Model Risk and Governance

*More Than Model Inventory and Validation
(To Infinity And Beyond !?!)*

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Financial Models

Overview
Model Definition

Definition

- the term model refers to a quantitative method, system, or approach that applies statistical, economic, financial, or mathematical theories, techniques, and assumptions to process input data into quantitative estimates... also covers quantitative approaches whose inputs are partially or wholly qualitative or based on expert judgment, provided that the output is quantitative in nature

- Models are simplified representations of real-world relationships among observed characteristics, values, and events

(from OCC 2011-12 / Fed SR 11-7)
A **model** is a tool used to calculate or estimate results based on a series of inputs often used for analysis or quantification.

Model risk is viewed as the adverse financial or economic impact caused by:
- Incorrect Implementation
- Misapplication
- Misspecification
Model Governance

History and Summary of Guidance
Financial Models

- A long, long time ago
  - A few basic models were used
    - Interest Rate Risk (Balance Sheet Value measure and Net Interest Income/Margin)
    - VaR for Trading Book
    - Simple valuation models/tools
Financial Models

- Over time, models have grown in number and increased their importance

  - Expanded modeling use includes areas such as:
    - Derivative and Financial Instrument Pricing and Valuation
    - Securitization (cashflow and waterfall)
    - Credit Decisioning/Underwriting
    - Credit Portfolio Management
    - Credit Loss Modeling (PD/LGD/EAD; ALLL; OTTI)
    - Operational Risk
    - Capital (Economic Capital, CCAR/Capital Adequacy and Forecasting, Stress Testing)
    - Risks associated with trading (Duration, Convexity; VaR; counterparty exposure)
    - Financial Reporting (CVA/DVA, Fair Value Balance Sheet)
Financial Models

- **Largest Institutions**
  - Goldman Sachs, Morgan Stanley, JPMorgan Chase, Bank of America Merrill Lynch, Citigroup, Wells Fargo,
  - Thousands of models, including some highly complex and interrelated, others very specific in their use

- **Large, Complex Institutions**
  - Fannie Mae, Freddie Mac, FHLBs
  - GE, Coca-Cola, AIG, MetLife, Prudential, State Street
  - Banks > $50 Billion (SunTrust, Regions, Capital One, BBVA Compass)
  - 100+ models/systems/tools
Financial Models

- **Other Large Companies**
  - Financial Reporting Models, especially around derivatives or investments
  - Financial Forecasting Models
  - Insurance – actuarial models and economic capital
  - Commodity and FX hedging (exposure, hedge accounting, derivative valuation)
Regulatory Guidance

- Originally included in few areas within guidance
- Model Validation guidance
  - OCC 2000-16
  - FHFA AB 06-02; FHFA AB 09-03
- Model Risk and Governance
  - OCC 2011-12 / Federal Reserve SR 11-7
Model Governance
(Post OCC 2011-12 / Fed SR 11-7)
Frequently-Seen Critical Regulatory Concerns on Model Risk Management:

1. An incomplete model inventory;
2. Lack of a robust method to update the model inventory on a regular basis;
3. Lack of independence of the model validation department;
4. Model validation failed to demonstrate “effective challenge”;
5. Lack of data used in the model development process to support review/validation;
6. Lack of developmental evidence to substantiate model assumptions;
7. Lack of an explanation to support the application of expert judgment and model overrides;
8. Lack of a transparent process to generate important inputs for a model; (e.g. a bank fails to demonstrate how it determines the magnitude of PD shocks in a macroeconomic stress testing model.)
9. Fail to include relevant risk drivers in the model; this is particular common in macroeconomic stress testing.
10. Models have not been validated.
11. Failure to maintain comprehensive and up-to-date model documentation.
Model Risk Sources

- Ineffective Governance
- Process Weaknesses
- Lack of System Controls
- Human Resource Issues
- External Changes
- Reporting Timing Changes
- Regulatory Changes
- Internal
- External
Model Governance

- New Guidance recognizes model life cycle

Note: model development includes new model versions, enhancements, updates, calibration, etc.
Model Governance

**A Roadmap for an Effective Model Risk Management Program:**

1. Robust Model Risk Governance including
   - The roles and responsibilities of the Board, senior management, model owners, model developers, model users, model validation team, and internal audit;
   - An organizational structure and effective model risk management framework providing various bank personnel appropriate incentive to carry out the bank-wide model risk management program

2. Design the structures of various model risk management policies and procedures:
   - Data management policy
   - Model validation policy and requirements
   - Model documentation requirements for both in-house developed models and 3rd party vendor models
Model Governance (continued)

A Roadmap for an Effective Model Risk Management Program...

3. Model Inventory
   • Completeness of current inventory
   • Process to ensure completeness and updating on a go-forward basis

4. Model Risk Rating Policy and Procedures

5. Model Development and Implementation Policy
   • Integrate into new products
   • Plan for model updates and changes
   • Plan for additional uses of existing models

6. Model Validation Program
   • Standard Report Procedures & Content
   • Qualified, efficient/experienced model validation team
Model Governance - Inventory

- Model Inventory
  - More than a list!
  - Not a one-time exercise!
  - Don’t argue over “what is a model, what is not a model!”
Model Governance – Model Risk Rating

- Model Risk Rating
  - Many approaches are seen – no single standard
  - Various “flags” are helpful, such as:
    - Financial Reporting
    - Model Complexity (see next slide)
    - Valuation
    - CCAR/Stress Testing/Capital; Regulatory Guidance
    - Ability to Benchmark/Backtest

- Scoring; Tiers
  - Total “points”
  - High-Medium-Low; 1-2-3-4; etc.
Model Governance – Model Complexity

- Model Complexity (examples of considerations)
  - Code available and “transparent”
  - Used for one asset class or instrument or many
  - Spreadsheet-based or similar without underlying code/macros
  - May involve subjective judgment
  - Result: High/Medium/Low, Complex/Non-Complex, etc.
How does this change model validation?

- Prior approach was focused on a one-time exercise

- New approach looks at model suitability, life cycle, and emphasizes feedback loop
Model Governance – Other Considerations

- Model Policy is Critical
  - Process for identification (ties to inventory)
  - Dealing with model change
  - Understanding model use(s), impact
  - Different approaches for vendor models
  - Applicability of benchmarking, backtesting – clear recognition of where this is impossible or impractical

- Model Validation Approach
  - Can be tailored based on above characteristics
  - Should be well-defined and avoid *ad hoc* procedures
Conclusion / Questions
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