Model Validation Report

Model Name:

Model ID:

Report Date:

**Document Version History**

| **Version #** | **Date** | **Author** | **Approved By** | **Version Description** |
| --- | --- | --- | --- | --- |
| X.X | MM/DD/YYYY | <Insert Author name> | <Insert Approver name> | <Insert a brief summary of changes made in the version> |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Model Identification and Stakeholders Summary:**

| **Model Name** | [Insert model name] |
| --- | --- |
| **Model Version** | [Include model version X.X] |
| **Model ID** | [Include Model ID] |
| **Model Developer/Vendor:** | [Include name of developer or vendor] |
| **Model Validator:** | [Include name of validator] |
| **Business Unit/Department:** | [Identify users of the model] |
| **Model Owner (Position):** | [Include name of model owner and position] |

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# Executive Summary

[The purpose of this section is to provide a high-level overview of the model, the validation outcome, and the findings identified.]

## Model Purpose and Use

[Provide a clear description of the model purpose and use(s). Identify which business function this model is used for and covered products as well as restrictions. If the model has specific regulatory requirements, provide a summary and briefly comment on compliance with such requirements.]

## Model Description

[Provide a brief description of the model and theoretical framework, including brief description of inputs and outputs. Include description of model category, business area, portfolio sizes / exposures, and management actions driven / impacted by the model]

## Model Risk Tier

[Include the model risk tier as well as the components used for its determination.]

## Validation Scope

[Identify the scope of the validation conducted; i.e. state whether this is a full scope, a revalidation, or a change-based validation:

* Full Scope validation: done when a new model is requested to be used in production, as well as for major model changes
* Change-based validation: targeted validation when revisions or a material change to targeted area is made to the model
* Revalidation: Occurs periodically or when a model is posing high residual risk (breaching monitoring thresholds, failed annual reviews). Periodic revalidations are based on risk tier of the model:
  + Every 2 years for high risk models
  + Every 3 years for medium risk models
  + Every 5 years for low risk models]

## Validation Outcome

[Provide the outcome of the validation, which should be reported as one of the following [3] outcomes, along with rational for assigning the outcome; i.e. conclusions of the model validation.

* Approval: unconditional approval of the model
* Conditional Approval: an approval contingent on the resolution/mitigation of identified findings
* Rejection: a model is generally rejected due to significant modeling deficiencies and weaknesses, rendering the model inappropriate for the intended usage. In such cases, the model will require further development or immediate resolution to be further considered for validation]

## Validation Findings

[Over the course of the validation, observations may be made by the validator(s) about different aspects of the model. Observations can be raised as findings if they are deemed model issues. Depending on the nature of the finding, actions by the developer(s) or owner(s) may be required.]

Findings should be listed in the following format:

| **Finding ID#** | **Category** | **Description** | **Severity** |
| --- | --- | --- | --- |
| **1** | [Data, Conceptual Soundness, Implementation, Performance Testing, Model Use] | [Include description of the finding] | [High, Medium, or Low] |
| **Response:** [Management, developer, or owner to provide a response to the finding and planned resolution/mitigation] | | | |

| **Finding ID#** | **Category** | **Description** | **Severity** |
| --- | --- | --- | --- |
| **X** | [Data, Conceptual Soundness, Implementation, Performance Testing, Model Use] | [Include description of the finding] | [High, Medium, or Low] |
| **Response:** [Management, developer, or owner to provide a response to the finding and planned resolution/mitigation] | | | |

# Model Assessment

## Development Overview

[Provide a brief description of the model development process employed by the developers for:

* Development data (including sources, sampling, and transformations)
* Theoretical approach and model design
* Model selection process
* Model segmentation
* Production platform, including upstream and downstream dependencies
* For vendor models, include name of third-party vendor and a brief overview of customization and implementation
* End-to-end model implementation process, including a process flow diagram as applicable]

## Development Documentation

[Assess whether development documentation is sufficient, including descriptions of:

* Comprehensiveness and transparency of model documentation
* Consistency of all aspects of the model with documentation
* Inclusion of all challenge sessions that occurred as a part of validation
* Availability of full development data set]

## Input and Data Integrity

[Provide a description of the model inputs and development data and asses the data calibration methods presented by developers in development documentation. Provide an assessment of any analyses or tests related to data characteristics that were performed by the developer and the validation team.

### Input Data Source

[Assess the suitability of the model input data for the modeling purpose including descriptions of:

* Definition, reliability, and appropriateness of chosen data source
* Consistency of chosen data source with typical industry practice
* Sufficiency of data quality checks and acceptability of outcomes
* Appropriateness of the use of qualitative data (i.e. expert judgment)
* Clear identification and assessment of data limitations
* Checks for quality of data feeds from the source]

### Data Transformation, Cleaning

[Assess that data transformation, cleaning, processing, and handling capabilities are appropriate, including descriptions of:

* Proper extraction of data from raw data source
* Appropriateness of data transformation, cleaning, processing, and handling procedures
* Utilization of reconciliation check post-data transformation, cleaning, processing, and handling to ensure final data sample consistency with sample pulled from raw source]

### Final Model Development Dataset

[Assess the dataset used during development, including descriptions of:

* Consistency of data sample design with modeling objective, typical industry practice, regulatory guidance, and intended use of the model
* Appropriateness of data sample and data proxies for the given purpose
* Consistency of sampling method with industry best practice and statistical theory
* Consistency of data sample generation
* Appropriate justification of data exclusions]

## Conceptual Soundness

### Methodology

[Provide an assessment of the model methodology and structure including, but not limited to:

* A description of the model approach and processing components that implement the theory, including the mathematical specification and the numerical techniques and approximations
* Critical Review of any approximations, judgmental and qualitative aspects of the model, where applicable
* The appropriateness and soundness of the chosen mathematical structure /design of the model.]

### Suitability

[Assess whether the modeling methodology utilized is appropriate, including descriptions of:

* Appropriateness for the stated business purpose and intended use
* Compliance with relevant regulatory requirements and internal policies, standards, and procedures' Comprehensive addressing of all internal and regulatory findings (e.g., audit reports, OCC exam reports)
* Assess the model's variable/output definitions for consistency with business and regulatory standards and relevance to the model purpose/scope (incl. unusual features such as lead variables). If there are deviations from the standard definition, assess the justification given by the business, and any potential impacts]
* Assess whether the merits and limitations of alternative theories and methodologies have been considered when selecting the modeling approach.]

### Variable Selection and Segmentation

[Assess the variable selection process as well as the completeness and appropriateness of the variables selected for use in the model per typical industry practice, business standards, and economic intuition.

* Assessment of the suitability of the model segmentation and the variables selected for the model.
* Description of the variable selection process based on economic intuition, in addition to statistical significance, where applicable.
* Assessment of the rationale for the macroeconomic variables or other risk drivers chosen for all quantitative approaches, including why certain variables or risk drivers were not selected
* Assessment of whether the variables selected are consistent with business rationale and capture material risks.
* Assessment of the risk drivers associated with each material risk.
* This sub section may not be applicable for all models]

### Development Platform and Code

[Assess and justify the development platform and code used to construct the model, including descriptions of:

* Appropriateness of chosen platform
* Merits and limitations of alternative platform choices
* Readability, reusability, and efficiency of code]

### Assumptions

[Assess the completeness and appropriateness of key model assumptions, including qualitative aspects of the model and expert opinions. Evaluate the appropriateness of each model assumption by assessing model developmental evidence such as statistical testing, business logic/industry practice, materiality or alternative assumptions considered and provide a conclusion. Identify and assess any additional key assumptions not flagged by developers.]

### Limitations

[Provide details regarding model limitations and any planned/existing mitigating controls.

Assess the documentation and communication of model use, limitations and weaknesses that ensure that model results are appropriately interpreted, including descriptions of:

* Clear definition of model use, scope of application, and restrictions
* Identification of external factors that may affect t-model performance
* Appropriateness of conservatism used in the model to compensate for limitations and weaknesses
* Assessment and communication of impact of limitations and weaknesses on business decisions and downstream models
* Appropriateness of model output, including units and measures of uncertainty

Each limitation should be documented in the following format:

| **Limitation ID#** | **Identified by** | **Description** | **Severity** |
| --- | --- | --- | --- |
| **1** | [Developer, Validator] | [Include description of the limitation] | [High, Medium, or Low] |

# Model Performance & Testing

## Model Diagnostic Testing

[Provide a description and an assessment of the Model diagnostic testing conducted.

* Evaluate the adequacy of diagnostic testing regarding the accuracy, robustness and stability of the implementation and the calibration, if applicable.
* Evaluate the model's behavior over a range of input values.
* Provide an overall conclusion of the adequacy of the diagnostic testing and the corresponding test results.

## Outcome Analysis / Back-testing

[Evaluate the adequacy of the outcome analysis tests provided by the Model Developers and assess their results. Include any independent tests conducted. An example of the three types of back-testing typically conducted as part of outcome analysis are:

* In-sample back-testing: Assess the graphical and numerical results on how the model prediction compares against the observed values on the training dataset as provided by the developers.
* Out-of-sample back-testing: Assess graphical and numerical results on how the model prediction compares against the observed values on a dataset on which the model was not trained as provided by the developers.
* Out-of-time back-testing: assess graphical and numerical results on how the model prediction compares against the observed values on a time period on which the model was not trained.

Review and challenge the outcome analysis methodology and results as documented by the Model Developers (when outcomes fall outside the intended intervals, an analysis of the discrepancies should be done; further analysis may be conducted to identify the underlying causes of significant gaps).]

## Benchmarking

[Provide a description of benchmarking tests conducted by the developer. Include any independent tests conducted by the validator.

* Review the comparison of model’s output to estimates from alternative internal or external data and/or models. If the model being developed will replace an existing model, the existing model may be one of the benchmarks.
* Any discrepancies between the model output and benchmarks should trigger further analysis; significant issues should be tied to a model limitation and corresponding action items.
* Provide an assessment of the model’s performance relative to the benchmark.
* Provide details of the independent tests performed to compare model outputs with estimates from alternative internal or external data and/or models.]

## Sensitivity, Stability, and Robustness

[Assess model outputs across a relevant range to ensure that they are sensitive, stable, and robust, including descriptions of:

* Appropriate output sensitivity to model inputs (i.e. is the resulting sensitivity of model output to ranges in perturbations in input consistent with expectations?)
* Does the specification of the model on a subset of the sampled data materially different than if specified on another sampled subset of data?
* Identification of input limits, beyond which model performance deteriorates
* Proper evaluation of goodness-of-fit measures
* Provide details of any independent tests performed to estimate the impact from shocks in inputs or parameter values on model outputs]

# Implementation and Controls

## Production Platform, Data, and Code

[Assess the production platform, including descriptions of:

* Feasibility of model implementation plan within desired production environment
* Potential for human or system error within desired production environment
* Appropriateness of the production platform to cater to the desired user base]

## Implementation Plan

[Assess whether the model implementation plan sufficiently details the necessary controls to be established, including descriptions of:

* Appropriateness of controls around proper model deployment
* Inclusion of quality assurance and user acceptance processes
* Appropriateness of security measures and access controls
* Inclusion of detailed back-up and storage processes
* Utilization of adequate and robust testing of the model and its supporting systems]

# Governance and Oversight

## Performance and Risk Monitoring

[Assess whether the performance and risk monitoring plan is in line with the Ongoing Model Management Standards, including descriptions of:

* Sufficiency of frequency of monitoring, outcomes analyses, and thresholds for performance degradation for detecting performance degradation
* Consistency of performance metrics with the model's intended use
* Adequacy of governance plan for security controls for model data, versions, and backup
* Inclusion of a defined escalation process when issues are identified during performance and risk monitoring]

# Documents and Evidence Reviewed

[List the documents and materials reviewed in relation to completing this validation report]