



*Celebrating 25 years of the CDIAC
Bond Buyer Preconference*

LEARNING TO CRITICALLY EXAMINE
REFUNDING OPPORTUNITIES

OCTOBER 14, 2026
SAN FRANCISCO, CA

SESSION ONE

Market Perspective Meets Issuer Objectives



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Market Preferences

- **Coupons:**

- The Budget Reconciliation Act of 1993 changed the tax-treatment of OID accretion for municipal bonds. It also included a de minimis rule to prevent minor market fluctuations from triggering the new provisions.
- Following the financial crisis in 2008, extremely low interest rates (e.g., 2-3%, etc.) drove investor preferences for premium coupon bonds to protect their bonds from trading at a discount larger than the “safe harbor” de minimis. As a result...
 - 5% coupons have grown to become industry “standard”
 - Higher coupons (e.g., 5.25% and 5.50%, etc.) are popular in times of rising yields to provide even more price protection
 - Lower 4% coupons or par-ish bonds come at a pricing yield concession; Investor betting that bond is less likely to get called, and if called, they benefit from pricing yield concession
 - 3% and lower coupon: Investors tend to be hold-to-maturity investors who want duration and are betting their bonds will not be called for economic reasons (e.g., insurance companies who don’t need to mark positions, retail accounts, etc.)

- **Call Features:**

- Investors resigned to issuers’ demand for 10yr par call; however, they get pricing based on final maturity
- In high-rate environments, short calls come at a concession to a 10yr par call as investors expect bonds to be called when rates decline (and they take reinvest risk)
- In low-rate environments, short calls are relatively costless as investors are betting that if the bonds get called, it will likely be in a higher rate environment (than when purchased, but lower than the coupon) and hence less reinvest risk

- **Amortization:**

- Maturity Size: Prevalence and influence of ETFs have made maturity sizes of at least \$15mm and \$25mm desirable
- Maturity Range: Prevalence and influence of SMAs, whose range has extended to 20 years, have allowed for serial bonds of size
- Mega Deals: Increased cadence of mega deals (greater than \$1bn) has created the need for issuers to offer alternative coupon and call options to appeal to a broader buyer base

Needs of Issuers

- Call Feature:
 - 10yr (or shorter) par call for refunding and restructuring flexibility
- Term Structure:
 - Serial and term bonds to amortize debt across supporting rate base
- Balloon Indebtedness (Put Bonds/Extendible Maturities/VRDBs/FRNs):
 - Long-term amortization with short-term rates, to take advantage of steep yield curve

Why Are Refundings Done?

- Interest rate savings (High-to-Low Refunding)
 - Current interest rates are below prior bond's coupon; Refunding generates cashflow and/or present value savings
- Defeasances (Low-to-High refunding)
 - Refunding bonds issued to defease required portion of prior debt to release the issuer from certain covenants associated with the prior bonds
- Restructurings
 - High-to-Low or Low-to-High refundings executed to change the amount of debt service due in any given year; May or may not generate present value savings

Tools Used to Effect Refundings

- Tax-Exempt Current Refundings of:
 - Tax-Exempt Bonds, invoking a current call
 - Taxable Bonds (eligible for tax-exempt financing) invoking a make-whole call
- Tax-Exempt Advance Refundings of:
 - Tax-Exempt debt that qualifies for acquisition treatment
 - Taxable Bonds (eligible for tax-exempt financing)

Tools Used to Effect Refundings (continued)

- Forward Delivery Refundings
- Taxable Advance Refundings
- Tender Refundings
- Forward Starting Swap Refunding
- Cinderella Bonds: Taxable Bonds that convert to Tax-Exempt in the future
- Cash Optimization: Two-Step Strategy to Effect an Advance Refunding
 - Use cash, otherwise earmarked for PayGo new money, to defease prior bonds
 - Issue new money bonds to replace cash used for defeasance

Refunding Criteria

- Simple Savings/Take-It-or-Leave-It Test
 - 3% for Current Refundings/5% for Advance Refundings/0% for bonds maturing within 2 years
- Sliding Scale Test (based on Callability, or years from call date to maturity date)
 - 0-5 years: 0.5%
 - 6-10 years: 1.0%
 - 11-15 years: 3%
 - 16-20 years: 4.0%
- Rate Efficiency Test
 - PV Savings @ Current Rates vs PV Savings @ Lower Rates (e.g. Current Rates – 25bps) > Threshold (e.g. 40%)

Refunding Criteria (continued)

- Opportunity Cost Index (OCI) Test
 - PV savings from Advance Refunding/PV Savings from Current Refunding using lower rates (e.g. - 50bps) > Threshold (e.g. 70%)
- Escrow Efficiency Test
 - Negative Arbitrage/PV Savings < Threshold (e.g. 75%)
- Option Value Test
 - PV savings from Refunding/Option Value (with defined terms for calculation) > Threshold (e.g. 70%)

Other Refunding Criteria/Considerations

- No extension of debt
- PV savings = Neutral (for Restructurings)
- Cashflow savings in every year
- Savings from Refunding using Derivatives - Savings from Refunding using Traditional Fixed Rate > Threshold (e.g. 5%)
- Different Savings Criteria for refunding of Taxable Debt/BABs (e.g. 0%) vs Tax-Exempt Debt (e.g. 3%)
- Different Savings Criteria for Individual Maturities (e.g. 0%) vs Entire Series (e.g. 3%)
- Different Savings Criteria for Partial Refundings vs Whole Refundings (to ease Administrative Burden)

Refunding Strategy

- What goal(s) is your refunding achieving?
- How important are the savings today?
- What are your cashflow timing considerations?
- How does your refunding strategy affect future borrowings?
- Who are the stakeholders affected by your refunding strategy and how do you balance their considerations?
- What products/tools/financing strategies do you plan to use to execute your refunding strategy?
- Do you have the financing team (internal and external) to help you execute your financing strategy?

Sound Refunding Decisions: Beyond the Savings Metric

- No single metric can answer every refunding question
- Context matters: issuer objectives, budget needs and market conditions
- Weigh savings today against the value of preserving the call option and future flexibility
- Apply a consistent decision-making framework across transactions and rate cycles, even as individual metrics evolve
- Historical experience informs decisions but does not determine future outcomes
- Judge decisions on what was known at the time, not where rates went afterward

A New Possible Refunding Evaluation Approach

- Quantifying additional benefits of a refunding

	How Important is the Money?	Do the Savings Help with Employment?
Possible Considerations	• Will the savings fund a critical service that will otherwise be cut? • Are the savings a critical part of a larger funding plan for a major project or initiative?	• What impact do the savings have on job security or employment? • Can elected officials or staff point to the savings as compelling rationale in support of a positive job review?
Category Score	Score (1-50)	Score (1-50)
Refunding Score	Equal to the sum of the two category scores	

- If the refunding score is at least 70, then the refunding should be pursued.

QUESTIONS?



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SESSION TWO

Refunding Efficiency: It's
What You Bargained For

ANDREW KALOTAY, Ph.D.
President, Kalotay Advisors



Agenda

- History of refunding transactions of tax-exempt debt
 - Bond structures, advance refunding
- Refunding efficiency
 - Compare savings to value of forfeited call option
- Calculation of refunding efficiency: examples
 - Optionless refunding bond
 - Callable refunding bond
- Recommended call provisions
- Closing thoughts

Background: Call Provisions of Munis

- Pre-1970: bonds issued near par, diverse call features, often short lock-out
- 1970-1980: bonds issued near par, call in Year 10 at par became popular
- Around 2000: 5% bonds callable in Year 10 at par introduced
 - Sold at a premium, to avoid 'de minimis' risk
 - Tax Reform Act of 1986: 'large' gain taxed as ordinary income
 - Today 5% NC-10 bonds dominate institutional market
 - Standard muni yield curve: YTC of 5% NC-10 bonds

Par Munis — Sub-Par Performance, The Journal of Fixed Income, Fall 2021

Background: Advance Refunding with Tax-Exempt Debt

- Proceeds invested in Treasury escrow, to defease outstanding bonds to call date
 - Escrow yield limited to cost of refunding issue (SLGs, yield burning scams)
 - ‘Low-to-high’ refunding to maturity could be practical
- Until 1986 unlimited advance refunding transactions allowed
- Tax Reform Act of 1986 limited advance refundings to only one
- Tax Cuts and Jobs Act of 2017 disallowed advance refunding with tax-exempt debt
 - Recent efforts to restore (headed by GFOA and bond lawyers)

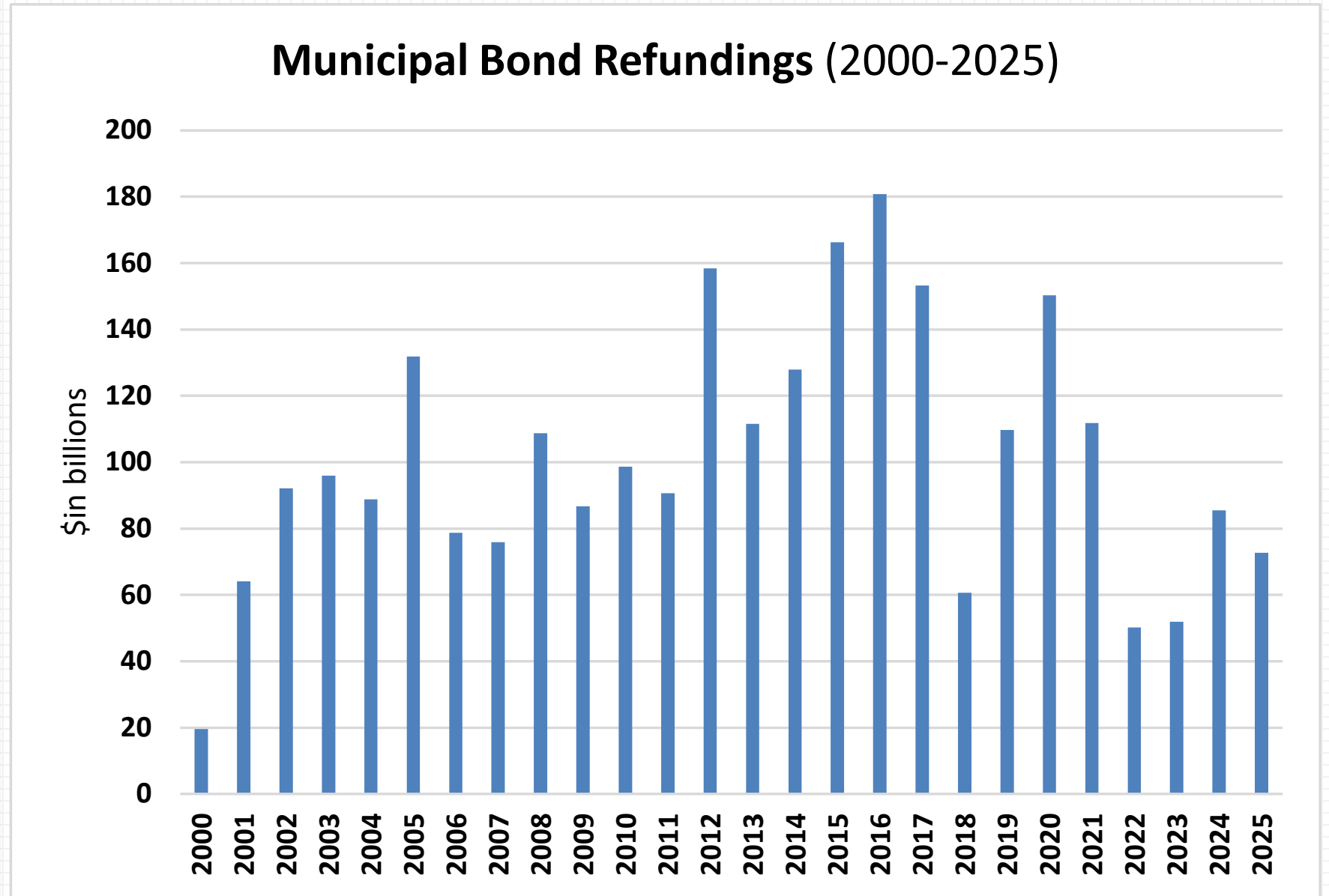
Recent Refunding Developments

- 5% NC-10 bonds turbocharge refundings
 - Refunded in Year 10, unless rates rise above 5%
 - Call decision is a no-brainer, generating large savings
 - Challenge: find 5% bonds older than 10 years
- Refunding transactions *prior to the call date*:
 - Advance refunding with taxable bonds
 - SF City/County PUC wasted \$69 million, by not waiting to call
 - Tender/refunding
 - Speculative and inefficient: premium over basis *not tax-deductible* by issuer
- Churning of 5% NC-10 bonds benefits issuance infrastructure, costly to taxpayers

Savings Lost: The Damage of Taxable Advance Refundings to Taxpayers

Public Finance Journal | Vol. 1 | 2024 |

Annual Refunding Activity



Source: Luby et al., 2026

5% Bonds Callable at Par Are Tailor-Made for Savings: From California Department of Finance Report

- GO bond refunding since 2019: about *\$6.8 billion* in total debt-service savings *over the life of the bonds*
 - On a net-present-value (NPV) basis, that equals about \$5.5 billion
- In the most recent transaction California issued \$2.3 billion of GO refunding bonds, producing about *\$330 million* savings
 - Or \$250 million NPV

Overview of the Call Option

- Primary intent: save interest by calling and refunding *if rates decline*
 - 5% bonds callable at par are refunded even if rates rise
- Cost at issuance: lower sale price or higher coupon
 - Depends on estimated value of a like optionless bond
 - Cost of call option of long 5% bond can exceed 10 points
- Refunding forfeits the call option
 - The opportunity to realize savings in the future
- Refunding decision: Are the savings adequate compensation for the *forfeited option value*?

Popular Heuristic Call Guidelines

Option Value Not Considered

- ‘100 basis points rule’ for long-term corporates: call if refunding rate declines
100 bps below the coupon
 - For bonds issued near par, callable above par
 - Reasonable
- 3% to 5% NPV savings for munis (GFOA)
 - Reasonable for long-term bonds *issued near par*
 - Fiasco: short-term bonds *not* called at savings below 3%
 - Absurd for 5% bonds callable at par --- threshold reachable at issuance

Refunding Efficiency Is the Right Decision Tool

- Tradeoffs: realized savings versus forfeited option value
- If refunding bond is non-callable:
Savings / Forfeited Option Value
- Invented at Bell Labs in **1976**, extensively used by corporations

OPTIMUM BOND CALLING AND REFUNDING
INTERFACES, Vol. 9, No. 5, November 1979

What if Refunding Bond is Callable?

Savings / (OV (Outstanding)-OV (Replacement))

- Applicable to calling/refunding and to market transactions
 - Even to mortgage refi
- Maximum efficiency of calling is 100%
 - Refunding recommended only if efficiency is near 100%

Refunding efficiency: a generalized approach
Applied Financial Economics Letters, 2007, 3

Calculation of Savings and Option Values

- Savings in PV, using issuer's spot rates to discount
 - Taxable or tax-exempt rates?
 - Examples based on tax-exempt rates, taxable rates more accurate

Subsidized Borrowing and the Discount Rate
Municipal Finance Journal, Vol. 19, 1999

- Option-based bond analytics are readily available
 - Lognormal interest rate process is industry-standard
- **Calculations require *optionless* interest rates**
 - Standard muni yield curve is based on prices of 5% NC-10 bonds
 - Yields to call are *not* interest rates
 - Commercially available optionless rates are questionable

How to Obtain Optionless Tax-Exempt Rates

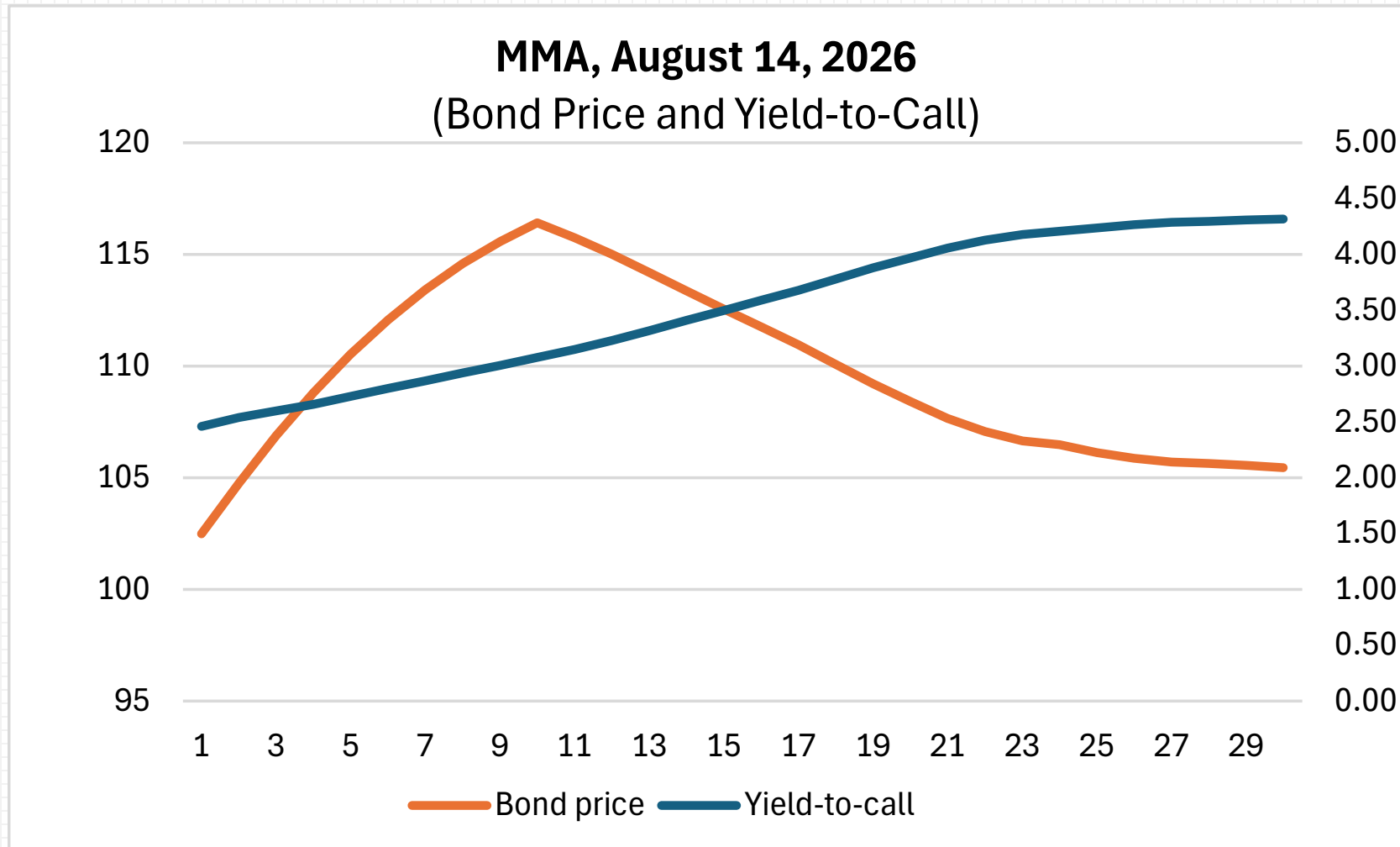
- Estimate from 5% NC-10 curve
 - Need bond analytics program and interest rate volatility
- How to choose volatility?
 - Optionless curve must be reasonable relative to Treasurys

The Intrigue of Municipal Debt Analytics

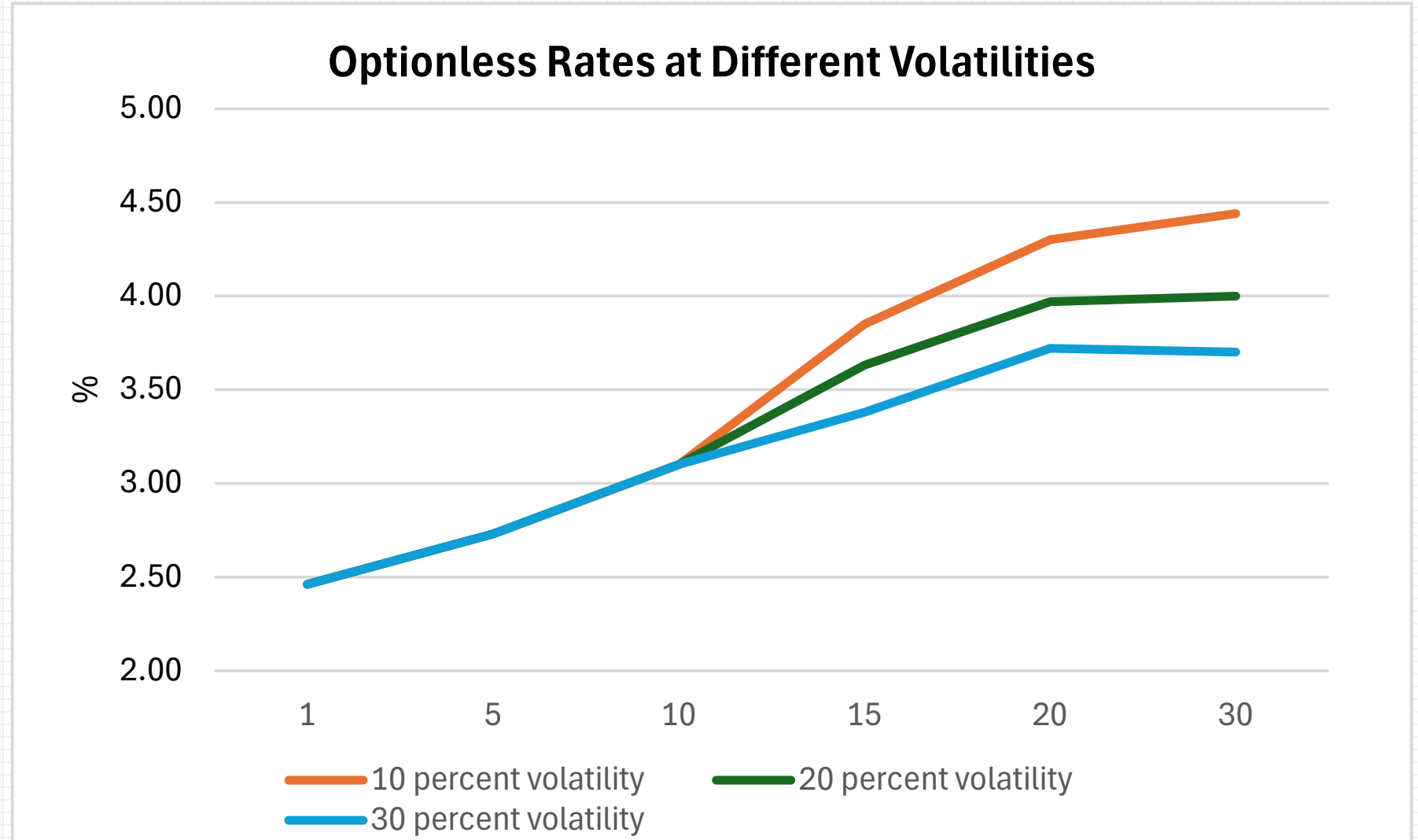
The Journal of Fixed Income, Summer 2025

- Process: 'bootstrapping'
 - Optionless rates known for years 1-10
 - Given the price of the 11-year 5% find optionless 11-year rate, etc.

MMA 5% Yield Curve and Prices, 8/14/2026



Optionless Rates at Different Volatilities



Refunding Efficiency of 10-Year Bond Callable at 100

Optionless Refunding Bond, No Transaction Cost

Coupon	PV	OV	Fair Value	PV Savings	Refunding Efficiency (%)
4.00	107.78	7.78	100.00	7.78	100
3.75	105.61	6.00	99.39	5.61	93
3.50	103.45	4.53	98.92	3.45	76
3.25	101.30	3.34	97.96	1.30	39

Savings = PV of outstanding bond – PV of refunding bond

PV of refunding bond = Call price = 100

PV and OV reported as % par
10-year MMA rate 3.10% (not used explicitly)

Refunding Efficiency of 10-Year Bond Callable at 100 Optionless Refunding Bond, 1 Point Transaction Cost

Coupon	PV	OV	PV Savings	Refunding Efficiency (%)
4.00	107.78	6.86	6.78	99
3.75	105.61	5.15	4.61	89
3.50	103.45	3.81	2.45	64
3.25	101.30	2.71	0.30	11

*Savings = PV of outstanding bond
– PV of refunding bond*

*PV of refunding bond = Call price
+ Transaction Cost = 101*

*Transaction cost reduces savings
and value of call option*

Efficiency of Tender/Refunding with Callable Bond MMA Yield Curve, 20% Interest Rate Volatility, No Transaction Cost

- Outstanding: 5% coupon, 15 years to maturity, callable at 100 in 3 years
 - **Fair value 104.30**, Option value 11.95, PV 116.25
- Refunding: 5% coupon, 15 years to maturity, callable at 100 in 10 years
 - Market price 112.52, **Option value 3.73**, PV 116.25

Tender Price	Premium	PV Savings	Loss of OV	Refunding Efficiency (%)
106.00	1.70	6.74	8.44	80
107.00	2.70	5.70	8.40	68
108.00	3.70	4.67	8.37	56

Size of refunding bond:
 $(\text{Tender price} / 112.52) \times 100$
 15-year optionless rate 3.63%,
 not used explicitly

Above-Par Call Prices Would Improve 5% Bonds

- **Objective: eliminate churning, by refunding only if rates decline**
- Call prices depend on prevailing interest rates (higher rates reduce call price)
 - Premium call price → Higher market price → Smaller issue size
- Example: Premium call prices for 30-year 5% NC-10 bond
 - MMA 8/14/2026 yield curve, YTC of 30-year bond 4.32% (*price **105.47***)
 - 30-year optionless rate **4.00%** (at 20% volatility)

Call prices for 5% NC-10 bond yielding 4.00% to maturity

Year	10	15	20
Call price	113.68	111.20	108.18

*Fair value of 5% bond callable at a premium: **110.00***

Ratchet Bonds Eliminate Transaction Cost

- Floating rate bonds, indexed to a benchmark
 - Coupon reset periodically, but **only if rates decline**
 - Pricing 'capped' floaters is straight forward
 - Case: TVA PARRs, **\$575MM**
 - Issued in 1998, maturing on June 1, 2028
 - Original coupon: 6.75%, current coupon: 2.10%
- **Ratchet Bonds: Maximum Refunding Efficiency at Minimum Transaction Cost**
– Journal of Applied Corporate Finance, Spring 1999

Optionless Tax-Exempt Bonds Should Be Considered

- Cost of call option exceeds its value to municipal issuer

Call Options on Tax-Exempt Bonds Are Pricey

The Journal of Fixed Income (Spring 2023)

- Reason: discount rate differential between investors and issuers
 - Investors use tax-exempt rates, issuers *should use* taxable rates (referenced earlier)

Tax Differentials and Callable Bonds

The Journal of Finance, September 1979

Performance Measurement Would Reduce Waste

If you cannot measure it, you can't improve it (Lord Kelvin, 1824-1907)

- *Objective: to minimize present value of debt service*
 - Instead of maximizing reported savings
 - Performance measured relative to a benchmark

A Framework for Corporate Treasury Performance Measurement

Journal of Applied Corporate Finance, Winter 2005

Summary

- Inefficient refunding transactions are costly to taxpayers
 - Savings don't justify forfeited option value; public kept unaware of the waste
- Call provisions need improvement
 - 5% NC-10 at 100 is an artificial stimulant, increases transaction cost
- Debt managers should be familiar with option-based analytics
 - Refunding efficiency is the right tool for decision-making
 - Implementation is straight forward
- Regulators and trade associations have dropped the ball
 - **GFOA 'Best Practice: Tender/Refunding of Municipal Bonds' does not mention option value**
 - 'Best Practice: Refunding Municipal Bonds' contains **35 'savings'** and **1 'option value'**
 - **MSRB certification** of municipal advisors is inadequate: **fails to cover option valuation**

QUESTIONS?



ANDREW KALOTAY, Ph.D.
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10-MINUTE **BREAK**

SESSION THREE

Evaluation of Refunding Strategy



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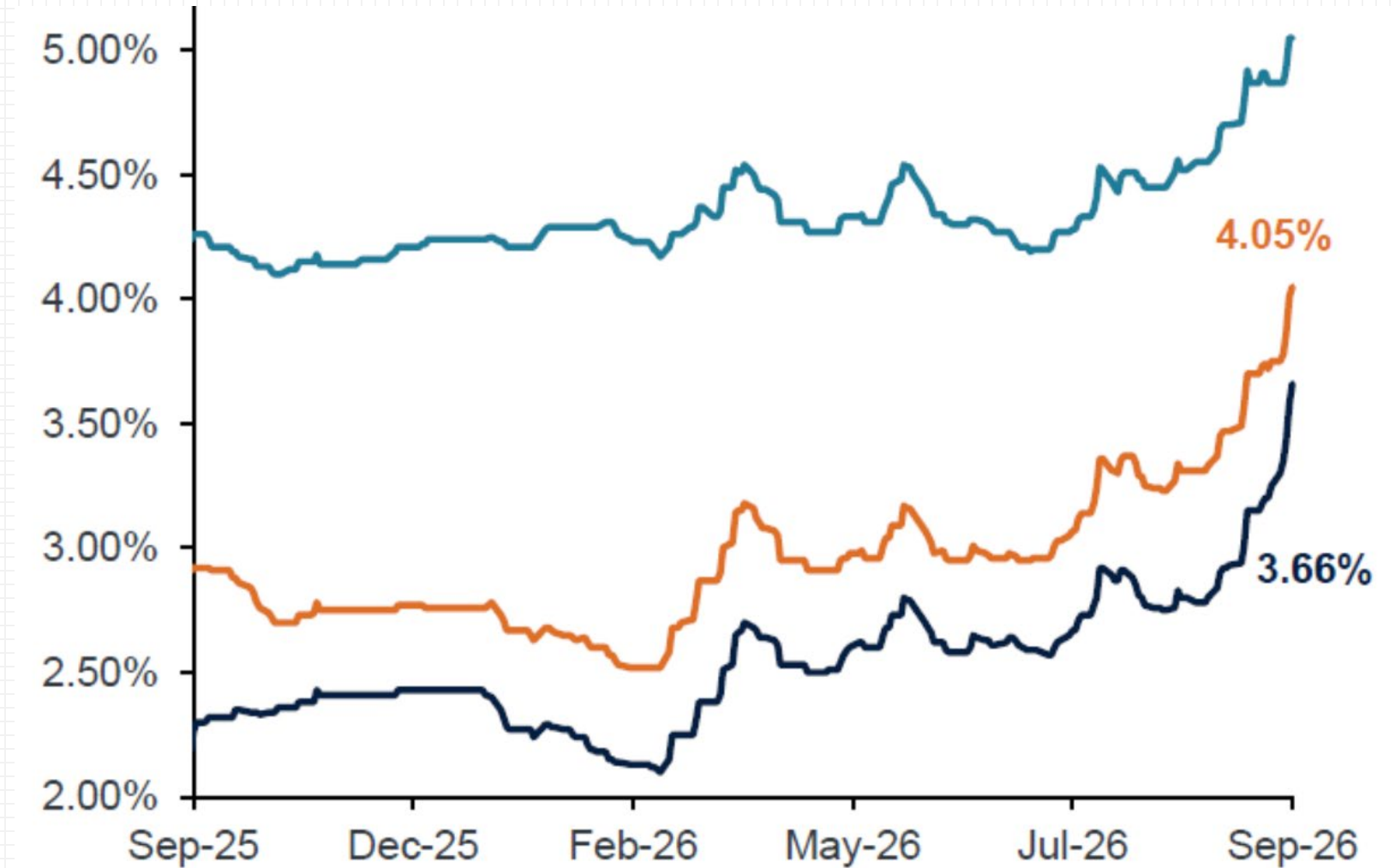
*Capital Finance
Director
San Francisco Public
Utilities Commission*

Caught in the Middle??



Making Decisions in Changing Markets

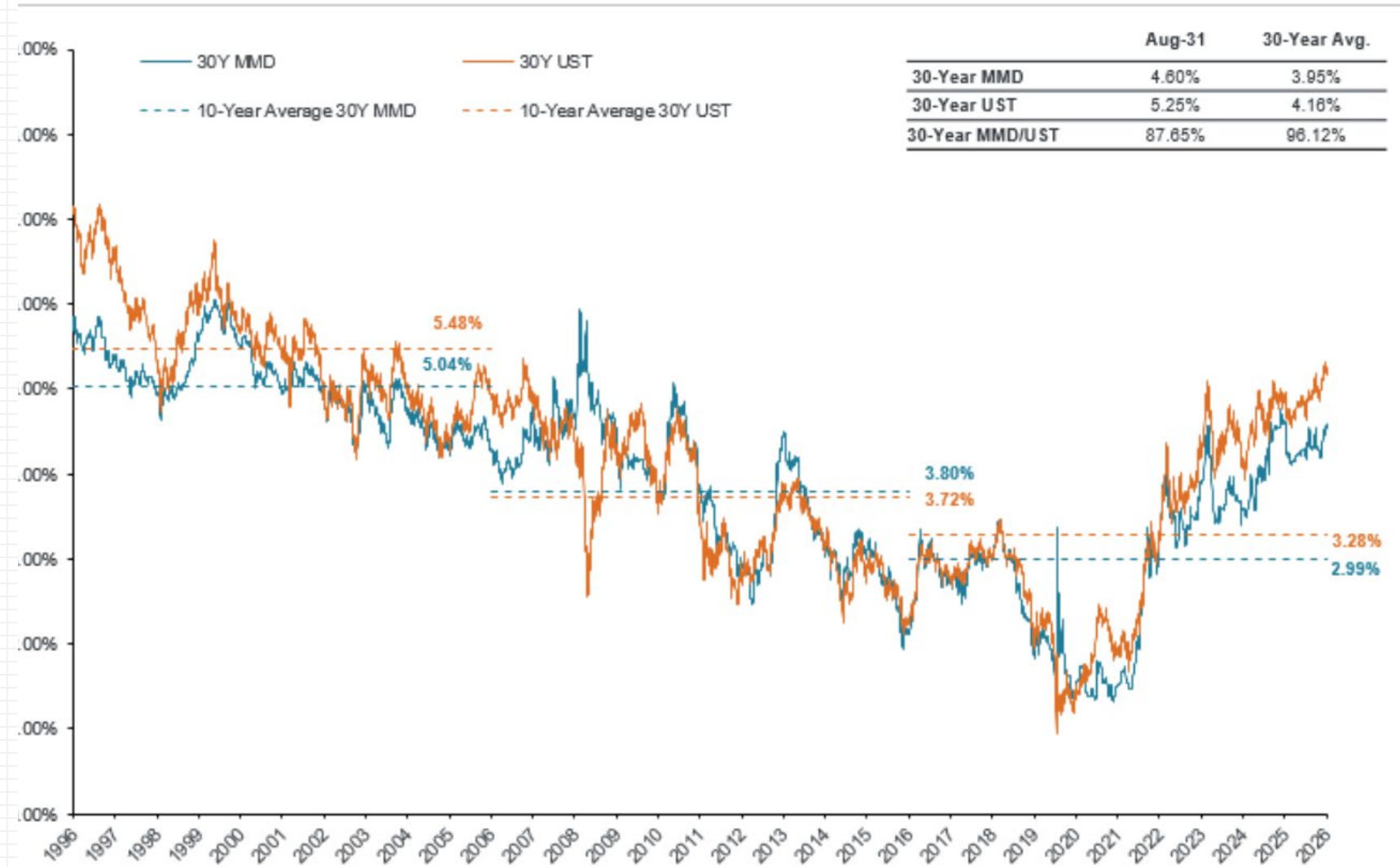
MMD YIELDS OVER THE PAST YEAR



Source: J.P. Morgan as of 9/25/2026; LSEG Municipal Market Monitor as of 9/25/2026; Weekly changes reflect a five-business day lookback

Taxable and Tax-Exempt 30-Year Yields:

Three Decades since 1996

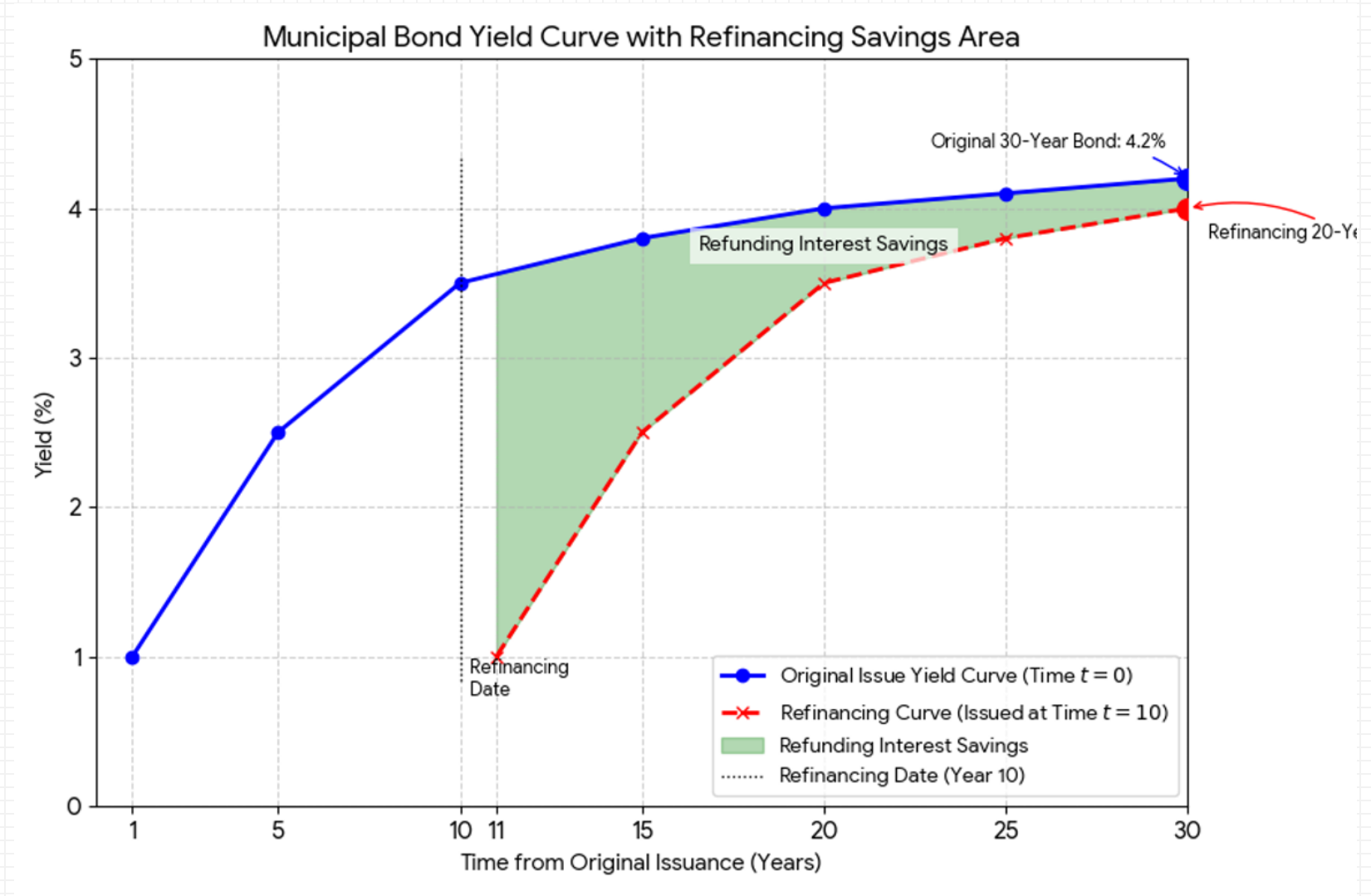


Source: LSEG Municipal Market Monitor,
J.P. Morgan as of 8/31/2026

Refunding Dynamics:

Serial Bonds,
Callable Bonds,

Moving
Down the
Yield Curve



SFPUC Has Issued \$5.8B Billion of Obligations Over the Past Four Years

- Over the past four years:
- **\$5.8** billion of Revenue Bonds (Water, Wastewater and Power)
- **\$408 million** of Federal and State Loans
- **\$2.4 billion** of new money and **\$3.4 billion** of refunding or refinancing bonds

	Cashflow Savings	NPV Savings
Water	\$181.0M	\$100.4M
Wastewater	\$88.6M	\$52.9M
Power	\$8.5M	\$3.9M
Total	\$278.1M	\$157.2M

- Refundings have allowed us to save ratepayers **\$278.1M** over the next three decades and mitigate subsidy reduction risk.



DEBT MANAGEMENT

Refunding Municipal Bonds

Issuers should include guidelines and criteria in their debt management policies that address when a refunding is permitted based on potential debt savings, future refunding flexibility when issuing any new debt, and opportunities on outstanding debt.

Bond refinancings or “refundings” are used by state and local governments to replace or restructure existing debt on outstanding bonds. Though less frequent, refunding is used to reduce interest costs, eliminate burdensome bond covenants or to restructure debt securities.

[HTTPS://WWW.GFOA.ORG](https://www.gfoa.org)



DEBT MANAGEMENT

Tender Refunding of Municipal Bonds

GFOA recommends that organizations pursuing tender refunding of municipal bonds establish policies and procedures around the tender refunding transaction that include specific guidance on articulating the intended goals, picking a financing team, calculating attributable costs, ensuring a clear understanding of fair pricing and determination of goal attainment.

[Read Best Practice](#)

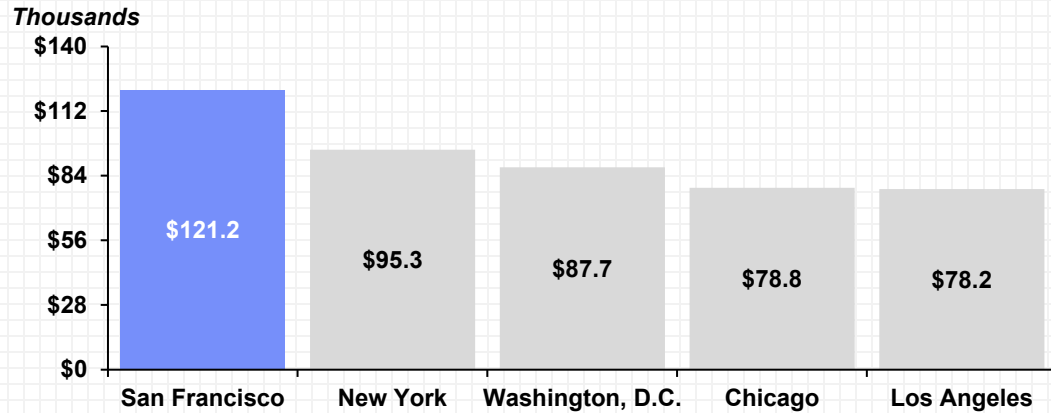
Committees: Governmental Debt Management (DEBT)
Board approval date: Thursday, June 26, 2025



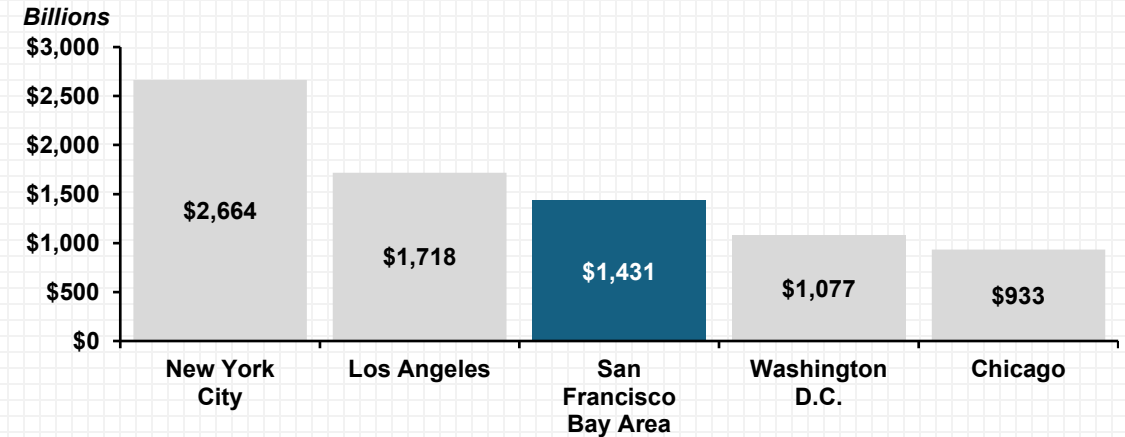
The San Francisco Bay Area – A Unique Air Service Market

Leading Tourist and Business Destination, Exceptional Demographics, and a High Propensity for Travel

Leading Per Capita Personal Income (2024)¹



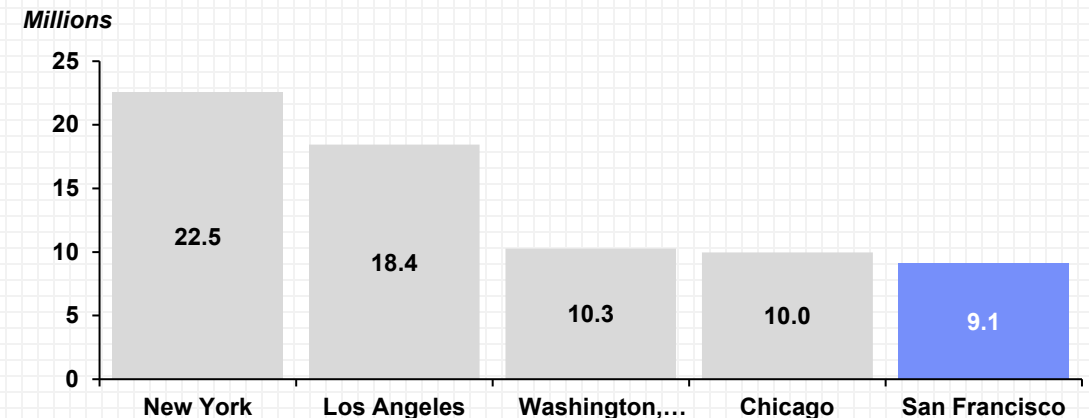
Strong Gross Domestic Product (2024)²



Notable Employment Growth (CAGR 2010-2025)¹



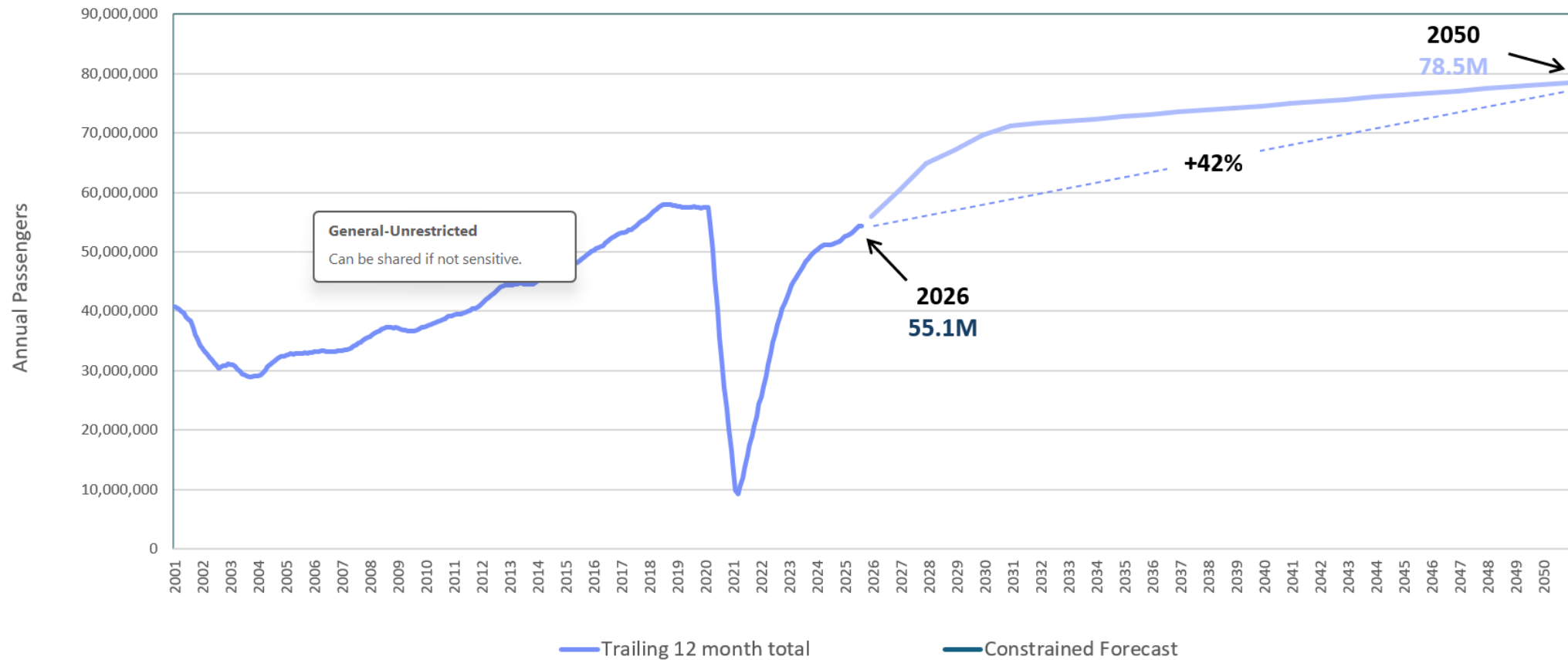
Significant Scale: Fifth Largest Metro Population (2025)¹



¹ Source: SFO Series 2026CDE Official Statement, Report of the Airport Consultant, Table 10
² Source: S&P Global database.

SFO's Future

Annual Passengers Project to Increase 42% from 55.1 million (FY2026) to 78.5 million by 2050



Source: San Francisco International Airport Planning

Accommodating Growth

Capital Improvement Plan

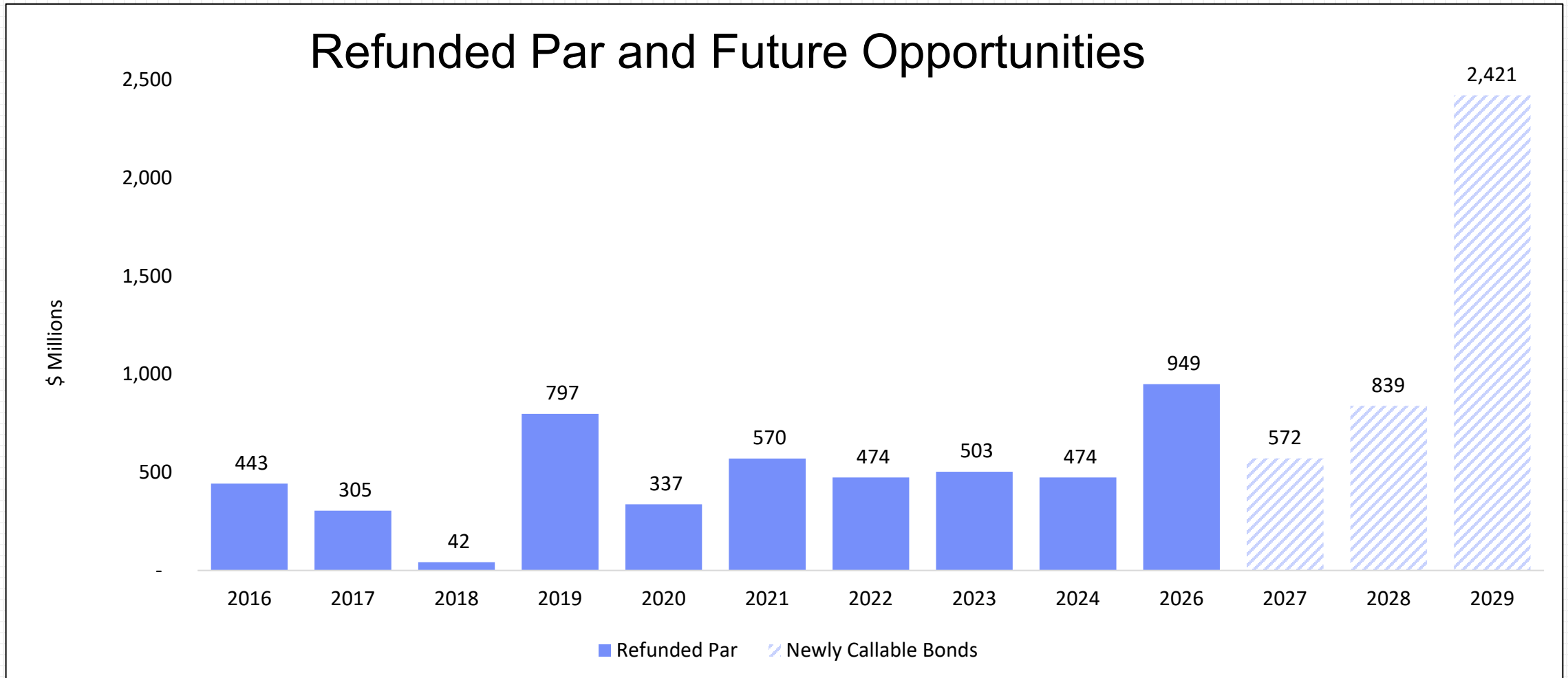
- \$12.5 billion, 10-year Capital Improvement underway



- SFO is a large, regular issuer of bonds - generally in the market twice per year
- \$11.0 billion in bonds currently outstanding
 - SFO is presented with annual refunding opportunities (as rates accommodate...)
- Philosophy
 1. **Primary Mission:** Funding the Capital Improvement Program
 2. **Secondary Mission:** Opportunistically capitalizing on refunding opportunities
 - Typically, this means focusing on current refundings in the context of new-money transactions.

Looking Ahead

Future Refunding Opportunities (Interest-Rate Dependent)



EBMUD View: The Right Bogey is "Wait," Not "Never Call"

- Standard PV savings compares the refunding to leaving the bonds outstanding to maturity.
- For 5% coupon bonds, the "never call" baseline has historically been inaccurate: in practice you usually call the bonds.
- The real alternative to refunding today is refunding later, so headline PV savings often overstates what you gain by acting now.

We Look at Breakevens vs. Waiting For a Current Call

- We ask our bankers and advisors to provide breakeven analyses.
- How far would rates have to rise before waiting to refund at the call date is worse than acting now?
- The question isn't whether there are savings, but whether locking them in now beats waiting.
- Taxable advance refundings and tenders add costs a current refunding doesn't have.
- Those costs hurt the breakeven: rates have to rise further before going early beats waiting.

What This Means in Practice for EBMUD

- We are less aggressive than some issuers with non-current refundings.
- We're usually comfortable waiting until bonds are currently callable.
- We consider how many eggs are in one pricing-day basket.
 - Each pricing is a one-day exposure to market conditions.
 - If we're already issuing a lot of bonds on one day, we may be even less aggressive on refundings.
- The fair counterpoint we hear: taking savings early does take risk off the table.

Sample Taxable Advance Refunding Analysis

			Taxable Advance Refunding			Future Tax-Exempt Current Refunding (Current Market Rates)			Advance Refunding Escrow	
Refunding Candidate	Call Date	Maturities Defeased/ Refunded	Net PV Savings (%)	Net PV Savings (\$)	Avg. Annual Savings (\$)	Net PV Savings (%)	Net PV Savings (\$)	Current Refunding Breakeven (Basis Points)	Escrow Efficiency (%)	Negative Arbitrage (\$)
1	3/1/2023	2022-2038	13.9%	\$40.4	\$2.9	24.2%	\$64.7	+110	81.6%	\$9.1
2	6/1/2023	2022-2029	7.0%	\$14.0	\$2.0	12.0%	\$21.6	+115	76.6%	\$4.2
3	6/1/2023	2022-2038	12.4%	\$6.1	\$0.4	22.0%	\$10.4	+119	77.0%	\$1.8

above \$ in millions; numbers are rounded; analysis date assumed to be Spring of 2021

- Taxable Advance Refunding Analysis includes multiple metrics: PV Savings (\$ and %), hypothetical future Current Refunding “breakeven analysis” and negative arbitrage/escrow efficiency
- Interest rate outlook and cyclicalities
- Issuer considerations such as timing of need for budgetary savings

“Good” Reasons to Execute a Tender in the Muni Market

- **Taxable to Tax-exempt**
- **Credit Arbitrage**
 - City of Chicago
 - Buy outstanding GOs/sell Sales Tax Bonds
- **Deminimus Arbitrage**
 - Tender for deep discounts and replace for premium bonds
 - Take advantage of tax treatment of municipal bonds
- **Yield Curve Arbitrage**
 - Long callable bonds sold in a flat yield curve environment
 - Tender for bonds at a discount to par
 - Finance with shorter bonds at lower yields
 - Take rollover risk
- **Necessity**
 - “I need savings relief like I need Oxygen!”
 - Cheaper than taxable borrowing (Line of credit, Public Taxable deal, Private taxable deal)
 - “Scoop and Toss” (it works!)
 - Examples (NYC, Commonwealth of Mass, etc.)



DISCUSSION

QUESTIONS?



ROBERT HANNAY

*Treasury Manager
East Bay Municipal
Utility District*



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THANK YOU

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

UPCOMING EVENTS

Annual Municipal Disclosure Training

November 5, 2026 | Free Webinar

Advanced Public Funds Investing: Portfolio Management Strategies

February 25-26, 2027 | Sacramento, CA

For more information, visit:
treasurer.ca.gov/CDIAC/education

LUNCHEON

Keynote Speaker

FIONA MA, CPA
California State Treasurer

