

SESSION TWO

Refunding Efficiency: It's
What You Bargained For

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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)

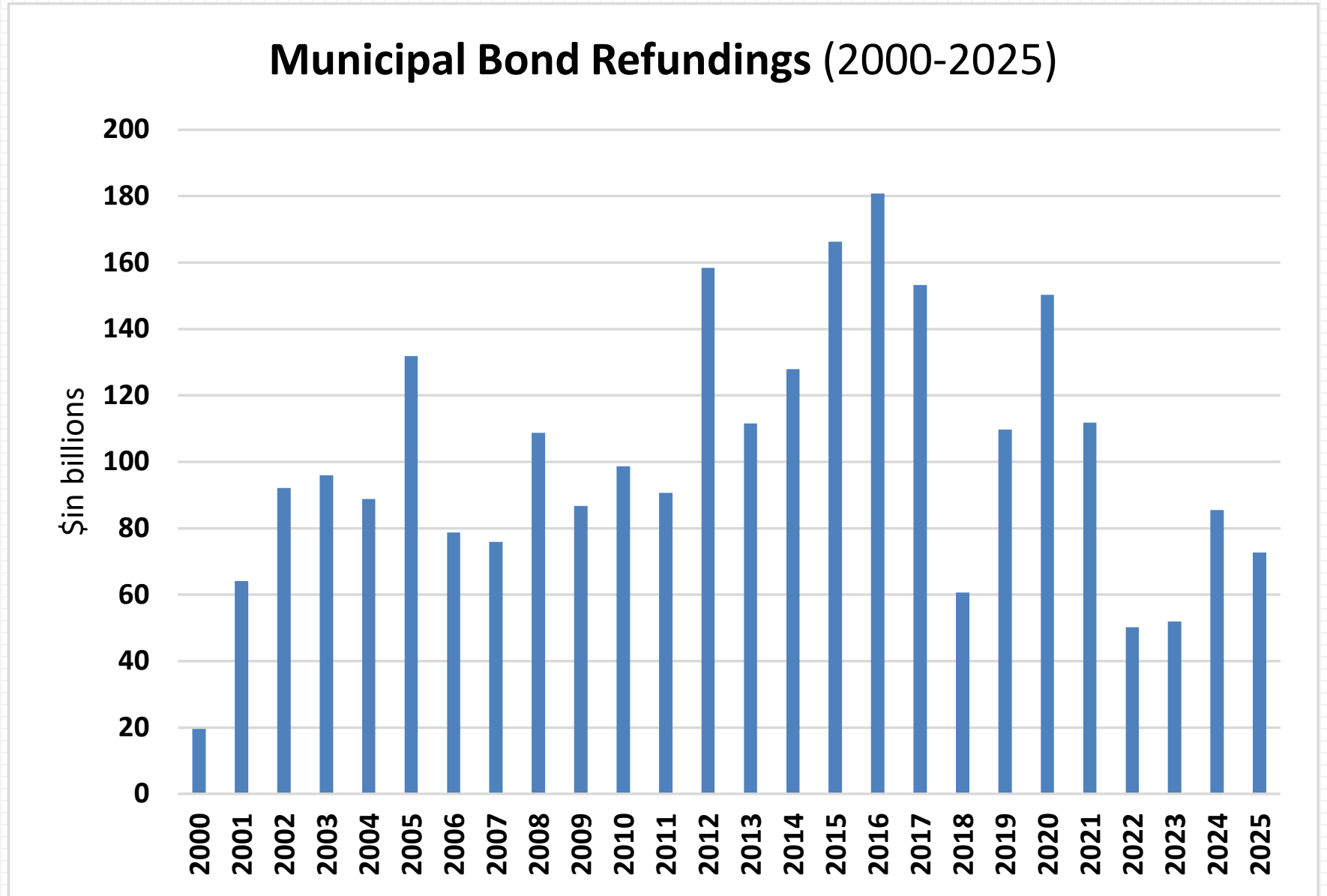
Recent Refunding Developments

- 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

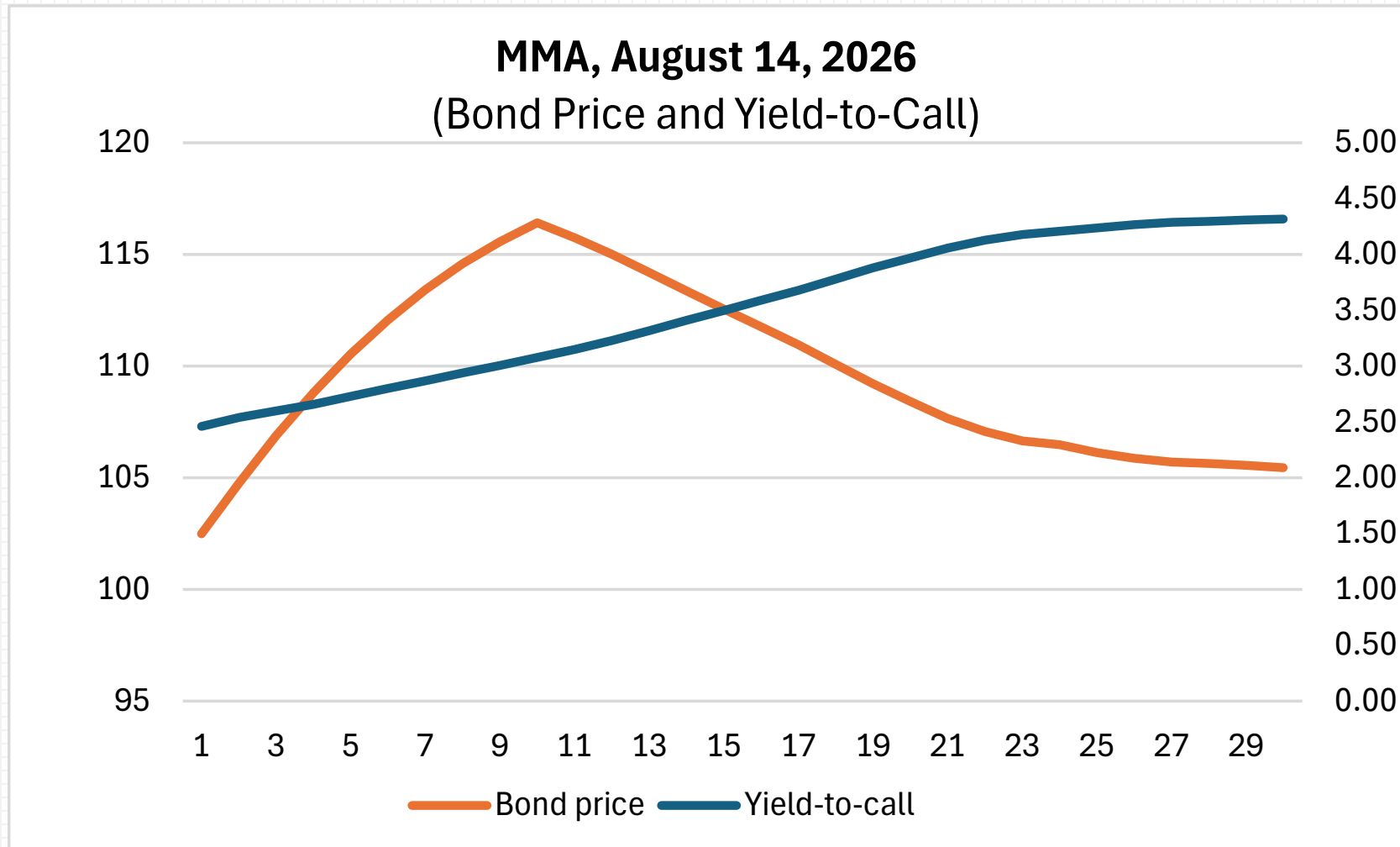
- Estimate from 5% NC-10 curve
 - Need bond analytics program and interest rate volatility
- How to choose volatility?
 - Optionless curve must be reasonable relative to Treasurys

The Intrigue of Municipal Debt Analytics

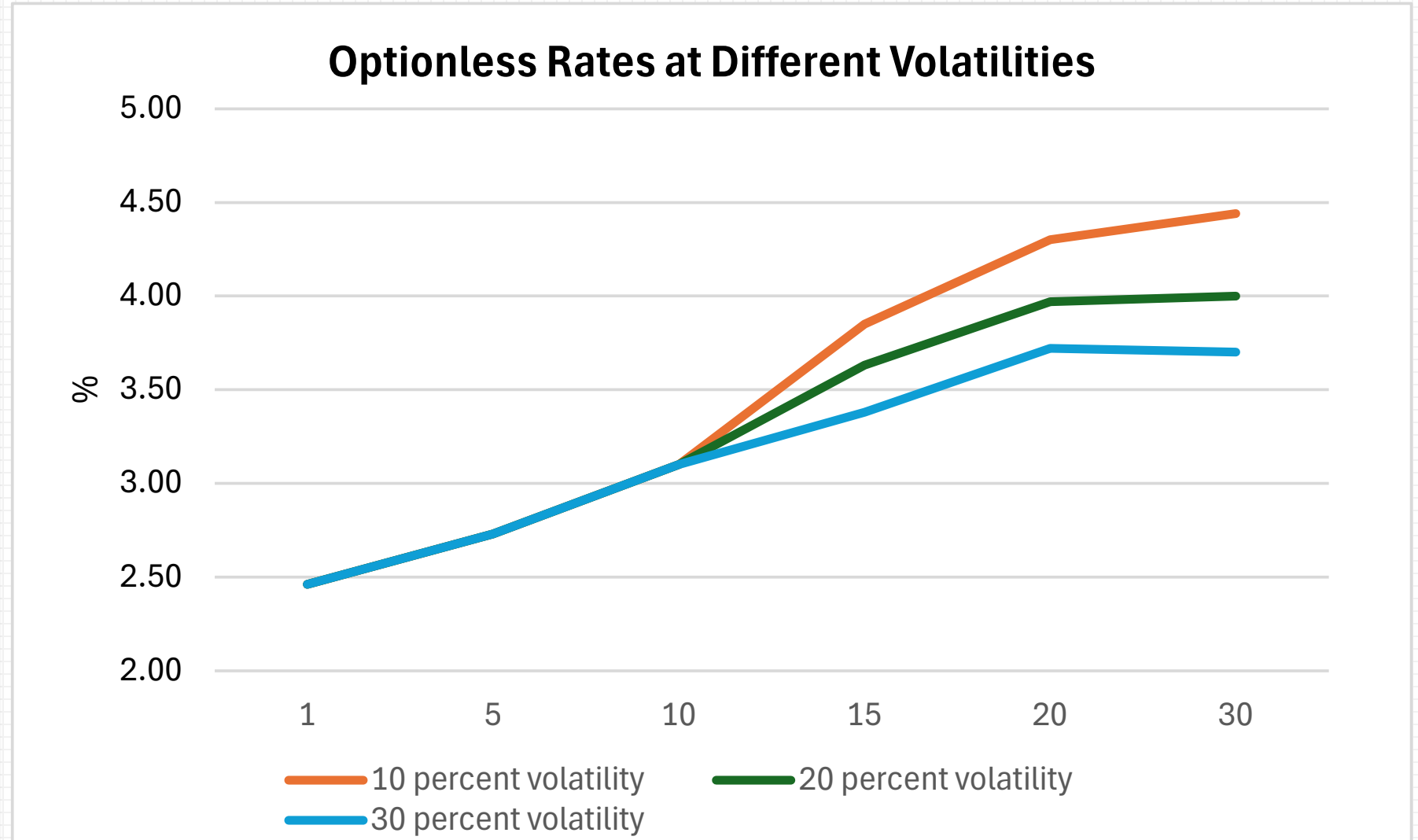
The Journal of Fixed Income, Summer 2025

- 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?



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