Internal Credit Risk Modelling Policy

This chapter outlines the Bank's comprehensive policy for the development, implementation, validation, and ongoing management of Internal Ratings Based (IRB) models for residential mortgage portfolios within the European Union (EU). It incorporates the requirements and supervisory expectations derived from Regulation (EU) No 575/2013 (CRR), Directive 2013/36/EU (CRD), the European Central Bank (ECB) Guide to Internal Models (July 2025, Version 4.0), and the EBA Guidelines on PD Estimation, LGD Estimation and the Treatment of Defaulted Exposures (EBA/GL/2017/16). This policy ensures compliance with the regulatory framework, promotes sound risk management practices, and maintains the integrity and accuracy of the Bank's internal models.

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## Chapter X: IRB Model Development for Residential Mortgage Portfolios

### 1. Introduction and Scope

#### 1.1. Purpose  
This policy document establishes the principles, requirements, and methodologies for the development, implementation, validation, 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.

#### 1.2. Scope and Applicability  
This chapter 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), and Expected Loss Best Estimate (ELBE). 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 references the following key regulatory documents:  
\* \*\*Regulation (EU) No 575/2013 (CRR)\*\*, as amended by CRR2 and CRR3.  
\* \*\*Directive 2013/36/EU (CRD)\*\*.  
\* \*\*ECB Guide to Internal Models (ECB Guide)\*\*, Version 4.0, dated July 2025.  
\* \*\*EBA Guidelines on PD Estimation, LGD Estimation and the Treatment of Defaulted Exposures (EBA GL on PD and LGD)\*\*, EBA/GL/2017/16, dated 20 November 2017.  
\* \*\*Commission Delegated Regulation (EU) No 2022/439\*\* (RTS on IRB Assessment Methodology).  
\* \*\*ECB Regulation on discretion on materiality threshold (ECB Reg on Materiality Threshold)\*\* (ECB/2018/26).  
\* \*\*EBA Guidelines on the application of the definition of default (EBA GL on DoD)\*\* (EBA/GL/2016/07).

### 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.

#### 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, model changes, and key policies, 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., training, workshops) to 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.  
\* \*\*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 (ECB Guide, Credit Risk, Section 3.3, para 30).

#### 2.2. Model Risk Management Framework  
The Bank shall implement a comprehensive model risk management framework to identify, understand, and manage model risk for all internal models across the group (ECB Guide, Overarching Principles, Section 4).  
\* \*\*Policy and Definition:\*\* A written model risk management policy shall define what constitutes a model, interpret model risk (CRD Article 3(1)(11)), and describe the framework's components.  
\* \*\*Model Register:\*\* A central register of internal models shall be maintained, including model owner(s), range of application, materiality, approval dates, restrictions, key weaknesses, and changes (ECB Guide, Overarching Principles, Section 4(b), para 6).  
\* \*\*Identification and Mitigation:\*\* Guidelines shall be in place for identifying and mitigating measurement uncertainty and model deficiencies, considering qualitative aspects like data deficiencies and model misuse.  
\* \*\*Model Life Cycle:\*\* Procedures for the entire model life cycle (development, calibration, validation, approval, implementation, application, review) shall be documented.

#### 2.3. Documentation Standards  
All internal models shall be thoroughly documented to enable a qualified third party to independently understand the methodology, assumptions, limitations, and use of the model, and to replicate its development and implementation (ECB Guide, Overarching Principles, Section 2, para 4).  
\* \*\*Scope:\*\* Documentation shall cover technical aspects, data processes, user instructions, and performance/validation results.  
\* \*\*Maintenance:\*\* Documentation shall be kept up-to-date, with clear policies for approval, change management, and archiving.

#### 2.4. Internal Validation Function  
The internal validation function shall be independent, adequately staffed, and possess the necessary expertise to effectively challenge internal models.  
\* \*\*Independence:\*\* Organisational arrangements shall ensure effective independence from the model development process, with large and complex institutions implementing the most robust options (ECB Guide, Overarching Principles, Section 6, para 19-23).  
\* \*\*Scope and Frequency:\*\* All internal models and estimates shall be subject to initial and at least annual internal validation (ECB Guide, Overarching Principles, Section 6, para 18; Credit Risk, Section 4.3, para 52(g)). For material rating systems, a full validation shall be performed at least every three years.  
\* \*\*Policies and Procedures:\*\* Internal validation policies shall explicitly account for the use of ML techniques and ensure effective challenge of modelling decisions (ECB Guide, Overarching Principles, Section 9.3, para 43).

#### 2.5. Internal Audit Function  
The internal audit function shall regularly review internal models with an adequate level of independence from the processes and units reviewed (CRR Article 191, ECB Guide, Overarching Principles, Section 7).  
\* \*\*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).  
\* \*\*Scope and Frequency:\*\* An annual general risk assessment shall inform the audit work plan, with 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).  
\* \*\*Follow-up:\*\* Conclusions, findings, and recommendations shall be reported to the audit committee, with action plans approved and monitored for timely implementation.

#### 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 (ECB Guide, Overarching Principles, Section 4(h), 9.2.1). Appropriate training programmes shall be devised and regularly reviewed.

#### 2.7. Third-Party Involvement  
Where third parties are involved in internal model-related tasks (e.g., data provisioning, model development, validation), the Bank shall retain ultimate responsibility and ensure adequate in-house knowledge, transparent contractual arrangements, and independent monitoring of third-party performance (ECB Guide, Overarching Principles, Section 11).

#### 2.8. Use of Machine Learning (ML) Techniques  
The use of ML techniques in IRB models shall be subject to enhanced scrutiny and specific governance requirements.  
\* \*\*Complexity Assessment:\*\* ML-based models are generally classified as more complex and likely material, leading to higher expectations for management reporting and validation (ECB Guide, Overarching Principles, Section 9.1, para 34).  
\* \*\*Management of Changes:\*\* The change policy shall define what constitutes a change for ML-based models, particularly for dynamic models, to ensure appropriate monitoring and supervisory notification (ECB Guide, Overarching Principles, Section 9.2.2, para 38-41).  
\* \*\*Explainability:\*\* The Bank shall rely on a set of explainability techniques and tools to support the plausibility and intuitiveness of ML-based model estimates, assessing the contribution of individual risk drivers (ECB Guide, Overarching Principles, Section 9.7.2, para 62-66).  
\* \*\*Use for Decision-Making:\*\* Internal policies shall explicitly define the scope, purpose, and limitations of ML-based models in risk management and decision-making, ensuring sufficient vigilance regarding added risks (ECB Guide, Overarching Principles, Section 9.8.1, para 68-73).  
\* \*\*Human Judgement in Overrides:\*\* Override policies for ML-based models shall consider excessive overrides as indicators of model design flaws. Personnel performing overrides shall have in-depth understanding supported by explainability tools (ECB Guide, Overarching Principles, Section 9.8.2, para 74-78).

### 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, as per ECB Guide on effective risk data aggregation and risk reporting, shall be in place for all data inputs to internal models (ECB Guide, Overarching Principles, Section 3, para 9).  
\* \*\*Organisational Measures:\*\* Adequate organisational measures for data management and security shall be in place, aligning with DORA and BCBS 239 (ECB Guide, Overarching Principles, Section 3, para 10).  
\* \*\*Consistency of Human Judgement:\*\* For target variables determined by human judgement (e.g., unlikeliness to pay flags), a data governance process shall ensure consistency in labelling through clear guidelines and regular analyses (ECB Guide, Overarching Principles, Section 3, para 11).

#### 3.2. Data Quality  
The Bank shall establish and implement an effective data quality management framework, formalised in policies and procedures, applicable to all IRB-related data (internal, external, pooled) (ECB Guide, Credit Risk, Section 8.4, para 130; EBA GL on PD and LGD, Section 4.2.1, para 15).  
\* \*\*Data Quality Dimensions:\*\* Standards shall be defined for completeness, accuracy, consistency, timeliness, uniqueness, validity, availability, and traceability for all data inputs at each stage of the data lifecycle (ECB Guide, Credit Risk, Section 8.4.3, para 137).  
\* \*\*Data Quality Controls:\*\* Indicators with tolerance levels and thresholds shall monitor compliance, supported by effective data quality checks and controls, including reconciliation across systems (ECB Guide, Credit Risk, Section 8.4.4, para 139-140).  
\* \*\*Remediation:\*\* A process for identifying and remediating data quality deficiencies shall be in place, with incidents recorded, owners appointed, and action plans defined (ECB Guide, Credit Risk, Section 8.4.5, para 141-142).  
\* \*\*Reporting:\*\* Formal reporting on data quality shall be provided to Senior Management and other relevant staff at least quarterly (ECB Guide, Credit Risk, Section 8.4.6, para 143-145).

#### 3.3. Data Representativeness  
The Bank shall have sound policies, processes, and methods for assessing the representativeness of data used for estimating risk parameters (EBA GL on PD and LGD, Section 4.2.2, para 17).  
\* \*\*Model Development:\*\* For model development, the dataset shall be representative of the application portfolio in terms of scope, definition of default, distribution of risk characteristics, lending standards, and recovery policies (EBA GL on PD and LGD, Section 4.2.3, para 20-26). Material differences shall be addressed by selecting an appropriate sample.  
\* \*\*Calibration:\*\* For calibration, the data used for long-run averages must be comparable in terms of scope, definition of default, risk characteristics, economic/market conditions, and policies (EBA GL on PD and LGD, Section 4.2.4, para 28-33). Insufficient representativeness in calibration data shall trigger appropriate adjustments and increased MoC (EBA GL on PD and LGD, Section 4.2.4, para 34).  
\* \*\*External/Pooled Data:\*\* When using external or pooled data, the Bank shall obtain sufficient information to assess representativeness and ensure consistency with internal portfolios and processes (ECB Guide, Credit Risk, Section 15.2, 15.4; EBA GL on PD and LGD, Section 4.2.2, para 19).

#### 3.4. Data Maintenance and IT Systems  
The Bank shall deploy robust, well-documented, and adequately tested IT systems to support its rating systems (ECB Guide, Credit Risk, Section 8.1, para 116).  
\* \*\*Infrastructure:\*\* The IT infrastructure shall support complex data needs, including for ML-based models, and provide traceable solutions for model versioning and replication (ECB Guide, Overarching Principles, Section 9.6, para 52-53; Credit Risk, Section 8.2.1, para 119-120).  
\* \*\*Implementation Testing:\*\* A consistent process for testing relevant IRB systems and applications shall be in place upon first implementation and on an ongoing basis, triggered by software releases, IT changes, regulatory changes, or model changes (ECB Guide, Credit Risk, Section 8.2.3, para 123-125).

#### 3.5. Definition of Default (DoD)  
The Bank shall apply a consistent and accurate definition of default across all exposures, aligned with CRR Article 178 and EBA GL on DoD.  
\* \*\*Criteria:\*\* Default is triggered by either the "days past due" criterion (90 consecutive days past due on a material credit obligation) or the "unlikeliness to pay" criterion (ECB Guide, Credit Risk, Section B, para 147).  
\* \*\*Materiality Thresholds:\*\* The materiality thresholds shall be €100 for retail exposures and €500 for non-retail, representing more than 1% of total on-balance sheet exposures to that obligor (ECB Reg on Materiality Threshold, ECB Guide, Credit Risk, Section B, para 147(b)).  
\* \*\*Obligor-Level Application:\*\* The DoD shall be applied at the obligor level, considering all exposures to the institution, parent, or subsidiaries, with mechanisms for consolidating information across the banking group (EBA GL on DoD, para 81, 82; ECB Guide, Credit Risk, Section 9, para 148-149).  
\* \*\*Days Past Due Criterion:\*\* Counting of days past due shall be precise, not relying on proxies like "months in arrears" (ECB Guide, Credit Risk, Section 10, para 154). Technical past due situations shall be identified and not considered defaults (EBA GL on DoD, para 23; ECB Guide, Credit Risk, Section 10, para 161).  
\* \*\*Unlikeliness to Pay Criterion:\*\* The Bank shall define and document additional indications of unlikeliness to pay beyond CRR Article 178(3)(a)-(f), appropriate for residential mortgages (e.g., property marketability, value declines) (EBA GL on DoD, para 58, 59; ECB Guide, Credit Risk, Section 11, para 169).  
\* \*\*Return to Non-Defaulted Status:\*\* Clear conditions, including minimum probation periods and material payments, shall be defined for reclassification to non-defaulted status, especially for distressed restructurings (EBA GL on DoD, para 71-73; ECB Guide, Credit Risk, Section 12, para 170-173).  
\* \*\*External Data Consistency:\*\* When using external or pooled data, appropriate adjustments shall be made to achieve broad equivalence with the internal DoD, if necessary (ECB Guide, Credit Risk, Section 13, para 174).

### 4. Model Development - General Principles

#### 4.1. Scope of Application of Rating Systems  
Rating systems shall cover exposures with common risk drivers and comparable credit-related information (EBA GL on PD and LGD, Section 4.1, para 12). For residential mortgages, this typically implies a dedicated rating system for this exposure class.  
\* \*\*Homogeneous Management:\*\* Exposures within the same rating system shall be homogeneously managed and assigned to common obligor and facility rating scales (EBA GL on PD and LGD, Section 4.1, para 13).  
\* \*\*Consistent DoD:\*\* The same DoD shall be applied for calibration of all models within a rating system (EBA GL on PD and LGD, Section 4.1, para 14).

#### 4.2. Materiality of Rating Systems  
The Bank shall assess and determine the materiality of its rating systems based on quantitative criteria (e.g., share of total EAD and RWEA) and qualitative criteria (e.g., riskiness, strategic importance, complexity, model risk) (ECB Guide, Credit Risk, Section 3.2, para 23). Material rating systems shall be subject to particular scrutiny and enhanced requirements.

#### 4.3. Human Judgement in Model Estimation  
Human judgement may complement statistical models but must be appropriately documented, justified, and proportionate to the number of available observations (CRR Article 174(e), ECB Guide, Credit Risk, Section 15.6, para 195; EBA GL on PD and LGD, Section 4.3, para 35). This includes assessing modelling assumptions, design, and choice of risk drivers.

#### 4.4. Climate-related and Environmental Risks  
The Bank shall assess the materiality of climate-related and environmental risks throughout the internal model lifecycle. Where these risk drivers are found to be relevant and material for residential mortgages, they shall be included in the internal models (ECB Guide, Overarching Principles, Section 8, para 29; Credit Risk, Section 16.1.1, footnote 136; 17.2.1, footnote 170; 17.4.1, footnote 184). This may include:  
\* Physical risks (e.g., flood risk impacting property value and LGD).  
\* Transition risks (e.g., energy efficiency ratings impacting property value and LGD, or borrower's income stability and PD).  
\* If sufficient information related to these risk drivers is not available, the Bank shall consider a more conservative approach in rating assignment or apply an override (ECB Guide, Credit Risk, Section 6.6.1, footnote 77).

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

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)).

#### 5.1. Structure of PD Models  
\* \*\*Risk Drivers:\*\* PD models shall incorporate material risk drivers relevant to residential mortgage obligors (CRR Article 179(1)(a), EBA GL on PD and LGD, Section 5.2.2, para 57). These may include:  
 \* Obligor characteristics (e.g., income, employment status, credit history).  
 \* Financial information (e.g., debt-to-income, other financial commitments).  
 \* Behavioural information (e.g., payment history, use of credit facilities).  
 \* Property characteristics (e.g., location, type, age, energy efficiency).  
 \* Macroeconomic factors (e.g., unemployment rates, interest rate changes).  
\* \*\*Overfitting:\*\* Measures shall be taken against model misspecification due to overfitting, particularly where default data is scarce. Model performance shall be assessed on independent out-of-sample and out-of-time datasets (ECB Guide, Credit Risk, Section 16.1.1, para 203).  
\* \*\*Sub-Ranges of Application:\*\* PD models shall perform adequately on economically significant and material sub-ranges of application (e.g., by region, property type, loan-to-value (LTV) buckets, past delinquency) (ECB Guide, Credit Risk, Section 16.1.1, para 204).  
\* \*\*Multiple Rating Systems:\*\* Where multiple rating systems are used, the rationale for assigning an obligor or transaction to a system shall be documented, and overlaps in application range avoided (CRR Article 169(1), ECB Guide, Credit Risk, Section 16.1.1, para 205).

#### 5.2. Risk Differentiation  
The PD model shall ensure meaningful differentiation of risk over time, considering the distribution of obligors, homogeneity within grades/pools, and distinct risk levels across grades/pools (ECB Guide, Credit Risk, Section 16.1.2, para 206; EBA GL on PD and LGD, Section 5.2.5, para 69).  
\* \*\*Grades/Pools:\*\* The number of grades and pools shall be adequate to achieve meaningful risk differentiation and quantification. Concentrations in any grade or pool must be empirically justified by homogeneity of risk (ECB Guide, Credit Risk, Section 16.1.2, para 209).  
\* \*\*Homogeneity:\*\* Obligors within a grade shall have reasonably similar default risk. Lack of homogeneity (e.g., material subsets with significantly different default rates) shall be addressed (ECB Guide, Credit Risk, Section 16.1.2, para 210).  
\* \*\*Heterogeneity:\*\* There shall be no significant overlaps in default risk distribution between grades (ECB Guide, Credit Risk, Section 16.1.2, para 211).

#### 5.3. Risk Drivers and Rating Criteria  
\* \*\*Selection:\*\* Selection of risk drivers 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).  
\* \*\*Information Reliability:\*\* The decrease in reliability of information over time (e.g., outdated financial statements, credit bureau data) shall be reflected, with conservative adjustments applied where information is lacking (EBA GL on PD and LGD, Section 5.2.2, para 59). For residential mortgages, this applies to property valuation data and borrower income verification.  
\* \*\*Consistency:\*\* Risk drivers and rating criteria shall be used consistently across model development, calibration, and application, especially regarding time horizon (EBA GL on PD and LGD, Section 5.2.2, para 60).

#### 5.4. Grade Assignment Dynamics (Rating Philosophy)  
The Bank shall define an appropriate rating philosophy, understanding its impact on migration across grades/pools and the dynamics/volatility of capital requirements (EBA GL on PD and LGD, Section 5.2.4, para 66).  
\* \*\*Anticipation of Risk:\*\* The rating assignment process shall adequately anticipate and reflect risk over a longer time horizon (2-3 years for most portfolios) and account for plausible changes in economic conditions (ECB Guide, Credit Risk, Section 16.1.3, para 213).  
\* \*\*Monitoring Consistency:\*\* The chosen rating philosophy shall be applied consistently over time and its impact monitored for back-testing purposes (EBA GL on PD and LGD, Section 5.2.4, para 67).

#### 5.5. Treatment of Ratings of Third Parties  
Where the rating of a third party (e.g., guarantor) is considered, clear policies shall specify conditions for its use in risk assessment, ensuring the obligor remains in its original exposure class (EBA GL on PD and LGD, Section 5.2.3, para 62, 64; ECB Guide, Credit Risk, Section 16.1.4, para 215). Transferred ratings shall be updated in a timely manner.

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

The LGD model for residential mortgages shall provide a meaningful assessment of transaction characteristics, differentiate risk, and produce accurate and consistent quantitative estimates of LGD (CRR Article 144(1)(a)).

#### 6.1. LGD Estimation Methodologies  
\* \*\*Own Loss Experience:\*\* LGD estimates shall be based on the Bank's own loss and recovery experience, supplemented by external data where necessary. Methodologies based purely on market prices of financial instruments are not permitted (EBA GL on PD and LGD, Section 6.1.1, para 102; ECB Guide, Credit Risk, Section 17.1.2, para 252).  
\* \*\*Retail/Purchased Receivables:\*\* For retail exposures, LGD estimates may be derived from realised losses and appropriate PD estimates, ensuring consistency with the economic loss concept (EBA GL on PD and LGD, Section 6.1.1, para 103; ECB Guide, Credit Risk, Section 17.1.3, para 257).  
\* \*\*Consistency with Recovery Processes:\*\* LGD estimation methods shall be appropriate to the Bank's activities and consistent with its collection and recovery policies, taking into account possible recovery scenarios and legal frameworks (EBA GL on PD and LGD, Section 6.1.1, para 105).

#### 6.2. Structure of LGD Models  
\* \*\*Risk Drivers:\*\* LGD estimates shall be based on material drivers of risk identified and analysed at the moment of default and at least within a year before default. For residential mortgages, this includes property characteristics, LTV, collateral type, seniority, exposure size, and recovery procedures (ECB Guide, Credit Risk, Section 17.2.1, para 281; EBA GL on PD and LGD, Section 6.2.1, para 121-122).  
\* \*\*Overfitting:\*\* Similar to PD, LGD model development shall take measures against overfitting, assessing performance on independent datasets (ECB Guide, Credit Risk, Section 17.2.1, para 282).  
\* \*\*Sub-Ranges of Application:\*\* LGD models shall perform adequately on economically significant and material sub-ranges (e.g., by region, LTV bands, property type) (ECB Guide, Credit Risk, Section 17.2.1, para 283).  
\* \*\*Grades/Pools:\*\* The number of grades/pools shall be adequate for meaningful risk differentiation and quantification, with empirical evidence of homogeneity within and heterogeneity across grades/pools (ECB Guide, Credit Risk, Section 17.2.1, para 284).

#### 6.3. Eligibility and Inclusion of Collaterals  
\* \*\*Eligibility:\*\* Any type of collateral may be taken into account if internal requirements for collateral management, legal certainty, and regular valuation are met, consistent with CRR Chapter 4 requirements (EBA GL on PD and LGD, Section 6.2.2, para 124). For residential mortgages, this primarily refers to the real estate itself.  
\* \*\*Main Types of Collateral:\*\* Information on all main types of collateral (e.g., primary residential, secondary residential, buy-to-let) shall be considered relevant and included in LGD estimates (EBA GL on PD and LGD, Section 6.2.2, para 126).  
\* \*\*Inclusion Principles:\*\* The approach to including collateral effects shall avoid bias from inappropriate treatment of cash flows or valuation. Separate recovery rates for specific collateral types may be estimated, including direct costs (EBA GL on PD and LGD, Section 6.2.3, para 129).  
\* \*\*Potential Decreases in Value:\*\* Estimates shall account for potential decreases in collateral value from LGD estimation to eventual recovery, reflecting market conditions, state and age of collateral, and currency fluctuations. Potential increases shall not be reflected (EBA GL on PD and LGD, Section 6.2.3, para 129(g)).

#### 6.4. Treatment of Multiple Defaults  
For LGD estimation, if an exposure returns to non-defaulted status and subsequently defaults within nine months, it shall be treated as constantly defaulted from the first default event (EBA GL on PD and LGD, Section 6.1.1, para 101; ECB Guide, Credit Risk, Section 17.1.4, para 263).

#### 6.5. Treatment of Repossessions  
\* \*\*Recognition of Recoveries:\*\* Repossession of collateral shall be treated as a recovery event, with the value of repossession being the amount by which the credit obligation is diminished and the asset is recorded on the balance sheet (EBA GL on PD and LGD, Section 6.1.3, para 116; ECB Guide, Credit Risk, Section 17.1.5, para 268).  
\* \*\*Haircuts:\*\* Where the value of repossession may not adequately reflect the market value, an appropriate haircut shall be applied, estimated assuming an intent to sell the asset as soon as reasonably possible. Haircuts shall be supported by historical observations and back-tested (EBA GL on PD and LGD, Section 6.1.3, para 117; ECB Guide, Credit Risk, Section 17.3.4, para 291).  
\* \*\*Massive Disposals:\*\* Adjustments to LGD estimates due to massive disposals of defaulted exposures (CRR Article 500) shall be applied in accordance with specific conditions and require careful assessment of representativeness and MoC (ECB Guide, Credit Risk, Section 17.1.5, para 264-277).

### 7. Risk Quantification and Calibration

#### 7.1. General Principles of Calibration  
Calibration aims to assign adequate levels of risk parameters to grades or pools, reflecting long-run averages and, for LGD, downturn conditions (EBA GL on PD and LGD, Section 2, para 10).  
\* \*\*Calibration Sample:\*\* The calibration sample shall be comparable to the current portfolio in terms of obligor and transaction characteristics and reflect the likely range of variability of default rates (EBA GL on PD and LGD, Section 5.3.5, para 88).  
\* \*\*Post-Overrides, Pre-MoC/Floors:\*\* Calibration shall be performed after taking into account any overrides, and before the application of MoC or regulatory floors (EBA GL on PD and LGD, Section 5.3.5, para 89).

#### 7.2. PD Quantification: Long-Run Average (LRA) Default Rate  
\* \*\*One-Year Default Rate Calculation:\*\* The one-year default rate shall be calculated based on the number of non-defaulted obligors with any credit obligation at the beginning of the period, with the numerator including all those that defaulted (EBA GL on PD and LGD, Section 5.3.2, para 73; ECB Guide, Credit Risk, Section 16.2.2, para 230). All obligors, even those migrating or with closed obligations, shall be included (EBA GL on PD and LGD, Section 5.3.2, para 76).  
\* \*\*Observed Average Default Rate:\*\* The observed average default rate shall be calculated for each rating grade/pool and calibration segment as an arithmetic average of one-year default rates (EBA GL on PD and LGD, Section 5.3.3, para 79, 81).  
\* \*\*LRA Default Rate Estimation:\*\* The LRA default rate shall be computed as the observed average if the historical observation period (at least 5 most recent years, extended if necessary to reflect a representative mix of good and bad years) is representative of the likely range of variability (EBA GL on PD and LGD, Section 5.3.4, para 82-84; ECB Guide, Credit Risk, Section 16.2.3, para 235-236). If not representative, appropriate adjustments shall be made (EBA GL on PD and LGD, Section 5.3.4, para 85).  
\* \*\*Calibration Tests:\*\* Calibration shall include quantitative tests at both grade/pool level and calibration segment level, as well as qualitative analyses (EBA GL on PD and LGD, Section 5.3.5, para 87, 92; ECB Guide, Credit Risk, Section 16.2.3, para 240, 242, 245-246).  
\* \*\*Direct PD Estimates:\*\* For direct PD estimates, the Bank shall demonstrate that theoretical assumptions are met, ensure good risk differentiation, and avoid undue influence of extreme values (ECB Guide, Credit Risk, Section 16.2.5, para 250).

#### 7.3. LGD Quantification: Realised LGD and LRA LGD  
\* \*\*Realised LGD Calculation:\*\* Realised LGD shall be calculated at a single facility level as the ratio of economic loss to the outstanding amount at default (EBA GL on PD and LGD, Section 6.3.1.1, para 131; ECB Guide, Credit Risk, Section 17.1.3, para 259, 261).  
\* \*\*Economic Loss:\*\* Economic loss includes the outstanding amount at default (plus material direct/indirect costs discounted to default) minus recoveries (discounted to default) (EBA GL on PD and LGD, Section 6.3.1.1, para 132; ECB Guide, Credit Risk, Section 17.1.3, para 261, 262).  
\* \*\*Fees, Interest, Additional Drawings:\*\* Fees and interest capitalised before default are included in the outstanding amount. Additional drawings after default shall be treated consistently with their inclusion in conversion factors (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 shall be discounted using an annual rate composed of a primary interbank offered rate (e.g., 3-month EURIBOR) applicable at 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)).  
\* \*\*Direct and Indirect Costs:\*\* All material direct costs (e.g., legal costs) and material indirect costs (e.g., recovery process overheads) incurred before or after default shall be included in economic loss (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)).  
\* \*\*LRA LGD Calculation:\*\* LRA LGD shall be calculated as an arithmetic average of realised LGDs over a historical observation period, weighted by the number of defaults (EBA GL on PD and LGD, Section 6.3.2.2, para 150; ECB Guide, Credit Risk, Section 17.3.5, para 293).  
\* \*\*Incomplete Recovery Processes:\*\* Relevant information from incomplete recovery processes shall be taken into account conservatively. Future recoveries may be estimated up to a maximum recovery period, supported by observed recovery patterns (EBA GL on PD and LGD, Section 6.3.2.3, para 153, 158; ECB Guide, Credit Risk, Section 17.3.3, para 290).  
\* \*\*No Loss/Positive Outcome:\*\* Where realised LGD is negative (profit), it 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)).  
\* \*\*Calibration Tests:\*\* LGD estimates shall be calibrated to the LRA LGD, with additional calibration tests at relevant granular levels (EBA GL on PD and LGD, Section 6.3.3, para 161; ECB Guide, Credit Risk, Section 17.3.5, para 294).

#### 7.4. 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 for downturn conditions, reflecting elevated levels of average realised LGD (ECB Guide, Credit Risk, Section 17.3.6, para 298, 300, 303; EBA GL on Downturn LGD). Downturn LGD shall be calibrated at the same level as LRA LGD.

#### 7.5. Estimation of ELBE and LGD in-default  
\* \*\*General Requirements:\*\* ELBE and LGD in-default shall be estimated using methods consistent with LGD for non-defaulted exposures, but incorporating all relevant post-default information (EBA GL on PD and LGD, Section 7.1.1, para 167-168; ECB Guide, Credit Risk, Section 17.4.1, para 309).  
\* \*\*Reference Dates:\*\* Discrete reference dates, aligned with observed recovery patterns (e.g., time in default, specific events), shall be used for grouping defaulted exposures (EBA GL on PD and LGD, Section 7.1.2, para 171-172; ECB Guide, Credit Risk, Section 17.4.1, para 309).  
\* \*\*ELBE and MoC:\*\* ELBE shall not include any MoC, as it represents the best estimate of expected loss (EBA GL on PD and LGD, Section 7.3.2.1, para 182; ECB Guide, Credit Risk, Section 17.4.1, para 310).  
\* \*\*Current Economic Circumstances (ELBE):\*\* ELBE shall reflect current economic circumstances, which may involve adjustments to LRA LGD for defaulted exposures if the model's risk drivers are not sufficiently sensitive to economic conditions (EBA GL on PD and LGD, Section 7.3.2.2, para 183-185; ECB Guide, Credit Risk, Section 17.4.1, para 310).  
\* \*\*LGD in-default:\*\* LGD in-default shall reflect at least downturn conditions and be increased for any additional unexpected losses during the recovery period, including an adequate MoC (EBA GL on PD and LGD, Section 7.3.3, para 189-191; ECB Guide, Credit Risk, Section 17.4.1, para 311).

#### 7.6. Appropriate Adjustment (AA)  
The Bank shall apply adequate methodologies to correct identified deficiencies (Category A: data and methodological; Category B: changes in processes/environment) that lead to bias in risk parameter quantification (EBA GL on PD and LGD, Section 4.4.2, para 38; ECB Guide, Credit Risk, Section 19, para 325). AAs shall result in the most accurate "best estimate" possible, be documented, justified, and regularly monitored.

#### 7.7. Margin of Conservatism (MoC)  
The Bank shall add a MoC to its best estimates of risk parameters, reflecting 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).  
\* \*\*Categories:\*\* MoC shall be quantified for three categories: A (data and methodological deficiencies), B (changes in processes or external environment leading to uncertainty), and C (general estimation error) (EBA GL on PD and LGD, Section 4.4.3, para 42).  
\* \*\*Quantification:\*\* MoC for A and B shall reflect additional uncertainty from adjustments or uncorrected deficiencies. MoC for C shall reflect the dispersion of the statistical estimator (EBA GL on PD and LGD, Section 4.4.3, para 43). For residential mortgages, this includes statistical uncertainty in historical default/loss rates and the impact of data scarcity for specific LTV bands or regions.  
\* \*\*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).  
\* \*\*Non-Negative:\*\* MoC for general estimation error (C) shall be greater than zero. MoC for A and B shall be greater than or equal to zero (EBA GL on PD and LGD, Section 4.4.3, para 47).  
\* \*\*Documentation and Monitoring:\*\* MoC levels shall be documented, regularly monitored, and reviewed. Plans to rectify deficiencies and reduce estimation errors shall be in place (EBA GL on PD and LGD, Section 4.4.3, para 49-51).

### 8. 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.

#### 8.1. Internal Validation  
The internal validation function shall perform comprehensive validation activities.  
\* \*\*Content and Frequency:\*\* Validation shall include qualitative and quantitative methods, assessing ranking power and calibration appropriateness. Annual validation is required, with full validation for material systems at least every three years (ECB Guide, Credit Risk, Section 4.3, para 50-52).  
\* \*\*Key Analyses:\*\* Validation shall encompass back-testing, discriminatory power, representativeness, stability analyses (obligor/facility migrations, concentration in grades), model specifications, input data evaluation, benchmarking against external data, data cleansing analyses, and quality assurance of computer codes (ECB Guide, Credit Risk, Section 4.3, para 52).  
\* \*\*Thresholds:\*\* Quantitative thresholds shall be set for key tests (back-testing, discriminatory power, overrides, stability) to trigger further investigation and action upon breach (ECB Guide, Credit Risk, Section 4.3, para 54).

#### 8.2. Management Reporting  
Validation results, including conclusions, recommendations, and identified deficiencies, shall be reported to Senior Management and the Management Body (ECB Guide, Credit Risk, Section 4.4, para 56). An aggregated overview of validation results for all rating systems shall be provided at least annually.

#### 8.3. Review of Estimates  
The Bank shall review its estimates at least annually, or whenever new information comes to light (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) (EBA GL on PD and LGD, Section 9, para 218).  
\* \*\*Materiality:\*\* For material models, an analysis of whether 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).

#### 8.4. Model Changes and Extensions  
Changes to a rating system's range of application or to the system itself are subject to supervisory approval (material changes) or notification (non-material changes) (ECB Guide, Credit Risk, Section 7, para 96).  
\* \*\*Change Policy:\*\* A comprehensive "change policy" shall define responsibilities, methods, metrics, and significance levels for materiality assessment, classification, impact assessment, notification, and documentation of changes (ECB Guide, Credit Risk, Section 7.2, para 98).  
\* \*\*Impact Assessment:\*\* Quantitative (on RWEAs) and qualitative assessments shall be performed, using the most recent data (ECB Guide, Credit Risk, Section 7.5, para 103-107).  
\* \*\*User Acceptance Test:\*\* The impact of changes on the use of parameters shall be assessed and documented, ensuring continued relevance of internal policies (ECB Guide, Credit Risk, Section 7.5.1, para 108-109).  
\* \*\*Re-rating Process:\*\* For material changes, an immediate re-rating process is expected. If not possible, for non-retail systems, re-rating shall occur within 12 months, with RWEA impact simulated and applied until full re-rating (ECB Guide, Credit Risk, Section 7.6, para 113-114).

### 9. Model Use and Application

The Bank shall ensure that internal ratings and default/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)).

#### 9.1. Use Test Requirement  
Internal ratings and estimates shall be extensively used in internal processes. 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).

#### 9.2. Human Judgement/Overrides in Application  
\* \*\*Policy and Criteria:\*\* Clear policies shall define situations for overrides (inputs or outputs of rating assignment), specify maximum limits for non-conservative overrides, and require appropriate justification and documentation for each override (CRR Article 172(3), EBA GL on PD and LGD, Section 8.2, para 203-204; ECB Guide, Credit Risk, Section 6.6.3, para 90-91).  
\* \*\*Monitoring and Analysis:\*\* The level and justifications for overrides shall be regularly monitored. Excessive overrides, or an accumulation of inappropriate justifications, shall trigger investigation into model weaknesses and potential model improvement (EBA GL on PD and LGD, Section 8.2, para 205; ECB Guide, Credit Risk, Section 6.6.3, para 93).

#### 9.3. Non-rated Exposures and Outdated Ratings  
The Bank shall have internal policies to prudentially monitor and manage non-rated exposures and outdated ratings (e.g., ratings not updated within 12 months, or based on outdated financial information) (CRR Article 144(1)(h), 173(1)(b), ECB Guide, Credit Risk, Section 6.6.2, para 84). Conservative measures (e.g., time-dependent downgrading, application of worst-performing grade) shall be applied to mitigate underestimation of own funds requirements (ECB Guide, Credit Risk, Section 6.6.2, para 86).

#### 9.4. IRB Shortfall/Excess  
The Bank shall calculate IRB shortfall or excess in accordance with CRR Article 159, comparing expected losses with credit risk adjustments. This calculation shall be performed at an aggregate level, separately for defaulted and non-defaulted portfolios, to ensure appropriate capital treatment (EBA GL on PD and LGD, Section 8.4, para 211-213). 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).

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