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**

<table>
<thead>
<tr>
<th>Purchase Price</th>
<th>Treatment</th>
<th>Tax Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>At a premium</td>
<td>Premium amortized to zero</td>
<td>N/A</td>
</tr>
<tr>
<td>At a de minimis discount</td>
<td>Taxed as capital gain</td>
<td>20%</td>
</tr>
<tr>
<td>At a non-de minimis discount</td>
<td>Taxed as ordinary income</td>
<td>40%</td>
</tr>
</tbody>
</table>

* 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

How to smooth out discontinuity?

10-Yr Rate 3%
Duration of 10-Year NCL Bonds

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Duration (yrs) vs. Coupon (%)

- **After-tax**
- **Pre-tax**

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www.bondbuyer.com/conferences/brandeis/  #MFC2013
Duration of 30NC10 Bonds

After-Tax
Pre-Tax

30-Yr Par  NCL Rate 4.5%
What Will Happen When Rates Rise?

![Graph showing yield (%) over time for Bloomberg GO 20yr AAA and Bloomberg GO 10yr AAA bonds from 1991 to 2011. The graph illustrates the trends and changes in yields during this period.]
When Rates Rise Prices Will Fall More Than Expected
Bond Buyer, March 18, 2013

<table>
<thead>
<tr>
<th>Single-A Par Bonds</th>
<th>Rates Rise 100bps</th>
<th></th>
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<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard Approach</td>
<td>Kalotay Approach</td>
<td>Price</td>
<td>Yield</td>
</tr>
<tr>
<td>Price</td>
<td>Yield</td>
<td>Price</td>
<td>Yield</td>
<td>Price</td>
</tr>
<tr>
<td>2-yr 0.90%</td>
<td>98.05</td>
<td>1.90</td>
<td>96.82</td>
<td>2.54</td>
</tr>
<tr>
<td>5-yr 1.65%</td>
<td>95.35</td>
<td>2.65</td>
<td>92.84</td>
<td>3.21</td>
</tr>
<tr>
<td>10-yr 3.00%</td>
<td>91.87</td>
<td>3.99</td>
<td>88.94</td>
<td>4.38</td>
</tr>
</tbody>
</table>
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

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
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


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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