Tax Optimization of Municipal Bond Portfolios: *Investment Selection and Tax Rate Arbitrage*

ANDREW KALOTAY

ANDREW KALOTAY
is president of Andrew Kalotay Associates, Inc., in New York, NY.
andy@kalotay.com

Tax-exempt municipal bonds (munis) are usually held in taxable accounts. This article discusses how after-tax performance can be increased by tax-beneficial sales. A well-known strategy is tax-loss harvesting, or selling a bond at a price below the investor's tax basis and recognizing the resulting loss for tax purposes.

There are two practical concerns with the tax-loss harvesting of munis. One is that bonds purchased near par are unattractive candidates because, when rates rise and the prices fall below par, the hold values (worth to investors who bought near par) will exceed the market prices, possibly by a wide margin (Kalotay 2016a, 2016b). This problem does not arise with bonds purchased at a reasonable premium.

The second concern is that tax-loss harvesting improves performance only when rates rise. When rates decline and prices increase, there are no tax-loss selling opportunities and thus no improvement relative to the buy-and-hold case. Clearly, a more balanced performance would be desirable. A possible strategy is tax rate arbitrage. If a bond that was purchased at a deep market discount is sold at a much higher price, the gain up to the accrued market discount is taxed at a high rate (as ordinary income), and any excess is taxed at a lower capital gains rate. The sale decision hinges on the trade-off between paying tax on part of the gain at a low rate at the time of the sale or paying the higher income tax rate on the entire gain at maturity. The applicable discount rate is a critical factor in determining the benefit.

Any tax-beneficial sale is an exercise of the so-called tax option, which is acquired automatically and at no cost upon investing. As discussed by Kalotay (2016c), the value of the tax option for munis can be determined with tax-neutral option-adjusted spread (OAS) analytics (Kalotay 2014a). Selling and reinvesting entails swapping the associated tax options. Reinvestment in a like bond (i.e., one with similar interest rate and credit exposure) preserves the risk profile of the portfolio. Transaction costs can be a major deterrent to transacting. The so-called tax efficiency measure, which compares the cash-flow benefit to the net loss of option value, provides the signal for the optimal time to transact (Kalotay 2014b).

Under prudent investing and tax-efficient selling, dynamic tax management can increase the expected annual return of an intermediate-duration muni portfolio by roughly 20 to 30 bps.

TAX CONSIDERATIONS

We will limit the discussion to non-OID (original issue discount) bonds. In general,

the tax treatment depends on whether the bond is purchased at a premium or at a discount.

First, assume that the bond is held to maturity or call. If a noncallable bond is purchased above par, its so-called tax basis is gradually amortized to par at maturity. If the bond is callable, it is amortized to the first call date. In either case, there will be no tax-related cash flows if the bond is held to redemption. If a bond is purchased at a discount in the secondary market, the treatment of a large (non–*de minimis*) discount differs from that of a small one. The gain on a purchase at a non–*de minimis* discount is taxed at maturity as ordinary income, whereas a *de minimis* discount is taxed at the applicable capital gains rate.

Selling before maturity or call is usually a taxable event. The short-term or long-term capital gains rate is applied depending on whether the bond was held for less than or more than a year. If a bond is purchased at a premium, the difference between the holder's basis and the sale price is a taxable gain or loss. If a bond is purchased at a discount, the holder's basis is the purchase price. Sale below the purchase price is a capital loss. The tax treatment on gains relative to the purchase price is a little more complicated. If the market discount is small, then any gain is taxed at the capital gains rate. If large, then it has to be accrued to determine how much of the gain is taxable as ordinary income and how much as capital gains. The rule is that a gain is taxable at the income tax rate up to the accrued market discount, and any excess is taxed as a capital gain. In this article, we assume the income tax rate is 40%, and the short-term and long-term gains rates are 40% and 20%, respectively.

DETERMINING HOLD VALUE

The market price of a muni is affected by the tax payable at maturity by the marginal buyer. Any tax payable at maturity depresses the current market price. The valuation of munis is discussed in (Kalotay 2014a), introducing the concept of tax-neutral OAS. The market price is the difference between the present value of the pretax cash flows and the present value of the tax payment at maturity. By applying the same OAS to the pretax cash flows and to the tax payment, we can determine their respective values. Because the following examples involve optionless bonds, we use after-tax yield-to-maturity as a surrogate for the tax-neutral OAS approach, making the calculations transparent enough for the interested reader to reproduce.

Simplified Example

Suppose the market price of a 10-year 3% bond is 90. Consequently, the tax payment at maturity is 4 (40% of 10) and the after-tax yield to maturity (YTM) is 3.89%. At this discount rate, the present value of the tax payment is 2.72; therefore, the present value of the pretax flows is 92.72 (90 + 2.72).

This example illustrates how to determine the value of the optionless cash flows. Although the calculation becomes considerably more complex if we apply an OAS approach, which handles callable bonds and takes into account the shape of the yield curve, the basic idea remains the same. It enables us to infer from the market price the hold value of the bond, which is the present value of the pretax flows minus the present value of the tax payable by the current holder at maturity.

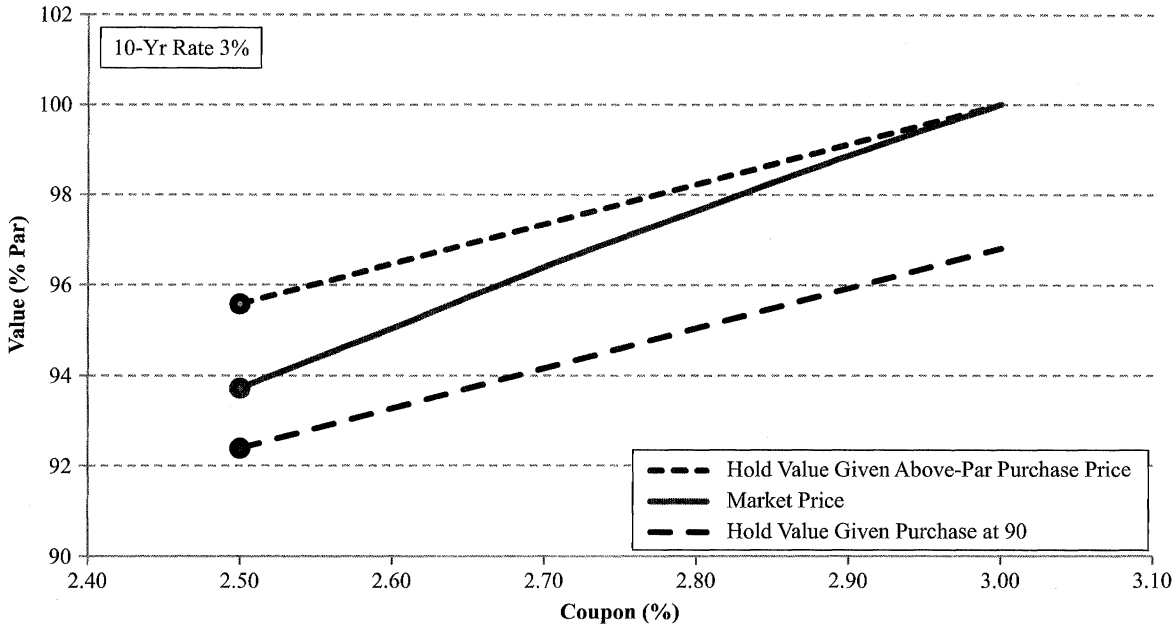
If the tax payable by the marginal buyer (which depends on the market price) is different from the tax payable by the holder (which depends on the date and price of purchase), the market price and the hold value will differ (Exhibit 1).

To summarize, the present value of the tax payable by the marginal buyer is implicit in the market price, and we can estimate this value by assuming that tax-related cash flows are discounted at the same rate as bond-related cash flows (interest and principal payments). In particular, in the case of a noncallable bond, the tax payable at maturity is discounted at the same rate as the principal payment. We can apply tax-neutral OAS methodology as follows:

1. From the market price, determine the tax-neutral OAS relative to the benchmark curve.
2. Use this OAS to value the pretax cash flows.
3. Determine the hold value by adjusting the value of the pretax flows by the tax payable by the current holder.

In the preceding example all flows are discounted at the same rate (3.89%); the differences among the hold values are the result of the differences of the tax payments at maturity, which are determined by the purchase prices.

EXHIBIT 1
Hold Value Can Differ from Market Price



Let's consider a different situation: two bonds with different coupons and identical maturities selling at the same discount. What can we say about the present value of the tax obligations? The bond with the lower coupon has a lower OAS (lower YTM); therefore, its associated tax payment is discounted at a lower rate, and it has a higher present value. Keeping in mind that discount rate is an indicator of risk, this relationship makes sense: The riskier bond is more likely to default, and therefore its associated tax payment is less certain.

A similar consideration applies to two bonds with identical coupons and maturities selling at the same price, but one is callable and the other is a bullet. Because of the presence of the call option, the OAS of the callable bond is lower, and therefore the present value of its associated tax is higher.

The following examples show how the net benefit of a tax-loss sale is calculated. For expository purposes, hold value is calculated using after-tax yield rather than tax-neutral OAS, because it works well enough for optionless bonds.

In the case of a bond purchased at a premium (Exhibit 2), the holder's basis at the time of sale is the price of the bond calculated at the purchase yield. The purchase price of 110 implies a purchase yield of 1.90%.

EXHIBIT 2
Bond Purchased at Premium, Sold above Par

3% Bond—8 Years to Maturity	
Purchase Price (2 years ago) ①	110.00
Holder's Basis ② Amortized at Purchase Yield of 1.90%	108.15
Sale Price (0.4% bid–ask spread) ③	106.50
Loss ④ = ③ − ②	(1.65)
Tax Savings at 20% ⑤ = ④ × 0.20	0.33
After-Tax Proceeds from Sale ⑥ = ③ + ⑤	106.83
Hold Value ⑦	106.70
Net Benefit of Transaction ⑧ = ⑥ − ⑦	0.13

Converting to a price on the sale date, using this yield, results in a basis of 108.15. The loss relative to this basis generates tax savings of 0.33. To obtain the net benefit, we compare the after-tax proceeds (sale price + tax savings) to the hold value, which in this case is simply the midmarket value of the bond (106.50 + 0.40/2).

When the market price is below par and the purchase price is at or above par, the calculation of hold value involves two steps (Exhibit 3). First, calculate the after-tax yield implied by the market price (97.20). The tax at maturity incorporated into the market price of 97.20 is 1.12 ([100 − 97.20] × 0.40). Thus the terminal

EXHIBIT 3
Bond Purchased at Par, Sold below Par

2.5% Bond—8 Years to Maturity	
Purchase Price (2 years ago) ①	100.00
Holder's Basis ②	100.00
Sale Price (0.4% bid–ask spread) ③	97.00
Loss ④ = ③ – ②	(3.00)
Tax Savings at 20% ⑤ = ④ × 0.20	0.60
After-Tax Proceeds from Sale ⑥ = ③ + ⑤	97.60
Hold Value at After-Tax Mid-Market Yield of 2.77% ⑦	98.10
Net Benefit of Transaction ⑧ = ⑥ – ⑦	(0.50)

payment is 98.88 (100 – 1.12). The resulting after-tax yield (2.77%) is applied to discounting the stated cash flows of the bond for a holder who pays no taxes at maturity, resulting in a hold value of 98.10.

TAX RATE ARBITRAGE

The candidates for tax rate arbitrage are bonds that were purchased at a discount and whose value subsequently surges (current YTM lower than the investor's purchase yield). Such a surge could be the result of a market rally because of a general decline in interest rates, or the result of issuer-specific credit improvement. If sold above the purchase price, the gain up to the accrued market discount is taxed at the higher ordinary income tax rate, and the excess gain is taxed at a lower long-term capital gains rate. If held to maturity, the entire gain relative to purchase price would be taxed as ordinary income. A dominant consideration in the sale decision is the present value of the tax at maturity. Sale is unlikely to be tax beneficial for long-term bonds because the present value of the tax payment at maturity is insignificant in comparison to paying the tax now, even if at a lower blended rate.

In the case of a bond purchased at a discount, determining the after-tax economics of selling at a gain can be complicated (Exhibit 4). First, the market discount must be accrued to the sale date. In this example, the purchase price of 82 implies a purchase yield of 4.23%. On the sale date, the "accreted" price of the bond at this yield is 85.02. Thus, the accrued market discount is 3.02 (85.02 – 82.00). The gain up to the accrued market discount is taxed at the income tax rate. Any excess gain is taxed as a capital gain. As shown, the resulting tax payable is 2.80.

EXHIBIT 4
Bond Purchased at Discount, Sold above Purchase Price

2% Bond—8 Years to Maturity	
Purchase Price (2 years ago) ①	82.00
Holder's Basis ②	82.00
Sale Price (0.4% bid–ask spread) ③	93.00
Gain ④ = ③ – ②	11.00
Accrued Market Discount at Purchase Yield of 4.23% ⑤	3.02
Gain over Accrued Market Discount ⑥ = ④ – ⑤	7.98
Tax Payable ⑦ = ⑤ × 0.40 + ⑥ × 0.20	(2.80)
After-Tax Proceeds from Sale ⑧ = ③ + ⑦	90.20
Hold Value at After-Tax Mid-Market Yield of 2.64% ⑨	89.57
Net Benefit of Transaction ⑩ = ⑧ – ⑨	0.63

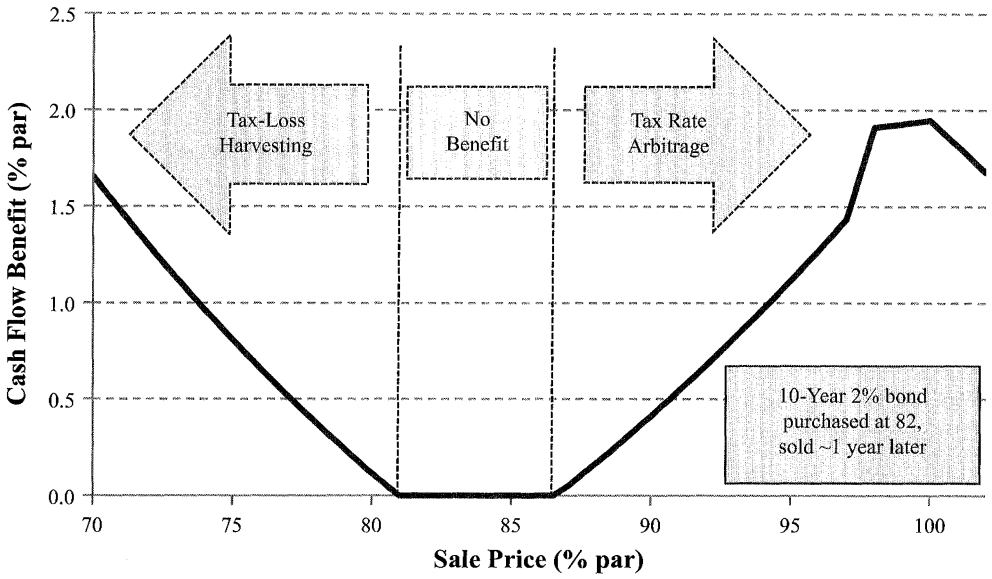
The next challenge is calculating the hold value. First, we calculate the after-tax yield of the mid-market price of 93.20. At this price the tax at maturity is (100 – 93.20) × 0.40, or 2.72. The implied after-tax yield given the tax flow and the bond's coupon and principal is 2.64%. We then use this yield to discount (1) the pretax cash flows of the bond, which results in a present value of 95.41, and (2) the tax payable at maturity from the perspective of the current holder, or 7.20 ([100 – 82] × 0.4). Discounting this flow at 2.64% results in a present value of 5.84. Thus, the hold value to the investor who bought at 82 is the pretax value of 95.41 less the 5.84 present value of the tax payable at maturity, or 89.57.

Exhibit 5 (see right-hand side) shows how tax rate arbitrage works. We see that a 10-year 2% bond purchased at 82 and sold at a gain slightly beyond a year later is tax beneficial because a portion of the gain is taxed at the lower long-term gains rate. This may be preferable to paying the income tax rate on the entire gain at maturity. Note that the benefit declines if the sale price is greater than par. In that case, the magnitude of the gain exceeds that which would occur at maturity. Thus, the tax bill on sale will be on a larger gain, albeit possibly at a lower blended tax rate. On the left-hand side, we see that a sale at a loss, just shy of one year from purchase, is beneficial because short-term losses are valuable (sale prices less than 81 overcome the transaction cost of 0.2).

In summary, intermediate-term bonds purchased at a reasonable discount can provide two distinct tax management opportunities:

- Tax rate arbitrage, if the price increases (held for more than one year)

EXHIBIT 5
Discount Bonds Provide Straddle



- Tax-loss harvesting, if the price declines (held for less than one year)

In contrast, bonds purchased above par are suitable only for tax-loss harvesting.

THE TAX OPTION

The tax option is the right to execute a tax-beneficial transaction (Kalotay and Howard 2014). It is acquired automatically and at no cost at the time of investment in a taxable portfolio. The tax option embedded in an investment-grade muni can be valued using tax-neutral OAS methodology; the approach is described by Kalotay (2016c). Valuing the tax option embedded in high-yield bonds requires different tools (credit default swap technology) because the prices of high-yield bonds depend only weakly on interest rates. We will leave this topic for future research.

In the following, we summarize the key facts about the tax option. Its value is derived from the price volatility of the underlying asset. The price of a muni depends on interest rates, and therefore greater interest rate volatility provides greater tax option value, even for non-callable bonds.

The value of a tax option also depends on the expected course of interest rates. Broadly speaking, an upward-sloping benchmark yield curve indicates that rates are expected to increase. Increasing rates and lower prices are favorable for tax-loss harvesting and unfavorable for tax rate arbitrage. A flat yield curve would reduce this bias (see effect on option value in Exhibits 6 and 7).

We assume that the proceeds from sale are reinvested, acquiring tax optionality at no cost in the process. By reinvesting in a like bond (without violating Internal Revenue Service wash sale rules), the manager can preserve the market and credit risk profiles of the portfolio, while locking in cash-flow savings. In practice the bond acquired upon reinvestment may differ significantly from the bond being sold (e.g., longer maturity). However, for analytical purposes we assume a like bond.

The criterion to determine the optimal time to sell is tax efficiency, defined as:

$$\text{Tax efficiency} = \frac{\text{Cash-flow benefit}}{\text{Net loss of option value}}$$

Sale is recommended when tax efficiency is close to or at the maximum value of 100%.

Exhibits 6 and 7 display the tax option values of 10-year bonds of various coupons under upward-sloping and flat yield curve assumptions, respectively. The purchase (market) prices are shown on the right axis. Both exhibits demonstrate that,

EXHIBIT 6

Tax Option Values of 10-Year Bonds—Upward-Sloping Yield Curve

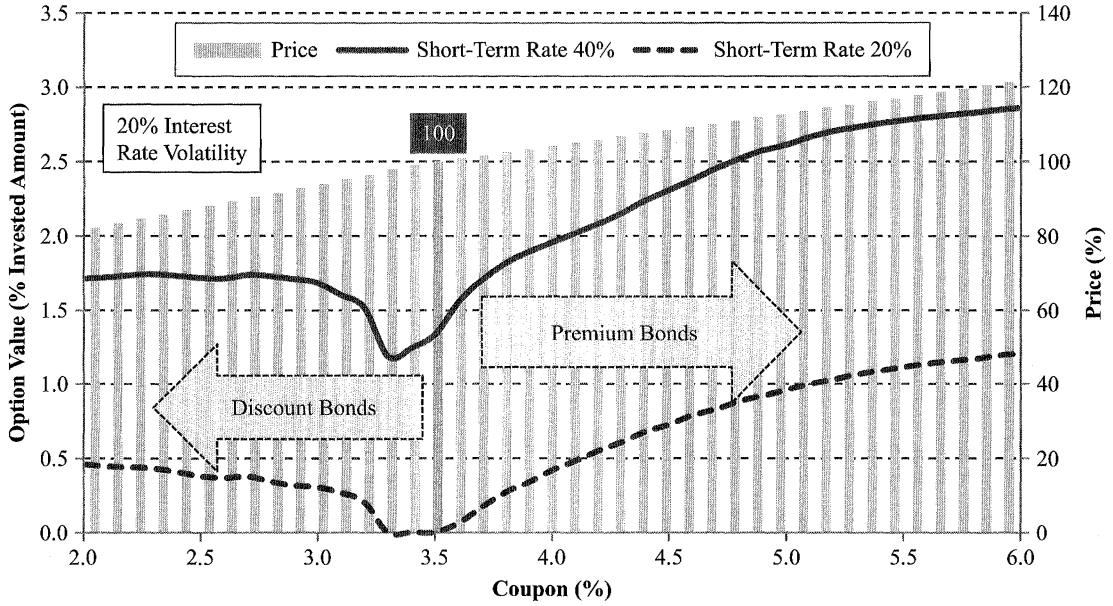
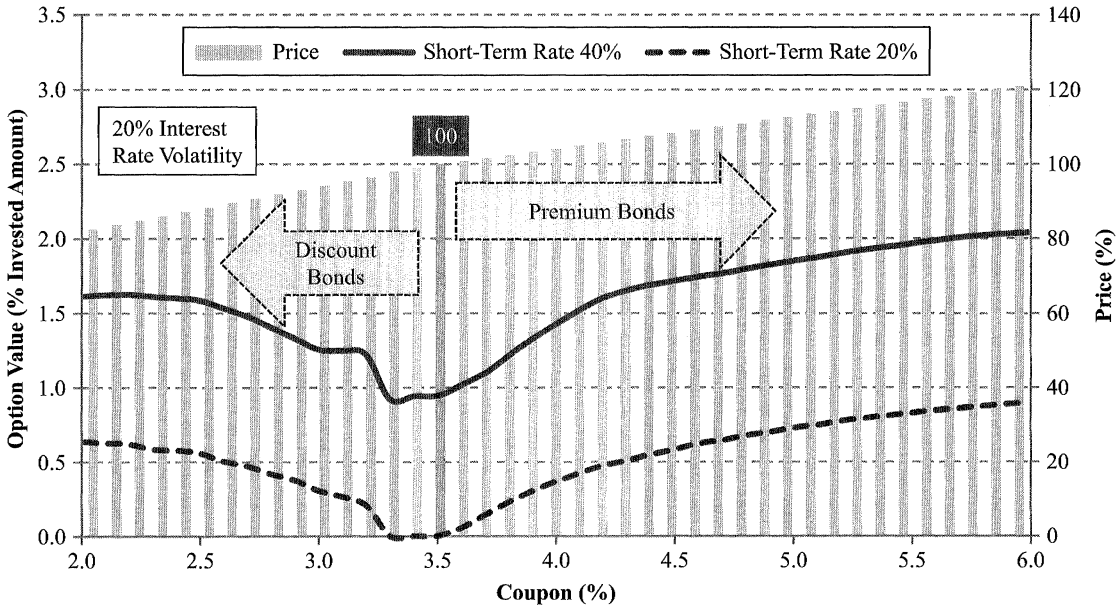


EXHIBIT 7

Tax Option Values of 10-Year Bonds—Flat Yield Curve 3.5%



when offsetting short-term gains are available, the tax option is valuable. When short-term losses must be offset against long-term gains (short-term rate effectively 20%—see dashed lines), the tax option values decline significantly. In fact, if the bond is purchased near par, the tax option is worthless.

The tax option values shown in Exhibits 6 and 7 can be used to approximate the expected performance

EXHIBIT 8
Estimating Performance Boost from Tax Option Value

Investment	Upward-Sloping (2.0% to 3.5% at 10 year)		Flat Yield Curve at 3.5%	
	Tax Option Value* (% amount invested)	Annual Expected Performance Boost (tax option value annuitized)	Tax Option Value* (% amount invested)	Annual Expected Performance Boost (tax option value annuitized)
10-Year 2% at ~82.3	1.72	~21 bps	1.61	~19 bps
10-Year 5% at ~112.7	2.61	~31 bps	1.85	~22 bps

**At 20% interest rate volatility.*

improvement through tax management. For example, a 2% 10-year bond purchased at around 82 would be expected to provide about 21 bps in extra return through tax management, assuming an upward-sloping yield curve as shown in Exhibit 8.

CONCLUSION

Performance has to be measured against a benchmark. In our case, the natural benchmark is the performance of an unmanaged buy-and-hold portfolio. After-tax performance relative to buy-and-hold can be improved by tax-beneficial selling. Two distinct opportunities may arise: tax-loss harvesting and tax rate arbitrage.

Tax-loss harvesting is applicable to securities whose value has declined below the investor's tax basis. Selling a muni at a loss reduces taxes, but it is beneficial only if the after-tax proceeds exceed the investor's hold value. The recommended investments are bonds selling at a substantial premium to par. Munis selling near par are less attractive, because sale prices below par are depressed by the tax payable at maturity by the marginal buyer. However, an investor who bought the bond above par is not subject to such tax. Thus in this case, the hold value exceeds the market price, possibly eliminating any benefit from the tax savings. There are two possible exceptions. First, within the first year, losses can be written off at a high short-term capital gains rate. Second, if the maturity is in the distant future, the present value of the tax payable at maturity may be relatively modest.

Tax loss harvesting opportunities present themselves only when rates rise, so potential outperformance relative to buy-and-hold is one-sided. For more balanced performance, we need investments with potential to deliver excess return when prices increase, whether because of lower interest rates or improved credit. In such cases, tax rate arbitrage may provide economic benefit. The motivation for tax rate arbitrage is to pay a lower tax rate on the gain in excess of the accrued market discount versus a higher income tax rate later.

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