5. PD Calibration

\* \*\*Calibration to LRA Default Rate:\*\* Calibration shall be performed after taking into account overrides and before applying MoC or floors (EBA GL on PD and LGD, Section 5.3.5, para 89; ECB Guide, Credit Risk, Section 16.2.3, para 247). The calibration sample shall balance comparability with the application portfolio and representativeness of the likely range of variability (EBA GL on PD and LGD, Section 5.3.5, para 88; ECB Guide, Credit Risk, Section 16.2.3, para 244).  
\* \*\*Calibration Segments:\*\* The Bank may choose to calibrate to the LRA default rate at either the grade/pool level or the calibration segment level, performing additional calibration tests at the alternative level to ensure robustness (EBA GL on PD and LGD, Section 5.3.5, para 92; ECB Guide, Credit Risk, Section 16.2.3, para 240-242).  
\* \*\*Direct PD Estimates:\*\* For direct PD estimates (continuous rating scale), the theoretical assumptions of the probability model shall be sufficiently met in practice, and the LRA default rate retained. Continuous PDs shall not be used to overcome data scarcity or deficiencies (EBA GL on PD and LGD, Section 5.3.5, para 96; ECB Guide, Credit Risk, Section 16.2.5, para 250). Mapping to a masterscale must be verified to avoid RWEA distortion (ECB Guide, Credit Risk, Section 16.2.5, para 251).

### 6. Loss Given Default (LGD) Model Development and Quantification

#### 6.1. LGD Estimation Methodologies

LGD estimates for residential mortgages shall be based on the Bank's own loss and recovery experience, supplemented by external data where necessary (EBA GL on PD and LGD, Section 6.1.1, para 102; ECB Guide, Credit Risk, Section 17.1.2, para 252). Methodologies based purely on market prices are not permitted. For retail exposures, LGDs may be derived from realised losses and appropriate PD estimates, ensuring consistency with the economic loss concept (CRR Article 161(2), 181(2)(a); EBA GL on PD and LGD, Section 6.1.1, para 103; ECB Guide, Credit Risk, Section 17.1.3, para 257).

#### 6.2. Data Requirements for LGD Estimation

The Reference Data Set (RDS) for LGD estimation shall cover all defaults identified during the historical observation period, including data for calculating realised LGDs and relevant loss drivers (EBA GL on PD and LGD, Section 6.1.2, para 107). This includes detailed information on collateral, its valuation, and realisation processes (EBA GL on PD and LGD, Section 6.1.2, para 109). The RDS shall contain climate-related and environmental information where relevant and material (ECB Guide, Credit Risk, Section 17.1.2, fn 164). Information about risk drivers shall be used consistently, with values from before the moment of default to align with non-defaulted exposures (EBA GL on PD and LGD, Section 6.2.1, para 122).

#### 6.3. Risk Drivers for LGD and Collateral Modelling

\* \*\*Risk Drivers:\*\* LGD estimates shall be based on material drivers of loss risk (CRR Article 179(1)(a)). For residential mortgage portfolios, this includes, but is not limited to, transaction-related characteristics (type of product, collateral type, geographical location of collateral, LTV ratio, exposure size, seniority, seasoning, recovery procedures), obligor-related characteristics (income stability, employment status, payment history), institution-related factors (internal organisation of recovery processes), and external factors (interest rates, legal framework, property market conditions, and climate-related and environmental risk drivers where relevant and material) (EBA GL on PD and LGD, Section 6.2.1, para 121; ECB Guide, Credit Risk, Section 17.2.1, para 281). Risk drivers shall be analyzed at an appropriate reference date, typically within a year before default, to be representative of non-defaulted exposures (EBA GL on PD and LGD, Section 6.2.1, para 122; ECB Guide, Credit Risk, Section 17.2.1, para 281).  
\* \*\*Collateral Modelling - Eligibility:\*\* Any type of collateral may be taken into account if internal requirements for collateral management, legal certainty, and valuation are generally consistent with CRR Chapter 4 (EBA GL on PD and LGD, Section 6.2.2, para 124). Information on main types of collateral shall be considered as risk drivers (EBA GL on PD and LGD, Section 6.2.2, para 126).  
\* \*\*Collateral Modelling - Inclusion of Effects:\*\* The approach to including collateral effects in LGD estimation shall avoid bias from inappropriate treatment of cash flows or valuation. This includes taking into account potential decreases in collateral value (e.g., due to market conditions) from the point of LGD estimation to eventual recovery, but not potential increases (EBA GL on PD and LGD, Section 6.2.3, para 129(g)).  
\* \*\*Homogeneity and Heterogeneity:\*\* Facility grades or pools shall be defined to ensure sufficient homogeneity of loss characteristics within each grade/pool and meaningful heterogeneity across different grades/pools (EBA GL on PD and LGD, Section 6.2.4, para 130; ECB Guide, Credit Risk, Section 17.2.1, para 284).

#### 6.4. Calculation of Economic Loss and Realised LGD

\* \*\*Economic Loss Definition:\*\* Economic loss shall be calculated as the difference between the outstanding amount at default (including principal, interest, fees, and material direct/indirect costs discounted to default) and any recoveries realised after default discounted to the moment of default (EBA GL on PD and LGD, Section 6.3.1.1, para 132; ECB Guide, Credit Risk, Section 17.1.3, para 261).  
\* \*\*Realised LGD Calculation:\*\* Realised LGD shall be calculated at the single facility level for each default (EBA GL on PD and LGD, Section 6.1.1, para 100; ECB Guide, Credit Risk, Section 17.1.3, para 259). In exceptional cases where recovery is not performed at the single facility level (e.g., several facilities secured by the same collateral), LGD may be calculated at a more aggregated level, provided specific conditions are met and documented (ECB Guide, Credit Risk, Section 17.1.3, para 260).  
\* \*\*Treatment of Fees, Interest, and Additional Drawings:\*\* Fees and interest capitalised before default shall be included in the outstanding amount at default. Additional drawings after default shall be included in the economic loss numerator. Their inclusion in the denominator of realised LGD depends on their treatment in conversion factors for consistency (EBA GL on PD and LGD, Section 6.3.1.2, para 137-142; ECB Guide, Credit Risk, Section 17.1.3, para 261(a)).  
\* \*\*Discounting Rate:\*\* All recoveries, costs, and additional drawings after default shall be discounted using an annual rate composed of a primary interbank offered rate (e.g., 3-month EURIBOR) applicable at the moment of default, increased by an add-on of 5 percentage points (EBA GL on PD and LGD, Section 6.3.1.3, para 143; ECB Guide, Credit Risk, Section 17.1.3, para 261(a)).  
\* \*\*Costs:\*\* All material direct and indirect costs related to the recovery process, incurred before or after default, shall be included in the economic loss calculation (EBA GL on PD and LGD, Section 6.3.1.4, para 144-146; ECB Guide, Credit Risk, Section 17.1.3, para 261(a)).  
\* \*\*Repossessed Collateral Haircuts:\*\* Where collateral is repossessed, the value of repossession shall be adjusted by an appropriate haircut to reflect potential sale price, costs, and discounting effects, assuming intent for immediate sale. Haircuts shall be supported by historical observations and regularly back-tested (EBA GL on PD and LGD, Section 6.1.3, para 117; ECB Guide, Credit Risk, Section 17.3.4, para 291).

#### 6.5. Treatment of Multiple Defaults and Massive Disposals

\* \*\*Multiple Defaults:\*\* For a single facility, if the time between returning to non-defaulted status and subsequent default is less than nine months, it shall be treated as continuously defaulted from the first default for LGD estimation purposes (EBA GL on PD and LGD, Section 6.1.1, para 101; ECB Guide, Credit Risk, Section 17.1.4, para 263).  
\* \*\*Massive Disposals (CRR Article 500):\*\* If applicable, adjustments to LGD estimates due to massive disposals of defaulted exposures are permitted under specific conditions and within defined timelines (CRR Article 500; ECB Guide, Credit Risk, Section 17.1.5, para 264-277). Such adjustments must be justified, documented, and regularly reviewed. Foreclosed assets are generally not included in Article 500 adjustments (ECB Guide, Credit Risk, Section 17.1.5, para 268).

#### 6.6. Long-Run Average (LRA) LGD

\* \*\*Historical Observation Period:\*\* The historical observation period for LRA LGD shall be as broad as possible, containing data from various economic circumstances, and include all available internal data (EBA GL on PD and LGD, Section 6.3.2.1, para 147; ECB Guide, Credit Risk, Section 17.3.2, para 288).  
\* \*\*Calculation:\*\* The LRA LGD shall be calculated as an arithmetic average of realised LGDs over a historical observation period, weighted by the number of defaults, for each facility grade/pool (EBA GL on PD and LGD, Section 6.3.2.2, para 150; ECB Guide, Credit Risk, Section 17.3.5, para 293(a)).  
\* \*\*Incomplete Recovery Processes:\*\* Relevant information from incomplete recovery processes shall be taken into account conservatively. Future recoveries and costs may be estimated within a defined maximum recovery period, reflecting the expected time during which the vast majority of recoveries are realised. Underlying assumptions shall be justified and back-tested (EBA GL on PD and LGD, Section 6.3.2.3, para 153, 156, 158-159; ECB Guide, Credit Risk, Section 17.3.3, para 290). Any uncertainty related to these estimations shall be reflected in an adequate MoC.  
\* \*\*No Loss/Positive Outcome:\*\* Realised LGDs that result in a negative number (profit) shall be floored at zero for LRA LGD calculation (EBA GL on PD and LGD, Section 6.3.2.4, para 160; ECB Guide, Credit Risk, Section 17.3.5, para 293(b)).  
\* \*\*Adjustments for Non-Representativeness:\*\* Where the data used for LGD quantification is not representative of the application portfolio, appropriate adjustments shall be made. These adjustments shall not lead to a decrease in LGD estimates (EBA GL on PD and LGD, Section 6.3.3, para 164; ECB Guide, Credit Risk, Section 17.3.5, para 297).  
\* \*\*Use of External/Pooled Data:\*\* If external or pooled data are used, LRA LGDs derived from these sources shall be calculated separately and compared with those based on internal data to assess representativeness. Material differences require thorough analysis and appropriate MoC (ECB Guide, Credit Risk, Section 17.3.5, para 296).

#### 6.7. Downturn LGD

LGD estimates shall be appropriate for an economic downturn. The Bank shall characterise an economic downturn in accordance with Commission Delegated Regulation (EU) No 2021/930 and derive LGD estimates appropriate for these conditions (ECB Guide, Credit Risk, Section 17.3.6, para 298). This typically involves assessing the observed impact of identified downturn period(s) on average realised LGDs and other loss components (ECB Guide, Credit Risk, Section 17.3.6, para 300-302). A reference value (e.g., average of the two worst years with highest observed economic loss) shall be calculated and compared with the final downturn LGD estimates, at least at the calibration segment level. Material deviations require scrutiny and potential quantification corrections (ECB Guide, Credit Risk, Section 17.3.6, para 304-308). Downturn LGD shall not be calibrated at a more aggregate level than LRA LGD (ECB Guide, Credit Risk, Section 17.3.6, para 299).

### 7. Expected Loss Best Estimate (ELBE) and LGD in-default

#### 7.1. General Requirements

ELBE and LGD in-default for defaulted residential mortgage exposures shall use consistent estimation methods with LGD for non-defaulted exposures, incorporating all relevant post-default information in a timely manner (EBA GL on PD and LGD, Section 7.1.1, para 167-168; ECB Guide, Credit Risk, Section 17.4.1, para 309). Discrete reference dates shall be set for grouping defaulted exposures based on observed recovery patterns (EBA GL on PD and LGD, Section 7.1.2, para 171; ECB Guide, Credit Risk, Section 17.4.1, para 309).

#### 7.2. Specific Requirements for ELBE

ELBE shall represent the best estimate of expected loss given current economic circumstances and exposure status (CRR Article 181(1)(h); EBA GL on PD and LGD, Section 7.3.2.2, para 183). ELBE shall not include any Margin of Conservatism (MoC) (EBA GL on PD and LGD, Section 7.3.2.1, para 182; ECB Guide, Credit Risk, Section 17.4.1, para 310). Adjustments to LRA LGD for defaulted exposures may be necessary if the model does not inherently capture economic sensitivity (EBA GL on PD and LGD, Section 7.3.2.2, para 184-185; ECB Guide, Credit Risk, Section 17.4.1, para 310). Accounting provisions may be used as ELBE only if the underlying model meets all CRR and EBA GL requirements for own LGD estimates, or if individually assessed provisions are used as a basis for overriding ELBE estimates after appropriate adjustments for consistency with economic loss definition (EBA GL on PD and LGD, Section 7.3.2.3, para 186-187).

#### 7.3. Specific Requirements for LGD in-default

LGD in-default shall reflect at least downturn conditions if they are more conservative than the LRA LGD for defaulted exposures (EBA GL on PD and LGD, Section 7.3.3, para 189; ECB Guide, Credit Risk, Section 17.4.1, para 311). It shall be higher than ELBE, accounting for any increased loss rate caused by possible additional unexpected losses during the recovery period (EBA GL on PD and LGD, Section 7.3.3, para 190-191; ECB Guide, Credit Risk, Section 17.4.1, para 311). The breakdown of LGD in-default into its components (ELBE and add-on, including downturn conditions, MoC, and additional unexpected losses) shall be documented separately (EBA GL on PD and LGD, Section 7.3.3, para 193).

### 8. Conversion Factors (CCF) Estimation

#### 8.1. Scope and Realised CCFs

\* \*\*Scope:\*\* IRB-CCFs are used for retail exposures, including residential mortgages, and for non-retail exposure classes where own estimates are permitted, for undrawn revolving commitments not subject to a 100% SA-CCF (CRR Article 151(7), (9), 166(8b); ECB Guide, Credit Risk, Section 18.1.1, para 312). The exposure value is subject to a CCF input floor (CRR Article 166(8c)). Commitments are contractual arrangements to extend credit (ECB Guide, Credit Risk, Section 18.1.1, para 313(b)). Unadvised limits may be disregarded if their availability is subject to further credit assessment including re-rating (ECB Guide, Credit Risk, Section 18.1.1, para 313(a)).  
\* \*\*Realised CCF:\*\* Realised CCF shall be calculated at the single facility level for each default (CRR Article 4(1)(56), 182(1)(a); ECB Guide, Credit Risk, Section 18.2.1, para 316). The definition of exposure must be identical to that used for LGD estimation, with consistent treatment of post-default drawings (ECB Guide, Credit Risk, Section 18.2.1, para 317(b)).

#### 8.2. CCF Structure and Quantification

\* \*\*Risk Drivers:\*\* IRB-CCF models shall reflect transaction characteristics (e.g., product profile transformations) and the Bank's current policies and strategies regarding account and limit monitoring (CRR Article 170, 182(1a); ECB Guide, Credit Risk, Section 18.3.1, para 319).  
\* \*\*Long-Run Average CCF:\*\* The LRA CCF shall be calculated from a broad historical observation period covering different economic circumstances (ECB Guide, Credit Risk, Section 18.4.1, para 322).  
\* \*\*Downturn CCF:\*\* IRB-CCF estimates shall be appropriate for an economic downturn, characterised by elevated levels of realised CCFs in accordance with Commission Delegated Regulation (EU) No 2021/930 (CRR Article 182(1)(b); ECB Guide, Credit Risk, Section 18.4.1, para 323).  
\* \*\*Region of Instability:\*\* The IRB-CCF model shall be robust against or adequately adjusted for potential effects of facilities being close to fully drawn at the reference date (CRR Article 182(1c); ECB Guide, Credit Risk, Section 18.4.1, para 324(a)).  
\* \*\*Judgmental CCFs:\*\* For immaterial exposures with scarce data, judgmental IRB-CCF values may be used, provided they are objectively conservative (e.g., a minimum value of 100% as a final estimate), justified, and regularly monitored (ECB Guide, Credit Risk, Section 18.4.1, para 324(b)).

### 9. Appropriate Adjustment (AA) and Margin of Conservatism (MoC)

The Bank shall incorporate an Appropriate Adjustment (AA) to correct identified biases and a Margin of Conservatism (MoC) into its risk parameter estimates for residential mortgages to account for expected estimation errors and uncertainties.

#### 9.1. Identification and Classification of Deficiencies

The Bank shall identify all deficiencies related to the estimation of risk parameters (PD, LGD, ELBE, LGD in-default, CCF) that may lead to a bias in quantification or increased uncertainty not fully captured by the general estimation error. Each deficiency shall be classified into one of the following categories (EBA GL on PD and LGD, Section 4.4.1, para 36-37; ECB Guide, Credit Risk, Section 19, para 325):  
\* \*\*Category A: Identified Data and Methodological Deficiencies:\*\* E.g., missing or inaccurate default triggers, outdated data on risk drivers, limited representativeness of external data, missing or inaccurate LTV data, outdated property valuations.  
\* \*\*Category B: Relevant Changes and Additional Uncertainty:\*\* E.g., changes to underwriting standards, risk appetite, collection/recovery policies, market/legal environment (e.g., changes in residential property market dynamics, foreclosure laws), or forward-looking expectations not yet reflected in observed data.  
\* \*\*Category C: General Estimation Error:\*\* Reflects the dispersion of the statistical estimator.

#### 9.2. Methodology for Appropriate Adjustment (AA)

Adequate methodologies shall be applied to correct identified biases to the extent possible, aiming to achieve the most accurate "best estimate" of the risk parameter. The impact of these methodologies (AA) can be either an increase or a decrease in the parameter value (EBA GL on PD and LGD, Section 4.4.2, para 38). All AA methods shall be documented, justified, and regularly monitored for adequacy (EBA GL on PD and LGD, Section 4.4.2, para 39-40).

#### 9.3. Quantification and Aggregation of Margin of Conservatism (MoC)

A MoC shall be added to the best estimate of the risk parameter to reflect the expected range of estimation errors (CRR Article 179(1)(f); ECB Guide, Credit Risk, Section 19, para 325; EBA GL on PD and LGD, Section 4.4.3, para 41).  
\* \*\*Components and Aggregation:\*\* The final MoC shall be the sum of MoCs from Categories A, B, and C (EBA GL on PD and LGD, Section 4.4.3, para 45). Different aggregation techniques may be used within each category (EBA GL on PD and LGD, Section 4.4.3, para 44).  
\* \*\*Category A and B MoC:\*\* Quantified at least at the calibration segment level. This MoC shall account for any increased uncertainty or additional estimation error associated with appropriate adjustments, or for deficiencies not corrected by AAs (EBA GL on PD and LGD, Section 4.4.3, para 43(a)).  
\* \*\*Category C MoC (General Estimation Error):\*\* Quantified at least for every calibration segment, reflecting the dispersion of the statistical estimator (EBA GL on PD and LGD, Section 4.4.3, para 43(b)). For PD, this MoC shall account for statistical uncertainty/sampling error affecting the LRA estimate at grade/pool level, primarily driven by the number of observations per grade and the length of the time series (ECB Guide, Credit Risk, Section 19, para 327(a)). For LGD and CCF, it shall reflect statistical uncertainty/sampling error affecting the final estimates, driven by observations used for long-run/downturn estimates and time series length (ECB Guide, Credit Risk, Section 19, para 327(b)).  
\* \*\*Proportionality and Positivity:\*\* MoC from Category C shall be greater than zero. MoCs from Categories A and B shall be greater than or equal to zero and proportionate to the increased uncertainty caused by identified deficiencies (EBA GL on PD and LGD, Section 4.4.3, para 47).  
\* \*\*Specific Considerations:\*\* For residential mortgage models, MoC shall particularly address the use of external or pooled data, which generally results in higher estimation uncertainty (ECB Guide, Credit Risk, Section 13, para 174; EBA GL on PD and LGD, Section 4.4.1, para 37(a)(viii)). The absence of publicly available statistics in the residential mortgage sector (EBA/EBA-RESPONSE/7934) may necessitate a larger MoC for data scarcity.  
\* \*\*Monotonicity:\*\* The Bank shall ensure monotonicity in its final risk parameter estimates while still reflecting the uncertainty at the grade or pool level (ECB Guide, Credit Risk, Section 19, para 325).

#### 9.4. Monitoring and Remediation

MoC levels shall be regularly monitored. The Bank shall develop and implement a plan to rectify underlying deficiencies, correct models, and reduce estimation errors within a reasonable timeframe, considering the materiality of the error and the rating system (EBA GL on PD and LGD, Section 4.4.3, para 50-51).

### 10. Model Performance Assessment and Review

The Bank shall implement a robust framework for assessing model performance and conducting regular reviews to ensure ongoing accuracy and compliance.

#### 10.1. Internal Validation

The internal validation function shall perform comprehensive validation activities.  
\* \*\*Content and Frequency:\*\* Validation shall assess model performance through qualitative and quantitative methods, including back-testing, discriminatory power, representativeness analyses, stability analyses, model specification/design stability, input data evaluation, benchmarking, data cleansing, and quality assurance of computer codes (ECB Guide, Credit Risk, Section 4.3, para 52). All internal models and estimates shall be subject to an initial and subsequently an annual internal validation (ECB Guide, Overarching Principles, Section 6, para 18; EBA GL on PD and LGD, Section 9, para 218). For material rating systems, a full validation shall be performed at least once every three years (ECB Guide, Credit Risk, Section 4.3, para 52(g)).  
\* \*\*Benchmarking for Residential Mortgages:\*\* For residential mortgage models, benchmarking analyses shall compare with up-to-date data from representative and comparable external data sources (ECB Guide, Credit Risk, Section 4.3, para 52(viii)), acknowledging the absence of publicly available statistics in this sector (EBA/EBA-RESPONSE/7934).  
\* \*\*Reporting and Follow-up:\*\* Validation conclusions and recommendations shall be reported to Senior Management and the Management Body, with clear processes for decision-making and tracking remediation actions (ECB Guide, Credit Risk, Section 4.4, para 56-59).

#### 10.2. Internal Audit

The internal audit function shall conduct regular reviews of the Bank's rating systems and their operations.  
\* \*\*Scope and Frequency:\*\* Internal models shall be subject to regular review by Internal Audit, at least annually (CRR Article 191; ECB Guide, Credit Risk, Section 5.2, para 61; EBA GL on PD and LGD, Section 9, para 218). This involves an annual general risk assessment to inform the audit work plan, with deep dives for high-risk areas or at least every three years for other areas (ECB Guide, Credit Risk, Section 5.2, para 62-63). This includes assessing the development and performance of rating systems, model use, materiality classification, data quality, and the integrity of the rating assignment process (ECB Guide, Credit Risk, Section 5.2, para 64).

#### 10.3. Ongoing Monitoring and Review of Estimates

Estimates shall be reviewed whenever new information comes to light, and at least annually (CRR Article 179(1)(c); ECB Guide, Credit Risk, Section 20, para 328; EBA GL on PD and LGD, Section 9, para 217).  
\* \*\*Scope:\*\* Reviews shall include analysis of data representativeness (development and application portfolios), model performance and stability over time (discriminatory power, trends), and predictive power (impact of recent data on LRA rates, back-testing against observed outcomes for each grade/pool) (EBA GL on PD and LGD, Section 9, para 218; ECB Guide, Credit Risk, Section 20, para 330). For LGD models with components (e.g., secured/unsecured), back-testing shall be run at both component and facility levels (ECB Guide, Credit Risk, Section 20, para 330(c)).  
\* \*\*Material Statistical Models:\*\* For material statistical models, an analysis of whether the inclusion of the most recent data would lead to materially different model outcomes shall be conducted at least every three years (ECB Guide, Credit Risk, Section 20, para 331).  
\* \*\*Low Observations:\*\* Where default observations are low, individual defaults (or a sample) shall be analysed to ensure material drivers are reflected (ECB Guide, Credit Risk, Section 20, para 332).  
\* \*\*Human Judgement Impact:\*\* The impact of human judgement on risk differentiation capability (e.g., discriminatory power) shall be assessed (ECB Guide, Credit Risk, Section 20, para 333; EBA GL on PD and LGD, Section 9, para 218(b)).

#### 10.4. IT Implementation Testing for Model Performance

A consistent process for testing relevant IRB systems and applications shall be in place upon first implementation and on an ongoing basis. This includes unit/component/module tests, integration tests, system tests, user acceptance testing (UAT), and regression testing. The unit responsible for testing shall be clearly identified, and results documented (ECB Guide, Credit Risk, Section 8.2.3, para 123-126). For new models or material changes, evidence of successful implementation in a live or non-live production environment is required before supervisory approval (ECB Guide, Credit Risk, Section 8.2.2, para 121-122).

### 11. Model Use (Use Test) and Application

The Bank shall ensure that internal ratings and default and loss estimates play an essential role in its risk management, decision-making, credit approval, internal capital allocation, and corporate governance functions (CRR Article 144(1)(b)).

#### 11.1. Integration into Decision-Making

Internal ratings and default and loss estimates derived from residential mortgage models shall play an essential role in the Bank's risk management and decision-making processes, as well as in credit approval, internal capital allocation, and corporate governance functions (CRR Article 144(1)(b); ECB Guide, Credit Risk, Section 6.2, para 69-70).  
\* \*\*Credit Approval:\*\* Internal ratings shall be incorporated into the overall credit granting, restructuring, and renewal process for residential mortgages, with related policies calibrated on rating classes or risk parameters. Staff involved must possess sufficient knowledge of the rating systems (ECB Guide, Credit Risk, Section 6.3, para 74(a)).  
\* \*\*Risk Management:\*\* Internal ratings and estimates shall be used in the monitoring process for obligors and exposures, promptly providing information on credit risk development (ECB Guide, Credit Risk, Section 6.3, para 74(b)).  
\* \*\*Internal Capital Assessment and Allocation:\*\* Internal ratings and estimates shall play an important role in the assessment, calculation, and allocation of internal capital (CRR Article 144(1)(b); ECB Guide, Credit Risk, Section 6.4, para 76).  
\* \*\*Corporate Governance:\*\* Internal ratings and estimates shall be used in management reporting and portfolio credit risk monitoring procedures (CRR Article 144(1)(b); ECB Guide, Credit Risk, Section 6.5, para 77-78).  
\* \*\*Adjustments for Internal Use:\*\* While adjustments (e.g., removing MoC, regulatory floors, or downturn adjustments) are permissible for internal purposes, they shall not lead to a change in rank ordering of obligors or exposures within a calibration segment (EBA GL on PD and LGD, Section 8.3, para 208; ECB Guide, Credit Risk, Section 6.2, para 70).

#### 11.2. Human Judgement and Overrides in Application

\* \*\*Override Policy:\*\* The Bank shall maintain clear, documented policies and criteria for situations where human judgment may override model inputs or outputs in the rating assignment process (CRR Article 172(3); EBA GL on PD and LGD, Section 8.2, para 203; ECB Guide, Credit Risk, Section 6.6.1, para 80). Overrides shall be limited to information relevant to the obligor's creditworthiness that is not well-captured by the model (ECB Guide, Credit Risk, Section 6.6.1, para 80).  
\* \*\*Documentation:\*\* Each override instance shall be comprehensively documented, including all quantitative and qualitative information, reasons for the override, interim ratings, date of override, and personnel involved (CRR Article 172(3); EBA GL on PD and LGD, Section 8.2, para 204; ECB Guide, Credit Risk, Section 6.6.3, para 91). For ML-based models, specific details of data not captured by the model should be included (ECB Guide, Overarching Principles, Section 9.8.2, para 76).  
\* \*\*Monitoring and Impact Assessment:\*\* Overrides shall be regularly monitored and assessed for their impact on the rating model's performance and discriminatory power (CRR Article 172(3); EBA GL on PD and LGD, Section 8.2, para 205-207; ECB Guide, Credit Risk, Section 6.6.3, para 92). Excessive numbers or inappropriate justifications for overrides shall be considered strong indicators of model weaknesses requiring remediation (ECB Guide, Credit Risk, Section 6.6.3, para 93). Personnel performing overrides shall have in-depth understanding of risk factors and utilize explainability techniques (ECB Guide, Overarching Principles, Section 9.8.2, para 77).

#### 11.3. Non-rated Exposures and Outdated Ratings

The Bank shall have internal policies and procedures to identify, monitor, and prudentially manage non-rated exposures and outdated ratings (e.g., ratings not updated within the 12-month period following the last rating date, or based on outdated financial information) (CRR Article 144(1)(h), 173(1)(b); ECB Guide, Credit Risk, Section 6.6.2, para 84). This includes applying conservative measures, such as time-dependent downgrading for outdated ratings and application of the worst-performing rating grade for unrated exposures (ECB Guide, Credit Risk, Section 6.6.2, para 86).

#### 11.4. IRB Shortfall or Excess

Risk parameters are used for calculating the IRB shortfall or excess (CRR Article 159; EBA GL on PD and LGD, Section 8.4, para 211). This calculation shall be performed at an aggregate level, separately for defaulted and non-defaulted portfolios. Rules for offsetting IRB excess against shortfall and for including IRB excess in Tier 2 capital shall be followed (EBA GL on PD and LGD, Section 8.4, para 212-213). Partial write-offs shall not be included in the calculation of general and specific credit risk adjustments for this purpose (EBA GL on PD and LGD, Section 8.4, para 214).

### 12. Model Changes and Extensions

#### 12.1. Change Policy

A comprehensive "change policy" shall be established, detailing criteria for materiality assessment, classification (material, ex-ante non-material, ex-post non-material), impact assessment, notification, and documentation of changes and extensions to IRB models (Commission Delegated Regulation (EU) No 529/2014; ECB Guide, Credit Risk, Section 7.2, para 97-98). This policy shall ensure consistency and prevent arbitrage by clearly defining metrics and significance levels for changes in RWEAs, distribution across grades, and rank ordering (ECB Guide, Credit Risk, Section 7.2, para 98(b)).

#### 12.2. Materiality Assessment and Classification

Changes and extensions shall be assessed and classified as material, ex ante non-material, or ex post non-material based on both quantitative (e.g., impact on RWEA) and qualitative criteria (ECB Guide, Credit Risk, Section 7.5, para 103-106). The assessment process shall involve a four-eye principle to confirm classification (ECB Guide, Credit Risk, Section 7.4, para 102). For ML-based models, the change policy shall explicitly define what constitutes a change, clarifying implications for qualitative criteria and distinguishing between model changes and maintenance (ECB Guide, Overarching Principles, Section 9.2.2, para 38). An initial switch to a mostly ML-based approach is generally a material change (ECB Guide, Overarching Principles, Section 9.2.2, para 39).

#### 12.3. Notification and Approval

Material changes or extensions require prior supervisory approval from the competent authority (CRR Article 143(3); ECB Guide, Credit Risk, Section 7.1, para 96). Non-material changes require ex ante or ex post notification. The Bank shall use standardised templates provided by the ECB for notifications and applications (ECB Guide, Credit Risk, Section 7.3, para 99).

#### 12.4. Re-rating Process

Where supervisory permission is granted for a material extension or change, the Bank shall calculate its own funds requirements based on the approved change from the specified implementation date (Commission Delegated Regulation (EU) No 529/2014, Article 3(5); ECB Guide, Credit Risk, Section 7.6, para 111). If immediate re-rating is not possible (e.g., for non-retail residential mortgages requiring manual input), a re-rating process within 12 months is allowed, with RWEA impact applied if a material increase is expected (ECB Guide, Credit Risk, Section 7.6, para 114). The impact on the use of parameters shall be assessed, and user feedback analysed (ECB Guide, Credit Risk, Section 7.5.1, para 108-109).

### 13. Third-Party Involvement (Detailed)

#### 13.1. General Principles and Contractual Requirements

Outsourcing of internal model-related tasks (e.g., data provisioning, model development, validation support) shall comply with all legal requirements and the Bank's internal guidelines (ECB Guide, Overarching Principles, Section 11, para 80).  
\* \*\*Contractual Requirements:\*\* Formal contracts or documented agreements (e.g., Service Level Agreements for internal outsourcing) shall ensure supervisory access to information, support from the third party, and the Bank's maintenance of sufficient in-house knowledge (ECB Guide, Overarching Principles, Section 11.2, para 81).  
\* \*\*Responsibility Retention:\*\* The Bank retains ultimate responsibility for outsourced tasks and functions (ECB Guide, Overarching Principles, Section 11.3.1, para 83).

#### 13.2. In-House Knowledge and Oversight

The Bank shall maintain adequate in-house knowledge and core competence for outsourced tasks, as it retains ultimate responsibility (ECB Guide, Overarching Principles, Section 11.3.3, para 87). This includes understanding methodologies, data, and having access to information for independent validation (ECB Guide, Overarching Principles, Section 11.3.3, para 89). The third party must provide support and attend interviews with competent authorities upon request (ECB Guide, Overarching Principles, Section 11.3.3, para 88(e)).

#### 13.3. Independent Monitoring of Third-Party Performance

The Bank shall independently monitor the performance of third parties involved in internal model-related tasks, applying the same standards as for in-house activities (ECB Guide, Overarching Principles, Section 11.3.4, para 91). This includes automated data quality checks, analysis of historical data differences, assessment of data representativeness, and cross-checks between databases (ECB Guide, Overarching Principles, Section 11.3.4, para 92).

#### 13.4. Use of External Credit Risk Parameters/Ratings and Pooled Data

When external credit risk parameters or pooled data are used as a component of the Bank's rating systems for residential mortgages:  
\* \*\*Representativeness Assessment:\*\* The Bank shall assess the representativeness of the pooled or external portfolio to its own, for both risk differentiation and quantification purposes (ECB Guide, Overarching Principles, Section 11.3.3, para 90(b)).  
\* \*\*Definition of Default:\*\* The definition of default applied to pooled or external data must be thoroughly understood and aligned with the Bank's internal DoD, with appropriate adjustments made if broad equivalence is not achieved (CRR Article 178(4); ECB Guide, Credit Risk, Section 13, para 174; ECB Guide, Overarching Principles, Section 11.3.3, para 90(c)).  
\* \*\*Methodology Understanding:\*\* The Bank must demonstrate good knowledge of the third party's work in producing estimates, including data cleansing, assumptions, methodologies, and limitations (ECB Guide, Overarching Principles, Section 11.3.5, para 94(b)).  
\* \*\*Internal Information Integration:\*\* Internal ratings and estimates must also incorporate internal information and be adjusted for the Bank's specificities (ECB Guide, Overarching Principles, Section 11.3.5, para 94(a)).  
\* \*\*Monitoring and Review:\*\* Performance monitoring and clear triggers for model review are required (ECB Guide, Overarching Principles, Section 11.3.5, para 94(b)).  
\* \*\*Data Scarcity:\*\* Acknowledge that the absence of publicly available statistics in the residential mortgage sector (EBA/EBA-RESPONSE/7934) may necessitate greater reliance on internal data and, where internal data is scarce, may lead to higher uncertainty and consequently a larger Margin of Conservatism (MoC) (ECB Guide, Credit Risk, Section 15.6, para 196). The Bank shall justify any use of external data by demonstrating its representativeness and the outweighing benefits compared to identified drawbacks (ECB Guide, Credit Risk, Section 15.2, para 187).

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