

INTERMEDIATE PUBLIC FUNDS INVESTING



WEBINAR 1 | ASSESSING AND ADJUSTING PORTFOLIO LIQUIDITY

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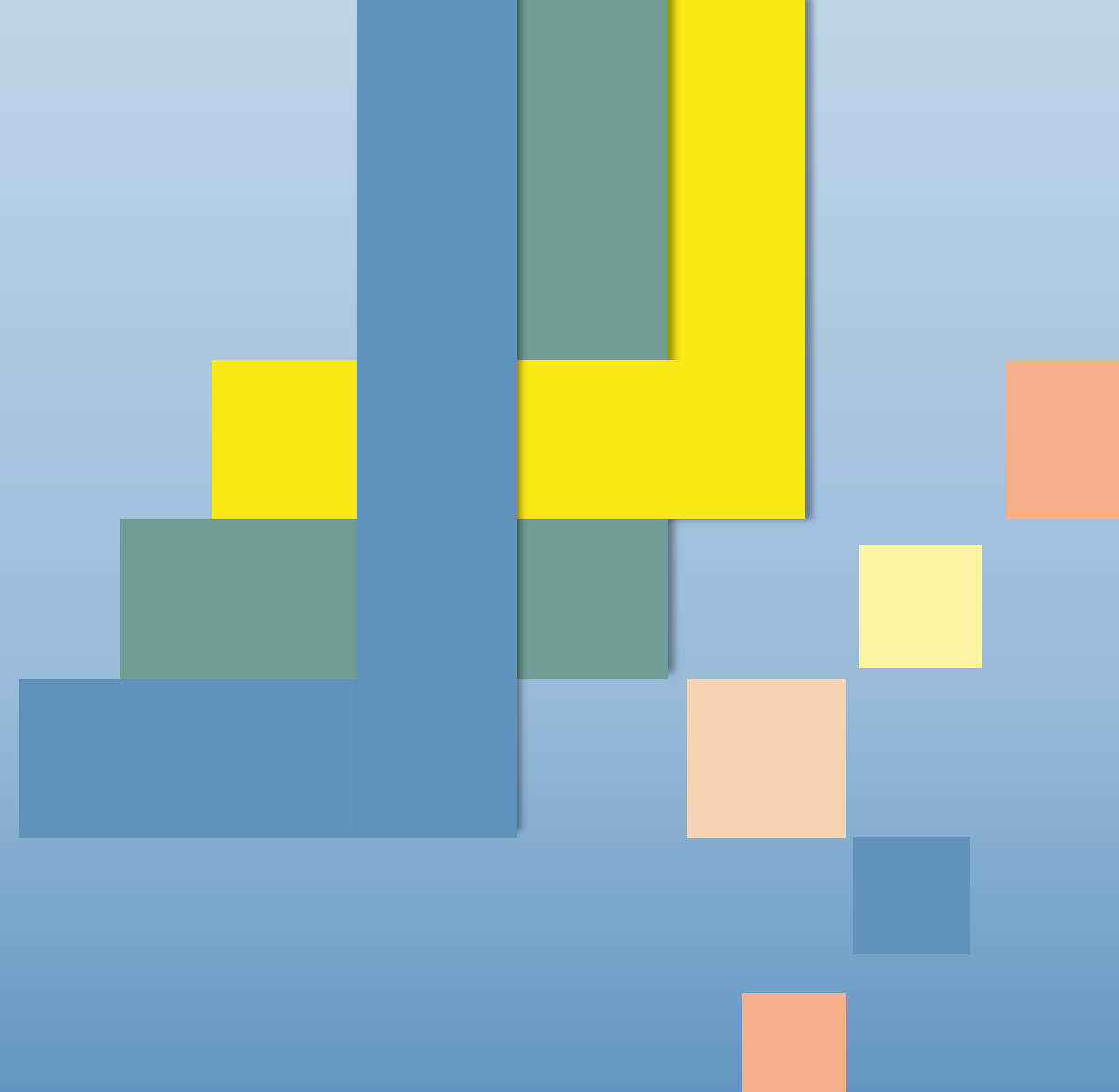
January 26, 2022



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DURATION, CONVEXITY, EARNINGS

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January 26, 2022

TYPES OF DURATION: Start with Macaulay Duration

- The Macaulay duration is the weighted average term to maturity of the cash flows from a bond. .
- It is a measure of the time required for an investor to be repaid the bond's price by the bond's total cash flows.
- The Macaulay duration is measured in units of time (e.g., years).
- Macaulay duration is frequently used by portfolio managers who use an immunization strategy.

$$\text{Macaulay Duration} = \sum_i^n t_i \times \frac{PV_i}{V}$$

Where:

- t_i – The time until the i th cash flow from the asset will be received
- PV_i – The present value of the i th cash flow from the asset
- V – The present value of all cash flows from the asset

• **Macaulay duration is the point where the weights (cash flows) are in balance**



TYPES OF DURATION: Modified Duration

- Relative to the Macaulay duration, the modified duration metric is a more precise measure of price sensitivity.
- The modified duration figure indicates the percentage change in the bond's value given an X% interest rate change. Unlike the Macaulay duration, modified duration is measured in percentages.
- The modified duration is often considered as an extension of the Macaulay duration. It is supported by the following mathematical formula:

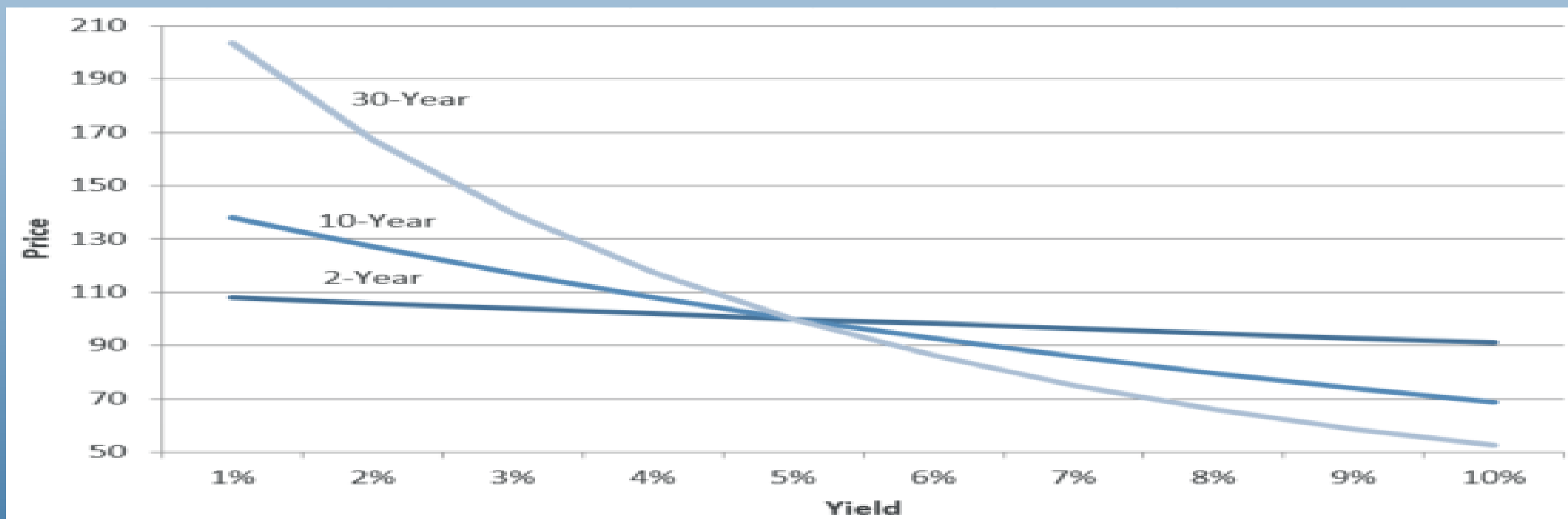
$$\text{Modified Duration} = \frac{\text{Macaulay Duration}}{\left(1 + \frac{\text{YTM}}{n}\right)}$$

- YTM – The yield to maturity of a bond
- n – The frequency of compounding
-

Duration and concepts of convexity

- **Duration:**

- **Simplified:** modified duration gives an idea of how the price of a bond will be affected should interest rates change. A higher duration implies greater price volatility should rates move. Duration is quoted as the percentage change in price for each given percent change in interest rates. For example, the price of a bond with a duration of 2 would be expected to increase (decline) by about 2.00% for each 1.00% move down (up) in rates.
- The duration of a bond is primarily affected by its coupon rate, yield, and remaining time to maturity. The duration of a bond will be higher the lower its coupon. Duration will be higher the lower its yield. Duration will also be higher the longer its maturity.



What does it look like in Basis Point Value?

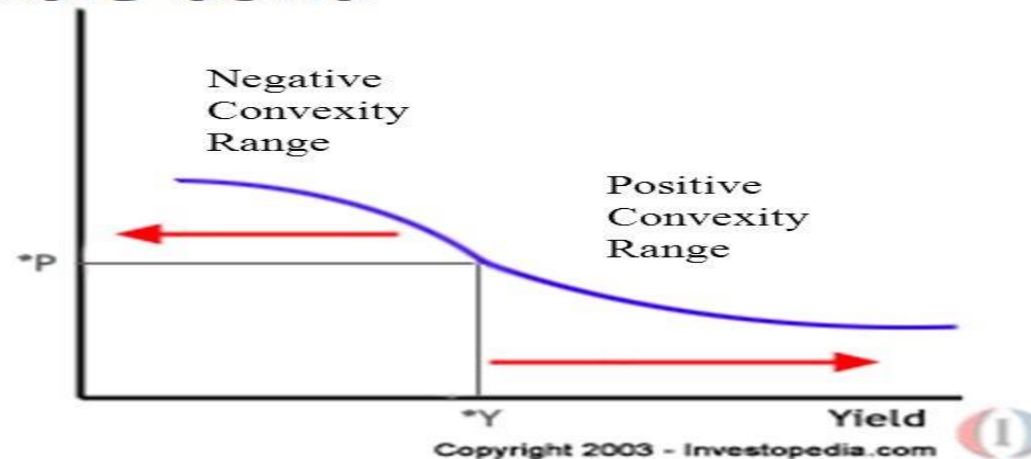
	\$1,000,000	Yield +/-	BPV
1 year	T 1.125% 1/31/2023	1	\$ -103.91
		-1	\$ 103.92
2 year	T .125% 1/15/24	1	\$ (193.86)
		-1	\$ 198.20
3 year	T 1.125% 1/15/25	1	\$ (292.58)
		-1	\$ 292.68
4 year	T .375% 1/31/26	1	\$ (382.18)
		-1	\$ 382.35
5 year	T 1.50% 1/31/27	1	\$ (483.41)
		-1	\$ 483.67

WHAT IS NEGATIVE CONVEXITY?

- **Negative convexity exists when the shape of a bond's yield curve is concave. A bond's convexity is the rate of change of its duration, and it is measured as the second derivative of the bond's price with respect to its yield.**
- **For example, with a callable bond, as interest rates fall, the incentive for the issuer to call the bond at par increases; therefore, its price will not rise as quickly as the price of a non-callable bond. The price of a callable bond might actually drop as the likelihood that the bond will be called increases. This is why the shape of a callable bond's curve of price with respect to yield is concave or negatively convex.**

Graphic Illustration of Negative Convexity

Callable bond

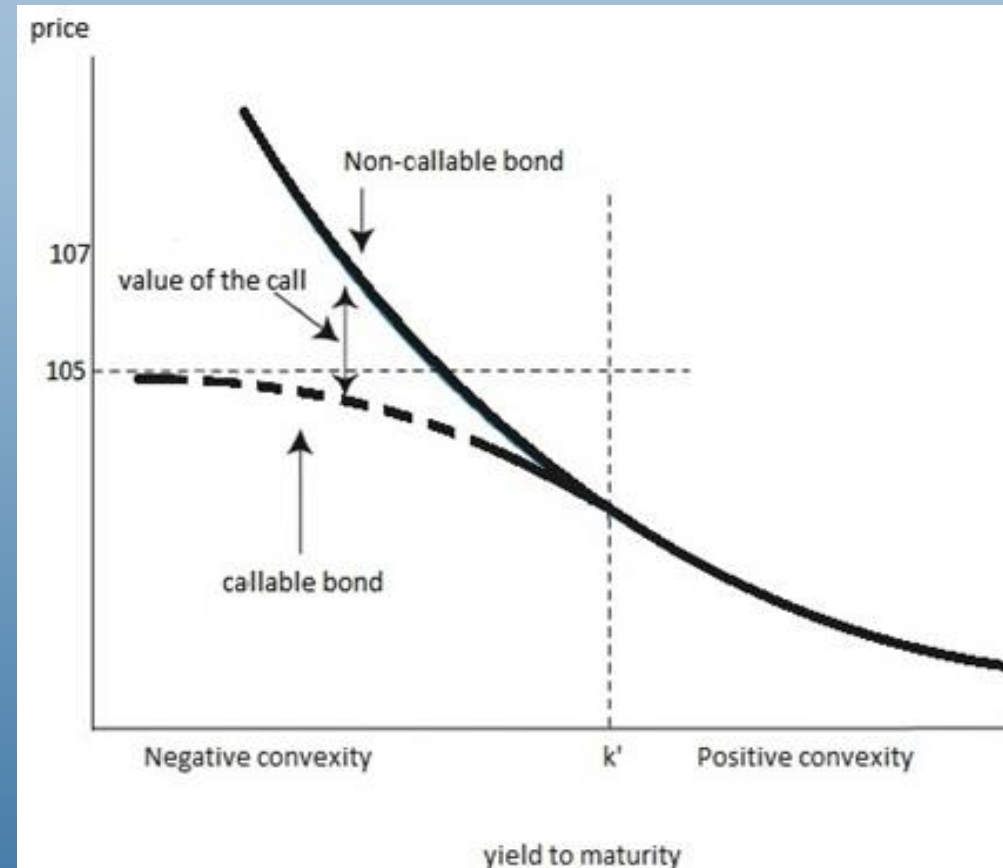


TYPES OF DURATION: Effective Duration

- Effective duration is a measure of the duration for bonds with embedded options (e.g., callable bonds).
- Unlike the modified duration and Macaulay duration, effective duration considers fluctuations in the bond's price movements relative to the changes in the bond's yield to maturity (YTM). In other words, the measure takes into account possible fluctuations in the expected cash flows of a bond.

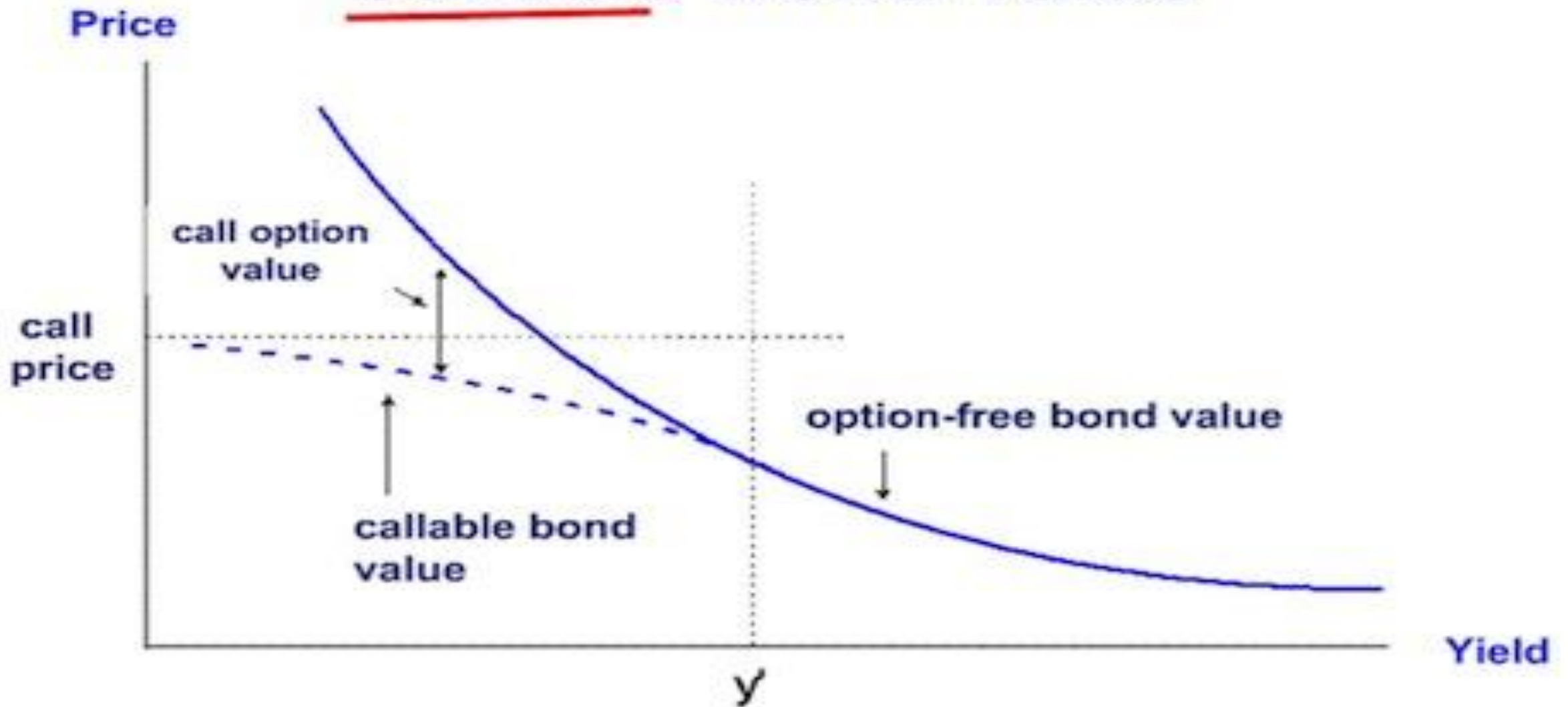
$$\text{Effective Duration} = \frac{V_{-\Delta y} - V_{+\Delta y}}{2 \times V_0 \times \Delta y}$$

- $V_{-\Delta y}$ - The bond's value if yield falls by $y\%$
- $V_{+\Delta y}$ - The bond's value if yield rises by $y\%$
- V_0 - The present value of all cash flows of the bond
- Δy - The yield change



IF RATES MOVE. BULLET VERSUS CALLABLE

Callable Bond Value

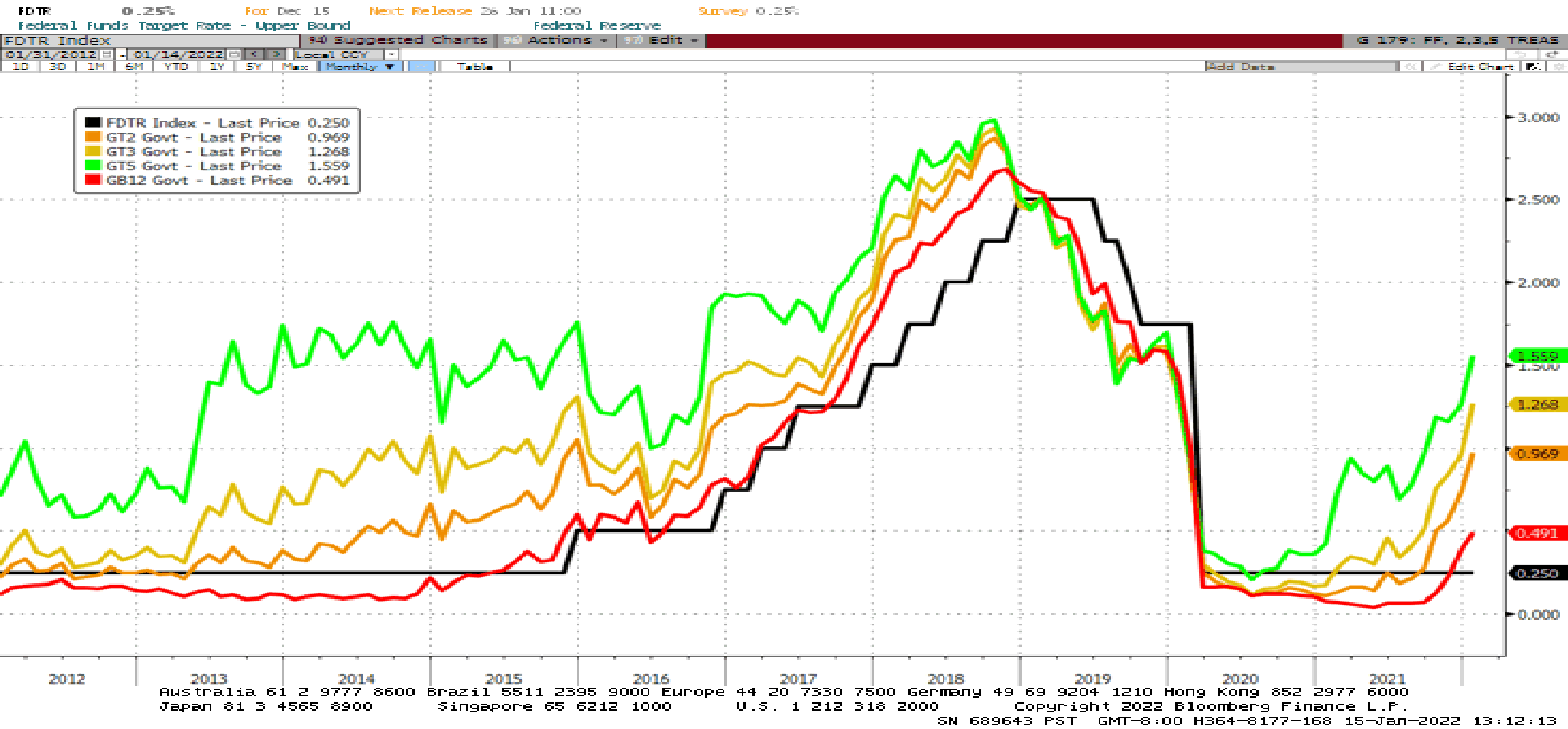


CHANGES IN MARKET VALUE AS INTEREST RATES SHIFT ON A CALLABLE (OPTION) SECURITY

- **5 YEAR, NON CALL 1 YEAR, QUARTERLY CALLABLE (BERMUDA CALL)**
- **FHLB 1.70% 1/27/2027, CALLABLE 1/27/23**
- **Purchase \$1,000,000.00 face at par (100.00)**
- **Negative Convexity**

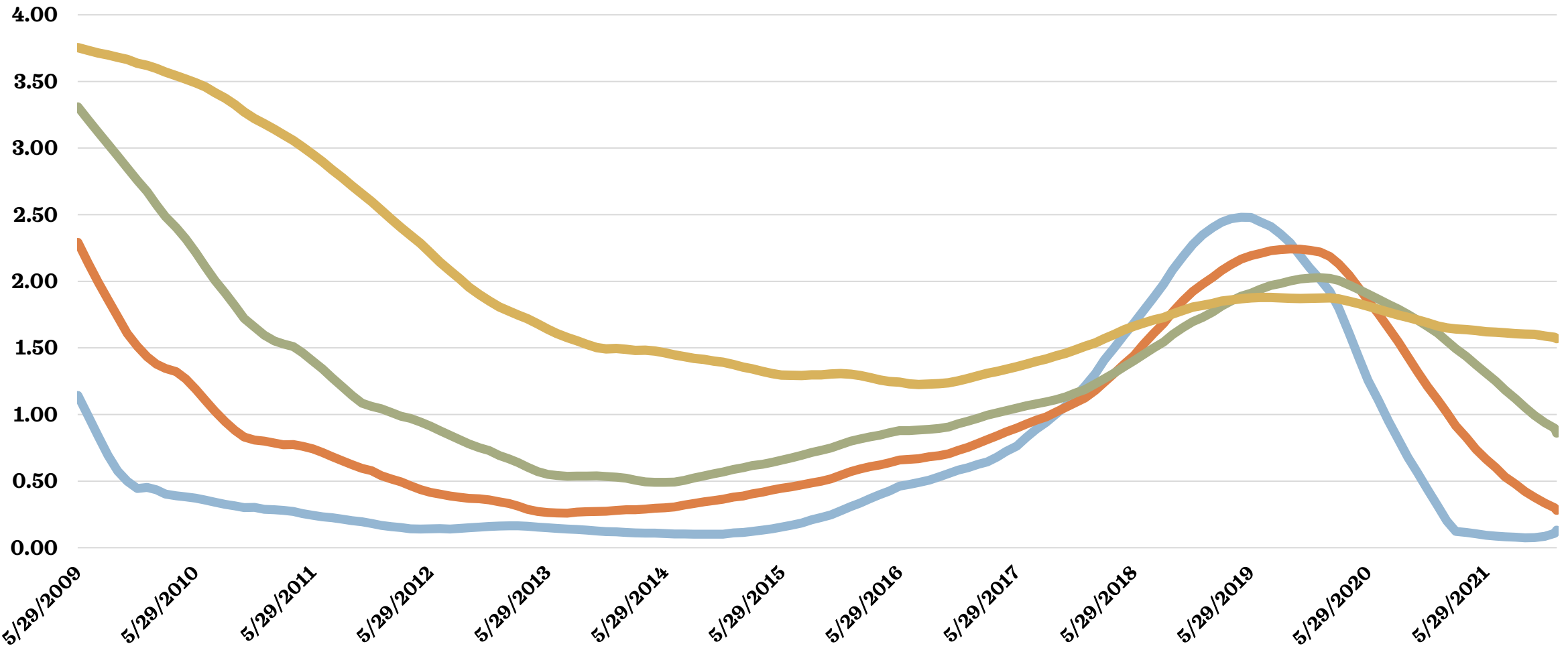
5YR NONCALL 1YR QTRLY CALL	Yield +/-	GAIN/LOSS	BPV
FHLB 1.70% 1/27/27 (1/27/23)	50	\$ (23,552.00)	\$ (471.04)
	-50	\$ 4,955.36	\$ 99.10

FED FUNDS, 1 YR BILL, 2, 3, 5 YEAR TREASURY NOTES



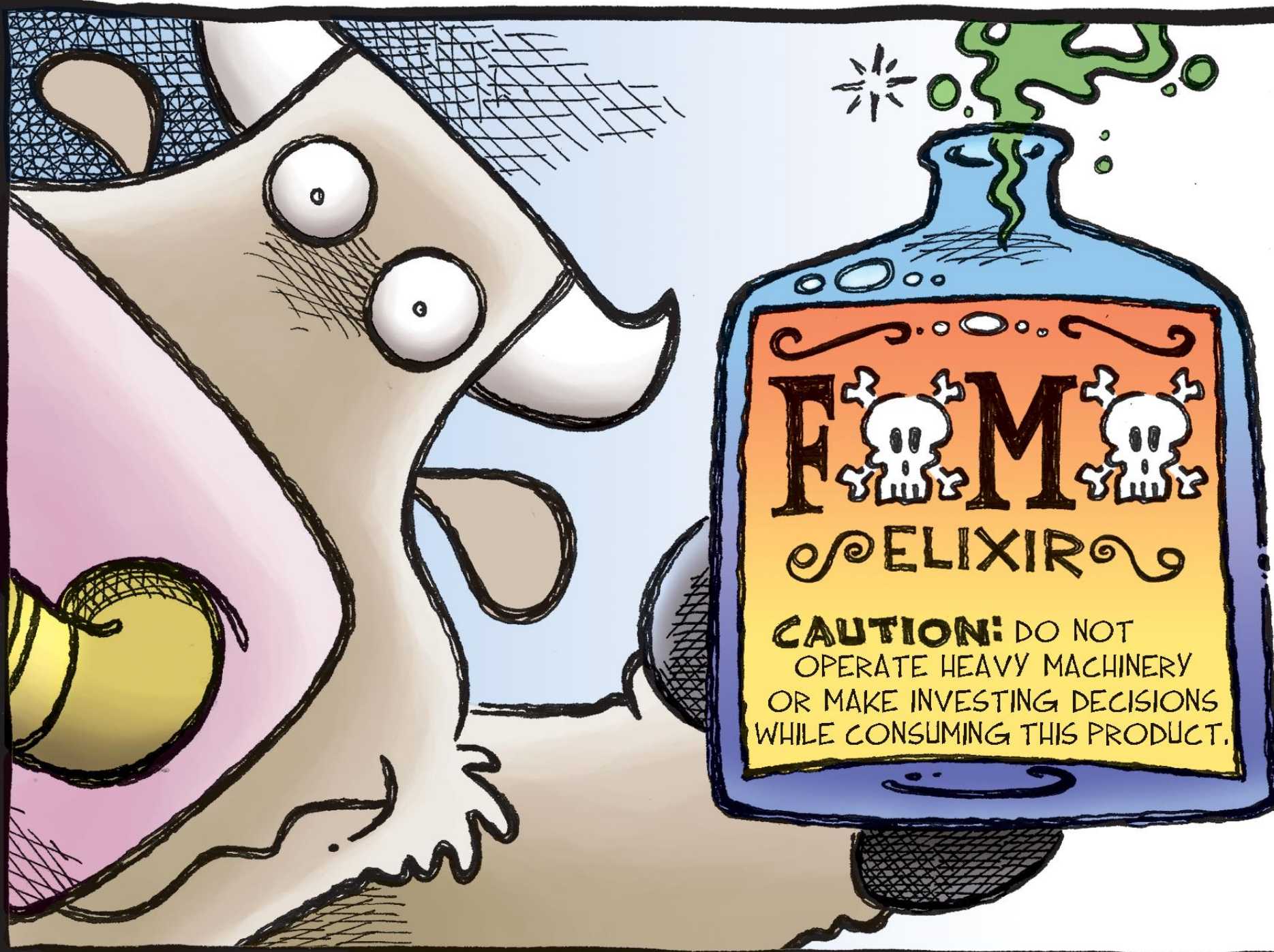
Yields over time comparing 1's, 2's, 3's, 5's

TREASURY MOVING AVERAGES FOR 1, 2, 3, 5 YR.



KEY TAKEAWAYS:

- **Stable duration over time will produce higher returns over time.**
- **Generally, a larger stable duration will outperform a lower duration over long time horizons.**
- **When explaining unrealized losses and or gains, the move up or down in portfolio market value is in direct proportion to changes in interest rates multiplied by the Duration and size of your portfolio.**
- **Unrealized losses should be celebrated with a laddered portfolio as you will be reinvesting in a higher rate environment thereby increasing the returns/cashflows over time.**
- **Opposite may be said for unrealized gains. As higher yielding bonds mature, they will be reinvested into a lower rate environment thereby reducing the returns/cashflows over time.**
- **Ever-changing interest rates introduce uncertainty in fixed-income investing. Duration and convexity let investors quantify this uncertainty, helping them manage their fixed-income portfolios.**



B. Kitch — HEDGE EYE

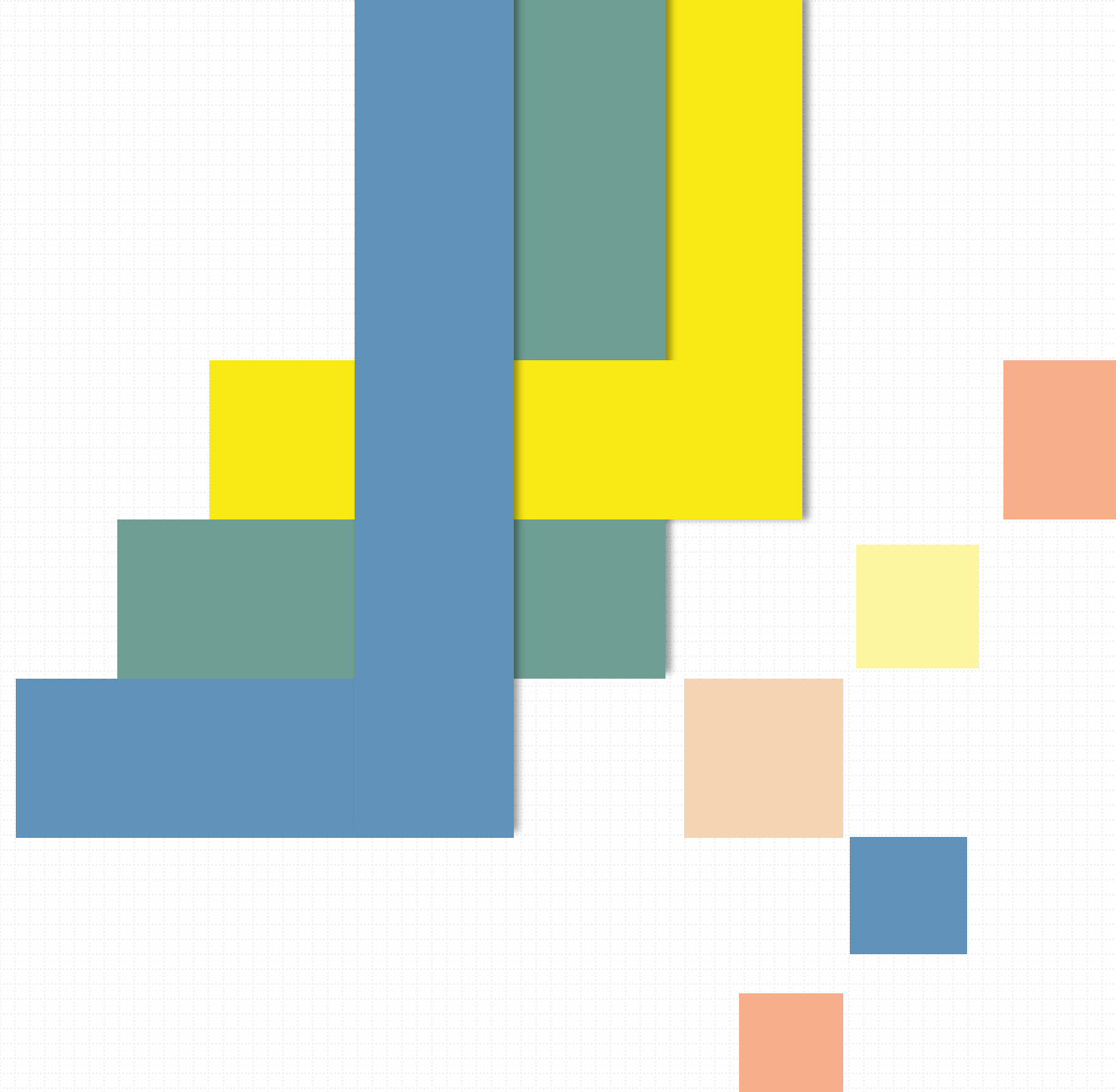
Hubert White, III, CFA, CTP



Chief Investment Officer
City and County of San Francisco



CMTA President





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.

The Importance of a Cash Forecast



Primary Objectives:

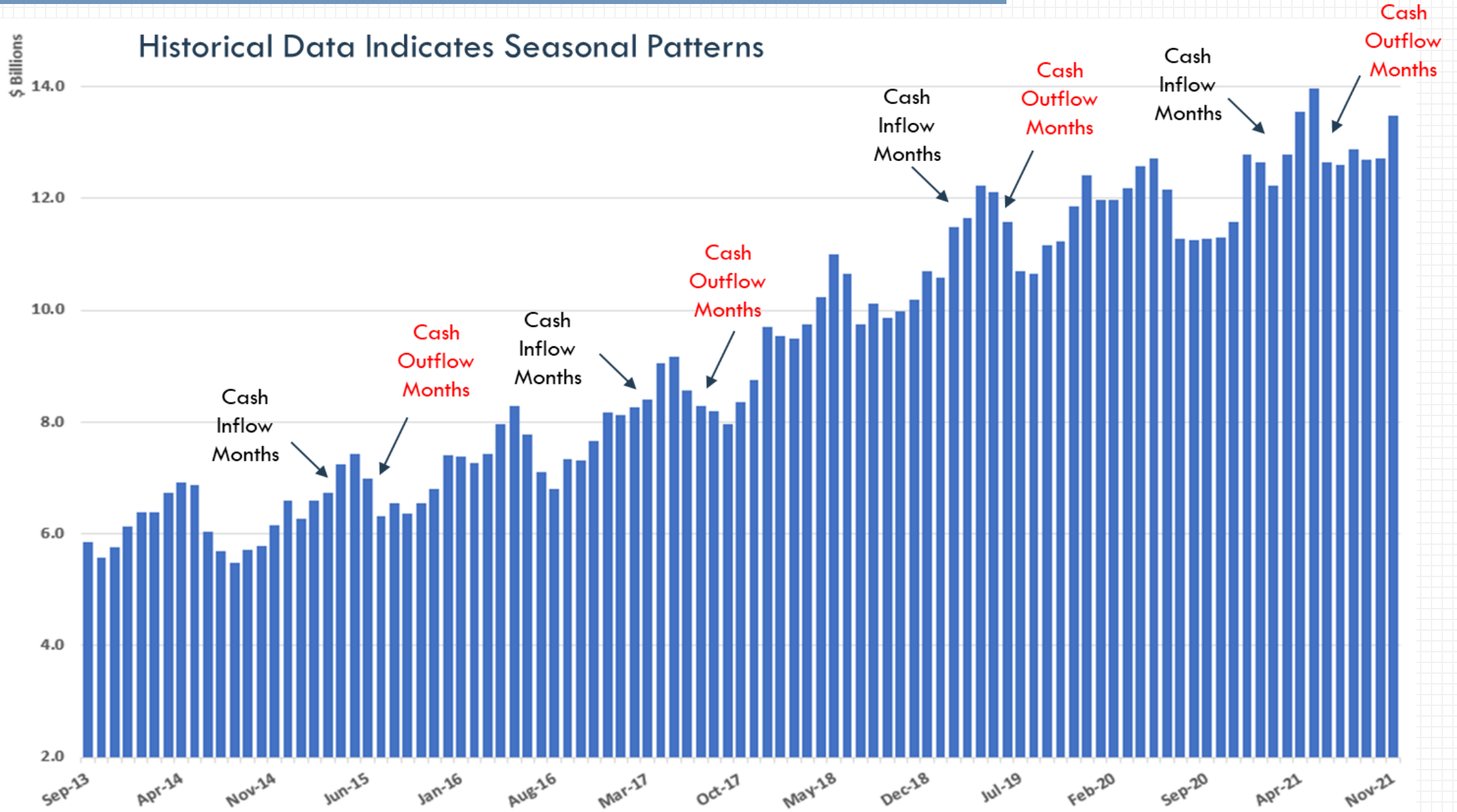
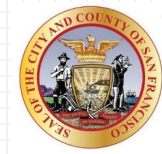
- **Liquidity Management** – having sufficient cash available to meet cash outflows. Matching an investment maturity to a known future cash disbursement immunizes the cash flow and reduces the liquidity risk in the portfolio. Theoretically, if all cash disbursements are matched to a portfolio security maturity, liquidity risk is mitigated.
- **Managing Costs** – cash forecasting can help minimize excess bank balances and increase portfolio returns. Idle cash creates cash drag on an investment portfolio. The impact of cash drag is not readily visible and can be difficult to quantify.

Higher degree of portfolio cashflow certainty can translate into longer portfolio average maturity and portfolio durations.

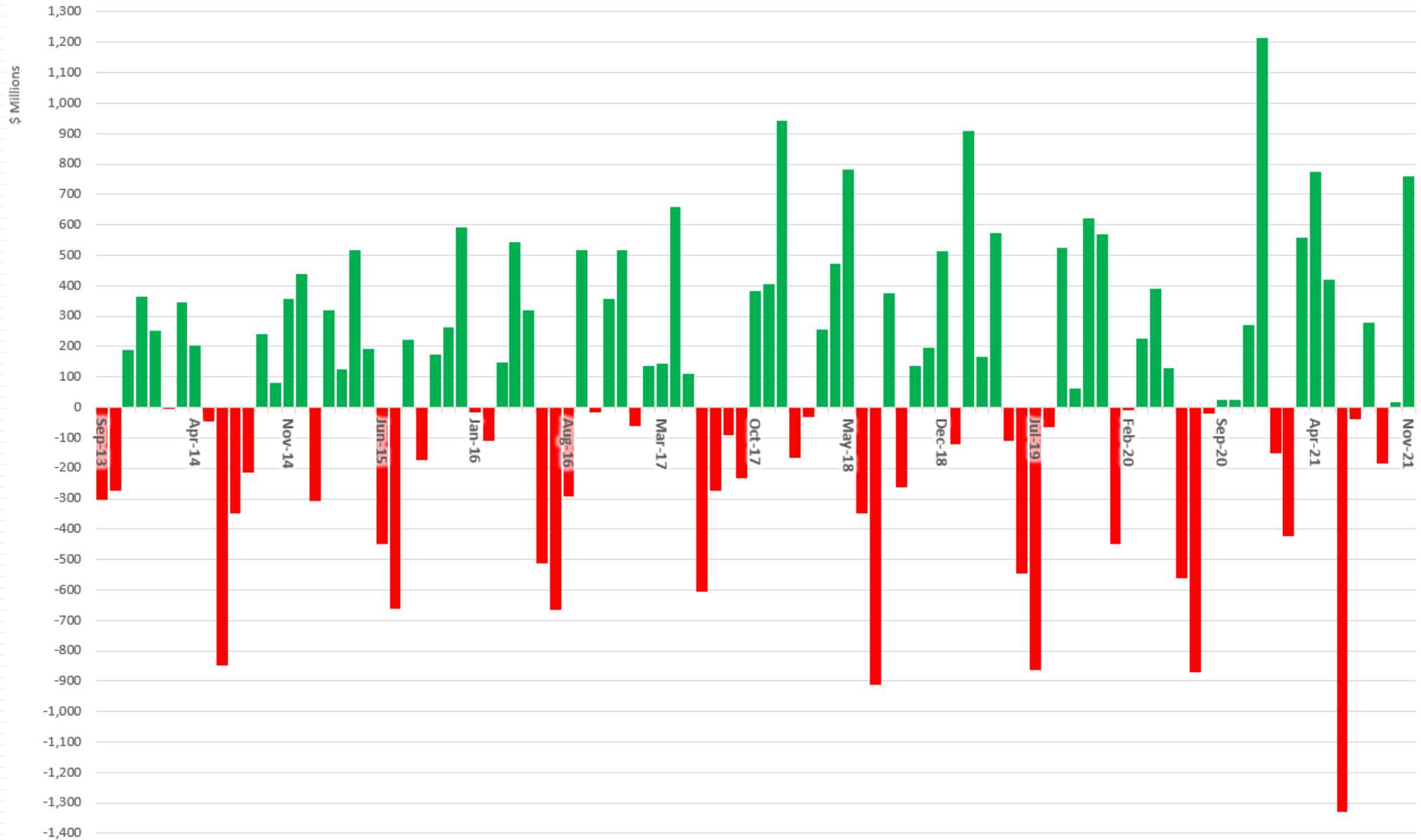
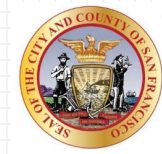
Developing a Cash Forecast – A Dynamic Process



- Examine historical data to identify seasonality/trends
- Gather information on future cash disbursements and cash receipts from the pool participants
- Use statistical extrapolation to predict a pattern of future cash flows (i.e. Moving Average, Exponential Smoothing)
- Create a model incorporating all cash disbursement, cash receipt, and portfolio information
- Update model as new information becomes available



CCSF Pooled Fund – Month to Month Portfolio Change



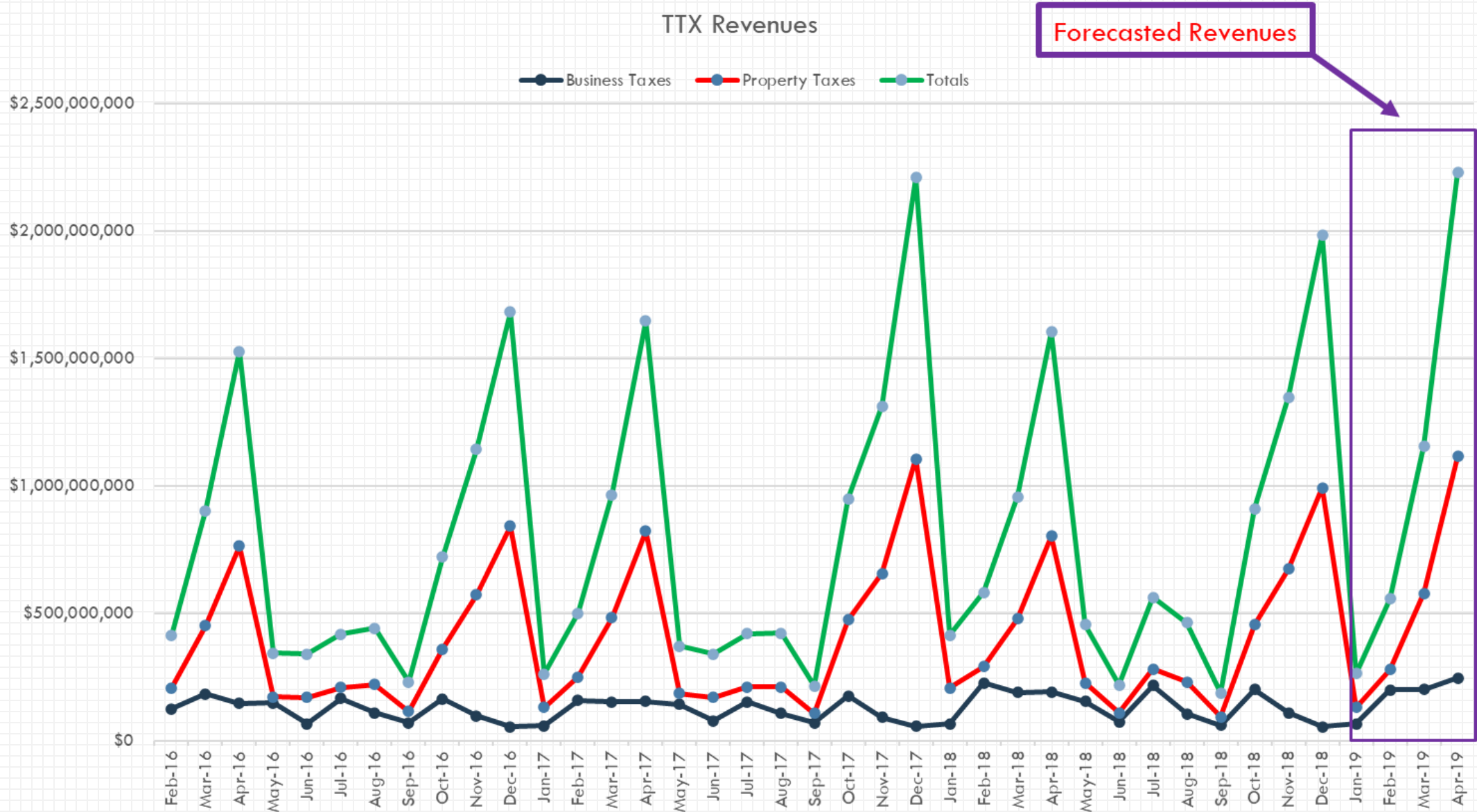
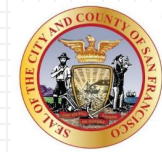
FORECASTING EXAMPLE – 6 Month Moving Average



	A	B	C	D	E	F	G	H	I	J	K
1		Property Taxes					De-seasonalized			2019 de-seasonalized	2019 re-seasonalized
2	Month	Year 2016	Year 2017	Year 2018	Month Average	Seasonal Index	Year 2016	Year 2017	Year 2018	Forecast (6m MA)	Forecast
3	January	\$72,684,698	\$139,888,490	\$65,241,751	\$92,604,980	0.33	\$217,338,964.10	\$418,289,136	\$195,083,352.73	\$288,332,167.98	\$96,426,964.40
4	February	\$81,977,743	\$92,863,543	\$65,760,714	\$80,200,667	0.29	\$283,039,417.64	\$320,624,137	\$227,047,897.55	\$281,920,764.79	\$81,653,743.48
5	March	\$267,360,052	\$329,046,467	\$288,168,178	\$294,858,232	1.06	\$251,080,047.74	\$309,010,273	\$270,621,131.87	\$278,030,423.02	\$296,057,886.83
6	April	\$616,335,031	\$668,966,963	\$611,342,351	\$632,214,782	2.28	\$269,948,643.88	\$293,000,909	\$267,761,899.45	\$283,860,044.29	\$648,096,936.82
7	May	\$23,785,049	\$43,021,205	\$72,753,363	\$46,519,872	0.17	\$141,577,578.30	\$256,078,431	\$433,055,443.65	\$284,344,747.79	\$47,769,949.45
8	June	\$104,112,396	\$92,182,589	\$35,551,934	\$77,282,306	0.28	\$373,036,484.95	\$330,291,784	\$127,383,183.96	\$282,874,609.96	\$78,948,721.10
9	July	\$43,886,114	\$56,998,552	\$65,426,587	\$55,437,084	0.20	\$219,207,641.39	\$284,703,224	\$326,800,587.10	\$283,227,126.31	\$56,703,032.22
10	August	\$110,823,880	\$103,742,309	\$124,653,628	\$113,073,272	0.41	\$271,395,306.87	\$254,053,330	\$305,262,815.41	\$282,376,286.03	\$115,307,946.91
11	September	\$44,495,383	\$37,857,479	\$34,060,728	\$38,804,530	0.14	\$317,512,966.00	\$270,145,791	\$243,052,695.41	\$282,452,206.23	\$39,582,065.75
12	October	\$196,593,074	\$299,028,192	\$253,284,692	\$249,635,319	0.90	\$218,067,590.89	\$331,692,038	\$280,951,823.32	\$283,189,170.10	\$255,301,712.86
13	November	\$473,153,696	\$563,487,381	\$565,361,004	\$534,000,694	1.93	\$245,351,862.36	\$292,194,015	\$293,165,574.76	\$283,077,357.74	\$545,906,180.52
14	December	\$786,574,456	\$1,048,391,130	\$936,780,115	\$923,915,234	3.34	\$235,741,831.81	\$314,210,109	\$280,759,511.87	\$282,866,126.06	\$943,809,028.35
15					\$276,903,818					\$288,332,167.98	
16										\$281,920,764.79	
17										\$278,030,423.02	
18										\$283,860,044.29	
19										\$284,344,747.79	
20										\$282,874,609.96	
21										\$283,227,126.31	
22										\$282,376,286.03	
23										\$282,452,206.23	
24										\$283,189,170.10	
25										\$283,077,357.74	
26										\$282,866,126.06	

Column E = Monthly Average of Years 2016,2017,2018
 Column F = Seasonal Index = Monthly AVG/E15
 Column I = 6 Month Moving Average
 Column K = Re-seasonalized Forecast = Seasonal Index * De-seasonalized Forecast

CCSF TTX Historic Revenues – Developing a Forecast



Developing a Forecast – Assuming Normal Cash Inflows

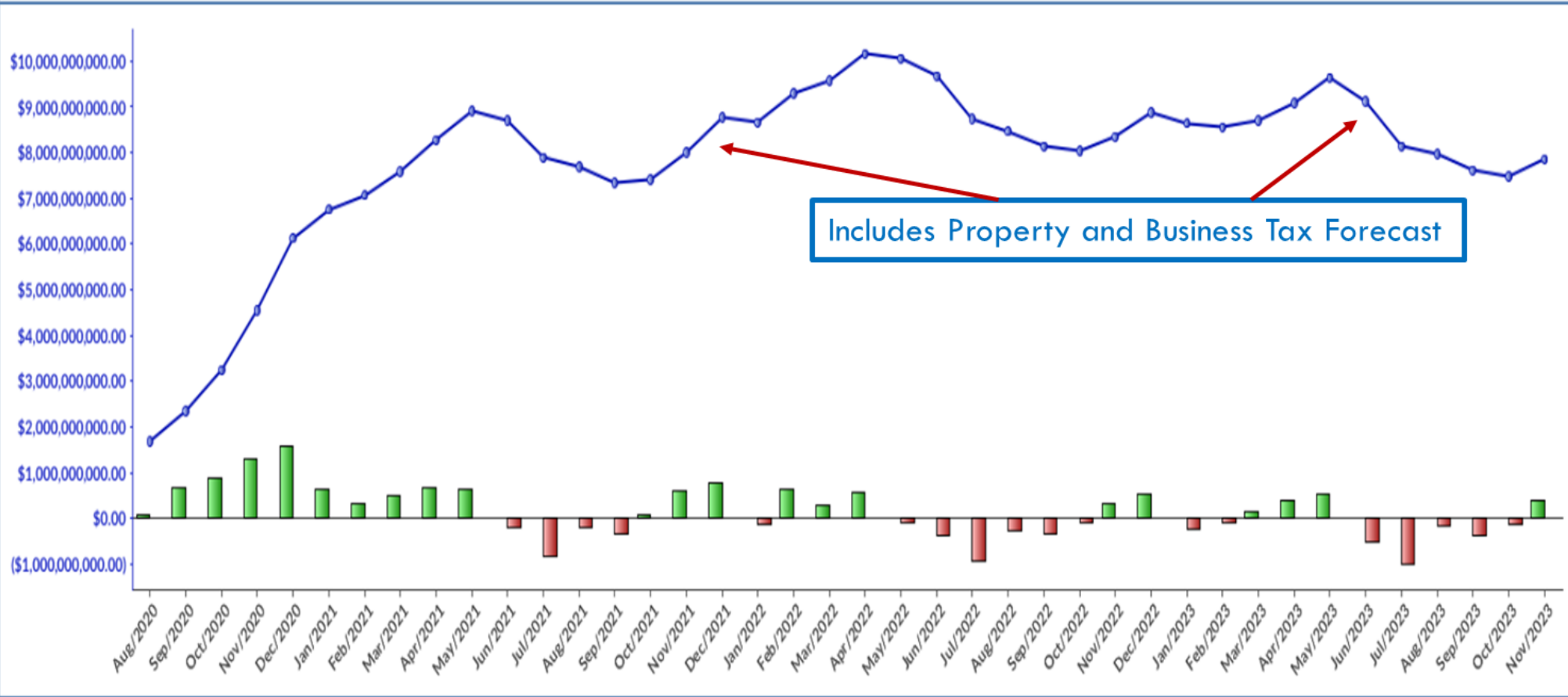


Total Cash Flow Graphed By Month

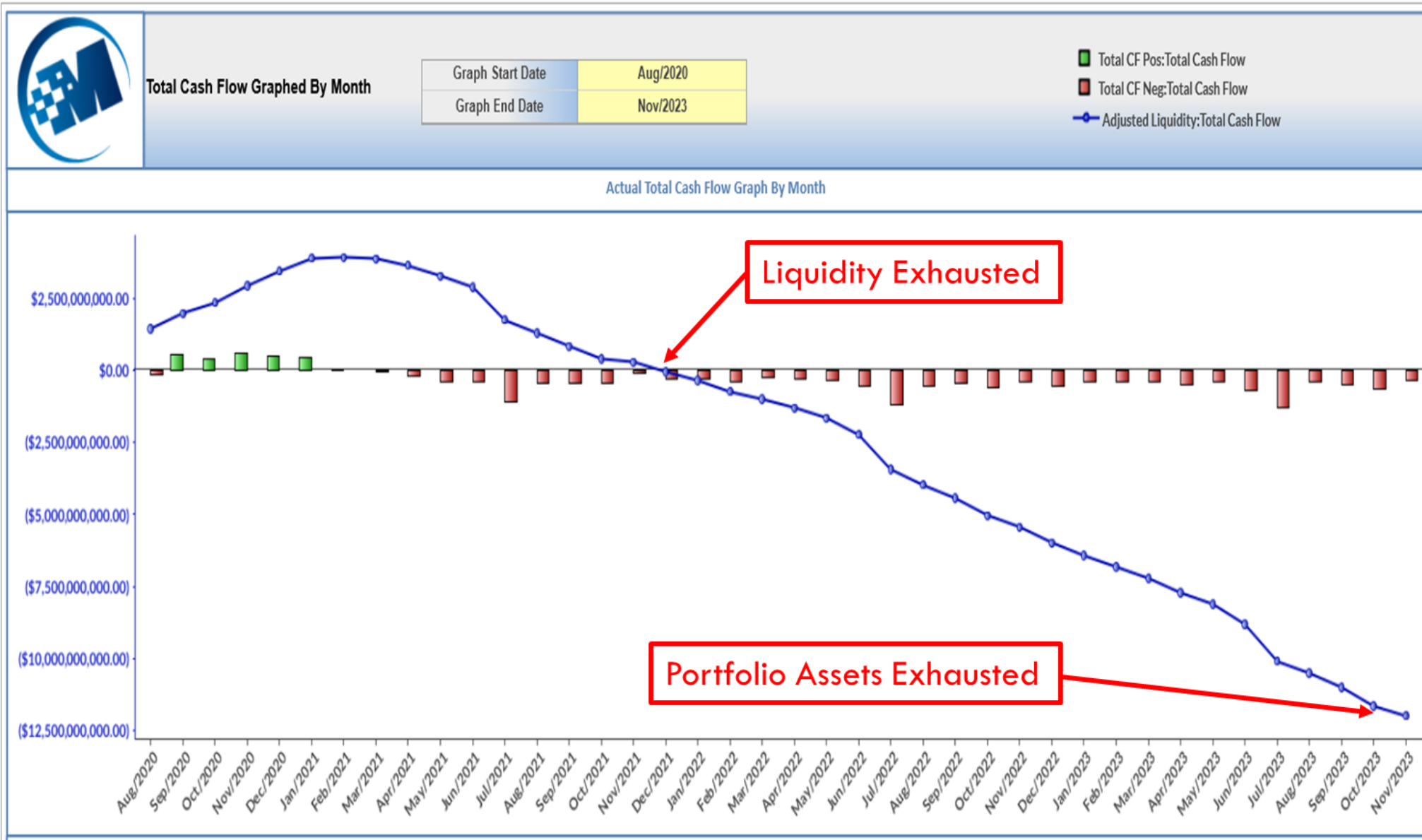
Graph Start Date	Aug/2020
Graph End Date	Nov/2023

- Total CF Pos: Total Cash Flow
- Total CF Neg: Total Cash Flow
- Adjusted Liquidity: Total Cash Flow

Actual Total Cash Flow Graph By Month



Developing a Forecast – Assuming Zero Cash Inflows



Assessing & Adjusting Portfolio Liquidity

Cash Forecast



Cash Balance	8/20/2020	\$29,418,942.41	MMKT Fund Limit	Money Market Balance	Overnight Target
ECA Target Balance		(\$30,000,000.00)	\$362,851,459.01	\$1,831,695,414.64	\$300,000,000.00
		(\$581,057.59)			

		USES	SOURCES	Daily Net Cash Flow	Cash Balance	Cash Balance + MMKT Funds	Spendable Cash
Friday, August 21, 2020	Payroll Taxes	(\$7,000,000.00)	\$0.00	(\$44,000,000.00)	(\$44,581,057.59)	\$1,787,114,357.05	\$1,487,114,357.05
	Kaiser Health Premium	(\$37,000,000.00)	\$0.00				
Saturday, August 22, 2020		\$0.00	\$0.00	\$0.00	(\$44,581,057.59)	\$1,787,114,357.05	\$1,487,114,357.05
Sunday, August 23, 2020		\$0.00	\$0.00	\$0.00	(\$44,581,057.59)	\$1,787,114,357.05	\$1,487,114,357.05
Monday, August 24, 2020	Maturity 313396D34	\$0.00	\$25,000,000.00	\$25,000,000.00	(\$19,581,057.59)	\$1,812,114,357.05	\$1,512,114,357.05
Tuesday, August 25, 2020	SFO Debt Service ACH	(\$50,000,000.00)	\$0.00	(\$10,178,076.33)	(\$29,759,133.92)	\$1,801,936,280.72	\$1,501,936,280.72
	Maturity 9127963Q0	\$0.00	\$50,000,000.00				
	Purchase 912796A82	(\$49,975,402.78)	\$0.00				
	ADM - Real Estate Debt Svc COP Ser 2015R1 081120	(\$5,202,673.55)	\$0.00				
	Maturity 62479LHR9	\$0.00	\$45,000,000.00				
Wednesday, August 26, 2020		\$0.00	\$0.00	\$0.00	(\$29,759,133.92)	\$1,801,936,280.72	\$1,501,936,280.72
Thursday, August 27, 2020	Maturity 912796XG9	\$0.00	\$100,000,000.00	\$100,000,000.00	\$70,240,866.08	\$1,901,936,280.72	\$1,601,936,280.72
Friday, August 28, 2020	Maturity 3130ABZE9	\$0.00	\$6,700,000.00	\$6,700,000.00	\$76,940,866.08	\$1,908,636,280.72	\$1,608,636,280.72
Saturday, August 29, 2020		\$0.00	\$0.00	\$0.00	\$76,940,866.08	\$1,908,636,280.72	\$1,608,636,280.72
Sunday, August 30, 2020		\$0.00	\$0.00	\$0.00	\$76,940,866.08	\$1,908,636,280.72	\$1,608,636,280.72
Monday, August 31, 2020	Payroll Transfer to US Bank	(\$86,000,000.00)	\$0.00	(\$167,238,238.00)	(\$90,297,371.92)	\$1,741,398,042.72	\$1,441,398,042.72
	SFO Capital Expense	(\$81,238,238.00)	\$0.00				
	Pension Payment received Northern Trust	\$0.00	\$102,000,000.00				
	Pension	(\$102,000,000.00)	\$0.00				
Tuesday, September 1, 2020	Maturity 9127963R8	\$0.00	\$50,000,000.00	\$50,000,000.00	(\$40,297,371.92)	\$1,791,398,042.72	\$1,491,398,042.72
Wednesday, September 2, 2020	Payroll Taxes	(\$36,000,000.00)	\$0.00	\$14,000,000.00	(\$26,297,371.92)	\$1,805,398,042.72	\$1,505,398,042.72
	Maturity 06367BAC3	\$0.00	\$50,000,000.00				
Thursday, September 3, 2020		\$0.00	\$0.00	\$0.00	(\$26,297,371.92)	\$1,805,398,042.72	\$1,505,398,042.72
Friday, September 4, 2020	Payroll Taxes	(\$7,000,000.00)	\$0.00	\$6,000,000.00	(\$20,297,371.92)	\$1,811,398,042.72	\$1,511,398,042.72
	Kaiser Health Premium	(\$37,000,000.00)	\$0.00				
	Maturity 459058GA5	\$0.00	\$50,000,000.00				
Saturday, September 5, 2020		\$0.00	\$0.00	\$0.00	(\$20,297,371.92)	\$1,811,398,042.72	\$1,511,398,042.72
Sunday, September 6, 2020		\$0.00	\$0.00	\$0.00	(\$20,297,371.92)	\$1,811,398,042.72	\$1,511,398,042.72
Monday, September 7, 2020		\$0.00	\$0.00	\$0.00	(\$20,297,371.92)	\$1,811,398,042.72	\$1,511,398,042.72
Tuesday, September 8, 2020	Maturity 91279463X5	\$0.00	\$50,000,000.00	\$50,000,000.00	\$29,702,628.08	\$1,861,398,042.72	\$1,561,398,042.72
Wednesday, September 9, 2020		\$0.00	\$0.00	\$0.00	\$29,702,628.08	\$1,861,398,042.72	\$1,561,398,042.72
Thursday, September 10, 2020	Maturity 912796TJ8	\$0.00	\$100,000,000.00	\$100,000,000.00	\$129,702,628.08	\$1,961,398,042.72	\$1,661,398,042.72
Friday, September 11, 2020		\$0.00	\$0.00	\$0.00	\$129,702,628.08	\$1,961,398,042.72	\$1,661,398,042.72

Assessing & Adjusting Portfolio Liquidity


CCSF Cash Flow Schedule By Day



Cash Flow Schedules By Day		CF Start Date	12/30/2021	Min Liquidity	(\$18,681,435,535.44)
Projected EOD Bank Balance	\$148,373,390.05	CF End Date	3/31/2027	Max Liquidity	\$1,991,465,014.58
EC Bank Balance Target	\$30,000,000.00	<input checked="" type="checkbox"/> Include MMKT Holdings <input checked="" type="checkbox"/> Include Target Liquidity		Avg Liquidity	(\$7,396,331,658.35)
Net Bank Balance Available	\$118,373,390.05			Portfolio MMKT Holdings	\$858,101,669.86
Portfolio MMKT Holdings	\$858,101,669.86	MMKT Holdings Immunized	\$27,293,840.00	Immun Max Liquidity	\$1,484,056,757.55
Intra-Day MMKT Transactions	(\$100,000,000.00)	Portfolio MMKT Actual	\$830,807,829.86	Immun Avg Liquidity	(\$7,300,724,231.56)
Target Liquidity	\$500,000,000.00	Intra-Day MMKT Transactions	(\$100,000,000.00)	Negative Net Outflow Filter Amount	(\$10,000,000.00)
Spendable Cash Non-Immunized	\$376,475,059.91	Target Liquidity	\$500,000,000.00	<input type="checkbox"/> Activate Filter	
		Spendable Cash Immunized	\$349,181,219.91		


Cash Flow By Day			Immunized Cash Flow By Day				
Date	Description	Total CF	Adjusted Liquidity	Date	Description	Total CF	Adjusted Liquidity
12/31/2021	Retiree Pension Payment	(\$102,000,000.00)		06/15/2022	CCSF Debt Service	(\$462,944,926.97)	
	SFO Projected Capital Expenditures	(\$27,293,840.00)			89233HFF6 : TOYCC 06/15/2022-47269	\$50,000,000.00	
	912828U81 : T 12/31/2021-46313	\$50,000,000.00			06417MTV7 : BNSHOU 06/15/2022-47220	\$100,000,000.00	
Total Cash Flow	(\$79,293,840.00)	\$297,181,219.91	89233HFE9 : TOYCC 06/14/2022-47181		\$50,000,000.00		
01/03/2022	Payroll Transfer to Bank	(\$95,000,000.00)			9128286Y1 : T 06/15/2022-47026	\$50,000,000.00	
	06367CCF2 : BMOCHG 01/03/2022-46957	\$50,000,000.00			9128286Y1 : T 06/15/2022-47004	\$50,000,000.00	
	Total Cash Flow	(\$45,000,000.00)	\$252,181,219.91		3133ELDK7 : FFCB 06/15/2022-46343	\$25,000,000.00	
01/05/2022	CCSF Payroll Tax 1	(\$36,000,000.00)			3133ELDK7 : FFCB 06/15/2022-46344	\$20,000,000.00	
	313313RK6 : FFCBDN 01/05/2022-46991	\$50,000,000.00			3133ELDK7 : FFCB 06/15/2022-46345	\$25,000,000.00	
	89114W3L7 : TDNY 01/05/2022-46956	\$50,000,000.00			3133EMF64 : FFCB 06/09/2022-47082	\$51,735,000.00	
Total Cash Flow	\$64,000,000.00	\$316,181,219.91	Total Cash Flow	(\$41,209,926.97)	\$1,442,846,830.58		
01/06/2022	Kaiser Health Premium	(\$37,000,000.00)		07/01/2022	Payroll Transfer to Bank	(\$95,000,000.00)	
	89114W3B9 : TDNY 01/06/2022-46952	\$60,000,000.00			SFERS Prepayment	(\$799,648,000.00)	
	Total Cash Flow	\$23,000,000.00	\$339,181,219.91		06367CQB6 : BMOCHG 07/01/2022-47266	\$50,000,000.00	
01/07/2022	CCSF Payroll Tax 2	(\$7,000,000.00)			89114WMZ5 : TDNY 06/30/2022-47253	\$50,000,000.00	
	Total Cash Flow	(\$7,000,000.00)	\$332,181,219.91		89233HFW9 : TOYCC 06/30/2022-47195	\$50,000,000.00	
	Payroll Transfer to Bank	(\$95,000,000.00)			06417MTY1 : BNSHOU 06/30/2022-47234	\$100,000,000.00	
01/14/2022	89114W2B0 : TDNY 01/14/2022-46931	\$100,000,000.00			78012UX42 : RY 06/30/2022-47192	\$50,000,000.00	
	Total Cash Flow	\$5,000,000.00	\$337,181,219.91		89233HFW9 : TOYCC 06/30/2022-47177	\$50,000,000.00	
	3133ELTN4 : FFCB 01/18/2022-46470	\$63,450,000.00			89114WJ89 : TDNY 07/01/2022-47178	\$50,000,000.00	
01/18/2022	3133ELTN4 : FFCB 01/18/2022-46449	\$50,000,000.00			89233HG16 : TOYCC 07/01/2022-47215	\$50,000,000.00	
	Total Cash Flow	\$113,450,000.00	\$450,631,219.91	912828ZX1 : T 06/30/2022-47019	\$50,000,000.00		
	CCSF Payroll Tax 1	(\$36,000,000.00)		912828ZX1 : T 06/30/2022-47015	\$50,000,000.00		
01/19/2022	Total Cash Flow	(\$36,000,000.00)	\$414,631,219.91	912828ZX1 : T 06/30/2022-47016	\$50,000,000.00		
	OCII Debt Service	(\$103,175,170.11)		912828ZX1 : T 06/30/2022-47005	\$50,000,000.00		
	06367CCQ8 : BMOCHG 01/20/2022-46964	\$50,000,000.00		912828ZX1 : T 06/30/2022-46992	\$50,000,000.00		
01/20/2022	89114W3W3 : TDNY 01/20/2022-46965	\$50,000,000.00		912828ZX1 : T 06/30/2022-46975	\$50,000,000.00		
	Total Cash Flow	(\$3,175,170.11)	\$411,456,049.80	912828XW5 : T 06/30/2022-44480	\$25,000,000.00		



 MAXQ Analytics POWERED BY QUANTRIX		Flow Selection Type							
		Maximum Maturity (Yrs)		5.00					
Historical Net Cash Flow by Year	2018	2019	2020	2021	Projected Net Cash Flows by Year	Worst Outflow	Average Outflow	User Outflow	
January		(\$119,847,491.40)	(\$448,647,971.30)	(\$152,567,793.13)	1	March	\$166,976,210.50	\$316,465,206.63	\$150,278,589.45
February		\$910,110,179.79	(\$7,539,007.66)	(\$424,131,996.20)		April	\$391,223,723.90	\$578,260,789.47	\$352,101,351.51
March		\$166,976,210.50	\$224,362,201.75	\$558,057,207.64		May	(\$111,065,990.48)	\$146,531,369.96	(\$122,172,589.53)
April		\$570,906,221.80	\$391,223,723.90	\$772,652,422.72		June	(\$1,328,609,209.83)	(\$811,616,924.06)	(\$1,461,470,130.81)
May		(\$111,065,990.48)	\$130,361,300.30	\$420,298,800.07		July	(\$911,426,445.57)	(\$881,149,210.02)	(\$2,500,000,000.00)
June		(\$546,499,906.34)	(\$559,741,656.00)	(\$1,328,609,209.83)		August	(\$63,582,107.76)	\$96,827,717.48	(\$69,940,318.54)
July	(\$911,426,445.57)	(\$862,520,286.80)	(\$869,500,897.70)			September	(\$522,496,417.17)	(\$253,747,720.17)	(\$574,746,058.89)
August	\$374,384,411.50	(\$63,582,107.76)	(\$20,319,151.31)			October	\$25,990,625.74	\$74,334,602.58	\$23,391,563.17
September	(\$263,481,773.40)	(\$522,496,417.17)	\$24,735,030.05			November	\$195,046,766.40	\$362,380,785.13	\$175,542,089.76
October	\$135,044,456.10	\$61,968,725.89	\$25,990,625.74			December	\$512,557,441.20	\$766,068,935.87	\$461,301,697.08
November	\$195,046,766.40	\$622,070,035.10	\$270,025,553.90			January	(\$448,647,971.30)	(\$240,354,418.61)	(\$493,512,768.43)
December	\$512,557,441.20	\$570,284,228.30	\$1,215,365,138.10			February	(\$424,131,996.20)	\$159,479,725.31	(\$466,545,195.82)
					March	\$166,976,210.50	\$316,465,206.63	\$150,278,589.45	
					April	\$391,223,723.90	\$578,260,789.47	\$352,101,351.51	
					May	(\$111,065,990.48)	\$146,531,369.96	(\$122,172,589.53)	
					June	(\$1,328,609,209.83)	(\$811,616,924.06)	(\$1,461,470,130.81)	
					July	(\$911,426,445.57)	(\$881,149,210.02)	(\$2,500,000,000.00)	

Determining An Optimal Portfolio Duration Model





Duration Optimization

Choose cashflow projection

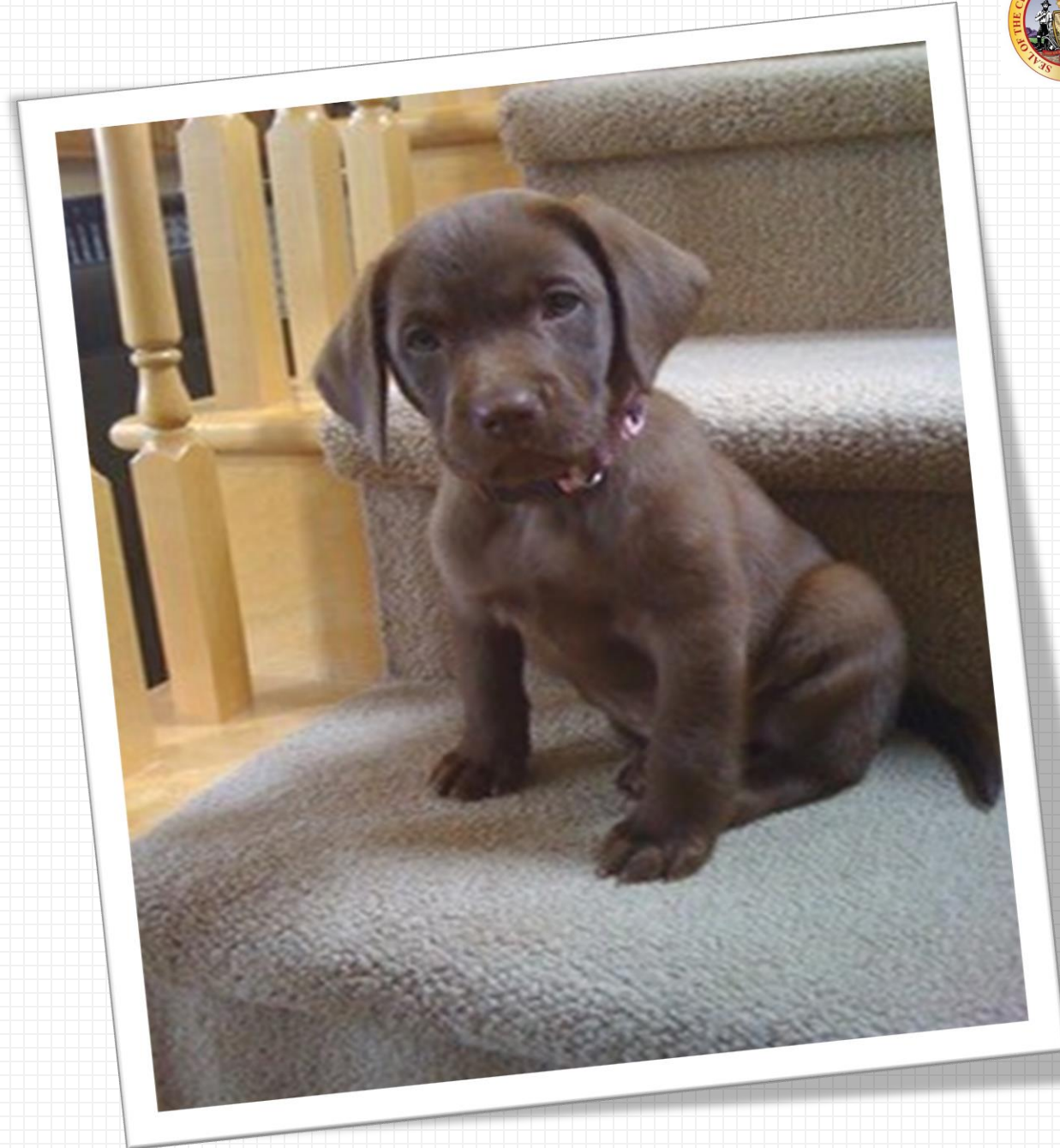
Calculated duration

Assign immunization weights

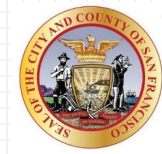
Duration Optimization Values by Year			Duration Estimation and Allocation Bucket Approximation				INDEX DATES	
1	Sum Present Value of Outflows	\$3,807,939,262.12	Portfolio Size	\$12,755,002,422.00	3Mo Tsy	0.237	Start Date	6/30/20
	Sum of Asset Matched Present Values	\$3,807,939,262.12	Immunized Portfolio	\$12,755,106,724.29	6Mo Tsy	0.486	End Date	6/30/21
	Asset Matched Weight in Portfolio	29.854%	Percent Immunized	100.00%	9Mo Tsy	0.740	Outflow Selection	
	Annualized Duration	0.531	Starting Liquidity	\$522,955,099.30	1.00Yr Tsy	0.993	OutFlow Selection	Worst Outflow
	Weighted Duration	0.158	1Yr Min Liquidity	\$522,955,099.30	1.25Yr Tsy	1.237	Maximum Maturity (Yrs)	5.00
			Weighted Average Cash Flow Duration	2.08	1.50Yr Tsy	1.480	Immunization Weight	
2	Sum Present Value of Outflows	\$3,801,872,344.72	Cash (Liquidity Profile)	4.10%	1.75Yr Tsy	1.724	Year 1	100.00%
	Sum of Asset Matched Present Values	\$2,471,217,024.07	0-1Yr	29.85%	2.00Yr Tsy	1.967	Year 2	65.00%
	Asset Matched Weight in Portfolio	19.374%	1-3Yr	35.72%	2.25Yr Tsy	2.212	Year 3	55.00%
	Annual Total Liquidity Coverage Required	\$1,330,655,320.65	3-5Yr	30.33%	2.50Yr Tsy	2.457	Year 4	54.20%
	Annualized Duration	1.531			2.75Yr Tsy	2.702	Year 5	49.00%
	Weighted Duration	0.297			3.00Yr Tsy	2.947		
				3.25Yr Tsy	3.196			

Assessing & Adjusting
Portfolio Liquidity

Mental & Visual Break



Short-Term Fixed
Income Market
Liquidity Options



Repurchase
Agreements

Money Market
Funds

US Treasury
Bills

Federal
Agency
Discount Notes

Commercial
Paper

Certificates of
Deposit /
Yankee CDs

Repurchase Agreements



- Secured loan with collateral for a specified term and an agreed upon rate
- Counterparty is usually a bank or a broker-dealer
- Rate is based on the counterparty, the term of the repo, and the collateral backing it
- Deliverable versus Tri-Party
- Customizable to fit investor needs
- Illiquid, no secondary market



SIFMA (Securities Industry and Financial Markets Association) –
www.sifma.org

Master Repurchase Agreement (MRA)

Last updated September 1, 1996

An agreement for use when parties may enter into transactions in which one party (a “Seller”) agrees to transfer to the other (a “Buyer”) securities or other assets against the transfer of funds by the Buyer, with a simultaneous agreement by the Buyer to transfer to the Seller such securities at a date certain or on demand, against the transfer of funds by the Seller.



Master Repurchase Agreement

September 1996 Version

Dated as of _____

Between: _____

and _____

1. Applicability

From time to time the parties hereto may enter into transactions in which one party ("Seller") agrees to transfer to the other ("Buyer") securities or other assets ("Securities") against the transfer of funds by Buyer, with a simultaneous agreement by Buyer to transfer to Seller such Securities at a date certain or on demand, against the transfer of funds by Seller. Each such transaction shall be referred to herein as a "Transaction" and, unless otherwise agreed in writing, shall be governed by this Agreement, including any supplemental terms or conditions contained in Annex I hereto and in any other annexes identified herein or therein as applicable hereunder.

Custodial Undertaking – Tri-Party Repo



**CUSTODIAL UNDERTAKING IN CONNECTION
WITH MASTER REPURCHASE AGREEMENT**

BY AND AMONG

CITY AND COUNTY OF SAN FRANCISCO

(Buyer)

AND

RBC CAPITAL MARKETS, LLC

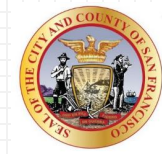
(Seller)

AND

THE BANK OF NEW YORK MELLON

(Custodian)

BONY Custodial Undertaking Schedule I



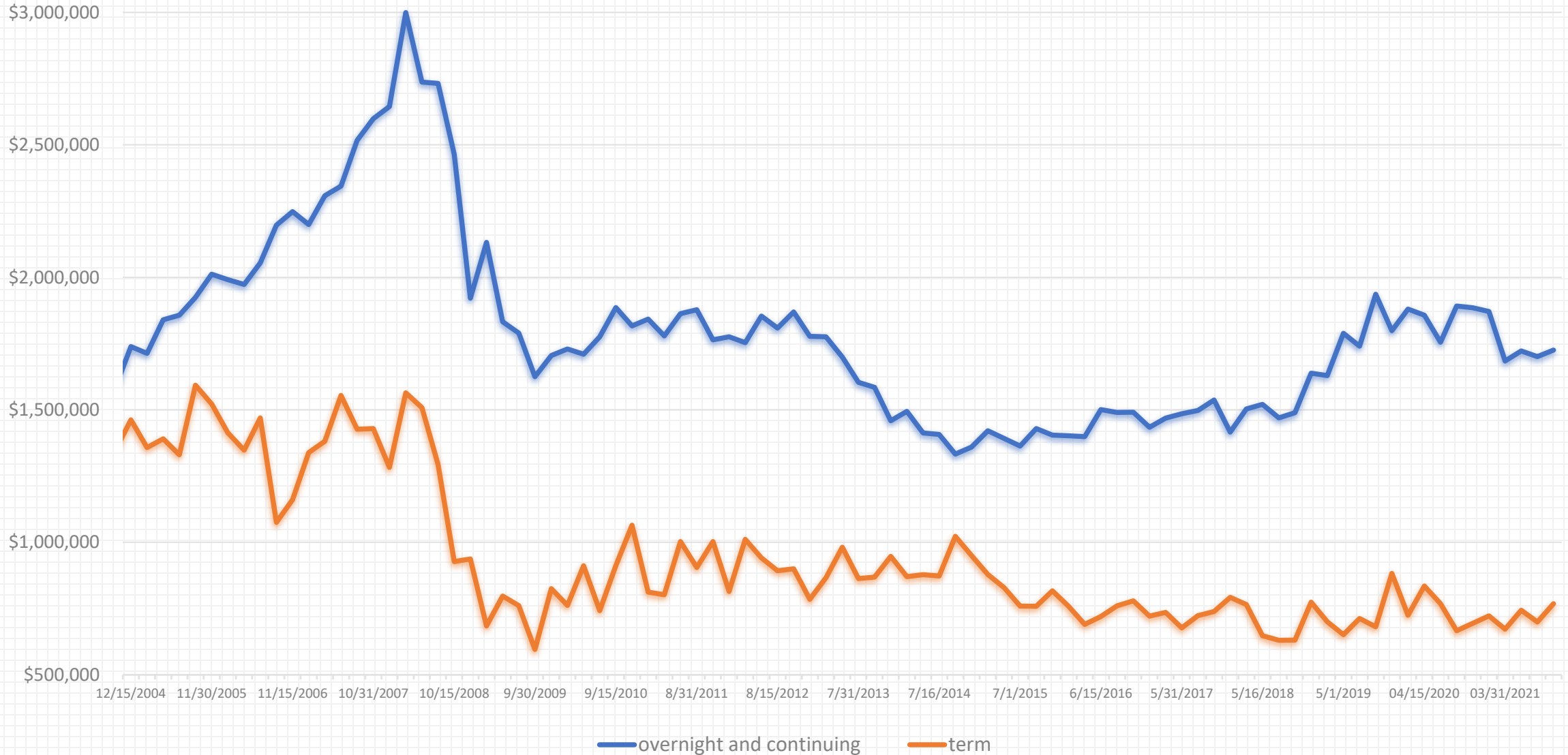
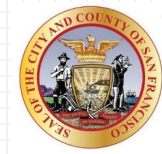
Custodial Undertaking in Connection with Master Repurchase Agreement dated as of [Date], among [Counterparty] ("Buyer"), Royal Bank of Canada ("Seller") and The Bank of New York Mellon.								
	Yes/No	Margin		Yes/No	Margin		Yes/No	Margin
U.S. TREASURIES			GNMA			PRIVATE LABELS CMOS		
BILLS	Yes	100%	TRUST RECEIPTS	Yes	102%	≥BBB-,Baa3,BBB-	No	
BONDS	Yes	100%	GNMA I/II-SINGLE FAMILY	Yes	102%	≤BB+,Ba1,BB+	No	
NOTES	Yes	100%	GNMA I/II-OTHERS-FIXED RATE	Yes	102%	CMO TYPES:		
STRIPS	Yes	100%	GNMA I/II OTHERS-ADJUST. RATE	Yes	102%	RESIDUALS	No	
SYNTHETIC TREASURIES	No					INVERSE IO FLOATERS	No	
			AGENCY MORTGAGE BACKS			IOETTES	No	
AGENCY DEBENTURES			TRUST RECEIPTS	Yes	102%	INTEREST ONLY (IO)	No	
FAMC (Fed Agriculture Mtge Corp)	Yes	102%	PASS THROUGH-FIXED RATE	Yes	102%	PRINCIPAL ONLY (PO)	No	
FCFAC (Farm Credit Finan. Asst.)	Yes	102%	PASS THROUGH-ADJUST. RATE	Yes	102%	INVERSE FLOATERS	No	
FFCB (Farm Credit System Banks)	Yes	102%	MBS STRIPS (IO,PO,RECOMB)	Yes	102%	SUPER FLOATERS	No	
FmHA (Farmers Home Admin.)	Yes	102%				COMPANION FLOATERS	No	
FHLB (Federal Home Loan Banks)	Yes	102%	AGENCY REMICS/CMOS			SEQUENTIAL AND OTHER FLOATERS	No	
FHLMC (Federal Home Loan Mtge)	Yes	102%	REMIC TYPES:			PAC & OTHER SCHEDULED FLOATERS	No	
FICO (Financing Corporation)	Yes	102%	RESIDUALS	Yes	102%	Z BONDS	No	
FLBB (Federal Land Bank Bonds)	Yes	102%	INVERSE IO FLOATERS	Yes	102%	COMPANION BONDS	No	
FNMA (Federal Nat'l Mtge Corp)	Yes	102%	IOETTES	Yes	102%	SEQUENTIAL BONDS	No	
REFCO (Resolution Funding Corp)	Yes	102%	INTEREST ONLY (IO)	Yes	102%	TAC BONDS	No	
SLMA (Student Loan Mtge Corp)	Yes	102%	PRINCIPAL ONLY (PO)	Yes	102%	PAC & OTHER SCHEDULED BONDS	No	
TVA (Tennessee Valley Authority)	Yes	102%	INVERSE FLOATERS	Yes	102%			
USPS (U.S. States Postal Service)	Yes	102%	SUPER FLOATERS	Yes	102%	ASSET BACKED SECURITIES		
AGENCY STRUCTURED NOTES	Yes	102%	COMPANION FLOATERS	Yes	102%	ASSET BACKED SECURITIES (≥BBB-,Baa3,BBB-)	No	
			SEQUENTIAL AND OTHER FLOATERS	Yes	102%	ASSET BACKED SECURITIES (≤BB+,Ba1,BB+)	No	
INTERNATIONAL AGENCIES			PAC & OTHER SCHEDULED FLOATERS	Yes	102%			
ADDB (Asian Development Bank)	No		Z BONDS	Yes	102%	CORPORATES		
AFDB (African Development Bank)	No		COMPANION BONDS	Yes	102%	CORPORATE BOND (≥BBB-,Baa3,BBB-)	No	105%
IADB (Inter-American Dev. Bank)	No		SEQUENTIAL BONDS	Yes	102%	CORPORATE BOND (≤BB+,Ba1,BB+)	No	108%
IFCO (International Finance Corp)	No		TAC BONDS	Yes	102%	MEDIUM-TERM NOTE (≥BBB-,Baa3,BBB-)	No	
WLDB (World Bank)	No		PAC & OTHER SCHEDULED BONDS	Yes	102%	MEDIUM-TERM NOTE (≤BB+,Ba1,BB+)	No	
FDIC Guaranteed Debt under TLGP	No		MUNICIPAL BOND			MONEY MARKETS		
GTC (Government Trust Certificate)	No		MUNICIPAL BONDS (≥BBB-,Baa3,BBB-)	No	105%	COMMERCIAL PAPER (≥A1/P1/F1)	No	
SBA (Small Business Administration)	No		MUNICIPAL BONDS (≤BB+,Ba1,BB+)	No		COMMERCIAL PAPER (≤A2/P2/F2)	No	
SVRN (Sovereign Debt)	No					BANKERS ACCEPTANCE	No	
CASH	Yes	100%				CD (DOMESTIC & EURO)	No	
						BANK NOTES	No	

BUYER ACKNOWLEDGES AND AGREES THAT IF A CLASS OF SECURITY CONTAINS NEW ISSUES OF SECURITIES, SUCH NEW ISSUES OF SECURITIES SHALL BE DEEMED TO BE ELIGIBLE SECURITIES.

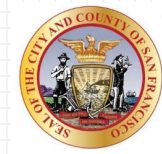
[BUYER] [COUNTERPARTY]	[SELLER] ROYAL BANK OF CANADA	ACCEPTED: THE BANK OF NEW YORK MELLON
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By:	By:	By:
Title:	Title:	Title:

Repurchase Agreement Outstanding Balances



Money Market Funds - Overview



- Per CA Government code, a money market fund must either attain the highest ranking by not less than two NRSROs or retain an investment advisor registered or exempt from registration with the SEC with not less than 5 years experience managing money market mutual funds with AUM in excess of \$500 million.
- US Treasury and Government Money Market Funds can use amortized investment accounting and trade at a stable NAV of \$1.00

Money Market Funds – Overview (continued)



- Institutional Prime Money Market Funds have floating NAVs, can be subject to liquidity fees and redemption gates
- Provide same day liquidity
- Transactions can be executed over the telephone, online, or on a portal
- Increased transparency into holdings/risk exposures
- Prospectus/Statement of Additional Information
- Different Share Classes/Expense Ratios
- Pays monthly interest

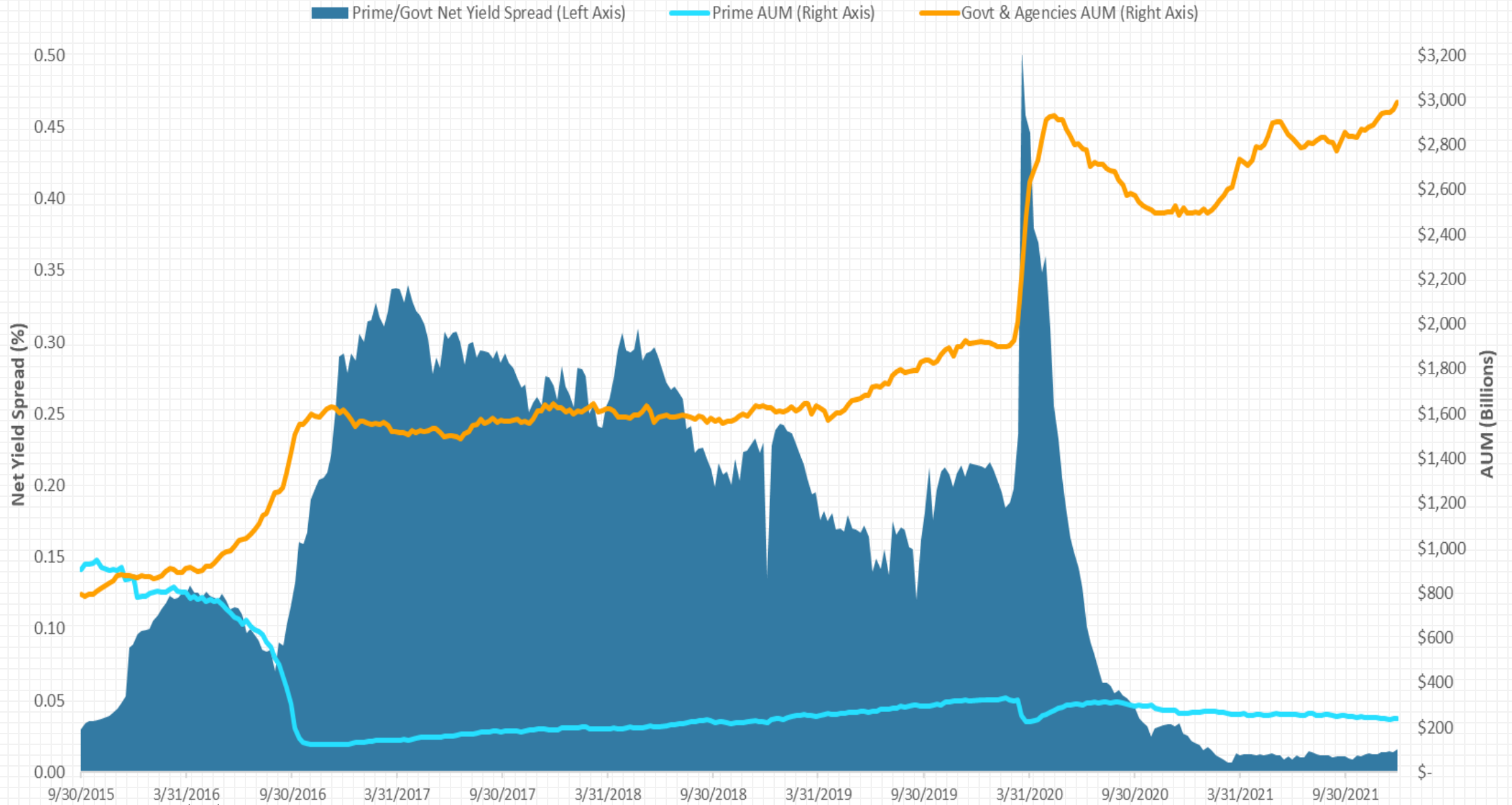
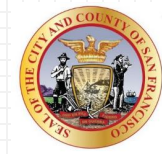
- Offers same day liquidity with some funds offering intra-day liquidity
- Most funds have multiple NAV strike times (4 decimals) with as many three times a day
- Subject to gates and fees
- Due diligence – monitoring daily and weekly liquidity, % of fund held, and fund composition (i.e. country exposure, asset allocation)



Fund Type	Net Asset Value (NAV)	Liquidity Fee	Redemption Gate
U.S. Treasury	Stable	No	No
Government	Stable	No	No
Retail Municipal/Tax-Exempt	Stable	Yes	Yes
Retail Prime/General Purpose	Stable	Yes	Yes
Institutional Municipal/Tax-Exempt	Floating	Yes	Yes
Institutional Prime/General Purpose	Floating	Yes	Yes

MMF Reform	Final Rule	Compliance Date*
Floating NAV	Applicable funds will price and transact at a net asset value per share that can change or “float,” based on pricing the underlying fund holdings out to four decimal places (\$1.0000)	October 14, 2016
Liquidity Fee	If a fund’s weekly liquid assets were to fall below 30%, fund’s board may impose a 2% fee on redemptions If a fund’s weekly liquid assets were to fall below 10%, redemptions will be subject to a 1% fee, unless the fund’s board determines otherwise	October 14, 2016
Redemption Gate	If a fund’s weekly liquid assets were to fall below 30%, fund’s board may suspend redemptions for up to 10 days	October 14, 2016
Retail Fund Definition	Retail funds limit shareholders to beneficial ownership by “natural persons” (individuals) Institutional funds are open to any shareholders, including individuals, small businesses, and large corporations	October 14, 2016

Money Market Funds – Institutional Prime vs. Government

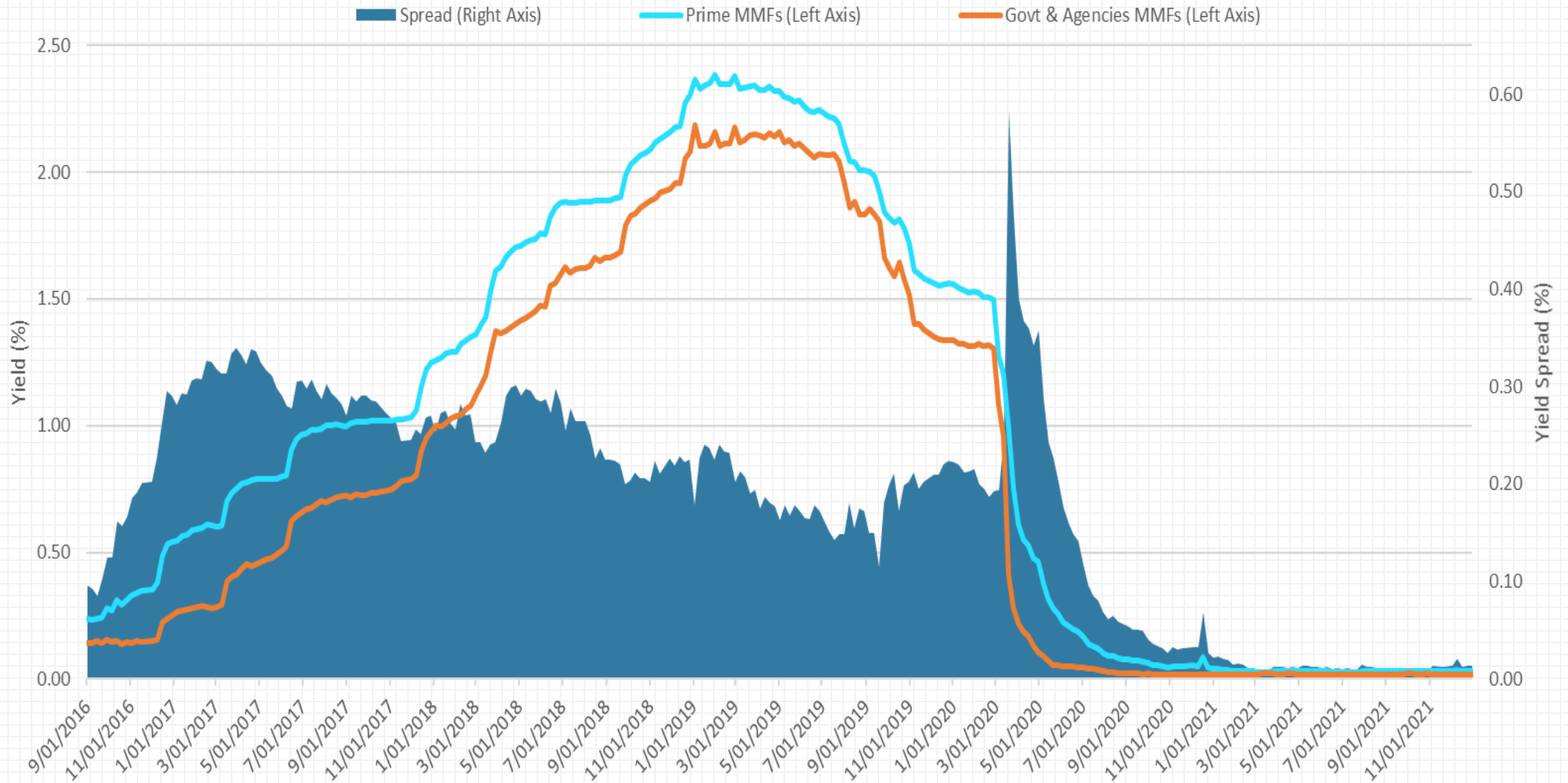


Source: iMoneyNet as of 12/31/2021

Money Market Funds – Institutional Prime vs. Government Yield Spread Difference



Yield Spread as of December 31, 2021



US Treasury Bills - Overview

- Issued for terms of 4, 8, 13, 26 and 52 weeks. Cash management bills are periodically issued for short periods
- Bills, except cash management bills, are auctioned on a regular schedule – 4, 8, 13, & 26 week bills auctioned every week, 52 week bill every 4 weeks
- Bids are submitted as either competitive or noncompetitive
- Sold at a discount rate, Act/360 basis

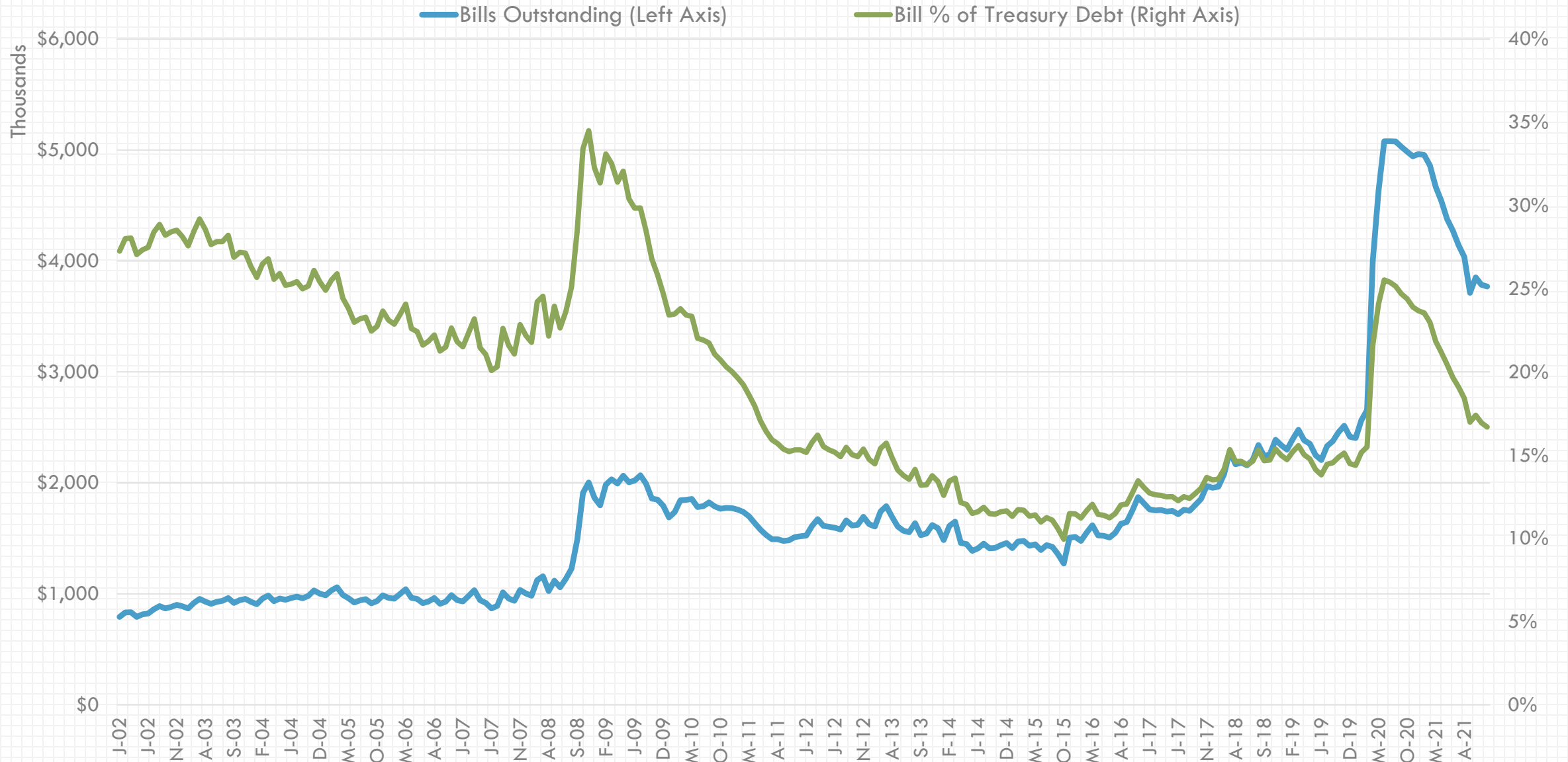
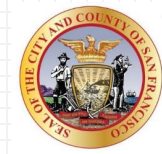
US Treasury Bills – Credit & Liquidity



- Guaranteed by the full faith and credit of the United States
- Highly liquid
- Bid/ask spread very tight – at or less than 1 basis point
- www.treasurydirect.gov

Assessing & Adjusting Portfolio Liquidity

US Treasury Bills – Amount Outstanding



Federal Agency Discount Notes - Overview



- US Dollar-denominated unsecured general obligation with a maturity less than 365 days
- Federal Farm Credit Bank (FFCB), Federal Home Loan Banks (FHLB), Federal Home Loan Mortgage Corp (FHLMC), Federal National Mortgage Association (FNMA), Federal Agricultural Mortgage Corp (FAMCA), Tennessee Valley Authority (TVA), International Bank for Reconstruction and Development (IBRD), International Finance Corporation (IFC), Inter-American Development Bank (IADB)
- Not a mortgage-backed security – no collateral backing issuance
- Quoted on a discount basis/Act/360 (same as T-Bills)
- In the market daily with date flexibility
- Open for reverse inquiry

Federal Agency Discount Notes – Credit & Liquidity



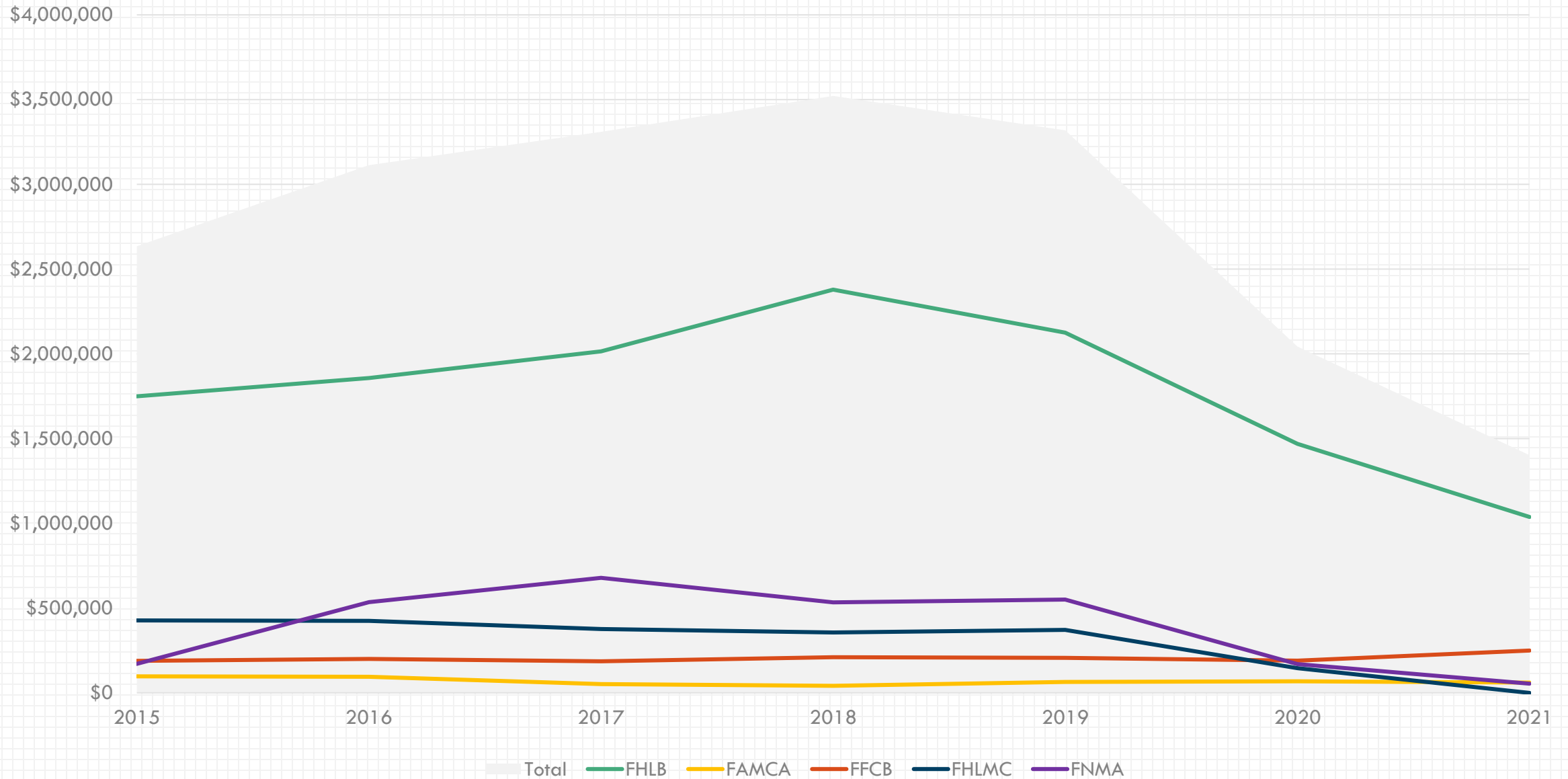
- High degree of safety – Very low degree of default risk
- High degree of liquidity
- Bid/ask spread usually very tight – 0.5 to 2 bps



	Farm Credit	Federal Home Loan Banks	Freddie Mac	World Bank
Mission	Fund U.S. agriculture and rural communities	Provide liquidity to financial institutions to support housing and community development	Support liquidity and stability of U.S. mortgage markets	Provide global development project financing and expertise that improve living standards in member countries
Credit Ratings	Aaa / AAA / AA+ Moody's / Fitch / S&P	Aaa / AA+ Moody's / S&P	Aaa / AAA / AA+ Moody's / Fitch / S&P	Aaa / AAA Moody's / S&P
Link to Government	GSE – Government charter	GSE - Government charter and \$4 Billion US Treasury credit facility	GSE - Government Sponsored Enterprise	Government ownership (188 member governments. US largest member with 17% ownership)
Regulator	Farm Credit Administration (FCA)	Federal Housing Finance Agency (FHFA)	Federal Housing Finance Agency (FHFA)	Collective Governance System framework established by the Bretton Woods Agreements Act (22 U.S.C. §286 designating the IBRD under United States law)
Total Assets YE 2015	\$303 Billion	\$969 Billion	\$2 Trillion	\$343 Billion
Capital Requirement	7% Perm. Capital Ratio 7% Total Surplus Ratio 3.5% Core Surplus Ratio	4% Capital-to-Assets	Subject to Senior Preferred Stock Purchase Agreement (\$141 Billion available from Treasury)	N/A
Capital Ratio YE 2015	16% Capital-to-Assets	5.1% Capital-to-Assets	N/A	25.1% Equity-to-Loans
Debt Outstanding YE2015	\$243 Billion	\$905 Billion	\$418 Billion	\$ 168 Billion
Debt Issued YE 2015	DNs = \$190 Billion Bullets = \$24 Billion Callables= \$37 Billion Floaters = \$49 Billion	DNs = \$2 Trillion Bullets = \$140 Billion Callables = \$55 Billion Floaters = \$89 Billion Structured Notes = \$20 Billion	DNs = \$428 Billion Callables = \$127 Billion FRNs = \$24 Billion Bullets = \$6 Billion Reference Notes = \$12 Billion STACRs = \$7 Billion	DNs = \$15 Billion Bullets = \$17 Billion Callables= \$3 Billion Floaters = \$355 Million
Market Access	DNs - daily (window) Bullets/Callables/Floaters - daily auctions/negotiated Designated Bonds - Syndicate	DNs – daily (window) and twice weekly auctions Benchmark Bullets – syndicate/auctions TAPS and Callables daily auctions Bullets/Callables/Floaters/Structured Notes – daily negotiated	DNs - daily (window) and weekly auctions Callables, Floaters, Bullets - daily negotiated Reference Notes - Syndicate/ Auctions (dates pre-determined) STACRs - Syndicate	DNs - daily (window) Benchmark Bullets - syndicate Bullets/Callables/Floaters/Structured Notes – daily negotiated
Contact	Regina Gill rgill@farmcreditfunding.com	Denise de Bombelles debombelles@fhfb-of.com	debt_securities@freddiemac.com	Investor Relations debtsecurities@worldbank.org
Website	www.farmcreditfunding.com	www.fhfb-of.com	www.freddiemac.com	www.worldbank.org/debtsecurities

Assessing & Adjusting Portfolio Liquidity

Federal Issuance – Discount Notes



Commercial Paper - Overview

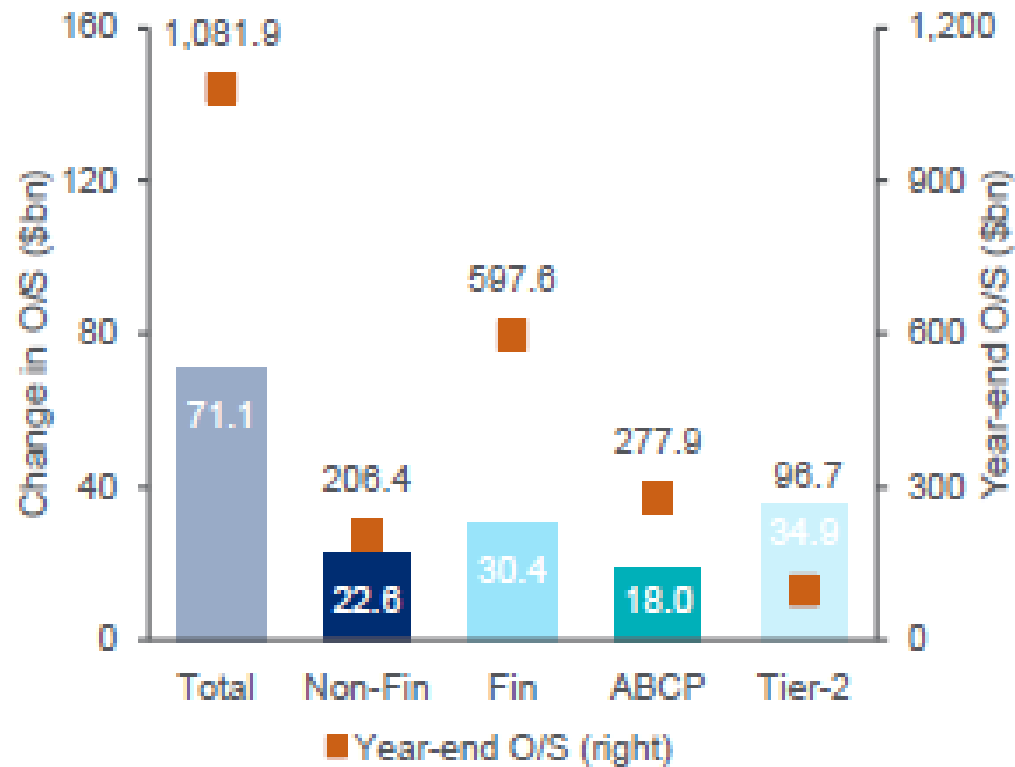


- Short-term unsecured promissory note
- Issuing corporation must be organized and operating in the US, have assets in excess of \$500 million, and debt other than CP rated “A”
- Asset backed commercial paper must be organized as a special purpose corporation, trust, or LLC within the US, have program wide credit enhancements, and has CP rated “A-1” or higher by a NRSRO
- Maturities range from 1 day to a max of 270 days
- Minimum ratings must be the highest letter and number by an NRSRO
- Sold both at a discount or as interest bearing
- Offered direct or through a broker/dealer
- 3(a)3 versus 4(2) 144a
- Issued direct or by Authorized Program Dealers



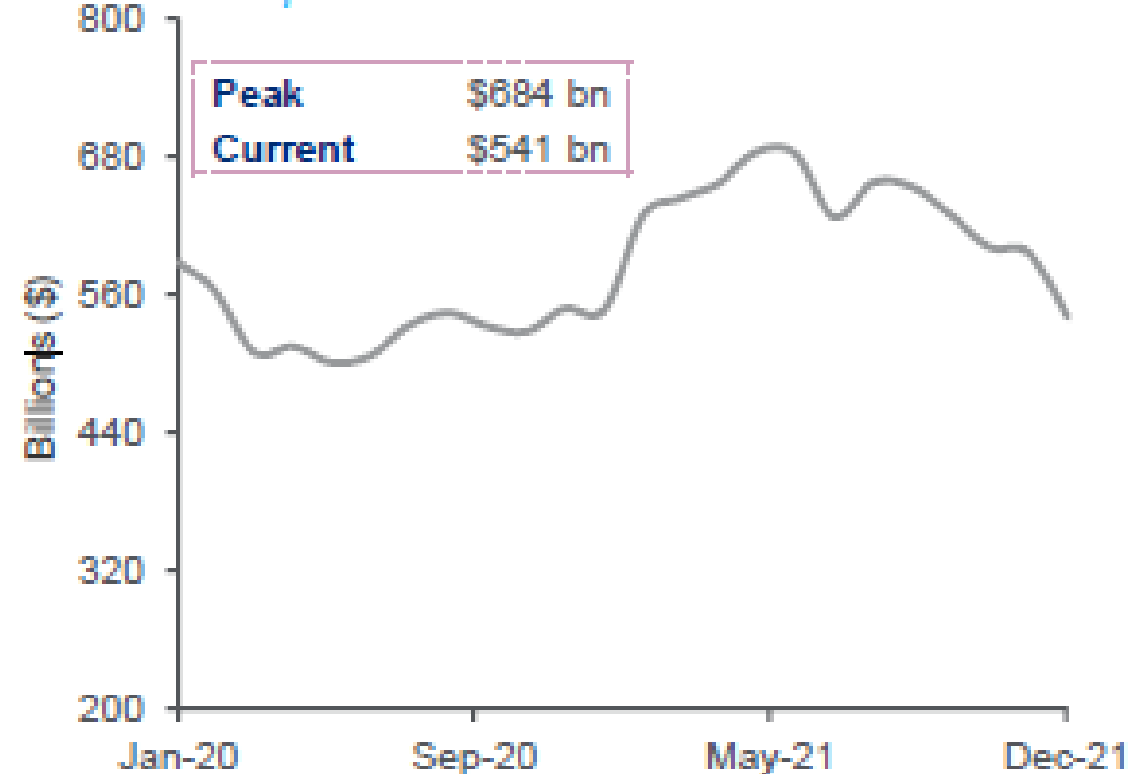
USCP Outstandings

All sectors of the USCP market increased in outstandings during 2021 while intra-year peaks represented even more impressive growth by sector.



Financial USCP Outstandings

Financial CP outstandings grew sharply following the Covid pandemic. Much of the growth was driven by banks borrowing in short-dates and placing the proceeds on deposit with the Fed to earn IORB.

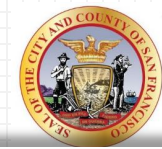


Assessing & Adjusting
Portfolio Liquidity
Negotiable Certificates
of Deposit / Yankee
CDs



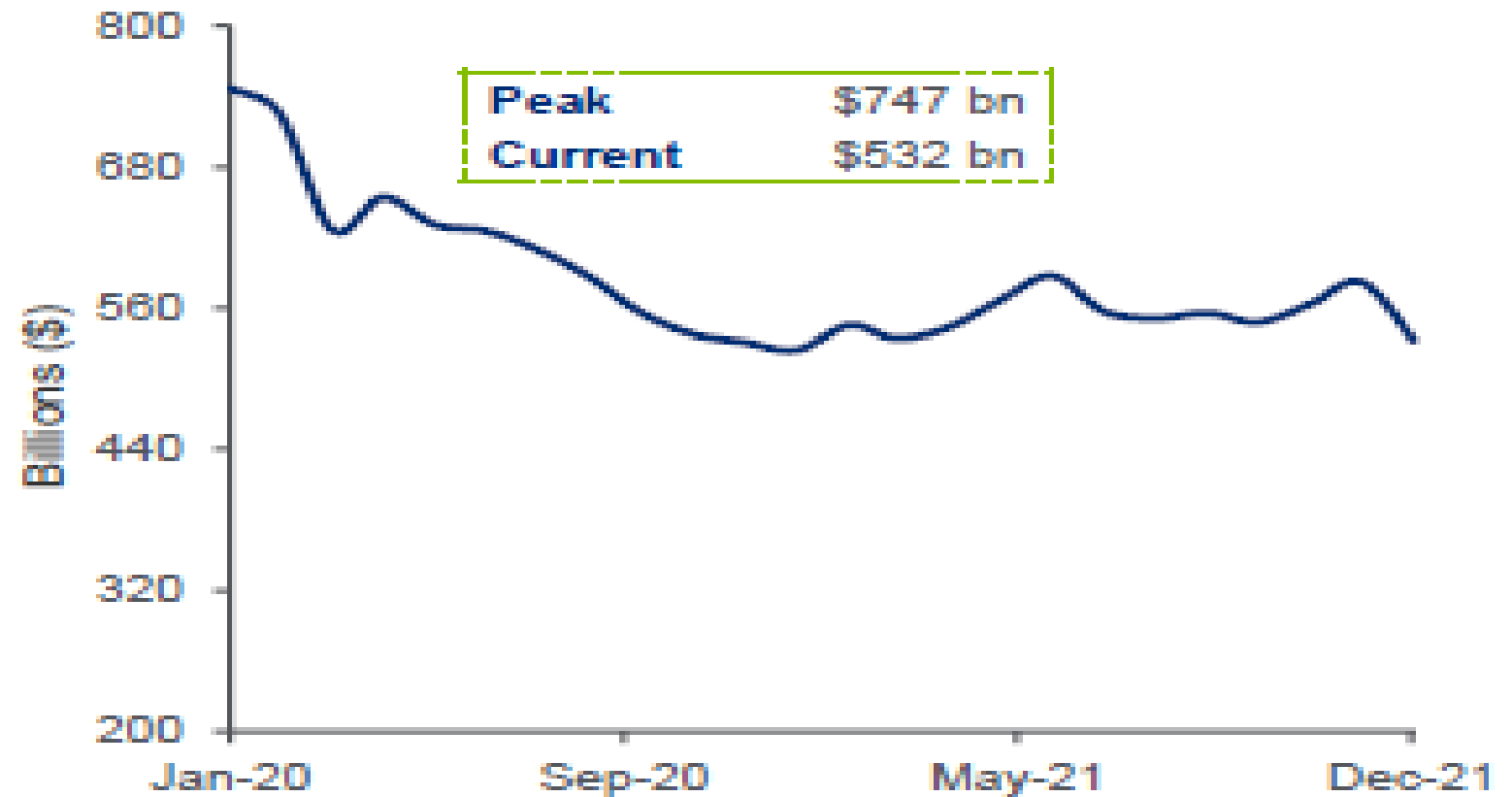
- Certificate of Deposit with a minimum face value of \$100,000 by Banks
- Cannot be cashed in before maturity but are traded in the highly liquid secondary market
- Issued with maturities ranging from 2 weeks to 5 years
- Flexible maturity dates/reverse inquiry
- Issued at par in both fixed and floating rate structures
- A Yankee CD is a negotiable CD issued by a domestic branch of a foreign bank

Assessing & Adjusting
Portfolio Liquidity
Negotiable Certificates
of Deposit / Yankee
CDs



Institutional CD Outstandings

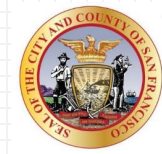
A contraction in institutional CD outstandings off-set the growth in financial CP. Total institutional CDs outstanding spent 2021 at decade low levels.





FINRA – Financial Industry Regulatory Authority

- www.finra.org
- Dedicated to investor protection and market integrity through effective regulation of broker-dealers
- A not-for-profit authorized by Congress
- Great resource for market and broker-dealer information
- Has authority to fine, suspend, or bar brokers for rule infractions



FINRA Mission

- Writing and enforcing rules governing the activities of 3,700 broker-dealers with 634,000 brokers
- Examining firms for compliance with those rules
- Fostering market transparency
- Educating investors



Last Updated: 03/05/2019

Market Data

Search:

Welcome to FINRA's Market Data Center. This comprehensive tool is designed to assist investors with market and investment research, both through the market data information provided as well as through the FINRA Investor Education material and tools.

Enter Cusip

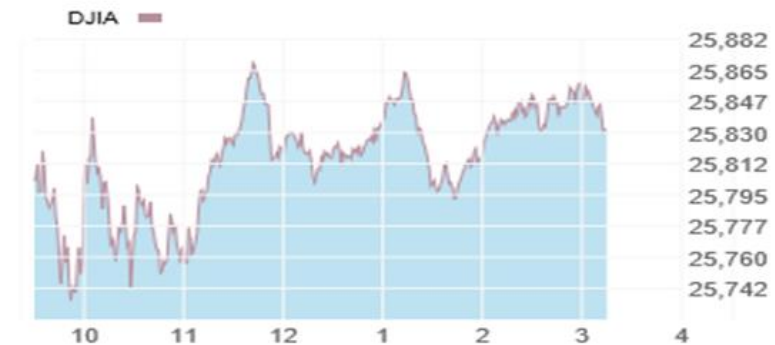
Market Data Center Overview Guide

Market Indices

DJIA	25,833.32	13.67	0.05%
NASDAQ	7,587.56	10.00	0.13%
S&P 500	2,792.49	-0.32	-0.01%

Data as of 03/05/2019 3:15:03 PM

* End of day data for previous business day



FINRA TRACE Bond Market Activity

View: [Corporate](#) | [Agency](#) | [Structured Products](#) |

	All Issues	Investment Grade	High Yield	Convertible
Total Issues Traded	8559	6430	1960	169
Advances	4655	3656	930	69
Declines	3418	2521	806	91
Unchanged	108	59	45	4
52 Week High	321	201	115	5
52 Week Low	77	46	29	2
Dollar Volume*	28503	20911	6899	692

More FINRA TRACE Bond Market Information

*Par value in millions

Quick Search

Debt / Asset Class

- Treasury/Agency
- Corporate
- Municipal
- Securitized Products

Show Results As

- Bonds
- Trades

Issuer Name

Symbol / CUSIP



Last Updated: 03/05/2019

Bond Detail

Lookup Symbol:

FEDERAL HOME LN BKS

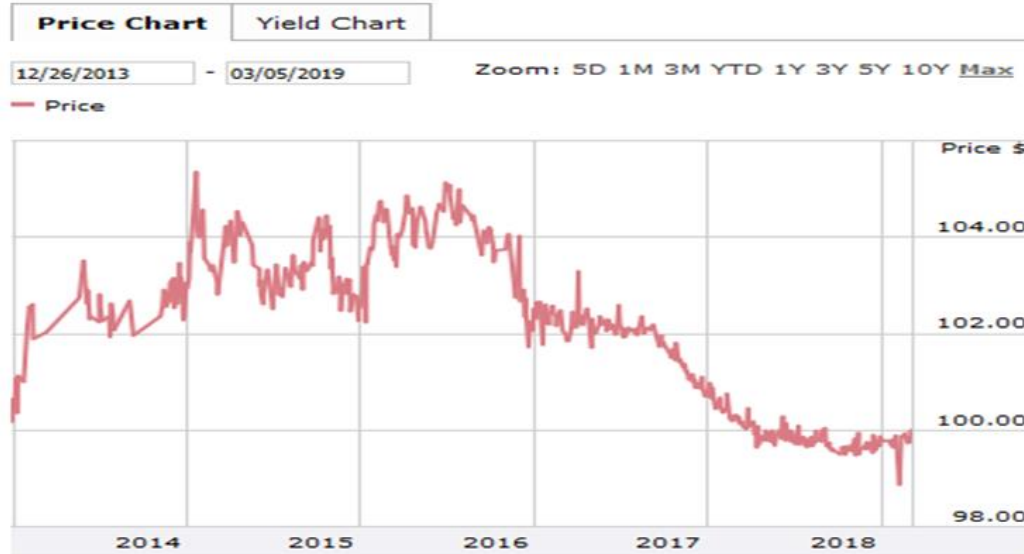
[+ ADD TO WATCHLIST](#)

Coupon Rate 2.375%	Maturity Date 12/13/2019	Symbol FHLN4085808	CUSIP 3130A0JR2	Next Call Date —	Callable —
Last Trade Price \$99.91	Last Trade Yield 2.490%	Last Trade Date 03/05/2019	US Treasury Yield —		

Click here for Trade History [Trade History](#)

[Prospectus](#)

Price/Yield Chart



Classification Elements

Bond Type	US Agency Debenture
Debt Type	Unsecured Bond
Industry Group	Government
Industry Sub Group	U.S. Agencies
Sub-Product Asset	AGCY
Sub-Product Asset Type	Agency Debt Bond
State	—
Use of Proceeds	—
Security Code	—

Special Characteristics

Medium Term Note	No
------------------	----

Issue Elements

Offering Date	12/26/2013
Dated Date	12/30/2013
First Coupon Date	06/13/2014
Original Offering*	\$20,000.00
Amount Outstanding*	\$2,413,425.00
Series	—
Issue Description	—
Project Name	—
Payment Frequency	Semi-Annual

Credit and Rating Elements

Moody's® Rating	Aaa (04/20/2016)
Standard & Poor's Rating	AA+ (12/26/2013)
TRACE Grade	Investment Grade
Default	—



Bond Trade Activity Search Results

From to | [Glossary of Terms](#)

Execution		Issue: UBS4154104 Description: UBS AG STAMFORD BRH MEDIUM TERM SR DEP N Coupon Rate: 2.375 Maturity Date: 08/14/2019													
Date	Time	Settlement	Status	Quantity	Price	Yield	Remuneration	ATS	Modifier	2nd Modifier	Special	As-Of	Side	Reporting Party Type	Contra Party Type
11/13/2017	16:36:00	11/15/2017	T	1150000	100.463	2.103	M		-	-	-	-	B	D	C
11/13/2017	13:48:32	11/15/2017	T	2000000	100.590	2.029	M		-	-	-	-	S	D	C
11/13/2017	13:40:37	11/15/2017	T	2000000	100.504	2.079			-	-	-	-	S	D	D
11/13/2017	13:29:17	11/15/2017	T	351000	100.418	2.129			-	-	-	-	S	D	D
11/13/2017	13:15:19	11/15/2017	T	250000	100.393	2.144	N		-	-	-	-	S	D	A
11/10/2017	16:00:46	11/14/2017	T	250000	100.535	2.061	M		-	-	-	-	S	D	C
11/10/2017	15:00:50	11/14/2017	T	300000	100.503	2.08	N		-	-	-	-	S	D	C
11/10/2017	12:01:38	11/14/2017	T	250000	100.489	2.088			-	-	-	-	S	D	D
11/10/2017	09:21:12	11/14/2017	T	5000000	100.947	1.822	M		-	-	-	-	S	D	C
11/10/2017	09:02:00	11/14/2017	T	5000000	100.507	2.078			-	-	-	-	S	D	D
11/10/2017	09:01:00	11/14/2017	T	5000000	100.527	2.066			-	-	-	-	S	D	D
11/9/2017	13:41:51	11/13/2017	T	700000	100.620	2.012	M		-	-	-	-	S	D	C
11/9/2017	13:41:00	11/13/2017	T	700000	100.569	2.042			-	-	-	-	S	D	D
11/9/2017	13:09:33	11/13/2017	T	5000000	100.528	2.066			-	-	-	-	S	D	D
11/9/2017	12:04:00	11/13/2017	T	5MM+	100.554	2.051	M		-	-	-	-	B	D	C
11/8/2017	15:47:24	11/10/2017	T	1200000	100.566	2.045	M		-	-	-	-	S	D	C
11/8/2017	15:01:43	11/13/2017	T	300000	100.547	2.055	M		-	-	-	-	B	D	C
11/8/2017	14:41:39	11/10/2017	T	100000	100.568	2.044	M	Z		-	-	-	S	D	C
11/7/2017	12:06:19	11/9/2017	T	5MM+	100.592	2.031	M		-	-	-	-	S	D	C
11/7/2017	10:55:46	11/9/2017	T	350000	100.579	2.038	N		-	-	-	-	B	D	C





Last Updated: 03/06/2019

Bond Trade Activity Search Results

From to | [Glossary of Terms](#)

Issue: FHLN4465601			Description: FEDERAL HOME LN BKS							Coupon Rate: 1.375			Maturity Date: 03/18/2019		
Execution			Status	Quantity	Price	Yield	Remuneration	ATS	Modifier	2nd Modifier	Special	As-Of	Side	Reporting Party Type	Contra Party Type
Date	Time	Settlement													
3/6/2019	09:29:03	3/7/2019	T	225000	99.965	2.505	M		-	-	-	-	B	D	C
3/6/2019	09:11:21	3/7/2019	T	225000	99.965	2.505			-	-	-	-	S	D	D
3/6/2019	09:09:30	3/7/2019	Cancel	225000	99.965	2.505	M		-	-	-	-	B	D	C
3/6/2019	09:09:30	3/7/2019	Cancel	225000	99.965	2.505	M		-	-	-	-	B	D	C
3/4/2019	13:33:45	3/6/2019	T	300000	99.966	2.381	M		-	-	-	-	B	D	C
3/4/2019	12:24:11	3/4/2019	T	1000000	99.961	2.364	M		-	-	-	-	B	D	C
3/1/2019	12:48:07	3/4/2019	T	2540000	99.960	2.402	M		-	-	-	-	S	D	C
2/28/2019	10:25:03	2/28/2019	T	750000	99.955	2.178	M		-	-	-	-	B	D	C
2/27/2019	16:28:07	2/28/2019	T	5MM+	99.955	2.173	M		-	-	-	-	B	D	C
2/27/2019	16:24:29	2/28/2019	T	400000	99.950	2.262	N		-	-	-	-	S	D	C
2/27/2019	16:24:29	2/28/2019	T	95000	99.950	2.262	N		-	-	-	-	S	D	C
2/27/2019	16:24:29	2/28/2019	T	30000	99.950	2.262	N		-	-	-	-	S	D	C
2/27/2019	16:23:23	2/28/2019	T	525000	99.950	2.262			-	-	-	-	S	D	D
2/27/2019	15:22:25	2/28/2019	T	1740000	99.957	2.137	M		-	-	-	-	B	D	C
2/27/2019	12:40:00	2/28/2019	T	250000	99.956	2.155			-	-	-	-	S	D	D
2/27/2019	12:40:00	2/28/2019	T	250000	100.073	0.061	M		-	-	-	-	S	D	C
2/27/2019	12:40:00	2/28/2019	T	250000	99.956	2.155		Y	-	-	-	-	S	D	D
2/26/2019	15:40:08	2/27/2019	T	300000	99.954	2.151		Y	-	-	-	-	S	D	D
2/26/2019	15:40:08	2/27/2019	T	300000	99.954	2.151	N		-	-	-	-	S	D	C
2/26/2019	14:31:58	2/28/2019	T	5MM+	99.957	2.137	M		-	-	-	-	B	D	C



Questions?

Don Collins

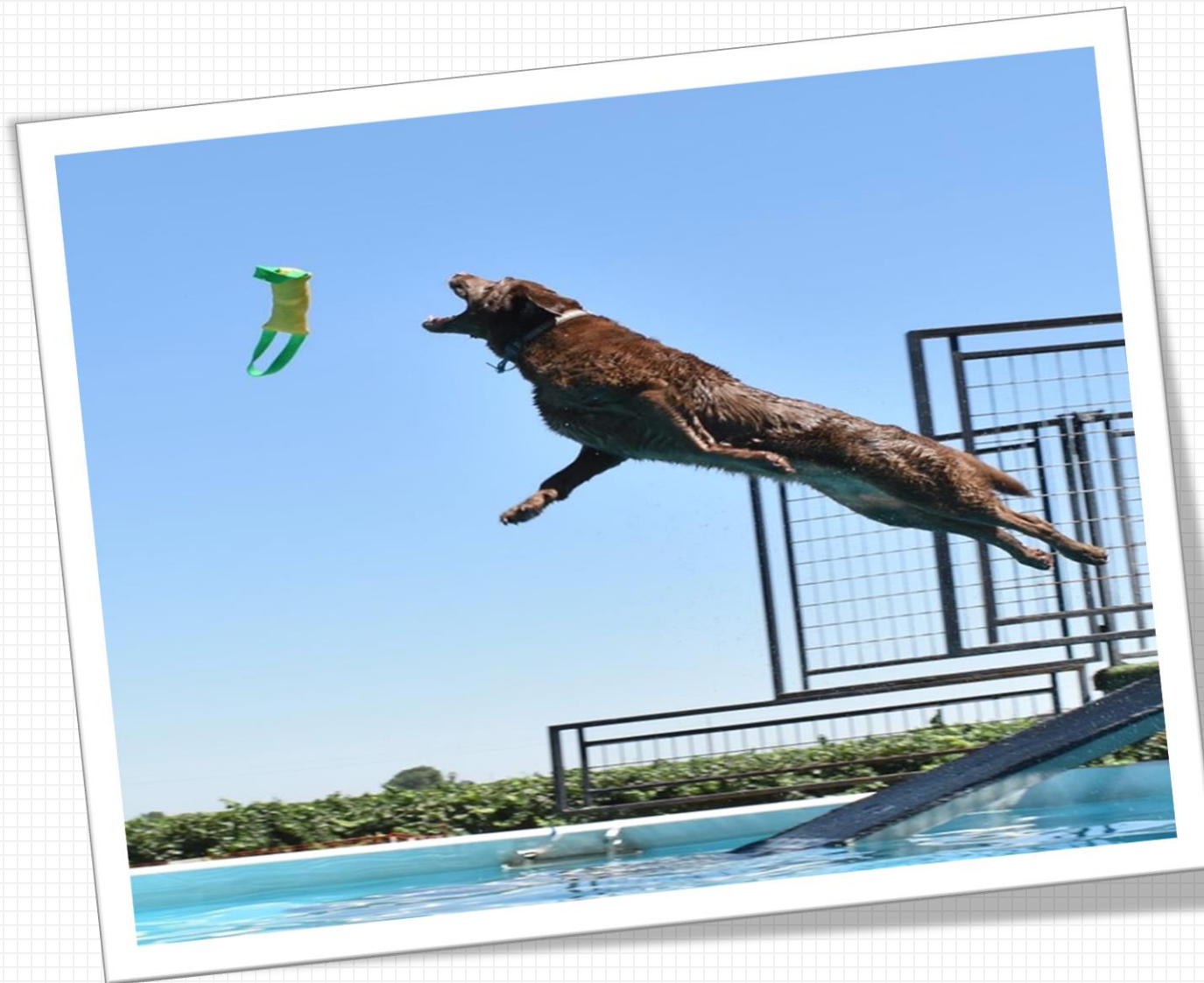
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THANK YOU

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

Cash Flow and Cash Flow Forecasting

