SUPERVISORY GUIDANCE ON MODEL RISK MANAGEMENT

SR Letter 11-7

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Introduction

- Model usage in banking
  - underwriting credits
  - valuing exposures, instruments, and positions
  - measuring risk
  - managing and safeguarding client assets
  - determining capital and reserve adequacy
- Regulation changes
  - U.S. regulatory capital rules for market, credit, and operational risk based framework by Basel Committee on Banking Supervision.
  - SR 11-7 Release April 4, 2011 by Office of the Comptroller of the Currency to manage model Risk for Banks
- Link to Source
  - https://www.federalreserve.gov/bankinforeg/srletters/sr1107a1.pdf

Using Models

- Improvements
  - Business decisions
- Cost
  - Resources to develop and implement
  - Adverse consequences of misuse or incorrect use
- Active risk management of models addresses consequences

SR 11-7 Overview

- Sec. 1: Introduction
- Sec. 2: Purpose and scope of guidance
- Sec. 3: Overview of model risk management
- Sec. 4: Robust model development implementation & use
- Sec. 5: Describes components of an effective validation framework
- Sec. 6: Explain salient features of governance, policies and control over development.
- Sec. 7: Conclusion

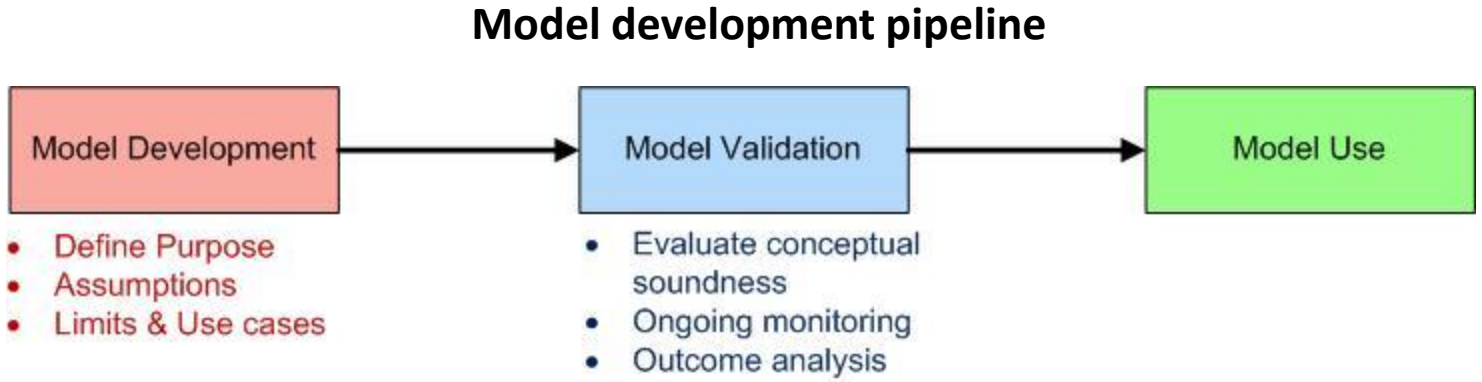
Purpose & Scope

- Guidance for effective model risk management
  - Rigor and validation
  - Sound development, implementation, and use of vital elements
  - Governance and management
- Details vary from bank to bank

What is a model?

- **Model**: quantitative method, system, or approach that applies statistical, economic, financial, or mathematical theories, techniques and assumptions to process input data into quantitative estimates.
- Model components
  - Information input: Delivers assumptions and data to the model.
  - Processing: transforms inputs into estimates
  - Reporting: translates estimates into useful business information

Overview of Model Risk Management



- Models are simplified representation of relationships among observed characteristics, values, and events.
  - Simplification due to inherent complexity and focus on aspects considered important for application
- Models are never perfect and metric for measuring quality should depend on situation

Overview of Model Risk Management

- Measuring quality of model
  - Precision
  - Accuracy
  - Discriminatory power
  - Robustness
  - Stability
  - Reliability
- Model risk may leads to poor decisions
- Occurrence of risk
  - Fundamental errors may produce inaccurate outputs
    - From design or implementation by approximations, additions, incorrect assumptions, and shortcuts.
  - Incorrect or inappropriate usage
    - Used outside environment which it was designed for

Understanding Model Risk

- Identify risk sources and assess the magnitudes
- Risk increases with complexity, higher uncertainty about input and assumptions, broader use, and larger potential impact.
- Aggregate risk for interactions and dependencies among models and their reliance on common assumptions, data, and methodologies

Managing Model Risk

- Analysis by objective, informed parties to limit models and assumptions, and produce appropriate changes
- Challenges provided to test model
  - Incentives: provide effective challenges to model
  - Competence: technical knowledge and modeling skills to analyze and critique
  - Influence: ensure action taken to address issues

Managing Model Risk

- Model risk cannot be eliminated, but can be managed
  - Establish use limits
  - Monitor performance
  - Adjust or revise over time
  - Supplement results with other analysis and information
- Models with higher impact should have more extensive rigor in risk management

Model development, implementation, and use

- Subjective judgment used in various stages
- Define purpose and use
- Rigorous assessment of data quality and relevance, & appropriate documentation.
- Assumptions should be properly tracked and analyzed
- Overall functioning is evaluated to determine if the model is performing as intended.
- Demonstrating the model is robust and stable
  - assessing potential limitations
  - evaluating the model's behavior over a range of input values
  - identify situations where the model performs poorly or becomes unreliable.
- Testing activities should include the purpose, design, and execution of test plans
  - nature will depend on the type of model
  - statistical tests cannot unambiguously reject false hypotheses or accept true ones based on sample information
  - Ensure testing for embedded in larger information systems
  - controls and testing to ensure proper implementation of models, effective systems integration, and appropriate use

Model Use

- Test whether model functionality
- Assess its performance over time as conditions and model applications change
- Explain and justify the assumptions and design of the models
- Reports should be clear and comprehensible
  - Account for decision makers and modelers often come from quite different backgrounds and may interpret the contents in different ways.
  - Provide a range of estimates for different input-value scenarios and assumption values can give decision makers important indications of the model's accuracy, robustness, and stability
  - Understanding of uncertainty and inaccuracy and demonstrate that it is accounted for appropriately.
    - Uncertainty can also include judgmental conservative adjustments
  - Model conservatism
    - sensitivity analysis or other types of stress testing used to demonstrate that a model is conservative
    - Justify substantiate claims that model outputs are conservative with definitions and measurements
    - Conservatism may dissuade making the effort to improve the model

Model validation

- Verify that models are performing as expected, in line with design objectives & business uses
- Identify errors, corrective action, appropriate use.
- All components subject to validation
  - input, processing, & reporting
- Independent validation
  - Validation done by independent group from developers
  - Validation may be critical review by an independent party

Model validation

- Validation is conducted prior to use
  - If issues exist, limited use may be permitted with stringent constraints
  - If data is limited, facts should be documented and results should be compensated by other controls
- Validation should be ongoing
  - Periodic review at fixed intervals

Comprehensive Validation

- **Evaluate conceptual soundness**, including developmental evidence
- **Ongoing monitoring**, including verification and benchmark
- **Outcome analysis** including back testing.

Evaluation of conceptual Soundness

- Assess the quality of model design & construction
  - Judgment of information usage
- Review of documentation and empirical evidence supporting methods used and variables selected
  - Comparison to alternative theories and approaches included
  - Key assumptions assessed
- Documentation and testing convey understanding of model limitations and assumptions
  - Sensitivity analysis of various inputs and stress test to validate performance and establish boundaries or limits
- Developmental evidence should be reviewed before model goes into use

Ongoing Monitoring

- Confirm model is appropriately implemented
  - checks for robustness and stability
- Assess and identify model limitations over time
  - Incorporate new information when available
  - Investigate model discrepancies
- Ongoing testing and evaluation of performance including benchmarks and process verification
  - Monitoring begins when model is implemented in production systems for business use
  - Check all model components
  - System integration of model
  - evaluate the reasons for overrides and track and analyze override performance.

Outcome Analysis

- comparison of model outputs to corresponding actual outcomes
  - Measure accuracy of forecasts
  - establishing expected ranges for actual outcomes in relation to the intended objectives
  - Reveal inaccuracies and errors in model
- Relies on statistical tests, quantitative measures, or expert judgment
- Testing techniques
  - Based on model's methodology, its complexity, data availability, and the magnitude of potential model risk
  - Use range of test because of weaknesses in individual test
  - Holding out samples and back testing
- Adjusted for new data or techniques
  - Warning metrics and trend analysis to assess performance

Validation of vendor & 3rd Party Products

- Follow similar principles as in-house methods
- Model selection process: Vendor provide developmental evidence
  - Explain components, design, and intended use
  - Appropriate for products, exposures, and risk
  - Testing results demonstrating proper function
  - Indicate limits and assumptions where products are problematic
  - Conduct ongoing performance monitor and outcome analysis with disclosure to clients
- Validation of vendor products
  - Sensitivity analysis and benchmark
  - Use Customization and documentation of justification
  - Ongoing monitoring and outcome analysis
- Contingency plan for termination of vendor contract where model is not supported

Governance

- Board of Directors
  - High level approach with risk management framework
- Policies & procedures
  - Updated as necessary to remain current
  - Include acceptable practices, development, scope and appropriate validation
  - Formalize, with emphasis on testing and analysis for model accuracy
  - Establish standards for validation
- Roles & Responsibilities
  - Ensure proper development of model
  - Monitor model usage
  - Establish control mechanisms for competition, model use, and validation
  - Compliance with policies and documentation
- Internal Audit
  - Assess model risk and evaluate comprehensive, rigor, and effectiveness of model
  - Assessment of operational support

Governance

- External Resources
  - Maybe used in validation and review in support of audit
  - Activities should be clearly specified including scope
  - Contingency plan is established if resource is unavailable.
- Model inventory
  - Comprehensive set of information for models including functionality.
  - List of individuals responsible for development and validation
  - Dates of completion, planning of activities, & expected time frame model remains valid
- Documentation
  - Development and validation to highlight deficiencies
  - Help track responses and continuity of operations

Questions