



ALM MODELS, LIQUIDITY MODELS AND THE ASSUMPTIONS THAT DRIVE THEM

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- ALM and Liquidity Models – a Brief Background
- Proper Model Oversight
- Assumptions in a Changing World
- Recent Regulatory Comments



What is ALM?

- A mechanism to address the risk faced by an institution due to a mismatch between assets and liabilities either due to liquidity or changes in interest rates

What is Liquidity?

- The availability of liquid assets to a market or company. Determining a surplus of liquid assets to support day-to-day operations in the current environment, as well as projected environments.

Common Outsourced Vendors

- ALM First
- C. Meyers
- Darling Consulting Group (DCG)
- Empyrean Solutions
- FinPro Inc. (FinPro)
- First Horizon National (FHN)



Model risk is the potential for adverse consequences from decisions based on incorrect or misused model outputs and reports.

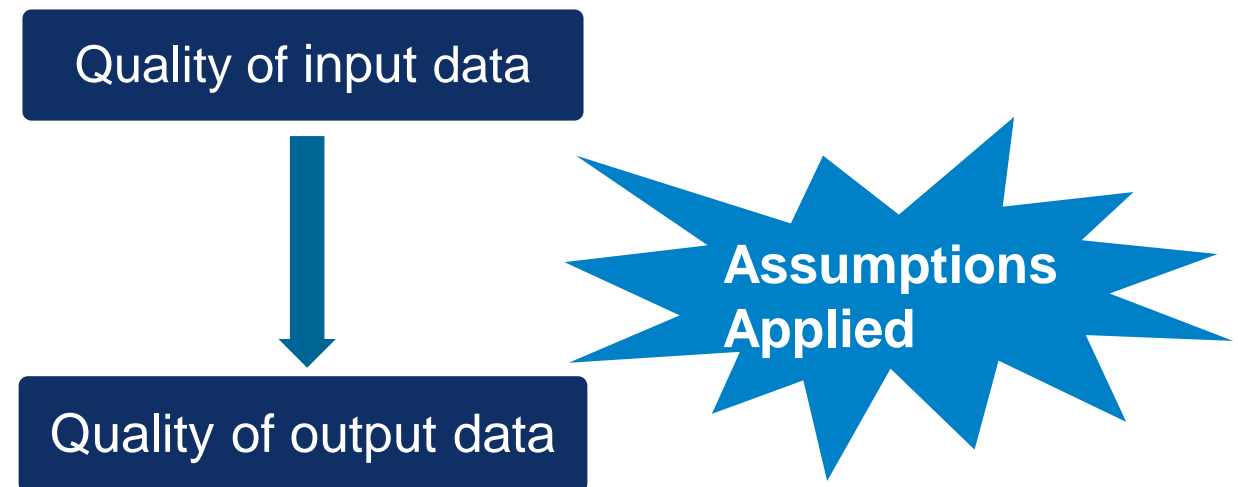
Mismanaged model risk can lead to:

- Poor business and strategic decision making
- Financial loss
- Damage to a Credit Union's reputation



How it happens:

1. Fundamental errors in the model
2. Blind spots
3. Model used incorrectly or inappropriately



Learning About ALM/Liquidity Internal Audit Tests

- **Policy Limit Testing:** Ensuring the Institution is complying with established Policy Guidelines, and reporting accurate results to decision makers.
- **Data Validation:** Reconciling data used in the ALM/Liquidity Reports to source documentation.
- **Maturity Testing:** Reconciling data in the GAP report to source documentation.
- **ALCO Attendance Testing:** Ensuring the ALCO is meeting as required by the Policy and the appropriate individuals are in attendance.
- **Assumption Testing:** Ensuring institution approved assumptions are appropriately being applied in the model.
- **Back-testing:** Compares the prior model/year's modeling results to actual institution performance. We ensure the accuracy of figures in this report and review results for appropriateness.
- **Liquidity Testing:** Reviewing liquidity reports to ensure accurate information is being presented and institution approved assumptions are appropriately being applied.

Time Management for an ALM Audit

<i>ALM & Liquidity Audit</i>	<i>Estimated Time (Hours)</i>	<i>%</i>
✦ Policy and Procedures		
Documenting the Entities Policies and Procedures	1.0	2%
Policy Limit Testing	3.0	6%
✦ Internal Controls		
IRR/ALMICQ	8.0	16%
Liquidity ICQ	7.0	14%
✦ Interest Rate Risk Reporting		
Asset Liability Committee Testing	3.0	6%
✦ Data Validation		
Data Validation Testing	2.5	5%
Maturity Testing	2.5	5%
✦ Interest Rate Risk Assumptions		
Assumption Testing	3.0	6%
✦ Interest Rate Risk Model Results Validation		
Backtesting	2.5	5%
✦ Liquidity		
Cash flow Stress Testing	5.0	10%
✦ Prior Year Follow Up		
Prior Year Documentation	1.0	2%
✦ Administrative		
Exit	0.5	1%
Management Review & Report	10.0	20%
Clearing Comments	1.0	2%
Total	50.0	100%

****These percentages are based on a 50-hour (all in) review. There will be fluctuations in percentage (%) depending on scope, complexity of the audit and size of institution. (For instance, some institutions ask us to include liquidity testing and give us more hours to complete other testing such as CD Maturities, Liquidity, Net Economic Value (NEV), etc.).*

1. **What is the minimum number of hours an internal audit department should allocate to an ALM internal audit annually?**
 - A. 40 hours
 - B. 50 hours
 - C. 100 hours
 - D. ALM is not reviewed annually.

3 Different IRR Reports

Interest Income Simulations

Strengths	Weaknesses
Reflects how an institution would respond over various interest rate change environments.	1 year time horizon does not capture the complete risk presented by assets and liabilities that will mature or reprice in more than a year.
Gives management a good idea if rates move in a certain direction, what the effect on its products will be.	Report is driven by institution made assumptions, so it is dependent on them.

Net Economic Value

Strengths	Weaknesses
Projects all balance sheet items at current market value over various scenarios.	Inability to identify the exact point where a change in earnings capacity will begin to affect net income.
Measures the potential exposure to capital.	Does not provide information on current and near-term earnings.

Gap Report

Strengths	Weaknesses
Easy to read and understand.	Does not reflect how the institution would respond to changes in interest rate (Environment).
Shows exactly when products are maturing.	Snapshot in time; not forward looking. Hard to compare to peers.

Area of Validation	In-house ALM Model	Outsourced ALM Model
New Theory	<ul style="list-style-type: none"> Model should be expanded to address 	<ul style="list-style-type: none"> Discuss with vendor
Comparison of Outputs	<ul style="list-style-type: none"> Back-testing should be performed periodically 	<ul style="list-style-type: none"> Provided by vendor or performed internally
Evaluate Performance	<ul style="list-style-type: none"> Discuss at ALCO 	<ul style="list-style-type: none"> Discuss at ALCO
Parallel Analysis	<ul style="list-style-type: none"> Determine if needed 	<ul style="list-style-type: none"> Determine if needed
Contingency Plan	<ul style="list-style-type: none"> Cross-train employees 	<ul style="list-style-type: none"> Evaluate in-house option or other vendors

Area of Validation	In-house ALM Model	Outsourced ALM Model
Model Documentation	<ul style="list-style-type: none"> • User Manual • Procedures over data input and assumption development 	<ul style="list-style-type: none"> • Procedures over data input and assumption development
Sensitivity Analysis	<ul style="list-style-type: none"> • Performed during development over model calculations • Assumption analysis 	<ul style="list-style-type: none"> • Assumption analysis
Changes to Model	<ul style="list-style-type: none"> • Document all improvements 	<ul style="list-style-type: none"> • Improvements should be communicated by vendor
Detail Testing	<ul style="list-style-type: none"> • Performed periodically over all areas 	<ul style="list-style-type: none"> • Validation Report • Supplemented by ALM audit • Detail testing for any customization



Types of Income Simulations:

- Static – Identify problems within balance sheet
- Dynamic – Present outcome based on management's expectations
- Shocks – Demonstrate instant change. (Less likely but demonstrates extreme)
- Ramps – Demonstrates gradual increase / decrease over time. (More likely)

Best to incorporate combination of all the above!

Other Items to Consider:

- Step-up Changes – Mini-shocks that occur over time (ex 25 basis point (bps) change every 3 months)
- Beta Rates – The amount Financial Institution rates will change as compared to driver rate

Commercial Real Estate (CRE)

Driver Rate: Prime Rate

Beta Rate: +100 bps

Result: In +200 bps scenario Prime becomes 5.25 and CRE rate becomes 6.25

Other Items to Consider Continued:

Floors and Ceilings

- Allows institution to customize scenarios and reflect reality for their institution.
- Example: All deposits products should have a floor above 0%. Rate sensitive products should be higher to reflect competitive forces.
- Current focus will be ceilings given future rate environment. How high are you willing to go?



- 2. The beta rates used in the interest rate risk model is the amount a Financial Institution's rates will change as compared to driver rate.**
- A. Yes**
 - B. No**

Liquidity Risk Monitoring

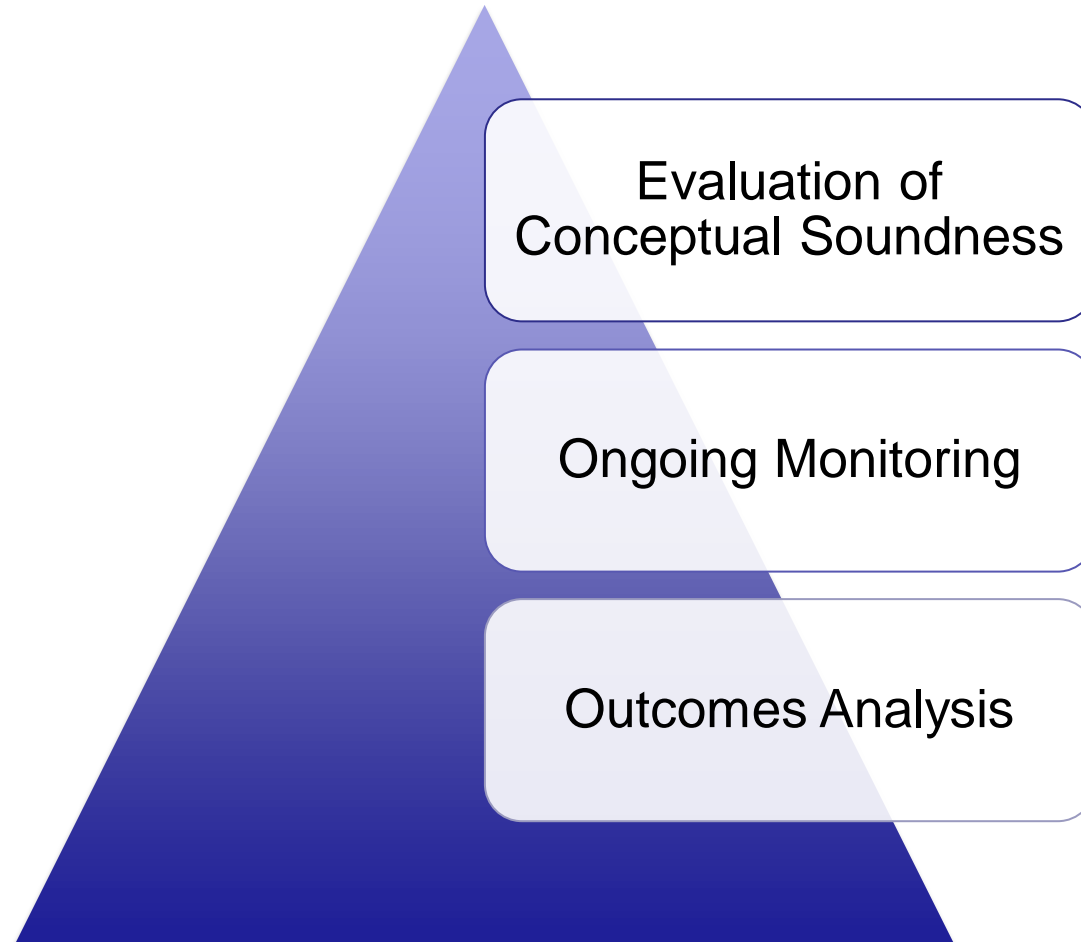


Institutions should evaluate and document potential stress events with significant impact.

These could include:

- Inability to fund asset growth
- Inability to replace maturing liabilities
- Unexpected deposit withdrawal
- Deterioration of asset quality
- Negative press coverage

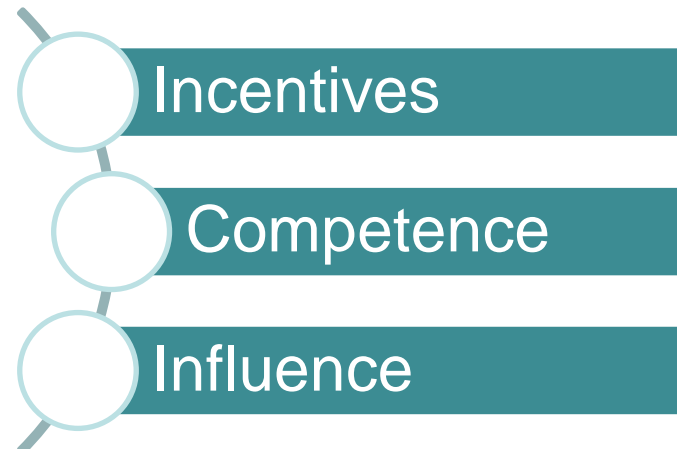
Model Oversight Requirements



- Does the individual who establishes the parameters have appropriate knowledge of the software and internal institution risks?
- Is there appropriate dual control in place for set up and changes to the parameters?
- Are key decisions regarding the parameters documented?
- Is the appropriate information reported to senior management regarding the usage of and key benefits of the software?

Critical analysis by objective, informed parties who can identify model limitations and assumptions and produce appropriate changes.

- Guiding principle for managing model risk.
- Depends on a combination of:



Evaluation of Conceptual Soundness Assumptions

- ALM Assumption Documentation and Reasonableness
 - Maintain analysis to ensure that appropriateness of driver rates, spreads, member behavior, and non-maturity deposit rates assumptions.
 - Vary prepayment speed, deposit sensitivity, and decay rates depending on the interest rate scenario.
 - Modeling should take into consideration the FI's members' reaction to adverse economic conditions

Evaluation of Conceptual Soundness Assumptions

- ALM Assumption Reasonableness Example

Indices	Starting Rates	Down 100Bps	Up 200 Bps	Up 400 bps
Regular Now	.17	-5 (1-12) .12	0 (0-0) .17	10 (13-24) .27
Success Business Savings	.27	-5 (1-12) .22	0 (0-0) .27	20 (13-24) .47
Premium MMDA	.05	-4 (1-2) .01	0 (0-0) .05	20 (13-24) .25

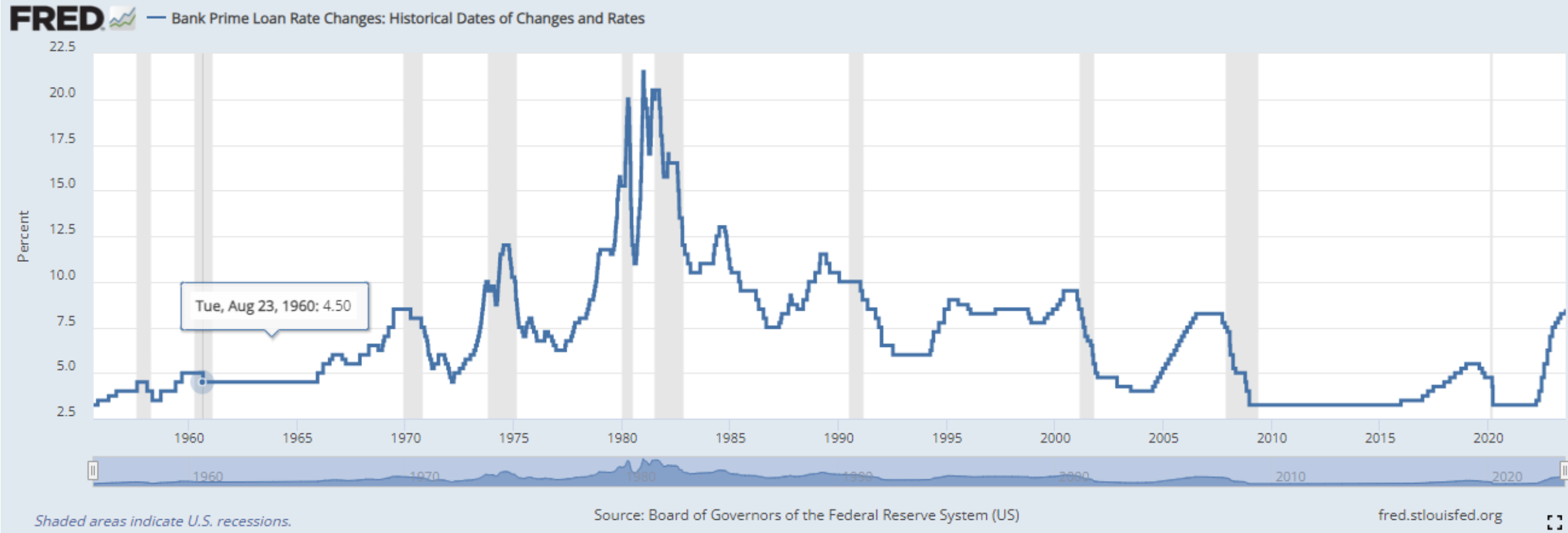
- Outcome Analysis Action Items
 - Vendor management
 - Verify vendor documentation is up-to-date including model certification
 - Has criteria been set-up to create in-depth review?
 - Back-testing frequency
 - Meeting minutes including back-testing
 - Corrective plans being put in action



Assumption Creation Responsibilities:

- Designating authority
- Review
- Evaluating appropriateness
- Ensuring documentation

It's Been a Long Time...



Mobile Banking – Impact on Assumptions

Mobile Wallets



Peer-to-Peer Payments



Digital Wallets



Figure 1: Total crypto market capitalization rose by 109% in 2023

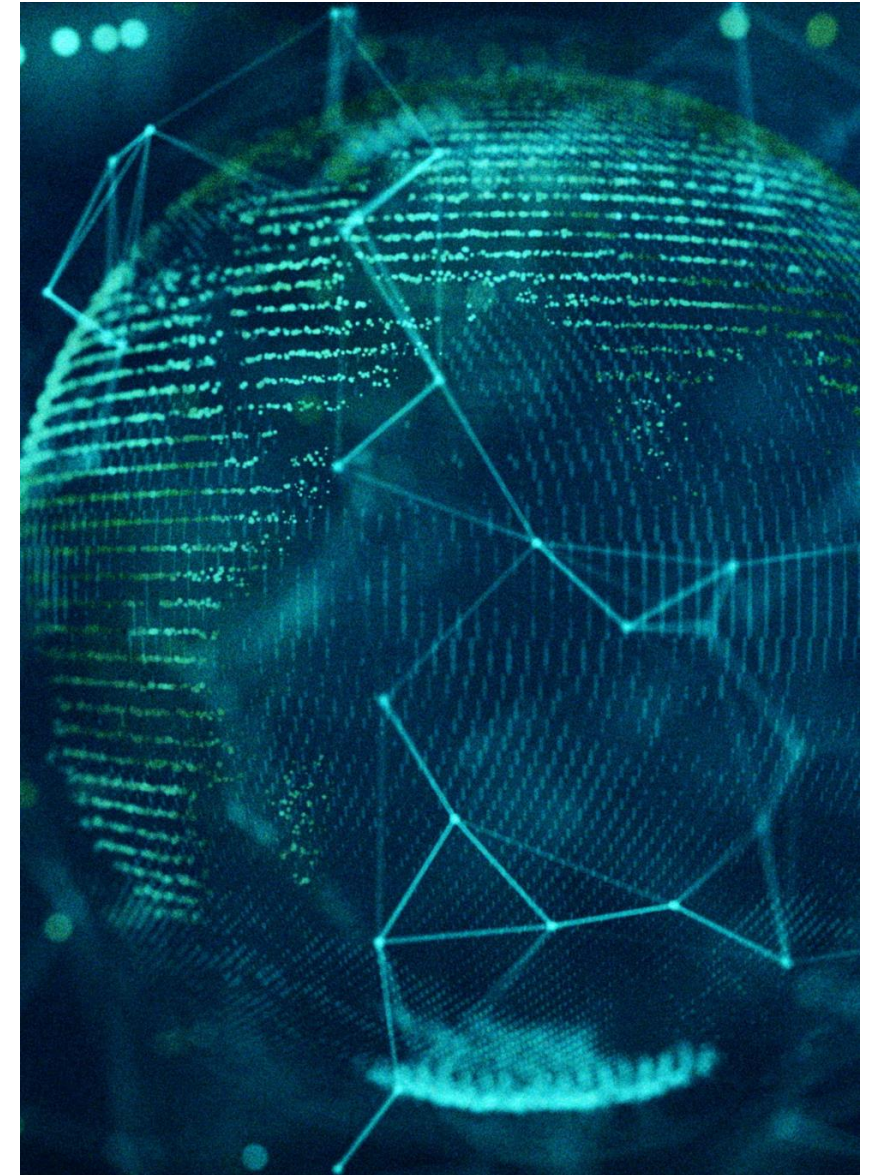


Source: Coinmarketcap, Binance Research, as of December 31, 2023

Embedded Finance



Current State of Competition



- Internal models vs vendor provided
- Stabilization from prior years
- Is slowing prepayment a sign of other things?

Assumption Back-testing

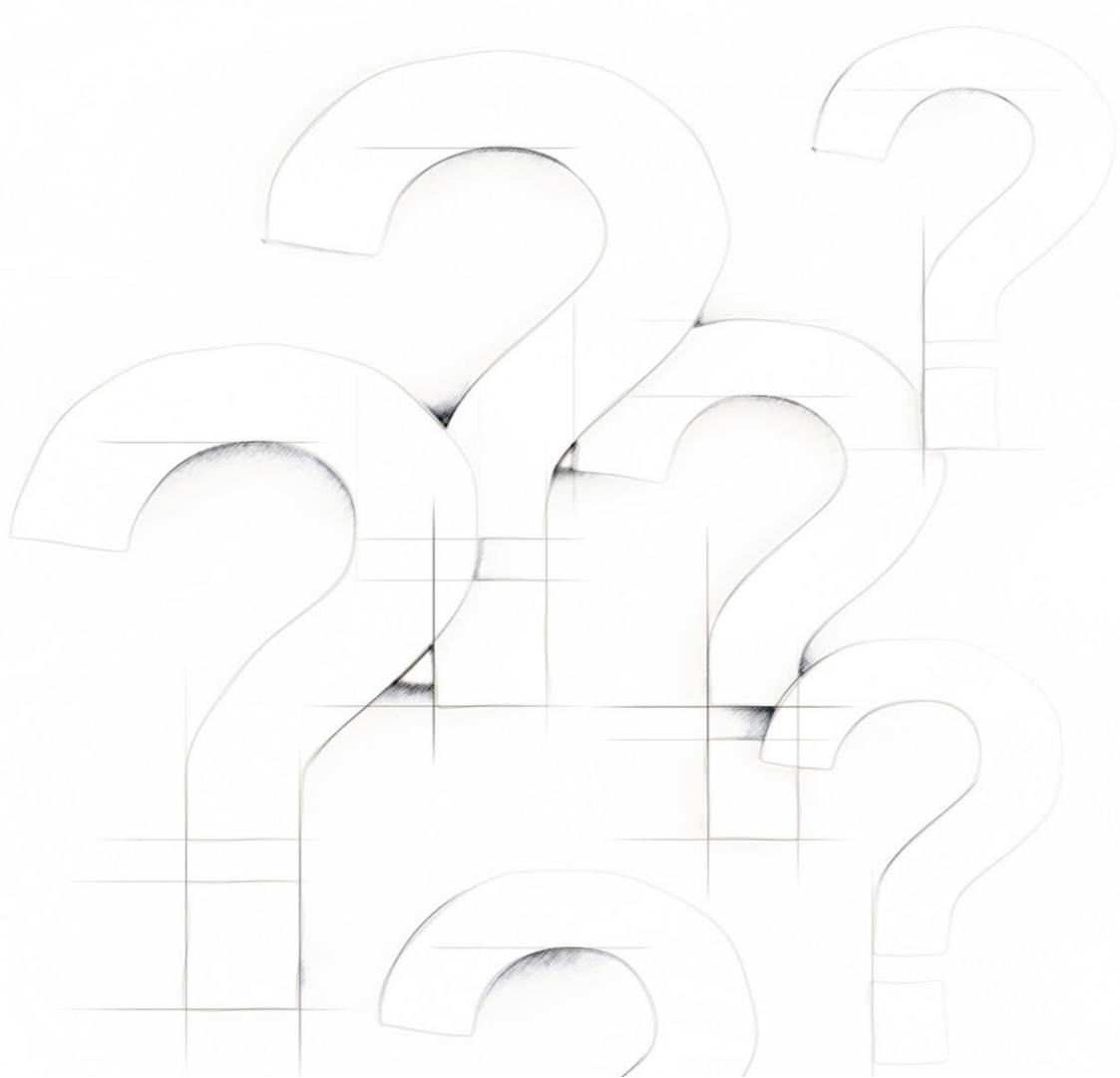
- Minimum: Net Income, Net Interest Income and Liquidity review
- Dig deeper: Projections vs. Reality
 - Balances
 - Interest Rate
 - Originations
 - Prepayments
- Explore variances closer

- 3. How often should an Institution back-test their ALM assumptions used in the interest rate risk model?**
- A. Monthly**
 - B. Quarterly**
 - C. Annually**
 - D. Every other year**

1. Monitoring of Uninsured Deposits and Large Depositor Relationships
2. Remediation of liquidity stress testing scenarios using the Institution's Contingency Funding Plan
3. Inclusion of Risk and Marketing individuals when appropriate at Asset Liability Management Committee meetings

Common Regulatory Comments & Findings

1. Reasonability of assumptions
2. Model risk management related oversight
3. Scenario based policy limits



Understanding ALM and Liquidity: Key Terms

- **Account Aggregation:** Occurs when the institution reports and models similar accounts together. This should only occur if accounts have similar characteristics for maturity and interest changes.
- ****ALCO:** Asset/Liability Committee comprised of members of senior management (and sometimes board members) that meet and discuss asset liability management of a periodic basis.
- ****Back-testing:** Compares the institution's IRR model's prior net interest income projections to the institution's actual net interest.
- **Basis Points (bps):** Unit that is equal to 1/100th of 1% (100 basis point change would equal 1% change in the interest rate) and is used to denote the change in a financial instrument. The basis point is commonly used for calculating changes in interest rates.
- **Brokered Deposits:** The institution goes through a third-party service provider (broker) to find deposits for an institution. A restriction can occur on this product if the institution is already experiencing a liquidity stress event.

Understanding ALM and Liquidity: Key Terms

- **Cash Flow Assumptions:** Prediction of the institution's cash inflows (such as income from loans, investments, new deposits, additional borrowings, prepayments, etc.) and outflows (such as deposit withdrawals, payments on any borrowings, loan origination, investment purchases, etc.).
- ****Contingency Funding Plan:** Mainly described as the institution's policy/plan if the institution or rate environment were to experience some turmoil. The plan should include early warning indicators or triggers, different steps/scenarios that can occur with a liquidity crisis, and responses or plan of action to counter the liquidity crisis.
- **Contractual Terms:** Obligation that the institution must perform or be in accordance with in order to access funding sources/maintain service agreements.
- **Core Deposit Analysis:** Analysis performed over non-maturity deposits generated in the institution's local marketplace. This includes retail deposits, commercial deposits, and other deposits as defined by the FDIC. This analysis is used to help determine the institution's decay rates and rate sensitivity.

Understanding ALM and Liquidity: Key Terms

- **Decay Rates for Deposits:** Volume at which the institution's deposit products decrease over a period of time. Decay Rates can be identified through a core deposit analysis. In expanding institutions, decay rates may have a negligible effect because deposit growth is greater than decay rates.
- **Deposit Sensitivity:** Analysis conducted on effect of accounts due to a change in the rate environment. It can also be described as the rate at which deposit products rate will change in comparison to market rate changes. Deposit sensitivity can be identified through a core deposit analysis.
- **Driver Rates:** The basis for rate assumptions in the ALM model.
- ****Interest Rate Risk:** The risk to an institution's earnings and/or capital resulting from a fluctuation in the interest rate environment.
- **Lag:** Delay of initial impact of a rate change (i.e. rates increase in months 2-13 would be a 1 month lag).
- ****Liquidity:** Term used to identify how quickly an institution can turn its assets into cash.

Understanding ALM and Liquidity: Key Terms

- **Market Rates:** Rates that are established by overseeing bodies, and used nationwide (i.e. prime rate established by Wall Street).
- **Model Certification:** Audit conducted on the institution's model vendor to ensure they are properly modeling the ALM function for its clients (the institution).
- **Non-Maturing Deposits:** The institution's deposit products that have no expiration date. Consumers can withdraw from the products with no penalty (i.e. checking accounts, savings accounts, etc.).
- **Originate to Sell:** Occurs when an institution offers loans to consumers with the intent to sell them to other institutions.
- **Prepayment Speeds:** The average rate at which borrowers are expected to pay off their loans ahead of schedule. This includes both early/additional payments and payoffs from refinancing.

Understanding ALM and Liquidity: Key Terms

- *****Pro-forma Cash Flow Statements:*** Annual statement that lists income and expenses for the institution. It includes revenue and operating expenses through net operating income.
- *****Ramp/Shock Scenarios:*** A shock scenario is an interest rate change, that all occurs in one month. A ramp scenario is an interest rate change that occurs over a given time period.
- ***Reputational Risk:*** Any negative publicity incurred by the institution. Usually the CEO or other members of senior management are in charge of handling reputational risk during adverse liquidity situations.
- ***Securitization:*** The process of pooling various types of debt (such as residential mortgages, commercial mortgages, auto loans or credit card debt) obligations and selling the consolidated debt as bonds, pass-through securities, or Collateralized Mortgage Obligation (CMOs), to other investors.

Understanding ALM and Liquidity: Key Terms

- **Spread:** The difference between driver rates and the rate change for the product.
- ****Stress Events:** Events that occur in the environment that can cause hardship to the institution's liquidity position (for example, if the institution becomes less than well capitalized, due to economic failure, a liquidity crisis may be assumed).
- **Volatile Funding Sources:** A way the institution may be able to access cash that have large swings in either value or accessibility.
- **Yield Curve:** Analysis that shows several interest rates across different periods of time.

Model Validation – Outcomes Analysis Testing

- ALM Back-testing Example

Income/Expense Comparison	Projected	Actual	Variance (\$)	
Earning Assets				
Interest Bearing Cash	30	28	2	
Investments	3,250	3,200	50	
Loans, Gross	14,500	14,700	(200)	
Total	17,780	17,928	(148)	
Costing Liabilities				
Interest Bearing Deposits			100	
Borrowings	1,350	1,600	(250)	
Total	4,650.00	4,800.00	(150)	
Net Interest Income	13,130.00	13,128.00	2.00	0.02%

Model Validation – Outcomes Analysis Testing

- ALM Back-testing Example - Continued

Balance Comparison	Projected	Actual	Variance	Impact on Net Interest Income
Earning Assets				
Interest Bearing Cash	57,000	27,000	30,000	90
Investments	350,000	355,000	(5,000)	(170)
Loans, Gross	1,100,000	1,110,000	(10,000)	(510)
Loans Prepayments	45	67	(22)	
Originations	250	110	140	
Total	1,507,000	1,492,000	15,000	(590)
Costing Liabilities				
Interest Bearing Deposits	1,000,000	1,100,000	(100,000)	(1,250.00)
Borrowings	180,000	170,000	10,000	360
Total	1,180,000	1,270,000	(90,000)	(890)
Balance Impact on Net Income				(300)

Model Validation – Outcomes Analysis Testing

- ALM Back-testing Example Continued

Rate Comparison	Projected	Actual	Variance	Impact on Net Interest Income
Earning Assets				
Interest Bearing Cash	0.25%	0.30%	-0.05%	(14)
Investments	3.50%	3.40%	0.10%	355
Loans, Gross	5.00%	5.10%	-0.10%	(1,110)
Total				(768)
Costing Liabilities				
Interest Bearing Deposits	1.30%	1.25%	0.05%	550
Borrowings	3.00%	3.60%	-0.60%	(1,020)
Total				(470)
Balance Impact on Net Income				298

