WILARY WINN LLC

Advice to Strengthen Financial Institutions

Understanding Duration Analysis: A Concept for Asset Liability Management

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INTRODUCTION

This white paper explores the significance of duration in asset liability management ("ALM"). By understanding duration and its effects on an institution's financial profile, organizations can more effectively manage interest rate risk, optimize capital management, and stabilize profitability and earnings. This paper illustrates how financial institutions can leverage their understanding of duration to strategically position themselves for success across various economic conditions.

Over the past year, many financial institutions have relied heavily on short-term funding through promotional certificates while investing in longer-term assets. This white paper aims to address how this can impact the institution and how to best manage the duration mismatch.

KEY TAKEAWAY
Understanding and managing duration is crucial for effectively handling interest rate risk and optimizing financial performance.

HOW CAN WE HELP YOU?
Founded in 2003, Wilary Winn LLC and its sister company, Wilary Winn Risk Management LLC, provide independent, objective, fee-based advice to nearly 600 financial institutions located across the country.

We provide the following services:

ASSET LIABILITY MANAGEMENT (ALM)
We provide outsourced ALM analyses that measure and report interest rate, liquidity, and credit risk on a fully integrated basis.

CURRENT EXPECTED CREDIT LOSSES (CECL)
We provide predictive, outsourced CECL reporting, developed from detailed analysis of granular cohorts, through a complete peak-to-trough business cycle.

MERGERS & ACQUISITIONS
We provide independent, fee-based determinations of fair value for mergers and acquisitions.

VALUATION OF LOAN SERVICING
We provide comprehensive and cost-effective valuations of servicing arising from the sale of residential mortgage, SBA 7(a), auto, home equity, and commercial loans.
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Understanding Duration Analysis: A Concept for Asset Liability Management

Defining Duration in Asset Liability Management

There are three key variations of duration used in financial modeling and analysis:

1. **Macaulay Duration** - This measures the weighted average time until all cash flows (interest payments and principal repayment) are received. It accounts for the time value of money by weighting each cash flow by its present value and then averaging these times.

2. **Modified Duration** - This indicates the percentage change in a bond's price for a 1% change in interest rates. Derived from Macaulay Duration, it provides a direct measure of a bond's sensitivity to interest rate changes.

3. **Effective Duration** - This measures the price sensitivity to interest rate changes, considering potential changes in cash flows due to options such as call or put provisions.

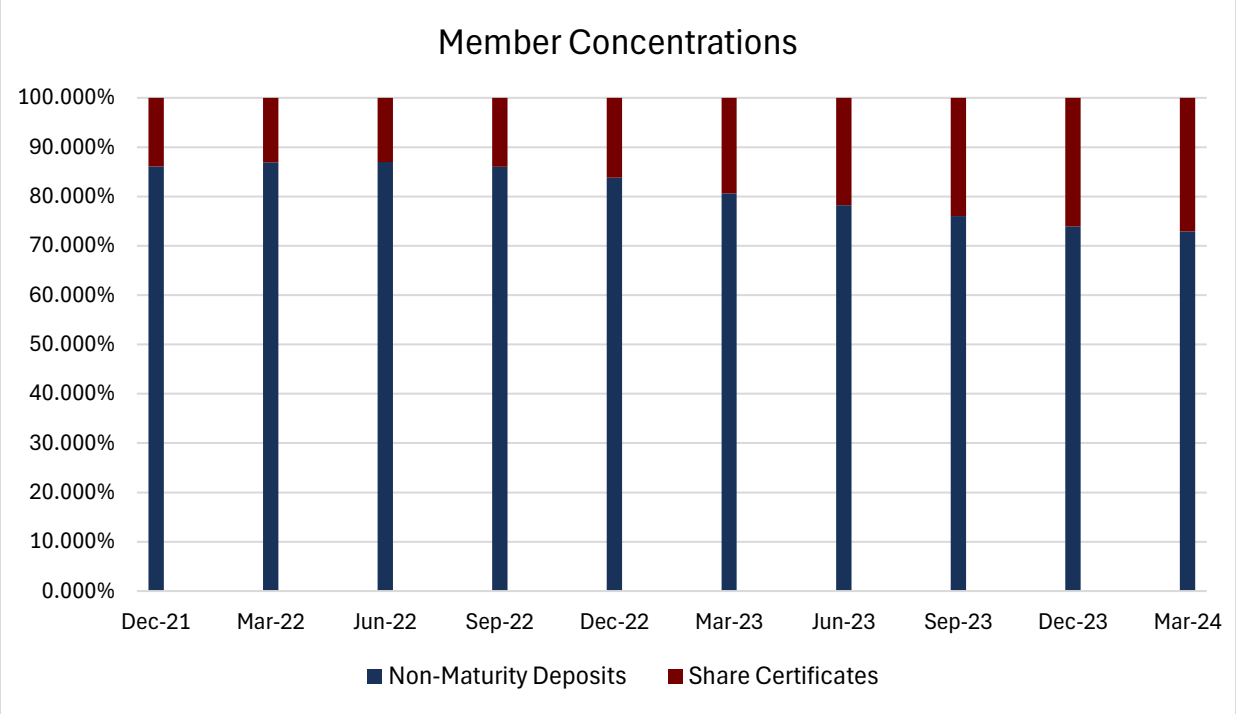
This white paper will focus primarily on using Effective Duration as a tool for managing an ALM profile.

Why Does This Matter Now?

Duration has always been a critical component of managing the financial profile of a financial institution; however, liquidity concerns and funding trends that began in the aftermath of the COVID-19 pandemic and continued into mid-2024 have significantly altered institutional operations, placing an even greater importance on duration. In the current environment of an inverted yield curve and higher interest rates, financial institutions have increasingly turned to short-term funding sources, such as promotional certificates of deposit ("CDs"), to attract deposits. These promotional CDs offer higher interest rates but are typically for shorter timeframes, with the idea that interest rates will come down by the time they mature. The primary goal of these certificates is to draw both existing and new customers, thereby expanding the institution's overall deposit base. Further, many institutions have used this shorter-term funding to originate loans, purchase investments, or maintain a highly liquid cash balance. The institutions that used this shorter-term funding to originate or purchase longer-term loans and investments have introduced a cashflow timing mismatch into their ALM profile and are the inspiration for this white paper.

Industry Trend at a Glance

To further illustrate the trend of non-maturity deposits migrating to shorter term funding such as CDs, the following chart shows the percentage of non-maturing deposits to total member deposits and the percentage of share certificates to total member deposits from year-end 2021 through March 31, 2024, for all US credit unions.



Source: S&P Capital IQ US Credit Unions | Regulatory Balance Sheet

As shown, the concentration in non-maturing deposits decreased from more than 86% of total member deposits to under 73% over this period.

Post-Pandemic ALM Profile Comparison

As mentioned previously, the economic environment shifted dramatically during the COVID-19 pandemic and in its aftermath. Consequently, financial institutions' ALM profiles changed as well. The following table presents the profile of a sample institution shortly after the pandemic, as well as its current profile.

12/31/2021 Profile					3/31/2024 Profile				
Account	Weighted Avg. Coupon	Avg. Life	Effective Duration	Book Value	Account	Weighted Avg. Coupon	Avg. Life	Effective Duration	Book Value
Cash	0.07	0.00	0.00	246,445,767	Cash	5.26	0.00	0.00	100,954,173
Agency Debt	NA	NA	NA	0	Agency Debt	1.55	1.49	1.42	12,272,102
Agency MBS	2.02	3.59	2.72	20,042,262	Agency MBS	3.71	3.48	3.05	28,383,464
Certificates of Deposit	2.08	1.05	1.01	15,298,821	Certificates of Deposit	2.30	1.05	0.98	4,750,128
U.S. Treasury	NA	NA	NA	0	U.S. Treasury	1.02	0.90	0.87	18,118,634
FHLB Stock	0.00	NA	NA	22,219,021	FHLB Stock	3.55	NA	NA	19,409,804
CUSO Loan	0.00	5.00	4.81	687,858	CUSO Loan	6.21	5.00	4.24	764,070
AFS FV Adjustment	NA	NA	NA	24,860	AFS FV Adjustment	NA	NA	NA	(3,283,917)
Total Investments	0.29	0.33	0.26	304,718,588	Total Investments	4.11	0.86	0.76	181,368,458
Consumer Loans	5.91	1.69	1.55	237,574,935	Consumer Loans	7.13	1.65	1.45	252,857,379
Member Business Loans	3.87	2.30	2.02	75,572,077	Member Business Loans	5.13	2.56	2.21	97,616,253
Real Estate Loans	3.49	3.33	2.17	224,791,470	Real Estate Loans	4.94	5.33	3.44	331,351,182
Allowance for Loan Losses	NA	NA	NA	(5,921,140)	Allowance for Loan Losses	NA	NA	NA	(10,765,487)
Total Loans	4.66	2.48	1.89	532,017,343	Total Loans	5.87	3.63	2.57	671,059,326
All Other Assets	NA	NA	NA	91,816,470	All Other Assets	NA	NA	NA	94,141,498
Total Assets	**3.05**	**1.72**	**1.32**	**928,552,401**	**Total Assets**	**5.42**	**3.09**	**2.21**	**946,569,282**
Total Non-Maturing Deposits	0.15	5.01	3.64	680,626,759	Total Non-Maturing Deposits	0.12	5.21	4.39	629,514,398
Share Certificates	1.60	1.31	1.26	126,939,606	Share Certificates	3.85	0.73	0.69	171,722,724
FHLB Advances	2.19	4.44	4.09	17,387,000	FHLB Advances	3.93	3.05	2.72	26,080,500
Other Liabilities	NA	NA	NA	18,074,039	Other Liabilities	NA	NA	NA	28,149,271
Total Liabilities	**0.41**	**4.43**	**3.28**	**843,027,405**	**Total Liabilities**	**1.02**	**4.21**	**3.57**	**855,466,893**
Total Equity				**85,524,996**	**Total Equity**				**91,102,389**

The table above illustrates two main changes in the profile. First, there was a significant decline in cash balances between the two periods. The institution's cash balance decreased from $246.45 million in the pre-rate hike profile to $100.95 million in the current profile. Second, there was a notable shift from non-maturity deposits to other sources of funding, primarily share certificates. Non-maturity deposits decreased by $51.11 million, while share certificates increased by $44.78 million.

With these changes in concentrations, both the institution's asset duration and liability duration were affected. In our ALM analyses, cash has a duration of zero. This implies that changes in interest rates, whether positive or negative, will have no impact on the fair value of cash. This is based on the assumption that cash will be repriced immediately in response to any changes in interest rates. In other words, cash carries no interest rate risk. In contrast, residential real estate loans, such as fixed-rate mortgages, typically have longer terms and thus higher durations because the principal is repaid over an extended period. While prepayment risk can reduce the effective duration of these loans, many of the loans issued during the period shown have relatively low interest rates, reducing the incentive to prepay in the current rate environment. So, by reducing the institution's concentration in low duration assets with higher duration assets, it increased its asset sensitivity to changes in interest rates.

On the liability side, the institution reacting to market conditions has replaced longer-duration liabilities with shorter-duration ones. Non-maturity deposits in this example exhibit characteristics similar to fixed-rate mortgages, including longer average lives and higher effective durations. This is due to the institution's highly loyal deposit base, where funds remain with the institution for extended periods despite changes in interest rates. In fact, as shown in the table above, the weighted average coupon for non-maturity deposits decreased by three basis points, even though interest rates increased by more than 500 basis points over the same period. In contrast, share certificates, especially promotional CDs, have defined, shorter maturities, and higher weighted average coupons. The shorter term of the CDs results in faster principal repayment to customers, leading to a shorter duration.

To summarize, the example financial institution has financed more of its long-term assets with shorter-term funding. This creates a timing mismatch between the receipt of cash flows from principal payments and the maturity and payout of certificates.

Managing Interest Rate Risk

One way in which institutions can manage their interest rate risk is through duration gap management. This financial strategy helps institutions manage the difference between the durations of their assets and liabilities. By controlling the duration gap, institutions can reduce their exposure to interest rate fluctuations and maintain financial stability.

Duration Gap is calculated using the following formula:

$$\text{Duration Gap} = \text{Duration of Assets} - ((\text{Liabilities} / \text{Assets}) \times \text{Duration of Liabilities})$$

Depending on the result of the calculation, the duration gap can have different implications for the institution's financial profile:

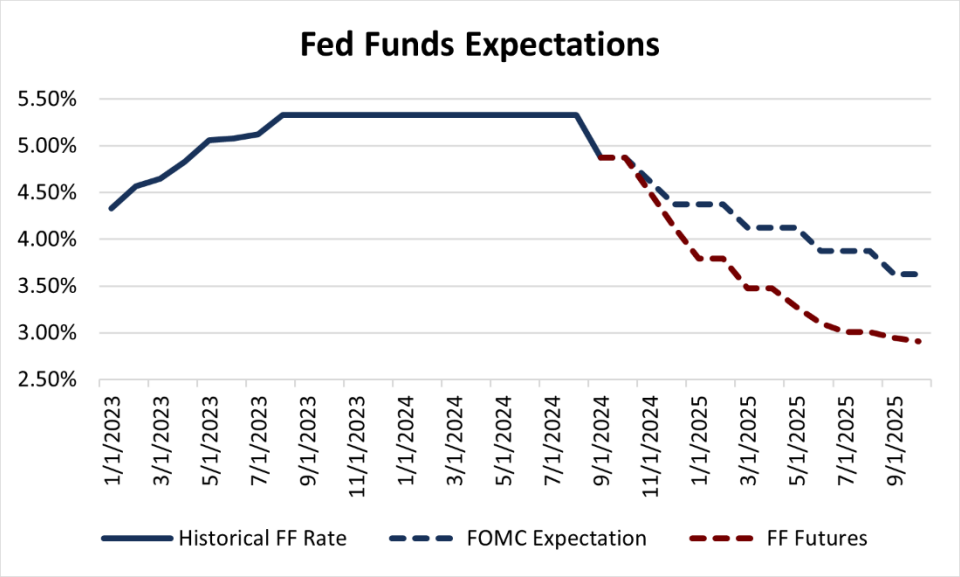
Positive Duration Gap: If the duration gap is positive, it indicates that the institution's assets are more sensitive to interest rate changes than its liabilities. This means that an increase in interest rates will typically cause a larger decrease in the value of the assets compared to the decrease in the value of the liabilities. As a result, the institution could face a negative impact on its net worth and financial stability.

Negative Duration Gap: If the duration gap is negative, it means that the institution's liabilities are more sensitive to interest rate changes than its assets. In this case, an increase in interest rates will generally cause a larger decrease in the value of the liabilities compared to a decrease in the value of the assets. This situation can be beneficial to the institution, as net worth may improve with rising interest rates.

Using the example institution, we can calculate the institution's duration gap at year-end 2021 and March 31, 2024, to understand how the institution's exposure to interest rate risk has evolved.

Duration Gap (December 31, 2021) = 1.32 – ((843,027,405 / 928,552,401) x 3.28) = - 1.658, meaning that the institution's liabilities are more sensitive to interest rate changes than its assets. This negative duration gap was a benefit to the institution as interest rates increased by more than 500 basis points in the following two years. As a result, the fair value of liabilities decreased to a greater extent than the fair value of assets.

Duration Gap (March 31, 2024) = 2.21 – ((855,466,893 / 946,569,282) x 3.57) = - 1.016, which still represents a negative duration gap, but to a lesser extent than before. The institution has adjusted its balance sheet to be less liability sensitive. This adjustment is beneficial if interest rates stabilize or do not increase further. However, a positive duration gap would be more advantageous if interest rates are expected to decline, as indicated by the following chart.



Source: Federal Open Market Committee September 18, 2024 Press Conference and CME Fed Watch

The previous graph displays the expected path of the Fed Funds Rate from two different sources. In general, these sources indicate that rates will fall an additional 0.25% to 0.50% by the end of 2024 and decline to a greater extent in 2025.

With interest rates expected to decline over the next several quarters, the institution's decision to adopt more longer-duration assets and shorter-duration liabilities, thus further reducing its duration gap, could prove advantageous in terms of interest rate management. By having longer-duration assets, the institution stands to benefit more from the anticipated decrease in interest rates, as the value of these assets is likely to increase. Meanwhile, shorter-duration liabilities will not lock the institution into higher interest payments for an extended period, allowing more flexibility to adjust as rates decline.

Optimizing Capital

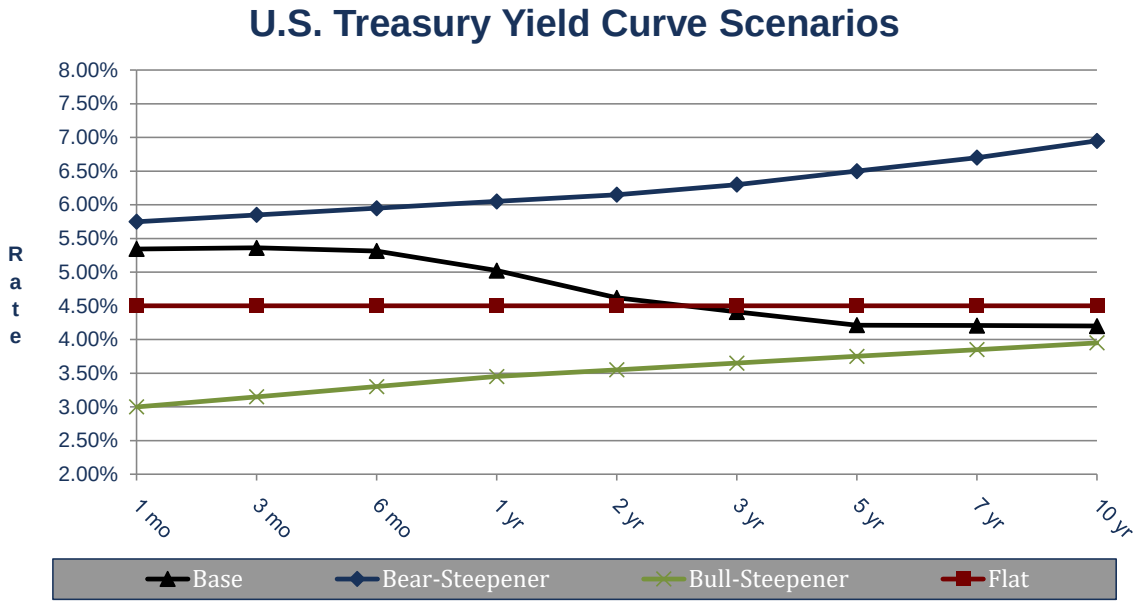
While the consensus is that interest rates will decline in the foreseeable future, uncertainty remains. Therefore, institutions must allocate capital in ways that align with their risk appetite and interest rate outlook. This approach helps manage the risks and opportunities associated with potential interest rate changes. A strategic approach to capital allocation includes diversifying assets and liabilities and conducting regular scenario and stress testing analyses.

By diversifying and managing the duration of assets and liabilities, institutions can avoid overexposure to interest rate movements in any one direction. Using the example on page four, the

institution originated residential real estate loans with longer durations, while also investing in both agency debt and treasury bonds with shorter, varied durations. This strategy balances flexibility and potential returns if rates do not move as expected.

Additionally, institutions can optimize their capital allocation and duration gap by performing regular scenario analyses. Conducting scenario analyses and stress testing can help assess the impact of various interest rate scenarios on the institution's financial position. Wilary Winn regularly performs interest rate twist scenarios for our ALM clients. These scenarios are built to measure the effects of varying interest rate curves on an institution's net interest income projections. The following table and chart reflect three scenarios that were run during March 31, 2024 ALM analyses.

3-31-24 Interest Rates							
Spot Rate	Base	Flat	Variance to Base	Bull-Steepener	Variance to Base	Bear-Steepener	Variance to Base
1 Mo. T-Bill	5.34%	4.50%	-0.84%	3.00%	-2.34%	5.75%	0.41%
3 Mo. T-Bill	5.36%	4.50%	-0.86%	3.15%	-2.21%	5.85%	0.49%
6 Mo. T-Bill	5.32%	4.50%	-0.82%	3.30%	-2.02%	5.95%	0.63%
12 Mo. T-Bill	5.02%	4.50%	-0.52%	3.45%	-1.57%	6.05%	1.03%
2 Yr. Treasury	4.62%	4.50%	-0.12%	3.55%	-1.07%	6.15%	1.53%
3 Yr. Treasury	4.41%	4.50%	0.09%	3.65%	-0.76%	6.30%	1.89%
5 Yr. Treasury	4.21%	4.50%	0.29%	3.75%	-0.46%	6.50%	2.29%
7 Yr. Treasury	4.21%	4.50%	0.29%	3.85%	-0.36%	6.70%	2.49%
10 Yr. Treasury	4.20%	4.50%	0.30%	3.95%	-0.25%	6.95%	2.75%



In adopting these practices, institutions can navigate the uncertainty of future interest rate movements and optimize their capital management strategies. This proactive and balanced approach helps institutions achieve their financial goals while managing risk effectively.

Stable Profitability and Earnings

While the industry has been utilizing short-term certificates to attract deposits, resulting in a shorter liability duration, there are significant costs and risks associated with this strategy: the high cost of funding, the inverted yield curve, and earnings pressure.

Many institutions are offering upwards of 5% on promotional CDs to lock in funding, anticipating that interest rates will fall in the future. This strategy aims to ensure stable funding now, with the expectation that these CDs will roll over into much lower rates once interest rates decline. However, paying 5% on these certificates does not allow much room for earning a spread in the current environment. Overnight cash at the Federal Reserve earns between 5.25% and 5.50%, meaning that the margin between the cost of funds and the interest income is minimal.

Furthermore, the current inverted yield curve means that short-term interest rates are higher than long-term rates and extending the duration of assets in such an environment will result in yields that are even lower than those on short-term assets, such as cash, which would further compress the institution's net interest margin. Additionally, institutions face a duration mismatch by locking in these high-cost short-term liabilities while the yields on longer-duration assets don't sufficiently compensate for the cost of funds.

Finally, the high cost of promotional CDs puts additional pressure on an institution's earnings in the short term, as the narrow spread between funding costs and interest income limits profitability. If high interest rates persist longer than expected, institutions may continue to face compressed spreads and earnings challenges, as the cost of rolling over short-term liabilities remains elevated.

Interest Rate Swaps

Many financial institutions use interest rate swaps to manage their duration profiles. These swaps allow institutions to adjust their interest rate sensitivity. Since duration measures how much a portfolio's price changes with shifts in interest rates, swaps help to manage that sensitivity. As discussed with the example institution on page four, an interest rate swap can benefit the institution if rates decline. Below is a summary of the institution's NEV profile under various parallel interest rate shocks as of March 31, 2024.

	Economic Value of Equity - 3/31/24						
	-300	-200	-100	Base	+100	+200	+300
Total Assets	962,227,644	945,923,799	928,837,953	911,763,444	895,114,446	878,841,427	862,830,917
Total Liabilities	822,687,407	790,793,194	762,235,546	736,642,758	713,811,422	696,501,371	681,841,564
Net EVE	139,540,237	155,130,605	166,602,407	175,120,686	181,303,024	182,340,056	180,989,352
% Change from Base	-20.32%	-11.42%	-4.86%		3.53%	4.12%	3.35%

As shown, the institution's NEV profile deteriorates as rates fall due to its liability-sensitive nature. By entering a "pay-floating, receive-fixed" swap, the institution's payments will decrease as rates decline, while it continues to receive fixed payments. The effect of a 3-year, $100MM pay-floating, receive-fixed interest rate swap is presented in the table below.

	Economic Value of Equity - 3/31/24						
	-300	-200	-100	Base	+100	+200	+300
$100MM 3 Yr SOFR Swap	8,681,324	5,674,797	2,783,433	-	(2,675,455)	(5,253,041)	(7,735,632)
Total Assets	970,908,968	951,598,597	931,621,385	911,763,444	892,438,991	873,588,386	855,095,284
Total Liabilities	822,687,407	790,793,194	762,235,546	736,642,758	713,811,422	696,501,371	681,841,564
Net EVE	148,221,562	160,805,402	169,385,840	175,120,686	178,627,569	177,087,015	173,253,720
% Change from Base	-15.36%	-8.17%	-3.27%		2.00%	1.12%	-1.07%

By agreeing to pay a floating rate over the next three years, anticipating a decline in rates, the institution reduces its NEV sensitivity in down-rate shock scenarios. For example, the -300 basis point shock reduces NEV sensitivity from -20.32% to -15.36%. While this trade-off slightly worsens the positive rate shock sensitivity, the overall strategy remains beneficial in reducing interest rate risk.

Conclusion

By using duration analysis, institutions can strategically manage the durations of their assets and liabilities to manage future interest rate risk, optimize capital allocation and enhance net interest margin. This involves balancing asset and liability durations, conducting thorough scenario analysis and optimizing yield curve positioning. Aligning these strategies with the interest rate outlook while maintaining robust risk management practices enables institutions to navigate challenging market conditions and protect their profitability.