



Brandeis University
INTERNATIONAL BUSINESS SCHOOL

& THE BOND BUYER

2013 Municipal Finance Conference

The Interest Rate Sensitivity of Tax-Exempt Bonds under Tax-Neutral Valuation

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Ultimate Goal: Optimize Tax-Loss Harvesting

Taxes play a major role in corporate debt management decisions

Repurchase high-coupon debt: premium paid over par tax-deductible

For taxable investors, selling a muni at a loss may be preferable to holding it

"Optimal Bond Trading with Personal Taxes"

But when is the right time to sell?

Need to model prices of munis in different rate environments



Ingredients for Modeling Prices of Munis

Capital gains and losses are taxable

Details follow

Investors are in the highest tax bracket

Taxes on tax-exempt bonds, Journal of Finance, 2010

Arbitrage-free bond valuation in use since the mid-'80's

'Option Adjusted Spread'

OAS framework can be extended to incorporate tax treatment

Applicable to interest rate risk management (subject of paper)

Provides foundation for optimal tax-loss harvesting (forthcoming)



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 x the number of remaining years to maturity (e.g. 2.50 for a 10-year bond)



Key Analytical Concept: Tax-Neutral Value*

Defined as the price that equals the PV of after-tax cashflows under 'buy-and-hold' (**Hold To Maturity**)

Determined iteratively, because PV of tax liability depends on purchase price

Yield curve is a required input

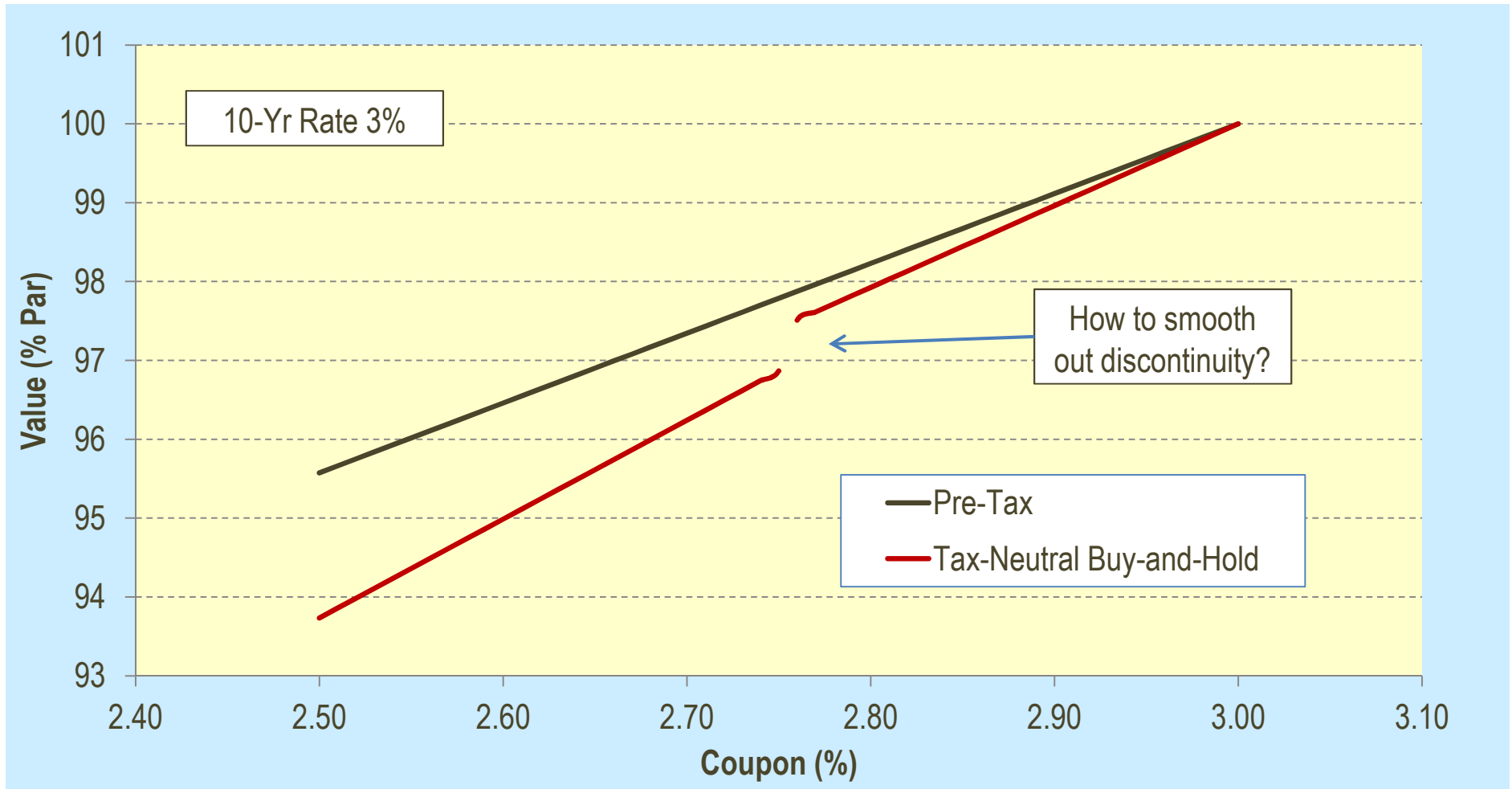
Either issuer-specific, or benchmark shifted by *tax-neutral* OAS

Tax-neutral OAS can be calculated from market price

* The after-tax 'fair price'

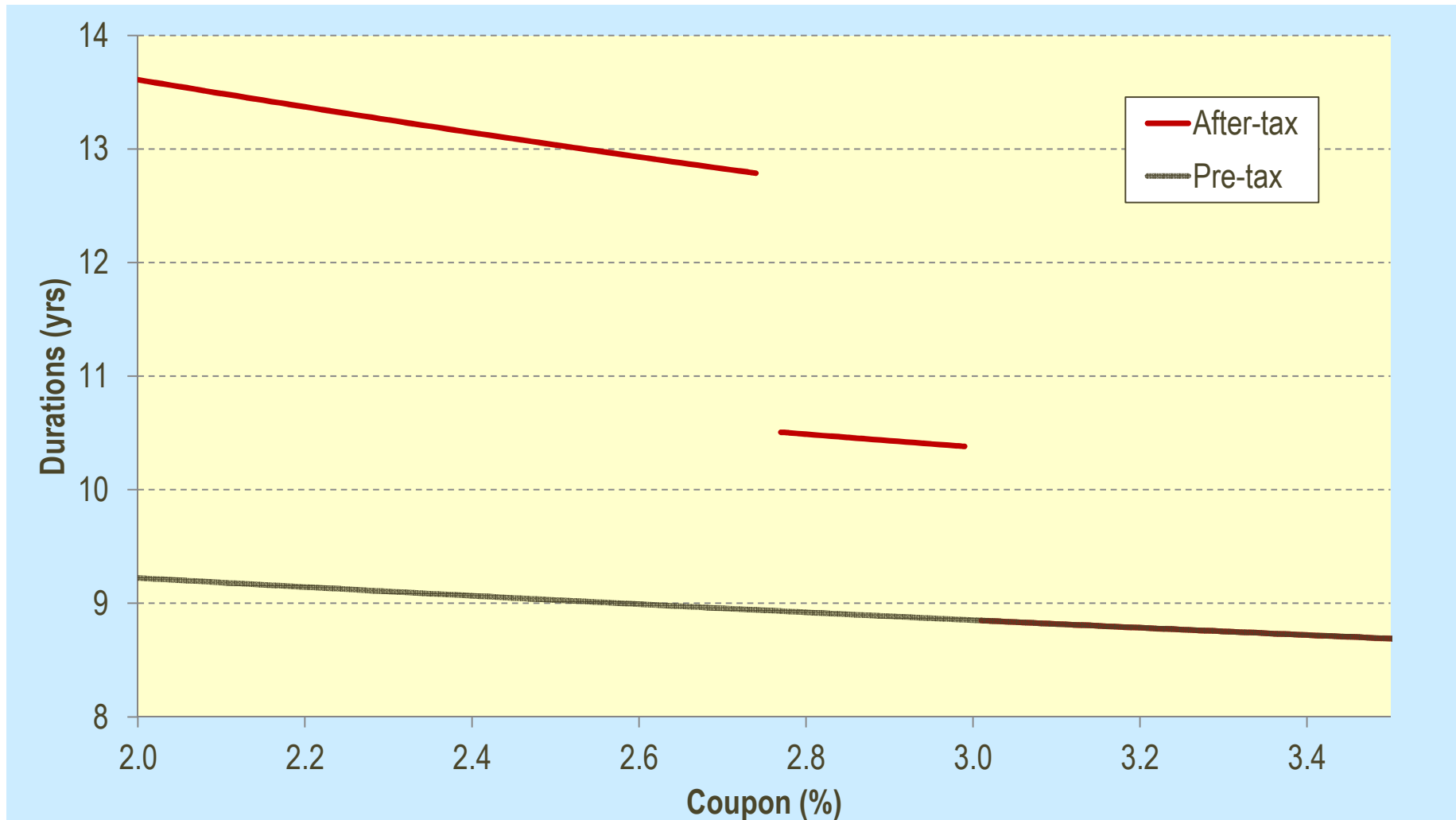


Taxes Depress Prices of Discounts 10NCL Based on Buy-and-Hold

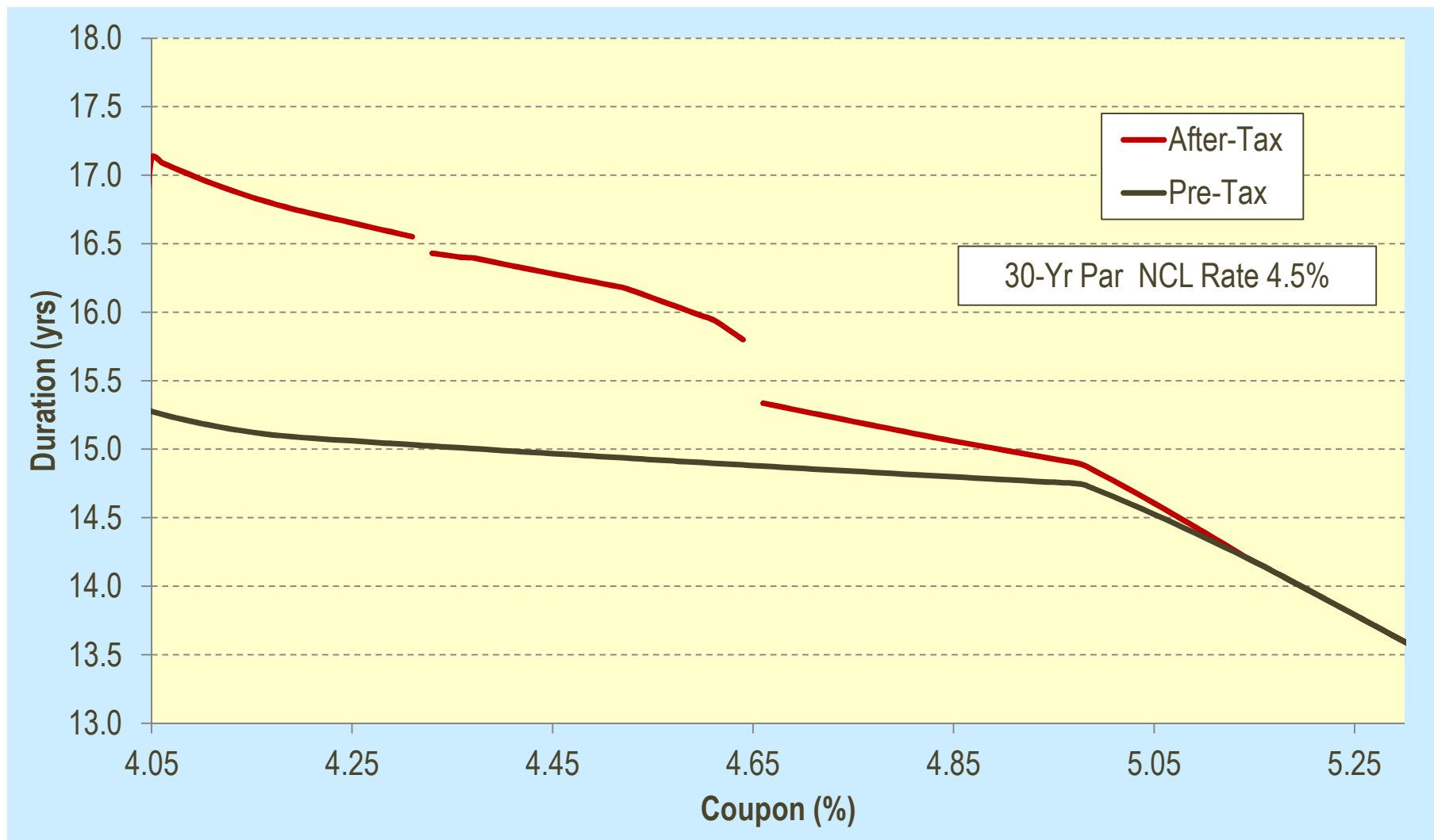




Duration of 10-Year NCL Bonds

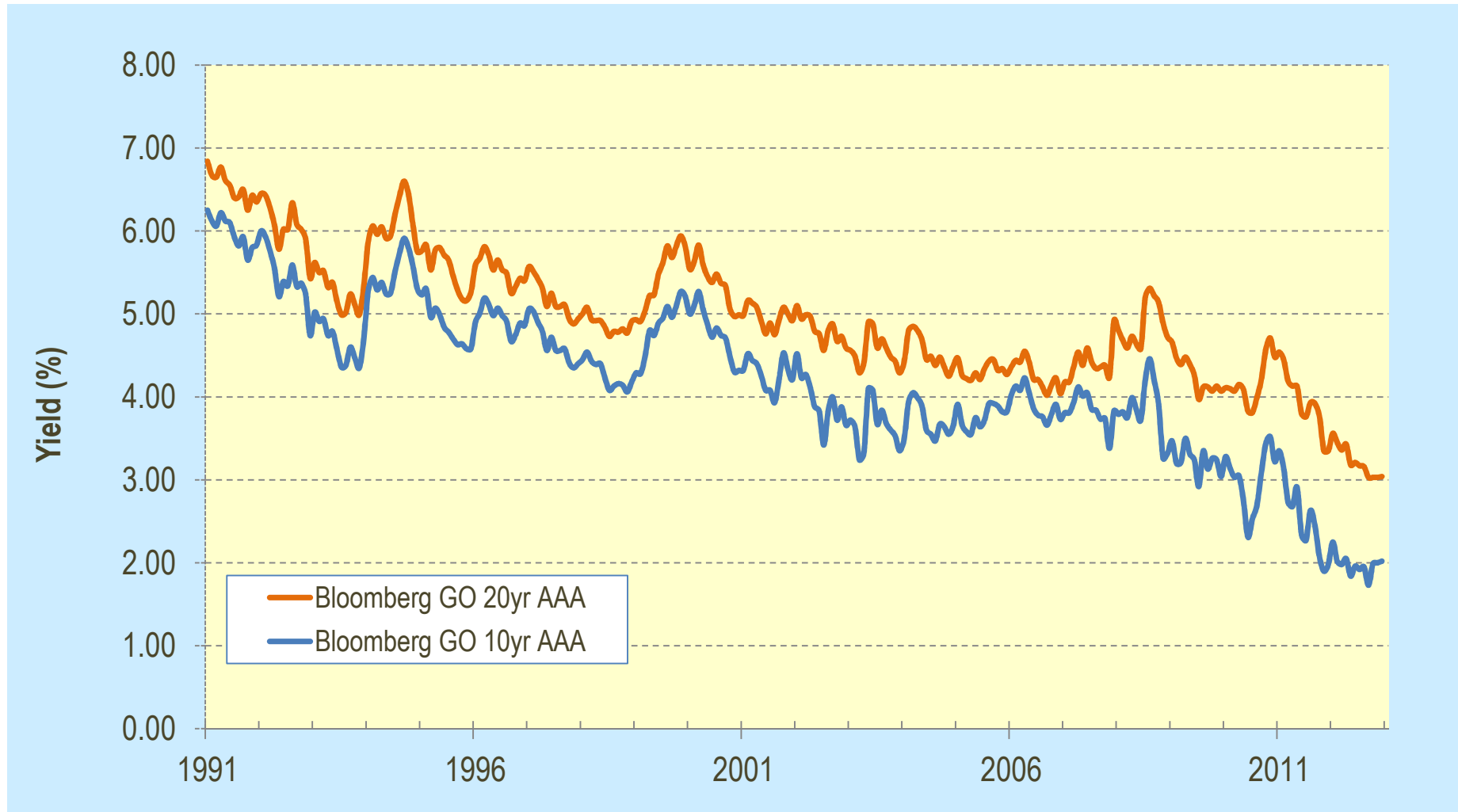


Duration of 30NC10 Bonds





What Will Happen When Rates Rise?





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%	91.87	3.99	88.94	4.38	-2.93	39



Investors Punish Low Coupon Bonds

THE BOND BUYER

Wednesday, July 3, 2013

In Selloff, Higher Coupons Outperformed

Markets - Buy Side
by: James Ramage

... buyers demanded an additional 40 basis points for 4% coupon bonds, industry analysts estimated, ... [and] ... they demanded an additional 80 basis points for 3% coupons [relative to 5% bonds].

Accordingly, while 5% coupons could be sold at these levels, buyers demanded an additional 40 basis points for 4% coupon bonds, industry analysts estimated. Following up, they demanded an additional 80 basis points for 3% coupons.



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



How Discount Munis Were Analyzed Before OAS

Implications of de minimis rule familiar to old-timers

Determined price based on desired after-tax cash-flow yield

Works reasonably well for optionless bonds

OAS approach is essential for rigorous valuation of callable bonds
and for stress testing/scenario analysis



Takeaways

We have extended conventional OAS-approach to the after-tax valuation of munis

Technology is essential for stress testing and to optimize tax-loss harvesting

When rates rise, prices of low-coupon munis decline significantly more than predicted by standard systems

Reported performance, based on mark-to-market, suffers unduly

Premium bonds mitigates adverse effect of higher rates

5% coupon has been the norm for institutional deals

Price less likely to decline below de minimis threshold



References

"Taxes on Tax-Exempt Bonds", A. Ang, V. Bhansali, Y. Xing, *Journal of Finance*, Vol. 65, No. 2 (2010)

"Optimal Bond Trading with Personal Taxes," Constantinides, G. M. and J. E. Ingersoll, 1984, *Journal of Financial Economics*, 13(No.3), 299-335.

"What Makes the Municipal Yield Curve Rise", A. Kalotay, M. Dorigan, *Journal of Fixed Income* (Winter 2008)

A. Kalotay working papers:

"The Interest Rate Sensitivity of Tax-Exempt Bonds under Tax-neutral Valuation"

"The Tax Option in Municipal Bonds"

"Managing the Tax Option in Municipal Bonds"



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