Validating ALM Systems: Challenges and Perspective on "Feeder Models"

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Today's ALM Systems are a hub that integrates numerous "feeder models". The use of ALM Systems as part of Stress Testing is focusing attention on how to manage multiple conjoined models. Model risk management must consider the materiality and complexity of each sub-model and apply appropriate methods to validate the ALM System as well as the feeder models. *This briefing provides our perspective on determining the scope of model validation for ALM systems and associated feeder models.*

As a leader in Model Risk Management, Montana Analytics has been active in developing models and utilizing rigorous analytical methods for examining models since 2002.

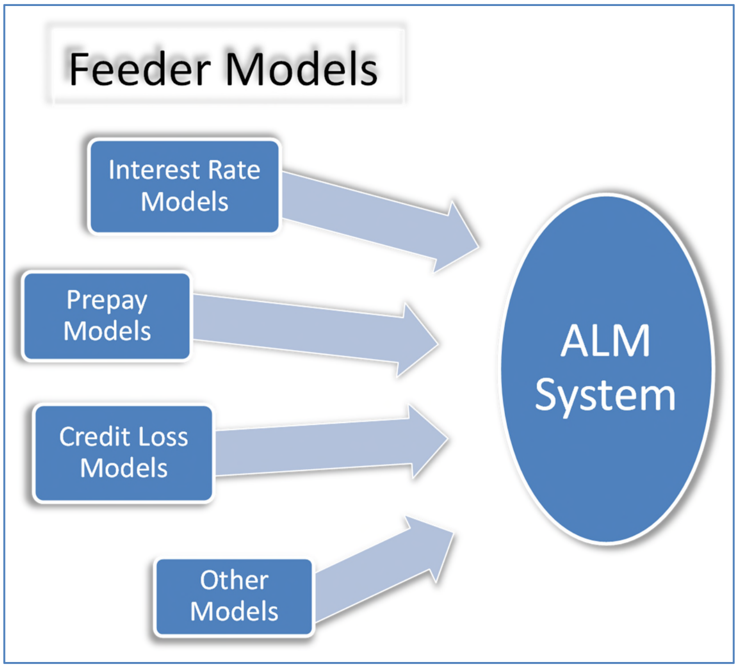
Introduction

The operational demand for analytical risk management at Banks has never been higher. The need to manage complex asset valuations and ensure business competitiveness in the current market environment along with increasing regulatory reporting requirements has led most Banks to use centralized Asset/Liability Management ("ALM") software for these purposes. Today's ALM systems, dominated by just a few vendors, have become a complex integration of numerous assumptions, inputs, functions and linkages to other external sub-models or "feeder models" needed to manage the risks associated with the Bank's various assets and liabilities.

The internal management and external reporting required by regulators are often for different purposes and increasingly rely on different forecasting methods for the same financial instruments. For example, prepayment modeling used in ALCO exposure analysis is different than incorporating macroeconomic variables for Stress Testing.

ALM software often serves as a *central calculation hub* for collating the different outputs and reports. Typically the ALM software is an open platform and an integrator of other tools - there is no particular model embedded within the ALM software for many of these financial instruments. This requires the banks to rely on a combination of external vendor models or internally developed models to produce the requisite cash flows.

Typical feeder models include interest rate models, prepayment models and credit loss models.



These external models often are uniquely complex themselves and are embedded within the ALM software via linkages, embedded intricate functions or simply as inputs to the system.

Banks (and their regulators and auditors) often question if the whole system is functioning properly and must determine how to validate the system to meet internal requirements and satisfy regulatory guidance.

This briefing provides our perspective on determining the scope of model validation for ALM systems and associated feeder models.

Simply put, it is highly recommended and considered a best-practice to fully validate associated feeder models separately from the ALM system. This establishes a more thorough examination of the unique analytical aspects of each feeder model and also a more transparent examination of the ALM system.

Model Validation Overview

Classic regulatory guidance defines a model as being composed of three components: an informational input component, a processing component, and a reporting component. Per guidance on Model Risk Management issued by the Federal Reserve and the OCC in bulletin OCC 2011-12, all components of a model should be subject to validation. Key elements of a comprehensive validation include several categories: evaluation of conceptual soundness, on-going monitoring and outcomes analysis.

The OCC bulletin specifies these categories as:

- **Evaluation of Conceptual Soundness.** This element involves assessing the quality of the model design and construction, as well as review of documentation and empirical evidence supporting the methods used and variables selected for the model. This step in validation should ensure that judgment exercised in model design and construction is well informed, carefully considered, and consistent with published research and with sound industry practice.

- **Ongoing Monitoring.** This step in validation is necessary to confirm that the model is appropriately implemented and is being used and performing as intended. It is essential to evaluate whether changes in products, exposures, activities, clients, or market conditions necessitate adjustment, redevelopment, or replacement of the model and to verify that any extension of the model beyond its original scope is valid. Process verification is a component to check that all model components are functioning as designed. Benchmarking a given model's inputs and outputs to estimates from alternative data or models is an important step for many models.

- **Outcomes Analysis.** This step involves comparing model outputs to corresponding actual outcomes. Back-testing is the prevalent type of outcomes analysis that involves the comparison of actual outcomes with model forecasts during a sample time period not used in model development at a frequency that matches the model's forecast horizon or performance window. Outcomes analysis should involve a range of tests because any individual test will have weaknesses.

The Federal Reserve, in SR 11-7, also discussed the importance of these elements. Though the FHFA defines the model components and hence what is necessary for validation in a different way, the principles are similar. Through these guidelines, industry best-practices and years of hands-on experience, we can establish the details needed to support each area of examination – and there are many to consider.

Defining the necessary steps to determining what constitutes a proper assessment of each of these model components is not part of this briefing. It is sufficient to state that a full validation for a stand-alone model, such as one that forecasts commercial loan losses, will assess the key points for each model component. At a high-level, examining documentation and the primary model data inputs and assumptions is necessary. Ensuring the system and its calculations work as intended and finally that the resulting output or forecast is reasonable are the key concepts to fully validate the model. Many detailed steps and tasks are required to accomplish this. In fact, we execute an entire *Program* with a project plan just to manage all the steps.

In contrast to these numerous steps, validating the typical feeder model may be limited to examining the linkages into the ALM system and verification of mathematical calculations to determine if the "feeder model" is producing interim results as expected.

Materiality and Suggested Approach

A full validation of such feeder models involves significantly more work than examining the linkages to the ALM system itself as discussed above. Consider for now that these feeder models are externally developed, managed and tested outside the ALM system. Validating the ALM system typically involves ensuring the external models pass inputs and assumptions correctly to the ALM software and that they are used appropriately for the defined modeling functions.

For example, a bank that originates only residential mortgages funded solely by deposits estimates residential mortgage prepayments using a vendor model and estimates the deposit decay with an internal proprietary model. If validating the ALM system, is it necessary to thoroughly validate the external feeder models? The Federal Reserve examiners, in their response[1] to industry questions regarding feeder models used in Dodd-Frank Act Stress Testing, have summarized their view as follows:

> *Bank holding companies should conduct independent review and validation of all models used in internal capital planning, consistent with existing supervisory guidance on model risk management (SR Letter 11-7). However, the intensity and frequency of model review and validation should be a function of the model's* ***materiality****, as evaluated as part of the broader model risk management framework. For example, if a* ***feeder model*** *is less material to the results reported in the pro forma financial statements, such models may not need as intensive a review as those models more central to the stress testing program.*

Though these statements were in response to models used for CCAR (many of which are used in the DFAST process), the principles for feeder models used in other functions is applicable. Both the OCC and FHFA guidance states that validation activities should be performed annually but they don't define exactly what this work entails for models that are not material in a given process. We assert that “materiality” should be viewed in two logical ways.

1. First, a model or feeder-model producing cash flows, valuations, pricing for most any portfolio asset is material. It needs to be accurate and tested periodically to ensure this.

2. Second, a model or feeder-model that provides one of the key drivers, factors or economic *effects* into a larger system (such as prepayment for rate sensitive assets) is *de facto* “material” to the overall accuracy of the system and its outputs. This leads us to suggest that the industry best-practice is to separately and independently validate feeder models that provide key drivers into an ALM system.

When feeder-models are not deemed “material” by the Model Risk Management governance function or the Risk Committee, a less intensive validation process may be reasonable. In this case, based on guidance and experience with validation, the suggested validation focus for feeder models is on input linkage, processing and accurate passing of information. The following are some key points for feeder models not subject to a full validation:

[1] Summary of CCAR Industry Call Questions & Responses June 23, 2014.

Feeder-Model:

- Evaluate feeder models for conceptual soundness. Are they appropriate for this process?
- Examine the model usage and appropriateness for its intended function (e.g., ensuring 15-year residential prepayment model is applied to the appropriate collateral). The latter task assesses that the model is used consistent with its construction and produces reliable estimates.
- Review the model assumptions to determine appropriate diligence and best-practices are evident.

Flow into ALM system:

- Review the model inputs to determine that summary balances and key terms of the financial instruments are being passed from internal data warehouses to the ALM system
- Assess whether external models and data inputs from external sources are properly set-up within ALM system
- Perform recalculation testing for a small sample of the financial instruments. This should be a controlled test compared with another model or system for as many variables as feasible. This provides further evidence the system is calculating results as expected.

This suggested approach will provide assurance the ALM system is functioning as intended. Among other important areas, this conjoined ALM-and-feeder-model validation approach excludes assessing theory, independent benchmarking, sensitivity analysis and backtesting of feeder model results.

However, if a feeder model provides a material contribution to the output, the additional steps are necessary. The Federal Reserve has stated some leading practices for Banks who participated in the Stress Testing process with regards to additional examination of feeder models. These best practices included re-examining data sources, methodologies, and model testing, identifying additional areas of uncertainty for new model use, and conducting additional sensitivity testing.[2] If a feeder model is complex and material, a full validation should be completed independently from the ALM system.

[2] Summary of CCAR Industry Call Questions & Responses June 23, 2014.

Montana Analytics Approach

Montana Analytics industry-leading *Model Validation Program* comprehensively examines all areas of model risk using rigorous and transparent tests that are consistent with regulatory guidance and best practices. Overall, the modular program contains seven core Sections to assess a model. We utilize over fifty specific examinations areas and include detailed tests in each of the following Sections:

- Documentation
- Operating Manual and Procedures
- Security and Change Control
- Data and Assumptions
- Theory and Logic
- Code and Mathematics
- Performance Assessment

Performance Assessment includes a number of tests that include:

- Backtesting predictive accuracy
- Independent Benchmarking results
- Assessing Bank results and policies for backtesting and benchmarking
- Performance monitoring
- Sensitivity Analysis to key macroeconomic factors
- Sensitivity Analysis to stress scenarios

This program includes examining the set-up, theory, mathematical recalculations, backtesting and independent benchmarking to provide a complete assessment. A typical validation of an ALM system with feeder models includes the model set-up, linkage verification and mathematical recalculations as stated above in the 'Suggested Approach' section. In addition to its transparency and completeness, the validation program is highly customizable and can include a full assessment of any feeder models in the ALM system.

Montana Analytics is a quantitatively-focused risk management consulting firm delivering innovative solutions in model risk management, model validation, analytical development, asset valuation and risk analytics for all types of Bank assets. We specialize in high-quality expert analysis coupled with an independent perspective that covers probabilistic risk exposure modeling, predictive models for performing and non-performing assets, competing-risks, Basel II PD, EAD, LGD models, economic capital, asset pricing and loan valuation techniques, default management and loss mitigation as well as solutions for CCAR/DFAST Stress Testing. We also analyze and develop consumer scoring solutions for origination decisions and behavioral analysis for community and regional banks. Additionally, since 2002, we have assisted in developing enterprise-level Model Risk Management programs and have conducted numerous independent validations of complex models.