



A DIVISION OF ANDREW KALOTAY ASSOCIATES, INC.

Tax-Integrated Risk Management of Municipal Bonds

The 2nd Fixed Income & Operational Risk Conference USA

in conjunction with



New York, NY
May 7, 2015

What Makes Munis Different?

Held in taxable accounts

Because interest is tax-exempt

Gains and losses are taxable

Large gain taxed at maturity as ordinary income, at roughly 40%

Market participants are aware of adverse effect of tax

Prices of discount munis are deeply depressed

But commercial software systems are in tax-denial

Reported 'Greeks' and spreads are materially misleading

Tax-Neutral Valuation

10-year 2.50% Muni, 10-year rate 3%

Pretax value: 95.71



Tax on 4.29% gain at 40%: 1.72

PV of tax: 1.28

Tax-adjusted price: 94.43



Tax on 5.57% gain at 40%: 2.23

PV of tax: 1.65

Tax-adjusted price: 94.06

Converges to 93.89

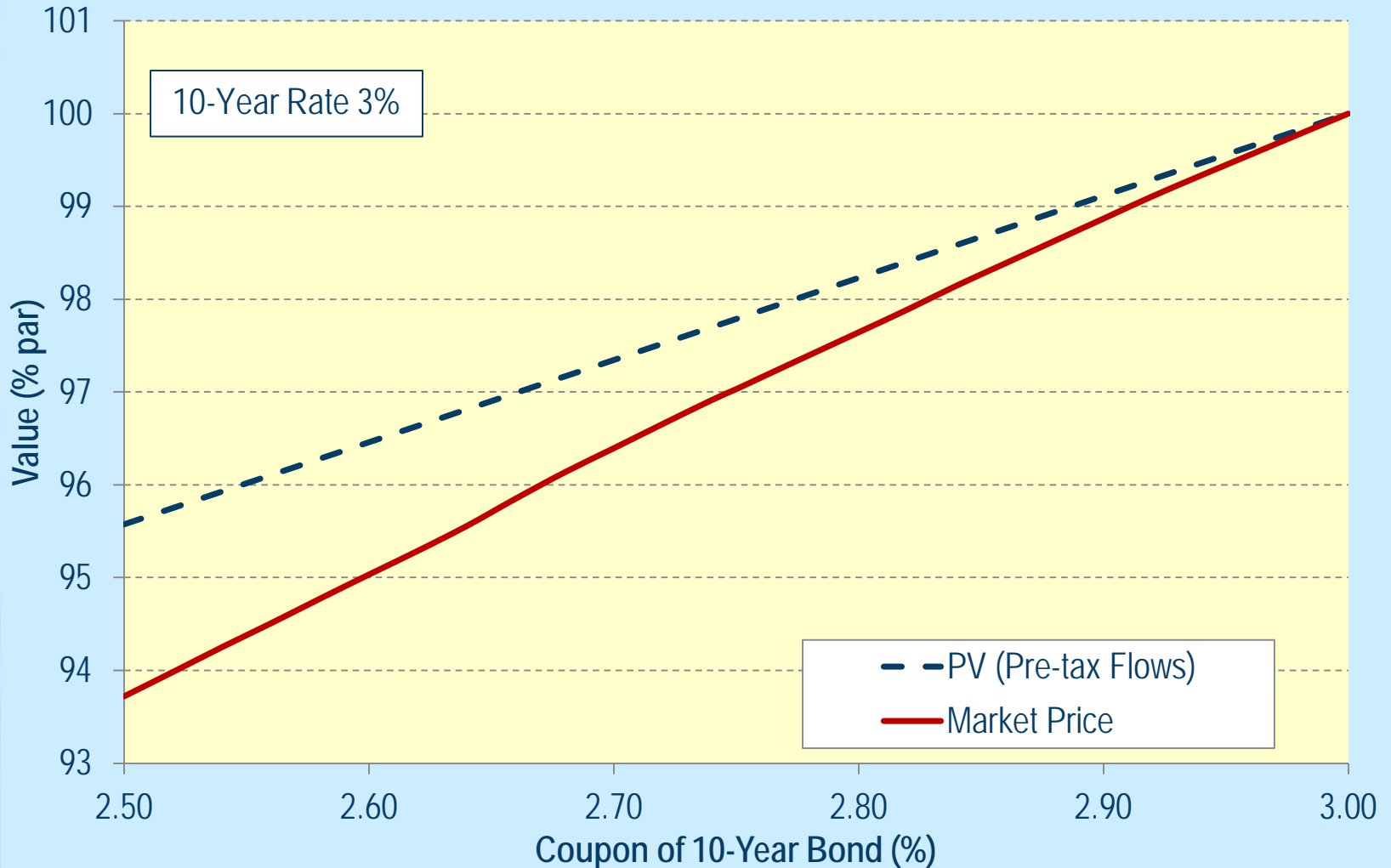
Tax Treatment of Tax-exempt Bonds Held to Maturity – Simple Version

Purchase Price	Treatment	Tax Rate*
At a premium	Premium amortized to zero	N/A
At a de minimis** discount	Taxed as capital gain	20%
At a non-de minimis discount	Taxed as ordinary income	40%

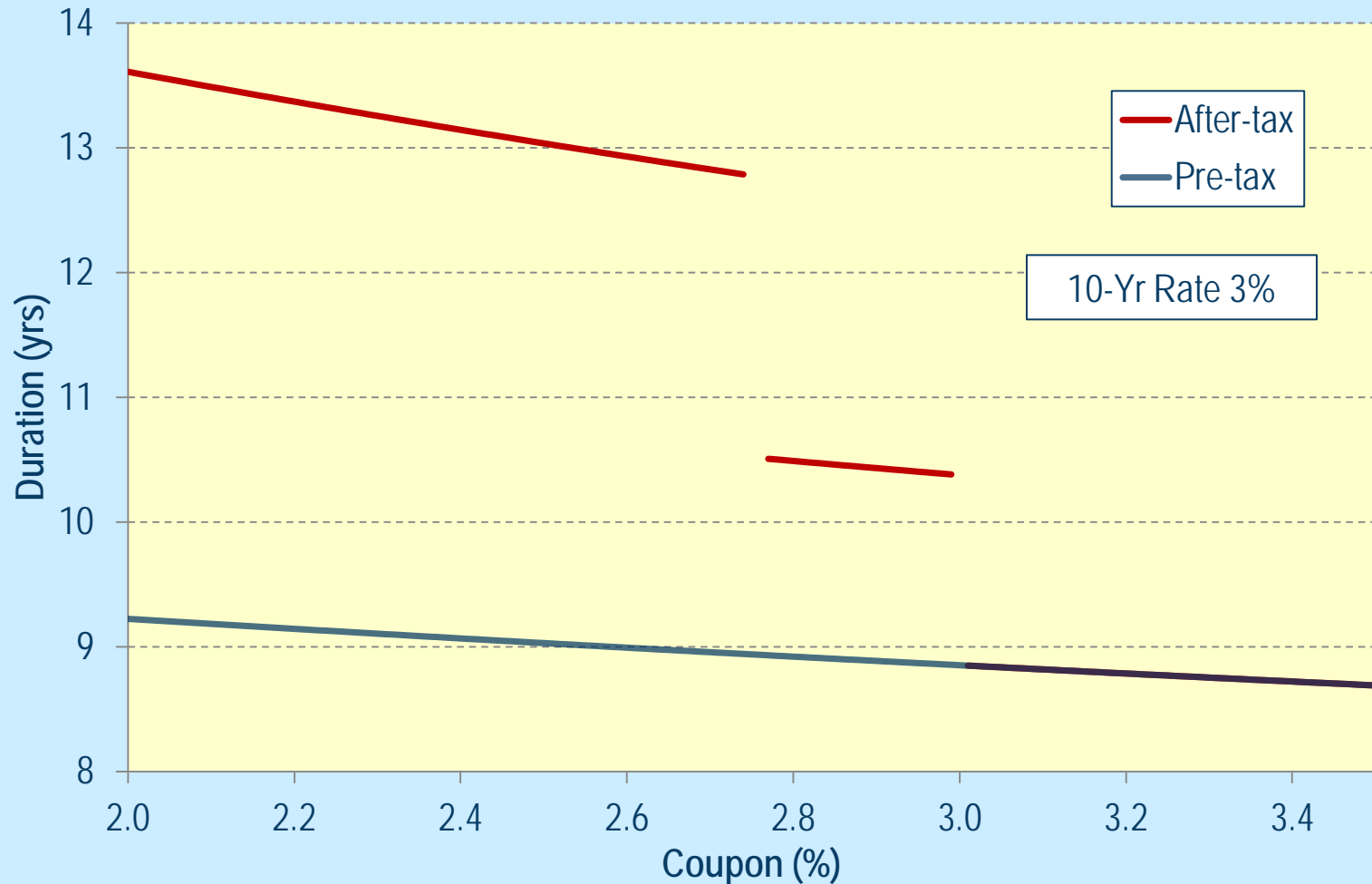
* Marginal tax rate implied by EMMA prices is 'very high'

** $0.25 \times$ the number of remaining years to maturity (e.g. 2.50 for a 10-year bond)

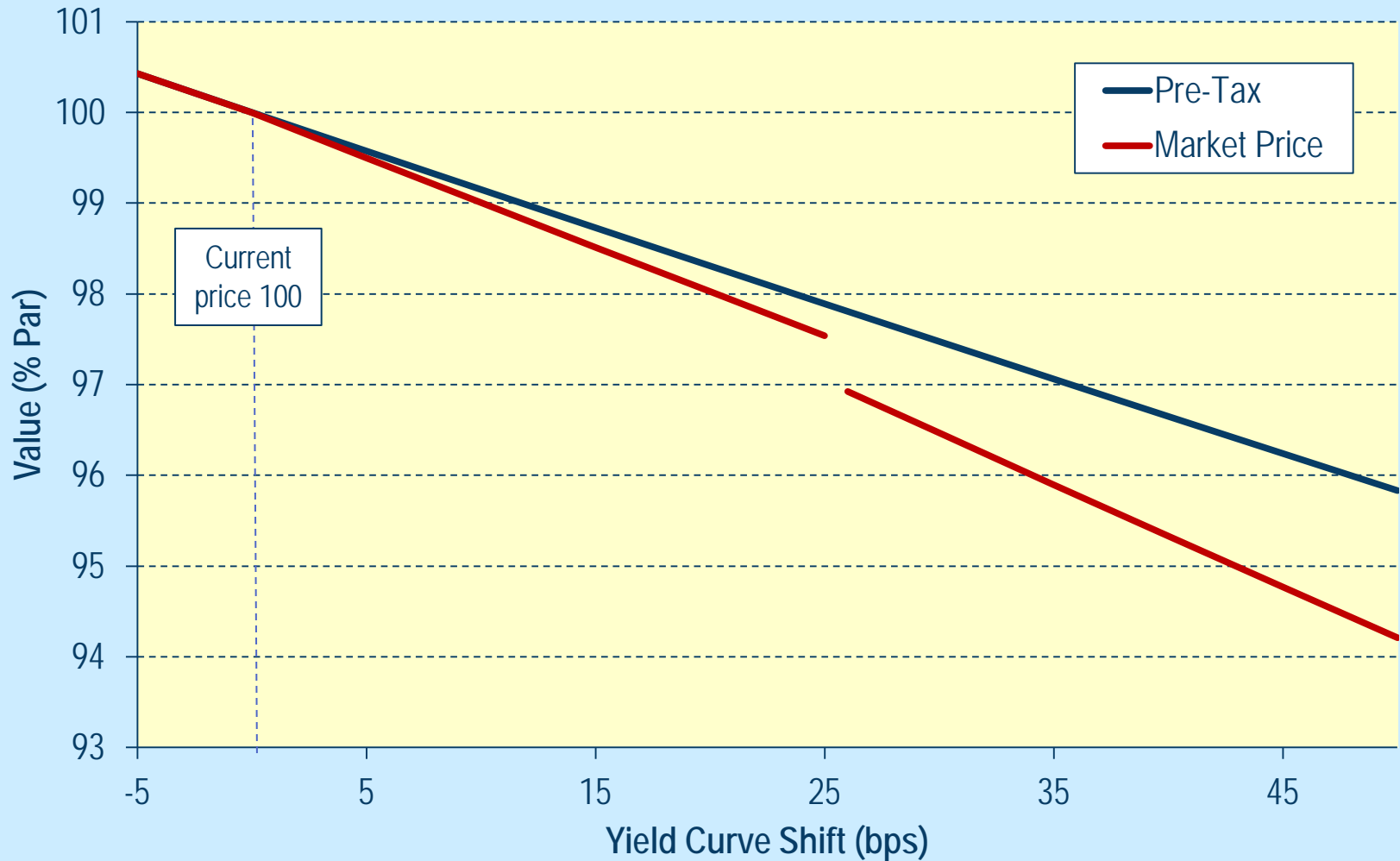
Taxes Depress Prices of Discount Munis



Ignoring Taxes → Duration Underestimated 10-Year Bullets



Interest Rate Sensitivity of 10-Year 3% Bond



When Rates Rise Prices Will Fall More Than Expected

Bond Buyer, March 18, 2013

Single-A Par Bonds	Rates Rise 100bps					
	Standard Approach		Kalotay Approach		Δ	
	Price	Yield	Price	Yield	Price	Yield (bps)
2-yr 0.90%	98.05	1.90	96.82	2.54	-1.23	64
5-yr 1.65%	95.35	2.65	92.84	3.21	-2.51	56
10-yr 3.00%	91.82	4.00	88.94	4.38	-2.88	38

Discount Bonds Get Hit Harder

THE BOND BUYER

Monday, July 8, 2013

After Price Drop, Discount Bonds Cheap

Markets - Market News

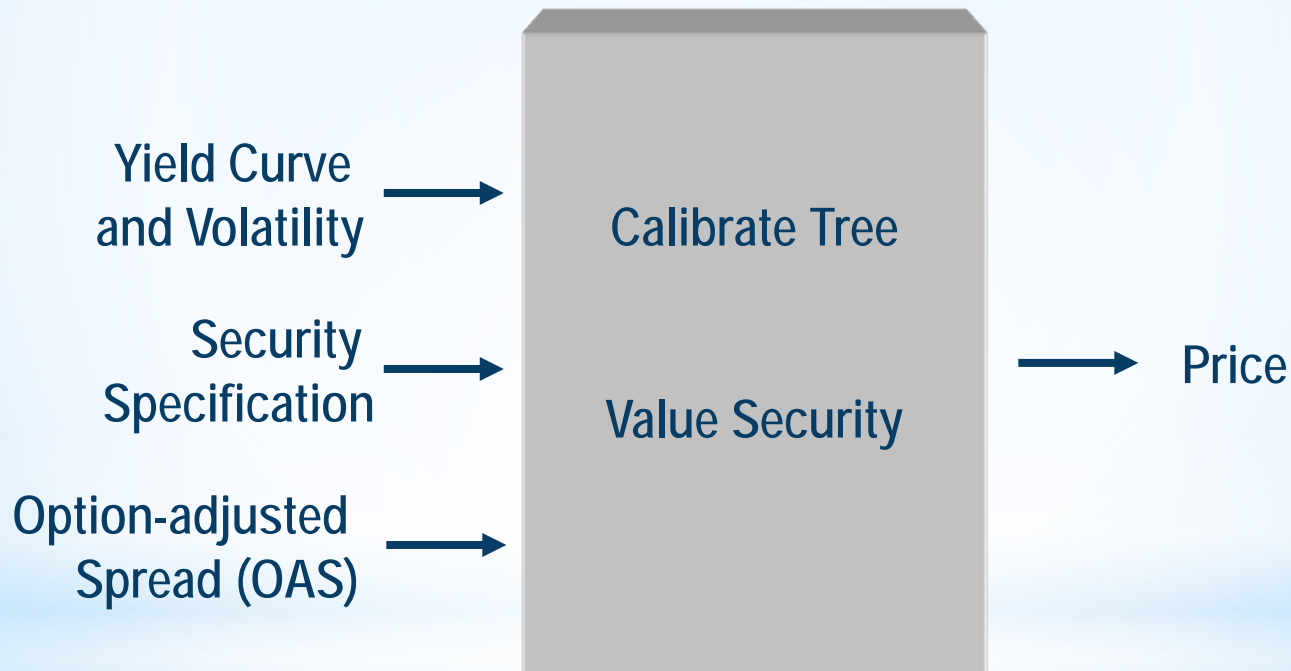
by: Taylor Riggs and Oliver Renick

Lower coupon bonds were hit the hardest in the recent selloff as prices declined much faster than premium bonds ...

Though lower coupon bonds don't hold up as well in a rising interest rate environment, a slew of 2% and 3% coupon bonds dropped to the 70-80 price range, making them much more attractive to the retail investor than 4% and 5% coupons priced over 100.

"If you have a true buy-and-hold investor, these low-coupon bonds are likely to be entirely suitable," said Phil Fischer, head of municipal bonds research and global index systems at Bank of America Merrill Lynch. "These lower coupon bonds all need to be priced and sold on an after-tax yield calculation. People need to be very sensitive, especially on the retail side, to make sure

Robust OAS Technology Provides the Foundation for Rigorous Analysis



Handbook of Municipal Finance (2008)

OAS Framework Extended to Munis

Incorporate taxes on capital gains and losses

Investors assumed to be in the highest tax bracket

Based on empirical analysis

Key concepts: *tax-neutral value* and *tax-neutral OAS*

Tax-neutral value is the PV of after-tax cashflows, *including tax payable at maturity* (determined iteratively)

Tax-neutral OAS 'explains' given market price

Tax-integrated valuation tools* are essential for managing interest rate risk and to maximize after-tax performance

* *MuniOAS™ and MuniSignal™ (patent pending)*

Implementation Challenges

Callable bonds

- Issuers refund without considering taxes

Original issue discounts (including callables)

- Discount or premium status of purchase determined relative to OID basis

Secondary market sales

- Need to keep track of investor tax basis

- Premium purchases amortized to maturity or call date

Risk Analysis for Munis

1. Select suitable benchmark yield curve
2. Calculate tax-neutral OAS given this benchmark
3. Estimate price given shocked benchmark, keeping OAS constant

Problem: Yields of standard muni benchmark curves are *YTC's of 5% NC-10 bonds*

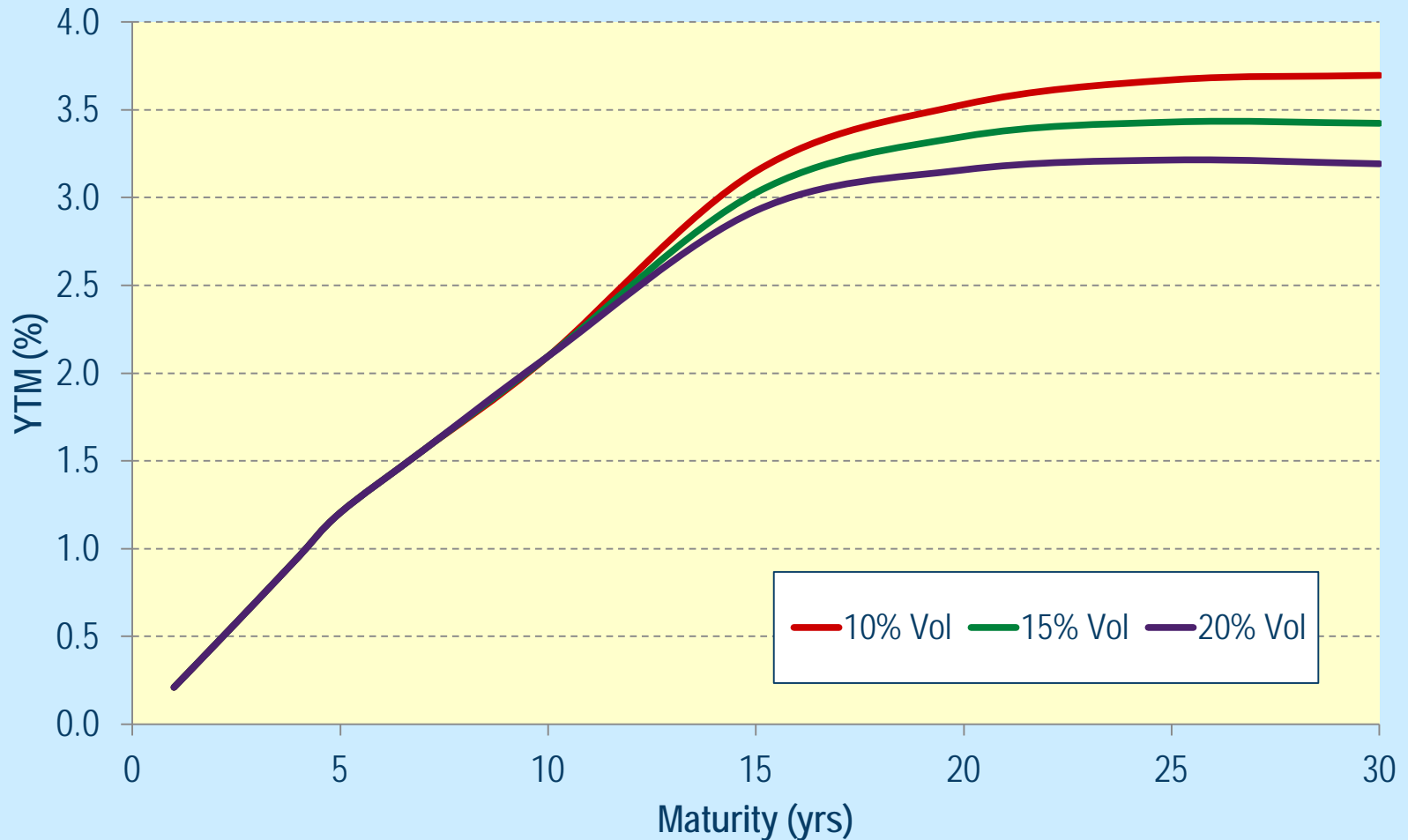
Proper risk analysis requires an *optionless par curve*

Need to strip out NC-10 options

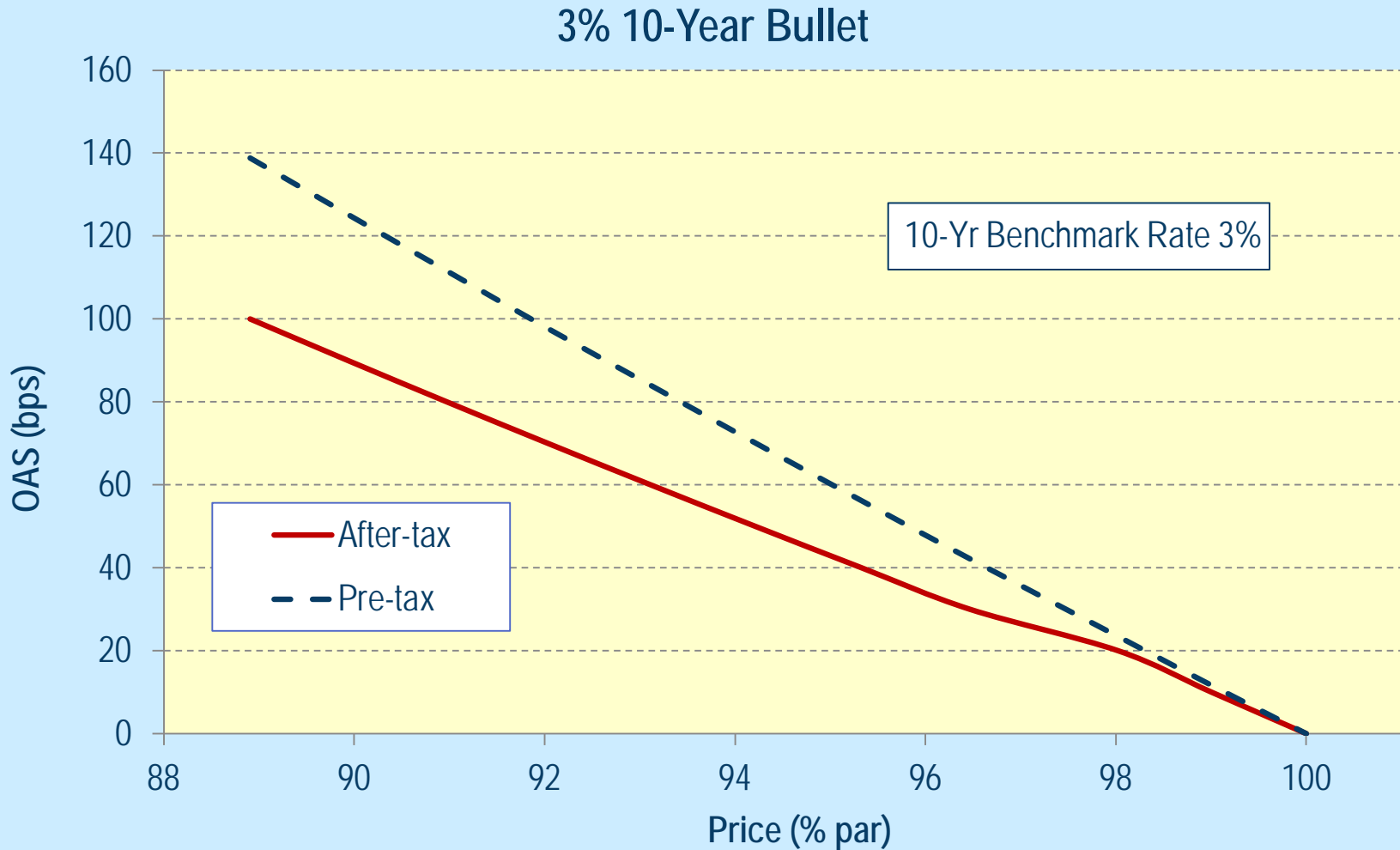
Recent AAA 5% NC-10 Curve



Implied Optionless Par Curves Depend on Vol Derived from 5% NC-10 Curve



Ignoring Taxes → Spread Overestimated



Tax Management of Munis

Familiar transaction: selling losers

Known as tax-loss harvesting

Short-term loss @ 40% can be very valuable

Sale decision is a two-step process

1. Is it profitable?
2. Do it now or wait?

Need scenario-dependent tax-neutral prices to determine optimum time to transact

Institutional Considerations

Institutional market is dominated by 5% NC-10 bonds

Preferred by investors for a variety of reasons

Advance refunding, reporting, tax management

Currently 5% bonds trade above par

But how far will your portfolio drop if rates rise 100 basis points? Standard analytics underestimate the damage

Kalotay approach to be offered by Investortools by year-end

References

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- "What Makes the Municipal Yield Curve Rise", A. Kalotay, M. Dorigan, *Journal of Fixed Income* (Winter 2008)
- "The Interest Rate Sensitivity of Tax-Exempt Bonds under Tax-neutral Valuation," *Journal of Investment Management (Journal of Investing, 2014)*
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- "Optimum Tax Management of Municipal Bonds" *Journal of Portfolio Management*, (Winter 2015)
- "Tax-Efficient Trading of Municipal Bonds" (working paper)
- "Optimal Municipal Bond Portfolios for Dynamic Tax Management" (working paper)