PUBLIC FUNDS INVESTMENT: STRATEGY IN PRACTICE

JANUARY 25-26, 2023 | MONTEBELLO, CALIFORNIA

CDIAC

CMTA

Session One
Public Fund Investment Bootcamp

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Kevin P. Webb, CFA, Managing Director, Robert W. Baird & Co.

Public Fund Investment Bootcamp

Rick Phillips

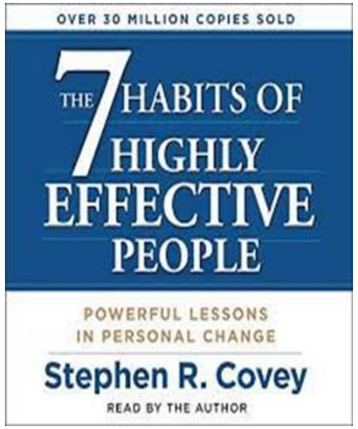
- City of Las Vegas Investment Officer 1989-1998
- Clark County Chief Investment Officer 1998-2005
- FHN Main Street President & Chief Investment Officer 2005 - Present
- Manage/Consult on $50+ Billion AUM for states and local agencies
- GIOA Founder

Kevin Webb, CFA

- RW Baird, Managing Director

7 Habits of Highly Effective Investment Programs

1. You Have a Detailed Asset/Liability Matching Model (aka: Cash Flow Model)
2. You Have a Responsible Amount of Interest Rate Risk and Credit Risk
3. You Don't Try to Time the Market
4. You Love Losses and Hate Gains (the unrealized kind)
5. You Follow GAAP (Generally Accepted Accounting Principles)
6. You Benchmark Your Investment Program and Portfolio in Multiple Ways
7. You Provide Quality, Timely, Transparent Reporting



Putting the FUNDAMENTALS in Your Favor

Habit #1

You Have a Detailed Asset/Liability Matching Model (aka: Cash Flow Model)

GIOA Model Investment Policy Primary Objectives

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.

Detailed Asset/Liability (Cash Flow) Model

- If You Don't Know Where You've Been, You Won't Know Where You're Going
- Many Municipalities Have Too Much Liquidity (But Your Risk is Asymmetrical)

Cash Flow Model:

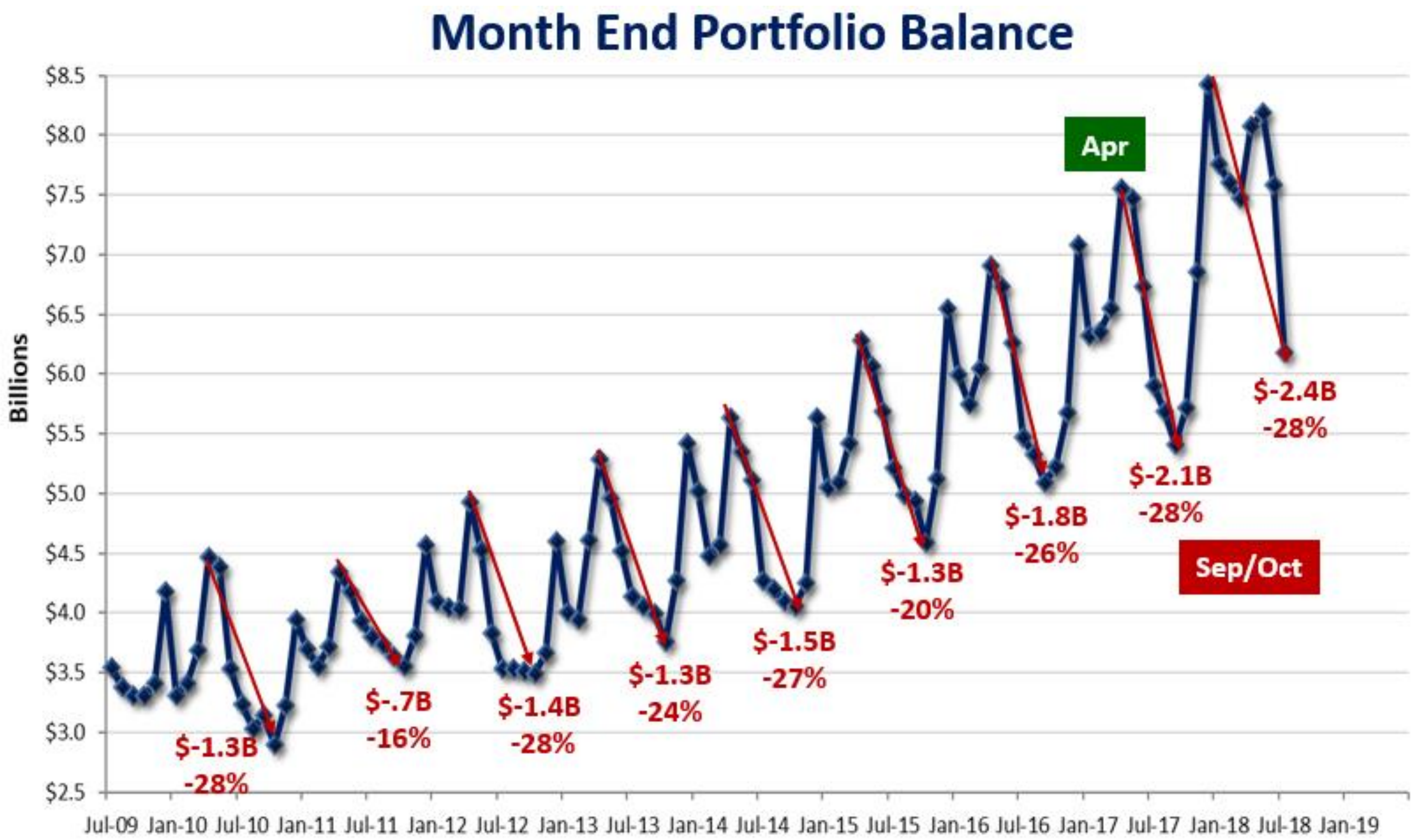
- Daily for 12 Months
- Monthly for 5 Years
- Worry About the Big Rocks (80/20 Rule)
- Excel is Awesome!

You Have a Responsible Amount of Liquidity to Ensure You Don't Need to Sell a Security for Liquidity

Cash Flow Model…Excel is Awesome!

			Current FY:	701.5	166.5	220.2	343.9	0.0	0.0			288.6	19.0	90.5	436.8	0.0	192.4	408.5		LGIP/MMF
	$789.9	WASHOE COUNTY INFLOWS ($Mil)									WASHOE COUNTY OUTFLOWS ($Mil)									137.1
	Date	Begin MMF/LGIP	Inv Mat/Sell	Prop Tax	Top Rev	Other InterGov	C-Tax	Bond Proceeds	Misc	Total	Inv Purchase	Payroll	Debt Svs	PERS	A/P	OPEB / RBIF	Other/ Misc	Prop Tax Apport	Total	End MMF/LGIP
Sun	12/25/22	69.9								69.9									0.0	69.9
Mon	12/26/22	69.9								69.9					0.6				0.6	59.5
Tue	12/27/22	59.5			0.5					60.0		2.3			1.5				3.8	59.5
Wed	12/28/22	59.5		45.0	2.0					106.5					7.9		2.0		9.9	59.5
Thu	12/29/22	59.5			0.1					59.6		0.7			1.2				2.0	59.5
Fri	12/30/22	59.5		24.9	4.0	0.0	26.3			114.8			3.6		2.0		6.2		11.8	135.1
Sat	12/31/22	135.1								135.1									0.0	135.1
Sun	1/1/23	135.1								135.1									0.0	135.1
Mon	1/2/23	135.1								135.1									0.0	135.1
Tue	1/3/23	135.1								135.1									0.0	135.1
Wed	1/4/23	135.1								135.1									0.0	135.1
Thu	1/5/23	135.1								135.1					8.1				8.1	127.0
Fri	1/6/23	127.0		32.5	2.3	4.0				165.8		11.3					2.7		14.0	151.8
Sat	1/7/23	151.8								151.8									0.0	151.8
Sun	1/8/23	151.8								151.8									0.0	151.8
Mon	1/9/23	151.8								151.8									0.0	151.8
Tue	1/10/23	151.8								151.8									0.0	151.8
Wed	1/11/23	151.8								151.8									0.0	151.8

Cash Flows May Not Repeat Exactly…But Usually Rhyme



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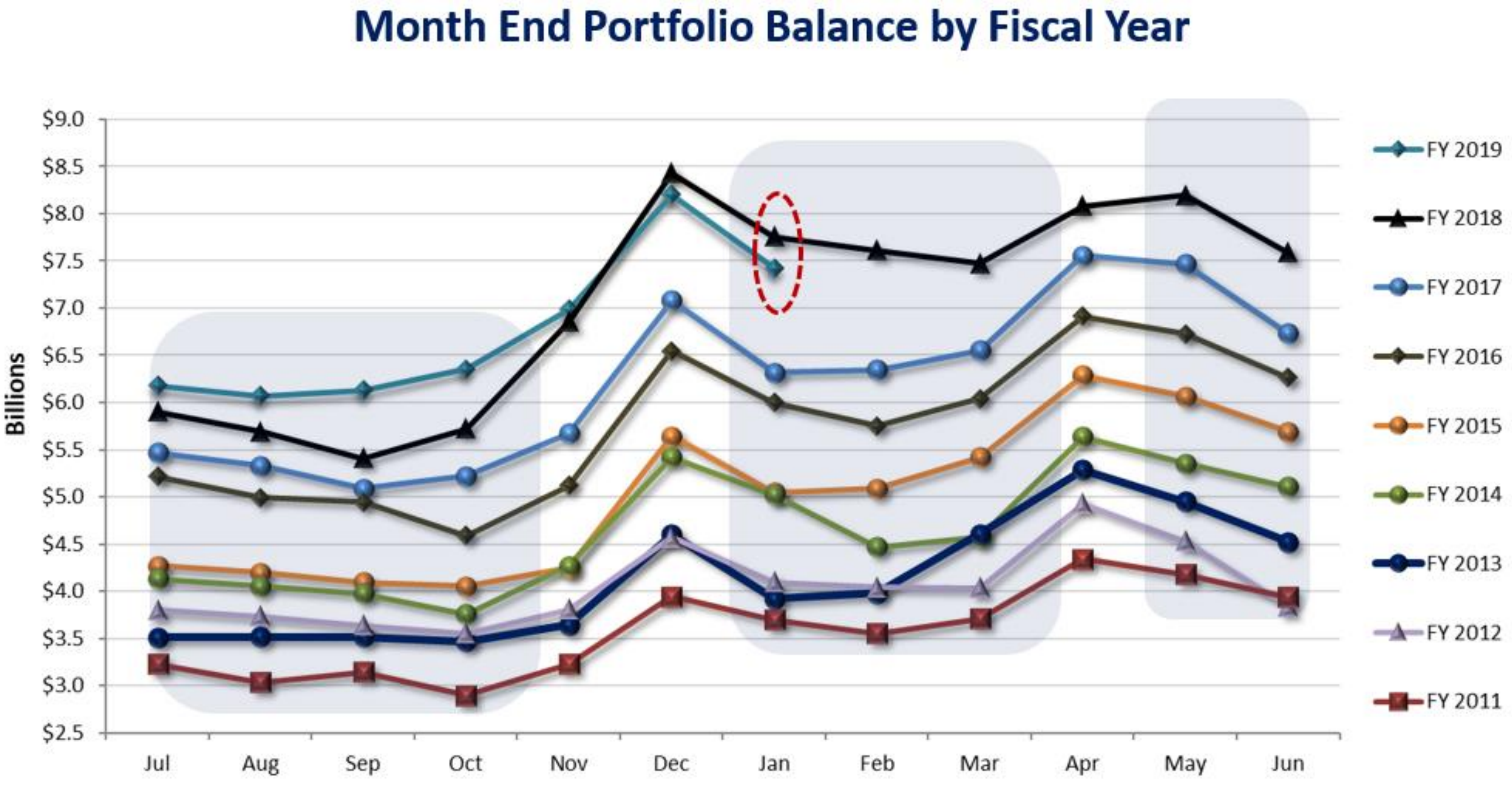
Knowing the Rhyme Helps Match Assets with Liabilities

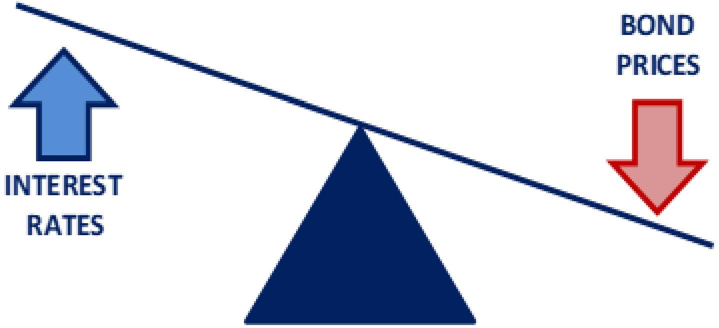


Habit #2

You Have a Responsible Amount of Interest Rate Risk and Credit Risk

Which Risk Has the Largest Long-Term Impact on My Investment Income?

Interest Rate Risk



Credit Risk

Optimal Operating Fund Duration: Risk Adjusted Return

Benchmark Treasury Modified Sharp Ratio Analysis
1/31/1990 to 12/31/2019

	Maturity	Avg Yield	Avg Duration	Modified Sharp Ratio	% Return of 30Yr / % 30Yr Risk
	3 Mon T-Bill	2.78	0.24		62% / 3%
	6 Mon T-Bill	2.91	0.48	0.277	65% / 6%
	1 Yr T-Bill	3.04	0.97	0.271	67% / 12%
Sweet Spot	2 Yr T-Note	3.35	1.90	0.299	74% / 24%
	3 Yr T-Note	3.57	2.85	0.277	79% / 36%
	5 Yr T-Note	3.97	4.45	0.267	88% / 56%
	10 Yr T-Note	4.52	7.96	0.218	100% / 100%

(Avg Yield – Risk Free Yield) / Avg Duration = MSR

(3.35% 2y – 2.78% 3m) / 1.90 2y = .299

3.35% 2yr / 4.52% 10yr = 74%	**1.90 2Yr / 7.96 10Yr = 24%**
Yield Comparison	**Duration Comparison**

Source: Bloomberg

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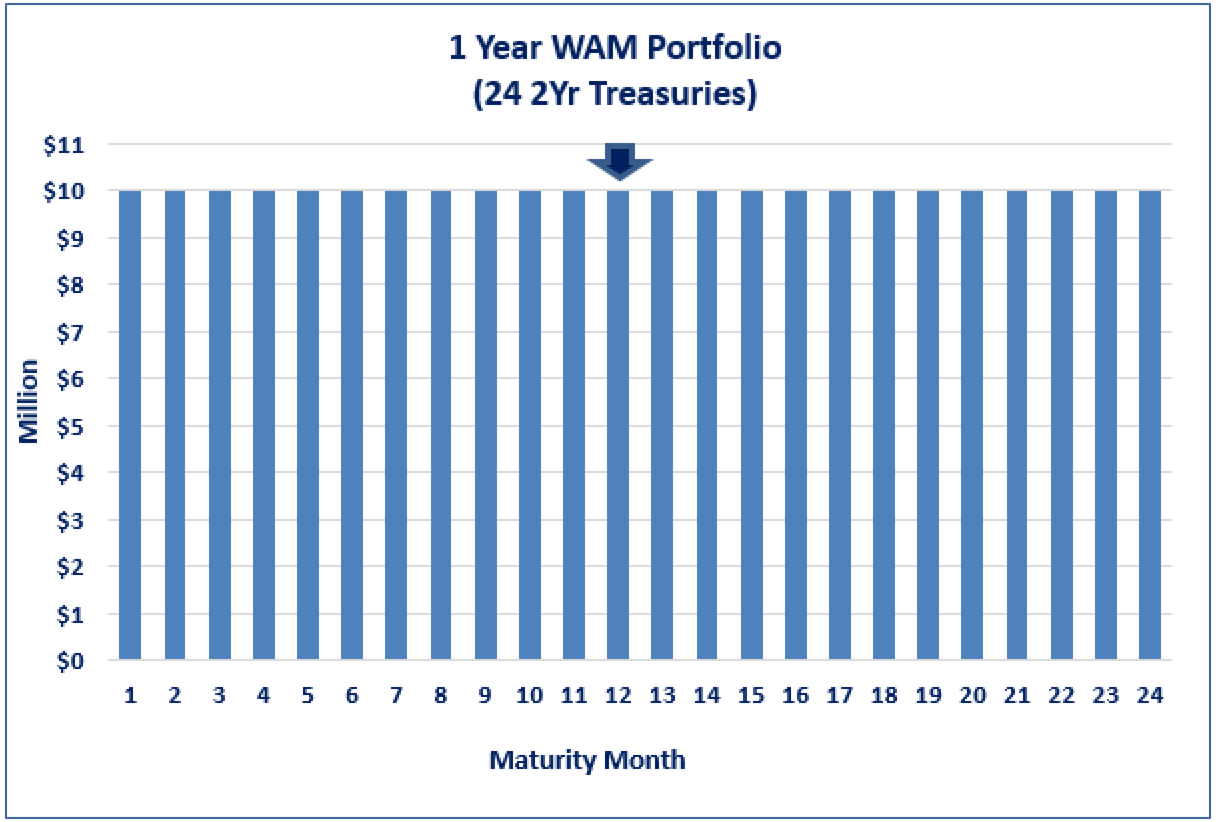
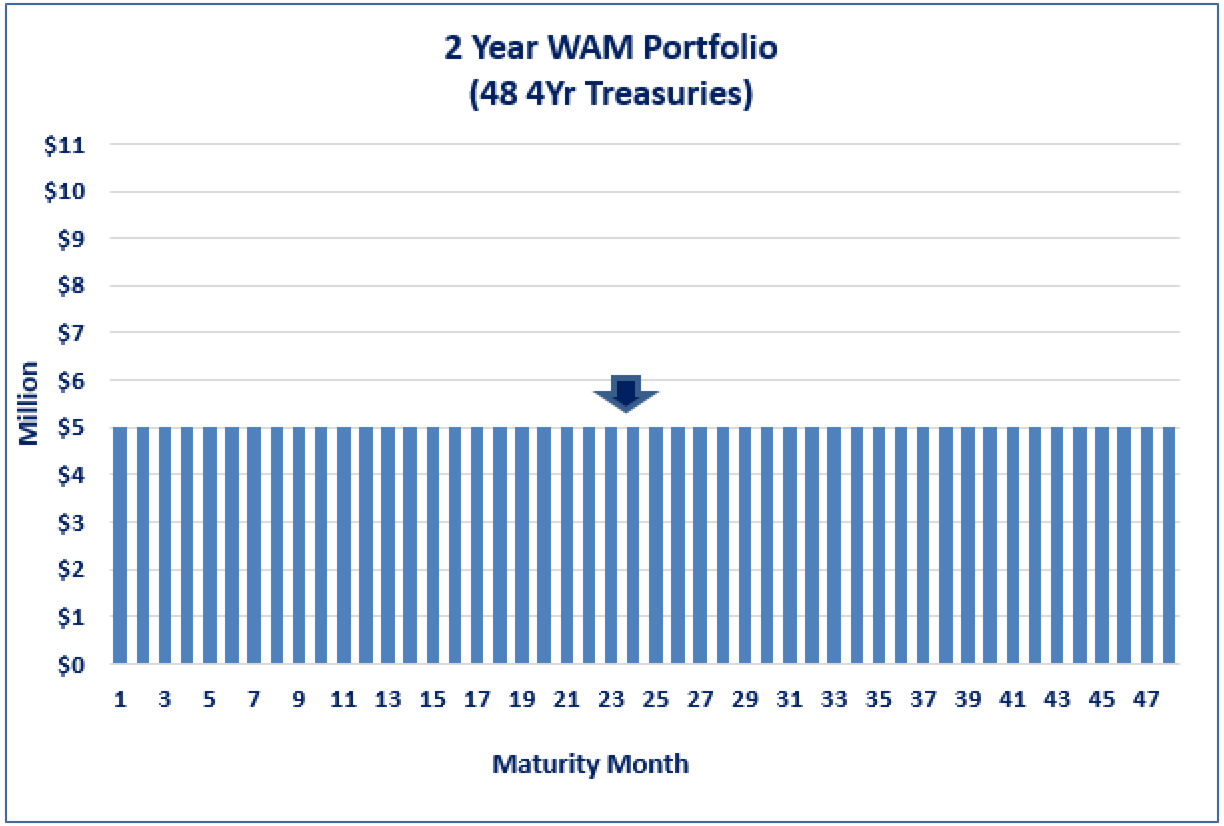
1 Year Weighted Avg Maturity vs. 2 Year Weighted Avg Maturity





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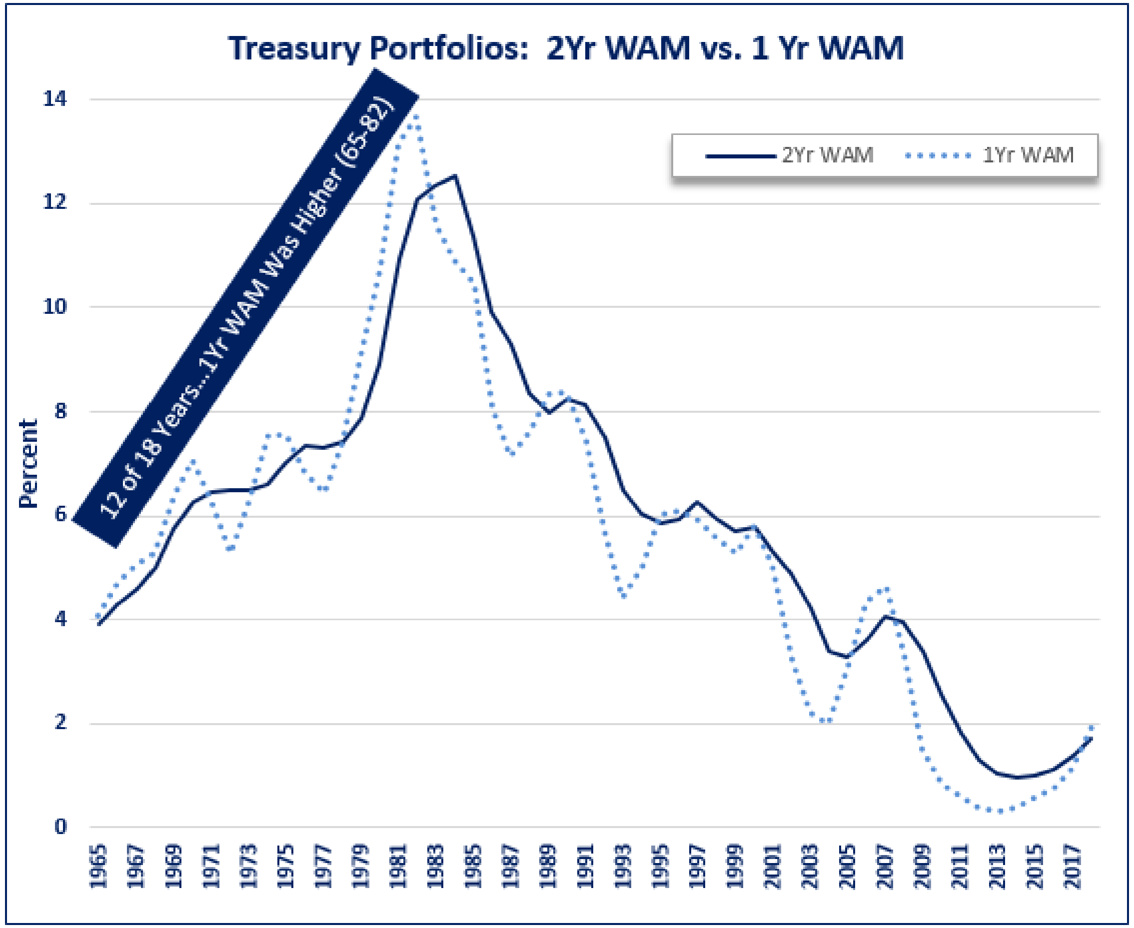
1 Year WAM vs. 2 Year WAM: A Long View of Returns

Year	1Y WAM	2Y WAM	Var
1965	4.06	3.90	(0.16)
1966	4.70	4.30	(0.40)
1967	5.05	4.60	(0.45)
1968	5.28	5.00	(0.29)
1969	6.38	5.73	(0.65)
1970	7.08	6.27	(0.81)
1971	6.31	6.46	0.15
1972	5.29	6.50	1.21
1973	6.24	6.48	0.24
1974	7.57	6.60	(0.97)
1975	7.56	7.01	(0.56)
1976	6.85	7.34	0.49
1977	6.43	7.31	0.88
1978	7.40	7.44	0.04
1979	9.06	7.87	(1.18)
1980	10.77	8.91	(1.86)
1981	13.17	10.94	(2.22)
1982	13.68	12.11	(1.57)
1983	11.61	12.34	0.74
1984	10.91	12.55	1.65
1985	10.46	11.38	0.93
1986	8.07	9.94	1.87
1987	7.15	9.30	2.15
1988	7.64	8.35	0.71
1989	8.34	7.97	(0.37)
1990	8.37	8.25	(0.11)
1991	7.44	8.13	0.69

1Yr WAM Avg Yield= 5.53

Year	1Y WAM	2Y WAM	Var
1992	5.74	7.49	1.75
1993	4.41	6.49	2.08
1994	4.99	6.03	1.03
1995	6.00	5.84	(0.16)
1996	6.08	5.91	(0.16)
1997	5.91	6.26	0.35
1998	5.56	5.93	0.37
1999	5.26	5.71	0.45
2000	5.81	5.77	(0.04)
2001	5.04	5.29	0.25
2002	3.23	4.87	1.64
2003	2.20	4.19	2.00
2004	1.97	3.39	1.42
2005	3.12	3.27	0.16
2006	4.33	3.60	(0.74)
2007	4.64	4.05	(0.59)
2008	3.34	3.95	0.61
2009	1.48	3.37	1.89
2010	0.83	2.56	1.73
2011	0.60	1.80	1.20
2012	0.38	1.27	0.89
2013	0.29	1.02	0.73
2014	0.39	0.96	0.57
2015	0.55	0.98	0.43
2016	0.74	1.12	0.38
2017	1.12	1.37	0.25
2018	1.96	1.72	(0.24)

2Yr WAM Avg Yield= 5.87



2Yr WAM vs. 1Yr WAM Yield = 0.34 Per Year

Notes: 2Yr WAM is the 48 month moving average of the 4yr treasury, the 1Yr WAM is the 24 month moving average of the 2 year treasury
The 4yr treasury is the average of the 3yr and 5yr treasury, since the US Treasury does not issue a 4 yr treasury

Source: Bloomberg

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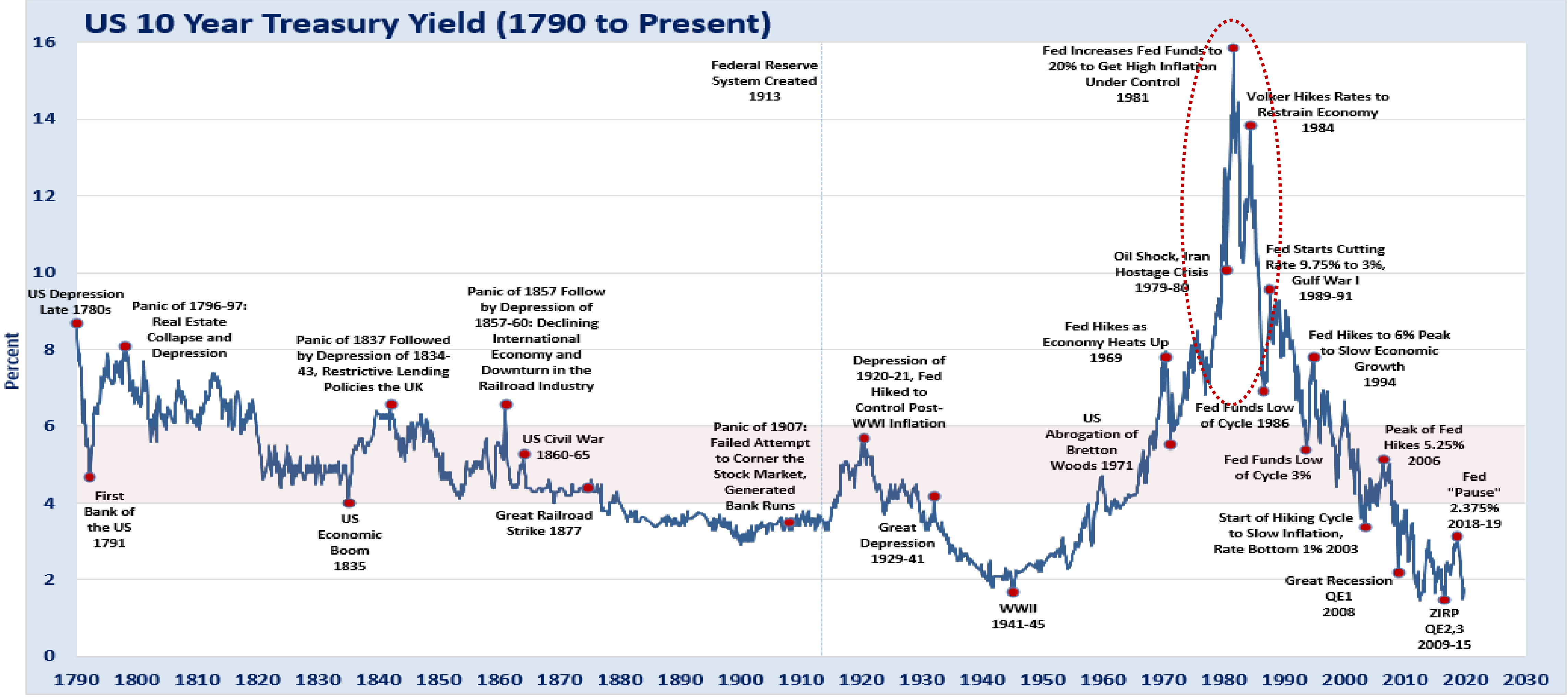
The Worry of Skyrocketing Interest Rates??



Sources: Goldman Sachs, Global Financial Database, Arbor Research

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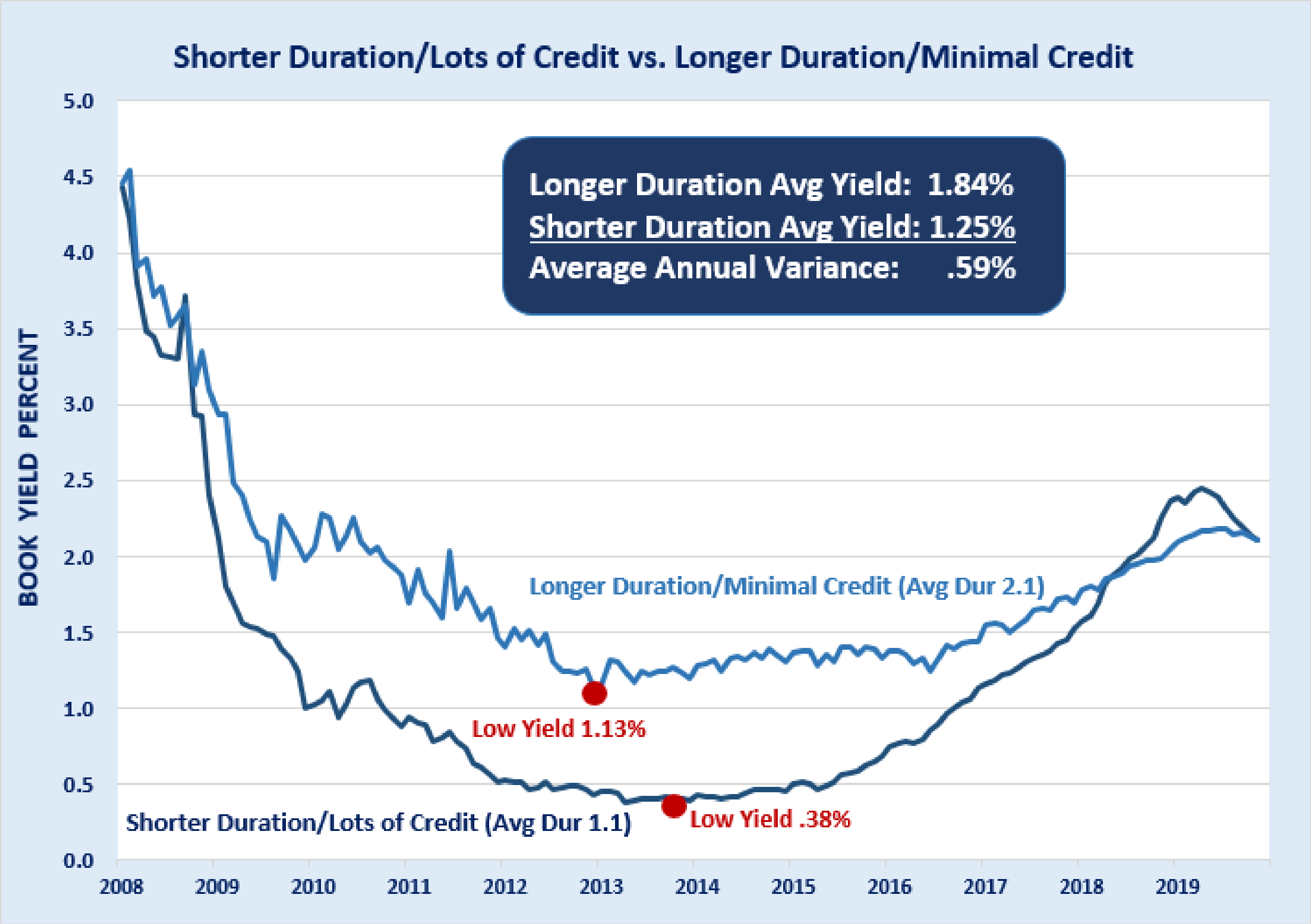
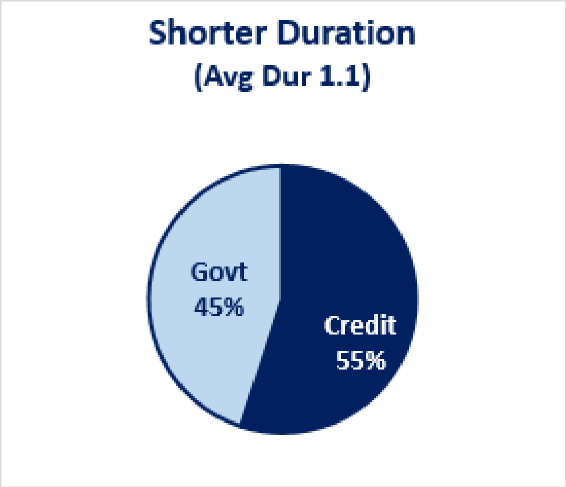
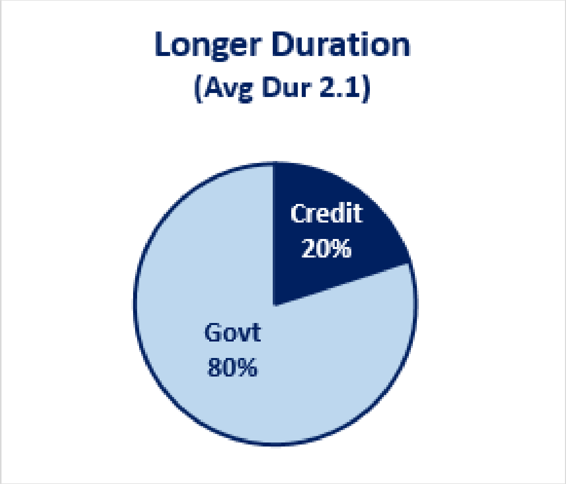
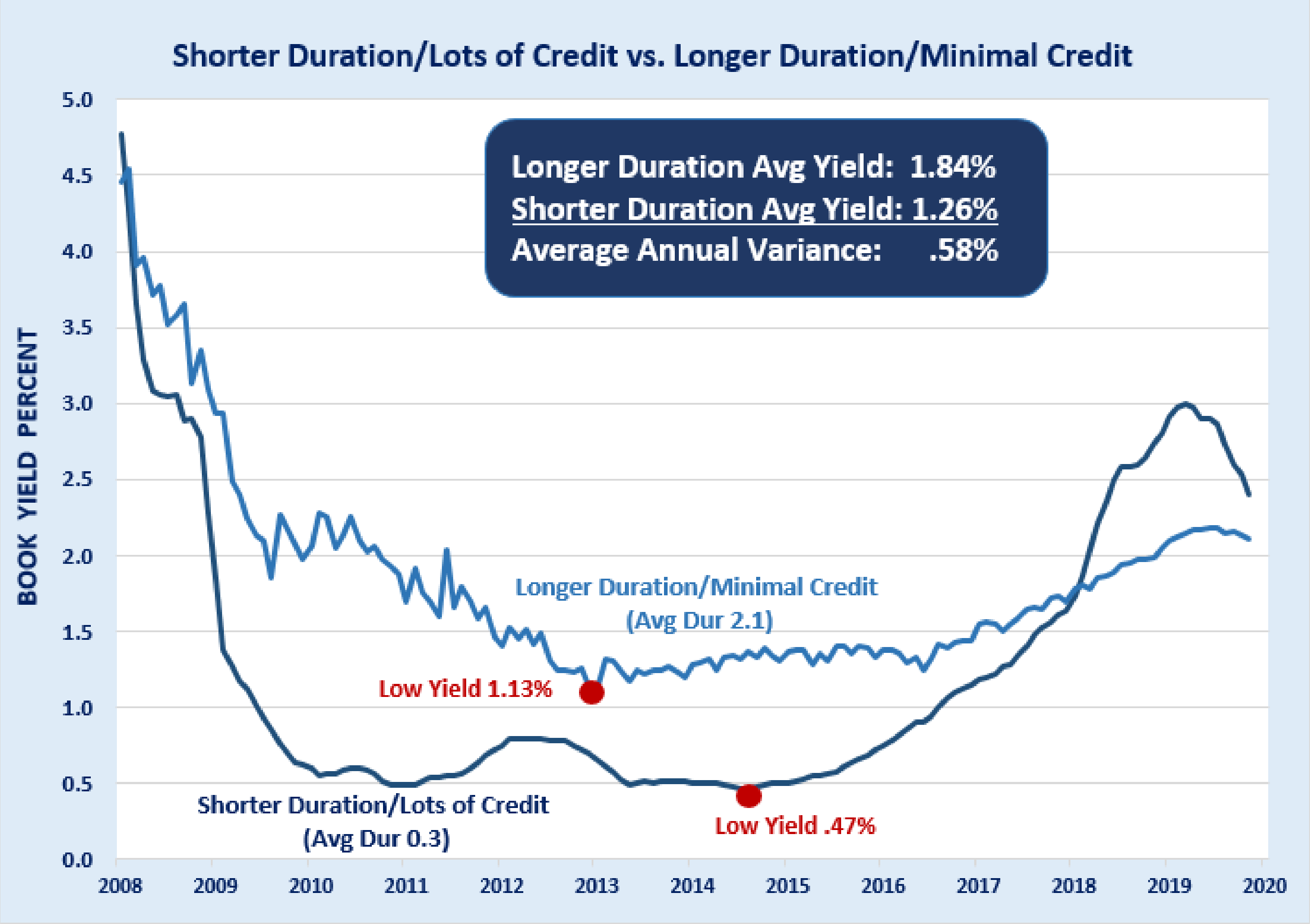
Real World Shorter Duration vs. Longer Duration #1

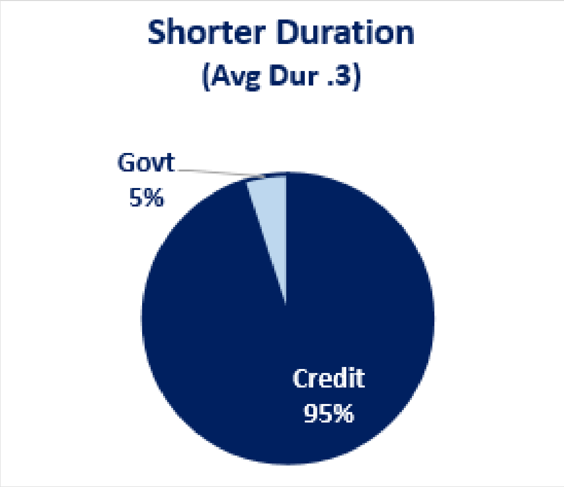


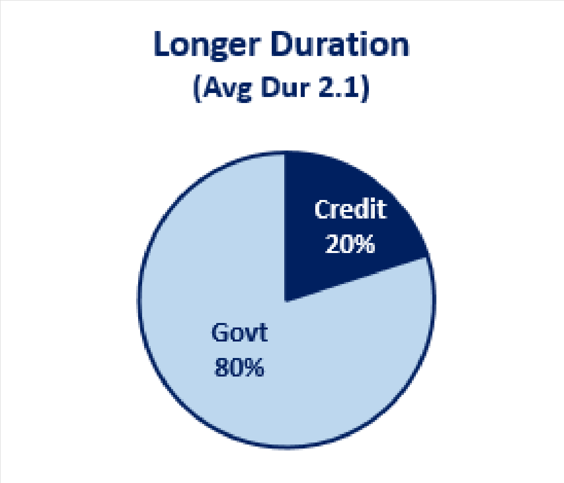




Real World Shorter Duration vs. Longer Duration #2







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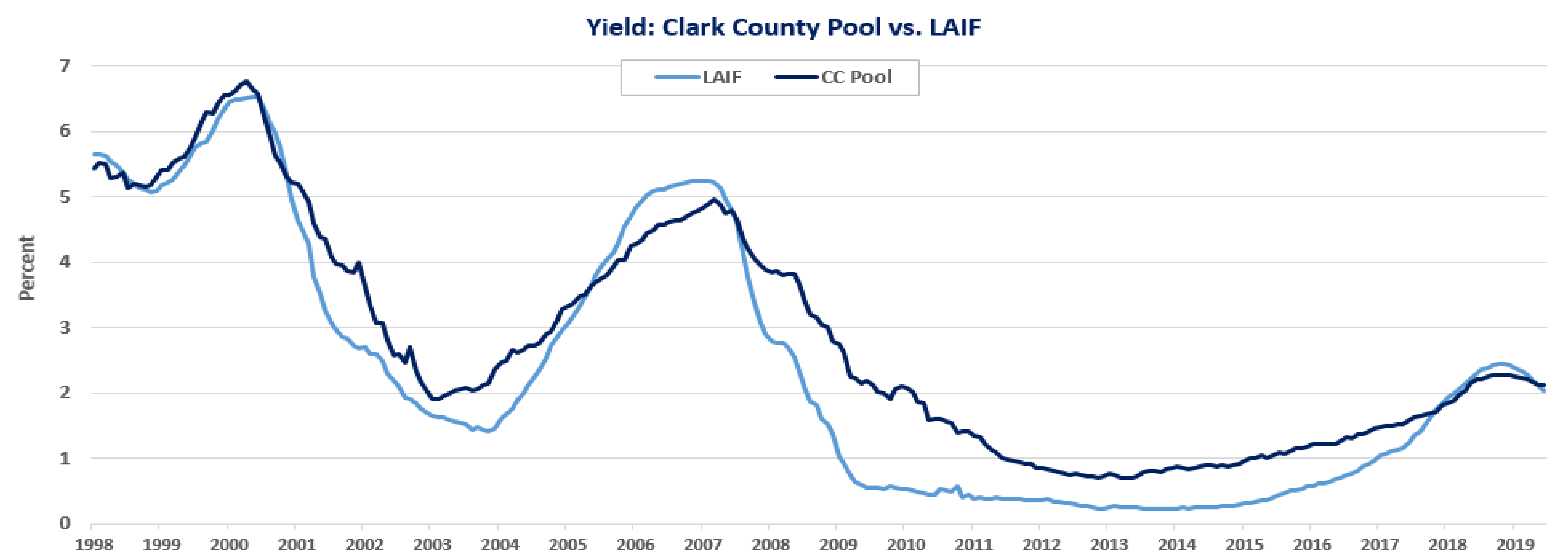
Real World Shorter Duration vs. Longer Duration #3



Average Fiscal Year Yields

Fiscal Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*	Avg
CC Pool	5.30	5.92	6.15	4.36	2.74	2.06	2.79	3.74	4.57	4.53	3.45	2.21	1.66	1.06	0.77	0.78	0.89	1.08	1.30	1.61	2.14	2.19	**2.79**
NV LGIP	5.36	5.68	6.13	3.43	2.18	1.53	2.23	3.85	5.12	4.38	2.19	0.66	0.49	0.38	0.31	0.25	0.27	0.43	0.75	1.36	2.26	2.22	**2.34**
Variance	**(0.05)**	**0.24**	**0.02**	**0.93**	**0.56**	**0.53**	**0.56**	**(0.11)**	**(0.55)**	**0.15**	**1.27**	**1.55**	**1.17**	**0.68**	**0.47**	**0.53**	**0.62**	**0.64**	**0.55**	**0.25**	**(0.12)**	**(0.03)**	**0.45**

*FYTD 2020

Avg WAMs: LAIF ~.5 Years, Clark County ~1.8 Years

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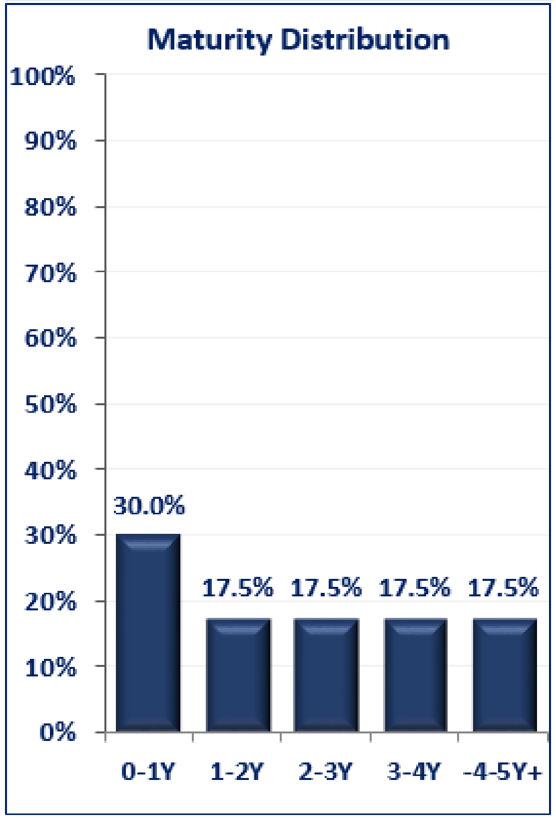
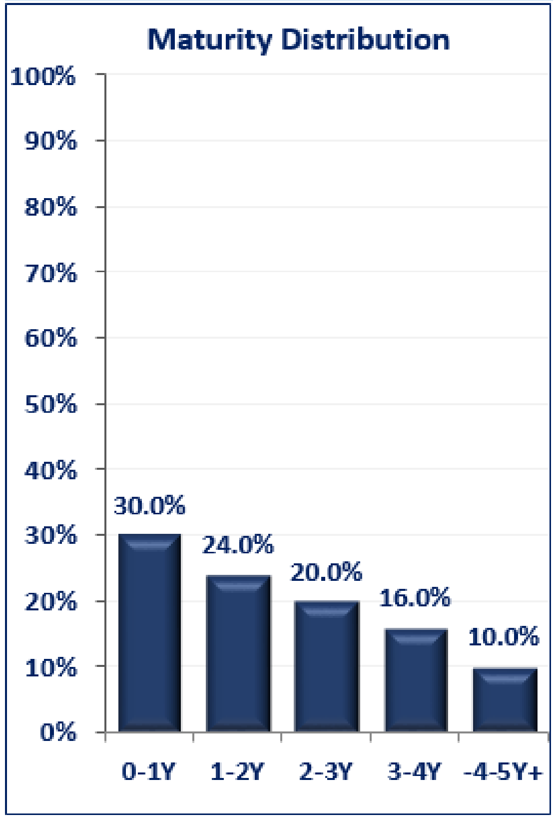
Different Operating Portfolio Strategies/Structures

Proactive Management or Buy & Hold

Cash Flow Matching

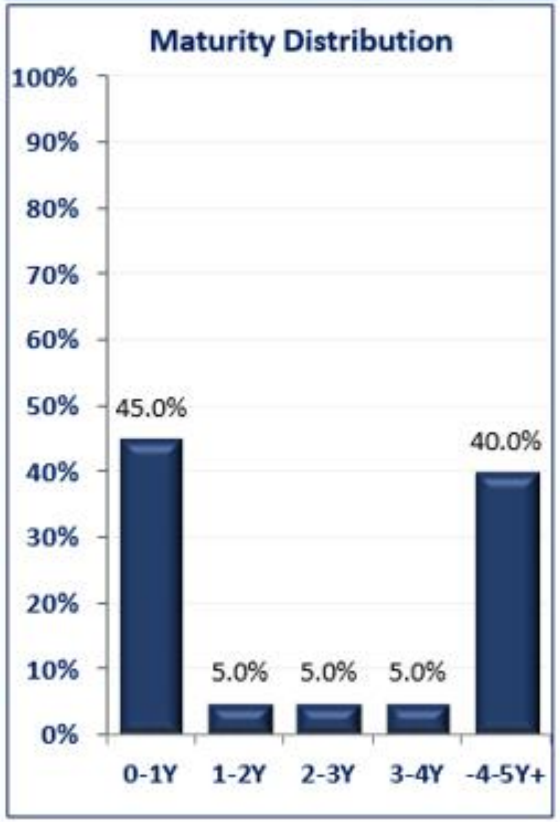


Index Matching

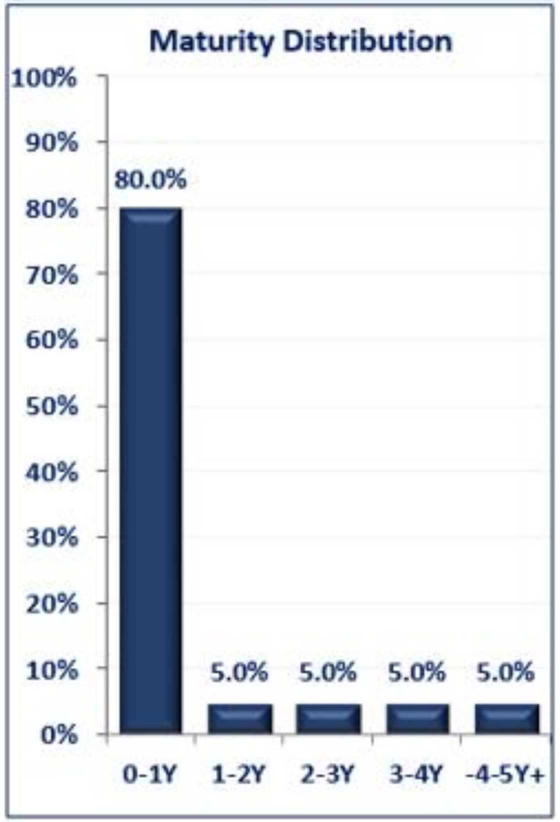


Active Management

Barbell/Maketing Timing

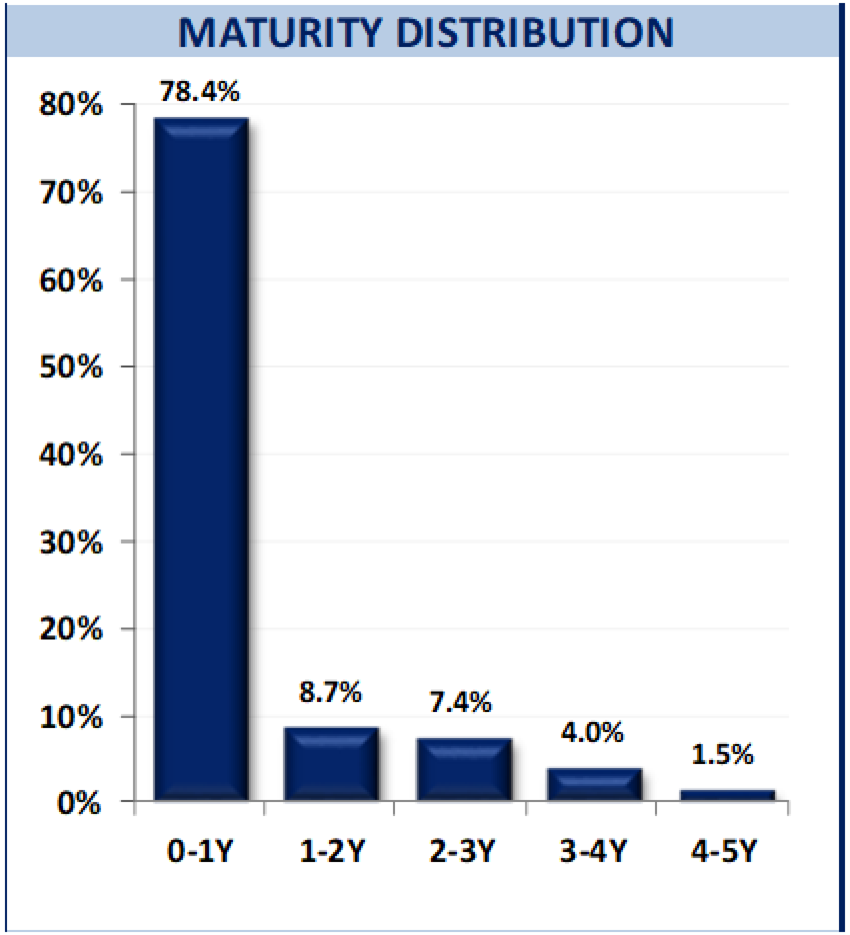


Market Timing/Relative Value

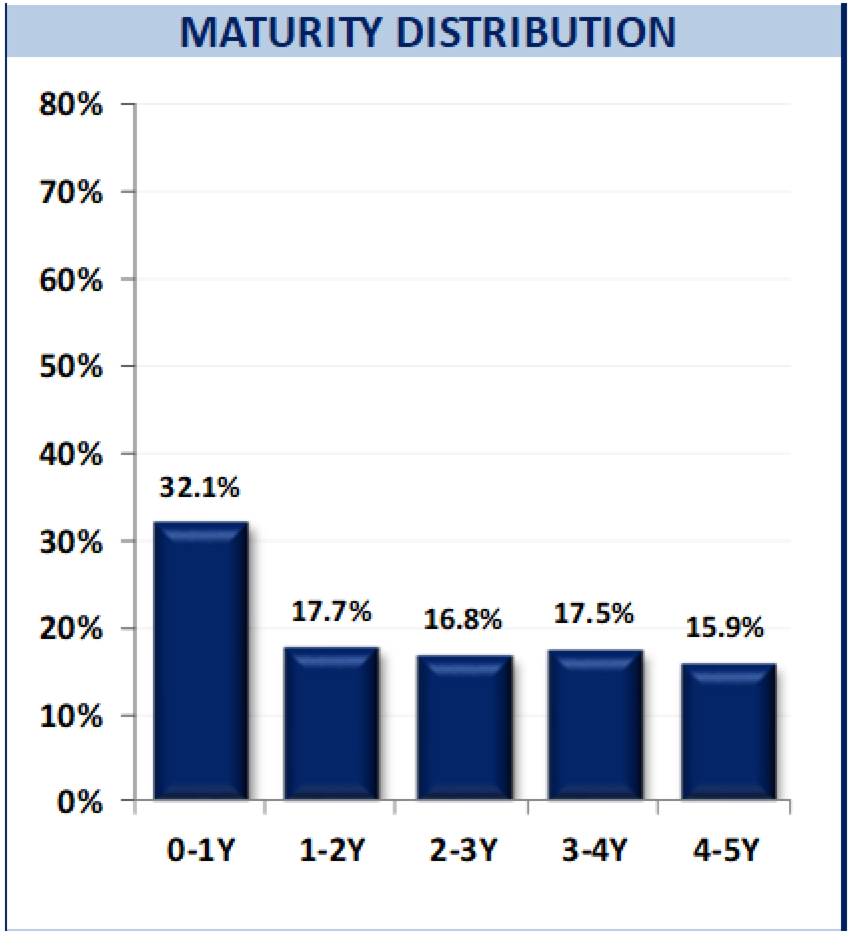


Before/After: Implementing a Asset/Liability Matching Strategy

Before: .9 Duration



After: 2.1 Duration



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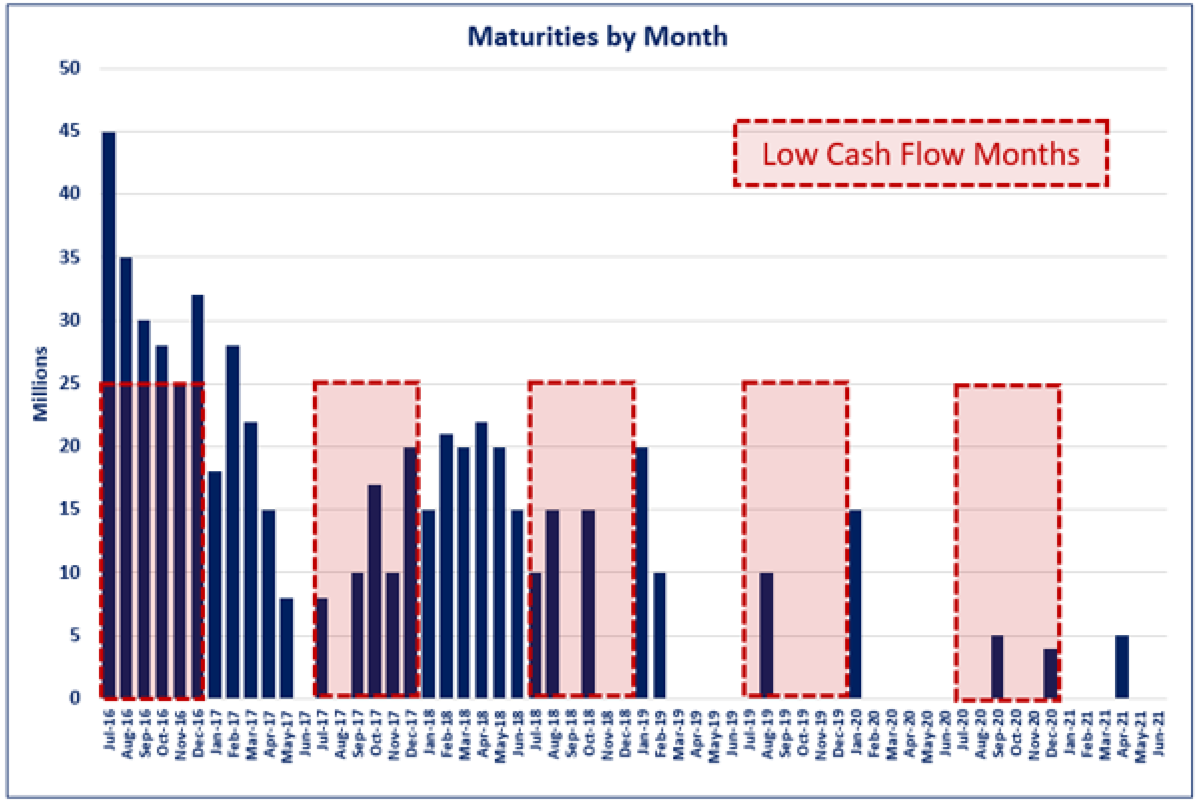
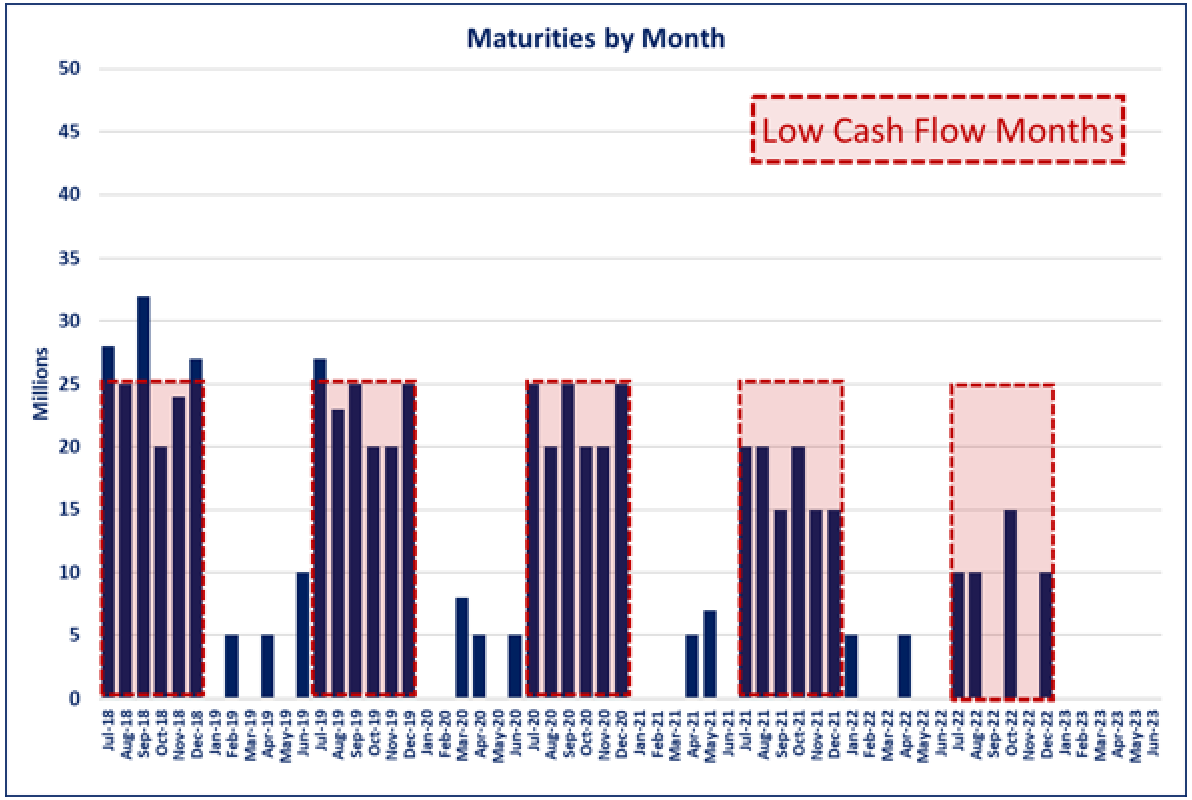
You Have a Responsible Amount of Interest Rate Risk

Before: .9 Duration



After: 2.1 Duration



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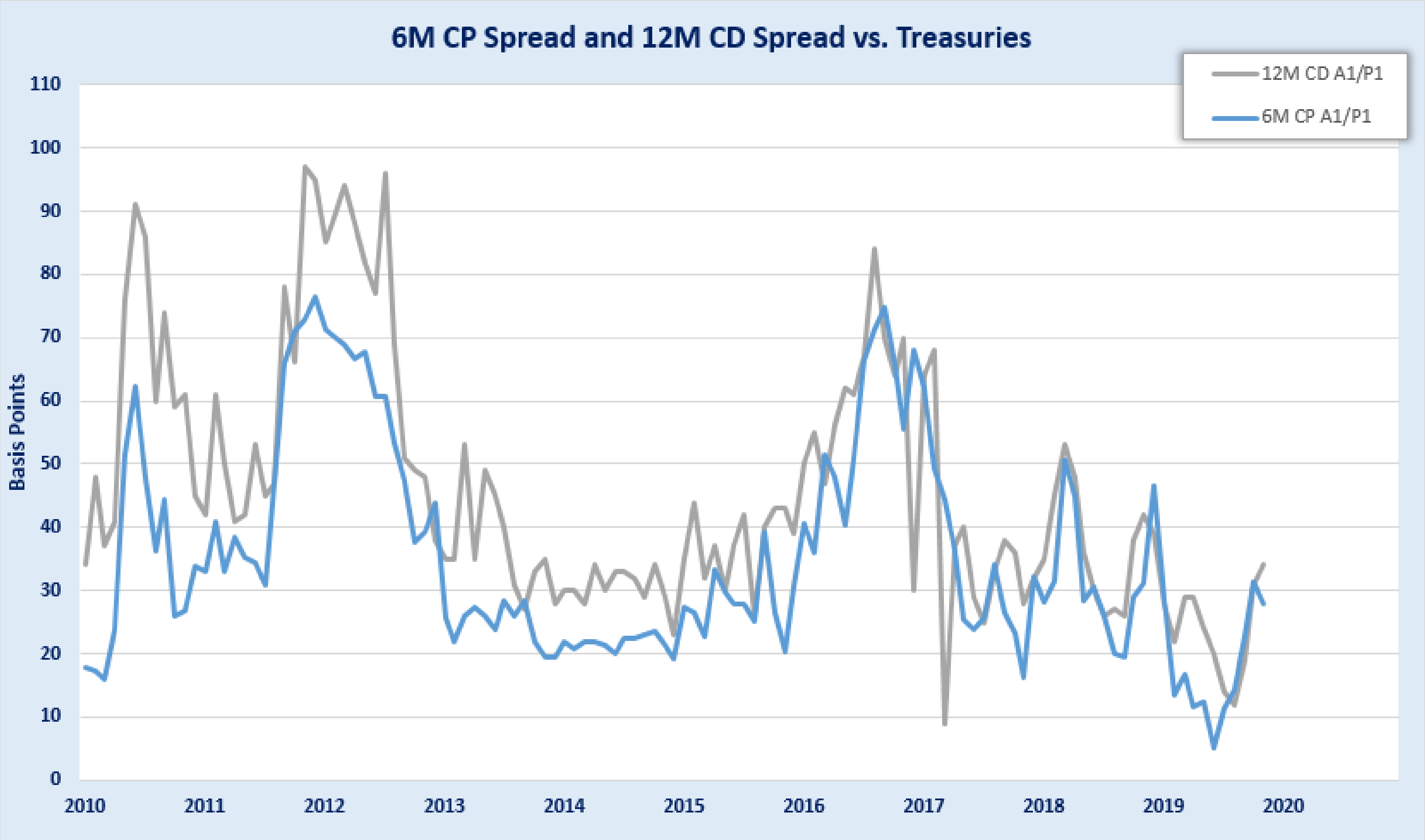
CREDIT

Is Credit Worth the Risk?



Avg Spd	35	46
Sector	CP 6M A1/P1	CD 12M A1/P1

Source: Bloomberg

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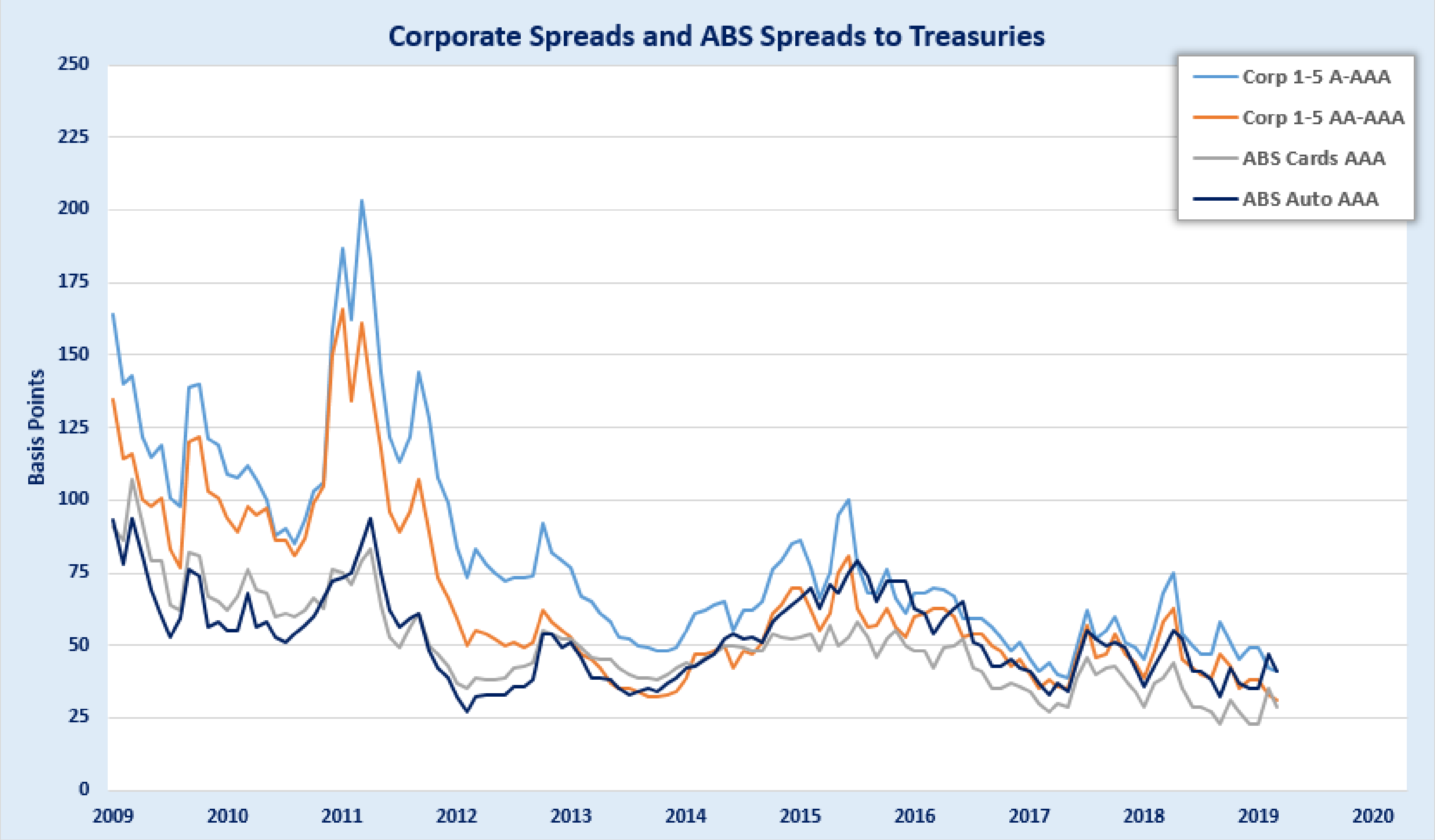
Is Credit Worth the Risk?



Avg Spd	81	66	50	53
Sector	Corp A-AAA	Corp AA-AAA	ABS Cards	ABS Auto

Source: Bloomberg

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$1,000,000,000 x 45% Credit Exposure x 40 BPs Avg Spread = $1,800,000/Yr Investment Income

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One-Year Default Rates

Descriptive Statistics On One-Year Global Default Rates

	AAA	AA	A	BBB	BB	B	CCC/C
Minimum	0.00	0.00	0.00	0.00	0.00	0.25	0.00
Maximum	0.00	0.38	0.39	1.02	4.22	13.84	49.46
Weighted long-term average	0.00	0.02	0.06	0.17	0.65	3.44	26.63
Median	0.00	0.00	0.00	0.06	0.58	3.40	24.83
Standard deviation	0.00	0.07	0.10	0.26	1.00	3.29	11.47
2008 default rates	0.00	0.38	0.39	0.49	0.81	4.10	27.27
Latest four quarters (2018Q1-2018Q4)	0.00	0.00	0.00	0.00	0.00	0.98	27.18
Difference between last four quarters and weighted average	0.00	(0.02)	(0.06)	(0.17)	(0.65)	(2.46)	0.54
Number of standard deviations	0.00	(0.29)	(0.55)	(0.64)	(0.64)	(0.75)	0.05

Sources: S&P Global Fixed Income Research and S&P Global Market Intelligence's CreditPro®.

Cumulative Default Rates

Average Cumulative Default Rates For Corporates By Region (1981-2018)

(%)	--Time horizon (years)--														
Rating	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
U.S.															
AAA	0.00	0.04	0.17	0.29	0.41	0.54	0.58	0.66	0.75	0.83	0.88	0.92	0.97	1.06	1.16
AA	0.03	0.08	0.17	0.30	0.43	0.58	0.72	0.83	0.92	1.03	1.12	1.20	1.29	1.36	1.45
A	0.07	0.19	0.34	0.52	0.69	0.90	1.12	1.33	1.56	1.78	1.99	2.18	2.37	2.53	2.71
BBB	0.20	0.54	0.92	1.41	1.92	2.44	2.90	3.37	3.82	4.26	4.70	5.02	5.31	5.64	5.97
BB	0.75	2.36	4.28	6.17	7.89	9.54	10.93	12.22	13.36	14.39	15.24	16.02	16.74	17.33	17.95
B	3.63	8.45	12.71	16.08	18.70	20.85	22.60	23.98	25.21	26.36	27.32	28.06	28.73	29.35	29.96
CCC/C	28.89	39.73	45.37	48.83	51.42	52.62	54.10	55.02	55.89	56.58	57.25	57.79	58.36	58.89	58.89

Sources: S&P Global Fixed Income Research and S&P Global Market Intelligence's CreditPro®.

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Composite Credit Rating: JPMorgan

Numeric Rating	Composite Rating	Moody's Rating	S&P Rating	Fitch Rating
1	AAA	Aaaa	AAA	AAA
2	AA1	Aa1	AA+	AA+
3	AA2	Aa2	AA	AA
4	AA3	Aa3	AA-	AA-
5	A1	A1	A+	A+
6	A2	A2	A	A
7	A3	A3	A-	A-
8	BBB1	Baa1	BBB+	BBB+
9	BBB2	Baa2	BBB	BBB
10	BBB3	Baa3	BBB-	BBB-

JPMorgan		
NRSRO	Rating	Number
Moody's	A2	6
S&P	A-	7
Fitch	AA-	4
Average		5.67
Rounded		6
Composite	A2	

Source: Bloomberg

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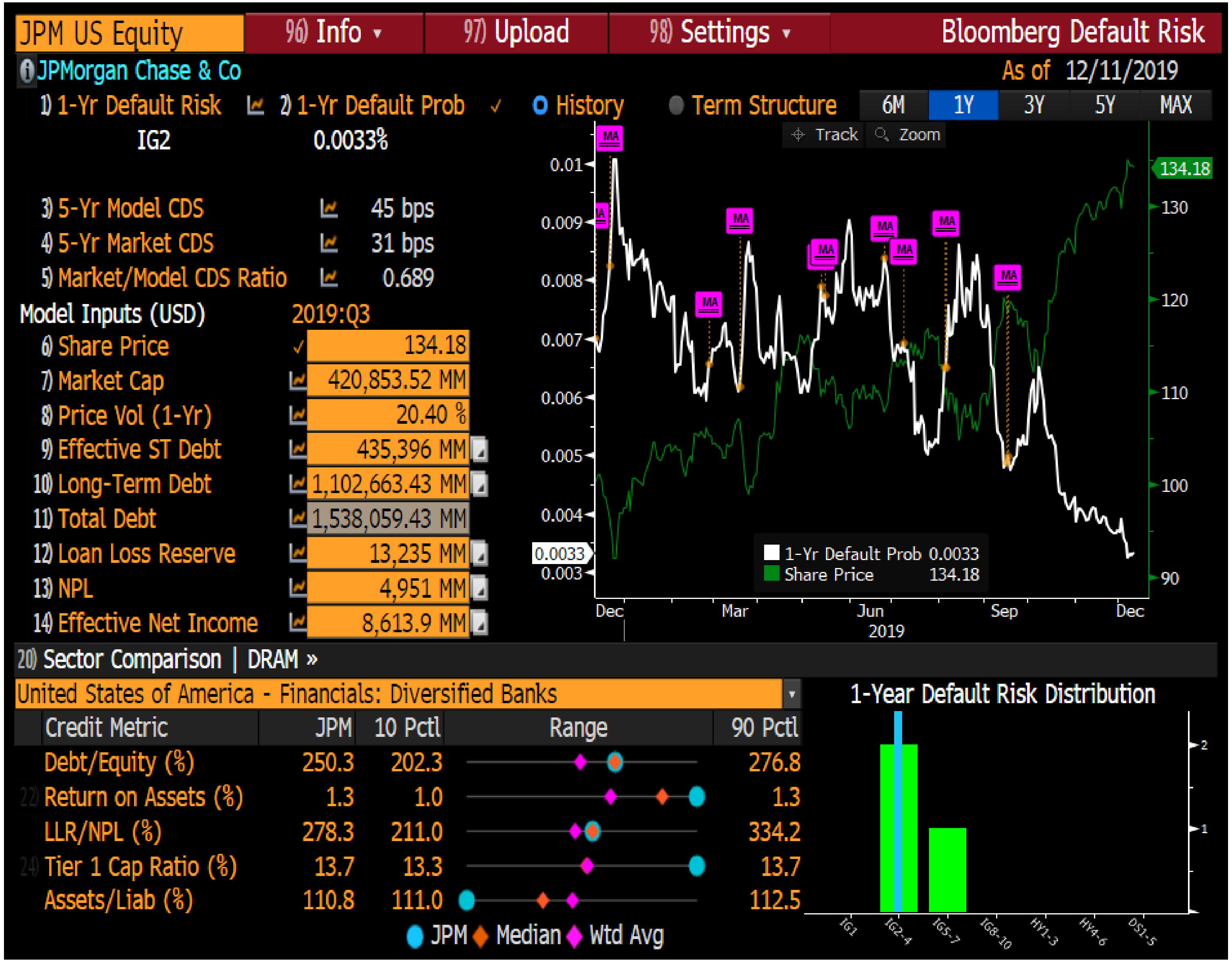
Credit Risk Tools



Source: Bloomberg

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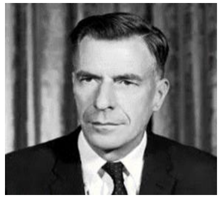
Habit #3

You Don’t Try to Time the Market

Forecasting



“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) November 2019

The "Bond King's" Predictions

CNBC

MENU

Bond King Gundlach predicts yields are headed much higher before this move ends

Published 12:44 PM ET Thu, 11 Oct 2018

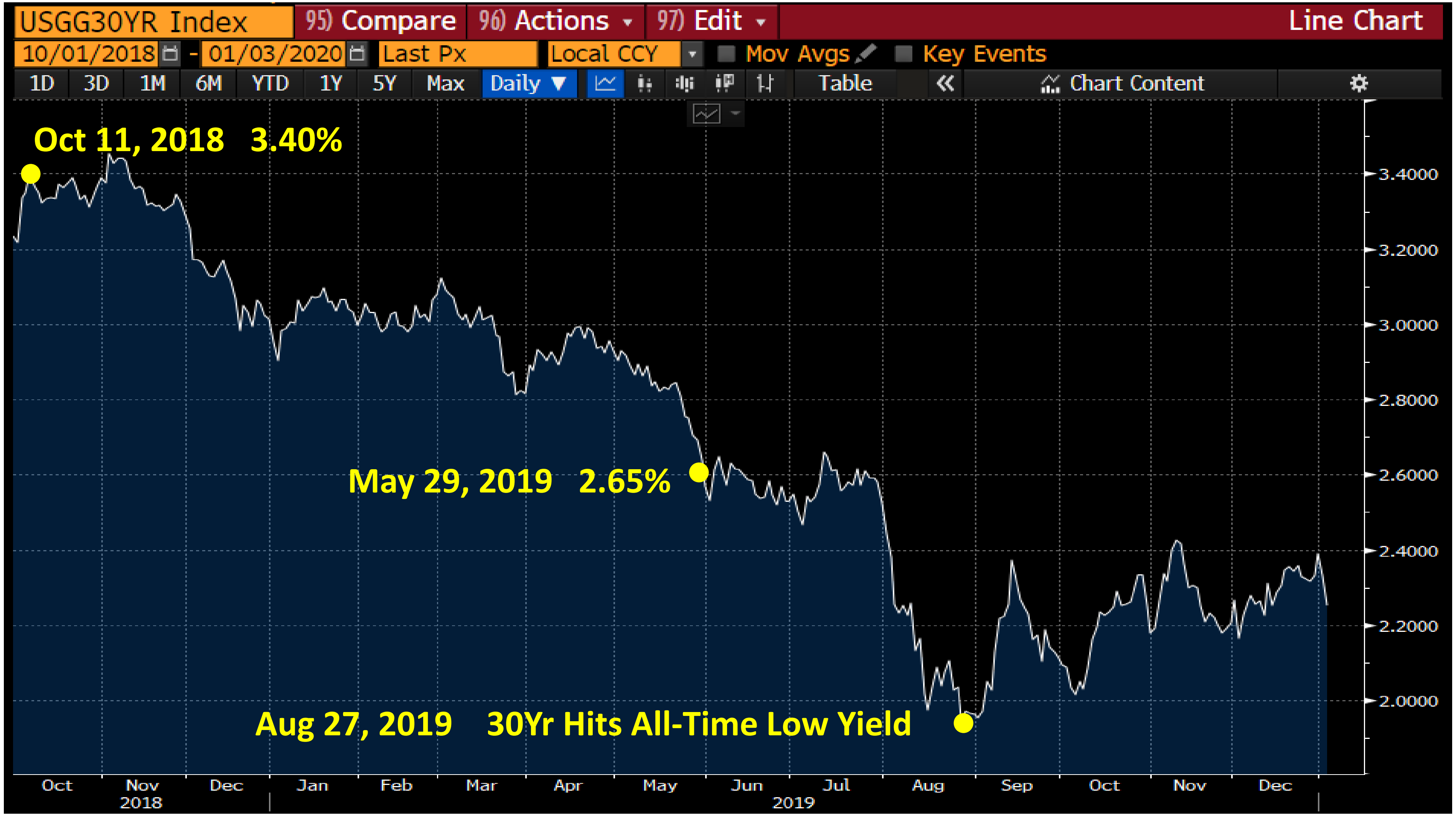
Jeffrey Gundlach
@TruthGundlach

Long maturity US Treasury price action today was consistent with a blowoff momentum top. I suspect buyer's remorse will set in fairly soon.

4:59 PM · 5/29/19

Source: CNBC, Twitter

How'd He Do? "Just a Bit Outside"



Source: Bloomberg

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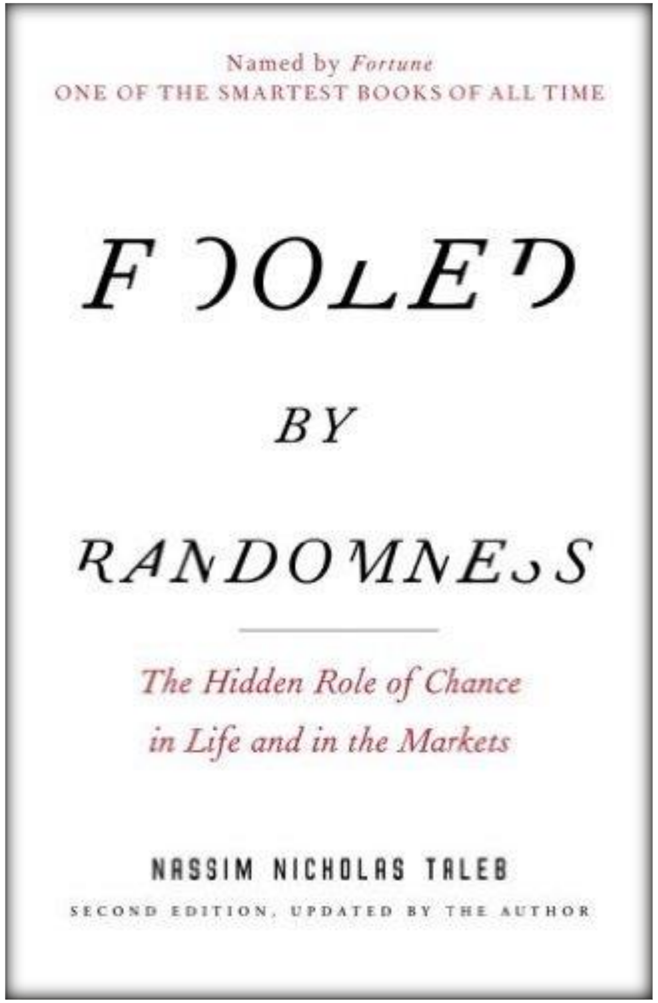
Fooled By Randomness

"Generate a long series of coin flips, producing heads and tails with 50% odds each and fill up sheets of paper. If the series is long enough you **may get eight heads or eight tails in a row**, perhaps even ten of each. Yet you know that in spite of these wins the conditional odds of getting a head or a tail is still 50%."



Source: Fooled by Randomness, Nassim Taleb

Investment Newsletter Forecasters

There's a large body of evidence demonstrating that stock market forecasts have no value (though they supply plenty of fodder for my writings) because their accuracy is no better than one would randomly expect. For example, David Bailey, Jonathan Borwein, Amir Salehipour and Marcos López de Prado, authors of the March 2017 study, Evaluation and Ranking of Market Forecasters, covering 6,627 market forecasts (specifically for the S&P 500 Index) made by 68 forecasters who employed technical, fundamental and sentiment indicators, and the period 1998 through 2012, found:

- Across all forecasts, accuracy was 48% – worse than the proverbial flip of a coin.
- Two-thirds of forecasters had accuracy scores below 50%.
- About 40% of forecasters had an accuracy score between 40% and 50%.
- About 3% of forecasters fell in the left tail, with accuracy scores below 20%.
- About 6% of forecasters fell in the far right tail, with accuracy scores between 70% and 79%.
- The highest accuracy score was 78% and the lowest was 17%.

The distribution of forecasting accuracy by the gurus examined in the study looks very much like the common bell curve – what you would expect from random processes. That makes it very difficult to tell if any skill is present.

Evidence such as this led Warren Buffett to state, "We have long felt that the only value of stock forecasters is to make fortune-tellers look good. Even now, Charlie (Munger) and I continue to believe that short-term market forecasts are poison and should be kept locked up in a safe place, away from children and also from grown-ups who behave in the market like children." Remarking on the value of forecasts, *Wall Street Journal* columnist Jason Zweig stated "Whenever some analyst seems to know what he's talking about, remember that pigs will fly before he'll ever release a full list of his past forecasts, including the bloopers."

Source: Larry Swedroe

It's Tough to Time the Bond Market

S&P Dow Jones Indices

A Division of S&P Global

Research

SPIVA® U.S. Scorecard

Report 11: Percentage of Fixed Income Funds Outperformed by Benchmarks

FUND CATEGORY	COMPARISON INDEX	1-YEAR (%)	3-YEAR (%)	5-YEAR (%)	10-YEAR (%)	15-YEAR (%)
Government Long Funds	Bloomberg Barclays US Government Long	100.00	76.79	98.31	98.73	98.00
Government Intermediate Funds	Bloomberg Barclays US Government Intermediate	94.12	89.47	85.71	85.29	91.07
Government Short Funds	Bloomberg Barclays US Government (1-3 Year)	91.67	84.00	82.14	69.70	82.86
Investment-Grade Long Funds	Bloomberg Barclays US Government/Credit Long	97.65	72.04	98.91	95.97	97.50
Investment-Grade Intermediate Funds	Bloomberg Barclays US Government/Credit Intermediate	50.50	39.90	55.50	51.65	72.68
Investment-Grade Short Funds	Bloomberg Barclays US Government/Credit (1-3 Year)	83.87	37.50	62.12	41.27	68.00

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Security Type Selection for Different Strategies

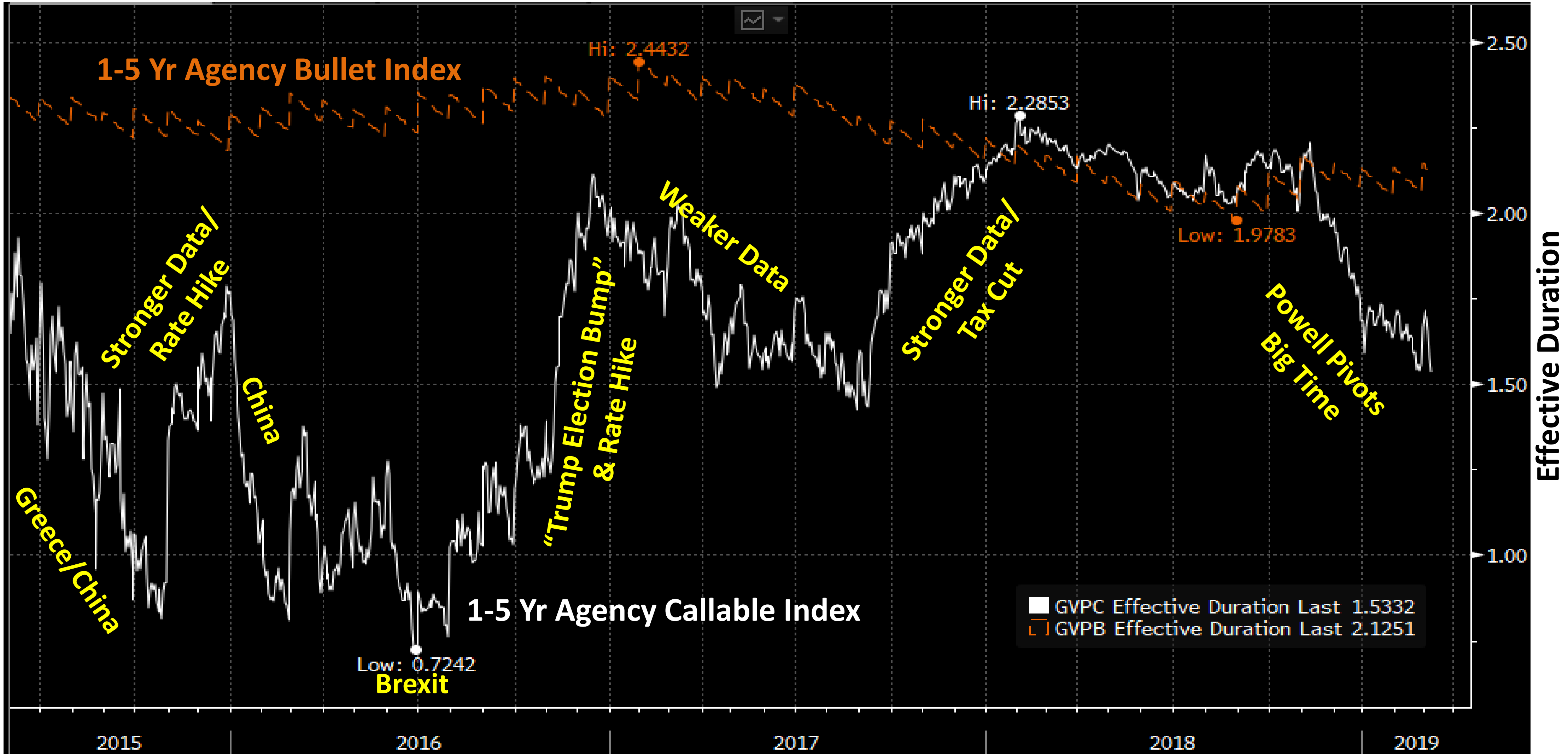
Securities to Match Cash Outflows:

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

Securities to Market Time:

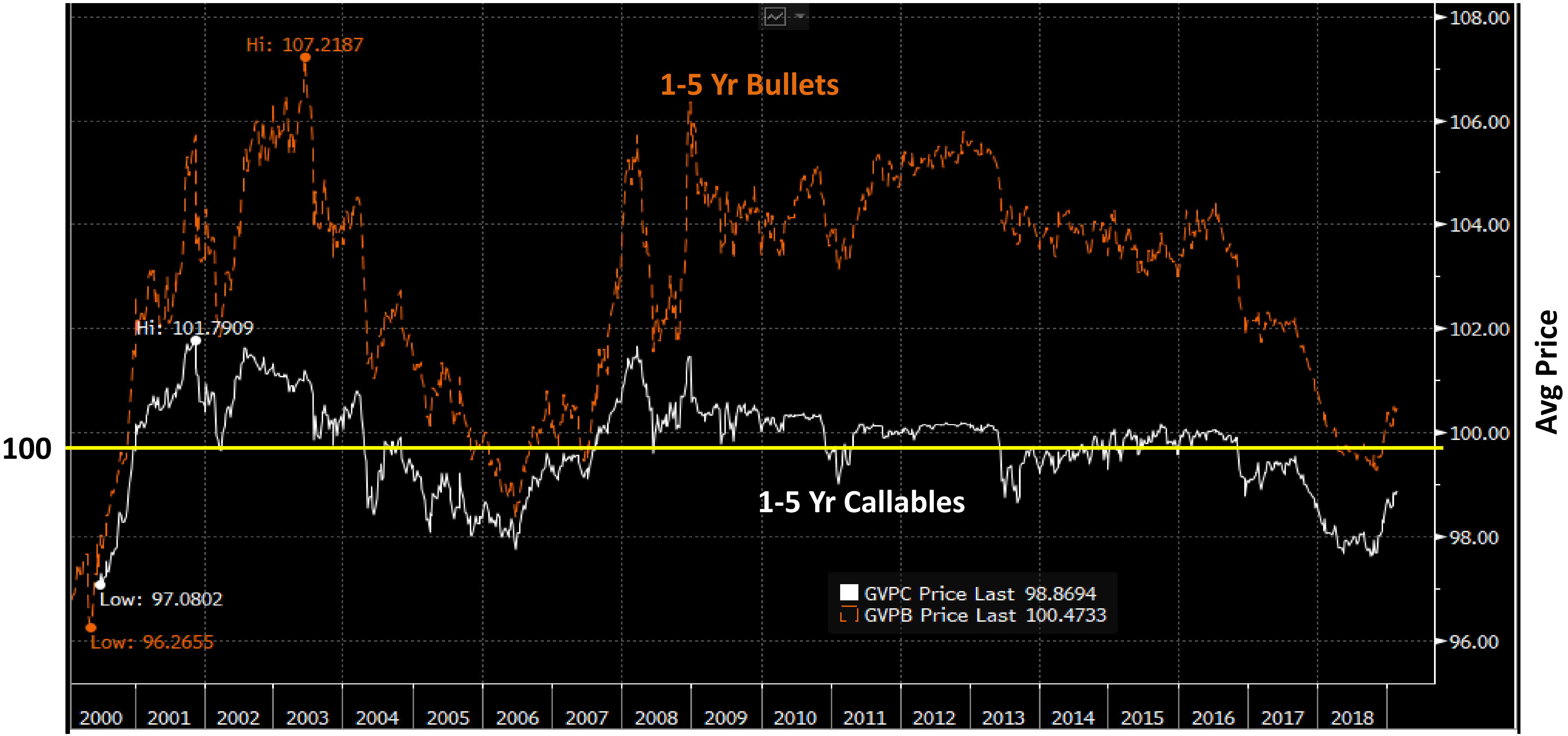
- Bullets
- Paydowns (ABS/MBS/SBA)
- Floating Rate Notes
- Callables
- Step-Ups/Step-Downs
- Bond Mutual Funds
- Floating NAV Funds

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



Source: Bloomberg

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



Source: Bloomberg

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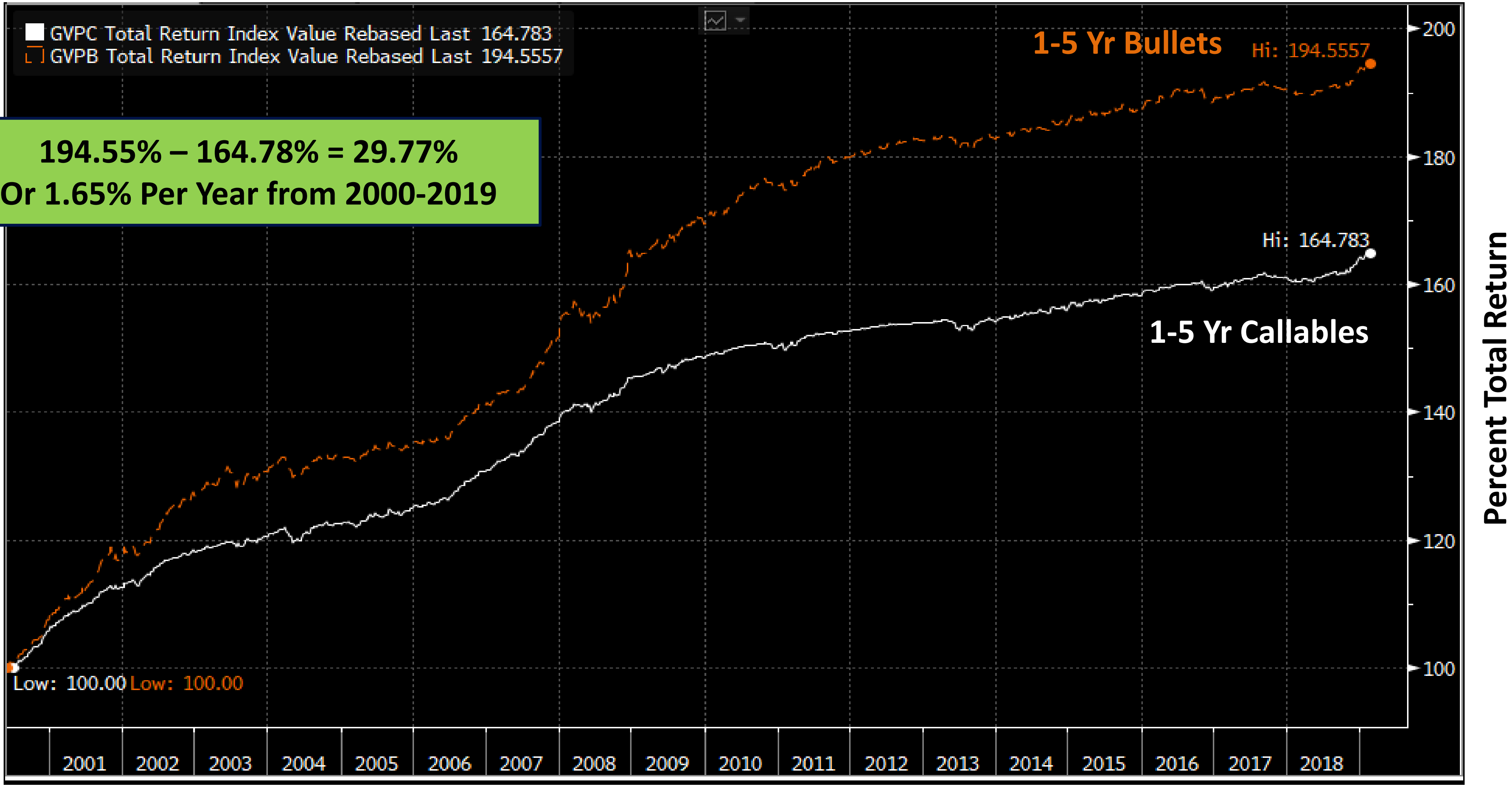
Total Return: 2000-2019   1-5Yr Callables vs. 1-5Yr Bullets



194.55% – 164.78% = 29.77%
Or 1.65% Per Year from 2000-2019

Source: Bloomberg

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Avg Effective Duration: Bullets 2.33   Callables 1.48

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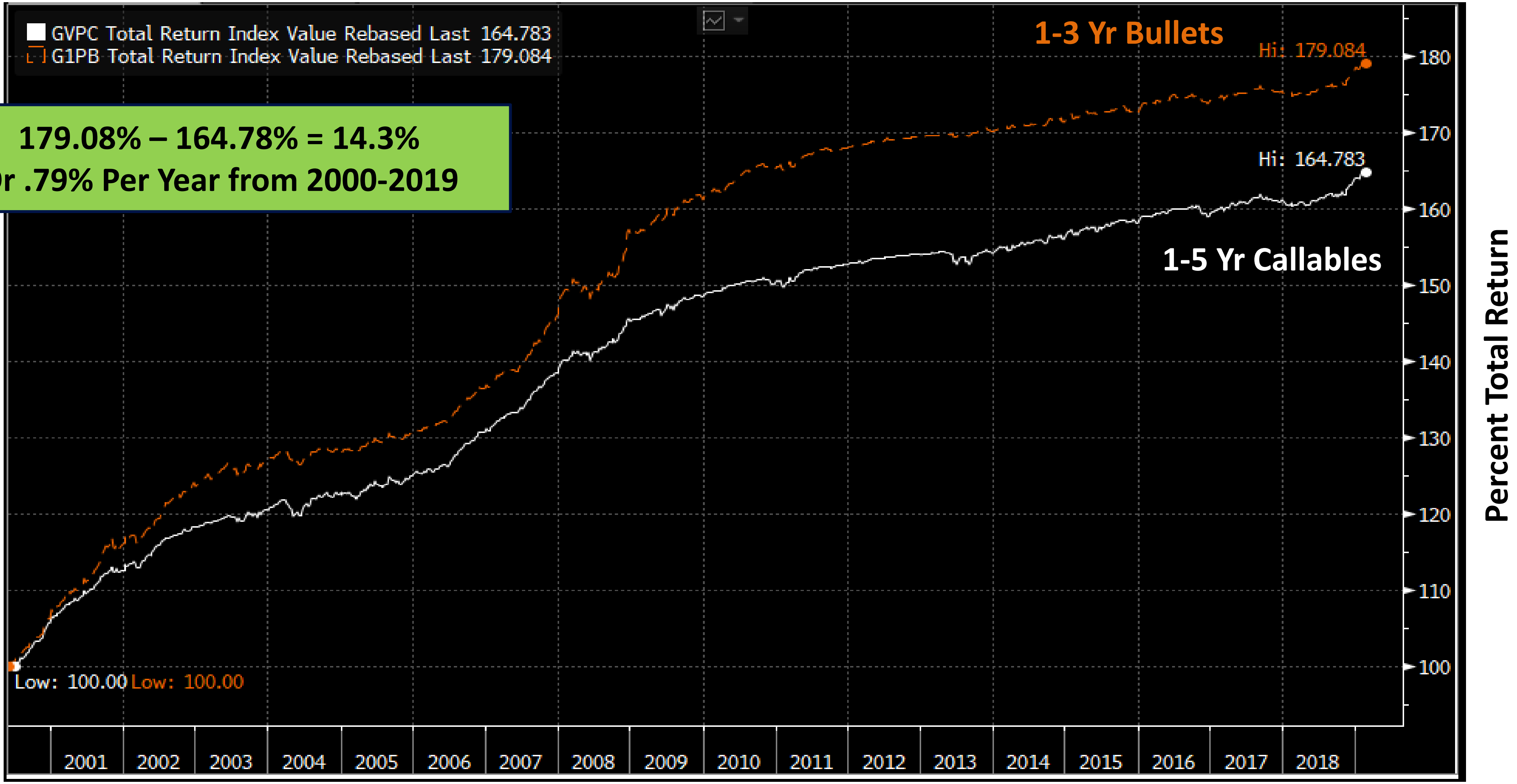
Total Return: 2000-2019 1-5Yr Callables vs. 1-3Yr Bullets



179.08% – 164.78% = 14.3%
Or .79% Per Year from 2000-2019

Source: Bloomberg

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Avg Effective Duration: Bullets 1.78 Callables 1.48

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But What If Your Timing Was Awesome!

Source: Bloomberg

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Awesome Timing: 1-3Yr Bullets vs. 1-5Yr Callables Total Return

Date Range	06/24/2016	-	11/08/2018	Frequency Daily

Index	Currency	Start	End	High	Low	Avg	StDev	Annl StDev
GVPC		100.000	101.108	101.446	99.365	100.485	0.437	6.939
G1PB		100.000	100.833	101.051	99.414	100.239	0.323	5.131

Attribute: Total Return Index Value — Rebase to 100 at Start Date

MTD | 1M | QTD | 1Q | YTD | 1Y | 3Y | 5Y | 10Y | Max

51) Data Chart | 52) Spread | 53) Correlation | 54) Data Table

101.108% – 100.833% = .275%
Or Only .12% Per Year from 2016-2018

Source: Bloomberg

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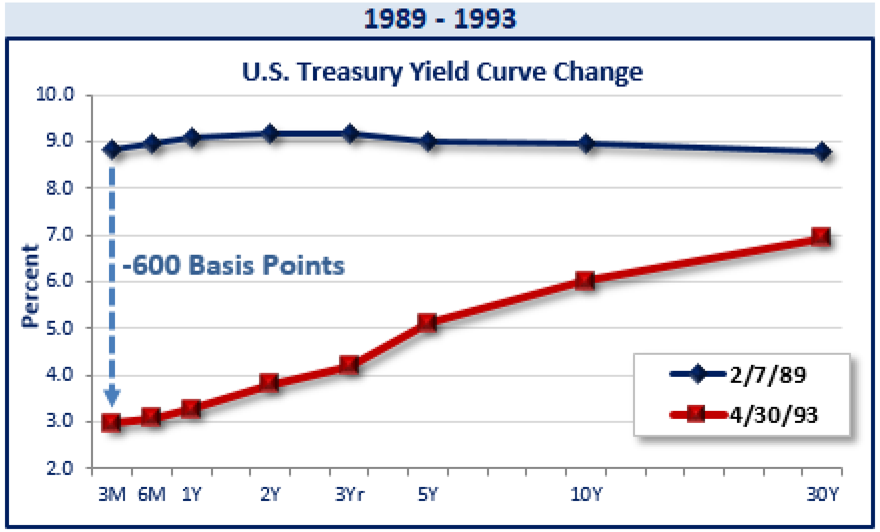
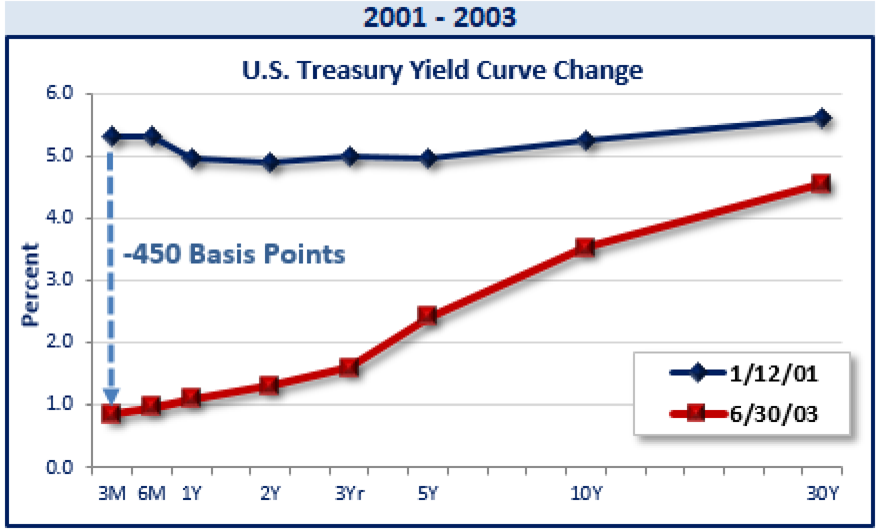
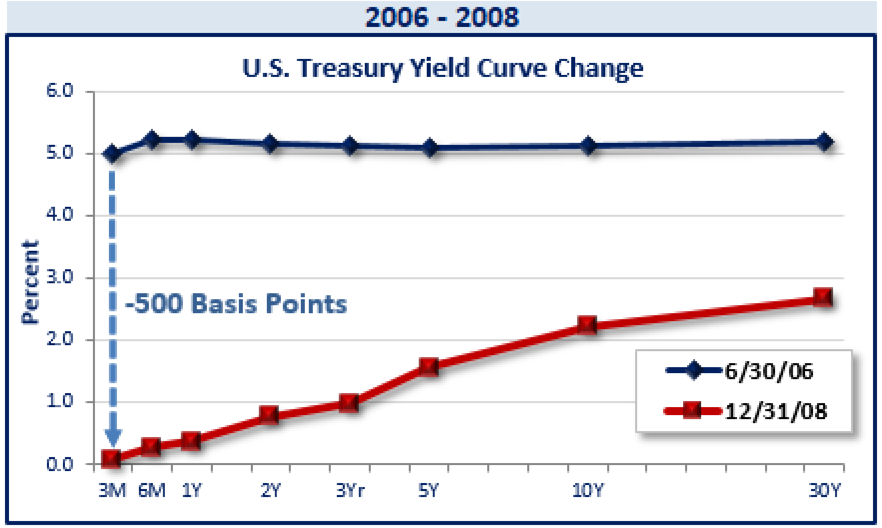
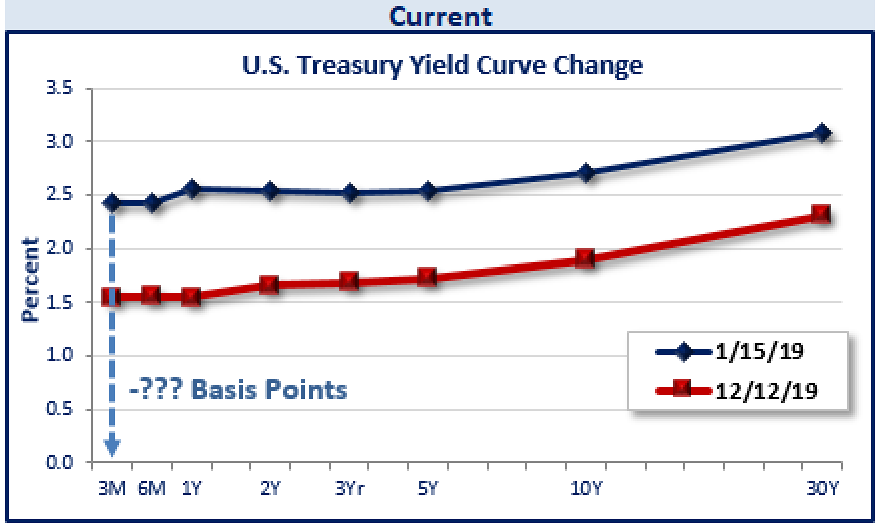
"Why Would I Buy a 5Yr When the 3Mo is the Same or Higher?"









Source: Bloomberg

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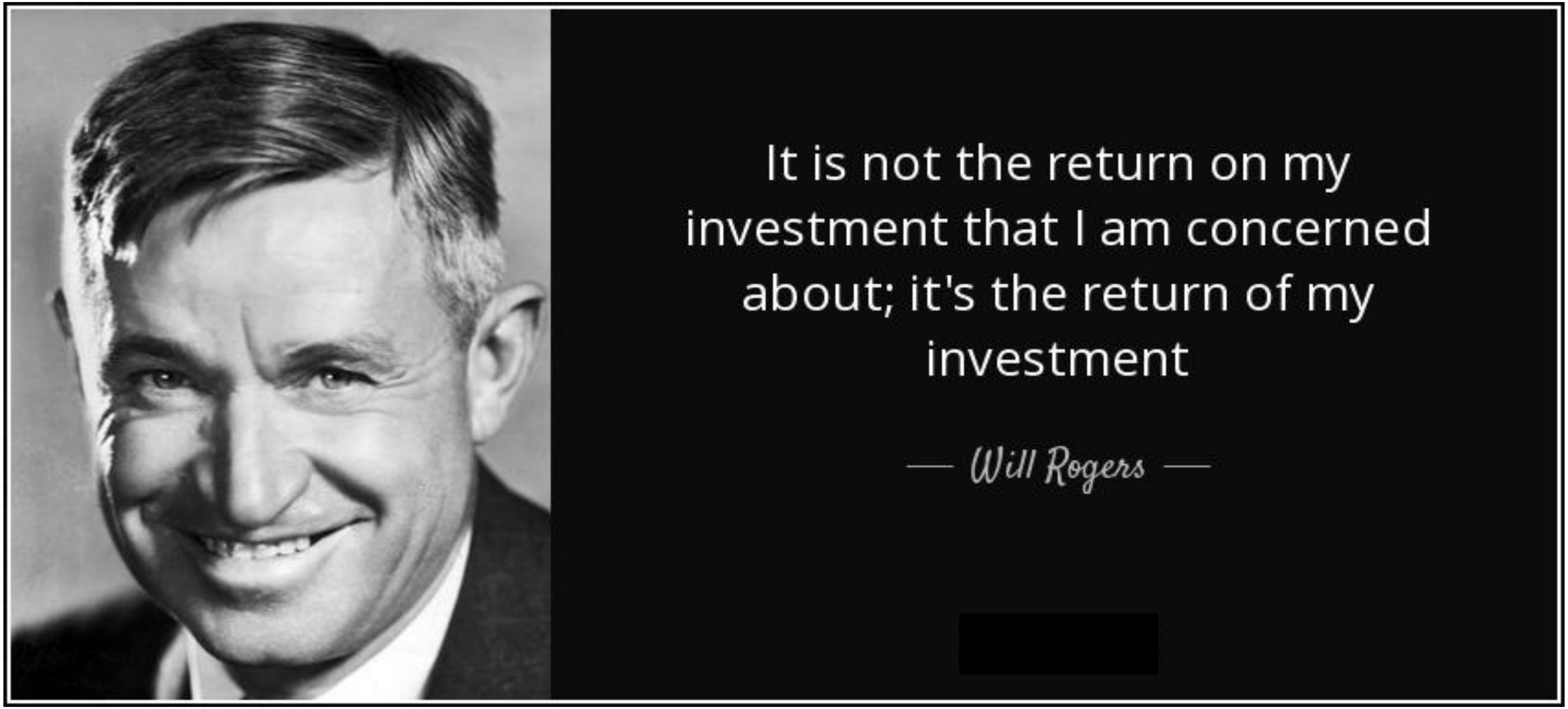
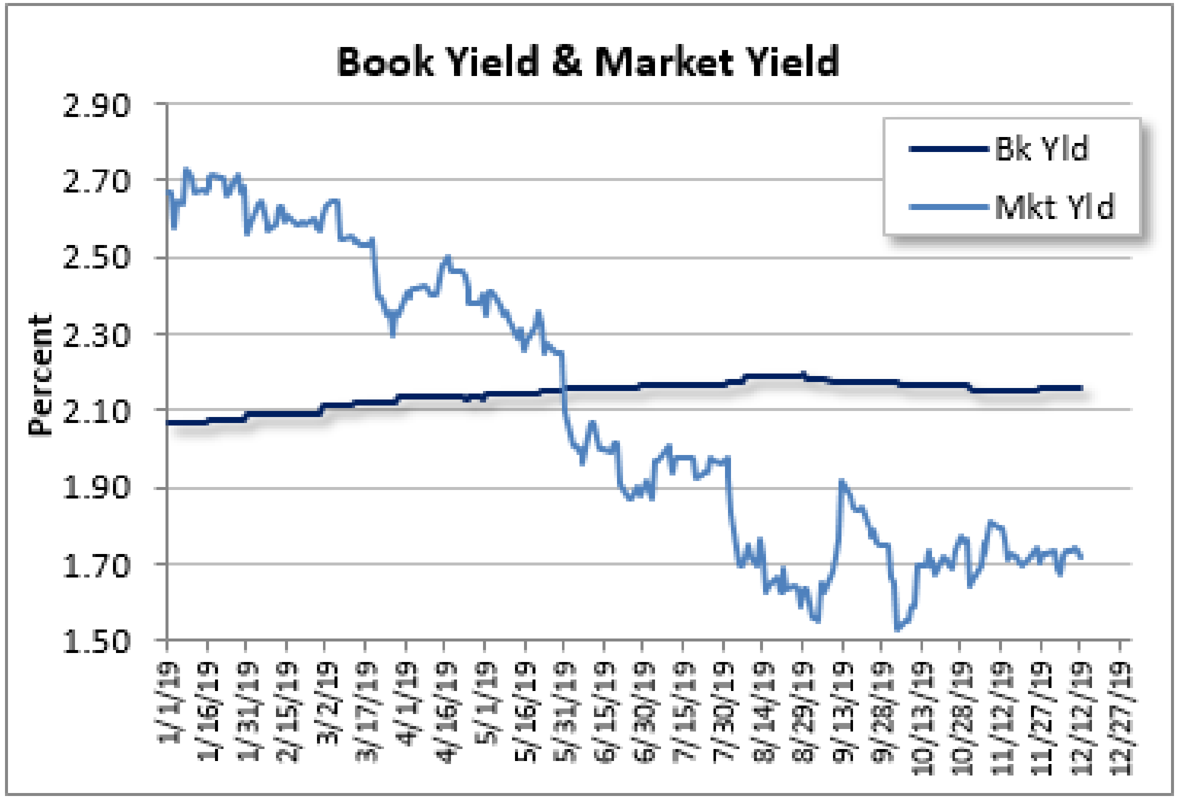
Habit #4

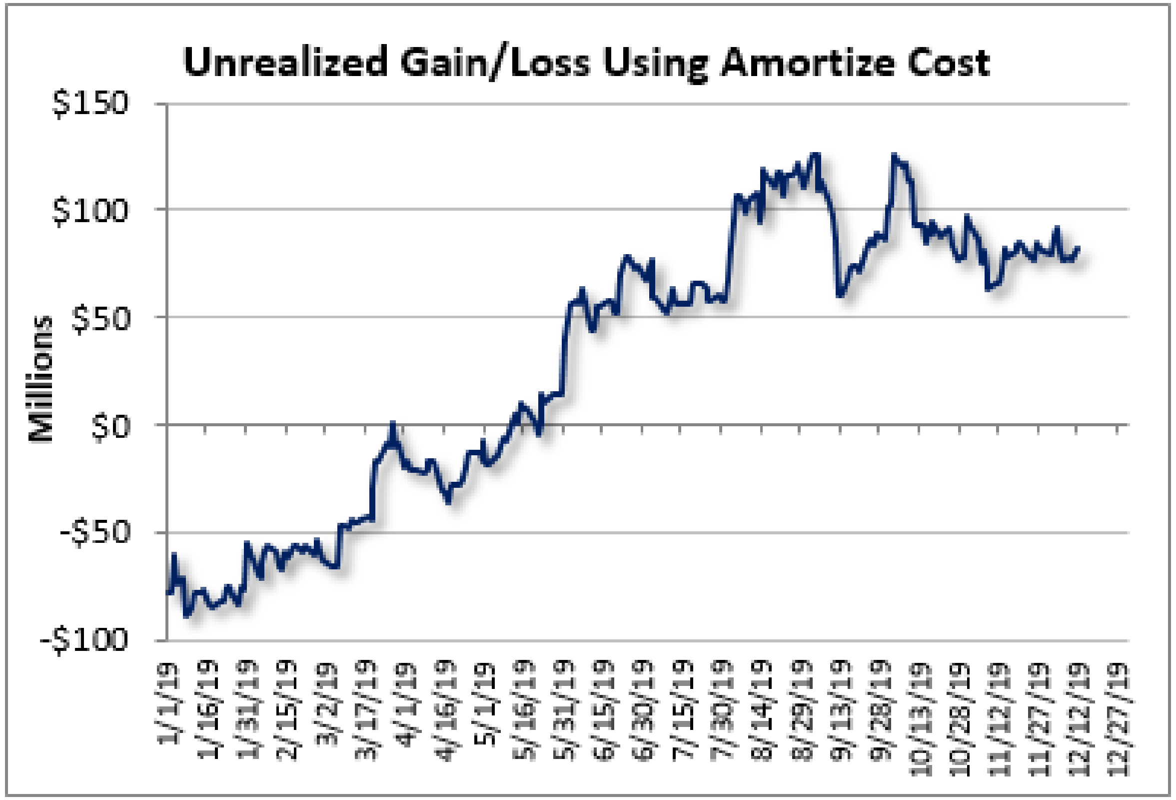
You Love Losses and Hate Gains

(the unrealized kind)


It is not the return on my investment that I am concerned about; it's the return of my investment
— Will Rogers —
[redacted]

The "Bad News" of "Good News"





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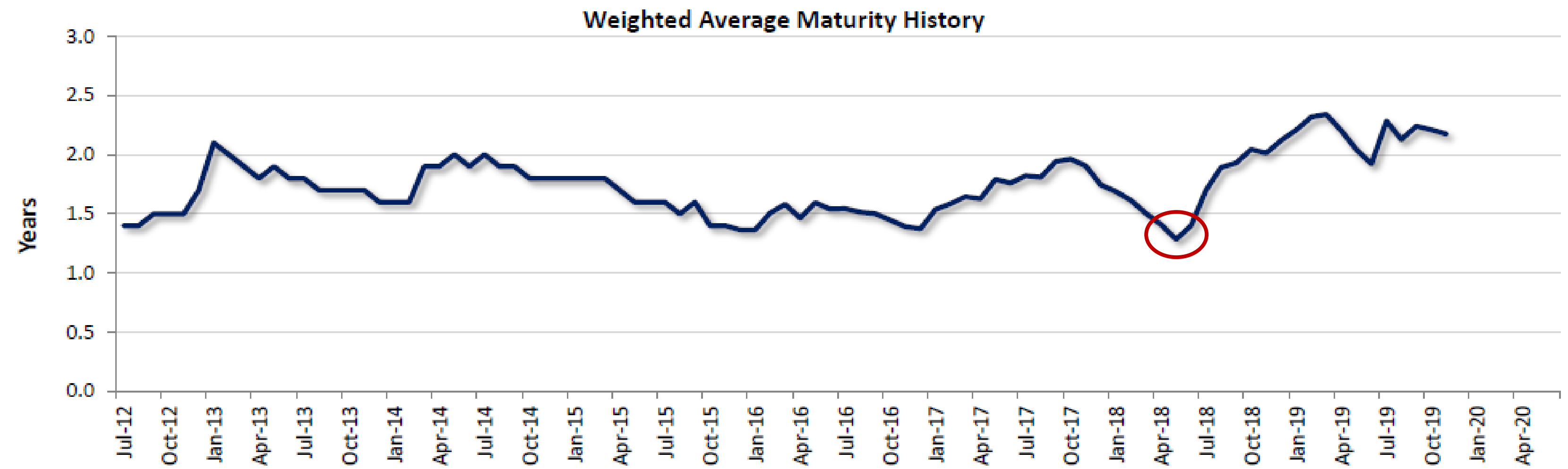
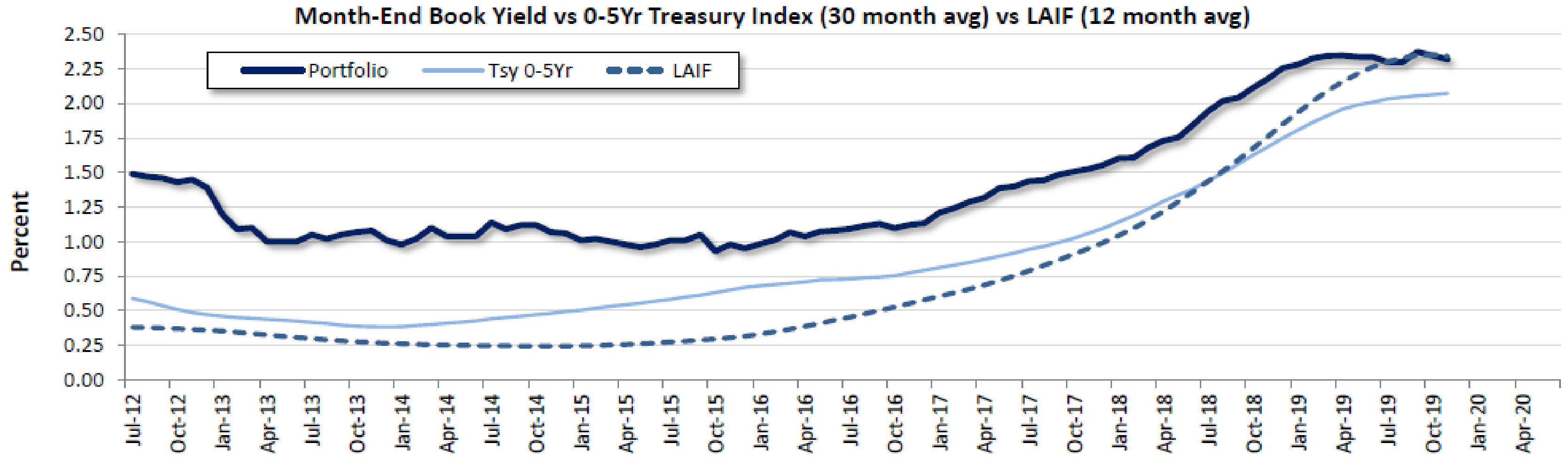
Creating a Stable'r Investment Income





Source: Bloomberg

ICE BofAML Index: 0-5Yr Treasury Index

Habit #5

You Follow GAAP
(Generally Accepted Accounting Principles)

GASB GOVERNMENTAL ACCOUNTING STANDARDS BOARD®

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ABOUT US

About the GASB

Established in 1984, the GASB is the independent, private-sector organization based in Norwalk, Connecticut, that establishes accounting and financial reporting standards for U.S. state and local governments that follow Generally Accepted Accounting Principles (GAAP). >> More

Source: GASB.org

#5: You Follow GAAP (Generally Accepted Accounting Principles)

You Amortize

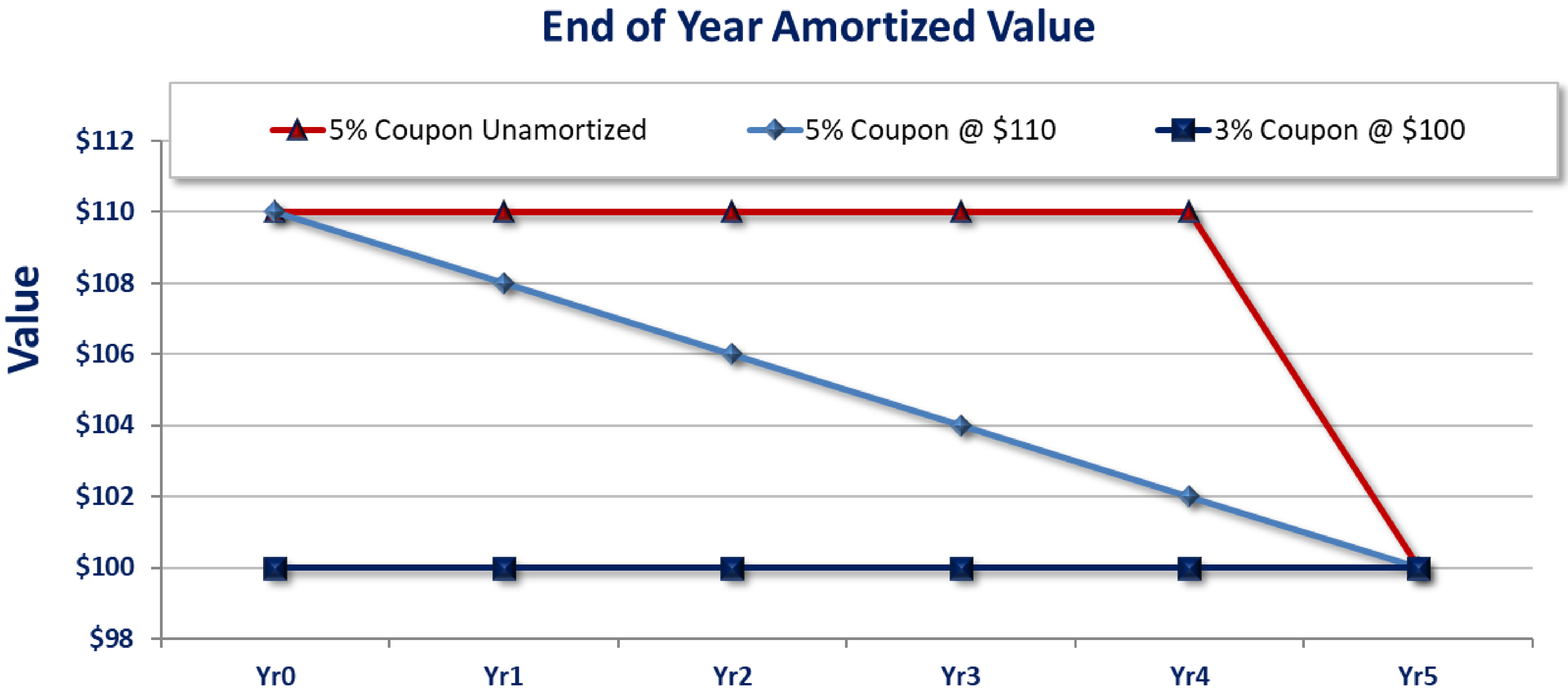
Buy/Sell	Buy	Cusip	313588HP3		
Issue	FNDN 0 07/01/19	Broker			
Audit Trail					
DlrFutBrkr	--				
Quantity	10,000,000	Disc Rate	1.0000	Principal	$ 9,900,000.00
Price	99.0000	Yield	1.0216	Acc Int	0.00
Settle Date	07/01/2018	Spread		Net	9,900,000.00

If you are not amortizing, when will you recognize the $100,000 gain (income)?

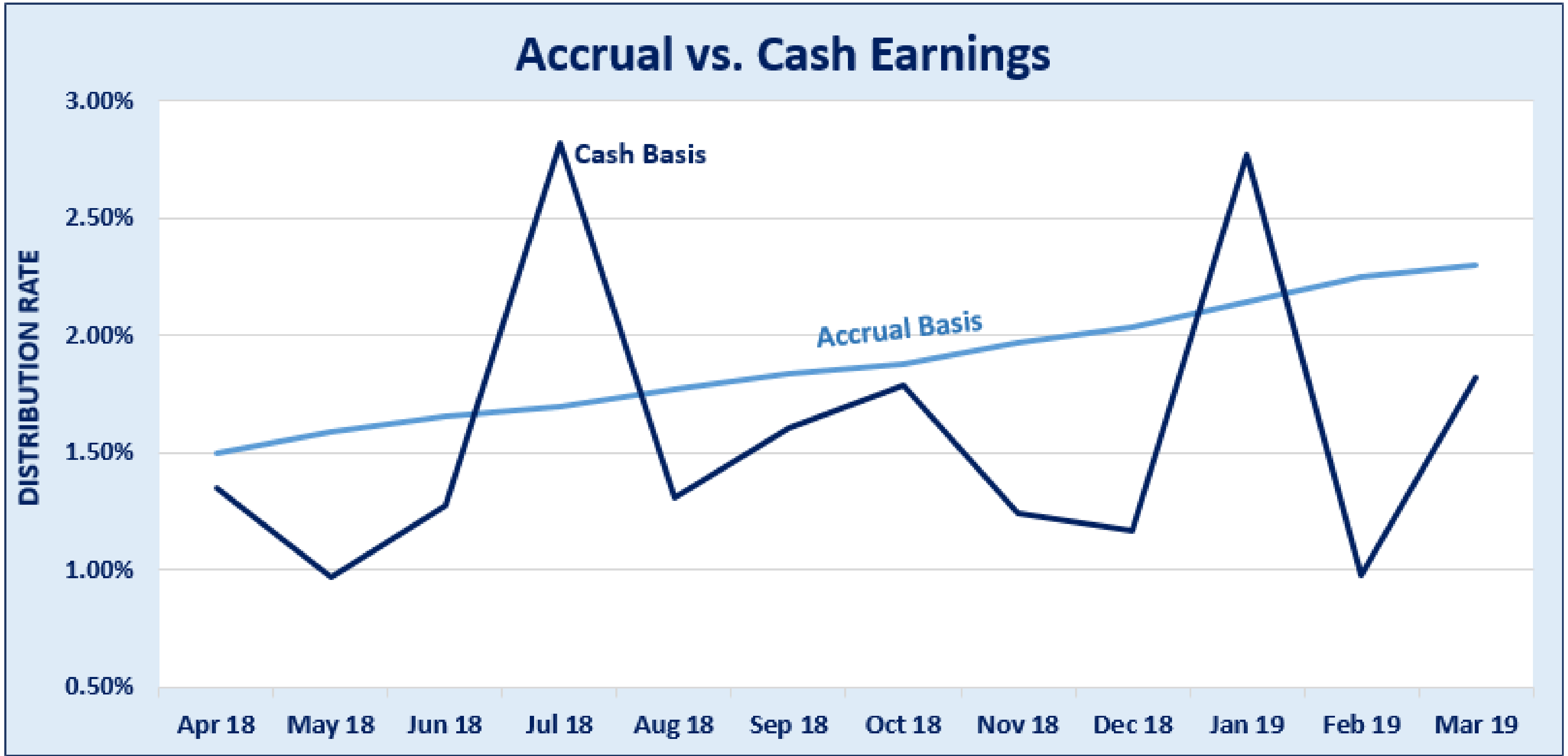
- ❑ Involves More Work: Monthly Journal Entries
- ❑ Custodians' Amortization Methodology May Not Match Your Investment Accounting System

Source: Bloomberg

Not Amortizing Premiums: Overstating Income



You Distribute Inv Income on an Accrual Basis…Not a Cash Basis



Month	Apr 18	May 18	Jun 18	Jul 18	Aug 18	Sep 18	Oct 18	Nov 18	Dec 18	Jan 19	Feb 19	Mar 19	Avg
Accrual	1.50%	1.59%	1.66%	1.70%	1.77%	1.84%	1.88%	1.97%	2.04%	2.14%	2.25%	2.30%	1.89%
Cash	1.35%	0.97%	1.28%	2.82%	1.31%	1.61%	1.79%	1.24%	1.17%	2.77%	0.98%	1.82%	1.59%
Variance	**0.15%**	**0.62%**	**0.38%**	**(1.12%)**	**0.46%**	**0.23%**	**0.09%**	**0.73%**	**0.87%**	**(0.63%)**	**1.27%**	**0.48%**	**0.29%**

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Habit #6

You Benchmark Your Investment Program and Portfolio in Multiple Ways

GIOA Model Investment Policy Primary Objectives

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.

Investment Portfolios are the Only Area Which Provide Revenue to Your Entity Without Charging Taxes or Fees to Your Citizens

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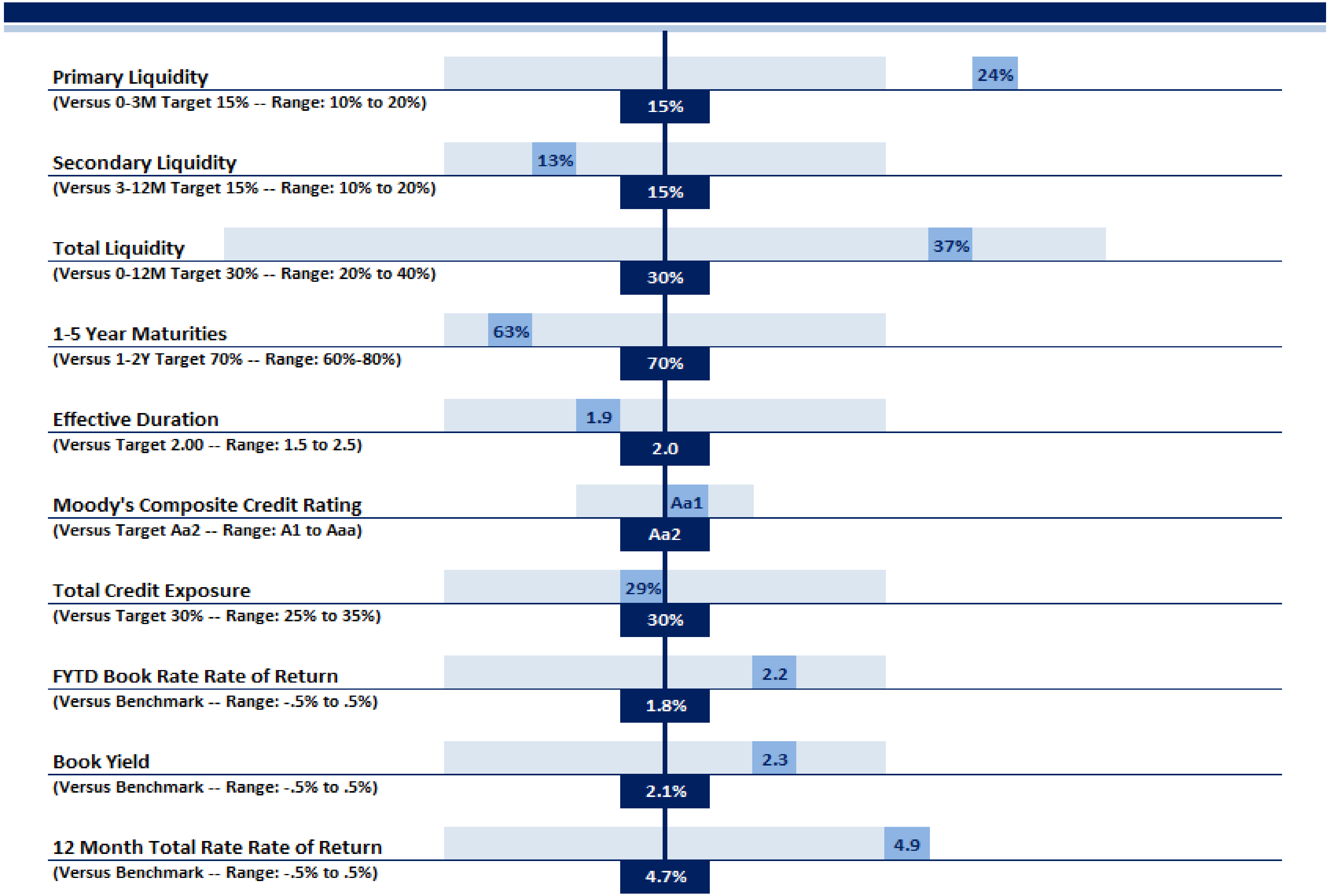
Benchmarking Your Investment Plan: Suitable vs. Legal



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CFA Institute: Characteristics of Useful Performance Benchmarks

A benchmark is a collection of securities or risk factors and associated weights that represents the persistent and prominent investment characteristics of a manager's investment process. A benchmark should be:

- **Unambiguous**: The identities and weights of securities constituting the benchmark are clearly defined.
- **Investable:** It is possible to forgo active management and simply hold the benchmark.
- **Measurable:** The benchmark's return is readily calculable on a reasonably frequent basis.
- **Appropriate:** The benchmark is consistent with the manager's investment style and sectors.
- **Specified in Advance**: The benchmark is specified prior to the start of an evaluation period and known to all interested parties.

> "The failure of a benchmark to possess these properties compromises its utility as an effective investment management tool. The properties listed merely formalize intuitive notions of what constitutes a fair and relevant performance comparison. It is interesting to observe that a number of commonly used benchmarks fail to satisfy these properties." **CFA Institute**

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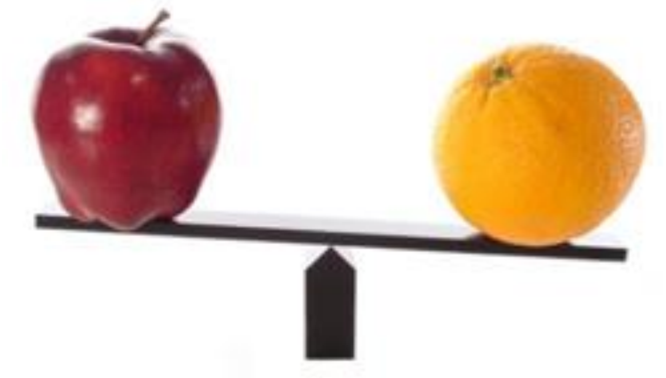
Important Benchmark Characteristics

To Be Relevant, Benchmarks Should Reflect the General Characteristics of a Portfolio's:

- Sector Allocations
- Duration/Maturity
- Turnover



<u>Three Types of Benchmarking:</u>

- Weighted Yield
- Book Rate of Return
- Total Rate of Return

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Performance Benchmarking

Book Return=

+ Accrued/Received Interest
+/- Amortization/Accretion or Premiums/Discounts
+/- Realized Gains/Losses

Average Daily Book Balance for the Period

Total Return=

+ Accrued/Received Interest
+/- Realized Gains/Losses
+/- Unrealized Gains/Losses

Time Weighted Invested Market Value for the Period

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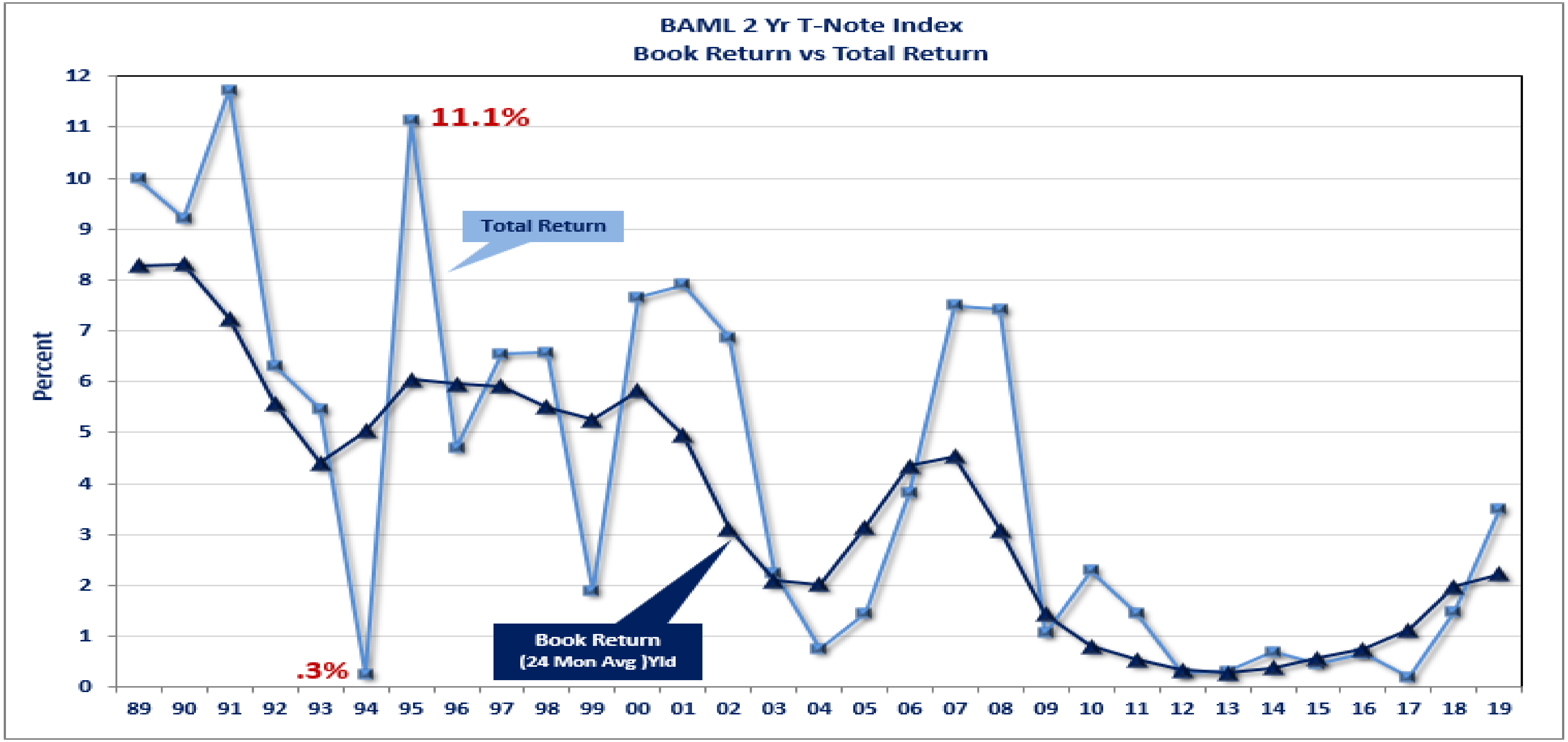
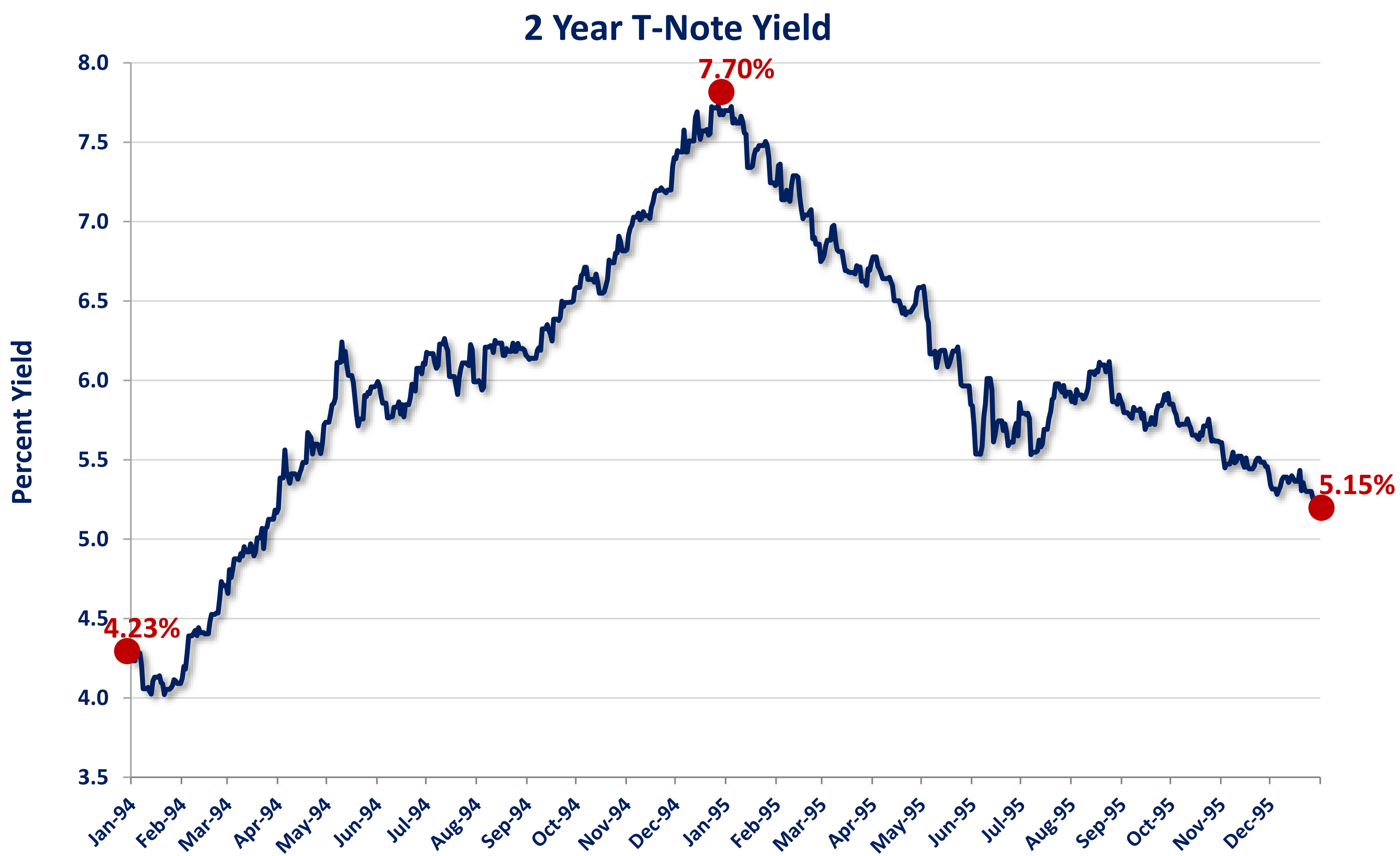
Book Return vs. Total Return



Source: Bloomberg

Book Return vs. Total Return



Source: Bloomberg

Long Run: Total Return and Book Return…Basically Equal

GVQ0	99) Download	ICE Bond Indices: Flexible Returns	
ICE BofAML 1-5 Year US Treasury Index		Inception Date	01/31/1978
02/26/1988 - 12/12/2019	Currency LOC	0 % Hedged	

	Periodic Return	Annualized Return	% of Total Return
Total Return Factors			
Price Return (Local)	1.139	0.036	0.8%
Income Return (Local)	330.194	4.667	99.2%
Total Return (Local)	331.332	4.702	100.0%
Total Return Index Values			
Beginning Index Value	282.006		
Ending Index Value	1,216.383		
Price Return Index Values			
Beginning Index Value	107.820		
Ending Index Value	109.048		

Source: Bloomberg

1-5 Year Tsy/Agy Index Yield History

Source: Bloomberg

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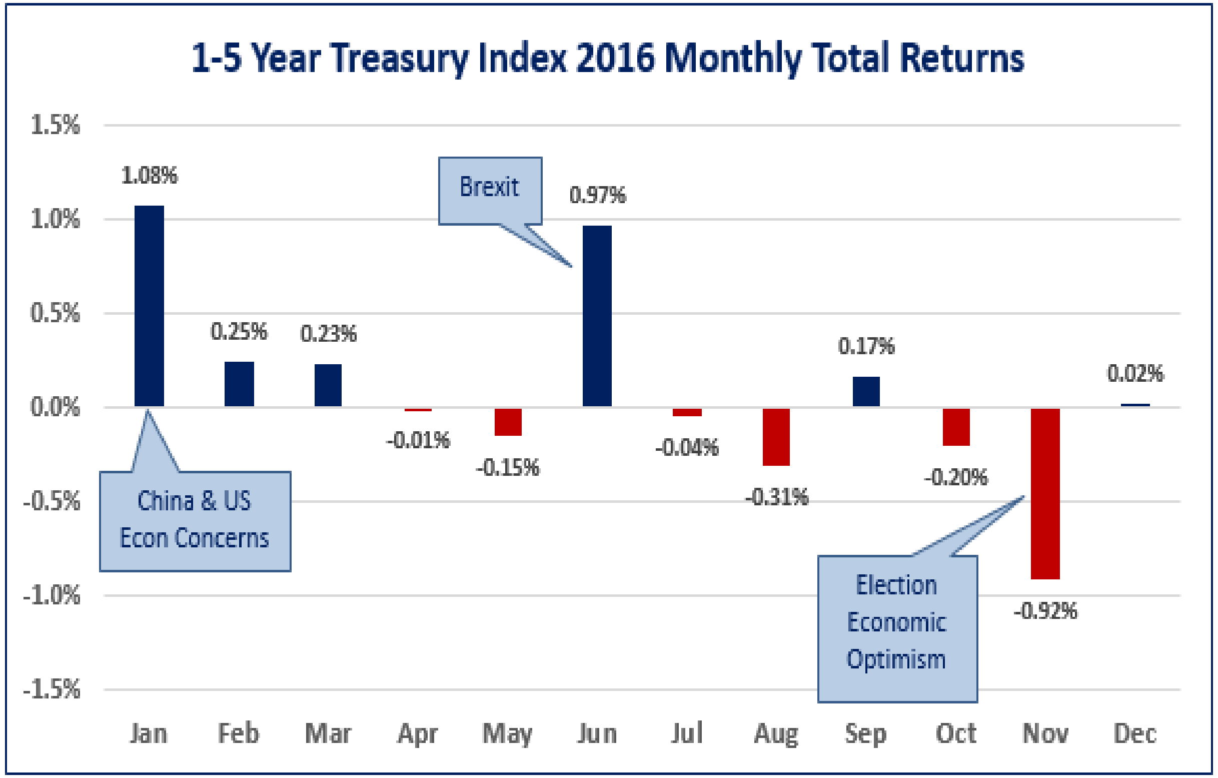
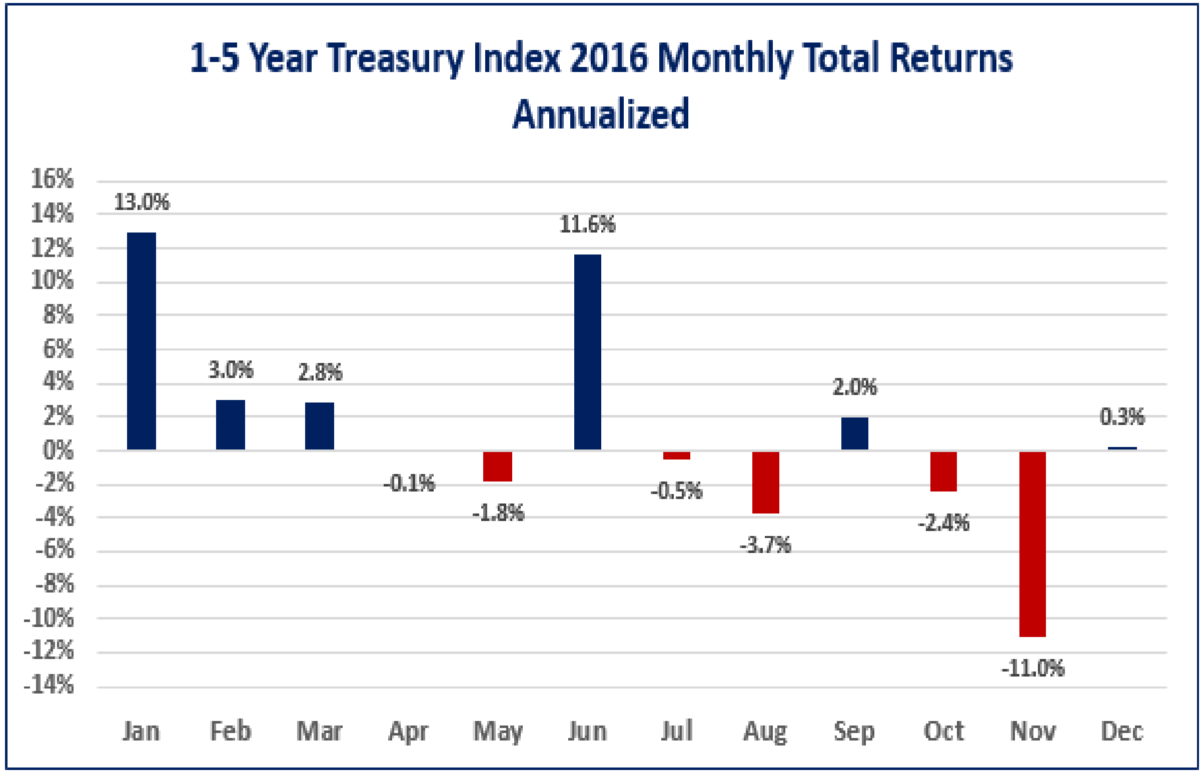
2016: A Volatile Total Return Year





GVQ0 | 99) Download | ICE Bc

ICE BofAML 1-5 Year US Treasury Index

12/31/2015 - 12/31/2016 Currency LOC 0 % Hedged

	Periodic Return	Annualized Return
Total Return Factors		
Price Return (Local)	-0.739	-0.739
Income Return (Local)	1.827	1.827
Total Return (Local)	1.088	1.088

Source: Bloomberg

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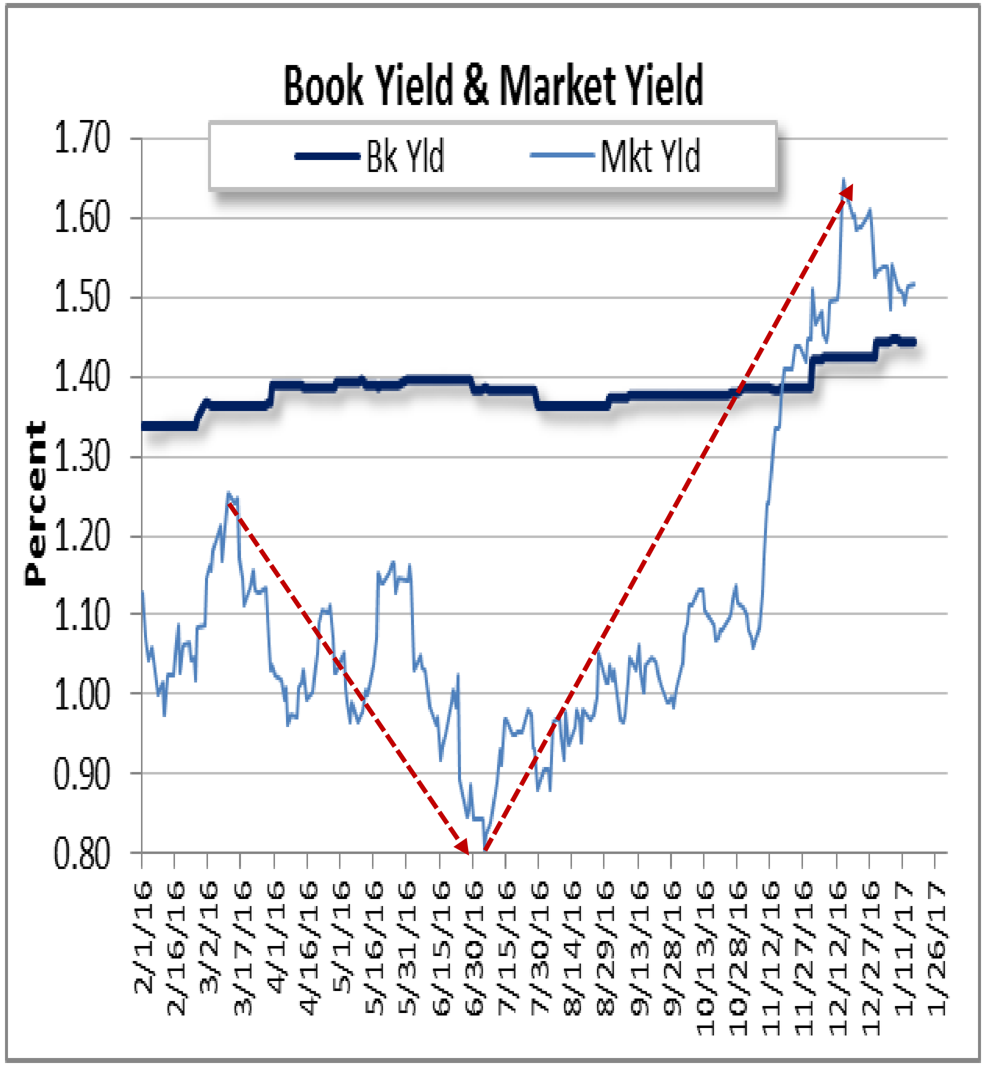
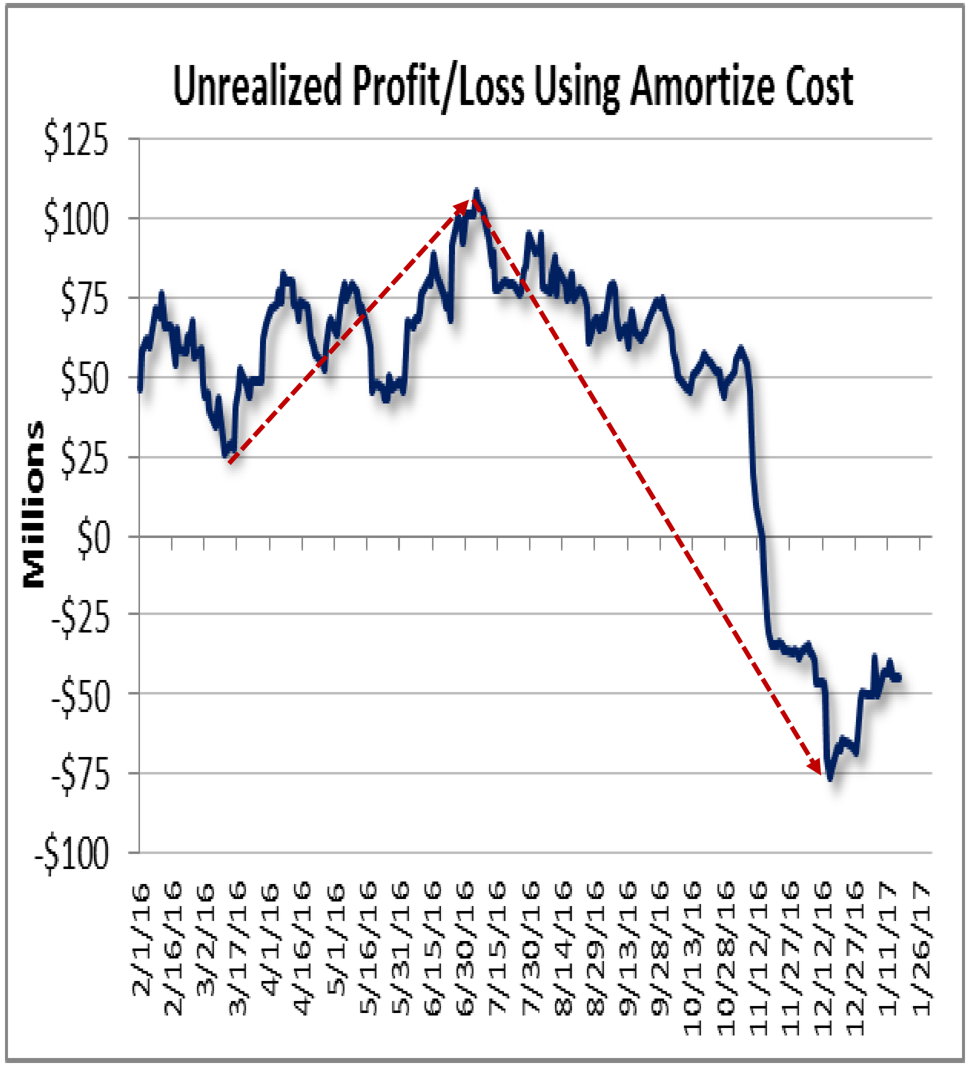
A Real World Example





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Habit #7

You Provide Quality, Timely, Transparent Reporting

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Clearly Communicating Information to Your Audiences

- **Know Your Audiences:**
  - Governing Body
  - Management
  - Auditors
  - Rating Agencies
  - GFOA (CAFR)
  - Peers
  - Taxpayers

- **Be Completely Transparent**

- **Keep it Simple – Charts/Graphs/Tables**

- **Provide Details to the Appropriate Audiences**

- **Demonstrate How the Investment Portfolio is Meeting Objectives**

"When performance is measured, performance improves. When performance is measured and reported, the **rate** of improvement accelerates." Thomas S. Monson

Your Investment Report Should Be on Your Website

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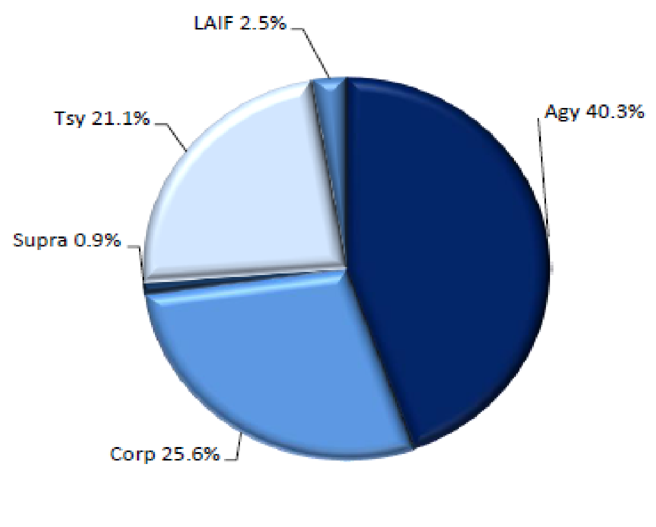
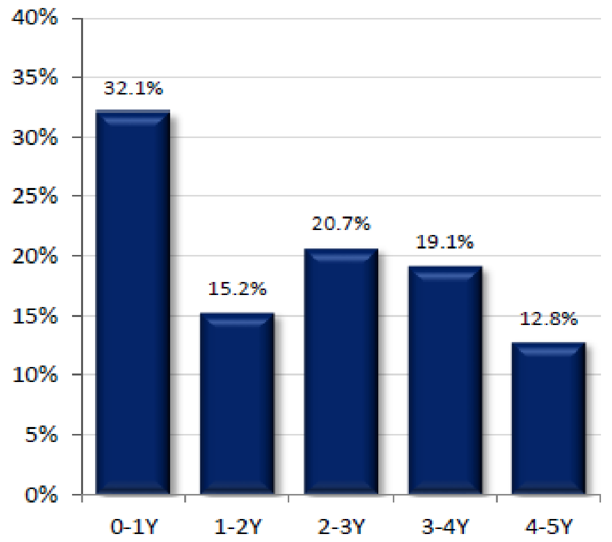
SECTOR ALLOCATION



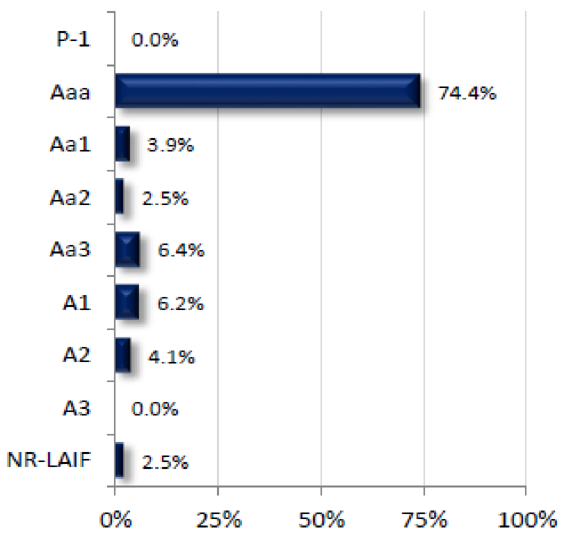
Per Book Value

MATURITY DISTRIBUTION



Per Book Value

CREDIT QUALITY (MOODY'S)



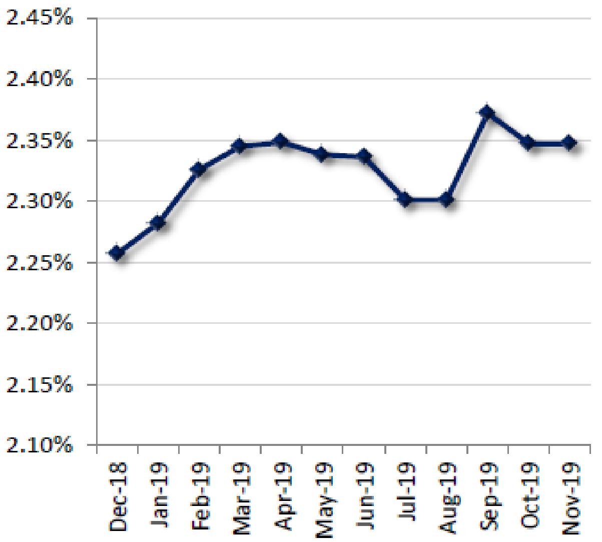
NR: Not Rated

ACCOUNT SUMMARY

	11/30/19	10/31/19
Market Value	$573,684,042	$566,339,090
Book Value	$563,843,802	$555,166,081
Variance	$9,840,241	$11,173,009
Par Value	$564,014,840	$555,809,862
Net Asset Value	$101.745	$102.013
Book Yield	2.32%	2.35%
Years to Maturity	2.17	2.21
Effective Duration	2.11	2.14

Book Value is Amortized

MONTH-END PORTFOLIO BOOK YIELD



TOP ISSUERS

Issuer	% Portfolio
U.S.Treasury	21.1%
FFCB	20.7%
FHLB	10.7%
Wells Fargo Govt Inst MMF	8.5%
FHLMC	5.3%
Apple	3.9%
FNMA	3.5%
Met Life	3.2%
LAIF	2.5%
Citibank	1.9%
Honda	1.8%
US Bank	1.8%
Cisco	1.8%
Wells Fargo Bank	1.6%
Microsoft	1.6%

Per Book Value

You Have a Repeatable, Structured Process Based Upon:

2 Things We Know Well and 1 We Don’t:

✓Longer Duration Provides Higher Returns Over the Long Run

✓Your Cash Flows Don’t Always Repeat, But They Usually Really Rhyme

✓Your Can’t Time the Market

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10-Minute Break

Session Two
Leveraging Available Data and Technology

Kevin P. Webb, CFA, Managing Director, Robert W. Baird & Co.

LUNCH

Skyview Room

Session Three
Don't Let Accounting Practices Hamstring Your Portfolio

Laura Glenn, CFA, Senior Director, Investment Advisory Services, Public Trust Advisors

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Don‘t Let Accounting Practices Hamstring Your Portfolio

California Debt and Investment Advisory Commission
Public Funds Investment: Strategy in Practice
January 25, 2023 – Montebello, CA

Without reflection, we go blindly on our way, creating more unintended consequences, and failing to achieve anything useful. – *Margaret Wheatley*

Investment Accounting Survey

What basis of accounting are you using?

- Accrual Basis (60%)
- Cash Basis (21%)
- Modified Approach (19%)

The basis used was determined by:

- Investment personnel (23%)
- Accounting/Finance personnel (75%)
- Other (2%)

Has it always been the basis?

- Yes (88%)
- No (12%)

Can the municipality buy a bond at a premium?

- Yes (95%)
- No (5%)

If the municipality can buy a bond at a premium, do you amortize the premium over the life of the bond or simply take a loss at maturity?

- Amortize over the life of the bond (90%)
- Loss at maturity (10%)

Can the municipality buy a bond with accrued interest?

- Yes (95%)
- No (5%)

Topics For Discussion

- Book Earnings Components and Calculations
- Trade Date vs. Settlement Date Accounting
- Accounting Method Breakdown and the Journal Entry Process

Day Count Conventions

What are they?

A day-count convention has two components:

1) The first component determines the number of days in a month which in total equals the total number of days in the accrual period

2) The second component defines the total days in a year.

So a day-count convention is presented in the form of “number of days in the accrual period/number of days in the year.

Security Information			
Mkt Iss	US DOMESTIC		
Ctry/Reg	US	Currency	USD
Rank	Unsecured	Series	
Coupon	4.375000	Type	Fixed
Cpn Freq	S/A		
Day Cnt	30/360	Iss Price	99.18275
Maturity	09/13/2024		

Day Count Conventions

30/360

In the 30/360 method, each month in the accrual period is assumed to have 30 days from the beginning accrual date to the end date, but the number of days in the year is assumed to be 360. This method is most commonly used for Agencies, Supras, Corporates and ABS/MBS.

Actual/360

In the Actual/360 method, the actual number of days from the beginning accrual date to the end date is used for the accrual period, but the number of days in the year is assumed to be 360. This method is commonly used by Money-Market instruments.

Actual/365

In the Actual/365 method, the actual number of days from the beginning accrual date to the end date is used for the accrual period, but the number of days in the year is assumed to be 365. This method is commonly used by term Certificates of Deposit.

Actual/Actual

In the Actual/Actual method, the actual number of days from the beginning accrual date to the end date is used for the accrual period and the actual number of actual days in a year. This method is commonly used by U.S Treasuries.

How Bonds Pay

Treasury Bills/Discount Notes/Commercial Paper

- Bills are typically sold at a discount from the par amount (par amount is also called face value)
- When a bill matures, you are paid its par amount. The difference between what you paid and the par amount is your “interest”.
- Day count is Actual/360

Treasury Bonds

- Bonds typically pay interest every six months
- Day Count is Actual/Actual

Government Sponsored Enterprises (GSEs)

- Bonds usually pay interest every six months
- Day count is 30/360

Corporate Medium Term Notes

- Bonds usually pay interest every six months
- Day count is 30/360

Municipals

- Bonds usually pay interest every six months
- Day count is 30/360

Mortgage-Backed and Asset-Backed Securities

- MBS pay monthly
- Day count is 30/360

Calculating Daily Accrual

30/360

Represents 30 days for each month and 360 days per year

Example (Using Excel) – LONG FIRST COUPON

5MM - FHLB 4.50 12/11/2026

1) Calculate Accrual Days in Period

30/360	
First Settlement Date	Par Amount
11/7/2022	5,000,000.00
CF Date	Accrual Days in Period
6/11/2023	=DAYS360(A13,A15) =214

2) Total Days in Period = 180

30/360		
First Settlement Date	Par Amount	Coupon
11/7/2022	5,000,000.00	4.500%
CF Date	Accrual Days in Period	Total Days in Period
6/11/2023	214	180

3) Calculate Daily Accrual Rate

30/360				
First Settlement Date	Par Amount	Coupon		
11/7/2022	5,000,000.00	4.500%		
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate
6/11/2023	214	180	2	=($B$8*($C$8/D10))/C10

=$625.00

4) Calculate Total Payout for Period

30/360					
First Settlement Date	Par Amount	Coupon			
11/7/2022	5,000,000.00	4.500%			
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
6/11/2023	214	180.00	2	625.00000	=E15*B15

=$133,750.00

Calculating Daily Accrual

Repeat Process for Each Period

1) Calculate Accrual Days in Period

30/360	
First Settlement Date	Par Amount
11/7/2022	5,000,000.00
CF Date	Accrual Days in Period
6/11/2023	214
12/11/2023	=DAYS360(A15,A16)

=180

2) Total Days in Period = 180

30/360		
First Settlement Date	Par Amount	Coupon
11/7/2022	5,000,000.00	4.500%
CF Date	Accrual Days in Period	Total Days in Period
6/11/2023	214	180
12/11/2023	180	180

3) Calculate Daily Accrual Rate

30/360				
First Settlement Date	Par Amount	Coupon		
11/7/2022	5,000,000.00	4.500%		
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate
6/11/2023	214	180	2	625.00000
12/11/2023	180	180	2	=($B$13*($C$13/D16))/C16

=$625.00

4) Calculate Total Payout for Period

30/360					
First Settlement Date	Par Amount	Coupon			
11/7/2022	5,000,000.00	4.500%			
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
6/11/2023	214	180	2	625.00000	133,750.00
12/11/2023	180	180	2	625.00000	=E16*B16

=$112,500.00

Calculating Daily Accrual

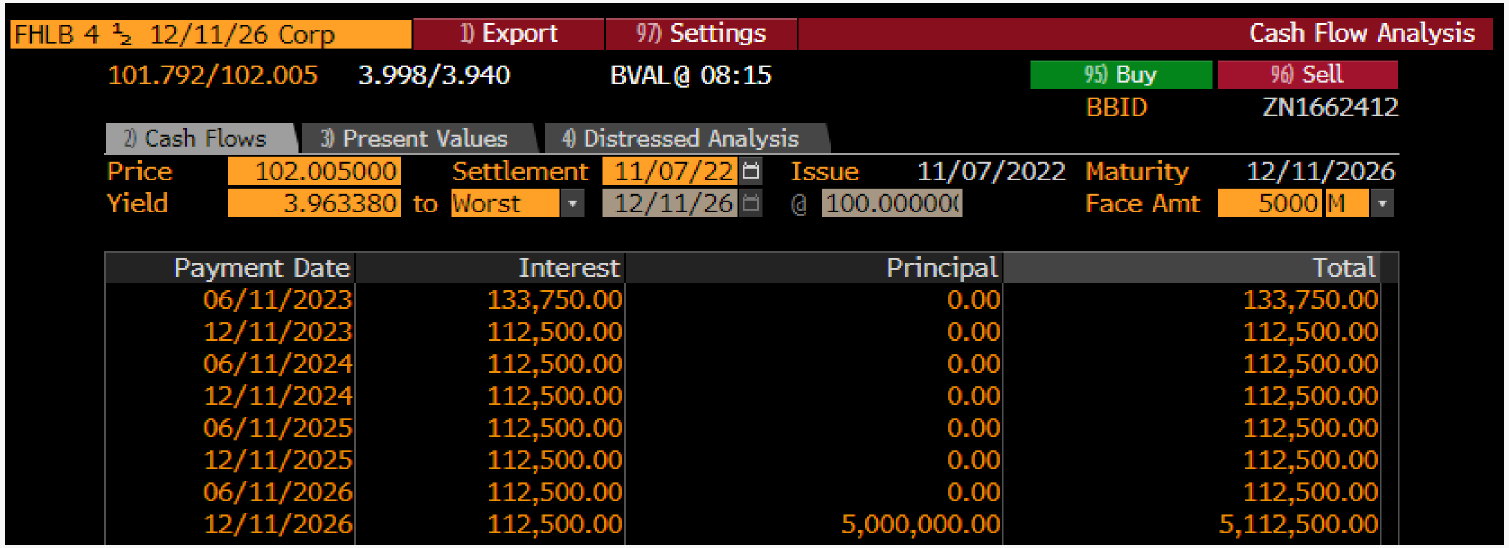
Example Continued(Using Excel)

5MM - FHLB 4.50 12/11/2026

30/360					
First Settlement Date	Par Amount	Coupon			
11/7/2022	5,000,000.00	4.500%			
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
6/11/2023	214	180	2	625.00000	133,750.00
12/11/2023	180	180	2	625.00000	112,500.00
6/11/2024	180	180	2	625.00000	112,500.00
12/11/2024	180	180	2	625.00000	112,500.00
6/11/2025	180	180	2	625.00000	112,500.00
12/11/2025	180	180	2	625.00000	112,500.00
6/11/2026	180	180	2	625.00000	112,500.00
12/11/2026	180	180	2	625.00000	112,500.00

Bloomberg CSHF Function

5MM - FHLB 4.50 12/11/2026



Payment Date	Interest	Principal	Total
06/11/2023	133,750.00	0.00	133,750.00
12/11/2023	112,500.00	0.00	112,500.00
06/11/2024	112,500.00	0.00	112,500.00
12/11/2024	112,500.00	0.00	112,500.00
06/11/2025	112,500.00	0.00	112,500.00
12/11/2025	112,500.00	0.00	112,500.00
06/11/2026	112,500.00	0.00	112,500.00
12/11/2026	112,500.00	5,000,000.00	5,112,500.00

Calculating Daily Accrual

<u>30/360 EOM</u>

EOM designation means bonds have pay dates that equate to the end of the month

Non-EOM designation means bonds have the same day for each pay period (most common)

**For Days360 calc, in Accrual Days in Period, you must add two days to 2/28 pay and one day to 2/29 date if previous period was EOM*

**For Non-EOM, you must add two days if previous pay date was 2/28 and one day if it was 2/29.*

<u>Example (Using Excel)</u>

5MM – C 3.80 07/30/2023

2) Cash Flows | 3) Present Values | 4) Distressed Analysis

Price	100.000000	Settlement	06/30/22	Issue	06/30/2022	Maturity	07/30/2023
Yield	3.800000	to Worst	07/30/23	@	100.00000(	Face Amt	5000 M

Payment Date	Interest	Principal	Total
07/31/2022	15,833.33	0.00	15,833.33
08/31/2022	15,833.33	0.00	15,833.33
09/30/2022	15,833.33	0.00	15,833.33
10/31/2022	15,833.33	0.00	15,833.33
11/30/2022	15,833.33	0.00	15,833.33
12/31/2022	15,833.33	0.00	15,833.33
01/31/2023	15,833.33	0.00	15,833.33
02/28/2023	15,833.33	0.00	15,833.33
03/31/2023	15,833.33	0.00	15,833.33
04/30/2023	15,833.33	0.00	15,833.33
05/31/2023	15,833.33	0.00	15,833.33
06/30/2023	15,833.33	0.00	15,833.33
07/30/2023	15,833.33	5,000,000.00	5,015,833.33

CF Date	Accrual Days in Period
1/31/2023	30
2/28/2023	=DAYS360(A15,A16)+2 =30

Calculating Daily Accrual

<u>ACT/ACT</u>

Represents <u>Actual</u> days for each month and <u>Actual</u> days per year. This method requires one additional calculation for Total Days in Period (these are static values under the other methods)

<u>Example (Using Excel)</u>
5MM – T 3.875 12/31/2027
(US Treasury)

1) Calculate Accrual Days in Period

ACT/ACT	
First Nominal Period Date	First Settlement Date
12/31/2022	12/31/2022
CF Date	Accrual Days in Period
6/30/2023	=A31-B29 =181

2) Calculate Total Days in Period

ACT/ACT		
First Nominal Period Date	First Settlement Date	Par Amount
12/31/2022	12/31/2022	5,000,000.00
CF Date	Accrual Days in Period	Total Days in Period
6/30/2023	181	=A31-A29 =181

3) Calculate Daily Accrual Rate

ACT/ACT				
First Nominal Period Date	First Settlement Date	Par Amount	Coupon	
12/31/2022	12/31/2022	5,000,000.00	3.875%	
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate
6/30/2023	181	181	2	=($C$29*($D$29/D31))/C31

=$535.22099

4) Calculate Total Payout for Period

ACT/ACT					
First Nominal Period Date	First Settlement Date	Par Amount	Coupon		
12/31/2022	12/31/2022	5,000,000.00	3.875%		
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
6/30/2023	181	181	2	535.22099	=E31*B31

=96,875.00

Calculating Daily Accrual

ACT/ACT
long/Short first Coupon

ACT/ACT				
First Nominal Period Date	First Settlement Date	Par Amount	Coupon	
12/31/2022	1/15/2023	5,000,000.00	3.875%	
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate
6/30/2023	166	181	2	=($C$29*($D$29/D31))/C31

If the bond has a long or short first coupon (First Settlement Date does not create equal period), you must use the Nominal Period date that would make the first cash flow an equal period. For example, if our First Settlement Date was instead 01/15/2023, we would use the Nominal Period Date input of 12/31/2022 in the Total Days in Period calculation. This is because 12/31/2022 creates the equal period to the first cash flow date 0f 6/30/2023.

Calculating Daily Accrual

Example Continued (Using Excel)

5MM – T 3.875 12/31/2027

ACT/ACT					
First Nominal Period Date	First Settlement Date	Par Amount	Coupon		
12/31/2022	12/31/2022	5,000,000.00	3.875%		
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
6/30/2023	181	181	2	535.22099	96,875.00
12/31/2023	184	184	2	526.49457	96,875.00
6/30/2024	182	182	2	532.28022	96,875.00
12/31/2024	184	184	2	526.49457	96,875.00
6/30/2025	181	181	2	535.22099	96,875.00
12/31/2025	184	184	2	526.49457	96,875.00
6/30/2026	181	181	2	535.22099	96,875.00
12/31/2026	184	184	2	526.49457	96,875.00
6/30/2027	181	181	2	535.22099	96,875.00
12/31/2027	184	184	2	526.49457	96,875.00

Bloomberg CSHF Function

5MM – T 3.875 12/31/2027

BBID 91282CGC9

2) Cash Flows 3) Present Values 4) Distressed Analysis

Price 100-20¼ Settlement 01/11/23 Issue 01/03/2023 Maturity 12/31/2027

Yield 3.734075 to Worst 12/31/27 @ 100.00000 Face Amt 5000 M

Payment Date	Interest	Principal	Total
06/30/2023	96,875.00	0.00	96,875.00
12/31/2023	96,875.00	0.00	96,875.00
06/30/2024	96,875.00	0.00	96,875.00
12/31/2024	96,875.00	0.00	96,875.00
06/30/2025	96,875.00	0.00	96,875.00
12/31/2025	96,875.00	0.00	96,875.00
06/30/2026	96,875.00	0.00	96,875.00
12/31/2026	96,875.00	0.00	96,875.00
06/30/2027	96,875.00	0.00	96,875.00
12/31/2027	96,875.00	5,000,000.00	5,096,875.00

Calculating Daily Accrual

ACT/360
Represents Actual days for each month and 360 days per year

Example (Using Excel)
5MM - NORHNY 3.99 05/10/2023

1) Calculate Accrual Days in Period

ACT/360	
First Settlement Date	Par Amount
9/20/2022	5,000,000.00
CF Date	Accrual Days in Period
5/10/2023	=A47-A45 =232

2) Total Days in Period = 180

ACT/360		
First Settlement Date	Par Amount	Coupon
9/20/2022	5,000,000.00	3.990%
CF Date	Accrual Days in Period	Total Days in Period
5/10/2023	232	180

3) Calculate Daily Accrual Rate

ACT/360				
First Settlement Date	Par Amount	Coupon		
9/20/2022	5,000,000.00	3.990%		
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate
5/10/2023	232	180	2	=($B$45*($C$45/D47))/C47

=$554.16667

4) Calculate Total Payout for Period

ACT/360					
First Settlement Date	Par Amount	Coupon			
9/20/2022	5,000,000.00	3.990%			
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
5/10/2023	232	180	2	554.16667	=E47*B47

=$128,566.67

Calculating Daily Accrual

Example Continued (Using Excel)
5MM - NORHNY 3.99 05/10/2023

ACT/360					
First Settlement Date	**Par Amount**	**Coupon**			
9/20/2022	**5,000,000.00**	**3.990%**			
CF Date	**Accrual Days in Period**	**Total Days in Period**	**Coupon Frequency**	**Daily Accrual Rate**	**Interest Expected**
5/10/2023	232	180	2	554.16667	128,566.67

Bloomberg CSHF Function
5MM - NORHNY 3.99 05/10/2023

2) Cash Flows | 3) Present Values | 4) Distressed Analysis

Price	100.000000	Settlement	09/20/22	Issue	09/20/2022	Maturity	05/10/2023
Yield	3.990000 to Worst		05/10/23	@	100.00000(	Face Amt	5000 M

Payment Date	Interest	Principal	Total
05/10/2023	128,566.67	5,000,000.00	5,128,566.67

Calculating Daily Accrual

ACT/365

Represents Actual days for each month and 365 days per year

Example (Using Excel)

5MM - HSBC USA 1.30 05/07/2025

(HSBC Bank Negotiable CD)

1) Calculate Accrual Days in Period

ACT/365	
First Settlement Date	Par Amount
5/7/2020	5,000,000.00
CF Date	Accrual Days in Period
11/7/2020	=A63-A61 =184

2) Total Days in Period = 182.5

ACT/365		
First Settlement Date	Par Amount	Coupon
5/7/2020	5,000,000.00	1.300%
CF Date	Accrual Days in Period	Total Days in Period
11/7/2020	184	182.5

3) Calculate Daily Accrual Rate

ACT/365				
First Settlement Date	Par Amount	Coupon		
5/7/2020	5,000,000.00	1.300%		
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate
11/7/2020	184	182.5	2	=($B$61*($C$61/D63))/C63

=$178.08219

4) Calculate Total Payout for Period

ACT/365					
First Settlement Date	Par Amount	Coupon			
5/7/2020	5,000,000.00	1.300%			
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
11/7/2020	184	182.5	2	178.08219	=E63*B63

=$32,767.12

Calculating Daily Accrual

Example Continued (Using Excel)

5MM – HSBC USA 1.30 05/07/2025

ACT/365					
First Settlement Date	Par Amount	Coupon			
5/7/2020	5,000,000.00	1.300%			
CF Date	Accrual Days in Period	Total Days in Period	Coupon Frequency	Daily Accrual Rate	Interest Expected
11/7/2020	184	182.5	2	178.08219	32,767.12
5/7/2021	181	182.5	2	178.08219	32,232.88
11/7/2021	184	182.5	2	178.08219	32,767.12
5/7/2022	181	182.5	2	178.08219	32,232.88
11/7/2022	184	182.5	2	178.08219	32,767.12
5/7/2023	181	182.5	2	178.08219	32,232.88
11/7/2023	184	182.5	2	178.08219	32,767.12
5/7/2024	182	182.5	2	178.08219	32,410.96
11/7/2024	184	182.5	2	178.08219	32,767.12
5/7/2025	181	182.5	2	178.08219	32,232.88

Bloomberg CSHF Function

5MM – HSBC USA 1.30 05/07/2025

2) Cash Flows | 3) Present Values | 4) Distressed Analysis

Price 94.071000 Settlement 05/07/20 Issue 05/07/2020 Maturity 05/07/2025

Yield 2.570583 to Maturity 05/07/25 @ 100.00000(Face Amt 5000 M

Payment Date	Interest	Principal	Total
11/07/2020	32,767.12	0.00	32,767.12
05/07/2021	32,232.88	0.00	32,232.88
11/07/2021	32,767.12	0.00	32,767.12
05/07/2022	32,232.88	0.00	32,232.88
11/07/2022	32,767.12	0.00	32,767.12
05/07/2023	32,232.88	0.00	32,232.88
11/07/2023	32,767.12	0.00	32,767.12
05/07/2024	32,410.96	0.00	32,410.96
11/07/2024	32,767.12	0.00	32,767.12
05/07/2025	32,232.88	5,000,000.00	5,032,232.88

Amortization & Accretion

- “Due to price volatility, valuing investments at their current price is necessary to provide a realistic measure of a portfolio’s true liquidation value”
- GFOA recommends that state and local government officials responsible for investment portfolio reporting determine the market value of all securities in the portfolio on at least a quarterly basis
- It is recommended that the written report include the market value, book value, and unrealized gain or loss of the securities in the portfolio

Amortization & Accretion

- Amortization and Marked-to-Market Reporting
  - Market Closing Price at June 30, 2021: 104-23 5/8 (104.73828125)
  - Market Value: $10,473,828.13
  - June 30, 2021:
    - Original Cost: $10,540,625.00
    - Amortized Cost (approximately): $10,483,356.04
    - Market Value: $10,473,828.13
    - *Unrealized* Loss at 6.30.21: ($10,473,828.13 - $10,483,356.04 = $9,527.91)

  - Market Closing Price at June 30, 2022: 99- 24 3/16 (99.755859375)
  - Market Value: $9,975,585.94
  - June 30, 2022
    - Original Cost: $10,540,625.00
    - Amortized Cost (approximately): $10,241,922.10
    - Market Value: $9,975,585.94
    - *Unrealized* Loss at 6.30.22: ($9,975,585.94 – 10,241,922.10 = $266,336.16)

Amortization & Accretion

Constant Yield/Effective Interest Method

This method utilizes the book yield and book value at purchase to create the amortization or accretion for each period through the Purchase to Worst (Workout) date.

This method is more complex than straight-line and is usually done using sophisticated programs.

Period Beg Book Value X Purchase Yield X Time in Period (where full year =1)

5,153,879.42 X .0175 X .5 = $45,096.44

Example (Using Excel)

5MM - FHLB 2.55 05/30/2023

Workout Date = Maturity Date

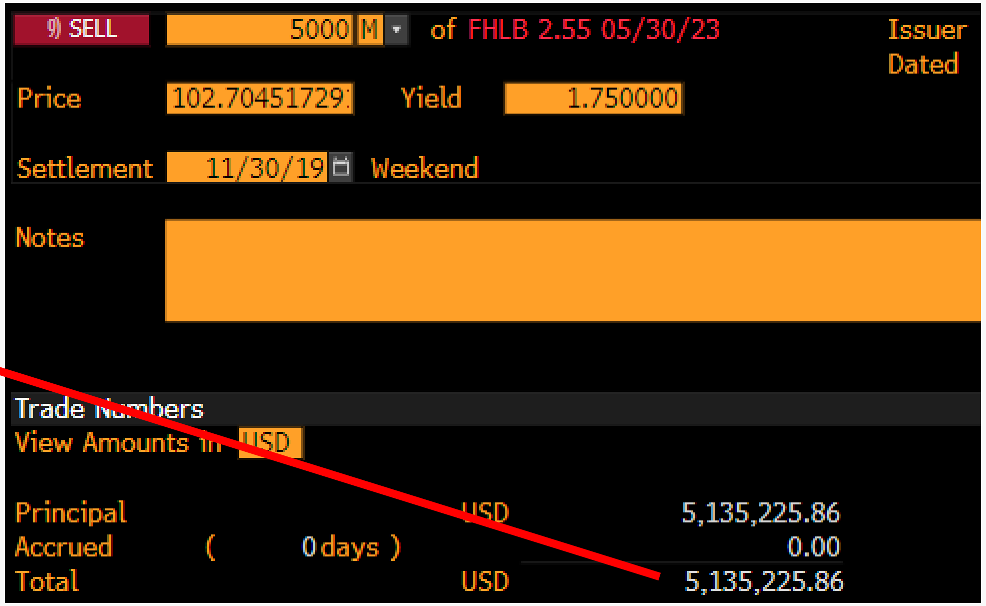
J	K	L	M	N	O
	Purchase Price	Principal Paid	Settlement Date	Coupon	Purchase Yield
	103.2848149381	5,164,240.75	2/20/2019	2.550%	1.750%
CF Date	Beg Book Value	Interest Earned on Yield	Actual CF Paid	Amount Amortized	Ending Book Value
5/30/2019	5,164,240.75	25,055.34	35,416.67	10,361.33	5,153,879.42
11/30/2019	5,153,879.42	45,096.44	63,750.00	18,653.56	5,135,225.87
5/30/2020	5,135,225.87	44,933.23	63,750.00	18,816.77	5,116,409.09
11/30/2020	5,116,409.09	44,768.58	63,750.00	18,981.42	5,097,427.67
5/30/2021	5,097,427.67	44,602.49	63,750.00	19,147.51	5,078,280.16
11/30/2021	5,078,280.16	44,434.95	63,750.00	19,315.05	5,058,965.12
5/30/2022	5,058,965.12	44,265.94	63,750.00	19,484.06	5,039,481.06
11/30/2022	5,039,481.06	44,095.46	63,750.00	19,654.54	5,019,826.52
5/30/2023	5,019,826.52	43,923.48	63,750.00	19,826.52	5,000,000.00

Amortization & Accretion

Constant Yield/Effective Interest Method

Example (Using Excel)
5MM - FHLB 2.55 05/30/2023
Workout Date = Maturity Date

J	K	L	M	N	O
	Purchase Price	Principal Paid	Settlement Date	Coupon	Purchase Yield
	103.2848149381	5,164,240.75	2/20/2019	2.550%	1.750%
CF Date	Beg Book Value	Interest Earned on Yield	Actual CF Paid	Amount Amortized	Ending Book Value
5/30/2019	5,164,240.75	25,055.34	35,416.67	10,361.33	5,153,879.42
11/30/2019	5,153,879.42	45,096.44	63,750.00	18,653.56	5,135,225.87
5/30/2020	5,135,225.87	44,933.23	63,750.00	18,816.77	5,116,409.09
11/30/2020	5,116,409.09	44,768.58	63,750.00	18,981.42	5,097,427.67
5/30/2021	5,097,427.67	44,602.49	63,750.00	19,147.51	5,078,280.16
11/30/2021	5,078,280.16	44,434.95	63,750.00	19,315.05	5,058,965.12
5/30/2022	5,058,965.12	44,265.94	63,750.00	19,484.06	5,039,481.06
11/30/2022	5,039,481.06	44,095.46	63,750.00	19,654.54	5,019,826.52
5/30/2023	5,019,826.52	43,923.48	63,750.00	19,826.52	5,000,000.00



*Slight rounding errors could be present between Excel and Bloomberg

Amortization & Accretion

Straight Line Method

This method simply takes the total amount to be amortized or accreted and applies an even amount across each period being measured

This method is easy to compute and is the primary method utilized by public entities.

Total to be Amortized / Days360(Settlement Date , Workout Date)
164,240.75 / 1540 = $106.6498377

Example (Using Excel)
5MM - FHLB 2.55 05/30/2023
Workout Date = Maturity Date

J	K	L	M	N
	Purchase Price	Principal Paid	Total to be Amortized	Settlement Date
	103.2848149381	5,164,240.75	164,240.75	2/20/2019
CF Date	Days in Period	Annual Interest Days	Daily Amortization Rate	Amount Amortized
5/30/2019	100	360	106.6498377	10,664.98
11/30/2019	180	360	106.6498377	19,196.97
5/30/2020	180	360	106.6498377	19,196.97
11/30/2020	180	360	106.6498377	19,196.97
5/30/2021	180	360	106.6498377	19,196.97
11/30/2021	180	360	106.6498377	19,196.97
5/30/2022	180	360	106.6498377	19,196.97
11/30/2022	180	360	106.6498377	19,196.97
5/30/2023	180	360	106.6498377	19,196.97

Amortization & Accretion

Selecting Amortization/Accretion Dates (Best Practices)

Bullet Structures (No Call Option or Busted Call)

** Amortize/Accrete to the maturity date.*

Callable Structures (Call Option is Present)

**Premium callables amortize to the next call date.*

**Discount callables accrete to maturity.*

Step Coupons Structures (Callable or Non-Callable)

**Amortize/Accrete to date corresponding to the yield-to-worst. This could be next call, next step, maturity or something in-between. YTC function in Bloomberg will give this date so you should obtain it from your broker.*

Floating Rates (SOFR, Prime, Fed Funds, 3MoCMT, etc.)

**Floaters should generally be amortized to maturity as that is typically how DM/Yield is reported. Other methods could be applied (to index reset, to coupon date)*

ABS/MBS

**To Weighted Avg Life principal window. In theory, it is best practice to adjust amortization rate each period by the adjusted principal window provided by changing prepayment rate speeds (labor intensive to say the least).*

Are you using Trade Date or Settlement Date when posting to your JE?

a) Trade Date
b) Settlement Date
c) Don’t Know

Trade Date vs Settlement Date Accounting

What Are They?

The trade date of a security is the date the agreement is entered into where elements of the transaction including the security description, quantity, price, and delivery terms are set.

The date the securities must be delivered and payment received is referred to as the settlement date.

The method you choose affects when the purchase or redemption of a security is recorded and whether a receivables (redemption) or payables (purchase) account must be created.

Purchase 6MM of a security on 08/09/2022 @ 100			
Bond Settles on 08/11/2022			
		Debit	**Credit**
Trade Date Accounting:			
8/9/2022	Bond Account	6,000,000.00	
	Payables Acccount		6,000,000.00
8/11/2022	Payables Acccount	6,000,000.00	
	Cash Account		6,000,000.00
Settlement Date Accounting:			
8/11/2022	Bond Account	6,000,000.00	
	Cash Account		6,000,000.00

Trade Date vs Settlement Date Accounting

Does It Matter What Method You Choose?

GASB has made it pretty clear that Trade Date Accounting is the method that public entities should be using.

6.28 Display in the Change Statement

6.28.1. *Q*—Should investment transactions be accounted for based on the trade date (the date the order to buy or sell the investment is placed) or the settlement date (the date that the cash and investment instrument are exchanged)? ~~(Q&A31-66) [Amended 2013]~~

A—Investment transactions should be accounted for based on the trade date. The trade date is the date on which the transaction occurred and is the date the government is exposed to (or released from) the rights and obligations of the ownership of the instrument. This guidance is consistent with paragraph 20 of Statement 25, as amended, and paragraph 18 of Statement 67.

However, under FASB, which maintains U.S. GAAP, ASC 320 allows either method unless you are a depository or lending institution, broker-dealer, or investment company (CFA GIPS follows suit by mandating GIPS compliant firms to using Trade Date).

Trade Date vs Settlement Date Accounting

<u>Does It Matter What Method You Choose?</u>
Despite the GASB advisory, Settlement Date accounting is still utilized by many public institutions.

The justification for this may come from several fronts.

1) U.S. GAAP does not require Trade Date accounting for general institutions not falling under the financial institution category.

2) Trade Date accounting roots are in mark-to-market and measuring potential value changes.
   - This can occur in securities classified as Trading or Available For Sale under U.S. GAAP, however public institutions generally carry securities as a Held-to-Maturity category.

   - GASB 31 requires mark to market only once a year so valuation changes would likely not be recorded for each purchase or redemption regardless of method.

3) Financial regulators have sought better technology to minimize time between trade date and settlement date. In 2017 they moved most transactions from T+3 to T+2 and there are talks that may move to T+1 in the near future. This would create virtually no benefit to Trade Date accounting.

What method of accounting are you currently using?

a) Full Accrual
b) Modified Accrual
c) Cash Basis
d) Don’t Know

Accounting Methods

<u>Full Accrual Method (Accrued Interest – Amortization/Accretion)</u>

This accounting method measures interest as it is earned and amortizes/accretes any premiums or discounts paid at purchase.

- Primary method used in both corporate and government accounting
- Represents the most accurate way to measure return
- Labor intensive requiring more journal entries than all other methods
- Can cause accounting headaches when dealing with pool/participant payouts. (e.g. can’t payout cash you haven’t received yet)

Accounting Methods

Full Accrual Basis (ACT/ACT) Security					
Purchase 3MM of T 1.50 10/31/2024 @ 101.617					
Settlement on 12/31/2021 - Dec 2021 Entries					
Account	**Date Posted**	**Debit**	**Credit**	**Activity**	**Notes**
Treasury (Asset)	12/31/2021	3,000,000.00		Investment Purchase	
Purchased Premium (Asset)	12/31/2021	48,510.00		Premium Paid at Purchase	
Purchased Accrued Interest (Asset)	12/31/2021	7,582.87		Accrued Paid at Purchase	
Cash (Asset)	12/31/2021		3,056,092.87	Investment Purchase	
Accrued Interest (Asset)	12/31/2021	124.31		Accrued Interest	Daily Rate = 124.30939
Interest Earnings (Income)	12/31/2021		124.31	Accrued Interest	Daily Rate = 124.30939
Amortization Expense (Income)	12/31/2021	46.87		Amortization	Daily Rate = 46.86956
Treasury (Asset)	12/31/2021		46.87	Amortization	Daily Rate = 46.86956

Full Accrual Basis (ACT/ACT) Security					
First Coupon Since Purchase - May 2022 Entries					
4/30/22 Pay Date is a Saturday					
Account	**Date Posted**	**Debit**	**Credit**	**Activity**	
Cash (Asset)	5/2/2022	22,500.00		Interest Income Payment	4/30/22 Is a Saturday
Accrued Interest (Asset)	5/2/2022		14,917.13	Interest Income Received	4/30/22 Is a Saturday
Purchased Accrued Interest (Asset)	5/2/2022		7,582.87	Interest Income - Purchase Adjustment	4/30/22 Is a Saturday
Accrued Interest (Asset)	5/31/2022	3,790.76		Accrued Interest	Daily Rate = 122.28261
Interest Earnings (Income)	5/31/2022		3,790.76	Accrued Interest	Daily Rate = 122.28261
Amortization Expense (Income)	5/31/2022	1,452.96		Amortization	Daily Rate = 46.86956
Treasury (Asset)	5/31/2022		1,452.96	Amortization	Daily Rate = 46.86956

Full Accrual Basis (ACT/ACT) Security					
Redemption on 10/31/2024 - Oct 2024 Entries					
Account	**Date Posted**	**Debit**	**Credit**	**Activity**	
Cash (Asset)	10/31/2024	3,000,000.00		Investment Maturity	
Treasury (Asset)	10/31/2024		3,000,000.00	Investment Maturity	
Cash (Asset)	10/31/2024	22,500.00		Interest Income Payment	
Accrued Interest (Asset)	10/31/2024		22,500.00	Interest Income Received	
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Treasury (Asset)	10/31/2024		1,452.96	Amortization	Daily Rate = 46.86956

Accounting Methods

<u>Modified Accrual Method (Accrued Interest – No Amortization/Accretion)</u>

This accounting method measures interest as it is earned and does not amortize/accrete any premiums or discounts paid at purchase.

- Decreases journal entries with removal of amortization/accretion
- Will force fund to take gain or loss at redemption for premium or discount paid
- Creates constraints to not buy premiums to avoid big losses at redemption
- Pools can be gamed by participants to avoid months with heavy redemptions
- Can create a volatile return number month over month
- Can cause accounting headaches when dealing with pool/participant payouts. (e.g. can't payout cash you haven't received yet)

Accounting Methods

Modified Accrual Basis (ACT/ACT) Security					
Purchase 3MM of T 1.50 10/31/2024 @ 101.617					
Settlement on 12/31/2021 - Dec 2021 Entries					
Account	**Date Posted**	**Debit**	**Credit**	**Activity**	**Notes**
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Modified Accrual Basis (ACT/ACT) Security					
Redemption on 10/31/2024 - Oct 2024 Entries					
Account	**Date Posted**	**Debit**	**Credit**	**Activity**	
Cash (Asset)	10/31/2024	3,000,000.00		Investment Maturity	
Treasury (Asset)	10/31/2024		3,000,000.00	Investment Maturity	
Realized Losses (Income)	10/31/2024	48,510.00		Realized Loss at Redemption	
Purchased Premium (Asset)	10/31/2024		48,510.00	Remaining Premium	
Cash (Asset)	10/31/2024	22,500.00		Interest Income Payment	
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Interest Earnings (Income)	10/31/2024		3,790.76	Accrued Interest	Daily Rate = 122.28261

Accounting Methods

<u>Modified Accrual Method (Cash Interest – Amortization/Accretion Included)</u>

This accounting method measures interest as it is paid and does amortize/accrete any premiums or discounts paid at purchase.

- Decreases journal entries with removal of accrued interest
- Purchased interest is usually counted against current month earnings
- Creates constraints to not buy secondary issues that have purchase accrued
- Pools can be gamed by participants avoiding low cash payment months
- Can create a volatile return number month over month
- Makes it easy to handle pool/participant payouts

Accounting Methods

Modified Cash Basis (ACT/ACT) Security					
Purchase 3MM of T 1.50 10/31/2024 @ 101.617					
Settlement on 12/31/2021 - Dec 2021 Entries					
Account	**Date Posted**	**Debit**	**Credit**	**Activity**	**Notes**
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Cash (Asset)	12/31/2021		3,056,092.87	Investment Purchase	
Interest Earnings (Income)	12/31/2021	7,582.87		Earnings Loss at Purchase	
Purchased Accrued Interest (Asset)	12/31/2021		7,582.87	Remaining Purchase Accrued	
Amortization Expense (Income)	12/31/2021	46.87		Amortization	Daily Rate = 46.86956
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Amortization Expense (Income)	10/31/2024	1,452.96		Amortization	Daily Rate = 46.86956
Treasury (Asset)	10/31/2024		1,452.96	Amortization	Daily Rate = 46.86956

Accounting Methods

<u>Cash Method (Cash Interest – No Amortization/Accretion)</u>

This accounting method measures interest as it is paid and does not amortize/accrete any premiums or discounts paid at purchase.

- Easiest method for JE with removal of accrued interest and amortization/accretion entries
- Purchased interest is usually counted against current month earnings
- Will force fund to take gain or loss at redemption for premium or discount paid
- Creates constraints to not buy secondary issues that have purchase accrued
- Creates constraints to not buy premiums to avoid big losses at redemption
- Pools can be gamed by participants avoiding low cash payment months
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Accounting Methods

Cash Basis (ACT/ACT) Security
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Settlement on 12/31/2021 - Dec 2021 Entries

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Interest Earnings (Income)	12/31/2021	7,582.87		Earnings Loss at Purchase	
Purchased Accrued Interest (Asset)	12/31/2021		7,582.87	Remaining Purchase Accrued	

Cash Basis (ACT/ACT) Security
First Coupon Since Purchase - May 2022 Entries
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Interest Earnings (Income)	10/31/2024		22,500.00	Interest Income Received	

Accounting Methods

Method Selection Definitely Matters

A few months back an account approached me with a peculiar problem. They were looking to do a trade of a full faith and credit bond (Treasury) out around the 1.5yr mark.

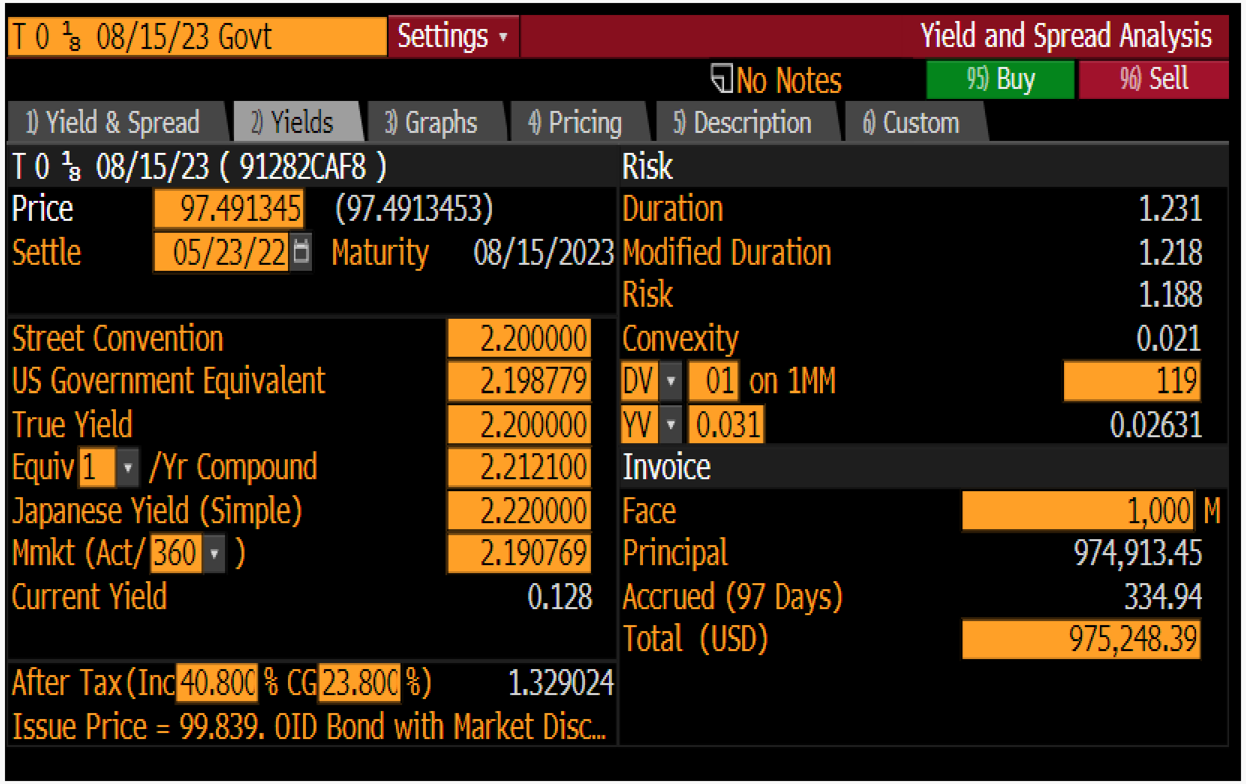
Doesn't sound too complicated, but in this case the account could not buy a bond with accrued interest and they could not buy a bond at a premium. Either component would create a negative hit to earnings as any accrued paid goes against that month's earnings and premiums will be reflected as losses at redemption.

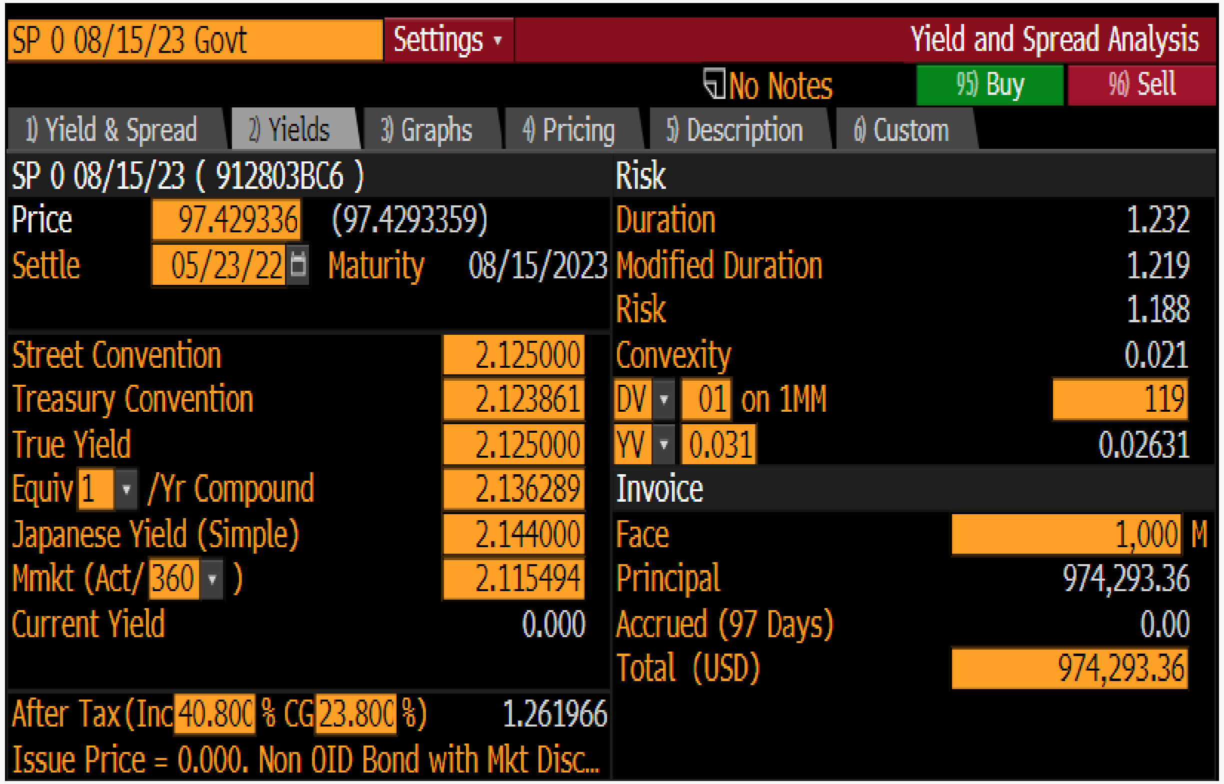
These constraints knocked out the ability to buy a coupon bearing Treasury (all had accrued interest factors) and we couldn't do a zero coupon bill that long. This left us with only being able to buy a Principal Strip (Separate Trading of Registered Interest and Principal of Securities).

The client was forced to buy a lower yielding asset that is less liquid all because of arbitrary accounting policies put in place.

To be fair, this was not the investment manager's fault as they were only working around the constraints placed on them by others.

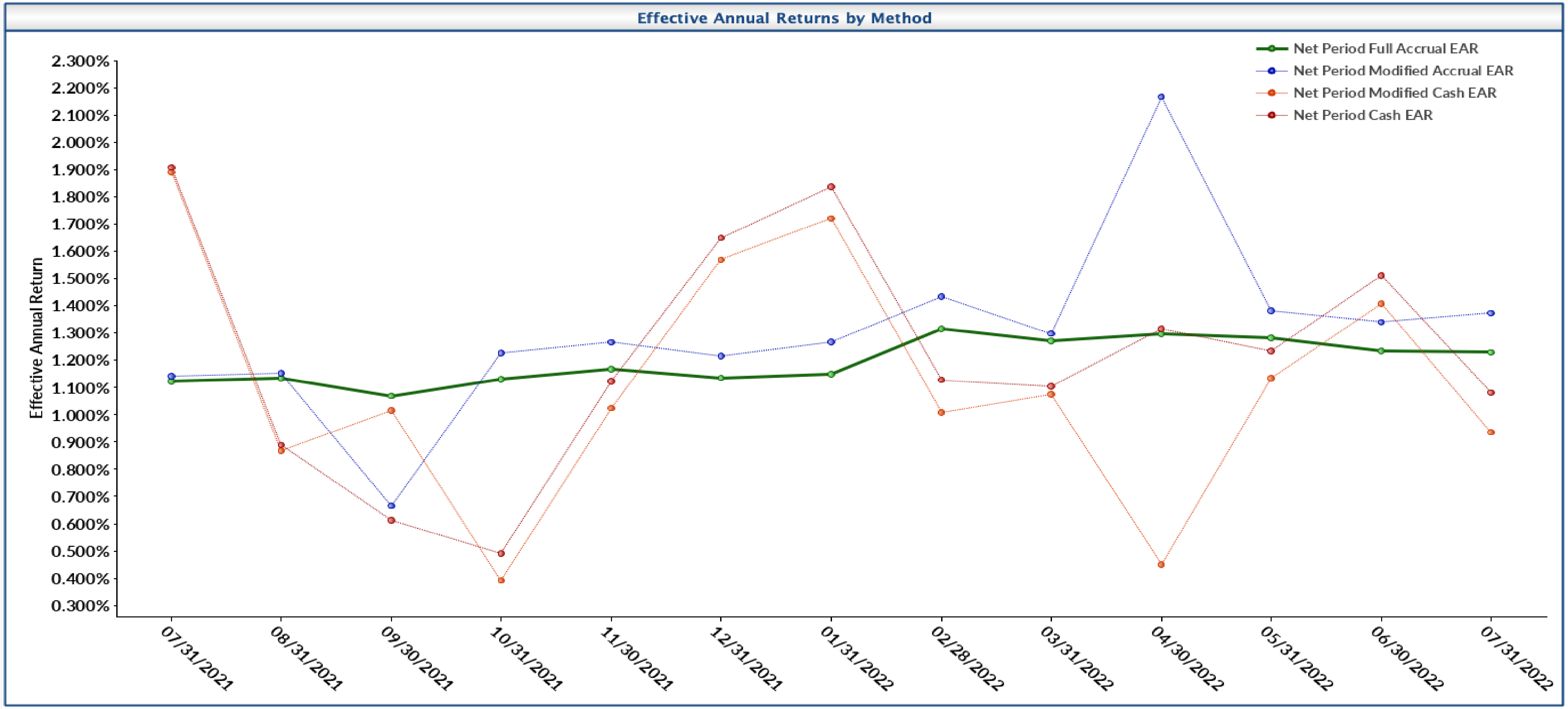
Accounting Methods





The account stands to miss out on tens of thousands per year in interest all because of this policy.

Accounting Methods



Summary

- Methodology has a significant impact on Treasury's ability to function appropriately
- Strive to develop a working relationship between accounting and treasury departments
- "It's just how we do it" is not an out to just keep doing what you are doing
- If you operate under any method besides full accrual, understand the tradeoffs and consider advocating for a change
- If you don't know what is happening in your organization, then do some research. You may be surprised to see your expectations differ from reality.

Knowing what you know now, are you satisfied with the way your entity is approaching the accounting process?

a) Yes
b) No
c) I Need To Do More Internal Research
d) I Don’t Really Care

Thank You!

If you have any questions or comments please reach out and we would be happy to discuss.

Thank you for attending!

Disclosure

This presentation is for informational purposes only. All information is assumed to be correct, but the accuracy has not been confirmed and therefore is not guaranteed to be correct. Information is obtained from third party sources that may or may not be verified. The information presented should not be used in making any investment decisions and is not a recommendation to buy, sell, implement, or change any securities or investment strategy, function, or process.
Any financial and/or investment decision should be made only after considerable research, consideration, and involvement with an experienced professional engaged for the specific purpose. All comments and discussion presented are purely based on opinion and assumptions, not fact. These assumptions may or may not be correct based on foreseen and unforeseen events.

All calculations and results presented are for discussion purposes only and should not be used for making calculations and/or decisions. The data in this presentation is unaudited.

Many factors affect performance including changes in market conditions and interest rates and in response to other economic, political, or financial developments. Investment involves risk including the possible loss of principal. No assurance can be given that the performance objectives of a given strategy will be achieved. Past performance is not an indicator of future performance or results. Any financial and/or investment decision may incur losses.

15-Minute Break

Session Four
Duration and Asset/Liability Management (ALM): Practical Approach, Theory and Case Study

Jason Klinghoffer, CFA, Director, Debt Capital Markets, Mischler Financial Group
Hubert R. White III, CFA, CTP, Chief Investment Officer, City and County of San Francisco

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Duration and Asset/Liability Management (ALM): Practical Approach, Theory and Case Study.

California Debt and Investment Advisory Commission
Public Funds Investment: Strategy in Practice
January 25, 2023 – Montebello, CA

If you are involved in the investment process, do you have a strategic plan in place that includes cash flow projections, duration targets, and sector/maturity allocation requirements?

A) Yes
B) No

Strategy Development Steps for Public Investors

Cash flow forecast / liquidity analysis is key. asset-liability (ALM) approach mitigates large liquidity needs

Set a strategic allocation among sectors to reflect cashflow profile and risk tolerances for a stable, legal and diversified portfolio

Review at least annually and make necessary changes

Cash Flow → Duration → Allocation → Market Return → Review

Setting a portfolio duration target tackles the core risk you face, interest-rate risk

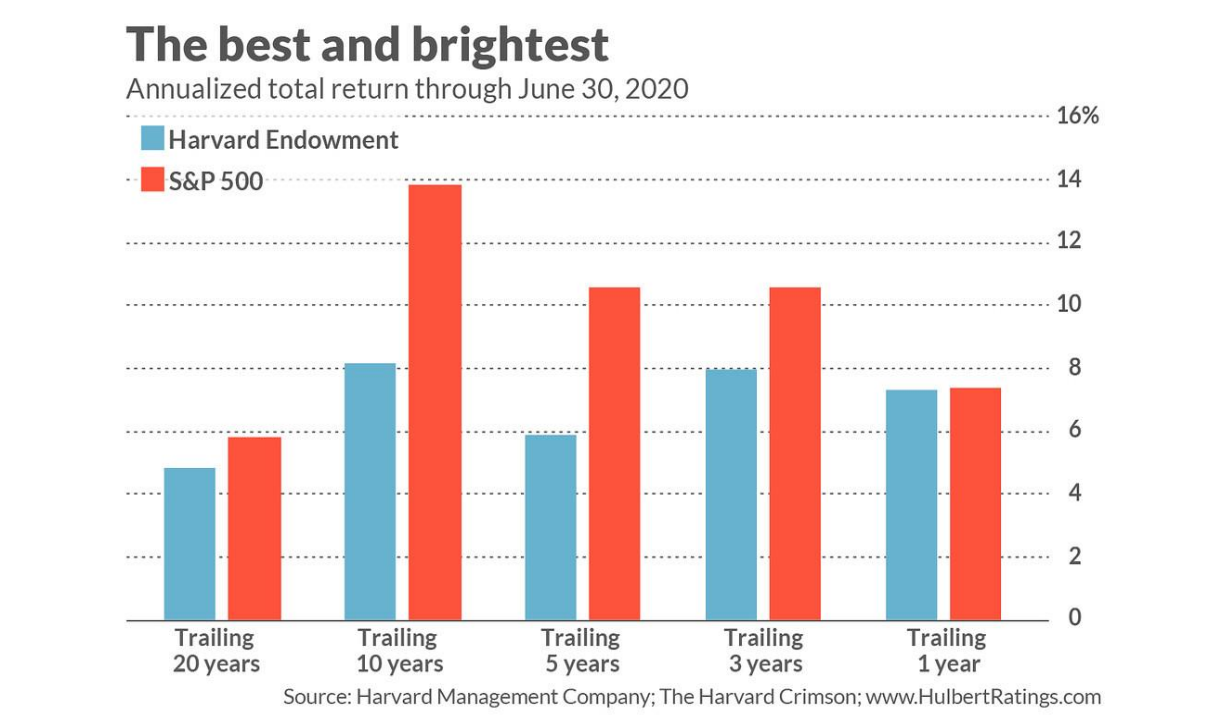
Utilize both excess liquidity investing and market opportunities to maintain a “market rate of return”

"Don't Beat the Market, Be the Market"

Harvard Endowment: Had 230 employees until 2017, Top 6 executives took home over $40MM in compensation.

Lost to S&P index by over 100bp over last 20 years and almost 500Bp over past 10 years.

Lost to the S&P annually for the last 12 years straight.



5 Takeaway's:

- Performance Persistance is Rare:
  - Harvard's few moments of glory have been dwarfed by it's failures.
- Overconfidence is an obstacle:
  - Those who have seen success get complacent and assume they are smarter than they really are.
- Reversion to the mean is powerful:
  - Sector outperformance comes and goes and is hard to predict.
- Many years of skill required to beat luck:
  - Statistically speaking, you would need many decades to understand if manager is superior.
- Indexes are hard to beat:
  - Harvard would have even lost out to a blended portfolio of 60% stocks, 40% US Bonds over last 20 years.

Source: Marketwatch - "What the Harvard Endowment's Below Average Grade Can Teach You About Index Funds and Your Investments", October 10, 2020

Interest Rate Speculation

The Truth About Flat Yield Curves

Rates: Dec 1986 to Dec 2022
$100MM Portfolio

Buy: 3Mo, Roll 3Mo
Buy: 2Yr

Speculate Holding 3Mo Tbill in Lieu of Longer Bond
Dates Reviewed: 12/31/1986 To 12/31/2022

Buy 3MoTBill

Start Date	12/31/1986	Portfolio Size	$100,000,000.00
End Date	12/31/2022		

3Mo TBill vs.	Observations in Months	Observations in Years	Number of Times Shorter Bond Wins	% of Wins	Number of Times Shorter Bond Loses	% of Losses	Average Annual Basis Point Win	Average Annual Basis Point Loss	Average Performance of Staying in Short Bond Over Period in Basis Points Annually	Average Performance of Staying in Short Bond Over Holding Period in Dollars	Average Spread of Shorter Bond to Buy Bond at Decision Time
Buy 2YrTsy	433	36.08	85	19.63%	348	80.37%	39.73	(108.97)	(79.78)	($1,595,588.91)	(61.78)
Buy 5YrTsy	433	36.08	20	4.62%	413	95.38%	19.48	(199.82)	(189.69)	($9,484,336.03)	(134.45)

Speculate Holding 3Mo Tbill in Lieu of Longer Bond
Dates Reviewed: 12/31/1986 To 12/31/2022

Buy 3MoTBill

Start Date	12/31/1986	Portfolio Size	$100,000,000.00
End Date	12/31/2022	3Mo Spread at Decision	0

3Mo TBill vs.	Observations in Months	Observations in Years	Number of Times Shorter Bond Wins	% of Wins	Number of Times Shorter Bond Loses	% of Losses	Average Annual Basis Point Win	Average Annual Basis Point Loss	Average Performance of Staying in Short Bond Over Period in Basis Points Annually	Average Performance of Staying in Short Bond Over Holding Period in Dollars	Average Spread of Shorter Bond to Buy Bond at Decision Time
Buy 2YrTsy	42	3.50	2	4.76%	40	95.24%	22.63	(156.17)	(147.65)	($2,953,095.24)	21.45
Buy 5YrTsy	26	2.17	0	0.00%	26	100.00%		(302.57)	(302.57)	($15,128,653.85)	30.38

Can’t Beat the Market, So Now What?

- Public entities generally exhibit predictive cash flows in both magnitude and timing.
- This allows public funds to create duration optimized (interest rate risk centric) allocations.
- Allocations should reflect the legal guidance of the investment policy and the desired weights of allowable sectors based on risk/reward and ALM preferences.
- Portfolio construction: Safety (IR Risk, credit), liquidity, diversified, legal, market rate of return.

Duration, Duration, Duration!

Being invested is more important than the allocation decision!

Moving from Cash to two duration in Treasuries:

Pickup approx. 40Bp Avg Yield

Moving from two duration in Treasuries to two duration in Agency Bullets

Pickup approx. 9Bp Avg Yield

Moving from two duration in Agency Bullets to maturity matched Agency Callables:

Pickup approx. 5Bp in Avg Yield

Custom Model Stats
Analysis Dates: Oct 31, 2010 - Sep 30, 2020

MODEL WEIGHTING		Cash Proxy	Treasury	Agy Blt	Agy Callable
L0US	OVERNIGHT CASH				
G0O1	3Mo T-Bill	100.00%			
G0QA	Treasury 0-1Yr		34.00%		
H541	Agy Composite 0-1Yr			32.00%	32.00%
G1O2	Treasury 1-3Yr		36.00%		
G1PB	Agy Bullet 1-3Yr			37.00%	
G1PC	Agy Callable 1-3Yr				37.00%
G2O2	Treasury 3-5Yr		30.00%		
G2PB	Agy Bullet 3-5Yr			31.00%	
G2PC	Agy Callable 3-5Yr				31.00%

MODEL STATS	Annualized Total Return	Annualized Price Return	Annualized Income Return	Annualized Std Dev Total Return	Avg Yield to Worst	Std Dev Yld	Avg Eff Dur	TR Sharpe Ratio	Yld Sharpe Ratio	Main Street Ratio
Cash Proxy	0.639%	0.639%	0.000%	0.248%	0.582%	0.785%	0.235	0.000	0.000	0.000
Treasury	1.432%	(0.413%)	1.784%	1.076%	0.976%	0.731%	1.997	0.737	0.538	0.197
Agy Blt	1.609%	(0.740%)	2.214%	1.006%	1.065%	0.708%	1.998	0.964	0.682	0.242
Agy Callable	1.163%	(0.415%)	1.524%	0.638%	1.117%	0.753%	1.284	0.820	0.710	0.416

Anatomy of Duration

MACAULAY DURATION

Economist Frederick Macaulay proposed simple formula (1938) to measure the ***time*** required to recover the initial cost of the bond (present value).

Weights are given to the present value of each cash flow (coupon payment) at the applicable interest rate for the life of the bond (YTM) then divided by the market price.

[PV(CF1)*p1+PV(CF2)*p2…PV(CFn)*Pn} / Market Price of Bond

Thus, Macaulay Duration states the time period within which the present value of the bond will be realized.

e.g. Current 5 Year Treasury has duration of 4.805.

The duration of a bond will always be less than its maturity period.

MODIFIED DURATION

Macaulay Duration was a good tool when it was conceived to compare bonds on a relative basis as to when an investor could expect to receive the cost of their investment back. The shorter the Macaulay Duration, the “less risk” was perceived by the investor since the PV of the bond would be received sooner.

However, Macaulay Duration’s shortfall was it’s inability to measure risk associated with holding the bond during its existence. Macaulay Duration lacks the ability to measure changes in value as interest rates fluctuate.

To correct for this, the simple division of the Macaulay Duration by (1+YTM) will convert the Mac Duration from a ***time*** based receipt of cash flows to the ***approximate change*** in price given a 100bp move in rates.

EFFECTIVE DURATION

Same as Modified Duration but accounts for prepayment risk in callables and amortizing product. Requires additional sophistication (OAS Model) to obtain.

Effective Duration ***SHOULD ALWAYS*** be used when a portfolio invests in callable or MBS type securities.

Why Do We Care?

- We know modified duration measures the approximate change in value for a 100bp change in interest rates.
- Because Modified Duration has Macaulay Duration as an input, we know that TVM (time value of money) principles apply.
- Thus, we can show that in normal markets over long periods of time, the more duration we take on (risk), the more return we can achieve.
- Since earning a Market Rate of Return is a core objective (albeit a lower priority one), maximizing duration given safety and liquidity are taken care of is important. It will be the **core** determinant of how much income/return can be derived from the portfolio.
- Sector and structure profile is of secondary importance to duration.

Approaches for Determining Portfolio Duration

Market Based – Curve(s)

- Manager uses a single or set of interest rate curves and measures risk/reward profile to establish duration.
- <u>Example:</u> A Treasury curve is used to remove credit risk and determine optimal spot on the curve over some period of time.
- Manager could also use a set of curves and based on sector and structure preference could weight each curve accordingly to get blended duration.

Approaches for Determining Portfolio Duration

Market Based Approach

Single or Multiple Curve Analysis

MAXQ Analytics
POWERED BY QUANTRIX

Interest Rate Risk Analysis
Analysis Dates: Jul 31, 2006 - Jul 31, 2021

RISK SELECTION	
Select	1.00Yr Tsy

	Annualized Total Return	Annualized Price Return	Annualized Income Return	Annualized Std Dev Total Return	Annualized Std Dev Price Return	Annualized Std Dev Income Return	Avg Yield to Worst	Avg Eff Dur	TR Sharpe Ratio	Yld Sharpe Ratio	Income Return Ratio	Price Return Ratio	Main Street Ratio	Yield/Edur % of 30Yr	TR/Std Dev % of 30Yr	Weighted Rank
3Mo Tsy	1.055%	1.055%		0.454%	0.454%	0.000%	0.946%	0.235						28.6% / 1.2%	15.2% / 3.1%	
6Mo Tsy	1.355%	1.355%		0.539%	0.539%	0.000%	1.040%	0.484	0.556	0.065		0.556	0.193	31.5% / 2.5%	19.5% / 3.6%	9
9Mo Tsy	1.466%	0.684%	0.783%	0.629%	0.533%	0.211%	1.101%	0.735	0.641	0.110	0.355	0.278	0.206	33.3% / 3.8%	21.1% / 4.2%	3
1.00Yr Tsy	1.576%	0.013%	1.566%	0.719%	0.528%	0.422%	1.162%	0.986	0.725	0.155	0.711		0.219	35.2% / 5.1%	22.7% / 4.9%	1
1.25Yr Tsy	1.718%	0.217%	1.539%	0.873%	0.701%	0.411%	1.193%	1.225	0.747	0.182	0.608	0.000	0.208	36.1% / 6.3%	24.7% / 5.9%	2
1.50Yr Tsy	1.860%	0.422%	1.512%	1.028%	0.874%	0.400%	1.225%	1.463	0.770	0.210	0.506	0.000	0.197	37.1% / 7.5%	26.8% / 6.9%	7
1.75Yr Tsy	2.002%	0.626%	1.486%	1.183%	1.047%	0.389%	1.256%	1.701	0.792	0.238	0.404	0.000	0.187	38.0% / 8.7%	28.8% / 8.0%	13
2.00Yr Tsy	2.144%	0.830%	1.459%	1.338%	1.221%	0.377%	1.287%	1.939	0.814	0.265	0.302		0.176	39.0% / 10.0%	30.9% / 9.0%	20
2.25Yr Tsy	2.305%	0.910%	1.565%	1.515%	1.400%	0.384%	1.334%	2.171	0.822	0.308	0.328	0.012	0.178	40.4% / 11.1%	33.2% / 10.2%	19
2.50Yr Tsy	2.466%	0.990%	1.672%	1.691%	1.580%	0.391%	1.381%	2.403	0.831	0.351	0.354	0.023	0.180	41.8% / 12.3%	35.5% / 11.4%	18
2.75Yr Tsy	2.626%	1.070%	1.778%	1.867%	1.760%	0.397%	1.427%	2.635	0.839	0.394	0.380	0.035	0.182	43.2% / 13.5%	37.8% / 12.6%	17
3.00Yr Tsy	2.787%	1.151%	1.884%	2.044%	1.940%	0.404%	1.474%	2.866	0.847	0.437	0.406	0.047	0.184	44.6% / 14.7%	40.1% / 13.8%	16
3.25Yr Tsy	2.929%	1.251%	1.959%	2.258%	2.158%	0.394%	1.528%	3.101	0.837	0.491	0.402	0.071	0.186	46.3% / 15.9%	42.2% / 15.3%	14
3.50Yr Tsy	3.071%	1.351%	2.034%	2.473%	2.377%	0.384%	1.582%	3.336	0.826	0.544	0.399	0.095	0.189	47.9% / 17.1%	44.2% / 16.7%	12
3.75Yr Tsy	3.213%	1.452%	2.108%	2.687%	2.595%	0.374%	1.636%	3.570	0.816	0.598	0.396	0.119	0.191	49.5% / 18.3%	46.3% / 18.2%	11
4.00Yr Tsy	3.355%	1.552%	2.183%	2.902%	2.814%	0.364%	1.690%	3.805	0.805	0.652	0.393	0.143	0.193	51.2% / 19.5%	48.3% / 19.6%	10
4.25Yr Tsy	3.497%	1.652%	2.258%	3.117%	3.033%	0.354%	1.744%	4.040	0.794	0.705	0.389	0.167	0.196	52.8% / 20.7%	50.4% / 21.1%	8
4.50Yr Tsy	3.639%	1.753%	2.332%	3.331%	3.251%	0.344%	1.798%	4.274	0.784	0.759	0.386	0.191	0.198	54.4% / 21.9%	52.4% / 22.5%	6
4.75Yr Tsy	3.781%	1.853%	2.407%	3.546%	3.470%	0.334%	1.852%	4.509	0.773	0.813	0.383	0.215	0.200	56.1% / 23.1%	54.4% / 24.0%	5
5.00Yr Tsy	3.923%	1.954%	2.482%	3.760%	3.689%	0.324%	1.906%	4.744	0.763	0.867	0.379	0.239	0.202	57.7% / 24.4%	56.5% / 25.4%	4
10.00Yr Tsy	4.761%	2.090%	3.375%	7.020%	6.968%	0.293%	2.594%	8.846	0.528	1.623	0.330	0.147	0.186	78.5% / 45.4%	68.6% / 47.4%	15
30.00Yr Tsy	6.945%	3.482%	4.960%	14.802%	14.766%	0.265%	3.303%	19.478	0.398	2.514	0.264	0.164	0.121			21

INDEX DATES	
Start Date	7/31/06
End Date	7/31/21

RISK/REWARD WEIGHTING	
TR Sharpe Ratio	0.00%
Yld Sharpe Ratio	0.00%
Income Return Ratio	0.00%
Price Return Ratio	0.00%
Main Street Ratio	100.00%

Market Based Approach

Single or Multiple Curve Analysis

- Uses simple methodology by utilizing a single or multiple curves that are easily accessible.
- Risk/Reward is measured through principles like the Sharpe Ratio or a duration modified Sharpe Ratio and are relatively simple calculations.
- Does not capture true portfolio exposure (single curve used to measure duration, but portfolio is allocated across different sectors).
- Multiple curve approach requires sector allocation desires before duration established (chicken vs. egg).
- Mean-Variance Analysis possible, but requires sophistication and still optimizes market-based volatility to expected returns.
- **Does not** account for liabilities or cash flow needs of portfolio.

Approaches for Determining Portfolio Duration

Market Based – Index Sets

- Manager uses a set of indices and measures risk/reward profiles accordingly (ICE/BAML, Lehman/Bloomberg, etc..).
- Like multiple curves, the manager could weight their preference of sectors and structures and determine the optimal blended duration for the portfolio.

Approaches for Determining Portfolio Duration

Market Based Approach

Single or Multiple Index Analysis

0 – 1Yr Agy Composite = .53
1 – 3Yr A-AAA Corporate = 1.93
Blended 50/50 Duration= 1.23

MAXQ Analytics
POWERED BY QUANTRIX

Static Index Stats
Analysis Dates: Nov 30, 2007 - Nov 30, 2019

INDEX DATES	
Start Date	11/30/07
End Date	11/30/19

INDEX STATS 0-1	Annualized Total Return	Annualized Price Return	Annualized Income Return	Annualized Std Dev Total Return	Avg Yield to Worst	Std Dev Yld	Avg Eff Dur	TR Sharpe Ratio	Yld Sharpe Ratio	Main Street Ratio	Weighted Rank
0-1 Treasury	0.925%	(1.137%)	1.843%	0.375%	0.767%	0.844%	0.515	0.644	0.180	0.296	4.0
0-1 Agy Composite	1.105%	(1.385%)	2.178%	0.469%	0.915%	0.965%	0.530	0.899	0.310	0.565	3.0
0-1 Supranational	1.395%	(1.565%)	2.553%	0.413%	1.315%	0.941%	0.539	1.724	0.743	1.298	2.0
0-1 A-AAA Corp	1.848%	(2.162%)	3.300%	0.841%	1.782%	1.508%	0.525	1.385	0.773	2.221	1.0

INDEX STATS 1-3	Annualized Total Return	Annualized Price Return	Annualized Income Return	Annualized Std Dev Total Return	Avg Yield to Worst	Std Dev Yld	Avg Eff Dur	TR Sharpe Ratio	Yld Sharpe Ratio	Main Street Ratio	Weighted Rank
1-3 Treasury	1.629%	(0.396%)	1.948%	1.125%	1.051%	0.784%	1.865	0.841	0.556	0.234	6.0
1-3 Agency Blt	1.993%	(0.587%)	2.440%	1.251%	1.233%	0.886%	1.835	1.047	0.697	0.337	4.0
1-3 Agency Clb	1.515%	0.052%	1.471%	0.662%	1.279%	0.895%	1.169	1.257	0.742	0.568	2.0
1-3 Municipal	1.902%	(2.674%)	3.614%	1.115%	1.159%	0.649%	1.805	1.093	0.838	0.301	5.0
1-3 Supranational	2.329%	(0.411%)	2.636%	1.166%	1.576%	0.801%	1.935	1.412	1.200	0.497	3.0
1-3 A-AAA Corp	2.682%	(1.089%)	3.419%	2.570%	2.318%	1.592%	1.930	0.778	1.070	0.882	1.0

Approaches for Determining Portfolio Duration

Market Based Approach

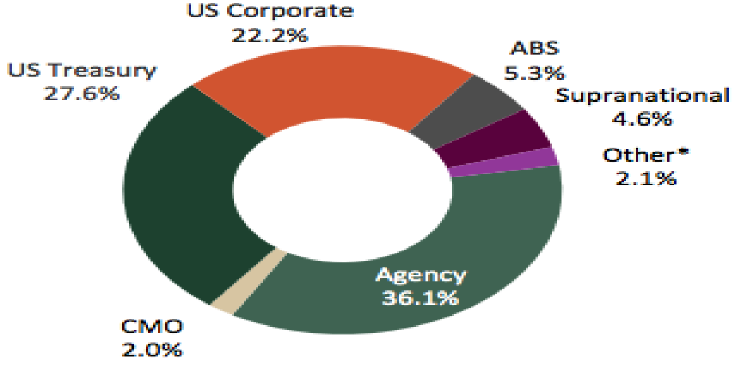
Single or Multiple Index Analysis

Treasuries represent 97.0% of this index as of Dec 31, 2022

CHARACTERISTICS	Chandler Short Term Bond	ICE BAML 1-5 Year US Treasury & Agency Index
Average Maturity	2.53	2.67
Average Duration	2.31	2.54
Yield-to-Maturity	2.71%	2.52%
Average Quality*	AA	AAA
Average Coupon	1.99%	2.18%

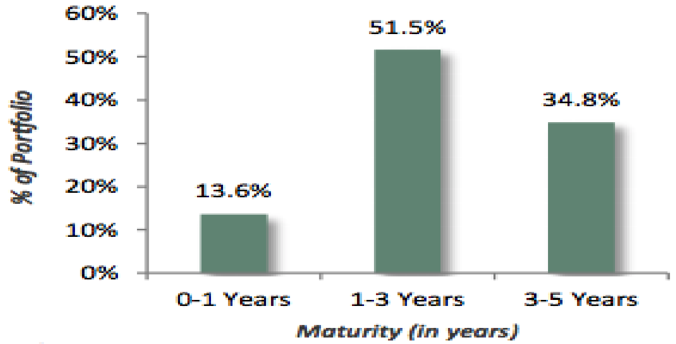
*Composite quality based on S&P ratings. Index quality reflects S&P equivalent of composite/average of S&P, Moody's and Fitch ratings. Composite characteristics are supplemental information under GIPS and supplement the composite presentation herein.

ASSET ALLOCATION



**Other includes Cash, Commercial Paper, Foreign Corporate, Municipal Bonds and Negotiable CD.*

MATURITY BREAKDOWN



Market Based Approach

Single or Multiple Index Analysis

- Again uses simple methodology by utilizing a single or multiple indices that are easily accessible.
- Risk/Reward is measured through principles like the Sharpe Ratio or a duration modified Sharpe Ratio and are relatively simple calculations.
- Single Indices like the ICE BofAML 1-5 Tsy / Agy can be heavily weighted in one sector.
- Does not capture liquidity needs or actual allocation exposure of your portfolio (unless several indices are used with actual exposure weights).
- Multiple index approach requires sector allocation desires before duration established (chicken vs. egg)
- **Does** not account for liabilities or cash flow needs of portfolio.

Approaches for Determining Portfolio Duration

Cash Flow Based - ALM

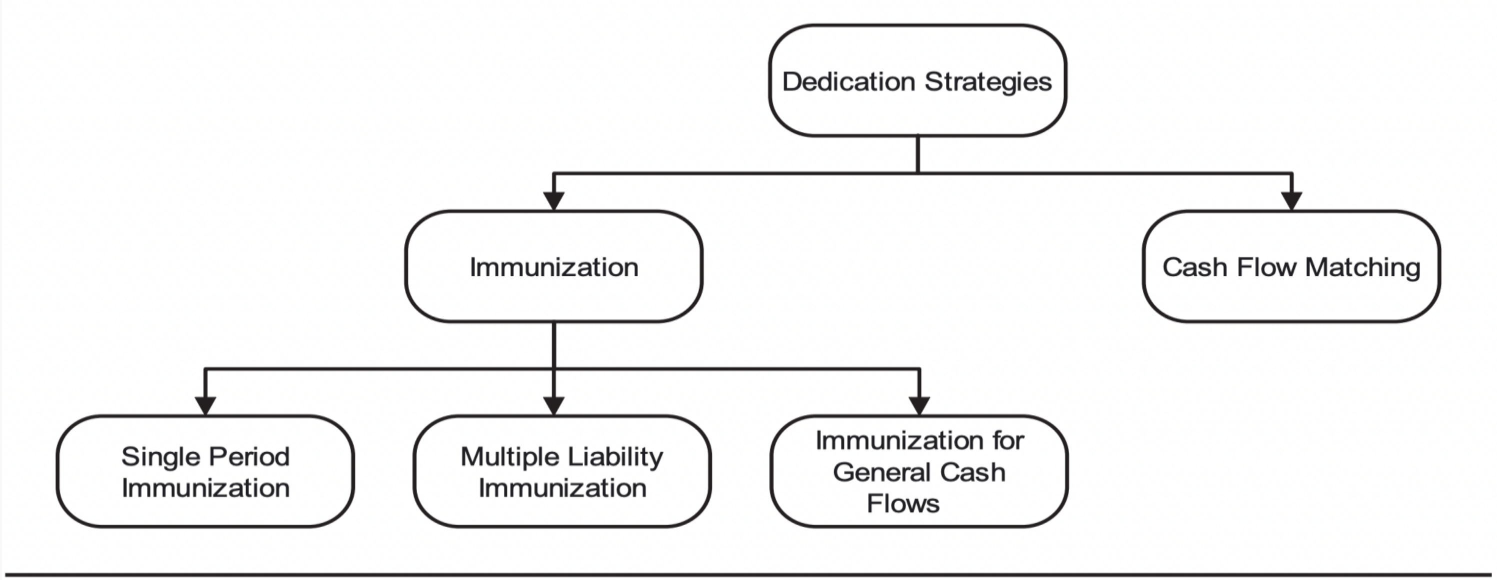
- Utilizes cash flow analysis to measure the timing and magnitude of liabilities.
- Uses immunization techniques utilized in the insurance and pension world to measure individual liability streams.
- These liability streams are combined and weighted to derive a total portfolio duration that will suffice to match the liability needs.

Cash Flow Based Approach

ALM Analysis

Dedication Strategy: Specialized fixed-income strategy designed to accommodate specific funding needs of the investor. They generally are classified as passive in nature, although it is possible to add some active management elements to them.

Exhibit 6 **Dedication Strategies**



***CFA Instititute, Fixed-Income Analysis 3rd Edition**

Cash Flow Based Approach

ALM Analysis

<u>Immunization</u>: Aims to construct a portfolio that, over a specified horizon, will earn a predetermined return regardless of interest rate changes (duration focused). An increase in rates and the corresponding drop in investment value partially offset by an increase in re-investment rates (and vice-versa).

<u>Cash Flow Matching</u>: Provides the future funding of a liability stream from the coupon and matured principal payments of the portfolio (not duration focused). A simple accumulation of the coupon, reinvestment return and value at horizon will offset liability in full.

Neither strategy perfectly fits public treasury as public entities must focus on Duration as a primary risk metric and typically spend coupons as anticipated by their budget.

CFA Instititute, Fixed-Income Analysis 3rd Edition

Cash Flow Based Approach

ALM Analysis

Combination Matching (also called horizon matching): Popular variation of multiple immunization and cash flow matching to fund liabilities by combining the two strategies. A portfolio is created that is duration-matched with the added constraint that it be cash flow-matched in the first few years, usually the first five years.

Since most public entities are policy constrained to five years and in, we can combine the strategies for the entire legal timeframe of the portfolio.

CFA Instititute, Fixed-Income Analysis 3rd Edition

Approaches for Determining Portfolio Duration

Cash Flow Based Approach

ALM Analysis

Step 1 – Liquidity Profile

Enter Receipts and Disbursements for 36 months (or desired length) to calculate Net Cash Flow per month over the last three years.

If data is difficult to obtain, a portfolio proxy can be used by utilizing the month over month change in book value of the portfolio as the net cash flow.

MAXQ Analytics POWERED BY QUANTRIX

Cash Flow Entry
Sample City

Update Data

	Date	Receipts	Expenditures	Net Flow
1	08/31/2018	$24,471,632.81	$26,953,467.16	($2,481,834.35)
2	09/30/2018	$23,559,974.56	$25,279,925.18	($1,719,950.62)
3	10/31/2018	$30,230,063.91	$32,487,689.44	($2,257,625.53)
4	11/30/2018	$51,936,945.68	$29,593,564.84	$22,343,380.84
5	12/31/2018	$24,127,233.19	$36,589,847.89	($12,462,614.70)
6	01/31/2019	$24,918,896.36	$38,186,973.19	($13,268,076.83)
7	02/28/2019	$25,734,823.79	$29,043,844.20	($3,309,020.41)
8	03/31/2019	$16,548,385.34	$27,337,583.28	($10,789,197.94)
9	04/30/2019	$20,508,348.59	$29,534,947.01	($9,026,598.42)
10	05/31/2019	$89,102,085.61	$36,728,474.91	$52,373,610.70
11	06/30/2019	$45,733,196.26	$41,057,162.97	$4,676,033.29
12	07/31/2019	$28,962,367.65	$32,115,824.92	($3,153,457.27)
13	08/31/2019	$27,149,309.89	$30,267,442.20	($3,118,132.31)
14	09/30/2019	$20,715,835.31	$26,719,598.11	($6,003,762.80)
15	10/31/2019	$26,003,560.74	$32,235,031.27	($6,231,470.53)
16	11/30/2019	$62,252,076.52	$37,799,795.37	$24,452,281.15
17	12/31/2019	$29,319,020.67	$40,322,210.03	($11,003,189.36)
18	01/31/2020	$28,241,721.32	$43,668,419.60	($15,426,698.28)
19	02/29/2020	$31,291,231.95	$34,078,791.63	($2,787,559.68)
20	03/31/2020	$19,500,350.84	$37,131,753.46	($17,631,402.62)
21	04/30/2020	$16,677,064.70	$26,304,041.58	($9,626,976.88)
22	05/31/2020	$88,324,955.64	$48,333,158.15	$39,991,797.49
23	06/30/2020	$52,111,610.18	$46,363,012.78	$5,748,597.40
24	07/31/2020	$33,638,613.02	$34,979,405.09	($1,340,792.07)
25	08/31/2020	$28,346,100.41	$31,194,182.34	($2,848,081.93)
26	09/30/2020	$22,215,127.23	$32,450,056.41	($10,234,929.18)
27	10/31/2020	$20,081,784.50	$35,741,768.07	($15,659,983.57)
28	11/30/2020	$62,542,916.58	$36,943,063.72	$25,599,852.86
29	12/31/2020	$30,429,996.34	$42,419,717.79	($11,989,721.45)
30	01/31/2021	$30,074,891.47	$43,632,363.40	($13,557,471.93)
31	02/28/2021	$31,592,189.05	$34,700,203.72	($3,108,014.67)
32	03/31/2021	$20,648,902.89	$34,525,669.42	($13,876,766.53)
33	04/30/2021	$30,150,467.58	$37,415,760.79	($7,265,293.21)
34	05/31/2021	$99,478,439.49	$48,720,733.83	$50,757,705.66
35	06/30/2021	$44,395,717.46	$43,679,333.78	$716,383.68
36	07/31/2021	$37,275,538.69	$34,980,269.97	$2,295,268.72

Cash Flow Based Approach

ALM Analysis

Step 1 – Liquidity Profile

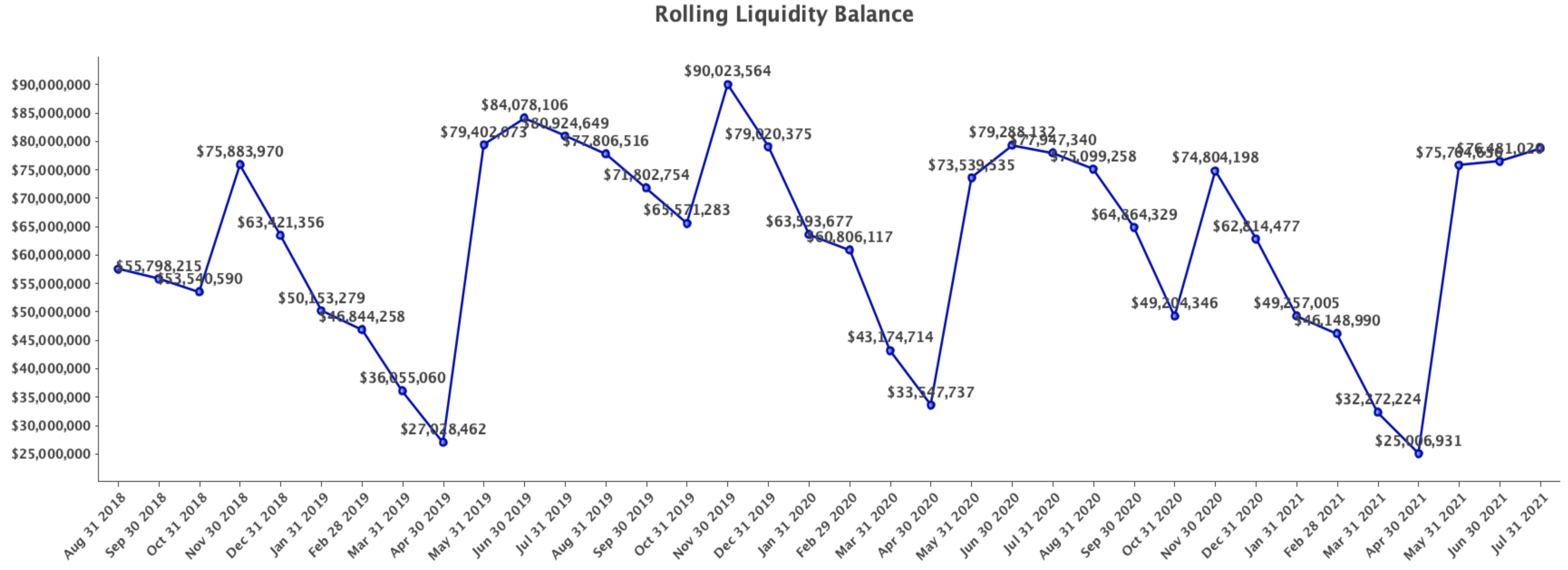
Institution Name	Sample City
Portfolio Balance	$300,000,000.00
Primary Liquidity	$60,000,000.00
Analysis Date	07/31/2021

MAXQ Analytics POWERED BY QUANTRIX

Liquidity Graph
Sample City
Analysis Date: Jul 31, 2021

MONTHS REVIEWED	
Months	36

BALANCE DATA	
Min Balance	$25,006,931
Max Balance	$90,023,564
Max Drawdown	$34,993,069



Cash Flow Based Approach

ALM Analysis

Step 1 – Liquidity Profile

Liquidity Buffer	1.50
Liquidity %	17.50%

Rolling Liquidity Evaluation	36	
	Value	**Date**
Minimum Balance	$25,006,930.66	
Maximum Balance	$90,023,564.27	
Maximum Drawdown	($34,993,069.34)	4/30/21
Required Liquidity		***Multiplier***
Strategic Primary Liquidity	**$34,993,069.34**	**1.00x / 11.7%**
Strategic Book Liquidity	**$34,993,069.34**	**1.00x / 11.7%**
Strategic Total Liquidity	**$69,986,138.68**	**2.00x / 23.3%**
Actual Liquidity		***Multiplier***
Actual Primary Liquidity	$60,000,000.00	1.71x / 20.0%
Actual Book Liquidity	$0.00	0.00x / 0.0%
Actual Total Liquidity	$60,000,000.00	1.71x / 20.0%
Investable Liquidity		***% Change***
Investable Primary Liquidity	$25,006,930.66	41.68%
Investable Book Liquidity	($34,993,069.34)	N/A
Total Investable Liquidity	($9,986,138.68)	N/A

Cash Flow Based Approach

ALM Analysis

Step 2 – Projected Cash Flows

Using your own assumptions or average/worst case cash flow projections, we can establish a liability ladder to measure against.

These projections are the net inflow and outflow expectations laddered over the policy limited timeframe of the portfolio.

Projected Net Cash Flows by Year		Worst Outflow	Average Outflow	User Outflow
1	August	($3,118,132.31)	($2,816,016.20)	
	September	($10,234,929.18)	($5,986,214.20)	
	October	($15,659,983.57)	($8,049,693.21)	
	November	$22,343,380.84	$24,131,838.28	
	December	($12,462,614.70)	($11,818,508.50)	
	January	($15,426,698.28)	($14,084,082.35)	
	February	($3,309,020.41)	($3,068,198.25)	
	March	($17,631,402.62)	($14,099,122.36)	
	April	($9,626,976.88)	($8,639,622.84)	
	May	$39,991,797.49	$47,707,704.62	
	June	$716,383.68	$3,713,671.46	
	July	($3,153,457.27)	($732,993.54)	
2	August	($3,118,132.31)	($2,816,016.20)	
	September	($10,234,929.18)	($5,986,214.20)	
	October	($15,659,983.57)	($8,049,693.21)	
	November	$22,343,380.84	$24,131,838.28	
	December	($12,462,614.70)	($11,818,508.50)	
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	November	$22,343,380.84	$24,131,838.28	
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	March	($17,631,402.62)	($14,099,122.36)	
	April	($9,626,976.88)	($8,639,622.84)	
	May	$39,991,797.49	$47,707,704.62	
	June	$716,383.68	$3,713,671.46	
	July	($3,153,457.27)	($732,993.54)	

Approaches for Determining Portfolio Duration

Cash Flow Based Approach

Year 1 Modified Monthly Duration = 5.815/(1+(Wtd Avg Tsy yield/12))=5.810
Year 1 Annualized Modified Duration = 5.810/12 = .484

ALM Analysis

Step 3 – DCF/Duration Analysis of Cash Flows

Duration Optimization Calcs		NetFlow	NegNetFlow	Hedge Security	PV Rate	Period	PV NegFlow	PV Factor	Weight	PeriodWt
1	August	($2,816,016.20)	($2,816,016.20)	3Mo Tsy	0.946%	1	$2,813,797.84	0.999	4.08%	0.041
	September	($5,986,214.20)	($5,986,214.20)	3Mo Tsy	0.946%	2	$5,976,786.48	0.998	8.67%	0.173
	October	($8,049,693.21)	($8,049,693.21)	3Mo Tsy	0.946%	3	$8,030,684.44	0.998	11.65%	0.349
	November	$24,131,838.28								
	December	($11,818,508.50)	($11,818,508.50)	6Mo Tsy	1.040%	5	$11,767,443.55	0.996	17.07%	0.853
	January	($14,084,082.35)	($14,084,082.35)	6Mo Tsy	1.040%	6	$14,011,089.19	0.995	20.32%	1.219
	February	($3,068,198.25)	($3,068,198.25)	9Mo Tsy	1.101%	7	$3,048,568.85	0.994	4.42%	0.310
	March	($14,099,122.36)	($14,099,122.36)	9Mo Tsy	1.101%	8	$13,996,081.63	0.993	20.30%	1.624
	April	($8,639,622.84)	($8,639,622.84)	9Mo Tsy	1.101%	9	$8,568,621.70	0.992	12.43%	1.119
	May	$47,707,704.62								
	June	$3,713,671.46								
	July	($732,993.54)	($732,993.54)	1.00Yr Tsy	1.162%	12	$724,530.44	0.988	1.05%	0.126
2	August	($2,816,016.20)	($2,816,016.20)	1.25Yr Tsy	1.193%	13	$2,779,866.49	0.987	4.09%	0.531
	September	($5,986,214.20)	($5,986,214.20)	1.25Yr Tsy	1.193%	14	$5,903,497.88	0.986	8.68%	1.215
	October	($8,049,693.21)	($8,049,693.21)	1.25Yr Tsy	1.193%	15	$7,930,578.28	0.985	11.66%	1.748
	November	$24,131,838.28								
	December	($11,818,508.50)	($11,818,508.50)	1.50Yr Tsy	1.225%	17	$11,615,346.67	0.983	17.07%	2.902
	January	($14,084,082.35)	($14,084,082.35)	1.50Yr Tsy	1.225%	18	$13,827,863.69	0.982	20.32%	3.658
	February	($3,068,198.25)	($3,068,198.25)	1.75Yr Tsy	1.256%	19	$3,007,817.97	0.980	4.42%	0.840
	March	($14,099,122.36)	($14,099,122.36)	1.75Yr Tsy	1.256%	20	$13,807,209.12	0.979	20.29%	4.059
	April	($8,639,622.84)	($8,639,622.84)	1.75Yr Tsy	1.256%	21	$8,451,898.98	0.978	12.42%	2.609
	May	$47,707,704.62								
	June	$3,713,671.46								
	July	($732,993.54)	($732,993.54)	2.00Yr Tsy	1.287%	24	$714,372.32	0.975	1.05%	0.252

Macaulay Dur = Sum PeriodWt = 5.815

Macaulay Dur = Sum PeriodWt = 17.814

Year 2 Modified Monthly Duration = 17.814/(1+(Wtd Avg Tsy yield/12))=17.795
Year 2 Annualized Mod Duration = 17.795/12 = 1.483

Cash Flow Based Approach

ALM Analysis

Step 3 – DCF/Duration Analysis of Cash Flows

Once the annualized duration's are calculated, we now weight each year based on our preference of coverage of each year's total liabilities.

Duration Optimization Values by Year		
1	*Annualized Duration*	*0.484*
2	*Annualized Duration*	*1.483*
3	*Annualized Duration*	*2.481*
4	*Annualized Duration*	*3.480*
5	*Annualized Duration*	*4.477*

Approaches for Determining Portfolio Duration

Cash Flow Based Approach

ALM Analysis

Step 3 – DCF/Duration Analysis of Cash Flows

Portfolio Size	$300,000,000.00
Immunized Portfolio	$299,992,155.11
Percent Immunized	100.00%

Immunization Weight	
Year 1	90.00%
Year 2	70.50%
Year 3	70.00%
Year 4	70.00%
Year 5	70.00%

The total immunization weights for each year should create a portfolio that is 100% immunized relative to the portfolio size.

Duration Optimization Values by Year		
1	Sum Present Value of Outflows	$68,937,604.13
	Sum of Asset Matched Present Values	$62,043,843.72
	Asset Matched Weight in Portfolio	20.681%
	Annual Total Liquidity Coverage Required	$6,893,760.41
	Annualized Duration	*0.484*
	Weighted Duration	*0.100*
2	Sum Present Value of Outflows	$68,038,451.40
	Sum of Asset Matched Present Values	$47,967,108.24
	Asset Matched Weight in Portfolio	15.989%
	Annual Total Liquidity Coverage Required	$20,071,343.16
	Annualized Duration	*1.483*
	Weighted Duration	*0.237*
3	Sum Present Value of Outflows	$66,942,361.12
	Sum of Asset Matched Present Values	$46,859,652.79
	Asset Matched Weight in Portfolio	15.620%
	Annual Total Liquidity Coverage Required	$20,082,708.34
	Annualized Duration	*2.481*
	Weighted Duration	*0.388*

Cash Flow Based Approach

ALM Analysis

Step 3 – DCF/Duration Analysis of Cash Flows

Duration Estimation and Allocation Bucket Approximation

Starting Liquidity	$52,500,000.00
1Yr Min Liquidity	$47,360,819.51
Weighted Average Cash Flow Duration	1.92
Cash (Liquidity Profile)	17.50%
0-1Yr	20.68%
1-3Yr	31.61%
3-5Yr	30.21%

Sum of Weighted Durations (4 & 5 Year Not Shown)

Duration Optimization Values by Year

1	Sum Present Value of Outflows	$68,937,604.13
	Sum of Asset Matched Present Values	$62,043,843.72
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Cash Flow Based Approach

ALM Analysis

Step 3 – DCF/Duration Analysis of Cash Flows

Duration Estimation and Allocation Bucket Approximation	
Starting Liquidity	$52,500,000.00
1Yr Min Liquidity	$47,360,819.51
Weighted Average Cash Flow Duration	1.92
Cash (Liquidity Profile)	17.50%
0-1Yr	20.68%
1-3Yr	31.61%
3-5Yr	30.21%

Sum of Asset Matched Weights (4 & 5 Year Not Shown)

Duration Optimization Values by Year		
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	Sum of Asset Matched Present Values	$62,043,843.72
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	Annual Total Liquidity Coverage Required	$6,893,760.41
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Cash Flow Based Approach

ALM Analysis

Step 3 – DCF/Duration Analysis of Cash Flows

Duration Estimation and Allocation Bucket Approximation	
Starting Liquidity	$52,500,000.00
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Cash (Liquidity Profile)	17.50%
0-1Yr	20.68%
1-3Yr	31.61%
3-5Yr	30.21%

Duration Optimization Values by Year		
1	Sum of Asset Matched Present Values	$62,043,843.72
	Weighted Duration	*0.100*
2	Sum of Asset Matched Present Values	$47,967,108.24
	Weighted Duration	*0.237*
3	Sum of Asset Matched Present Values	$46,859,652.79
	Weighted Duration	*0.388*
4	Sum of Asset Matched Present Values	$45,889,528.29
	Weighted Duration	*0.532*
5	Sum of Asset Matched Present Values	$44,732,022.07
	Weighted Duration	*0.668*

Approaches for Determining Portfolio Duration

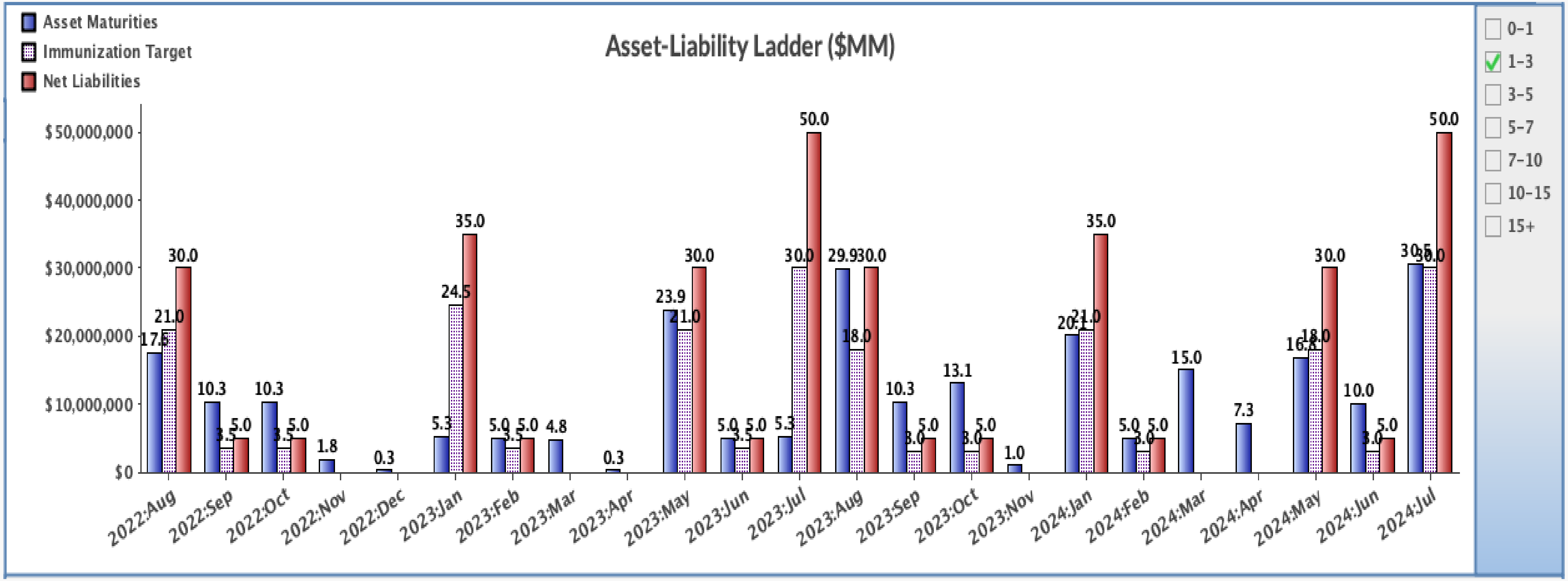
Cash Flow Based Approach

ALM Analysis

		NetFlow	PV NegFlow	Assets Needed	1Yr Liquidity Change	1Yr Liquidity Rolling Balance
1	August	($2,816,016.20)	$2,813,797.84	$2,532,418	($281,380)	$52,218,620
	September	($5,986,214.20)	$5,976,786.48	$5,379,108	($597,679)	$51,620,942
	October	($8,049,693.21)	$8,030,684.44	$7,227,616	($803,068)	$50,817,873
	November	$24,131,838.28			$1,682,127	$52,500,000
	December	($11,818,508.50)	$11,767,443.55	$10,590,699	($1,176,744)	$51,323,256
	January	($14,084,082.35)	$14,011,089.19	$12,609,980	($1,401,109)	$49,922,147
	February	($3,068,198.25)	$3,048,568.85	$2,743,712	($304,857)	$49,617,290
	March	($14,099,122.36)	$13,996,081.63	$12,596,473	($1,399,608)	$48,217,682
	April	($8,639,622.84)	$8,568,621.70	$7,711,760	($856,862)	$47,360,820
	May	$47,707,704.62			$5,139,180	$52,500,000
	June	$3,713,671.46				$52,500,000
	July	($732,993.54)	$724,530.44	$652,077	($72,453)	$52,427,547
2	August	($2,816,016.20)	$2,779,866.49	$1,959,806		
	September	($5,986,214.20)	$5,903,497.88	$4,161,966		
	October	($8,049,693.21)	$7,930,578.28	$5,591,058		
	November	$24,131,838.28				
	December	($11,818,508.50)	$11,615,346.67	$8,188,819		
	January	($14,084,082.35)	$13,827,863.69	$9,748,644		
	February	($3,068,198.25)	$3,007,817.97	$2,120,512		
	March	($14,099,122.36)	$13,807,209.12	$9,734,082		
	April	($8,639,622.84)	$8,451,898.98	$5,958,589		
	May	$47,707,704.62				
	June	$3,713,671.46				
	July	($732,993.54)	$714,372.32	$503,632		
3	August	($2,816,016.20)	$2,738,872.78	$1,917,211		
	September	($5,986,214.20)	$5,815,759.42	$4,071,032		
	October	($8,049,693.21)	$7,811,797.51	$5,468,258		
	November	$24,131,838.28				
	December	($11,818,508.50)	$11,430,879.00	$8,001,615		
	January	($14,084,082.35)	$13,606,489.65	$9,524,543		
	February	($3,068,198.25)	$2,957,182.76	$2,070,028		
	March	($14,099,122.36)	$13,572,833.72	$9,500,984		
	April	($8,639,622.84)	$8,307,243.38	$5,815,070		
	May	$47,707,704.62				
	June	$3,713,671.46				
	July	($732,993.54)	$701,302.90	$490,912		

Cash Flow Based Approach

ALM Analysis



Case Study: City and County of San Francisco

CCSF Investment Pool

- CCSF Investment Pool currently is $14.7 billion
- Many different participants both discretionary and non-discretionary with 13 major participants
- Monthly apportionment to each participant
- Consists of operating reserves and bond issuance proceeds

Investment Strategy

- Focus is on Safety of Principal and Liquidity – return is considered after the first two mandates are satisfied
- Emphasis on Asset/Liability Management – matching asset maturities with cash outflows
- Maintaining a consistent average maturity consistent with cashflow profile – not market timing
- Income generation is key – not total return

CA Government Code 53600.5

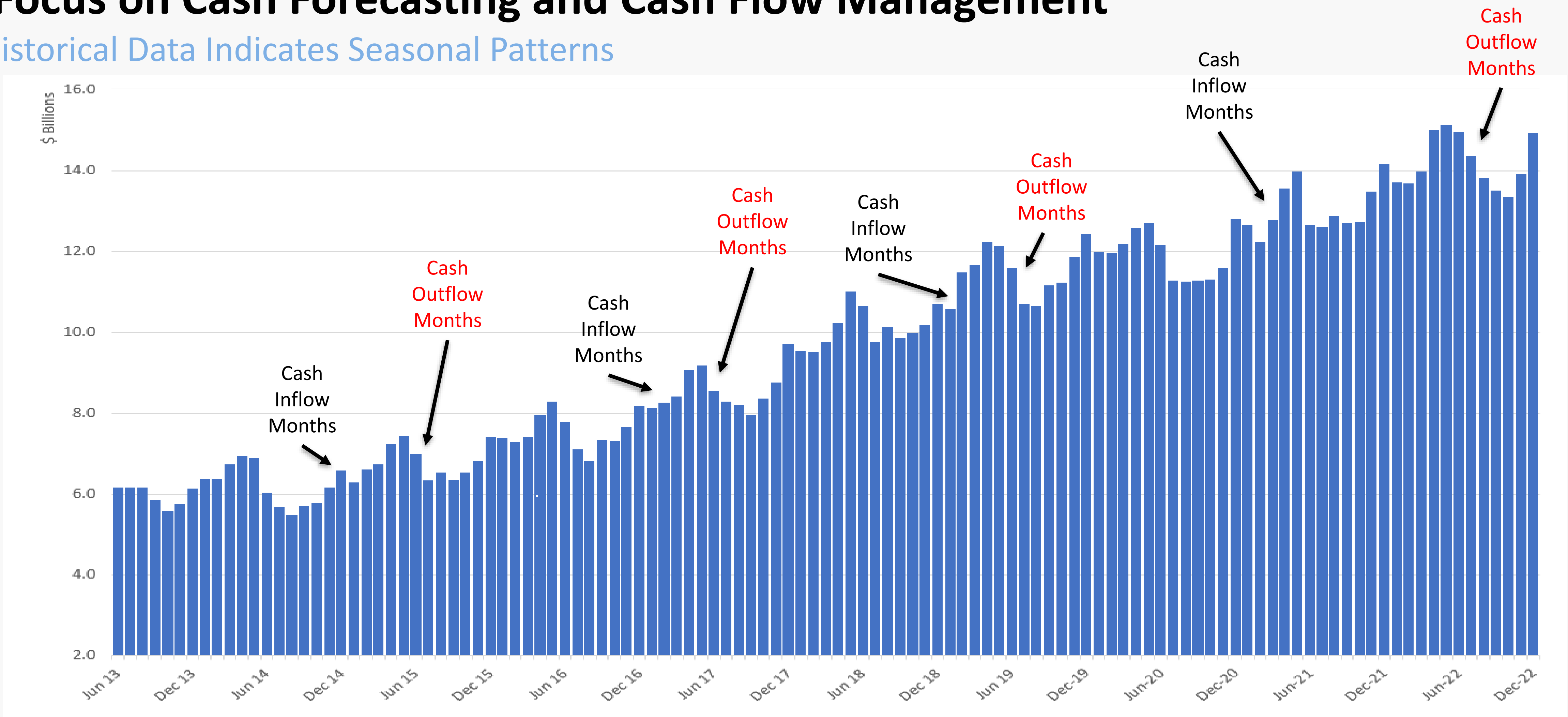
Objectives

When investing, reinvesting, purchasing, acquiring, exchanging, selling, or managing public funds, the primary objective of a trustee shall be to safeguard the principal of the funds under its control. The secondary objective shall be to meet the liquidity needs of the depositor. The third objective shall be to achieve a return on the funds under its control.

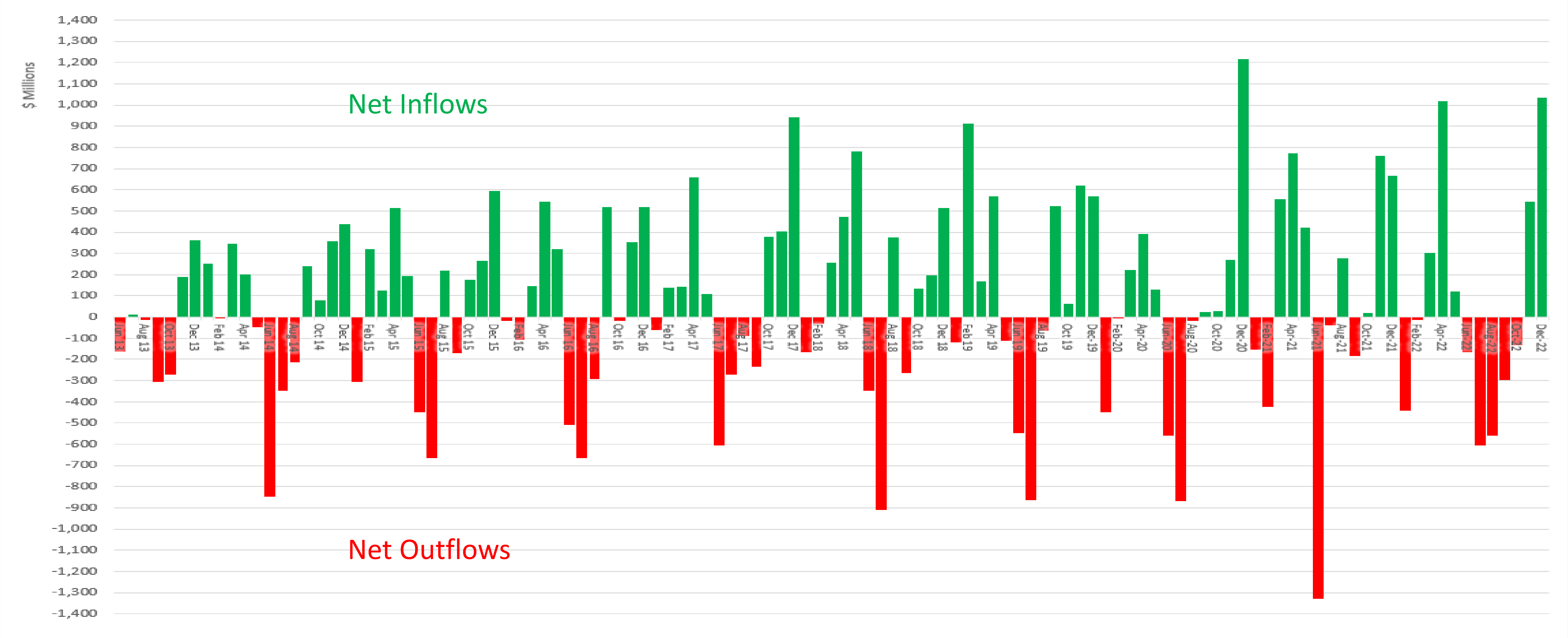
Case Study: City and County of San Francisco

Focus on Cash Forecasting and Cash Flow Management

Historical Data Indicates Seasonal Patterns



Historic Monthly Net Cash Flows



Historic Monthly Net Cash Flows By Year

Flow Selection Type

Historical Net Cash Flow by Year	2020	2021	2022
January	($448,647,971.30)	($152,567,793.13)	($439,872,611.00)
February	($7,539,007.66)	($424,131,996.20)	($16,209,979.34)
March	$224,362,201.75	$558,057,207.64	$302,531,367.33
April	$391,223,723.90	$772,652,422.72	$1,016,711,651.48
May	$130,361,300.30	$420,298,800.07	$120,346,417.41
June	($559,741,656.00)	($478,948,512.72)	($167,005,356.90)
July	($869,500,897.70)	($888,436,677.20)	($605,180,069.90)
August	($20,319,151.31)	$279,306,180.50	($558,558,396.91)
September	$24,735,030.05	($183,099,387.80)	($299,599,809.30)
October	$25,990,625.74	$17,904,953.55	($134,221,025.12)
November	$270,025,553.90	$760,418,717.00	$543,970,916.97
December	$1,215,365,138.10	$664,570,791.80	$1,032,680,667.38

Case Study: City and County of San Francisco

Projected Cash Flows

Projected Net Cash Flows by Year		Worst Outflow	Average Outflow	User Outflow
1	January	($448,647,971.30)	($347,029,458.48)	
	February	($424,131,996.20)	($149,293,661.07)	
	March	$224,362,201.75	$361,650,258.91	
	April	$391,223,723.90	$726,862,599.37	
	May	$120,346,417.41	$223,668,839.26	
	June	($559,741,656.00)	($401,898,508.54)	
	July	($888,436,677.20)	($787,705,881.60)	
	August	($558,558,396.91)	($99,857,122.57)	
	September	($299,599,809.30)	($152,654,722.35)	
	October	($134,221,025.12)	($30,108,481.94)	
	November	$270,025,553.90	$524,805,062.62	
	December	$664,570,791.80	$970,872,199.09	
2	January	($448,647,971.30)	($347,029,458.48)	
	February	($424,131,996.20)	($149,293,661.07)	
	March	$224,362,201.75	$361,650,258.91	
	April	$391,223,723.90	$726,862,599.37	
	May	$120,346,417.41	$223,668,839.26	
	June	($559,741,656.00)	($401,898,508.54)	
	July	($888,436,677.20)	($787,705,881.60)	
	August	($558,558,396.91)	($99,857,122.57)	
	September	($299,599,809.30)	($152,654,722.35)	
	October	($134,221,025.12)	($30,108,481.94)	
	November	$270,025,553.90	$524,805,062.62	
	December	$664,570,791.80	$970,872,199.09	
3	January	($448,647,971.30)	($347,029,458.48)	
	February	($424,131,996.20)	($149,293,661.07)	
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	May	$120,346,417.41	$223,668,839.26	
	June	($559,741,656.00)	($401,898,508.54)	
	July	($888,436,677.20)	($787,705,881.60)	
	August	($558,558,396.91)	($99,857,122.57)	
	September	($299,599,809.30)	($152,654,722.35)	
	October	($134,221,025.12)	($30,108,481.94)	
	November	$270,025,553.90	$524,805,062.62	
	December	$664,570,791.80	$970,872,199.09	

Projected Net Cash Flows by Year		Worst Outflow	Average Outflow	User Outflow
4	January	($448,647,971.30)	($347,029,458.48)	
	February	($424,131,996.20)	($149,293,661.07)	
	March	$224,362,201.75	$361,650,258.91	
	April	$391,223,723.90	$726,862,599.37	
	May	$120,346,417.41	$223,668,839.26	
	June	($559,741,656.00)	($401,898,508.54)	
	July	($888,436,677.20)	($787,705,881.60)	
	August	($558,558,396.91)	($99,857,122.57)	
	September	($299,599,809.30)	($152,654,722.35)	
	October	($134,221,025.12)	($30,108,481.94)	
	November	$270,025,553.90	$524,805,062.62	
	December	$664,570,791.80	$970,872,199.09	
5	January	($448,647,971.30)	($347,029,458.48)	
	February	($424,131,996.20)	($149,293,661.07)	
	March	$224,362,201.75	$361,650,258.91	
	April	$391,223,723.90	$726,862,599.37	
	May	$120,346,417.41	$223,668,839.26	
	June	($559,741,656.00)	($401,898,508.54)	
	July	($888,436,677.20)	($787,705,881.60)	
	August	($558,558,396.91)	($99,857,122.57)	
	September	($299,599,809.30)	($152,654,722.35)	
	October	($134,221,025.12)	($30,108,481.94)	
	November	$270,025,553.90	$524,805,062.62	
	December	$664,570,791.80	$970,872,199.09	

Average Outflow Scenario

Duration Optimization

Duration Estimation and Allocation Bucket Approximation

Portfolio Size	$14,937,401,021.16
Immunized Portfolio	$14,937,266,745.05
Percent Immunized	100.00%
Starting Liquidity	$1,194,992,081.69
1Yr Min Liquidity	$1,194,992,081.69
Weighted Average Cash Flow Duration	2.12
Cash (Liquidity Profile)	8.00%
0-1Yr	22.57%
1-3Yr	36.31%
3-5Yr	33.12%

3Mo Tsy	0.228
6Mo Tsy	0.474
9Mo Tsy	0.723
1.00Yr Tsy	0.972
1.25Yr Tsy	1.202
1.50Yr Tsy	1.431
1.75Yr Tsy	1.661
2.00Yr Tsy	1.891
2.25Yr Tsy	2.103
2.50Yr Tsy	2.315
2.75Yr Tsy	2.527
3.00Yr Tsy	2.739
3.25Yr Tsy	2.951

INDEX DATES	
Start Date	11/30/22
End Date	12/31/22
Outflow Selection	
OutFlow Selection	Average Outflow
Maximum Maturity (Yrs)	5.00
Immunization Weight	
Year 1	175.00%
Year 2	150.00%
Year 3	150.00%
Year 4	150.00%
Year 5	144.20%

Average Outflow Scenario

Duration Optimization Values by Year

Year	Measure	Value
1	Sum Present Value of Outflows	$1,926,462,807.38
	Sum of Asset Matched Present Values	$3,371,309,912.92
	Asset Matched Weight in Portfolio	22.570%
	Annual Total Liquidity Coverage Required	($1,444,847,105.54)
	Annualized Duration	*0.463*
	Weighted Duration	*0.105*
2	Sum Present Value of Outflows	$1,842,237,143.79
	Sum of Asset Matched Present Values	$2,763,355,715.69
	Asset Matched Weight in Portfolio	18.500%
	Annual Total Liquidity Coverage Required	($921,118,571.90)
	Annualized Duration	*1.460*
	Weighted Duration	*0.270*
3	Sum Present Value of Outflows	$1,773,496,994.48
	Sum of Asset Matched Present Values	$2,660,245,491.72
	Asset Matched Weight in Portfolio	17.809%
	Annual Total Liquidity Coverage Required	($886,748,497.24)
	Annualized Duration	*2.457*
	Weighted Duration	*0.438*
4	Sum Present Value of Outflows	$1,710,172,792.44
	Sum of Asset Matched Present Values	$2,565,259,188.67
	Asset Matched Weight in Portfolio	17.173%
	Annual Total Liquidity Coverage Required	($855,086,396.22)
	Annualized Duration	*3.454*
	Weighted Duration	*0.593*
5	Sum Present Value of Outflows	$1,651,944,767.24
	Sum of Asset Matched Present Values	$2,382,104,354.35
	Asset Matched Weight in Portfolio	15.947%
	Annual Total Liquidity Coverage Required	($730,159,587.12)
	Annualized Duration	*4.451*
	Weighted Duration	*0.710*

Average Outflow Scenario

Duration Optimization Calcs		NetFlow	NegNetFlow	Hedge Security	PV Rate	Period	PV NegFlow	PV Factor	Weight	Assets Needed	1Yr Liquidity Change	1Yr Liquidity Rolling Balance
1	January	($347,029,458.48)	($347,029,458.48)	3Mo Tsy	4.214%	1	$345,815,071.22	0.997	17.95%	$605,176,375	$259,361,303	$1,194,992,082
	February	($149,293,661.07)	($149,293,661.07)	3Mo Tsy	4.214%	2	$148,250,619.35	0.993	7.70%	$259,438,584	$111,187,965	$1,306,180,046
	March	$361,650,258.91									($111,187,965)	$1,194,992,082
	April	$726,862,599.37										$1,194,992,082
	May	$223,668,839.26										$1,194,992,082
	June	($401,898,508.54)	($401,898,508.54)	6Mo Tsy	4.602%	6	$392,773,692.37	0.977	20.39%	$687,353,962	$294,580,269	$1,489,572,351
	July	($787,705,881.60)	($787,705,881.60)	9Mo Tsy	4.687%	7	$766,503,027.86	0.973	39.79%	$1,341,380,299	$574,877,271	$2,064,449,622
	August	($99,857,122.57)	($99,857,122.57)	9Mo Tsy	4.687%	8	$96,791,216.09	0.969	5.02%	$169,384,628	$72,593,412	$2,137,043,034
	September	($152,654,722.35)	($152,654,722.35)	9Mo Tsy	4.687%	9	$147,392,116.39	0.966	7.65%	$257,936,204	$110,544,087	$2,247,587,121
	October	($30,108,481.94)	($30,108,481.94)	1.00Yr Tsy	4.772%	10	$28,937,064.10	0.961	1.50%	$50,639,862	$21,702,798	$2,269,289,919
	November	$524,805,062.62									($1,074,297,838)	$1,194,992,082
	December	$970,872,199.09										$1,194,992,082
2	January	($347,029,458.48)	($347,029,458.48)	1.25Yr Tsy	4.672%	13	$329,934,206.76	0.951	17.91%	$494,901,310		
	February	($149,293,661.07)	($149,293,661.07)	1.25Yr Tsy	4.672%	14	$141,388,717.42	0.947	7.67%	$212,083,076		
	March	$361,650,258.91										
	April	$726,862,599.37										
	May	$223,668,839.26										
	June	($401,898,508.54)	($401,898,508.54)	1.50Yr Tsy	4.573%	18	$375,304,875.55	0.934	20.37%	$562,957,313		
	July	($787,705,881.60)	($787,705,881.60)	1.75Yr Tsy	4.473%	19	$733,940,546.76	0.932	39.84%	$1,100,910,820		
	August	($99,857,122.57)	($99,857,122.57)	1.75Yr Tsy	4.473%	20	$92,695,762.68	0.928	5.03%	$139,043,644		
	September	($152,654,722.35)	($152,654,722.35)	1.75Yr Tsy	4.473%	21	$141,180,631.44	0.925	7.66%	$211,770,947		
	October	($30,108,481.94)	($30,108,481.94)	2.00Yr Tsy	4.374%	22	$27,792,403.18	0.923	1.51%	$41,688,605		
	November	$524,805,062.62										
	December	$970,872,199.09										
3	January	($347,029,458.48)	($347,029,458.48)	2.25Yr Tsy	4.317%	25	$317,234,530.35	0.914	17.89%	$475,851,796		
	February	($149,293,661.07)	($149,293,661.07)	2.25Yr Tsy	4.317%	26	$135,986,577.43	0.911	7.67%	$203,979,866		
	March	$361,650,258.91										
	April	$726,862,599.37										
	May	$223,668,839.26										
	June	($401,898,508.54)	($401,898,508.54)	2.50Yr Tsy	4.259%	30	$361,371,626.60	0.899	20.38%	$542,057,440		
	July	($787,705,881.60)	($787,705,881.60)	2.75Yr Tsy	4.202%	31	$706,812,862.20	0.897	39.85%	$1,060,219,293		
	August	($99,857,122.57)	($99,857,122.57)	2.75Yr Tsy	4.202%	32	$89,289,697.20	0.894	5.03%	$133,934,546		
	September	($152,654,722.35)	($152,654,722.35)	2.75Yr Tsy	4.202%	33	$136,023,671.60	0.891	7.67%	$204,035,507		
	October	($30,108,481.94)	($30,108,481.94)	3.00Yr Tsy	4.145%	34	$26,778,029.09	0.889	1.51%	$40,167,044		
	November	$524,805,062.62										
	December	$970,872,199.09										

Average Outflow Scenario

Duration Optimization Calcs		NetFlow	NegNetFlow	Hedge Security	PV Rate	Period	PV NegFlow	PV Factor	Weight	Assets Needed	1Yr Liquidity Change	1Yr Liquidity Rolling Balance
4	January	($347,029,458.48)	($347,029,458.48)	3.25Yr Tsy	4.111%	37	$305,781,399.31	0.881	17.88%	$458,672,099	[redacted]	[redacted]
	February	($149,293,661.07)	($149,293,661.07)	3.25Yr Tsy	4.111%	38	$131,099,432.45	0.878	7.67%	$196,649,149	[redacted]	[redacted]
	March	$361,650,258.91									[redacted]	[redacted]
	April	$726,862,599.37									[redacted]	[redacted]
	May	$223,668,839.26									[redacted]	[redacted]
	June	($401,898,508.54)	($401,898,508.54)	3.50Yr Tsy	4.078%	42	$348,531,636.51	0.867	20.38%	$522,797,455	[redacted]	[redacted]
	July	($787,705,881.60)	($787,705,881.60)	3.75Yr Tsy	4.044%	43	$681,610,513.16	0.865	39.86%	$1,022,415,770	[redacted]	[redacted]
	August	($99,857,122.57)	($99,857,122.57)	3.75Yr Tsy	4.044%	44	$86,117,245.02	0.862	5.04%	$129,175,868	[redacted]	[redacted]
	September	($152,654,722.35)	($152,654,722.35)	3.75Yr Tsy	4.044%	45	$131,207,968.75	0.860	7.67%	$196,811,953	[redacted]	[redacted]
	October	($30,108,481.94)	($30,108,481.94)	4.00Yr Tsy	4.011%	46	$25,824,597.23	0.858	1.51%	$38,736,896	[redacted]	[redacted]
	November	$524,805,062.62									[redacted]	[redacted]
	December	$970,872,199.09									[redacted]	[redacted]
5	January	($347,029,458.48)	($347,029,458.48)	4.25Yr Tsy	3.977%	49	$295,091,067.47	0.850	17.86%	$425,521,319	[redacted]	[redacted]
	February	($149,293,661.07)	($149,293,661.07)	4.25Yr Tsy	3.977%	50	$126,530,185.46	0.848	7.66%	$182,456,527	[redacted]	[redacted]
	March	$361,650,258.91									[redacted]	[redacted]
	April	$726,862,599.37									[redacted]	[redacted]
	May	$223,668,839.26									[redacted]	[redacted]
	June	($401,898,508.54)	($401,898,508.54)	4.50Yr Tsy	3.944%	54	$336,646,371.96	0.838	20.38%	$485,444,068	[redacted]	[redacted]
	July	($787,705,881.60)	($787,705,881.60)	4.75Yr Tsy	3.910%	55	$658,660,197.34	0.836	39.87%	$949,788,005	[redacted]	[redacted]
	August	($99,857,122.57)	($99,857,122.57)	4.75Yr Tsy	3.910%	56	$83,226,877.94	0.833	5.04%	$120,013,158	[redacted]	[redacted]
	September	($152,654,722.35)	($152,654,722.35)	4.75Yr Tsy	3.910%	57	$126,818,328.21	0.831	7.68%	$182,872,029	[redacted]	[redacted]
	October	($30,108,481.94)	($30,108,481.94)	5.00Yr Tsy	3.877%	58	$24,971,738.85	0.829	1.51%	$36,009,247	[redacted]	[redacted]
	November	$524,805,062.62									[redacted]	[redacted]
	December	$970,872,199.09									[redacted]	[redacted]

Worst Outflow Scenario

Duration Optimization

Duration Estimation and Allocation Bucket Approximation

Portfolio Size	$14,937,401,021.16
Immunized Portfolio	$14,937,132,909.84
Percent Immunized	100.00%
Starting Liquidity	$1,194,992,081.69
1Yr Min Liquidity	$1,194,992,081.69
Weighted Average Cash Flow Duration	2.07
Cash (Liquidity Profile)	8.00%
0-1Yr	21.69%
1-3Yr	40.71%
3-5Yr	29.60%

3Mo Tsy	0.228
6Mo Tsy	0.474
9Mo Tsy	0.723
1.00Yr Tsy	0.972
1.25Yr Tsy	1.202
1.50Yr Tsy	1.431
1.75Yr Tsy	1.661
2.00Yr Tsy	1.891
2.25Yr Tsy	2.103
2.50Yr Tsy	2.315
2.75Yr Tsy	2.527
3.00Yr Tsy	2.739
3.25Yr Tsy	2.951

INDEX DATES	
Start Date	11/30/22
End Date	12/31/22
Outflow Selection	
OutFlow Selection	Worst Outflow
Maximum Maturity (Yrs)	5.00
Immunization Weight	
Year 1	100.00%
Year 2	100.00%
Year 3	100.00%
Year 4	85.00%
Year 5	71.15%

Worst Outflow Scenario

Duration Optimization Values by Year					
1	Sum Present Value of Outflows	$3,239,481,723.32	4	Sum Present Value of Outflows	$2,876,289,956.04
	Sum of Asset Matched Present Values	$3,239,481,723.32		Sum of Asset Matched Present Values	$2,444,846,462.63
	Asset Matched Weight in Portfolio	21.687%		Asset Matched Weight in Portfolio	16.367%
	Annualized Duration	0.483		Annual Total Liquidity Coverage Required	$431,443,493.41
	Weighted Duration	0.105		*Annualized Duration*	3.474
2	Sum Present Value of Outflows	$3,098,198,627.66		*Weighted Duration*	0.569
	Sum of Asset Matched Present Values	$3,098,198,627.66	5	Sum Present Value of Outflows	$2,778,465,498.52
	Asset Matched Weight in Portfolio	20.741%		Sum of Asset Matched Present Values	$1,976,878,202.19
	Annualized Duration	1.480		Asset Matched Weight in Portfolio	13.234%
	Weighted Duration	0.307		Annual Total Liquidity Coverage Required	$801,587,296.32
3	Sum Present Value of Outflows	$2,982,735,812.34		*Annualized Duration*	4.471
	Sum of Asset Matched Present Values	$2,982,735,812.34		*Weighted Duration*	0.592
	Asset Matched Weight in Portfolio	19.968%			
	Annualized Duration	2.477			
	Weighted Duration	0.495			

Case Study: City and County of San Francisco

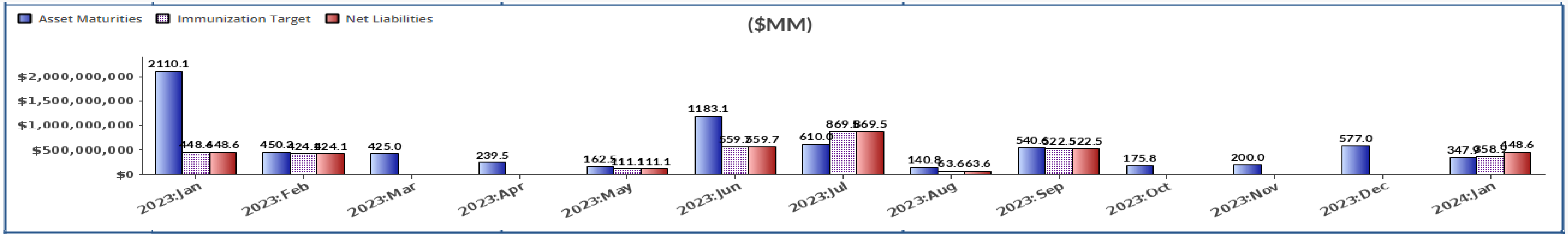
Worst Outflow Scenario

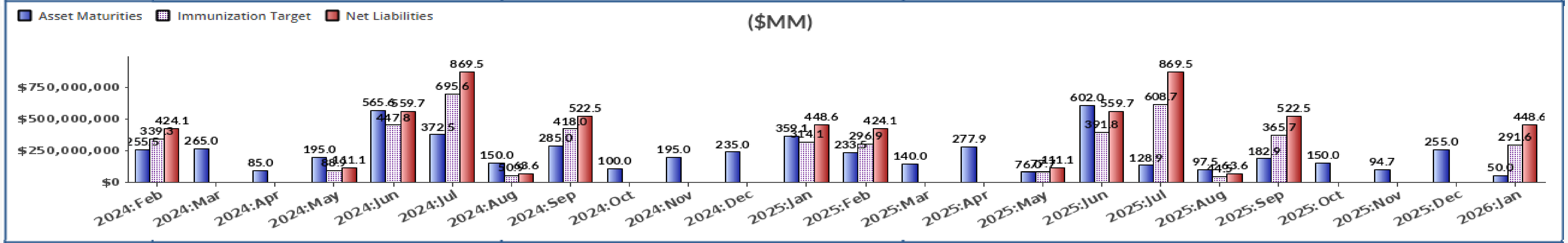
Duration Optimization Calcs		NetFlow	NegNetFlow	Hedge Security	PV Rate	Period	PV NegFlow	PV Factor	Weight	Assets Needed	1Yr Liquidity Change	1Yr Liquidity Rolling Balance
1	January	($448,647,971.30)	($448,647,971.30)	3Mo Tsy	4.214%	1	$447,077,982.45	0.997	13.80%	$447,077,982		$1,194,992,082
	February	($424,131,996.20)	($424,131,996.20)	3Mo Tsy	4.214%	2	$421,168,793.60	0.993	13.00%	$421,168,794		$1,194,992,082
	March	$224,362,201.75										$1,194,992,082
	April	$391,223,723.90										$1,194,992,082
	May	$120,346,417.41										$1,194,992,082
	June	($559,741,656.00)	($559,741,656.00)	6Mo Tsy	4.602%	6	$547,033,124.85	0.977	16.89%	$547,033,125		$1,194,992,082
	July	($888,436,677.20)	($888,436,677.20)	9Mo Tsy	4.687%	7	$864,522,430.32	0.973	26.69%	$864,522,430		$1,194,992,082
	August	($558,558,396.91)	($558,558,396.91)	9Mo Tsy	4.687%	8	$541,409,016.20	0.969	16.71%	$541,409,016		$1,194,992,082
	September	($299,599,809.30)	($299,599,809.30)	9Mo Tsy	4.687%	9	$289,271,430.87	0.966	8.93%	$289,271,431		$1,194,992,082
	October	($134,221,025.12)	($134,221,025.12)	1.00Yr Tsy	4.772%	10	$128,998,945.02	0.961	3.98%	$128,998,945		$1,194,992,082
	November	$270,025,553.90										$1,194,992,082
	December	$664,570,791.80										$1,194,992,082
2	January	($448,647,971.30)	($448,647,971.30)	1.25Yr Tsy	4.672%	13	$426,546,821.64	0.951	13.77%	$426,546,822		
	February	($424,131,996.20)	($424,131,996.20)	1.25Yr Tsy	4.672%	14	$401,674,649.34	0.947	12.96%	$401,674,649		
	March	$224,362,201.75										
	April	$391,223,723.90										
	May	$120,346,417.41										
	June	($559,741,656.00)	($559,741,656.00)	1.50Yr Tsy	4.573%	18	$522,703,538.54	0.934	16.87%	$522,703,539		
	July	($888,436,677.20)	($888,436,677.20)	1.75Yr Tsy	4.473%	19	$827,795,901.82	0.932	26.72%	$827,795,902		
	August	($558,558,396.91)	($558,558,396.91)	1.75Yr Tsy	4.473%	20	$518,500,786.62	0.928	16.74%	$518,500,787		
	September	($299,599,809.30)	($299,599,809.30)	1.75Yr Tsy	4.473%	21	$277,080,784.69	0.925	8.94%	$277,080,785		
	October	($134,221,025.12)	($134,221,025.12)	2.00Yr Tsy	4.374%	22	$123,896,145.01	0.923	4.00%	$123,896,145		
	November	$270,025,553.90										
	December	$664,570,791.80										
3	January	($448,647,971.30)	($448,647,971.30)	2.25Yr Tsy	4.317%	25	$410,128,376.69	0.914	13.75%	$410,128,377		
	February	($424,131,996.20)	($424,131,996.20)	2.25Yr Tsy	4.317%	26	$386,327,578.34	0.911	12.95%	$386,327,578		
	March	$224,362,201.75										
	April	$391,223,723.90										
	May	$120,346,417.41										
	June	($559,741,656.00)	($559,741,656.00)	2.50Yr Tsy	4.259%	30	$503,298,092.45	0.899	16.87%	$503,298,092		
	July	($888,436,677.20)	($888,436,677.20)	2.75Yr Tsy	4.202%	31	$797,199,164.52	0.897	26.73%	$797,199,165		
	August	($558,558,396.91)	($558,558,396.91)	2.75Yr Tsy	4.202%	32	$499,448,700.75	0.894	16.74%	$499,448,701		
	September	($299,599,809.30)	($299,599,809.30)	2.75Yr Tsy	4.202%	33	$266,959,747.10	0.891	8.95%	$266,959,747		
	October	($134,221,025.12)	($134,221,025.12)	3.00Yr Tsy	4.145%	34	$119,374,152.49	0.889	4.00%	$119,374,152		
	November	$270,025,553.90										
	December	$664,570,791.80										

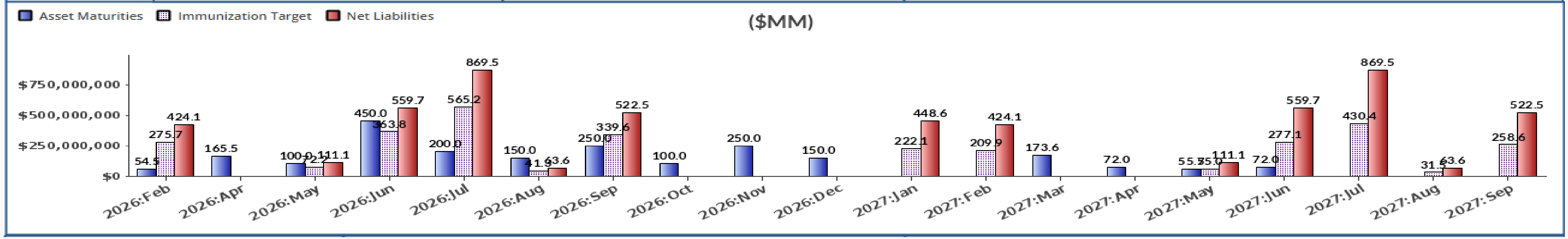
Worst Outflow Scenario

Duration Optimization Calcs		NetFlow	NegNetFlow	Hedge Security	PV Rate	Period	PV NegFlow	PV Factor	Weight	Assets Needed	1Yr Liquidity Change	1Yr Liquidity Rolling Balance
4	January	($448,647,971.30)	($448,647,971.30)	3.25Yr Tsy	4.111%	37	$395,321,495.37	0.881	13.74%	$336,023,271	[redacted]	[redacted]
	February	($424,131,996.20)	($424,131,996.20)	3.25Yr Tsy	4.111%	38	$372,443,569.21	0.878	12.95%	$316,577,034	[redacted]	[redacted]
	March	$224,362,201.75									[redacted]	[redacted]
	April	$391,223,723.90									[redacted]	[redacted]
	May	$120,346,417.41									[redacted]	[redacted]
	June	($559,741,656.00)	($559,741,656.00)	3.50Yr Tsy	4.078%	42	$485,415,275.86	0.867	16.88%	$412,602,984	[redacted]	[redacted]
	July	($888,436,677.20)	($888,436,677.20)	3.75Yr Tsy	4.044%	43	$768,773,972.12	0.865	26.73%	$653,457,876	[redacted]	[redacted]
	August	($558,558,396.91)	($558,558,396.91)	3.75Yr Tsy	4.044%	44	$481,703,348.58	0.862	16.75%	$409,447,846	[redacted]	[redacted]
	September	($299,599,809.30)	($299,599,809.30)	3.75Yr Tsy	4.044%	45	$257,508,459.69	0.860	8.95%	$218,882,191	[redacted]	[redacted]
	October	($134,221,025.12)	($134,221,025.12)	4.00Yr Tsy	4.011%	46	$115,123,835.22	0.858	4.00%	$97,855,260	[redacted]	[redacted]
	November	$270,025,553.90									[redacted]	[redacted]
	December	$664,570,791.80									[redacted]	[redacted]
5	January	($448,647,971.30)	($448,647,971.30)	4.25Yr Tsy	3.977%	49	$381,500,779.07	0.850	13.73%	$271,437,804	[redacted]	[redacted]
	February	($424,131,996.20)	($424,131,996.20)	4.25Yr Tsy	3.977%	50	$359,462,684.19	0.848	12.94%	$255,757,700	[redacted]	[redacted]
	March	$224,362,201.75									[redacted]	[redacted]
	April	$391,223,723.90									[redacted]	[redacted]
	May	$120,346,417.41									[redacted]	[redacted]
	June	($559,741,656.00)	($559,741,656.00)	4.50Yr Tsy	3.944%	54	$468,862,147.34	0.838	16.87%	$333,595,418	[redacted]	[redacted]
	July	($888,436,677.20)	($888,436,677.20)	4.75Yr Tsy	3.910%	55	$742,888,799.99	0.836	26.74%	$528,565,381	[redacted]	[redacted]
	August	($558,558,396.91)	($558,558,396.91)	4.75Yr Tsy	3.910%	56	$465,535,860.88	0.833	16.76%	$331,228,765	[redacted]	[redacted]
	September	($299,599,809.30)	($299,599,809.30)	4.75Yr Tsy	3.910%	57	$248,893,361.20	0.831	8.96%	$177,087,626	[redacted]	[redacted]
	October	($134,221,025.12)	($134,221,025.12)	5.00Yr Tsy	3.877%	58	$111,321,865.85	0.829	4.01%	$79,205,508	[redacted]	[redacted]
	November	$270,025,553.90									[redacted]	[redacted]
	December	$664,570,791.80									[redacted]	[redacted]

Asset-Liability Ladder ($MM)







Case Study: City and County of San Francisco

Cash Flow Schedule

Cash Flow Schedules By Day

Projected EOD Bank Balance	($37,450,879.94)
EC Bank Balance Target	$30,000,000.00
Net Bank Balance Available	($67,450,879.94)
Portfolio MMKT Holdings	$1,690,006,035.01
Intra-Day MMKT Transactions	
Target Liquidity	$1,000,000,000.00
Spendable Cash Non-Immunized	$622,555,155.07

CF Start Date	1/6/2023
CF End Date	1/31/2028

☑ Include MMKT Holdings

☑ Include Target Liquidity

Portfolio MMKT Holdings	$1,690,006,035.01
MMKT Holdings Immunized	$0.00
Portfolio MMKT Actual	$1,690,006,035.01
Intra-Day MMKT Transactions	
Target Liquidity	$1,000,000,000.00
Spendable Cash Immunized	$622,555,155.07

Min Liquidity	($21,262,676,505.98)
Max Liquidity	$700,322,804.07
Avg Liquidity	($8,185,525,434.54)
Immun Min Liquidity	($21,312,676,505.98)
Immun Max Liquidity	$635,139,105.07
Immun Avg Liquidity	($8,242,168,291.68)
Negative Net Outflow Filter Amount	($10,000,000.00)

☑ Activate Filter

Cash Flow By Day

		Total CF	Adjusted Liquidity
01/13/2023	Payroll Transfer to Bank	($102,000,000.00)	
	3133EN6A3 : FFCB 01/13/2026-57567	($29,977,200.00)	
	3133EN6A3 : FFCB 01/13/2026-57568	($19,982,400.00)	
	06367CTW7 : BMOCHG 01/13/2023-47344	$50,000,000.00	
	89114WU94 : TDNY 01/13/2023-47345	$50,000,000.00	
	Total Cash Flow	($51,959,600.00)	$570,595,555.07
01/18/2023	CCSF Payroll Tax 1	($41,000,000.00)	
	06367CUZ8 : BMOCHG 01/18/2023-47370	$50,000,000.00	
	Total Cash Flow	$9,000,000.00	$579,595,555.07
01/19/2023	3133EMWK4 : FFCB 01/19/2023-47053	$60,000,000.00	
	Total Cash Flow	$60,000,000.00	$639,595,555.07
01/20/2023	CCSF Payroll Tax 2	($10,000,000.00)	
	OCII Debt Service	($18,291,991.00)	
	Total Cash Flow	($28,291,991.00)	$611,303,564.07
01/23/2023	3133ELJH8 : FFCB 01/23/2023-46472	$10,140,000.00	
	Total Cash Flow	$10,140,000.00	$621,443,564.07
01/24/2023	SFO Debt Service ACH	($36,961,583.00)	
	89114WWX9 : TDNY 01/24/2023-47363	$50,000,000.00	
	Total Cash Flow	$13,038,417.00	$634,481,981.07
01/27/2023	OCII Debt Service	($73,006,867.00)	
	78012U5C5 : RY 01/27/2023-47357	$50,000,000.00	
	Total Cash Flow	($23,006,867.00)	$611,475,114.07
01/30/2023	Payroll Transfer to Bank	($102,000,000.00)	
	89114WQL2 : TDNY 01/30/2023-47282	$50,000,000.00	
	06367CSR9 : BMOCHG 01/30/2023-47304	$50,000,000.00	
	Total Cash Flow	($2,000,000.00)	$609,475,114.07
01/31/2023	Retiree Pension Payment	($115,000,000.00)	
	SFO Projected Capital Expenditures	($25,452,310.00)	
	Pension Payment Northern Trust Pmt	$115,000,000.00	
	Total Cash Flow	($25,452,310.00)	$584,022,804.07

Immunized Cash Flow By Day

		Total CF	Adjusted Liquidity
01/13/2023	Payroll Transfer to Bank	($102,000,000.00)	
	3133EN6A3 : FFCB 01/13/2026-57567	($29,977,200.00)	
	3133EN6A3 : FFCB 01/13/2026-57568	($19,982,400.00)	
	06367CTW7 : BMOCHG 01/13/2023-47344	$50,000,000.00	
	89114WU94 : TDNY 01/13/2023-47345	$50,000,000.00	
	Total Cash Flow	($51,959,600.00)	$570,595,555.07
01/31/2023	Retiree Pension Payment	($115,000,000.00)	
	SFO Projected Capital Expenditures	($25,452,310.00)	
	Pension Payment Northern Trust Pmt	$115,000,000.00	
	3133EMWK4 : FFCB 01/19/2023-47053	$15,000,000.00	
	Total Cash Flow	($10,452,310.00)	$584,022,804.07
02/01/2023	CCSF Payroll Tax 1	($41,000,000.00)	
	313384BH : FHLBDN 02/01/2023-57570	$10,400,000.00	
	Total Cash Flow	($30,600,000.00)	$553,422,804.07
03/06/2023	Kaiser Health Premium	($40,000,000.00)	
	Total Cash Flow	($40,000,000.00)	$585,139,105.07
03/16/2023	CCSF COP 2017B Moscone Debt Service	($19,557,856.25)	
	CCSF COP 2010A Debt Service	($1,785,300.00)	
	CCSF COP 2009A Debt Service	($10,458,715.00)	
	Total Cash Flow	($31,801,871.25)	$560,337,233.82
03/29/2023	CCSF Payroll Tax 1	($41,000,000.00)	
	Total Cash Flow	($41,000,000.00)	$509,236,424.82
03/31/2023	CCSF Payroll Tax 2	($10,000,000.00)	
	Retiree Pension Payment	($115,000,000.00)	
	SFO Projected Capital Expenditures	($28,369,090.00)	
	Pension Payment Northern Trust Pmt	$115,000,000.00	
	Total Cash Flow	($38,369,090.00)	$470,867,334.82
04/10/2023	Payroll Transfer to Bank	($102,000,000.00)	

Cash Flow Based Approach

ALM Analysis

Step 4 – Sector/Maturity Allocation

INDEX STATS	Annualized Total Return	Annualized Price Return	Annualized Income Return	Annualized Std Dev Total Return	Avg Yield to Worst	Std Dev Yld	Avg Eff Dur	TR Sharpe Ratio	Yld Sharpe Ratio	Main Stree Ratio	Weighted Rank
1-3 A-AAA Corp	3.010%	(0.769%)	3.476%	2.427%	2.415%	1.750%	1.914	0.805	0.840	0.768	1.0
1-3 Agency Clb	1.827%	0.148%	1.711%	0.715%	1.537%	1.399%	1.143	1.080	0.423	0.517	2.0
1-3 Supranational	2.762%	(0.119%)	2.842%	1.213%	1.774%	1.276%	1.921	1.408	0.649	0.431	3.0
1-3 Agency Blt	2.418%	(0.253%)	2.593%	1.277%	1.468%	1.376%	1.832	1.067	0.379	0.285	4.0
1-3 Municipal	2.103%	(2.500%)	3.529%	1.111%	1.310%	0.962%	1.811	0.943	0.379	0.201	5.0
1-3 Treasury	2.133%	(0.061%)	2.178%	1.240%	1.291%	1.291%	1.856	0.869	0.267	0.186	6.0
3-5 A-AAA Corp	4.280%	0.312%	4.100%	3.698%	2.948%	1.515%	3.665	0.872	1.321	0.546	1.0
3-5 Agency Clb	2.361%	0.099%	2.289%	1.406%	1.932%	1.315%	2.048	0.929	0.750	0.482	2.0
3-5 Supranational	4.323%	0.999%	3.706%	2.495%	2.397%	1.191%	3.712	1.310	1.218	0.391	3.0
3-5 Agency Blt	3.983%	0.816%	3.466%	2.676%	1.936%	1.245%	3.685	1.094	0.795	0.269	4.0
3-5 Municipal	3.228%	(1.204%)	3.906%	2.388%	1.717%	0.905%	3.416	0.910	0.852	0.226	5.0
3-5 Treasury	3.602%	0.980%	2.933%	2.918%	1.714%	1.146%	3.793	0.873	0.670	0.203	6.0

Cash Flow Based Approach

ALM Analysis

Step 4 – Sector/Maturity Allocation

MODEL WEIGHTING		Target Allocation	Agy and Credit	Agency Portfolio	Treasury Portfolio
L0US	OVERNIGHT CASH	17.50%	17.50%	17.50%	17.50%
G0QA	Treasury 0-1Yr				20.68%
H541	Agy Composite 0-1Yr	10.68%	10.68%	20.68%	
C01A	US Corp A-AAA 0-1Yr	10.00%	10.00%		
G1O2	Treasury 1-3Yr				31.61%
G1PB	Agy Bullet 1-3Yr	11.61%	21.61%	31.61%	
G1PC	Agy Callable 1-3Yr	10.00%			
C110	US Corp A-AAA 1-3Yr	10.00%	10.00%		
G2O2	Treasury 3-5Yr				30.21%
G2PB	Agy Bullet 3-5Yr	15.21%	25.21%	30.21%	
G2PC	Agy Callable 3-5Yr	10.00%			
C210	US Corp A-AAA 3-5Yr	5.00%	5.00%		

MODEL STATS	Annualized Total Return	Annualized Price Return	Annualized Income Return	Annualized Std Dev Total Return	Avg Yield to Worst	Std Dev Yld	Avg Eff Dur	TR Sharpe Ratio	Yld Sharpe Ratio	Main Street Ratio	*Weighted Rank*
Target Allocation	2.372%	(0.252%)	2.548%	1.091%	1.719%	1.417%	1.576	1.207	0.545	0.490	1
Agy and Credit	2.594%	(0.219%)	2.743%	1.275%	1.712%	1.410%	1.809	1.207	0.543	0.424	2
Agency Portfolio	2.452%	(0.076%)	2.506%	1.284%	1.491%	1.387%	1.802	1.087	0.393	0.302	3
Treasury Portfolio	2.218%	0.090%	2.151%	1.350%	1.337%	1.306%	1.839	0.861	0.300	0.213	4

Duration Estimation and Allocation Bucket Approximation	
Starting Liquidity	**$52,500,000.00**
1Yr Min Liquidity	**$47,360,819.51**
Weighted Average Cash Flow Duration	**1.92**
Cash (Liquidity Profile)	**17.50%**
0-1Yr	**20.68%**
1-3Yr	**31.61%**
3-5Yr	**30.21%**

ICE/BAML Index Data - July 2006 to July 2021

Cash Flow Based Approach

ALM Analysis

- Uses institution's actual cash flow data to measure future liabilities and derive duration needs
- Eliminates bias and idiosyncratic problems that public entities can have with market based approaches (liquidity, sector and structure differences).
- Ensures each institution's duration is unique and not peer or market related.
- Places emphasis on timing and magnitude of investments relative to liabilities versus market based optimizations for the masses.
- Does require more data and effort to establish the projected liability stream and involves calculations that may not be familiar.
- There are opportunity costs associated by limiting the investment universe to any particular timeframe, however it can be argued that maintaining a stable duration and limiting cash balances can more than offset any costs associated with security selection constraints (without this process, cash balances tend to be higher and more conservative securities are purchased due to uncertainty).

Thank You!

If you have any questions or comments please reach out and we would be happy to discuss.

Thank you for attending!

Disclosure

This presentation is for informational purposes only. All information is assumed to be correct, but the accuracy has not been confirmed and therefore is not guaranteed to be correct. Information is obtained from third party sources that may or may not be verified. The information presented should not be used in making any investment decisions and is not a recommendation to buy, sell, implement, or change any securities or investment strategy, function, or process.
Any financial and/or investment decision should be made only after considerable research, consideration, and involvement with an experienced professional engaged for the specific purpose. All comments and discussion presented are purely based on opinion and assumptions, not fact. These assumptions may or may not be correct based on foreseen and unforeseen events.

All calculations and results presented are for discussion purposes only and should not be used for making calculations and/or decisions. The data in this presentation is unaudited.

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Please complete the seminar evaluation and leave it on your table.

Please join CMTA and CDIAC in the **Skyview Room** for light refreshments and networking from 5:15-6:15 PM.