ADVANCED PUBLIC FUNDS INVESTING

WEBINAR 7 | ADVANCED INVESTMENT ANALYSIS

Rick Phillips

President and Chief Investment Officer | FHN Financial Main Street Advisors

February 22, 2022

CDIAC 40 YEARS

CMTA

Background

Rick Phillips

- FHN Main Street Advisors President- 2005 to Present
- Clark County Nevada Chief Investment Officer- 1998 to 2005
- City of Las Vegas Investment Officer- 1989 to 1998
- Government Investment Officers Association (GIOA) Founder
- Firm Manages and Consults on $70+ Billion for States and Local Governments

Fantastic Fundamentals of Treasury Programs

1. Detailed Asset/Liability Matching Model (aka: Cash Flow Model) is a Must
2. Longer Duration Will Generate More Investment Income Over the Long Run
3. Interest Rate Risk (WAM/Duration) Matches Cash Flow Metrics
4. Credit Can Enhance Income, But Duration is the Bigger Determinant of Income
5. You…Nor Anyone Else Can't Time the Market Accurately Over the Long Run
6. Limit Optionality (Callables) in the Portfolio
7. Do Not Let GASB 31 (mark-to-market) Drive Investment Decisions/WAM-Duration
8. Understand the Risks of Funds in LAIF and Other Pools
9. Follow GAAP (Generally Accepted Accounting Principles)
10. Benchmark Your Investment Program and Portfolio in Multiple Ways
11. Tell the Story: Provide Quality, Timely, Transparent Reporting

Investment Policy Objectives Should Drive Investment Program Decisions

1. **Safety of Principal:** Safety of principal is the foremost objective of the [entity's] investment program. Investments by the [designated official] shall be undertaken in a manner that seeks to ensure the preservation of capital in the overall portfolio. To attain this objective, diversification of security types, sectors, issuers, and maturities is necessary in order that potential losses on individual securities do not exceed the income generated from the remainder of the portfolio.

2. **Liquidity:** The investment portfolio shall be structured to timely meet expected cash outflow needs and associated obligations which might be reasonably anticipated. This objective shall be achieved by matching investment maturities with forecasted cash outflows and maintaining an additional liquidity buffer for unexpected liabilities.

3. **Investment Income:** The investment portfolio shall be designed to earn a market rate of investment income in relation to prevailing budgetary and economic cycles, while taking into account investment risk constraints and liquidity needs of the portfolio.

Polling Question

To earn CPE credits, participants must participate in at least three of the polling questions.

What is the first analysis/modeling you should do for your investment program before you buy a bond?

A. Future interest rates model
B. Cash Flow model
C. Option Adjusted Spread analysis

The Most Important and First Analysis of Investment Programs…Cash Flow Analysis

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		INFLOWS								OUTFLOWS							
2	Date	Begin MMF	Inv Mat/Sell	Prop Tax	State Rev	Debt Svc Inflows	Wells Rev /Bus Lic	BofA Rev	Total	Payroll	AP/Cont Disb	Debt Svc	Wires/ PERS	Misc Outflow	Inv Purchase	Total	End MMF
63	8/30/21	18.4	50.0		6.5			14.9	89.8		5.8	30.1	0.2			36.1	72.8
64	8/31/21	72.8			131.5			10.1	214.4		3.0		7.5		150.0	160.5	54.0
65	9/1/21	54.0						8.0	62.0		6.5	6.5	1.8			14.8	49.4
66	9/2/21	49.4						8.0	57.4		6.0		6.0			12.0	45.4
67	9/3/21	45.4						8.0	53.4		6.0					6.0	47.4
68	9/4/21	47.4							47.4							0.0	47.4
69	9/5/21	47.4							47.4							0.0	47.4
70	9/6/21	47.4							47.4							0.0	47.4
71	9/7/21	47.4						8.0	55.4		6.0		20.0			26.0	29.4
72	9/8/21	29.4						8.0	37.4		6.0					6.0	31.4
73	9/9/21	31.4				20.0		8.0	59.4	34.0	6.0					40.0	19.4
74	9/10/21	19.4			6.5			8.0	33.9	7.0	10.0					17.0	16.9
75	9/11/21	16.9							16.9							0.0	16.9
76	9/12/21	16.9							16.9							0.0	16.9
77	9/13/21	16.9						8.0	24.9		6.0					6.0	18.9
78	9/14/21	18.9						8.0	26.9		6.0					6.0	20.9
79	9/15/21	20.9		210.0				8.0	238.9		6.0		23.0			29.0	209.9

5 Years

Portfolio Value "Top to Bottom" Analysis #1

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Average
FY 2019	$535.7	$525.2	$679.6	$722.0	$847.4	$859.4	$838.6	$956.1	$1,054.9	$1,104.0	$1,152.8	$952.0	**$852.3**
FY 2020	$694.8	$770.1	$1,078.0	$1,060.9	$1,263.4	$1,241.0	$1,229.6	$1,353.7	$1,260.3	$1,311.5	$1,380.8	$1,137.2	**$1,148.4**
FY 2021	$1,033.7	$1,013.7	$1,231.8	$1,296.9	$1,367.6	$1,379.1	$1,310.8	$1,390.6	$1,435.3	$1,483.7	$1,559.3	$1,288.5	**$1,315.9**
FY 2022	$1,000.0	$1,020.1											**$1,010.0**

Figures in Millions, Average Monthly Book Value

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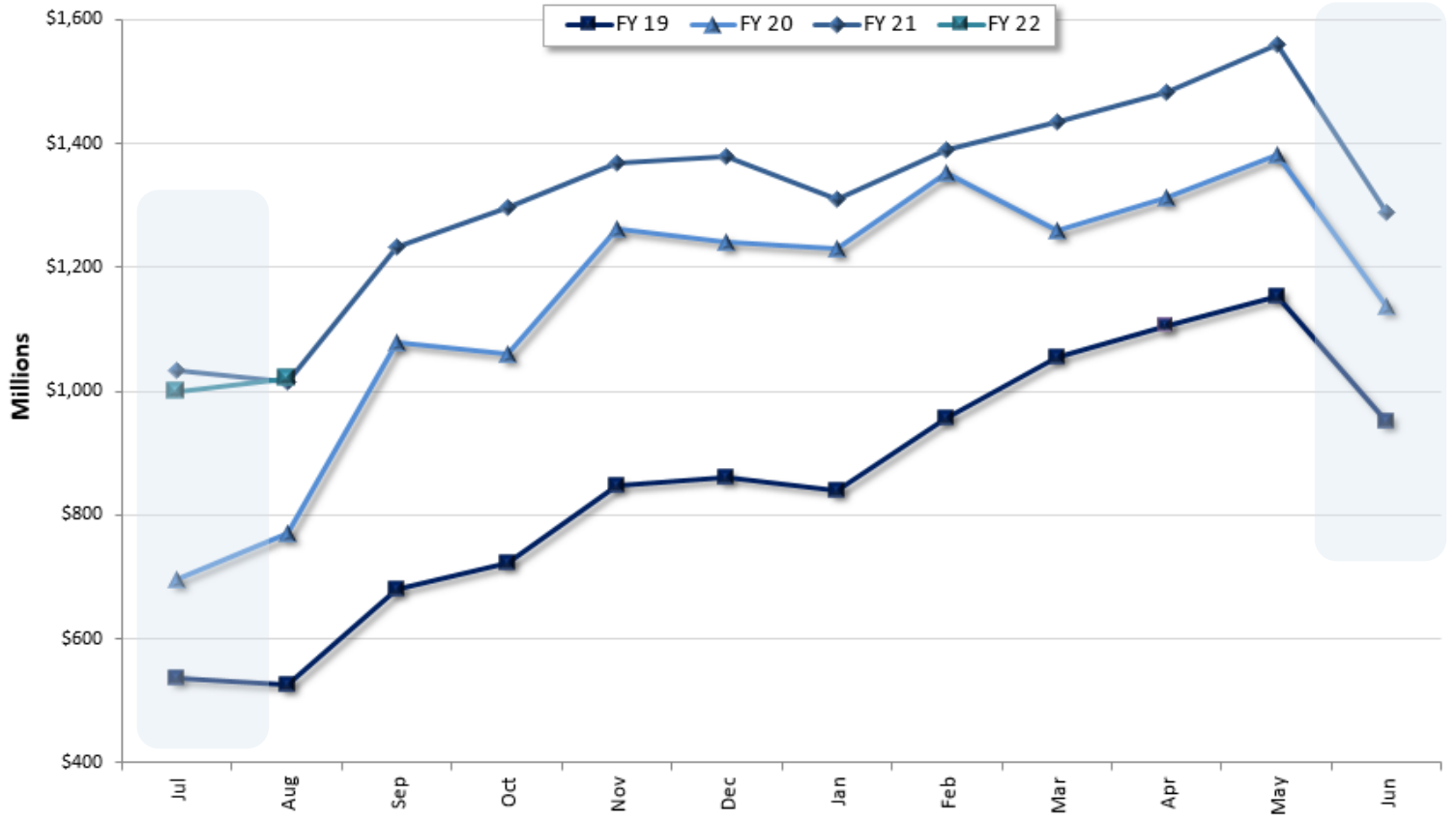
CDIAC 40 YEARS CMTA

Portfolio Value “Top to Bottom” Analysis #1

Historical Book Values Per Fiscal Year

7/31/2021



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Average
FY 2019	$535.7	$525.2	$679.6	$722.0	$847.4	$859.4	$838.6	$956.1	$1,054.9	$1,104.0	$1,152.8	$952.0	**$852.3**
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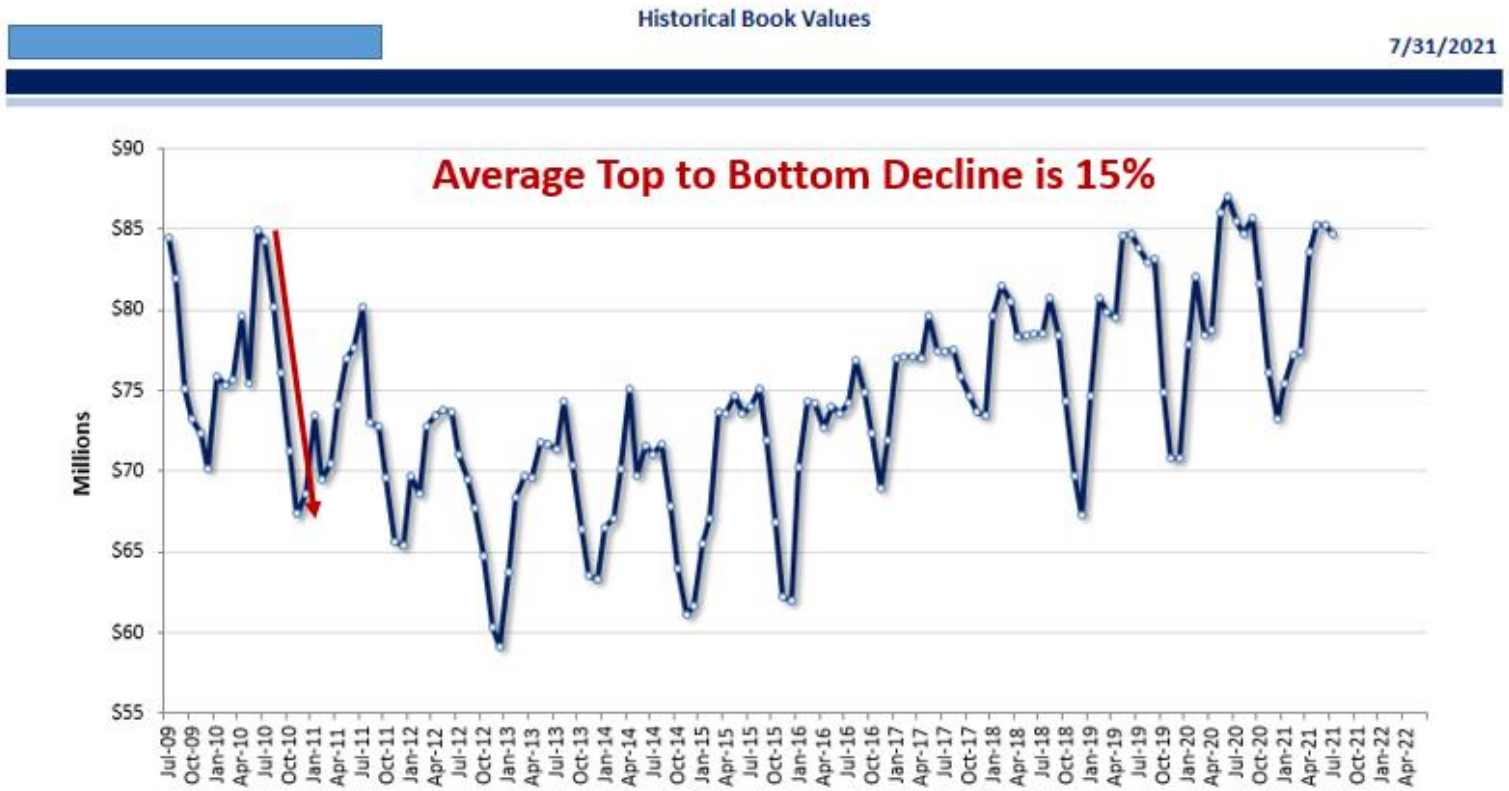
Portfolio Value “Top to Bottom” Analysis #1



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Average
FY 2013	$71.0	$69.5	$67.7	$64.8	$60.4	$59.1	$63.8	$68.4	$69.7	$69.6	$71.8	$71.7	**$67.3**
FY 2014	$71.3	$74.4	$70.4	$66.4	$63.5	$63.4	$66.5	$67.0	$70.1	$75.1	$69.7	$71.6	**$69.1**
FY 2015	$71.1	$71.7	$67.9	$64.0	$61.1	$61.7	$65.6	$67.0	$73.7	$73.6	$74.7	$72.8	**$68.7**
FY 2016	$73.6	$74.1	$75.1	$66.9	$62.2	$61.9	$70.3	$74.4	$74.2	$72.7	$74.0	$73.6	**$71.1**
FY 2017	$74.3	$76.8	$74.9	$72.3	$69.0	$72.0	$77.0	$77.1	$77.1	$77.0	$79.6	$77.4	**$75.4**
FY 2018	$77.4	$77.5	$75.9	$74.6	$73.7	$73.4	$79.7	$81.5	$80.6	$78.3	$78.4	$78.5	**$77.5**
FY 2019	$78.5	$80.7	$78.4	$74.4	$69.7	$67.3	$74.7	$80.7	$79.8	$79.5	$84.6	$84.8	**$77.8**
FY 2020	$83.8	$82.9	$83.1	$80.3	$74.9	$70.8	$77.9	$82.0	$78.4	$78.8	$86.0	$87.0	**$80.5**
FY 2021	$85.5	$84.8	$85.7	$81.6	$76.1	$73.2	$75.4	$77.3	$77.4	$83.6	$85.3	$85.2	**$80.9**
FY 2022	$84.7												**$84.7**

Figures in Millions, Average Daily Balance

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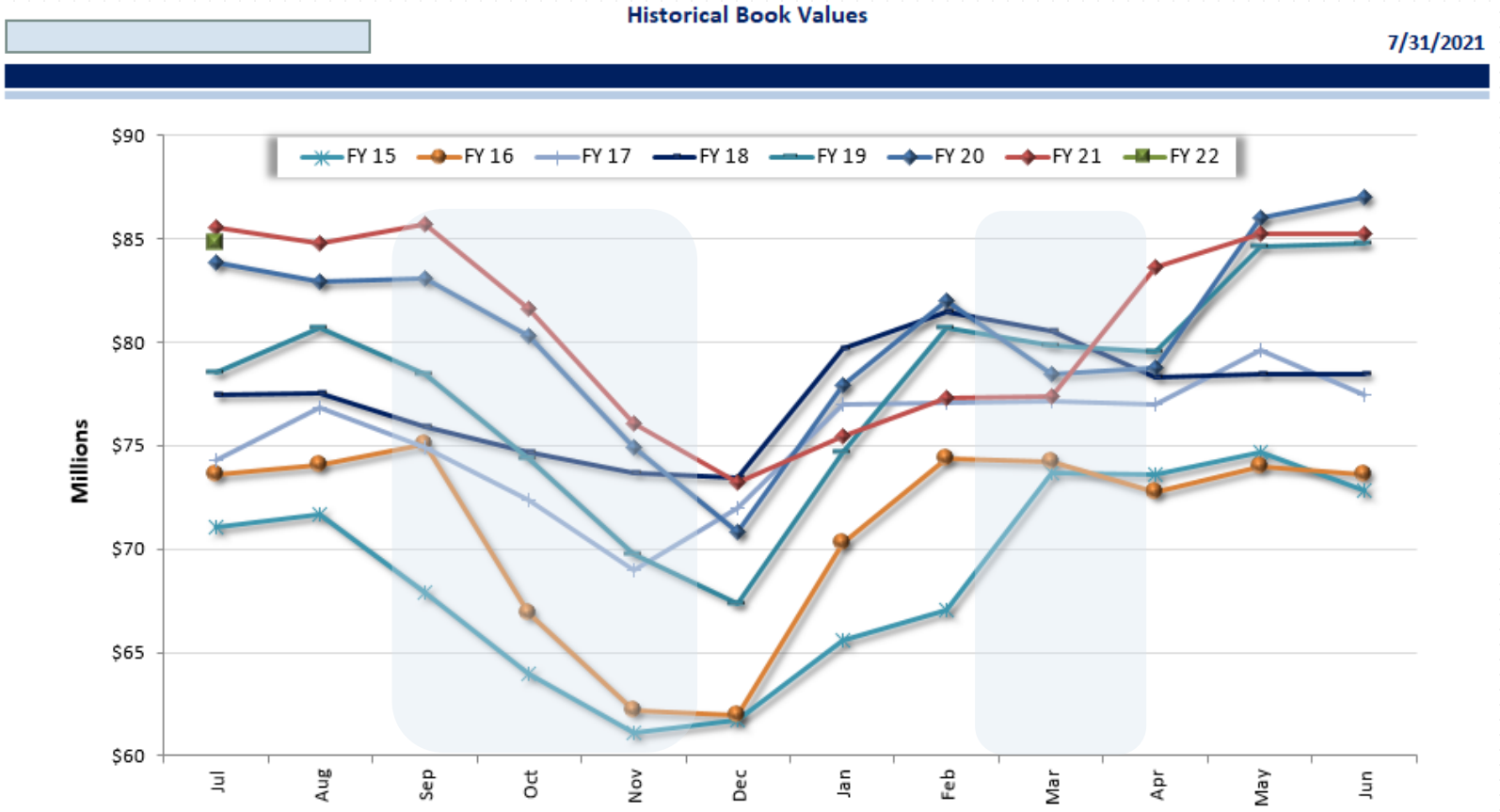
Portfolio Value “Top to Bottom” Analysis #1



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Average
FY 2015	$71.1	$71.7	$67.9	$64.0	$61.1	$61.7	$65.6	$67.0	$73.7	$73.6	$74.7	$72.8	**$68.7**
FY 2016	$73.6	$74.1	$75.1	$66.9	$62.2	$61.9	$70.3	$74.4	$74.2	$72.7	$74.0	$73.6	**$71.1**
FY 2017	$74.3	$76.8	$74.9	$72.3	$69.0	$72.0	$77.0	$77.1	$77.1	$77.0	$79.6	$77.4	**$75.4**
FY 2018	$77.4	$77.5	$75.9	$74.6	$73.7	$73.4	$79.7	$81.5	$80.6	$78.3	$78.4	$78.5	**$77.5**
FY 2019	$78.5	$80.7	$78.4	$74.4	$69.7	$67.3	$74.7	$80.7	$79.8	$79.5	$84.6	$84.8	**$77.8**
FY 2020	$83.8	$82.9	$83.1	$80.3	$74.9	$70.8	$77.9	$82.0	$78.4	$78.8	$86.0	$87.0	**$80.5**
FY 2021	$85.5	$84.8	$85.7	$81.6	$76.1	$73.2	$75.4	$77.3	$77.4	$83.6	$85.3	$85.2	**$80.9**
FY 2022	$84.7												**$84.7**

Figures in Millions, Average Daily Balance

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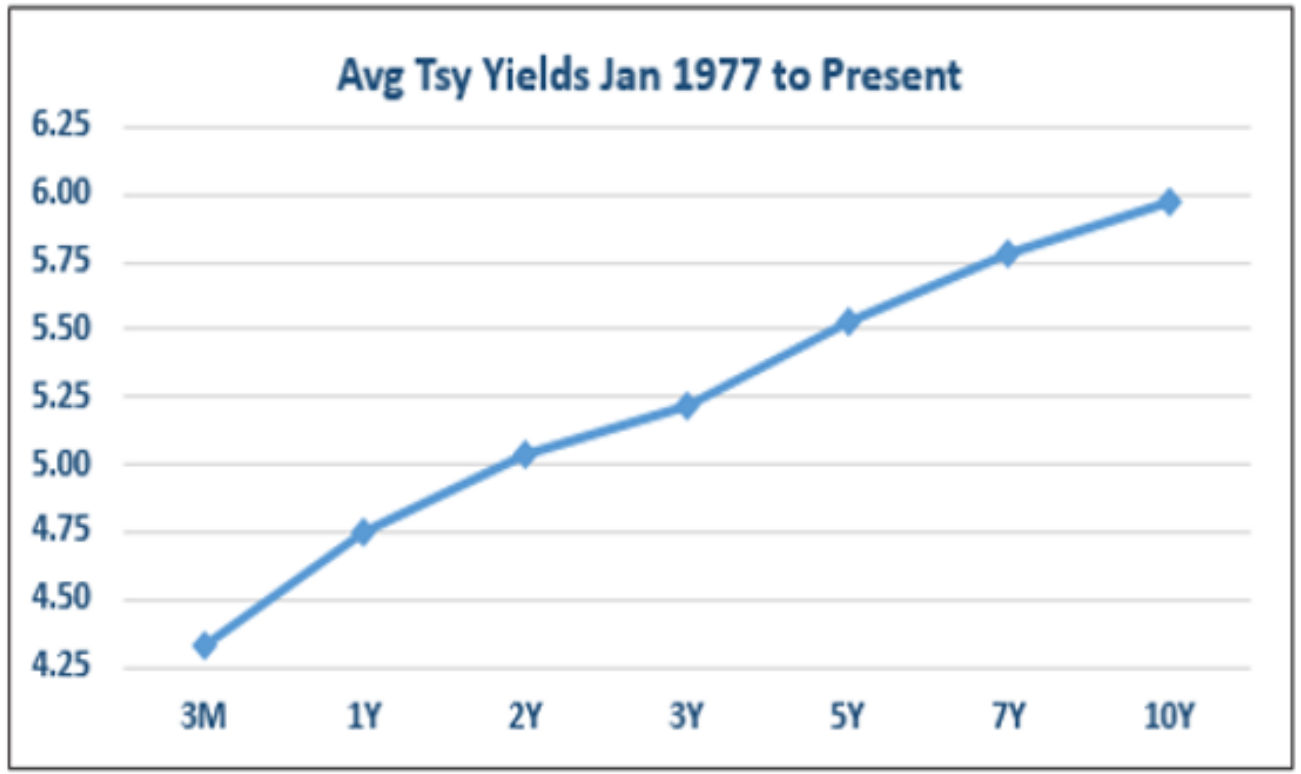
Longer Duration Will Generate More Investment Income Over the Long Run

Benchmark Treasury Modified Sharp Ratio (MSR) Analysis

Jan 1977 to Present

Maturity	Avg Yield	Avg Duration	Modified Sharp Ratio	% Return of 10Yr / % 10Yr Risk
3 Mon T-Bill	4.32	0.25		72% / 3%
1 Yr T-Bill	4.75	1.00	0.43	80% / 12%
2 Yr T-Note	5.04	1.91	0.37	84% / 24%
3 Yr T-Note	5.21	2.78	0.32	87% / 34%
5 Yr T-Note	5.53	4.55	0.27	93% / 56%
7 Yr T-Note	5.78	6.24	0.23	97% / 77%
10 Yr T-Note	5.97	8.10	0.20	100% / 100%



Source: Bloomberg

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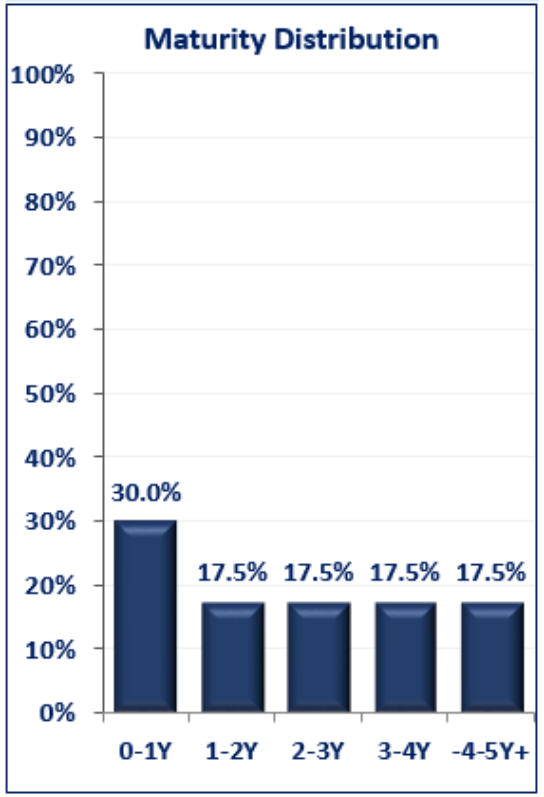
Portfolio Structures and Strategies

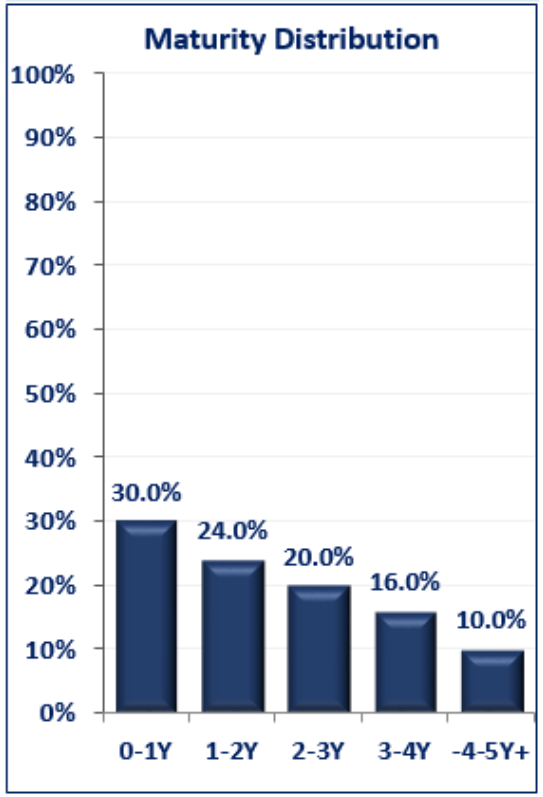
Using Bullets, Callables, Floaters, and Step-Ups

Proactive Management or Buy & Hold

Cash Flow Matching

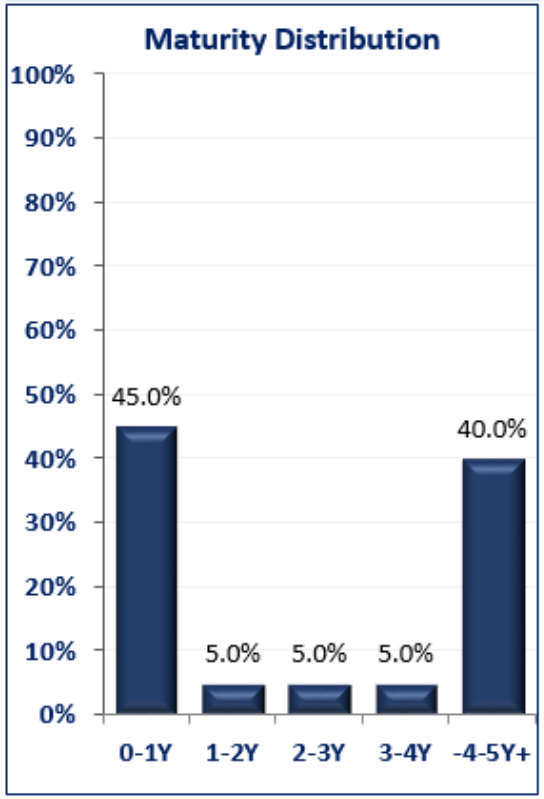


Index Matching

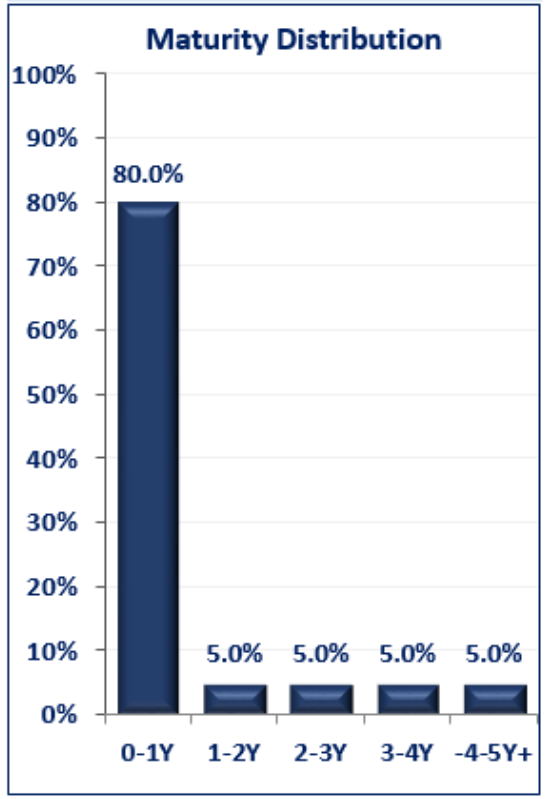


Active Management

Barbell/Maketing Timing

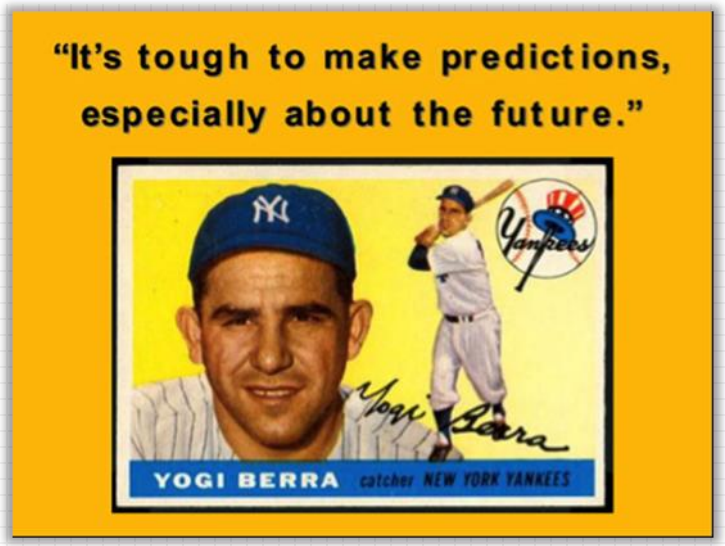


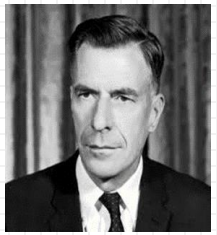
Market Timing/Relative Value



Creating a Stable'r Investment Income

Timing the Market



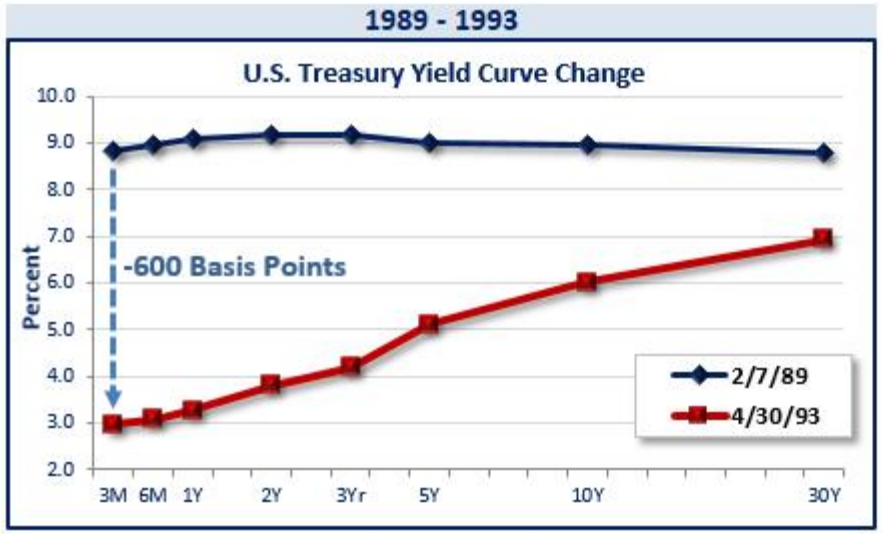


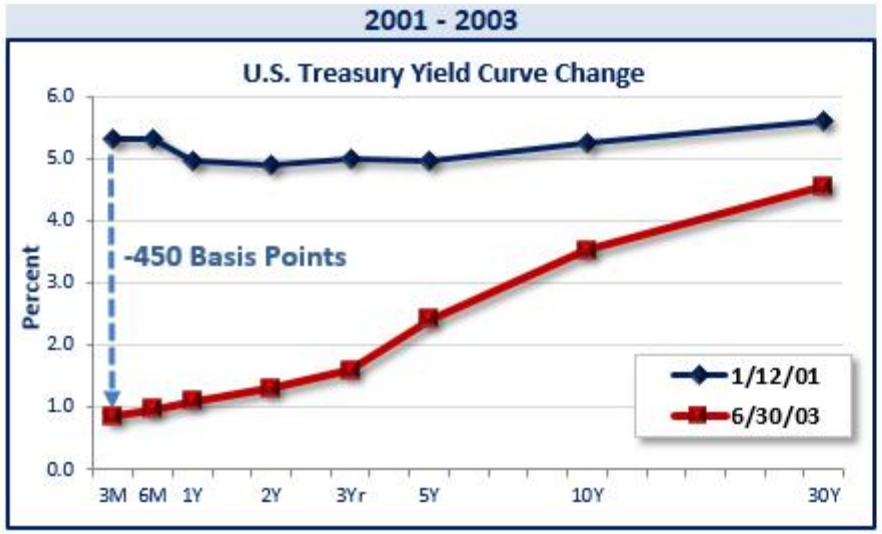
"The only function of economic (and interest rate) forecasting is to make astrology look respectable."
John Kenneth Galbraith, Economist

"The Federal Reserve is currently not forecasting a recession."
Ben Bernanke (former Fed Chair), January 10, 2008

"Our ability to forecast is limited".
Alan Greenspan (former Fed Chair) CNBC November 2019

The “Yield Curve Trap”





Now Witness the Firepower of a Fully Operational Flat Yield Curve

Source: Bloomberg

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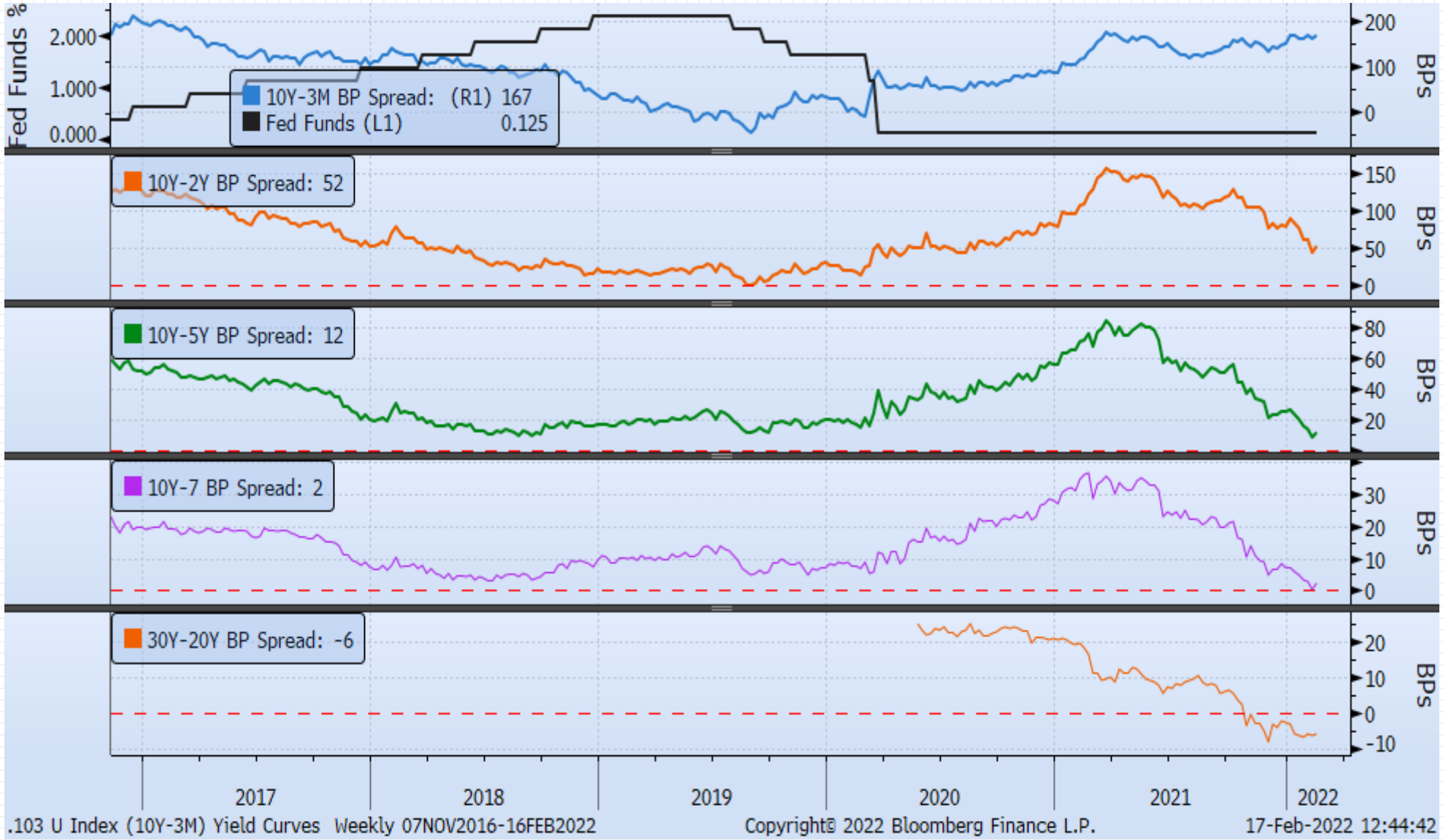
First Yield Curve "Canary in the Coal Mine"?



Basis Points

Source: Bloomberg

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What is the Market Pricing for Fed Hikes?

Probability of Fed Hikes
CME GROUP
2/17/2022

FOMC Meeting	2 Hikes .50%-.75%	3 Hikes .75%-1.00%	4 Hikes 1.00%-1.25%	5 Hikes 1.25-1.50%	6 Hikes 1.50%-1.75%	7 Hikes 1.75%-2.00%	8 Hikes 2.00%-2.25%	9 Hikes 2.25%-2.50%	10 Hikes 2.25%-2.50%	11 Hikes 2.50%-2.75%	12 Hikes 2.75%-3.00%
16-Mar-2022	62%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4-May-2022	100%	71%	15%	0%	0%	0%	0%	0%	0%	0%	0%
15-Jun-2022	100%	100%	77%	27%	0%	0%	0%	0%	0%	0%	0%
27-Jul-2022	100%	100%	95%	67%	3%	3%	0%	0%	0%	0%	0%
21-Sep-2022	100%	100%	99%	89%	57%	18%	2%	0%	0%	0%	0%
2-Nov-2022	100%	100%	99%	94%	72%	36%	9%	1%	0%	0%	0%
14-Dec-2022	100%	100%	100%	97%	86%	60%	27%	7%	1%	0%	0%
1-Feb-2023	100%	100%	100%	98%	90%	69%	39%	14%	3%	0%	0%
15-Mar-2023	100%	100%	100%	99%	95%	82%	57%	29%	9%	2%	0%
3-May-2023	100%	100%	100%	99%	96%	85%	63%	36%	14%	4%	1%
14-Jun-2023	100%	100%	100%	100%	96%	89%	71%	46%	22%	7%	2%
26-Jul-2023	100%	100%	100%	100%	95%	90%	74%	50%	26%	10%	3%

Values in Green = Probability Over 50%

Source: CME

Polling Question

To earn CPE credits, participants must participate in at least three of the polling questions.

How many 25 basis point hikes will the Fed do this year?

A. 1 to 2
B. 3 to 4
C. 5 to 6
D. 7 or more

Security Types for Different Strategies

Securities to Match Cash Outflows:

- Bullets
- Floating Rate Notes*
- ABS Credit Card (soft bullets)*

Securities to Market Time:

- Bullets
- Callables
- Floating Rate Notes*
- Step-Ups/Step-Downs*
- Paydowns*(ABS/MBS/SBA)
- Bond Mutual Funds
- Floating NAV Funds
- TIPS

* “WAM Real Estate”

Bullet Basics: 5 Year T-Note vs 5 Year T-Strip

Bullet

T 1 ½ 01/31/27 Govt | Settings | Yield and Spread Analysis | No Notes | 95) Buy | 96) Sell

1) Yield & Spread | 2) Yields | 3) Graphs | 4) Description | 5) Pricing | 6) Custom

T 1 ½ 01/31/27 (912828Z78)

Price	100-00 (100.00)		
Settle	01/31/22	Maturity	01/31/2027
Street Convention	1.5000		
Treasury Convention	1.5000		
True Yield	1.4992		
Equiv 1 /Yr Compound	1.5056		
Japanese Yield (Simple)	1.5000		
Mmkt (Act/ 360)			
Current Yield	1.500		

Risk	
Duration	4.836
Modified Duration	4.800
Risk	4.800
Convexity	0.259
DV 01 on 1MM	480
YV 0.031	0.00651

Invoice	
Face	1,000 M
Principal	1,000,000.00
Accrued (0 Days)	0.00
Total (USD)	1,000,000.00

Strip

S 0 02/15/27 Govt | Settings | Yield and Spread Analysis | No Notes | 95) Buy | 96) Sell

1) Yield & Spread | 2) Yields | 3) Graphs | 4) Description | 5) Pricing | 6) Custom

S 0 02/15/27 (912833PC8)

Price	91.0908 (91.0908092)		
Settle	02/15/22	Maturity	02/15/2027
Street Convention	1.8750		
Treasury Convention	1.8750		
True Yield	1.8740		
Equiv 1 /Yr Compound	1.8838		
Japanese Yield (Simple)	1.9560		
Mmkt (Act/ 360)			
Current Yield	0.000		

Risk	
Duration	5.000
Modified Duration	4.954
Risk	4.512
Convexity	0.270
DV 01 on 1MM	451
YV 0.031	0.00693

Invoice	
Face	1,000 M
Principal	910,908.00
Accrued (0 Days)	0.00
Total (USD)	910,908.00

Source: Bloomberg

Callable Characteristics: Types, Rights, and Obligations

Two Types of Options

Calls and Puts

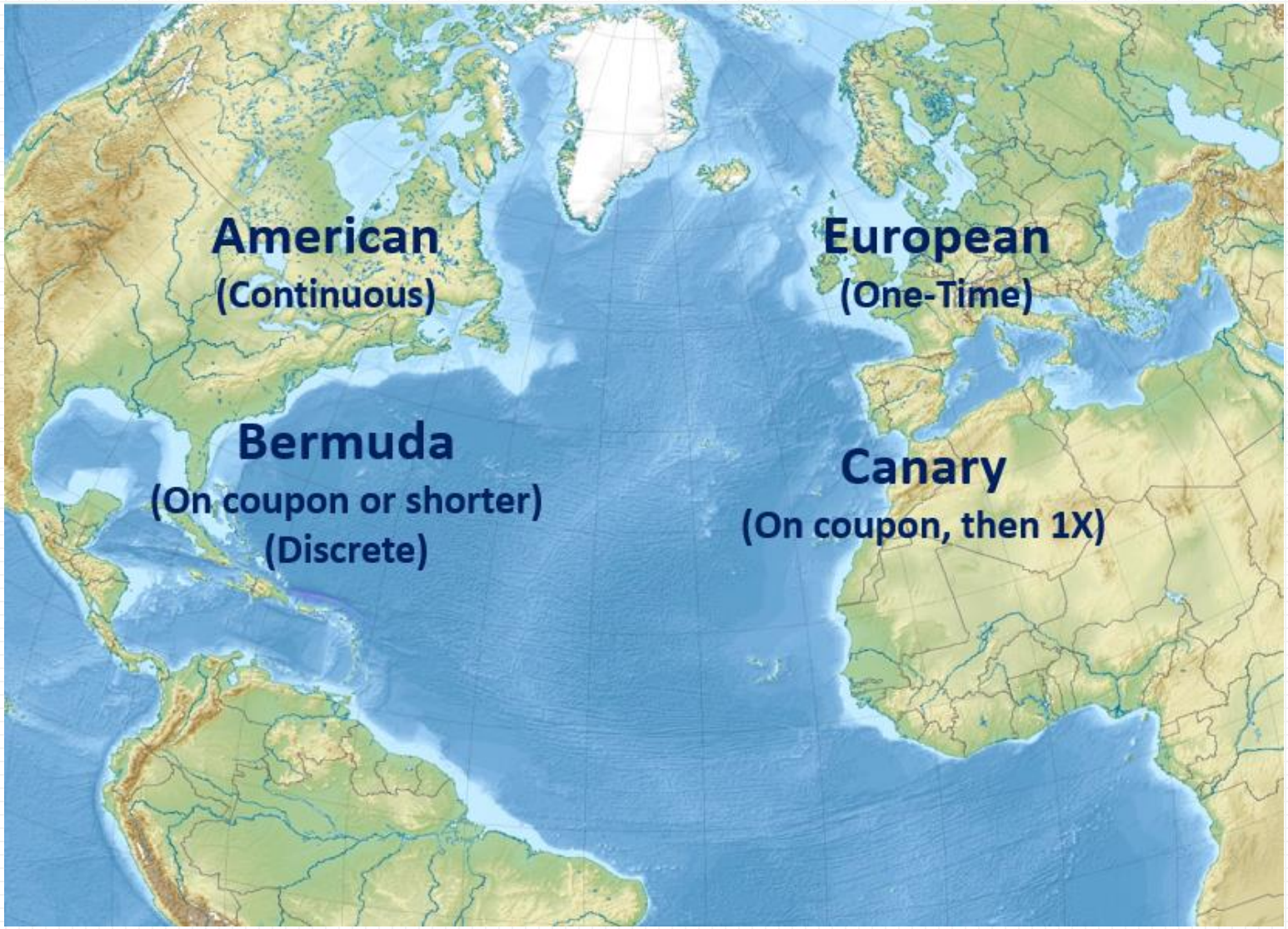
When you purchase a callable bond, you are selling a call option to the issuer

What is the issuer's right?

What is your obligation?

How are you getting paid when you sell that option?

Callable Characteristics: Type Subgroups



Callable Characteristics: Yield/Coupon

Primary Items Affecting Yield/Coupon

- Level of Treasury Rates
- Number of Calls
- Volatility
- Days to Settlement/Cost of Carry
- Auction/Reverse Inquiry
- Fees

Callable Characteristics: Number of Calls

5 Year Securities: Callables' Lockouts 1 Year

Instrument	Number of Calls	Yield
Treasury	0	1.95%
Bullet	0	1.98%
One-Time Call	1	2.03%
Discrete Call (quarterly)	15	2.12%
Continuous Call*	1,450	2.24%

*10 Day Call Notice

Are You Getting Paid Enough For the Options You're Selling?

Source: Bloomberg, FHN Capital Markets (callables: using avg spreads, 3 weeks settlement, standard fees)

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Callable Characteristics: Volatility

USSV014 BGN Curncy — Security Description: Swap

Properties | Related Instruments | Related Curves

USD Swaption ATM %VOL 3M (OIS) 1Yx4Y — FIGI BBG007QJT583

A swaption is the option to enter into an interest rate swap. In exchange for an option premium, the buyer gains the right but not the obligation to enter into a specific swap agreement with the issuer on a specified future date. The time period between the valuation date and such date is called the expiry of the option. The length of the underlying swap is referred to as the tenor of the swaption. The coupon of the fixed leg of the swap is called the strike of the swaption.

Overview		Fixed Leg		Float Leg	
Currency	USD	Day Count	30I/360	Day Count	ACT/360
Expiry	1Y (17-FEB-2023)	Pay Freq	SemiAnnual	Pay Freq	Quarterly
Swaption Tenor	4Y (17-FEB-2027)	Bus Adj	ModifiedFollowing	Index	US0003M Index
Quote	45.77% (Black Vol)	Adjust	Accrl and Pay Dates	Reset Freq	Quarterly
Exercise	European	Roll Conv	Backward (EOM)	Bus Adj	ModifiedFollowing
Strike Type	ATM	Calc Cal	FD, EN	Adjust	Accrl and Pay Dates
Discounting	OIS	Pay Delay	0 Business Days	Roll Conv	Backward (EOM)
Style	Straddle			Calc Cal	FD, EN
Notification D...	2 Business Days			Fix Cal	EN

Price Chart | GP »

Source: Bloomberg

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Callable Characteristics: Days to Settlement/Cost of Carry

95) Actions ▾ | 96) Alerts ▾ | 97) Summary | 98) Set Homepage | 99) Export ▾ | New Issue Monitor

Selection *NIM2-Agency (NIM2) ▾ | 1) Show Filters | 2) Clear Filters | Issues ▾

Real Time | Issue History | Date Range 01/15/22 - 02/15/22 | 6) Prelim Bonds | PREL

	Date ↓	Issuer	Coupon	Maturity	Spread	Curr	Outst	Book Mgr	Note
			Fixed ▾	All ▾	All ▾	US ▾	All ▾		5
101)	13:21	FED HOME LN BANK	2.170	03/08/27		USD	15	STONEX-sole	5-NC2 1X
102)	9:43	FED HOME LN BANK	2.770	03/04/27		USD	35	RBCCM-sole	5-NC1MO BERM
103)	9:19	FED HOME LN BANK	3.220	02/25/37		USD	35	JOINT LEADS	15-NC6MO INC
104)	8:51	FED HOME LN BANK	2.375	03/08/27		USD	25	JOINT LEADS	5-NC1 BERM
105)	8:44	FED HOME LN BANK	2.000	08/28/25		USD	50	CCB,RJA,TSI	3.5-NC1 1INC
106)	2/14	FED HOME LN BANK	2.625	02/25/27		USD	35	JOINT LEADS	5-NC1MO INC
107)	2/14	FED HOME LN BANK	2.750	03/08/27		USD	85	JOINT LEADS	5-NC1MO INC

11 Days

Source: Bloomberg

Callable Characteristics: Auction/Reverse Inquiry

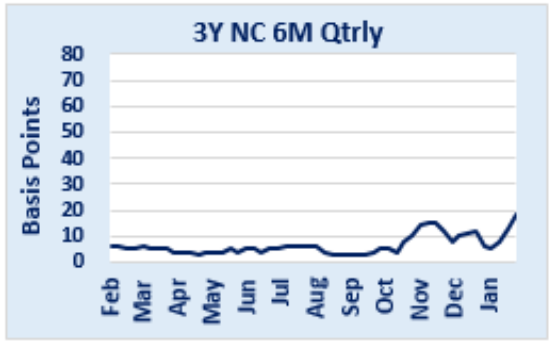
Generally, if a Federal Agency issues at auction, you will get a higher yield than if you do a reverse inquiry.

The higher the fee (selling concession) to the broker/dealer, the lower the yield to you.

Generally, broker/dealers make more of callables than bullets.

Agency Callable Spreads

5



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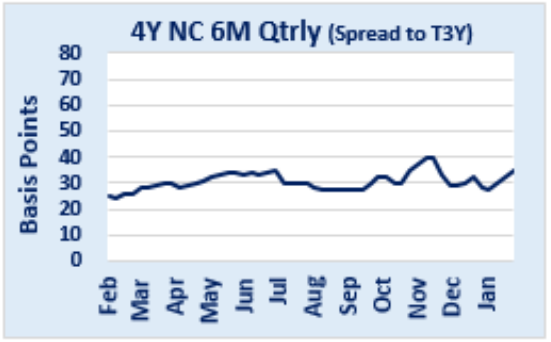

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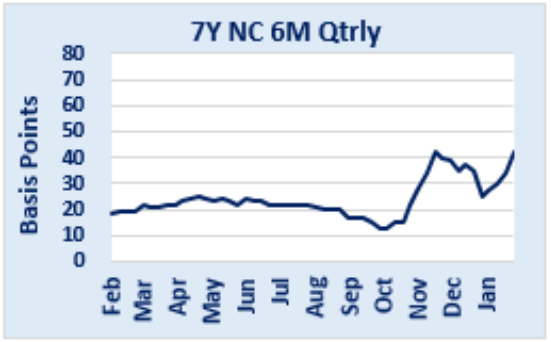
34



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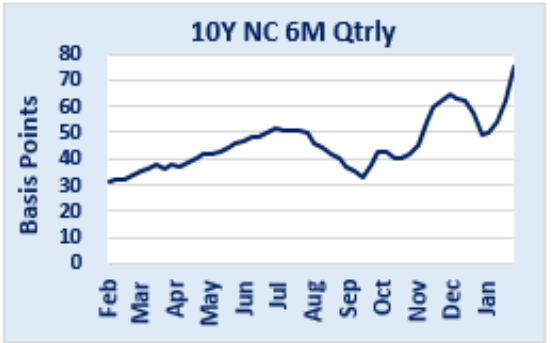

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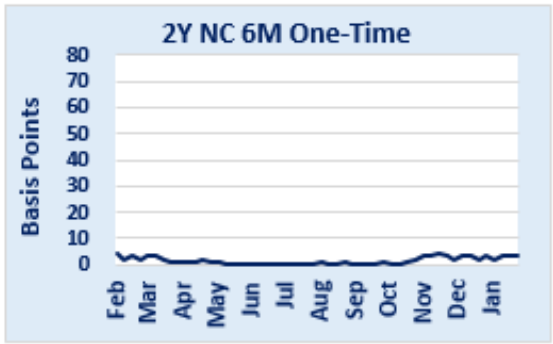

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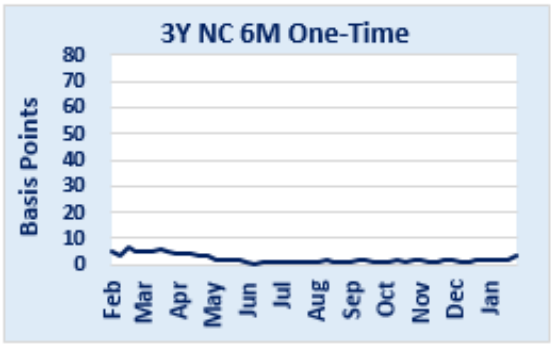

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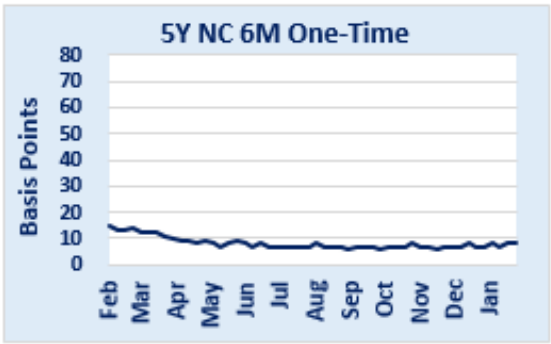


8

Source: Bloomberg, FHN Financial

2/15/2022

Duration

Duration: A measure of the timing of the cash flows, such as the interest payments and the principal repayment, to be received from a given fixed income security. This calculation is based on three variables: term to maturity, coupon rate, and yield to maturity. The duration of a security is a useful indicator of its price volatility for given changes in interest rates. There are three primary types of duration: Macaulay Duration, Modified Duration, and Effective Duration.

- **Macaulay Duration** was developed in 1938 by Frederic Macaulay, this form of duration measures the number of years required to recover the true cost of a bond, considering the present value of all coupon and principal payments received in the future. Thus, it is the only type of duration quoted in **"years"**. Interest rates are assumed to be continuously compounded.

- **Modified Duration** expands or modifies Macaulay duration to measure the responsiveness of a bond's price to interest rate changes. **It is defined as the percentage change in price for a 100 basis point change in interest rates**. The formula assumes that the cash flows of the bond do not change as interest rates change (which is not the case for most callable bonds).

- **Effective Duration (sometimes called option-adjusted duration)** further refines the modified duration calculation and is particularly useful when a portfolio contains callable securities. **Effective duration requires the use of a complex model for pricing bonds that adjusts the price of the bond to reflect changes in the value of the bond's "embedded options" (e.g., call options or a sinking fund schedule) based on the probability that the option will be exercised**. Effective duration incorporates a bond's yield, coupon, final maturity and call features into one number that indicates how price-sensitive a bond or portfolio is to changes in interest rates.

Source: CDIAC

Polling Question

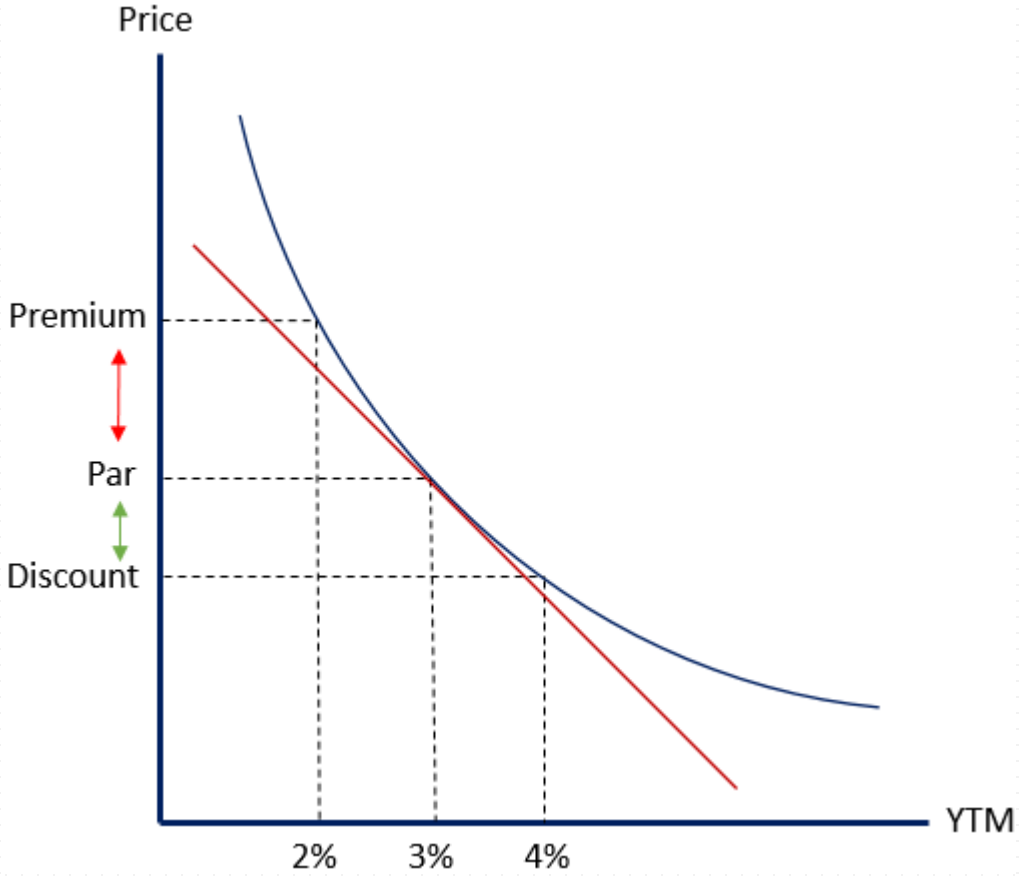
To earn CPE credits, participants must participate in at least three of the polling questions.

Which bond (with the exact same maturities) has a higher effective duration?

A. 5 Year Agency Callable
B. 5 Year T-Note
C. 5 Year Zero Coupon T-Strip

Duration and Convexity

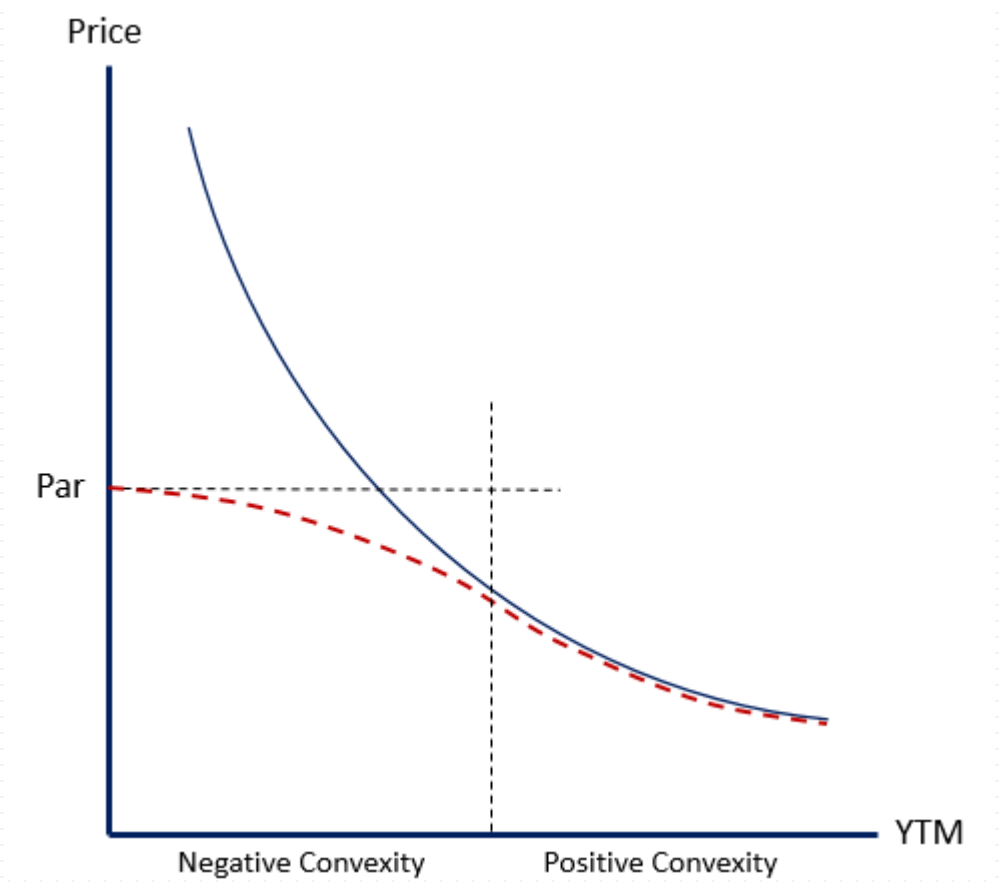
$$\Delta Bond\ Price \approx -Modified\ Duration(\Delta YTM) + \frac{1}{2} Convexity(\Delta YTM)^2$$



- Because duration is a linear assumption, it miscalculates the change in the price of a bond given a change in the yield to maturity
- Duration underestimates the bond price when yields fall and overestimates the bond price when yields rise
- **Convexity** measures the curvature of the price/yield relationship of a bond
- You can better estimate the change in price, given a change in the yield to maturity, by adding a convexity adjustment to our previous formula

Source: Bloomberg, FHN Financial

Callable Bonds and Convexity



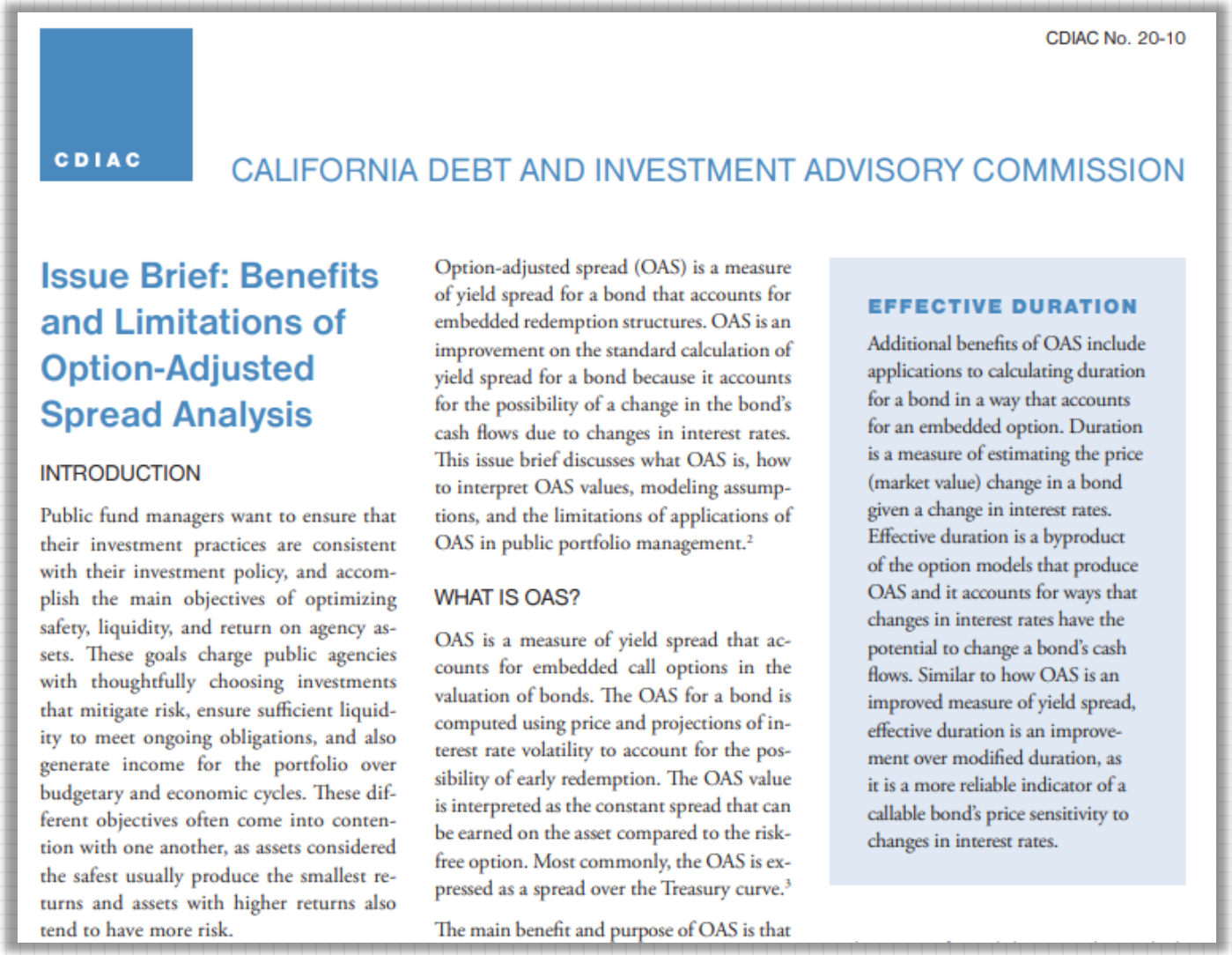
- As interest rates drop, callable bonds become negatively convex and duration decreases
- If the bonds coupon is higher than a comparable bullet security, the issuer will call back the bond and you will have to reinvest at lower rates
- As interest rates rise, callable bonds act like normal bullet bonds and can become positively convex

Source: Bloomberg, FHN Financial

Option Adjusted Spread (OAS)

WHAT IS OAS?

OAS is a measure of yield spread that accounts for embedded call options in the valuation of bonds. The OAS for a bond is computed using price and projections of interest rate volatility to account for the possibility of early redemption. The OAS value is interpreted as the constant spread that can be earned on the asset compared to the risk-free option. Most commonly, the OAS is expressed as a spread over the Treasury curve.



CDIAC No. 20-10

CDIAC

CALIFORNIA DEBT AND INVESTMENT ADVISORY COMMISSION

Issue Brief: Benefits and Limitations of Option-Adjusted Spread Analysis

INTRODUCTION

Public fund managers want to ensure that their investment practices are consistent with their investment policy, and accomplish the main objectives of optimizing safety, liquidity, and return on agency assets. These goals charge public agencies with thoughtfully choosing investments that mitigate risk, ensure sufficient liquidity to meet ongoing obligations, and also generate income for the portfolio over budgetary and economic cycles. These different objectives often come into contention with one another, as assets considered the safest usually produce the smallest returns and assets with higher returns also tend to have more risk.

Option-adjusted spread (OAS) is a measure of yield spread for a bond that accounts for embedded redemption structures. OAS is an improvement on the standard calculation of yield spread for a bond because it accounts for the possibility of a change in the bond's cash flows due to changes in interest rates. This issue brief discusses what OAS is, how to interpret OAS values, modeling assumptions, and the limitations of applications of OAS in public portfolio management.[2]

WHAT IS OAS?

OAS is a measure of yield spread that accounts for embedded call options in the valuation of bonds. The OAS for a bond is computed using price and projections of interest rate volatility to account for the possibility of early redemption. The OAS value is interpreted as the constant spread that can be earned on the asset compared to the risk-free option. Most commonly, the OAS is expressed as a spread over the Treasury curve.[3]

The main benefit and purpose of OAS is that

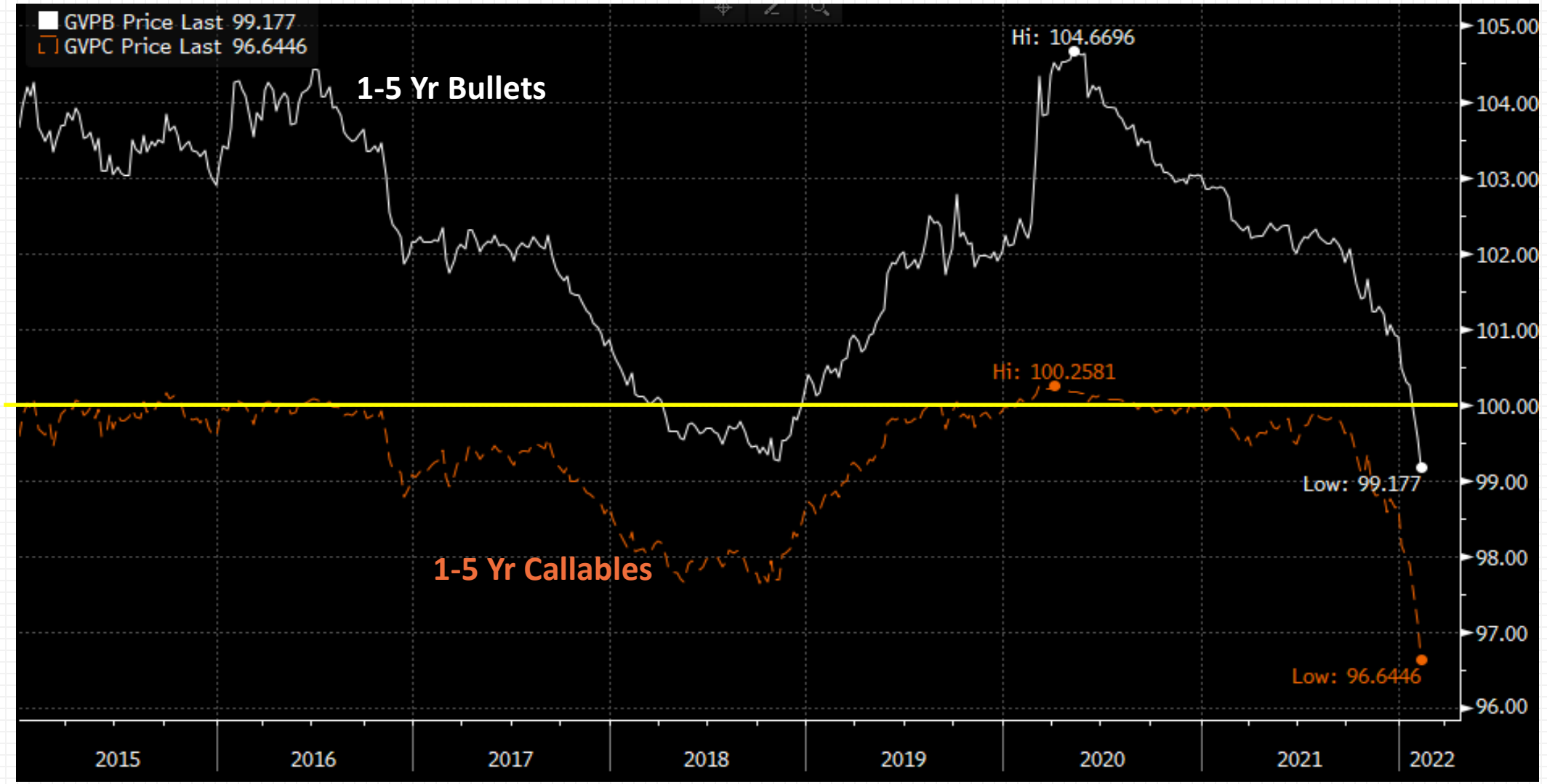
EFFECTIVE DURATION

Additional benefits of OAS include applications to calculating duration for a bond in a way that accounts for an embedded option. Duration is a measure of estimating the price (market value) change in a bond given a change in interest rates. Effective duration is a byproduct of the option models that produce OAS and it accounts for ways that changes in interest rates have the potential to change a bond's cash flows. Similar to how OAS is an improved measure of yield spread, effective duration is an improvement over modified duration, as it is a more reliable indicator of a callable bond's price sensitivity to changes in interest rates.

https://www.treasurer.ca.gov/cdiac/publications/issue-brief/2020/20-10.pdf

Source: CDIAC

Average Prices: 1-5Yr Callables vs. 1-5Yr Bullets



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Source: Bloomberg

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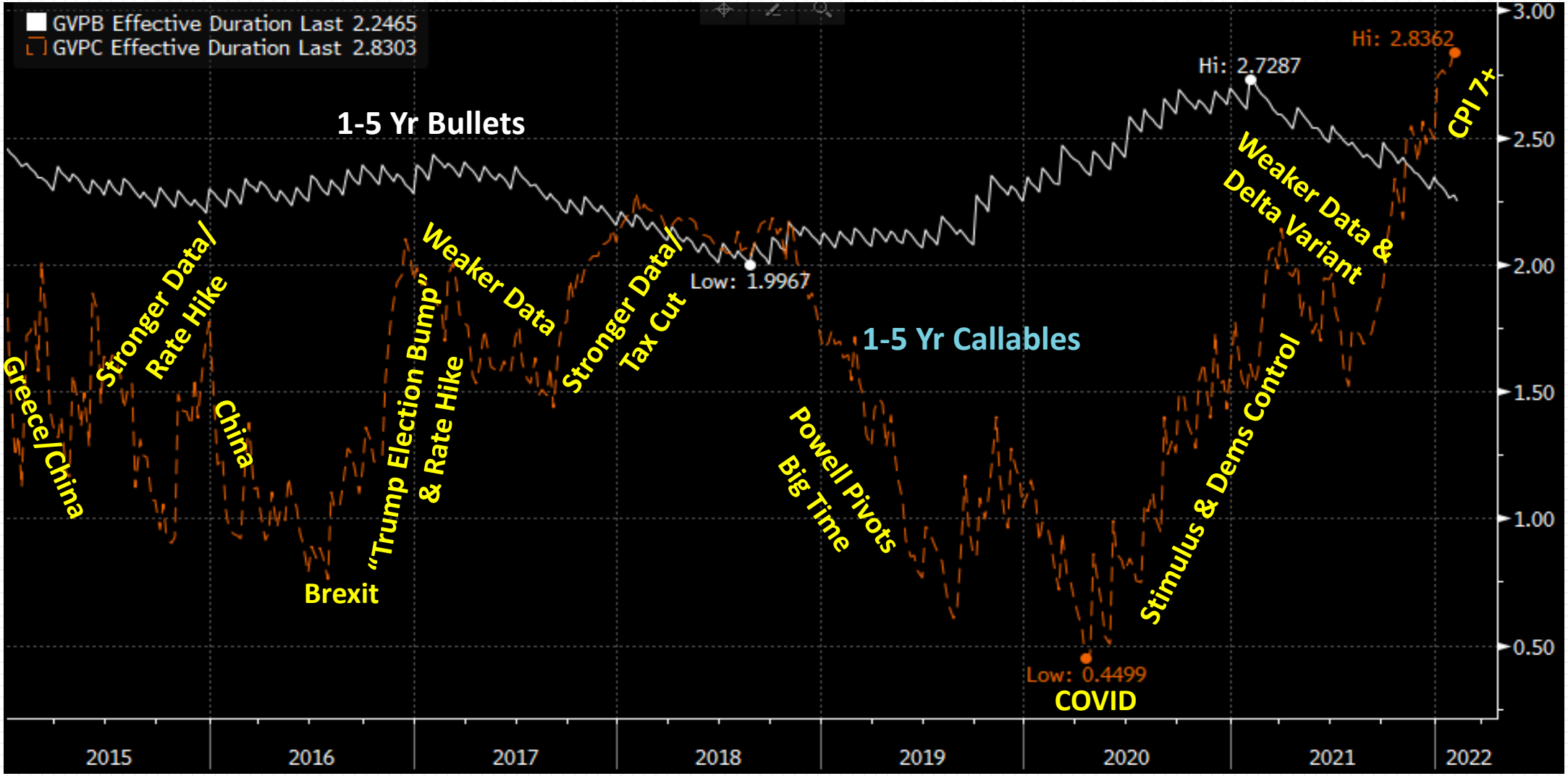
CDIAC 40 YEARS CMTA

Effective Duration: Agency 1-5Yr Bullets vs. 1-5 Yr Callables



Source: Bloomberg

Avg Effective Duration: Bullets 2.31 Callables 1.54

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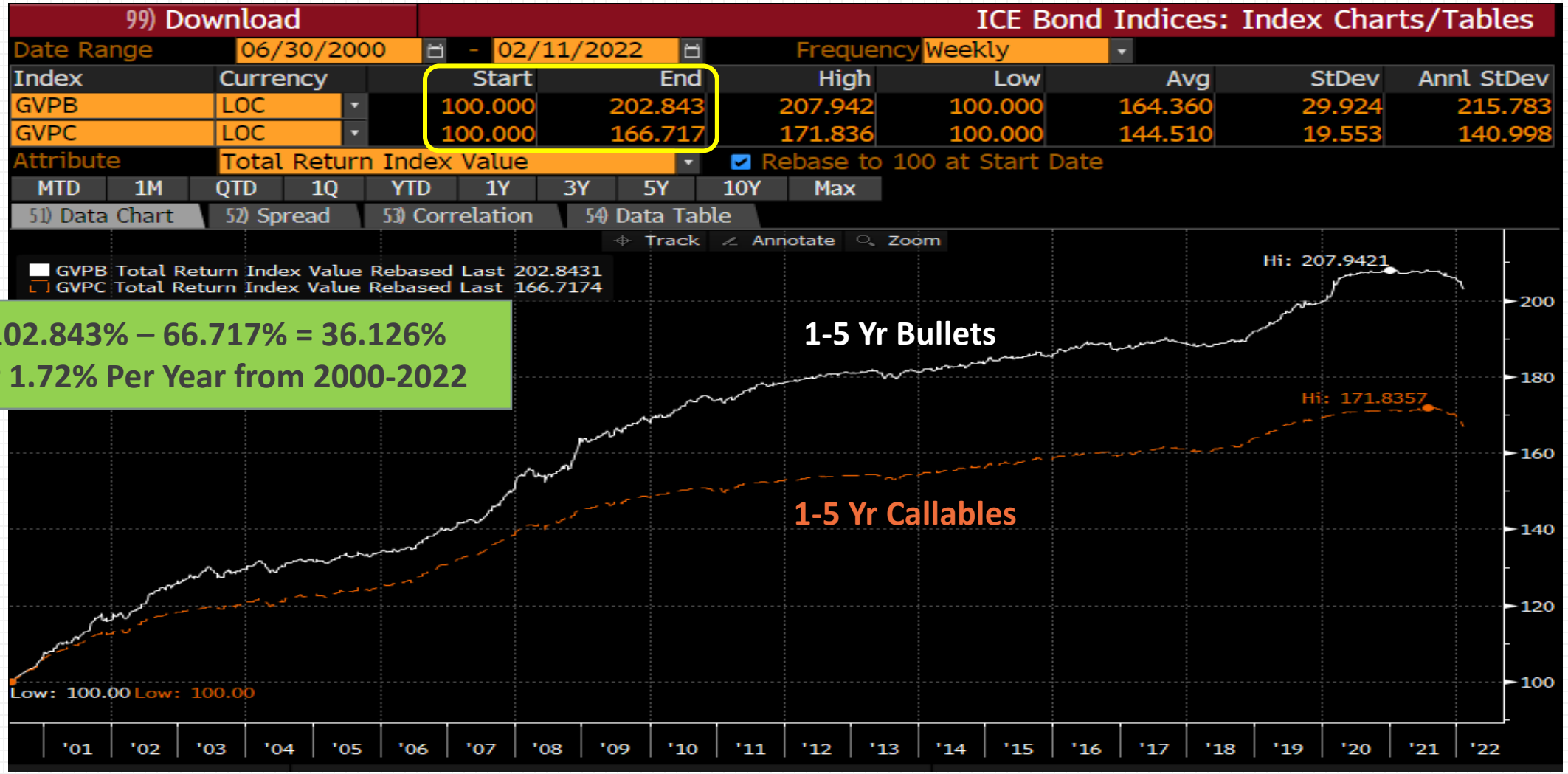
Long Run Return: Agency 1-5 Yr Bullets vs. 1-5 Yr Callables



102.843% – 66.717% = 36.126%
Or 1.72% Per Year from 2000-2022

Source: Bloomberg

Avg Effective Duration: Bullets 2.31 Callables 1.54

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CDIAC 40 YEARS CMTA

Total Return Comparison

1-5Yr Bullets

GVPB | 99) Download | ICE

ICE BofA 1-5 Year US Bullet Agency Index

06/30/2000 - 02/11/2022 Currency LOC 0 % Hedged

Total Return Factors	Periodic Return	Annualized Return
Price Return (Local)	0.207	0.010
Income Return (Local)	102.636	3.314
Total Return (Local)	102.843	3.324

1-5Yr Callables

GVPC | 99) Download | ICE

ICE BofA 1-5 Year US Non-Bullet Agency Index

06/30/2000 - 02/11/2022 Currency LOC 0 % Hedged

Total Return Factors	Periodic Return	Annualized Return
Price Return (Local)	-1.346	-0.063
Income Return (Local)	68.063	2.454
Total Return (Local)	66.717	2.391

3.324% Bullets
2.391% Callables
.933%

Source: Bloomberg

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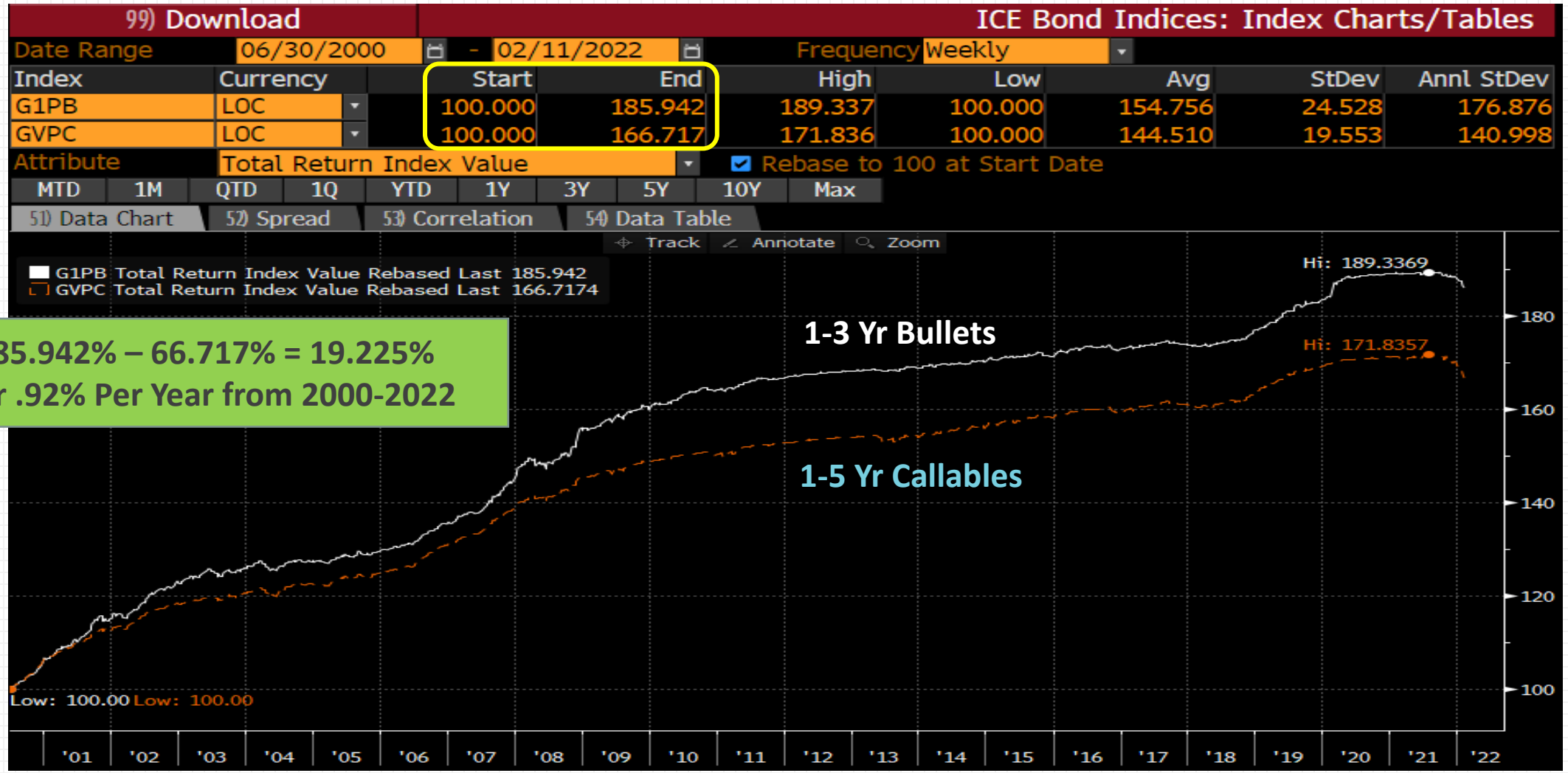
Long Run Return: Agency 1-3 Yr Bullets vs. 1-5 Yr Callables



85.942% – 66.717% = 19.225%
Or .92% Per Year from 2000-2022

Avg Effective Duration: Bullets 1.78 Callables 1.54

Source: Bloomberg

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CDIAC 40 YEARS CMTA

Callable Characteristics: OAS

95) Actions ▾ | 96) Alerts ▾ | 97) Summary | 98) Set Homepage | 99) Export ▾ | New Issue Monitor

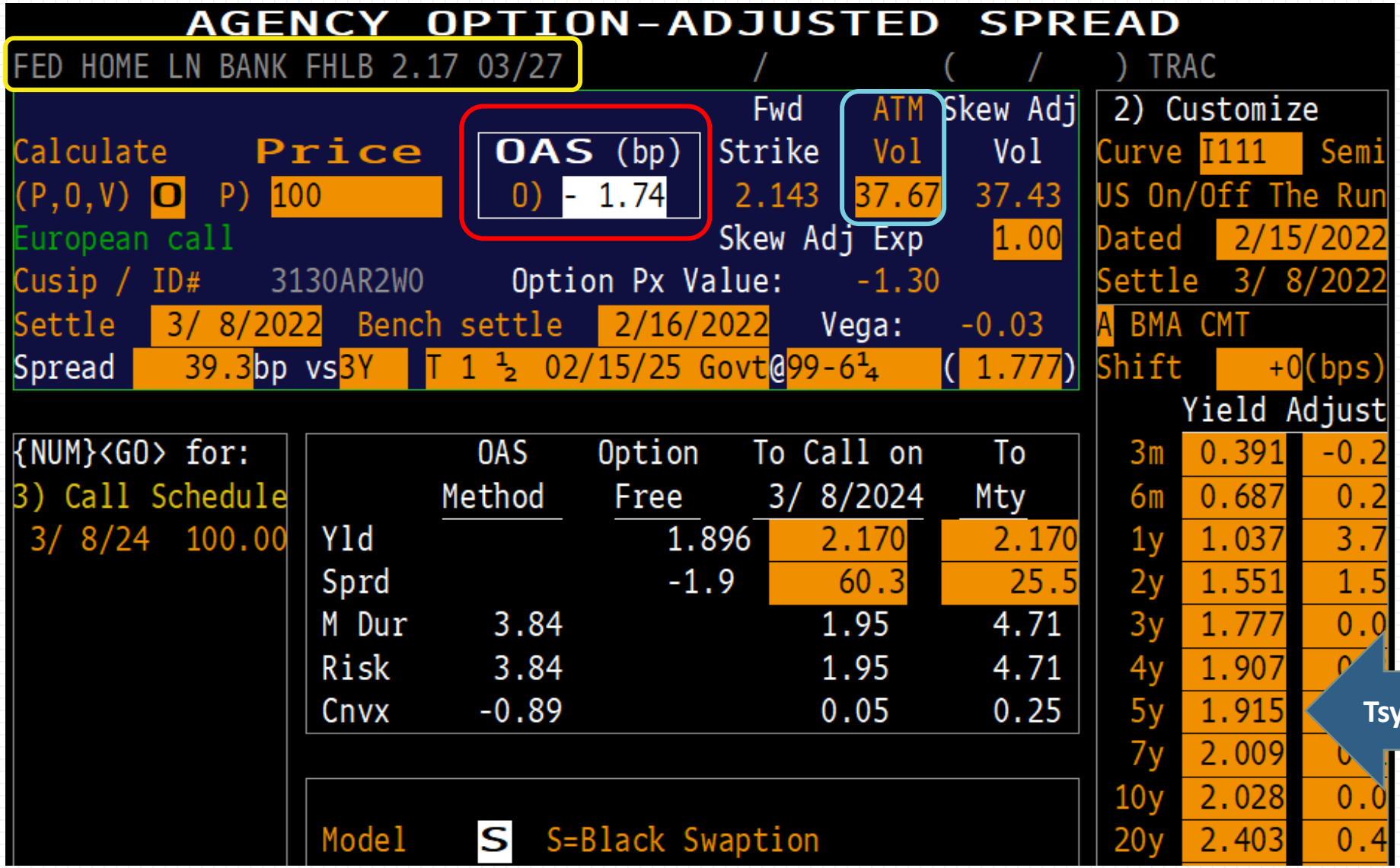
Selection *NIM2-Agency (NIM2) ▾ | 1) Show Filters | 2) Clear Filters | Issues & News ▾

Real Time | Issue History | Date Range 01/15/22 - 02/15/22 | 6) Prelim Bonds | PREL

	Date ↓	Issuer/Headline	Coupon	Maturity	Spread	Curr	Outst	Book Mgr	Note
			Fixed ▾	All ▾	All ▾	US ▾	All ▾		1x
101)	13:21	FED HOME LN BANK	2.170	03/08/27		USD	15	STONEX-sole	5-NC2 1X
102)	13:11	FED HOME LN BANK	1.900	03/07/25		USD	15	STONEX-sole	3-NC1 1X

Source: Bloomberg

Callable Characteristics: OAS 5NC 2Y 1X



Tsy Curve

Source: Bloomberg

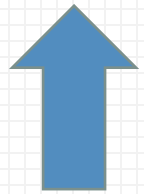
Effective Duration Comparison

95) Actions ▾ | 96) Alerts ▾ | 97) Summary | 98) Set Homepage | 99) Export ▾ | New Issue Monitor

Selection *NIM2-Agency (NIM2) | 1) Show Filters | 2) Clear Filters | Issues

Real Time | Issue History | Date Range 01/17/22 - 02/16/22 | 6) Prelim Bonds | PREL

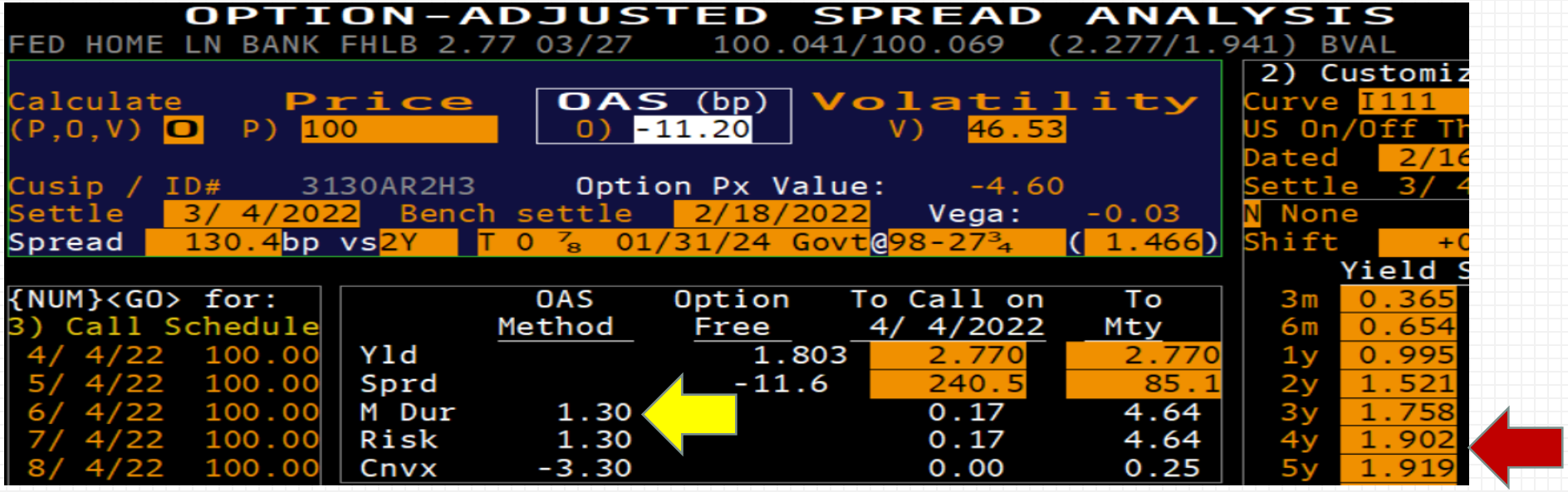
	Date ↓	Issuer	Coupon	Maturity	Spread	Curr	Outst	Book Mgr	Note
			All	All	All	US	All		5-nc1
101)	2/16	FED HOME LN BANK	2.250	02/24/27		USD	85	FHN-sole	5-NC1 BERINC
102)	2/15	FED HOME LN BANK	2.770	03/04/27		USD	35	RBCCM-sole	5-NC1MO BERM



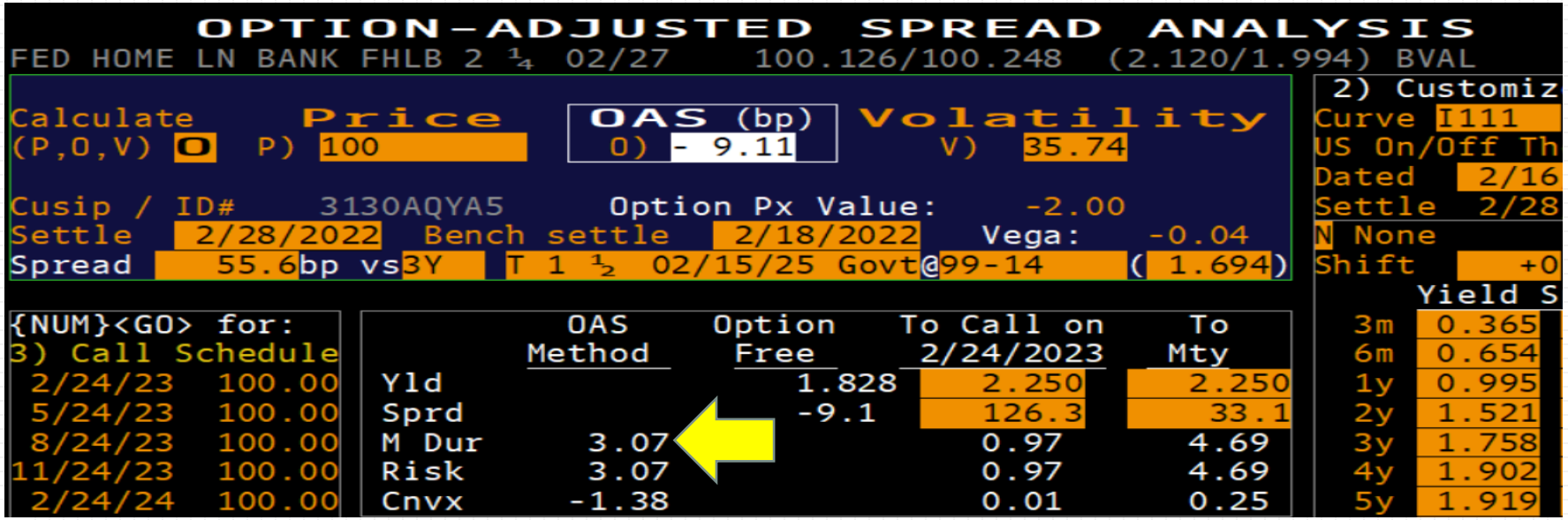
Source: Bloomberg

Effective Duration Comparison

5Y-NC-1M



5Y-NC-1Y



Source: Bloomberg

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MAIN STREET ADVISORS

Step-Ups

95) Actions | 96) Alerts | 97) Summary | 98) Set Homepage | 99) Export | New Issue Monitor

Selection: *NIM2-Agency (NIM2) | 1) Show Filters | 2) Clear Filters | Issues

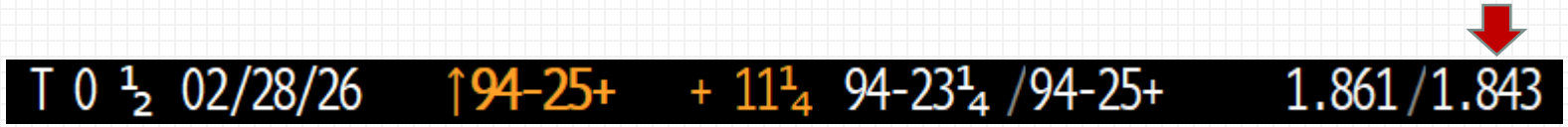
Real Time | Issue History | Date Range: 01/11/22 - 02/11/22 | 6) Prelim Bonds | PREL

	Date	Issuer	Coupon	Maturity	Spread	Curr	Outst	Book Mgr	Note
			Step	All	All	US	All		
101)	15:38	FED HOME LN BANK	STEP	02/28/25		USD	65	JOINT LEADS	3-NC1 BERINC
102)	11:48	FED HOME LN BANK	STEP	02/28/24		USD	10	MTBK-sole	2-NC1 1X
103)	11:06	FED HOME LN BANK	STEP	02/27/26		USD	15	BOSC,DW	4-NC1 1X
104)	2/10	FED HOME LN BANK	STEP	02/28/25		USD	25	MIZ-sole	3-NC1 1X
105)	2/10	FED HOME LN BANK	STEP	08/28/24		USD	15	JOINT LEADS	2.5-NC1 1X
106)	2/10	FED HOME LN BANK	STEP	02/28/25		USD	15	JOINT LEADS	3-NC1 1X
107)	2/9	FED HOME LN BANK	STEP	02/24/27		USD	25	FHN-sole	5-NC1 BERM
108)	2/9	FED HOME LN BANK	STEP	02/28/25		USD	45	BOSC,CCB,DW	3-NC1 BERINC
109)	2/9	FED HOME LN BANK	STEP	02/25/27		USD	25	HUNSEC,MTBK	5-NC3MO INC

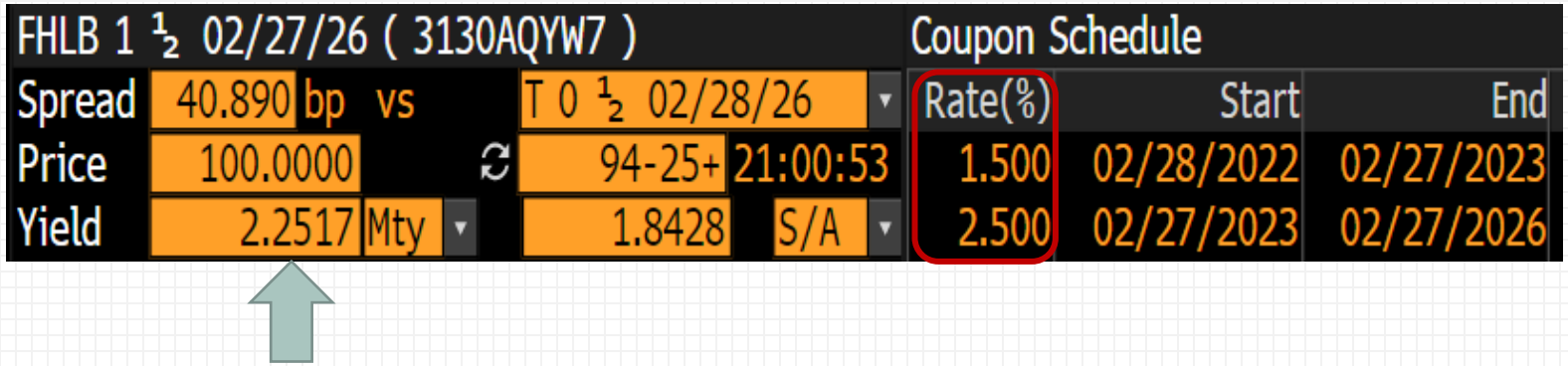
Source: Bloomberg

1 Time Step-Up Callable vs. Bullet

4Y Tsy



4Y Step-Up



3Y Tsy

Breakeven: 2.50% (Step Coupon) – 1.698% (3 Year Treasury) = .80% Higher In One Year from Now

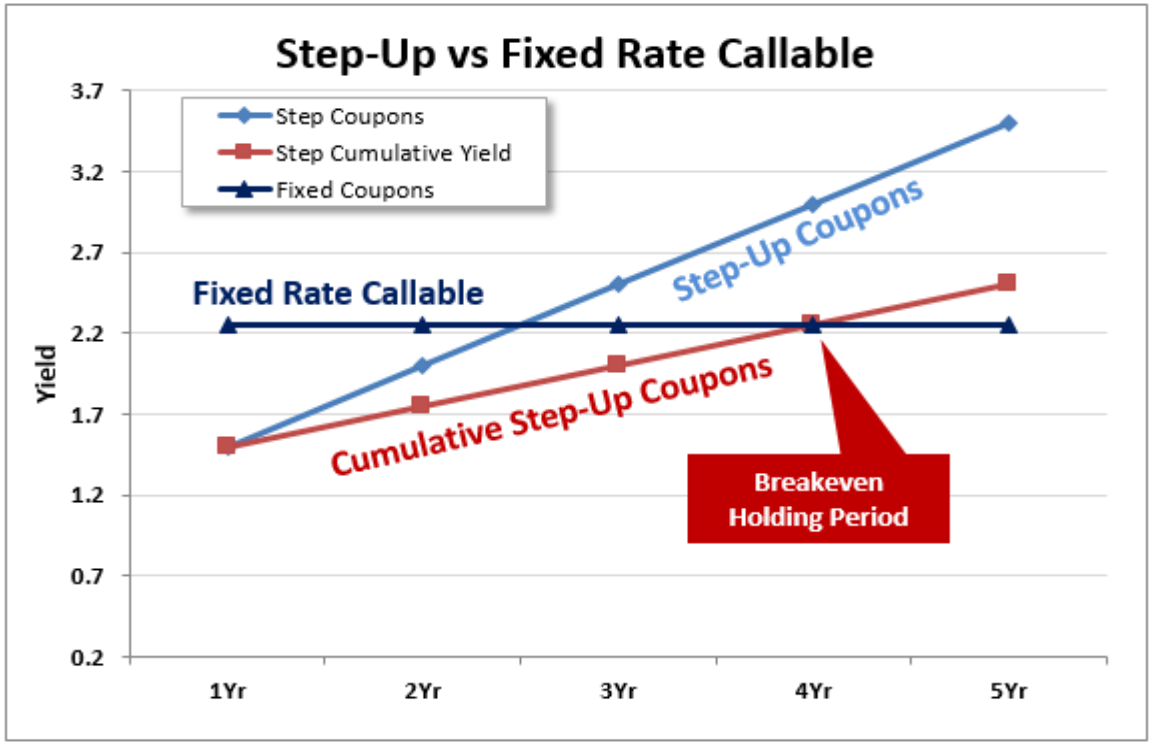
Source: Bloomberg

5 Year Agency Step-Up Breakeven Analysis

Coupons			
Coupon Information			
Issue Date	02/25/2022	First Coupon	Normal
1st Coupon Date	08/25/2022	Last Coupon	Normal
Observation Index	N/A	Paying Index	N/A

	Coupon	End Date
Step-Up's Coupons >	1.500	02/25/2023
	2.000	02/25/2024
	2.500	02/25/2025
	3.000	02/25/2026
	3.500	02/25/2027

Step Up Analysis - 5yr Annual Steps				
Time	Step Cpns	SU Cumltv Cpn	Fixed Coupons	Var
1Yr	1.500	1.500	2.250	(0.750)
2Yr	2.000	1.750	2.250	(0.500)
3Yr	2.500	2.000	2.250	(0.250)
4Yr	3.000	2.250	2.250	0.000
5Yr	3.500	2.500	2.250	0.250



Source: Bloomberg, FHN Main Street

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Floaters

95) Actions | 96) Alerts | 97) Summary | 98) Set Homepage | 99) Export | New Issue Monitor

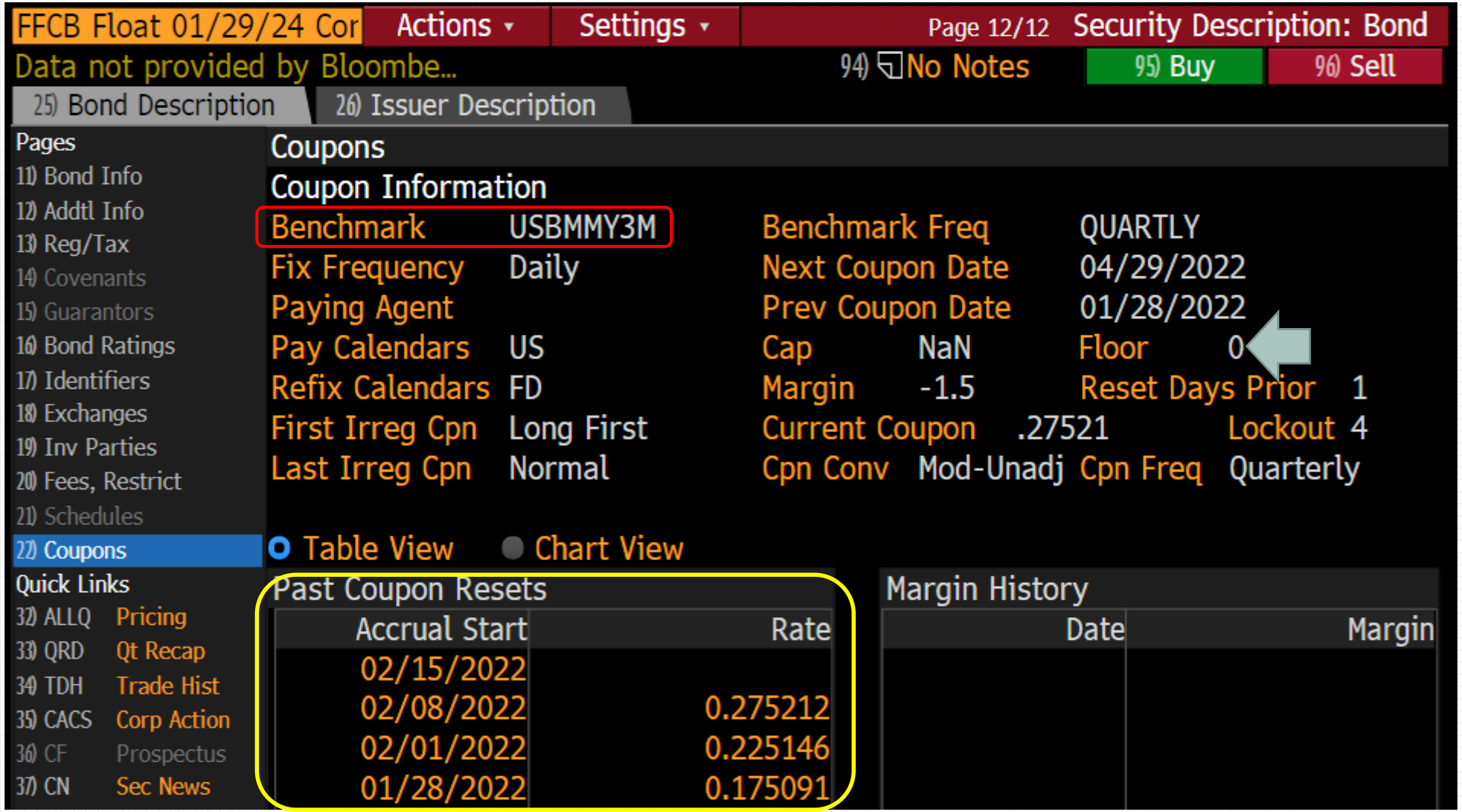
Selection *NIM2-Agency (NIM2) | 1) Show Filters | 2) Clear Filters | Issues

Real Time | Issue History | Date Range 01/11/22 - 02/11/22 | 6) Prelim Bonds | PREL

	Date ↓	Issuer	Coupon	Maturity	Spread	Curr	Outst	Book Mgr	Note
			Float	All	All	US	All		
102)	2/9	FARMER MAC	FRN	08/18/22		USD	100	CASOAK-sole	INCREASE
103)	2/8	FED FARM CREDIT	FRN	02/14/25		USD	100	JOINT LEADS	3-NC
104)	2/4	FARMER MAC	FRN	02/14/29		USD	5	CASOAK-sole	7-NC
105)	2/4	FED FARM CREDIT	FRN	02/09/24		USD	550	JOINT LEADS	2-NC
106)	2/2	FED HOME LN BANK	FRN	04/29/22		USD	500	ACADSE-sole	3MO-NC
107)	2/1	FED HOME LN BANK	FRN	06/24/22		USD	301.5	JOINT LEADS	5MO-NC
108)	2/1	FED HOME LN BANK	FRN	06/30/22		USD	1000	JOINT LEADS	5MO-NC
109)	1/21	FARMER MAC	FRN	02/02/28		USD	5	VS-sole	6-NC
110)	1/21	FED FARM CREDIT	FRN	01/29/24		USD	325	TDSEC-sole	2-NC
111)	1/20	FARMER MAC	FRN	01/28/30		USD	5	PIPR-sole	8-NC
112)	1/20	FARMER MAC	FRN	01/28/31		USD	5	PIPR-sole	9-NC
113)	1/20	FED FARM CREDIT	FRN	01/26/24		USD	100	ACADSE,MIZ	2-NC

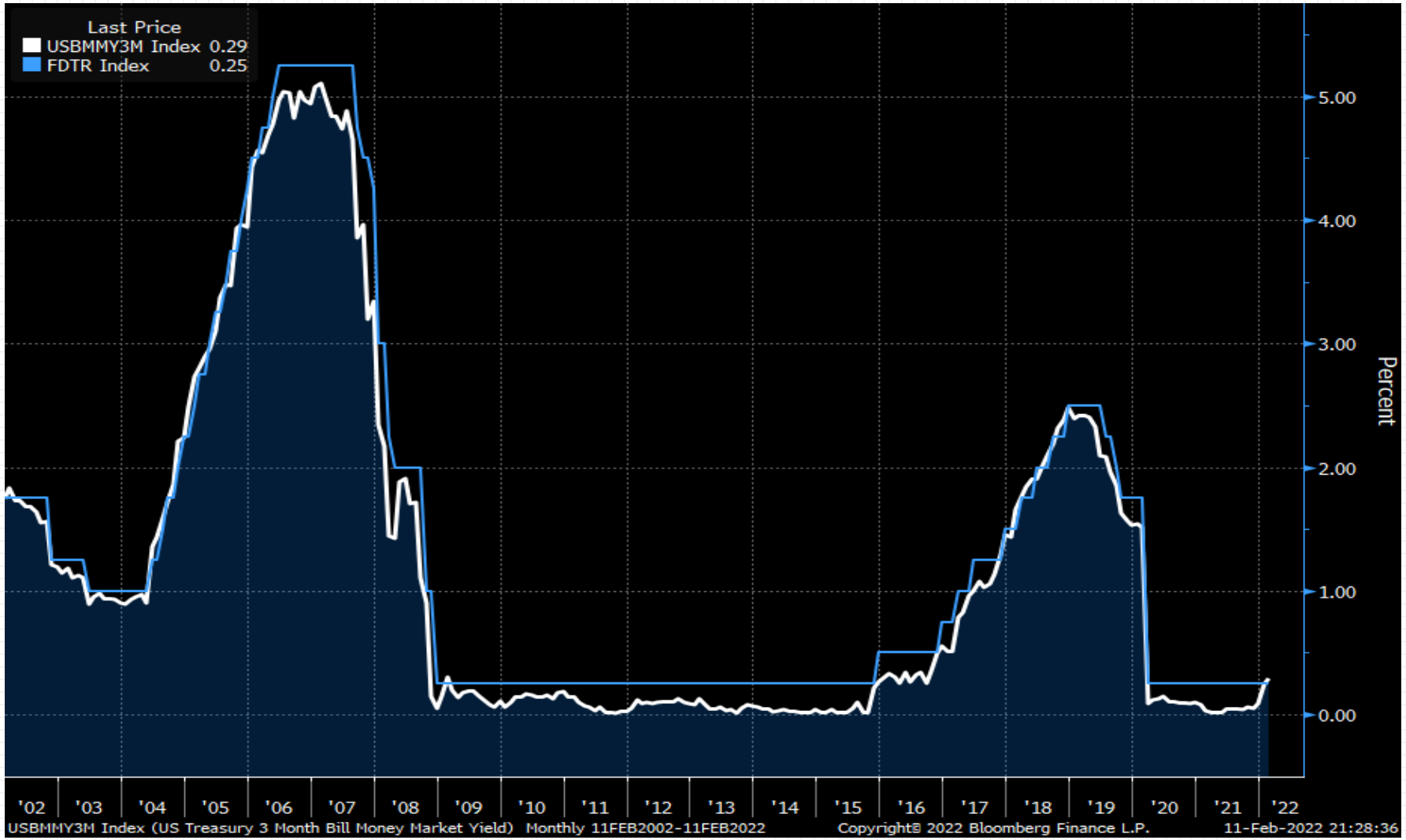
Source: Bloomberg

Floater Details: 2 Year



Source: Bloomberg

USBMMY3M (US Treasury 3 Month Bill) vs. Fed Funds



Floater Current Coupon .27%

2 Year Bullet Current Coupon 1.55%

How Fast Do Rates Need to Climb to Breakeven?

Source: Bloomberg

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Deeply Discounted Callables

Offer Size	Cusip	Ticker	Coup	Maturity	CallDate	CallType	Price	YTM	Spread	Benchmark	Deal Size	Settle
24,600,000	3130ANMH0	FHLB	1.1	8/20/2026	3/20/2022	Monthly	96.0799	2.0133	8	T 1 1/2 01/31/27	1,600,000,000	2/16/2022
1,475,000	3130APB79	FHLB	1	9/30/2026	9/30/2022	Quarterly	95.4625	2.0333	10	T 1 1/2 01/31/27	100,000,000	2/16/2022
2,125,000	3130AKYH3	FHLB	0.83	2/10/2027	5/10/2022	Quarterly	94.2333	2.0533	12	T 1 1/2 01/31/27	550,000,000	2/16/2022
4,500,000	3133EMAC6	FFCB	0.75	9/21/2027	9/21/2023	Anytime	92.9396	2.0933	16	T 1 1/2 01/31/27	105,000,000	2/16/2022
2,575,000	3135GACC3	FNMA	0.875	1/20/2028	4/20/2022	Quarterly	93.0274	2.1333	20	T 1 1/2 01/31/27	15,000,000	2/16/2022
6,750,000	3133EL5Y6	FFCB	1	3/2/2028	2/23/2022	Anytime	93.5368	2.1457	12	T 1 3/4 01/31/29	185,000,000	2/16/2022
4,000,000	3133ELA20	FFCB	1.06	5/26/2028	5/26/2022	Anytime	93.6546	2.1457	12	T 1 3/4 01/31/29	180,000,000	2/16/2022
12,500,000	3130AQZS5	FHLB	2.625	2/27/2029	5/27/2022	Quarterly	100	2.625			15,000,000	2/28/2022
2,750,000	3133ELH31	FFCB	1.45	6/11/2030	2/23/2022	Anytime	93.6352	2.2946	26	T 1 7/8 02/15/32	275,000,000	2/16/2022
21,000,000	3133EL2C7	FFCB	1.23	7/29/2030	2/23/2022	Anytime	91.7159	2.3146	28	T 1 7/8 02/15/32	380,000,000	2/16/2022
16,050,000	3134GXFJ8	FHLMC	1.29	9/9/2030	3/9/2022	Quarterly	92.2288	2.2946	26	T 1 7/8 02/15/32	25,000,000	2/16/2022
9,073,000	3133ENJS0	FFCB	2	12/30/2030	3/30/2022	Anytime	96.9008	2.3901			110,000,000	2/16/2022
21,700,000	3133ENKN9	FFCB	2.1	1/13/2031	4/13/2022	Anytime	97.5674	2.4054			50,000,000	2/16/2022
1,000,000	3130AKTV8	FHLB	1.32	1/28/2031	4/28/2022	Quarterly	91.2365	2.4146	38	T 1 7/8 02/15/32	75,000,000	2/16/2022
4,100,000	3133EL5X8	FFCB	1.35	3/3/2031	2/23/2022	Anytime	91.3935	2.4146	38	T 1 7/8 02/15/32	202,000,000	2/16/2022
12,834,000	3133ENKP4	FFCB	2.2	1/12/2032	4/12/2022	Anytime	97.7823	2.4541			50,000,000	2/16/2022
3,000,000	3134GV6A1	FHLMC	1.55	7/21/2032	4/21/2022	Quarterly	91.894	2.4346	40	T 1 7/8 02/15/32	175,000,000	2/16/2022

Source: FHN Financial

FHN FINANCIAL MAIN STREET ADVISORS

Deeply Discounted Callables

Source: FHN Financial

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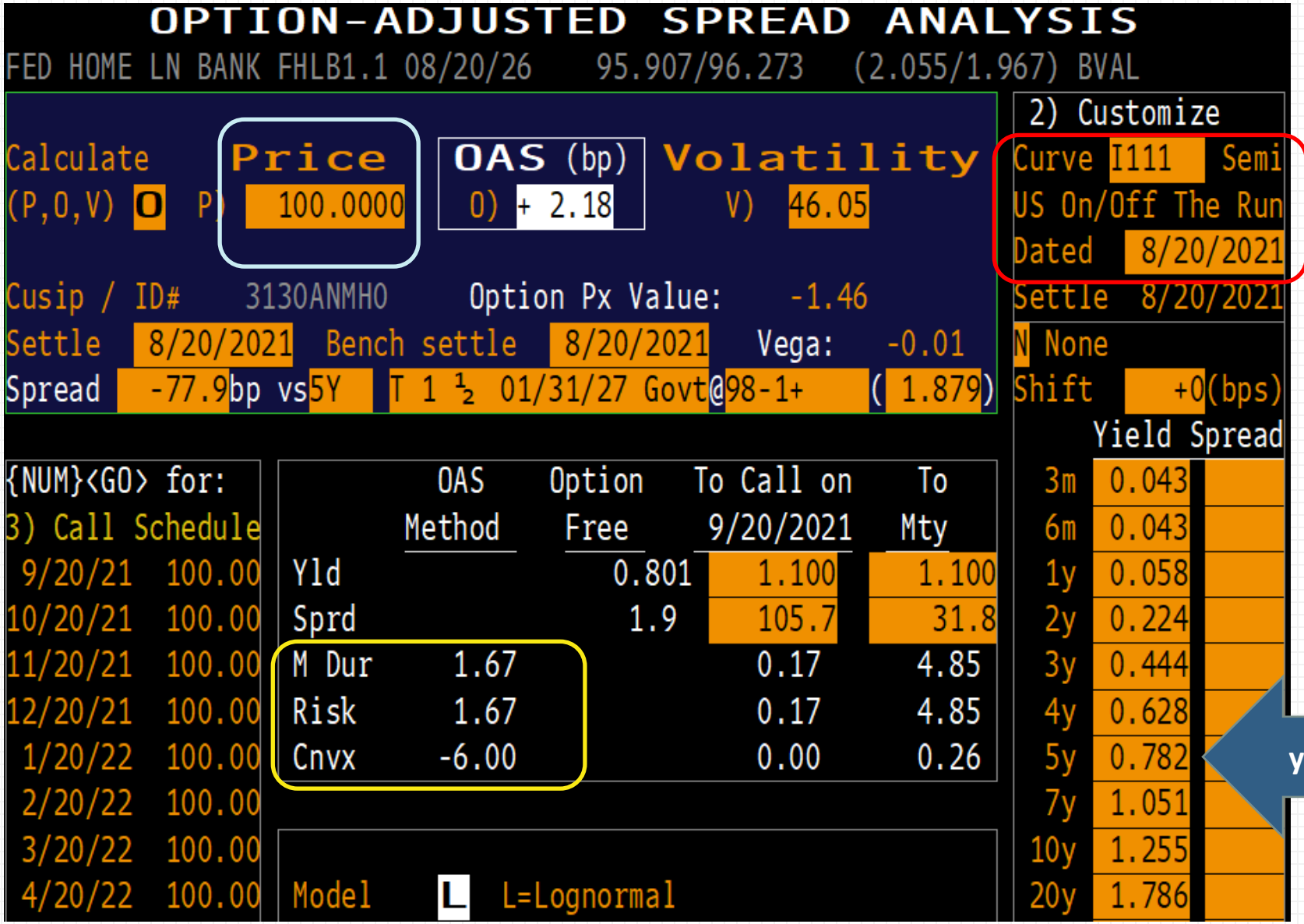
Deeply Discounted Callables—At New Issue



Monthly Calls

y Curve

Source: Bloomberg

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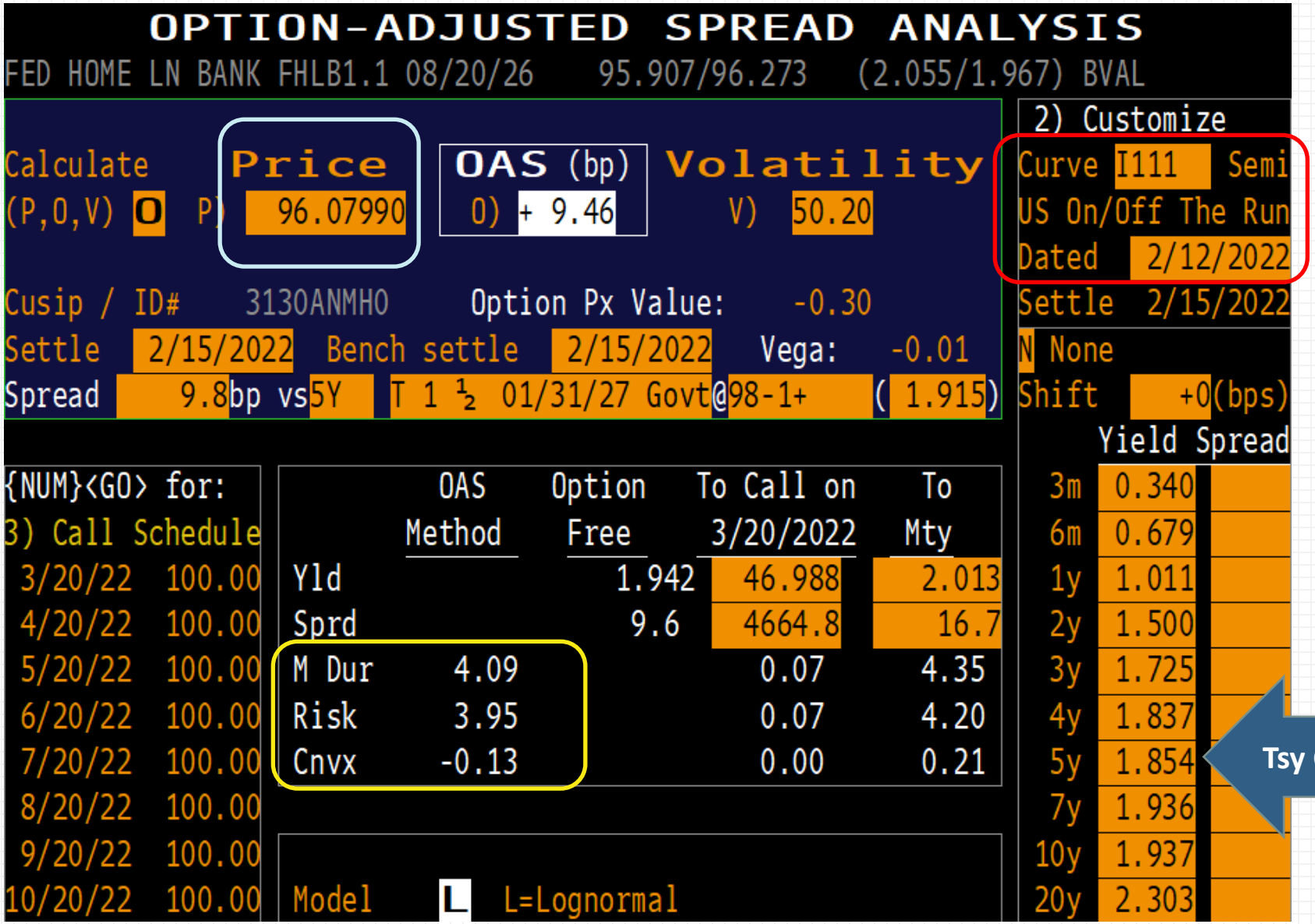
Deeply Discounted Callables—Current Market Context



Source: Bloomberg

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Polling Question

To earn CPE credits, participants must participate in at least three of the polling questions.

Do you have a limit in your Investment Policy on the percentage of callables you can purchase?

A. Yes
B. No
C. Not sure

THANK YOU

We look forward to your participation in the next webinar in this series:

Interpreting Economic Forecasts as a Public Investment Official

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