Just in Time

EBA Supervisory Handbook on the Validation of Rating Systems Under the Internal Ratings-Based Approach

Part 2 - Focus on Modelling Environment and Other Points and Specific Challenges

Oct 2023

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Executive Summary

- In August 2023, the **European Banking Authority (EBA)** published its ***Supervisory handbook on the validation of rating systems under the Internal-Ratings Based approach*** (EBA/REP/2023/29).
- The handbook provides an **overview of the validation framework** and describes the **elements where the Validation function is expected to form an opinion**. It covers both the tasks related to the **model performance assessment** as well those dealing with the **modelling environment**, such as data quality and model implementation assessment.
- With the publication of the handbook, the EBA aims to achieve **harmonised supervisory understanding and supervisory practices** and to **promote convergence on Competent Authorities (CA) approaches** by providing **good and best practices** for a sound IRB validation.
- The present publication is organized in **two parts**. The first one, presented in the previous publication (available here), focused on the assessment of the **risk differentiation** and **risk quantification** phase. This second part, following a brief introduction, focuses on the assessments the Validation function is expected to perform on **other specific points** and on the **modelling environment**, as well as on **specific challenges** for the Validation when dealing with external data, outsourcing and data scarcity.

At a Glance

Keywords: EBA, Credit Risk, IRB models, Model Validation

01

Introduction

Background and Objectives of the EBA Supervisory Handbook

Specificities of the Validation in the Regulatory Framework

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Background and Objectives of the EBA Supervisory Handbook

In August 2023, the **European Banking Authority (EBA)** published *its* ***Supervisory handbook on the validation of rating systems under the Internal-Ratings Based approach***, through which the EBA aims to achieve **harmonised supervisory understanding and supervisory practices** and to promote convergence on Competent Authorities (CA) approaches by providing **good and best practices for a sound IRB validation**.

Background and legal status

EBA is mandated to develop a supervisory handbook by **Article 8(1) of EBA Regulation**[1], which states that EBA shall "***develop and maintain an up-to-date Union supervisory handbook on the supervision of financial institutions*** *in the Union which is to set out* ***supervisory best practices and high-quality methodologies and processes*** *and takes into account, inter alia, changing* ***business practices and business models*** *and the* ***size of financial institutions and of markets***". In addition, **Article 29(2)**, of the same Regulation specifies that "*For the purpose of* ***establishing a common supervisory culture****, the Authority shall* ***develop and maintain an up-to-date Union supervisory handbook on the supervision of financial institutions*** *in the Union, which duly* ***takes into account the nature, scale and complexity of risks, business practices, business models*** *and* ***the size of financial institutions and of markets.***"

Objectives of the handbook

The **objective of the EBA supervisory handbook** is to ensure a **robust measurement of credit risk** within the IRB approach and, ultimately, to contribute to **reducing the unjustified variability of *Risk-Weighted Exposure Amount* (*RWEA* or *RWA*)** stemming from different supervisory and bank-specific practices. At the same time, the handbook aims to achieve a **harmonized supervisory understanding** by providing an outline of **best practices**, promoting **convergence of approaches used by Competent Authorities (CAs)**, within both institutions (in terms of **validation frameworks**) and supervisors (in terms of **supervisory practices and expectations**).

1 *Regulation (EU) No 1093/2010 establishing a European Supervisory Authority (European Banking Authority).*

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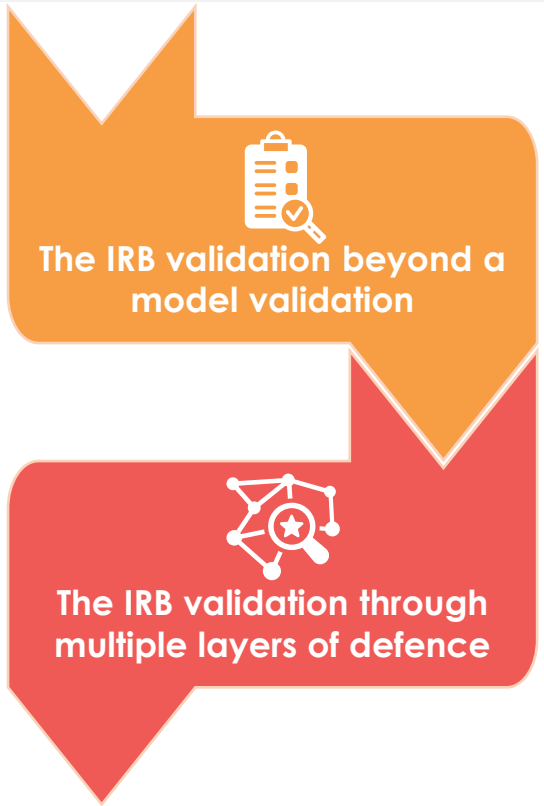
Specificities of the Validation in the Regulatory Framework

EBA generally defines the **model validation activity** as a **process whose aim is to prevent models from producing inadequate results** by **effectively challenging** them and by **assessing and identifying possible assumptions, limitations and shortcomings**.
However, in the context of **IRB rating systems** and for the purpose of the supervisory handbook, EBA outlines that the definition of model validation entails a **broader set of activities and controls**, whose responsibility falls on **several functions**, each of them with its own perspective.



According to EBA, **the validation of IRB rating systems goes beyond the pure concept of model validation** and shall **not be limited to the proper functioning** of the model from a **statistical perspective**.
As a matter of fact, it also includes the **assessment of data quality**, the **structure of the rating system** and its **correct application** as well as the set of **policies**, **processes** and **procedures** put in place to assess the **accuracy and performance of the rating systems** on the institution-specific portfolios and to verify that the **models used by the institutions work properly**.

The activities related to IRB models validation are **not exclusively attributable to the Internal Validation function** but follow specific organizational requirements. In particular, the assessment of the model performance is conducted by several functions, each of them with its own perspective. While the **Credit Risk Control Unit (CRCU) is the first function to analyse and validate the model**, a specific **independent Validation function with its own responsibilities is required and essential** to allow for an **objective assessment of the rating systems** by people not involved in the development process. Other activities can fall under the **responsibility of other organizational units**, such as the **Data Quality unit** and **Internal Audit function**, which are however not in scope of the present document.

Focus of the presentation is on the tasks of the Validation function

02

General Principles for the Validation Framework

Scope, Objectives and Tasks of the Validation

Validation Policy and Validation Report

General Principles for the Validation Framework 1/2

Scope, Objectives and Tasks of the Validation

1 Scope and objectives of the validation

The internal validation activities should be performed at **each level where a CA has granted approval** for a rating system.
In the case where a rating system is used at **different levels of a group**, the **Validation functions of the involved entities are expected to share their findings**.
The Validation function is expected to **form an opinion** on whether the final rating system meets the regulatory requirements, and to this aim, it is **expected to provide a list of all the deficiencies identified** along with an **assessment of their materiality and severity**, an **assessment of the consequences** of these deficiencies on the performance of the rating system, and an evaluation on the level of confidence in the results of its assessments.
Outcomes of the validation analyses shall be communicated to the senior management and the management body, who are expected to understand the model deficiencies and be able to decide on a remediation action plan.

2 Independence of the Validation function

As a second layer of defence, the Validation function **should challenge in an independent manner** the choices made by the CRCU during the model development. Independence of the Validation function is crucial to **prevent any conflict of interest** and to **ensure no subordination** in relation to the CRCU, and is guaranteed by **two means**:

- **structural independence**, ensured via an adequate organizational setup;
- **sufficient resource allocation**, i.e., the number, seniority and expertise of the validation staff should be **commensurate with the complexity and materiality** of the rating systems to be validated.

3 Validation tasks

Institutions shall have **robust systems** in place to **validate the accuracy and consistency of rating systems**, **processes** and the **estimation of relevant risk parameters**, with validation methods **appropriate to the nature**, **complexity** and **range of application** of rating systems and to the **data availability**. This should be done by the Validation function by:

- **Assessing the CRCU's work and related documentation**, reviewing and challenging the steps performed and the decisions made;
- Forming an **opinion on the accuracy and consistency of the rating system** as a whole, also via statistical tests;
- **Reviewing the materiality of all rating systems changes and extensions** and their overall effects;
- **Developing and implementing validation methods and procedures** which should be **consistent** and **meaningful** across rating systems as well as over time.

General Principles for the Validation Framework 2/2

Validation Policy and Validation Report

Two fundamental elements of a sound and robust validation framework are the **validation policy** and the **validation report**. The former documents the **validation framework, roles, responsibilities, processes and content of the validation activities**, while the latter has the goal to **communicate**, in a clear and comprehensive manner, **how the validation policy has been applied to a particular rating system** and the **results of the validation activity**.

Validation policy

The **validation policy** documents the validation framework, i.e., it defines the **roles, responsibilities, processes and content of the validation activities** that are expected to be performed in a sufficiently precise manner such that a third party can gain a good understanding of the tasks the Validation function will perform. It is expected to include:

- A **description of how the validation forms its opinion on the rating system** and the **aggregation methodologies used across different analyses**;
- A **description of the data collection** and **selection process** underlying the **construction of the validation datasets**;
- The **list of analyses to be performed** and a description of their **purposes**, **limitations**, **scope**, **frequency** and **methodology**, including details on **data preparation, computation, targets and tolerance thresholds** for quantitative analyses;
- The **conditions** under which the **Validation function may leverage on the work performed by the CRCU**;
- The main **content**, **frequency** and **recipients** of the **validation reports**.

Validation report

The **validation report** structure is left to the Validation function's judgement, so as to **optimise the communication of its opinion**, and is not expected to be harmonized across institutions, nor across different rating systems within the same institution. Nevertheless, it shall at least detail:

- The **rating system version subject to validation**, and a description of the on-going model development activities, as well as an **opinion of the Validation function on the rating system changes**, including their materiality assessment;
- The **relevant tests performed to challenge the rating system** along with a **description of the data preparation steps** and the related **data quality of the validation samples**;
- The **outcomes of the validation analyses** and **clear opinions on the performance of the rating system**, with findings categorized in accordance with their materiality (e.g., **traffic light approach**);
- A **comparison between the latest results of the validation** and **the ones observed in the previous years**.

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Validation Content

The Validation Cycle: First Validation and On-going Validation

Assessment of the Core Model Performance

Assessment of the Modelling Environment

Validation Content 1/6

The Validation Cycle: First Validation and On-going Validation

Regarding the validation content, the actual tasks to be performed by the Validation function may differ depending on the position in the **validation cycle**, which leads to the distinction between **first validation**, which is the assessment conducted on the rating system **before submitting the application to the Competent Authority (CA)**, and **on-going validation**, which includes the activities to be conducted **after the rating system has been approved by the CA**.

First validation

The **first validation activities** take place during or subsequently to the model development, to assess the **regulatory compliance** and **performance of the rating system**, in view of receiving approval from the CA. The first validation aims at ensuring:

- the **appropriateness of the rating system** once being used for own funds requirements and internal risk management;
- that the newly developed rating system is **ready for a supervisory assessment**.

An important focus point is then on the **methodological choices** of the CRCU regarding the **model design** and the **risk quantification**, since they are assessed by the Validation function for the first time.

The Validation function is then expected to **assess and challenge the modelling and calibration choices** in a comprehensive and independent manner.

The first validation of the rating system can be used as a **starting point for the on-going validation** and the related validation activities that are required to be conducted after the granting of regulatory approval.

On-going validation

On-going validation aims at ensuring an **effective challenge** for the **adequate model performance** and **appropriateness of the rating system on an on-going basis**. In this regard, the outcome of the on-going validation will typically be taken into account in the on-going supervisory assessment performed by the CA.

The on-going validation differs from the first validation as it benefits from **additional data** and from **previous conclusions** from the first validation, on which the assessment of the Validation function can be based for some specific tasks. During on-going validation:

- on the empirical side, the Validation function should form an opinion on the **performance of the model over time**, comparing results obtained using latest available data with those observed in the previous periods;
- on the methodological side, the Validation function is expected to **assess the identified deficiencies over time**, i.e., to verify that all planned changes have been implemented;
- in case of a rating system change, the Validation function should **check the materiality of rating system changes** that occurred since its last review.

Validation Content 2/6

Assessment of the Core Model Performance: Overview

The activities the Validation function is expected to perform focus on two main areas: the **assessment of the core performance** of the rating system and the **assessment of modelling environment**. While the risk differentiation and risk quantification aspects have been already covered by the previous publication, the present one focuses on the other assessments the Validation Function should perform, including the assessment of **other specific points of the model performance** (slides 13-15) and of the **modelling environment** (slide 16).

Following the structure defined by **Reg. EU 575/2013 (CRR)**, the **assessment of the core model performance** follows the distinction between **risk differentiation** and **risk quantification**. In addition, **other specific points** must be assessed by the Validation function in terms of performance of the rating system.

OTHER SPECIFIC POINTS

The Validation function is also expected to assess the following **three aspects** of rating systems:

1) the methodology used to derive **LGD in-default** and **expected loss best estimates (ELBE)** for defaulted exposures;
2) **Credit Risk Mitigation (CRM) techniques**;
3) Exposure-weighting using the **slotting approach**.

See slides 13-15

In the context of the assessment of the core model performance, the Validation function is also expected to form an opinion on the **compliance with regulatory requirements of IRB metrics used by the CRCU**. In addition, regarding the **correct implementation of the definition of default (DoD)**, the Validation function is expected to **review the documentation related to the definition of the default** and **related impacts on the RDS**, as it might determine some issues in the model development or risk quantification.

Validation Content 3/6

Assessment of the Core Model Performance: Other Specific Points 1/3

Validation of rating systems in relation to defaulted exposures, CRM techniques and slotting approach

1 – Specificities related to the validation of defaulted exposures' risk parameters

The validation of the LGD within a rating system encompasses a **specific review for defaulted exposures** (**LGD in-default** and **ELBE**). In general, it is expected that all relevant validation activities are performed but **using appropriately defined reference dates** instead of the dates of default. These dates should be **consistent with observed recovery patterns,** and it should be checked that the **realised LGDs are appropriately calculated**. Moreover, concerning the RDS validation it is important to verify that all relevant information from and after the default have been taken into account.

- **ELBE specifics:** ELBE parameters should **not include any adjustments for conservatism nor MoC**, and **they should be reflective of economic conditions**. In addition, the Validation function is expected to check that any situations where the **specific credit risk adjustments exceed the ELBE amounts** are justified adequately;
- **LGD in-default specifics:** the Validation function is expected to **compare the average LGD estimates immediately before and after default** in order to check consistency between defaulted and non-defaulted estimates and it should verify that the LGD in-default is always higher that the ELBE by a sufficient margin to cover for the effects of the downturn, MoC and potential additional unexpected loss.

Validation cycle specificities

First validation

With respect to the **assessment of the risk parameters for defaulted exposures**, **all the analysis** described in section are
expected to be performed.

On-going validation

In the context of the regular validation, regarding the general assessment of the risk parameters for defaulted exposures, the Validation function performs an **assessment of whether new systematic deviations between realisations and estimates were observed on the most recent data**. On the other hand, with respect to **all other assessment mentioned, the Validation function may rely on its previous assessments.**

Validation Content 4/6

Assessment of the Core Model Performance: Other Specific Points 2/3

Validation of rating systems in relation to defaulted exposures, CRM techniques and slotting approach

2 – Specificities related to the validation of Credit Risk Mitigation

Exposures benefitting from a CRM are subject to all the general requirements already discussed in the part dedicated to risk differentiation and quantification, and additionally to some **specific requirements to ensure a prudent and consistent recognition of the CRM effects**. In general, it is required that any validation activities on exposures with CRM are performed at least at the same level (e.g., obligor or facility level) than those on exposures without CRM and that it is checked that there is no double counting in the recognition of any CRM in the estimates.

Moreover, some specific requirements are foreseen:

- **Validation of the RDS:** the Validation function is expected to check that the **source of the recovery cash flows is properly identified**, that the data contains the information on the eligibility of the CRM for each exposure and the overall traceability of the recoveries;
- **Recognition of Funded Credit Protection (FCP) effect:** the Validation function should check that **cases with adverse dependency** between the **risk of the obligor and that of the collateral** are dealt with an appropriate level of conservatism;
- **Recognition of Unfunded Funded Credit Protection (UFCP) effect:** the recognition of the effect of UFCP can be performed according to three **different methods** (modelling approach, substitution of risk parameters approach and override approach), which must be consistent (in case of multiple CRM) and satisfy all requirements outlined in the EBA GL on CRM[1];
- **Multiple CRM:** the use of multiple CRM can bring **additional modelling challenges**, which are expected to be checked by the Validation function.

Validation cycle specificities

First validation

With respect to the **assessment of the CRM, all the analyses** described on the left are expected to be performed.

On-going validation

With respect to the assessment of the specificities of the **incorporation of the CRM in the risk parameters**, the Validation function may **rely on its previous assessments**.

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Assessment of the Core Model Performance: Other Specific Points 3/3

Validation of rating systems in relation to defaulted exposures, CRM techniques and slotting approach

3 – Specificities related to the validation of the slotting approach

The Validation is expected to assess the **consistency and replicability of the exposure assignment process to specialised lending exposure category** and subsequently the **assignment of such exposures into a specific slotting approach.** In the assessment of the input data, it is good practice to perform **representativeness analysis on long and short-term exposures separately** (at a 2.5 years threshold).

When assessing the modelling choices three topics should be reviewed:

3.a. **The selection of relevant information** and rating criteria by challenging any deviation from the definition of the sub-factor components as defined in the CDR on slotting approach[1];

3.b. **The aggregation of relevant information**, starting from the categorization methodology of sub-factor components up to reviewing the weights used to aggregate the relevant factors' category;

3.c. **The definition of obligor grades** by verifying that minimum number of grades should match the number of categories prescribed by Art. 170(2) CRR.

Finally, the **predictive power** is expected to be assessed, but as some of the dimensions described in the risk differentiation section might not be fully appropriate, these analyses may be conducted **via specific challenger analyses.**

Moreover, the Validation function should perform some **general challenger analyses**:

- Challenge the **use of overrides**;
- Use other **external data sources**;
- Assess **monotonicity** of the observed loss rates.

Validation cycle specificities

First validation

With respect to the **assessment of the slotting approach, all the analyses** described on the left are expected to be performed during the **first validation**.

On-going validation

Using the most recent data available, the Validation function is expected to focus on:

- The assessment of **representativeness of exposures** (in particular, if there is a change in the granting or renewal of loans when it comes to maturity and bullet payments);
- The **specific challenger analyses**;
- The **general challenger analyses**.

Validation Content 6/6

Assessment of the Modelling Environment: Data Quality and IT Implementation

Data quality and maintenance

To ensure a proper assessment of the data quality and maintenance, the **data quality framework should define clearly the policies, roles and responsibilities in data processing and data quality management**. It should **cover all relevant data quality dimensions**, including completeness, accuracy, consistency, timeliness, uniqueness, validity, and traceability, and should **cover the full data life cycle**, from data entry to reporting, and should **encompass both historical data and current application databases.**

The Validation function is expected to **form an opinion on the above-mentioned data quality dimensions for data used for IRB modelling**. It should check the quality of both the data used for its own validation activities as well as the data used by the CRCU for the estimation of risk parameters. In case **any error is detected** in the data, it should **assess its impact in the estimation** of risk parameters.

To form such opinion, the Validation function should **check that any data used in model development and risk quantification is encompassed by the institution's data quality framework**. To perform this check, the Validation function is **expected to have access to the relevant data quality management reports** submitted to the institution's senior management.

IT implementation of the rating system

The Validation function is expected to **verify the adequacy of the implementation of internal ratings and risk parameters in IT systems**. For this purpose, it expected to **analyse the relevant functional documentation** and **check the consistency with the rating system documentation**. Moreover, it should ensure that the implementation of the rating system in the relevant IT systems is compliant with and reproduces exactly the documented rating system under review.

Validation cycle specificities

First validation

The Validation function is expected to conduct its **data quality analysis along two dimensions: on the RDS for the modelling development, and for the application of the model.**

Regarding the IT implementation all analyses are to be performed to ensure that the model in production reproduces the business and functional requirements defined by the new or changed model.

On-going validation

The Validation function is expected to **assess the data quality management reports submitted to the institution's senior management** directly such that it is aware of any new deficiency. In addition, it is expected to **check how the previously identified deficiencies have been treated and addressed by the CRCU**.

With respect to the **assessment of the adequacy of the implementation**, the Validation function can rely on its previous assessment.

04

Focus on Specific Validation Challenges

Validation in the Context of the Use of External Data

Validation in the Context of Outsourcing of Validation Tasks

Validation in the Context of Data Scarcity

Focus on Specific Validation Challenges 1/3

Validation in the Context of the Use of External Data

In the specific situation where a **rating system is developed on a broader range of exposures than it is afterwards applied** (i.e., with **external data on additional obligor or facilities** added to the RDS vis-à-vis the application and historical portfolios), the validation of the rating system is not expected to materially differ from the validation of other rating systems but **entails some specificities**.

The use of external data without adding obligors or facilities **does not fall within the cases described in this slide,** whose cases in scope are instead:

- **Case 1**: the development of the rating system is based on **both internal and purchased external data stored in the internal systems**, i.e., to which the institution has access to;
- **Case 2**: the development of the rating system is **based on internal data**, as well as on **external data to which the institution does not have access to**. In practice, this can be the case when the rating system is developed:
  a) **at group level** while used at stand-alone level of multiple subsidiaries, or
  b) **externally** based on **pooled data of several institutions not belonging to the same group**.

The validation of a rating system built on external data is expected to follow the **five principles on the right**.

1. **Appropriateness of the use of external data (representativeness)**: the representativeness for risk differentiation and risk quantification is expected to be **carefully assessed vis-à-vis the individual entity's application portfolio**. The Validation function is expected to **challenge the appropriateness of the external data used**, and to **carefully review the quantification of the (Category A) MoC**.

2. **Access to data**: the Validation function is expected to be in a position to **challenge methodological choices** related to the development of the rating system and to **perform addition quantitative analyses**. In the cases 2.a and 2.b, this implies that it has the possibility to **request any further analyses** from the data provider.

3. **Methodological choices' assessment**: the Validation function is expected to **assess whether any bias has been introduced due to the duplication of observations** on the same obligors or facilities used in the risk quantification.

4. **Performance assessment**: even if the rating system has been developed using external data, the quantitative evaluation of its performance is expected to be **performed first on the internal data**. In addition, in the case where external data is used to circumvent **data scarcity issues**, the previous assessment can be complemented by an assessment of the performance **using all data available**.

5. **Data quality**: the external data **is not expected to be treated differently** than internal data in terms of data quality assessment from the moment where it is stored in the internal system of the institution. In addition, the Validation function is expected to **form an opinion on the data quality framework of the data provider.**

Focus on Specific Validation Challenges 2/3

Validation in the Context of Outsourcing of Validation Tasks

Where an institution takes the decision to start the process of **outsourcing** **certain operational tasks of the Validation function**, it is expected to perform a **comprehensive analysis** of its **compliance with all the regulatory requirements on outsourcing**, according to the **general principles** outlined below. In particular, any changes to the validation methodology and/or validation processes of existing IRB models have to be assessed and subsequently **notified to the CA**.

1 **Non-transferability of the responsibility**: in this context only 'operational tasks of internal control functions' can be outsourced to anyone outside of the **validation function**, which should in any case **retain the responsibility of the opinion and of the final assessment on the rating system**, of its validation policy and of the correct implementation of the validation methodology.

2 **Involvement of the senior management and management body**: **the management of the Validation function should remain responsible for all validation activities** and should approve all changes to validation methodologies and/or validation processes and reports.

3 **Assessment of the outsourcing providers**: the **outsourcing policy** of the institution should detail the elements to be analyzed when performing the **assessment of the outsourcing providers**.

4 **Communication with the CA**: all planned outsourcing of operational tasks of the Validation function **has to be communicated to the CA in a timely manner**.

5 **Transparency of outsourcing**: outsourcing requires to retain a **clear and transparent organizational framework and structure**. To that end, any outsourcing of operational tasks should be **properly documented**.

6 **Access and inspection in the context of outsourcing**: the institution as well as the CA has to have **full access to the service provider** and **unrestricted rights of inspection** and **auditing** related to the outsourced operational tasks.

7 **Quality of outsourced operational tasks**: institutions should monitor the performance of the service providers **on an on-going basis**.

8 **Business continuity in the context of outsourcing**: the existence of a **business continuity plan** is required. Therefore, the institution must be able to either transfer the function to **alternative service providers** or **reintegrate the function** within an appropriate time frame.

9 **Intragroup outsourcing**: when it comes to **outsourcing within a banking group** it is also not possible to outsource any part of the Validation function **with the exception of operational tasks**.

Focus on Specific Validation Challenges 3/3

Validation in the Context of Data Scarcity

Data scarcity refers to the **lack of a sufficient number of observations on the empirical realization of 'risk metrics'**, i.e., defaults, realised LGDs and realised CFs.

Adaption of the validation policy

Validation policy is expected to provide:

a) **Specific metrics or tolerances defined**: special attention has to be paid to the interpretation of the results. In any case, statistical uncertainty stemming is expected to be treated conservatively when it comes to drawing conclusions;

b) A **description of complementary analyses** to supplement quantitative measures;

c) An **adjustment when using external data**, as provided for **in the previous slide**.

Specific assessment of the risk differentiation

The Validation function is expected to verify:

a) Whether the **main risk drivers of the observed defaults and losses are appropriately reflected in the model** by analysing observed individual defaults;

b) The **adequacy of the number of rating grades and pools** in relation to the available data to allow for a quantification and validation of the default and loss characteristics at grade or pool level.

Specific assessment of the risk quantification

In case a second-best approach is used for either retail or purchased corporate based on an estimate of total losses, **the back-testing is expected to be performed on the estimated parameters** as well as on the 'intermediate parameters' (i.e., total losses).

Examples of alternative validation approaches where certain statistical tests are not applicable

Risk differentiation

- Comparison with internal credit expert ranking

Risk differentiation and risk quantification

- Aggregation of data from different observation periods or consideration of analyses based on multi-year periods
- Data enhancements
- Testing with external benchmarks

Risk differentiation – OOT and OOS validation samples

- Complement the tests performed by the CRCU with in sample tests and qualitative analysis
- Conduct the validation solely based on either an OOT or an OOS sample
- Leverage on the analyses performed by the CRCU, where the CRCU has assessed the performance of the model via OOT and OOS samples only during intermediate steps
- Other approaches based on simulations or bootstrapping techniques

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