

# Performance Monitoring

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*Confidential*

# Performance Monitoring

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- Elements of a comprehensive model performance monitoring program in CCAR
  - Key elements: Assessment of model behavior and identification of model limitations and uncertainties
  - Establishment of thresholds
  - Definition of frequency
  - Escalation upon breach of thresholds
  - Review and oversight by MRM
  - Performed during development and as part of ongoing monitoring
  
- Example 1: Assessment of model behavior
  - Test design and purpose: Suite of tests in the form of assertions of specific behaviors
    - Types of tests: monotonicity of price, interpolation/extrapolation smoothness, calibration, benchmarking, numerical convergence, and model consistency
    - Applied to both feeder models (e.g., pricing models) and core CCAR models
    - Under BAU market conditions and under stress scenarios
  - Thresholds: established by developers, subject to approval by MRM; produces binary output (pass/fail)
  - Frequency: daily, using changing market data and randomly generated securities from a defined testing space
  - Escalation: Notification to developers/MRM of failures; continuous failures result in un-approval of the model

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- Example 2: Identification of model limitations and uncertainties
  - Testing of feeder pricing model performance under CCAR-like stress scenarios is an important component of a comprehensive testing program
  - Test design and purpose:
    - Quantify the impact of a limitation/uncertainty using sensitivity analysis, benchmarking, etc.
    - Alternative model assumptions/risk factors/dynamics, input/parameter uncertainty, numerical convergence
  - Frequency:
    - Identified and assessed during model development and validation
    - Reassessed weekly under BAU market conditions
    - Reassessed annually under stress scenarios
  - Escalation: results subject to review by MRM; depending on materiality MRM may require the following actions:
    - Application of model overlays
    - Changes to the model
    - Restrictions on model usage

# Benchmarking

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- Where should benchmark methodologies be utilized?
  - Material estimation approaches (ie, ones with significant contribution to capital ratios and signification limitations or uncertainties)
- What makes a good benchmark model?
  - Provides a different perspective
    - An approach which is sufficiently different may be preferred over a more complex approach that is too similar to the primary
  - Targets specific limitations/uncertainties of the primary model, where appropriate
- How should benchmark models be used?
  - Support the primary model projections; or point to weaknesses
  - Motivate changes to the primary model
  - Inform overlays
  - Review by governance committees and MRM