Tax Efficient Trading of Municipal Bonds

New York
February 25, 2015
Hot Off The Press: Largest Corporate Debt Exchange
Can You Spot the Tax Play?

Partial Exchange Offer
Up to $12.5 Billion of New Notes

Up to $3.0 Billion of New 2026 Notes
5.15% Notes due 2023 (pre-launch price 114.58)

Up to $4.5 Billion of New 2048 Notes
5 Series of Notes maturing 2028 – 2038 (pre-launch price range 128.78 -137.10)

Up to $5.0 Billion of New 2055 Notes
6.55% Notes due 2043 (pre-launch price 133.93)

<table>
<thead>
<tr>
<th>Commencement</th>
<th>Price Determination</th>
<th>Expiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 25, 2015, 11:00am ET</td>
<td>Feb 25, 2015, 5:00pm ET</td>
<td>Mar 11, 2015, 11:59pm ET</td>
</tr>
</tbody>
</table>
New Toolkit to Boost Performance

### Daily Tax Management Monitor

3/15/2015

<table>
<thead>
<tr>
<th>Bond</th>
<th>Par Amount ($)</th>
<th>Purchase Date</th>
<th>Purchase Price</th>
<th>Current Basis</th>
<th>Sale Price*</th>
<th>After-Tax Benefit if Sold ($)</th>
<th>Tax Efficiency (%)</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>5539928A2 5% due 3/1/2039-Call 3/1/2018</td>
<td>60,000</td>
<td>8/15/2014</td>
<td>123.00</td>
<td>119.14</td>
<td>118.00</td>
<td>-66.00</td>
<td>N/A</td>
<td>No Benefit</td>
</tr>
<tr>
<td>319995AH6 5% due 6/15/2024</td>
<td>85,000</td>
<td>8/15/2014</td>
<td>112.00</td>
<td>111.40</td>
<td>108.00</td>
<td>365.50</td>
<td>97.93</td>
<td>Sell</td>
</tr>
<tr>
<td>297552QR5 3% due 3/1/2021</td>
<td>95,000</td>
<td>12/2/2012</td>
<td>108.00</td>
<td>105.91</td>
<td>100.50</td>
<td>788.50</td>
<td>99.48</td>
<td>Sell</td>
</tr>
<tr>
<td>615887YE5 3% due 3/1/2024</td>
<td>78,000</td>
<td>7/8/2014</td>
<td>104.00</td>
<td>103.62</td>
<td>101.00</td>
<td>210.60</td>
<td>85.84</td>
<td>Watch</td>
</tr>
<tr>
<td>977564HW5 2% due 5/1/2023</td>
<td>65,000</td>
<td>11/7/2012</td>
<td>80.00</td>
<td>80.00</td>
<td>94.00</td>
<td>552.50</td>
<td>100.00</td>
<td>Sell**</td>
</tr>
<tr>
<td>546787UX8 3% due 5/1/2023</td>
<td>80,000</td>
<td>10/1/2014</td>
<td>100.00</td>
<td>100.00</td>
<td>95.00</td>
<td>-544.00</td>
<td>N/A</td>
<td>No Benefit</td>
</tr>
<tr>
<td>855972ZA9 5% due 6/15/2043-Call 6/15/2024</td>
<td>90,000</td>
<td>8/15/2013</td>
<td>122.00</td>
<td>119.16</td>
<td>117.00</td>
<td>162.00</td>
<td>71.15</td>
<td>Hold</td>
</tr>
</tbody>
</table>

Short-term losses offset against long-term gains (20%). Income tax rate: 40%.

*Assumes 0.50 bid/ask spread. **Bifurcated tax treatment.
Analytical Challenges of Managing Munis

Valuation and risk management: price depends on tax on gain at maturity
  Large gain taxed as ordinary income, small gain as capital gains, loss not deductible
  Standard systems ignore taxes; reported Greeks are unreliable

Tax management: maximizing after-tax return
  Benefit from selling?
  When to sell?
  What to invest in?
  Expected excess performance?
Taxes Depress Prices of Discount Munis

10-Year Bullets

Value (% Par) vs. Coupon (%)

- Pre-tax
- Market Smoothed
- Buy-and-Hold

10-Yr Rate 3%
Ignoring Taxes ➔ Effective Duration Underestimated

10-Year Bullets

Duration

Price < 100

Price > 100

10-Yr Rate 3%

Coupon (%)

Pre-tax

After-tax

Ignoring Taxes ➔ Effective Duration Underestimated
Ignoring Taxes ➔ Credit Spread Overestimated

3% 10-Year Bullet

OAS (bps)

Price (% par)

After-tax

Pre-tax

10-Yr Benchmark Rate 3%
Performance Can Be Enhanced by Tax-Beneficial Sales

Tax treatment depends on investor’s tax basis
   Above-par purchase: premium amortized to maturity or call
   Below-par purchase: remains at purchase price
      Gain can have split treatment
Gain or loss can be short-term or long-term
   Short-term rate 40%, long-term rate 20%
Losses need offsetting gains; otherwise carry forward
‘Hold Value’ is Critical to Sale Decision

**Hold Value** = PV (*bond flows* + *tax due from current holder*)

- Tax rate depends on purchase date and purchase price
- Discount rates estimated from market price (using tax-neutral OAS)

Hold value and market price can diverge

- Market price depends on tax considerations of the new buyer
Market Price and Hold Value Can Diverge
10-Year Bullets

10-Yr Rate 3%
Sale Decision Is a Two-Step Process

1. Is it beneficial?
   Excess of after-tax proceeds from sale over hold value
   *Independent of reinvestment; like bond maintains risk exposure*
   *In practice, tax-driven sales are presented to retail clients as ‘swaps’ – an unnecessary source of confusion*

2. Do it now or wait?
   Sale at a later time may be more beneficial
   How to deal with interest rate uncertainty?
   What is the role of reinvestment?
Calculation of Benefit from Selling a Loser Bond Purchased at a Premium, Sold Below Par

### 2.50% Bond – 10 Years to Maturity

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Price (2 years ago)</td>
<td>111.85</td>
</tr>
<tr>
<td>Holder's Basis</td>
<td>110.00</td>
</tr>
<tr>
<td>Sale Price (after 0.25% transaction cost)</td>
<td>93.22</td>
</tr>
<tr>
<td>Loss = Sale Price – Holder's Basis</td>
<td>(16.78)</td>
</tr>
<tr>
<td>Tax Savings @ 23.8%</td>
<td>3.99</td>
</tr>
<tr>
<td>After-tax Proceeds from Sale = Sale Price + Tax Savings</td>
<td>97.21</td>
</tr>
<tr>
<td>Hold Value</td>
<td>95.57</td>
</tr>
<tr>
<td>Net Benefit of Transaction = After-tax Proceeds from Sale – Hold Value</td>
<td>1.64</td>
</tr>
</tbody>
</table>

*All values in percent of par*
Introducing the Tax Option

The right to execute tax-driven trades
   Acquired automatically, at no cost, upon purchase
   But only astute managers know how to ‘monetize’ it
Value, and therefore optimal exercise, depend on:

*Reinvestment strategy*
   Dynamic tax management or one-time sale

*Availability of short-term gains*
   Aggressive or conservative management style

*Interest rate volatility and transaction cost*
Short-Term Losses Increase Tax Option Value Par Bonds

[Graph showing the incremental value (% par) over maturity (yrs) for One-Time and Dynamic options.]

Incremental Value (% par)

Maturity (yrs)
Tax Efficiency Signals When to Sell

\[ \text{Tax Efficiency} = \frac{\text{Aftertax Proceeds} - \text{Hold Value}}{\text{Net Loss of Tax Option Value}} \]

Cashflow benefit from sale (numerator) should capture most of forfeited option value
Maximum 100%

See demo at http://analytics.kalotay.com/munisignal/
Tax-Driven Sales Improve Performance*
Par Bonds of Various Maturities – One Year Horizon

*Based on simulated rate scenarios using Black-Karasinski process @15% vol. Transaction cost 0.25% par.
Performance* Boost From Tax Management
Various Maturities – One Year Horizon

*Based on simulated rate scenarios using Black-Karasinski process @15% vol. Transaction cost 0.25% par.
Performance* Boost Reduced If Short-Term Losses Are Offset Against Long-Term Gains

*Based on simulated rate scenarios using Black-Karasinski process @15% vol. Transaction cost 0.25% par.
## Setting Up For Success: Buy Premium Bonds

Optimizing Portfolio of Desired Duration

<table>
<thead>
<tr>
<th>Bond</th>
<th>Purchase Price</th>
<th>Hold Value Duration (Yrs)</th>
<th>Tax Option Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Short-Term Losses Offset</td>
</tr>
<tr>
<td>5% 13-year NC-L</td>
<td>120.83</td>
<td>10.04</td>
<td>2.91</td>
</tr>
<tr>
<td>5% 20-year NC-10</td>
<td>116.18</td>
<td>10.04</td>
<td>2.90</td>
</tr>
<tr>
<td>3.05% 12-year NC-L</td>
<td>100.00</td>
<td>10.15</td>
<td>0.79</td>
</tr>
</tbody>
</table>
### Tax Option Value is a Good Predictor Of Tax-Managed Performance

<table>
<thead>
<tr>
<th>Bond</th>
<th>Purchase Price</th>
<th>One-Year Expected Returns (%)</th>
<th>Tax-Managed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Buy and Hold</td>
<td>Short-Term Loss @ 40%</td>
</tr>
<tr>
<td>5% 13-year NC-L</td>
<td>120.83</td>
<td>1.95</td>
<td>2.78</td>
</tr>
<tr>
<td>5% 20-year NC-10</td>
<td>116.18</td>
<td>2.14</td>
<td>2.90</td>
</tr>
<tr>
<td>3.05% 12-year NC-L</td>
<td>100.00</td>
<td>1.96</td>
<td>2.32</td>
</tr>
</tbody>
</table>
Recap: Tax-Driven Sales Enhance Performance

Value of tax option depends on management strategy

Tax efficiency signals when to sell

Dynamic tax management improves annual return of intermediate-duration portfolio by 30 to 80 basis points

Superior performance requires tax-efficient investing; premium bonds get the job done
Analytical Approach

Bond valuation: overlay taxes on OAS framework
  Capital gains and losses, including OID’s
  Tax-neutral value is the PV of after-tax cashflows
    Determined iteratively
  Tax-neutral OAS adjusts for both call option and taxes

Tax option valuation: recursive, lattice-based
  Option acquired upon reinvestment considered in sale decision
    (added to cashflow benefit)
Potential benefit is considerable

But tax-driven opportunities are largely ignored
   Mutual funds and ETF’s report only pretax performance
      Investors are responsible for taxes on capital gains
   Managers of SMA’s are reluctant to advise on taxes
For individuals, transaction cost is prohibitive
References

“Bond Valuation in Tax Denial”, Quant Forum (March 29, 2014)


“The Interest Rate Sensitivity of Tax-Exempt Bonds under Tax-Neutral Valuation,” Journal of Investment Management, (First Quarter 2014)


“Tax-Efficient Trading of Municipal Bonds” (Working paper)

“The Boost from Dynamic Tax Management” (Working paper)

“How to Take a Tax Loss and Then Profit From Obamacare”, Bond Buyer, (December 11, 2013)