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# Tax-Efficient Trading of Municipal Bonds

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*The author proposes a dynamic strategy to optimize the after-tax performance of a municipal bond portfolio. This study extends previous work on one-time tax-loss selling. He considers a potential tax-driven trading opportunity as an option with quantifiable value, acquired automatically and without cost in a taxable account. Within this formulation, selling a bond and reinvesting in another also entails the swap of the associated tax options. When considering the value of the tax option acquired upon reinvestment, the time to optimum execution is drastically reduced in comparison to one-time selling. The author assumes that the choice of reinvestment bonds maintains the same interest rate exposure as that from before the sale.*

Municipal bonds are widely thought of as "tax-efficient" investments, but the tax exemption of interest does not on its own guarantee tax-efficient returns. Current practice emphasizes "tax-aware" investing, with little attention paid to tax-driven trading (see Horan and Adler 2009). Although tax-loss selling is recognized as a potential enhancer of performance (see Bergstresser and Pontiff 2013), it is considered as an ad hoc opportunity rather than as part of comprehensive strategy. Related academic studies focus on equity, in particular the so-called January effect (for example, see Starks, Yong, and Zheng 2006). Optimal tax-loss selling of municipal bonds, the central topic of this article, has received scant academic attention, although there are occasional references to tax management being an "option." In particular, Wilcox and Fabozzi (2013, p. 131) referred to "the option value stemming from your ability to *choose the timing of taxable events*" (emphasis mine) and that "tax loss harvesting to capture option values" is an *investment strategy*. Constantinides and Ingersoll (1984) did discuss "optimal trading with personal taxes" but made no reference to a tax option. Landoni (2014) recognized the existence of incremental value from tax-driven transactions and argued that it could accrue to issuers through competitive bidding by investors.[1] Because there is no evidence of systematic use of tax-driven strategies by investors as a whole (including mutual funds), there is no reason to believe that they would bid up prices on that basis. Notwithstanding the previous discussion, the quantification of the tax option value and the corresponding optimal transaction strategy for municipal bonds had received no attention until the publication of two recent articles (Kalotay 2014a, 2014b).

I propose a dynamic strategy to optimize the after-tax performance of a municipal bond portfolio. This article extends previous work on optimal one-time tax-loss selling (Kalotay 2014b). I consider a potential tax-beneficial trading opportunity as an option with quantifiable value, acquired automatically and without cost in a taxable account. Within this formulation, selling a bond and reinvesting in another bond also entails the exchange of the associated tax options. When considering the value of the tax option acquired upon reinvestment, the time to optimum execution of tax-driven sales is drastically reduced in comparison to one-time selling. In one-time selling, the investor has just one opportunity to get it right. Dynamic selling and reinvestment affords multiple opportunities to capture tax savings.

## Background and Assumptions

An asset held in a taxable portfolio provides the holder with an option to economically divest it under favorable circumstances and thus increase the value of the portfolio. Tax-driven divesting is usually considered in the context of real assets; however, the concept is also applicable to securities. Tax-exempt municipal bonds provide a particularly rich vein for examining the dynamics of optimal divesting; owing to the tax exemption of interest, they are held in taxable accounts, but capital gains and losses are subject to taxes. Tax management of municipal bonds is also challenging analytically because the tax option has

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a finite life and because the market price of a bond can significantly differ from its worth to the holder.

Three recent papers regarding the valuation and management of municipal bonds provide background for this article. The analytical foundation for after-tax valuation, the so-called tax-neutral approach, is formulated in Kalotay (2014a). The tax-neutral approach is essential to the proper management of discount munis because their prices are depressed by the tax payable at maturity and, therefore, are considerably more sensitive to interest rates than indicated by pretax analysis. The tax-neutral approach, which incorporates this tax effect, is a rigorous extension of the conventional option-adjusted spread–based bond valuation.

The second paper, Kalotay (2014b), explores the optimum time to sell without considering how the proceeds are reinvested. Consequently, the only tangible benefit from a "one-time sale" is cash flow savings. A key input in the calculation of the benefit is the hold value—in essence, the present value of the bond's cash flows, including any tax payable at maturity, to its current holder. Note that the tax depends on the purchase date and purchase price. The cash flow benefit from selling is the difference between after-tax proceeds and the hold value. Kalotay (2014b) presents two types of potentially beneficial opportunities: selling losers (commonly known as tax-loss harvesting) and selling winners (in order to convert taxes payable at the ordinary income rate to the long-term capital gains rate). The other input in the sell decision is the value of the forfeited tax option. The paper also describes how to value the one-time tax option by a recursive algorithm. The value depends on the price volatility of the bond (modeled by a stochastic interest rate process) and on transaction costs (indicated by the bid–ask spread). If the bond is callable, the same interest rate process is used to determine when it will be called. Selling is recommended only if the benefit is sufficiently high relative to the value of the forfeited tax option, as measured by the so-called tax efficiency.

The third paper, Kalotay and Howard (2014), quantifies the incremental value of active tax management over buy-and-hold investing. In this paper, a muni is monitored from cradle to grave as it migrates among investors who optimally manage it. This paper shows that, collectively, active tax managers can extract considerable incremental value—as much as 5%, in present value terms—from a long muni.

Before turning to dynamic trading strategies, I must first state my assumptions. The municipal bond holdings of a wealthy individual are typically managed in a separately managed account, or SMA. After-tax proceeds from sale or maturity are reinvested (in practice, usually only pretax cash flows are reinvested; this assumption is not critical, but it simplifies the analysis). The holder has offsetting long-term and short-term capital gains, possibly in other asset classes, such as equity. Finally, I assume that tax-driven trades do not change the interest rate risk of the portfolio, which is specified by effective duration.

Keeping the duration unchanged is a theoretical constraint; what happens in practice is a different matter. The rationale for this assumption is as follows. The value of the tax option depends on the price volatility of the bond; the higher the volatility, the greater the value of this option, which is completely free. Without a constraint on reinvestment, there would be an incentive to increase tax optionality by extending duration.

## Institutional Aspects of the Municipal Bond Market

The current size of the municipal bond market in the United States exceeds $3.5 trillion and consists of roughly 2 million individual securities. Municipal bonds are usually callable at par at any time after 10 years (referred to as "non-call 10"), and they may be eligible for advance refunding. In recent years, it has become customary to issue bonds with a 5% coupon independent of maturity, at a substantial premium over par. The preference of institutional investors and of municipal issuers for premium bonds is discussed in Kalotay (2012). In fact, 5% non-call 10 bonds have become so prevalent that the industry-standard yield curves consist of yields of this structure across the maturity spectrum. For example, the quoted 15-year yield is the yield-to-call of a 5% bond callable at par after 10 years.

The practice of issuing 5% non-call 10 bonds is relevant to this article in several ways. For example, because contemporary bond valuation is based on an optionless par yield curve, implementation of the methods described later requires converting the 5% callable curve to an optionless par curve. The method for stripping out the call option given a stochastic model of interest rates is described in Kalotay and Dorigan (2009).

In this study, I assume that interest rates evolve according to an industry-standard Black–Karasinski process, with a modest mean reversion factor. Note that the methodology proposed in this article can be readily adapted to other interest rate processes.

The abundance of 5% bonds facilitates the reinvestment process. In a typical tax-loss harvesting transaction involving a stock, the seller cannot repurchase the security for at least one month; otherwise, the transaction would be deemed a wash sale. The one-month delay exposes the investor to

considerable market risk. But if the security being sold is a municipal bond, finding a similar replacement in a timely manner should be relatively simple.

The municipal market is illiquid, and the bid–ask spread of a modest-sized transaction is likely to be significant. It can amount to several points. The spread of a large institutional transaction is typically much less. Sirri (2014) reported on the relationship between trade size and transaction cost; the practical implication of his study is that, owing to the significant transaction cost, individual investors are unlikely to be able to implement the dynamic trading strategy proposed in this article. The intended users of the strategy are the managers of the so-called separately managed accounts. The typical manager may be able to execute a single sizable buy or sell transaction for hundreds of accounts at a relatively low transaction cost.

Note that currently, relatively little attention is being paid to after-tax performance, even when the assets under management are held in taxable accounts (as is the case with municipal bonds). In particular, the performance of mutual funds and exchange-traded funds is conventionally reported only on a pretax basis. Due to the lack of attention, it is reasonable to assume that the market prices of municipal bonds are not currently influenced by potential tax-driven trading opportunities. As discussed in Kalotay (2015), the dynamic trading strategy proposed in this article would increase after-tax return by 30–100 bps annually, depending on the duration of the portfolio and on holder-specific tax considerations. It is evident that after-tax portfolio management deserves considerably more attention than it is receiving presently.

## Fundamental Concepts of After-Tax Valuation

Market price is an indication of the pretax liquidation value of a muni; however, a holder's after-tax value can be significantly different. Nevertheless, market price is needed for estimating after-tax value. In this section, I will discuss the key concepts required for after-tax management: liquidation value, hold value, cash flow benefit, and tax option value. First, I will introduce the notion of tax basis because it affects every aspect of after-tax valuation.

**Tax Basis.** For tax purposes, the gain or loss resulting from a sale is the difference between the transacted price and the investor's tax basis. Tax basis is investor specific: It depends on the purchase date and the purchase price. It can be constant, as is the case with stocks. However, the tax basis of a muni usually changes over time. If the bond is purchased above par, the basis is amortized at a constant yield to reach par at maturity (or if callable, to the initial call date and call price). The tax basis of a non-OID (original issue discount) bond purchased at a market discount[2] remains at the purchase price, but the discount is accrued to maturity; a gain up to the accrued portion of the market discount is taxed as ordinary income, and the gain in excess of that is taxed as a capital gain.

OID bonds can be particularly complicated: At the time of sale, accrued OID is not taxable; gains above accrued OID are taxable at the capital gains rate. It is also possible to buy an OID bond at a market discount. As in the non-OID case, accrued market discount at the time of sale is taxed as ordinary income.

Depending on the holding period, gains and losses may be taxed as short term (holding period less than one year) or long term (more than one year). Currently, the tax rates applicable to short-term and long-term capital gains are roughly 40% and 20%, respectively. The usual method for amortizing a premium or accreting a discount is by using the purchase yield, as described in Ang, Bhansali, and Xing (2010).

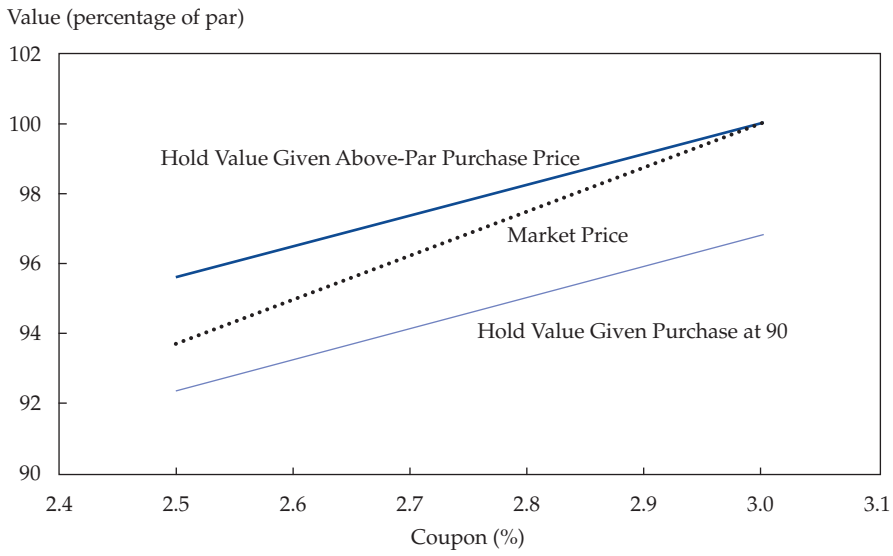
**Liquidation Value.** The after-tax liquidation value is the sum of the sale price and the tax due to the resulting the gain or loss. As discussed previously, the gain/loss is the difference between the sale price and the holder's tax basis. For example, selling a bond whose tax basis is 110 at 105 results in a 5-point loss. Assuming this loss is short term at a 40% tax rate, the tax savings would be 2 points and the liquidation value would be 107.

**Hold Value.** Hold value is the worth of the bond to its holder. In the absence of taxes, an indicator of the hold value is the mid-market price (which is assumed to be fair). The calculation is more complicated if the bond either is selling below par or was purchased previously below par because the market price reflects the tax to be paid by the marginal investor whereas the hold value depends on the tax payable by the *current* holder (Kalotay 2014b). Hold value is not directly observable but can be inferred from market prices.

**Figure 1** demonstrates this effect for 10-year discount bonds when the prevailing market rate is 3%. A higher purchase price increases the hold value, and the hold value can be higher or lower than the market price, depending on the purchase price.

If the issuer's yield curve, which is needed for discounting, is unavailable, the hold value has to be inferred from market prices. The recommended approach is to use the tax-neutral option-adjusted spread (OAS) implied by the market price, relative to a suitable benchmark yield curve. The tax-neutral OAS of a discount muni will be lower than the pretax

**Figure 1. Hold Value and Market Price Can Differ Significantly**
(3% 10-year rate)




OAS, and therefore, the pretax OAS would undervalue the cash flows and distort the hold value.

If the market price is above par, the tax-neutral OAS is equal to the pretax OAS. Assuming that the bond was purchased above par, the hold value equals the market price.

**Cash Flow Benefit from Selling.** The cash flow benefit is the difference between liquidation value (i.e., after-tax proceeds from sale) and hold value. If the difference is negative, the benefit is defined to be zero. The cash flow benefit is the intrinsic (exercise) value of the tax option, whose definition follows.

If the hold value is the same as the market price, the benefit from selling is the tax savings resulting from sale. Such would be the case for a bond purchased above par and currently selling above par. However, if a bond was purchased above par and is currently selling below par, the hold value would exceed the market price (by the present value of the tax on the discount implied by the market price).

**Tax Option.** The tax option is the potential opportunity to execute tax-beneficial trades. It is acquired automatically and without cost upon the purchase of a muni. Although the tax option is not contractual, a value can be assigned to it using standard bond analytics; the approach is similar to that for valuing bond-embedded call and put options. The value depends on both investor-specific information and market data, such as the price volatility of the bond and transaction costs. In the subsequent examples, the price volatility of a bond is driven by the Black–Karasinski interest rate process. Details regarding the recursive valuation of the tax option are provided in Kalotay (2014b) and Kalotay and Howard (2014). Suffice it to say that the process is similar to the recursive valuation of a call option on an interest rate lattice. The values of tax-driven sales in different states of the world are discounted probabilistically to today.

In the absence of reinvesting, we can think of the tax option as a put option whose exercise price depends on the market price. The exercise value of a put option at time $t$ is the cash flow benefit (CFB) from sale:

$$\text{CFB}_t = P_t + T_t(B_t - P_t) - H_t,$$

where

$B_t$ = Tax basis at time $t$

$H_t$ = Hold value

$P_t$ = Bid price

$T_t$ = Applicable tax rate

If the bond was purchased above par and is currently selling above par, $H_t$ is the mid-market price and the exercise value of the put simplifies to tax savings reduced by transaction cost ($C$):

$$\text{CFB}_t = T_t(B_t - P_t) - C.$$

Calculating the intrinsic value of a tax option is relatively straightforward; however, the calculation of its time value raises an interesting question. Although any asset in a taxable portfolio has an associated tax option, this option has value only if it is monitored and managed. Therefore, we need to consider the contemplated tax strategy in assigning a value to the option. Bear in mind that this option is free; it is automatically acquired with

any investment and, equally importantly, with any *reinvestment*. Should we consider the value of the new tax option in the sale decision? It depends, because this option has value only if it is actively managed; otherwise, it is worthless. Thus, option value depends on management strategy. We can conceive of a hierarchy of strategies and observe how they affect the value of the tax option (see **Exhibit 1**).

The distinction between one-time sale and dynamic management is the role of the option acquired upon reinvestment (the "new" option). Optimal management assuming one-time sale is covered in Kalotay (2014b); dynamic management is the topic of this article. In the next section, I provide an example to illustrate why the optimal strategy under dynamic management is very different from the optimal one-time sale strategy.

In all the figures that follow, unless otherwise stated, I assume the following:

- a yield curve where the 10-year rate is 3%, the 20-year rate is 3.25%, and the 30-year rate is 3.5%;
- interest rate volatility of 15% and a mean reversion factor of 2; and
- a transaction cost of 0.25% of par.

**Exhibit 1. Option Value under Different Strategies**

| Strategy | Option Value |
|---|---|
| 1. Buy and hold | Worthless |
| 2. Sell now (if beneficial) | Intrinsic value |
| 3. One-time sale | Kalotay (2014b) |
| 4. Dynamic management | See text for discussion |

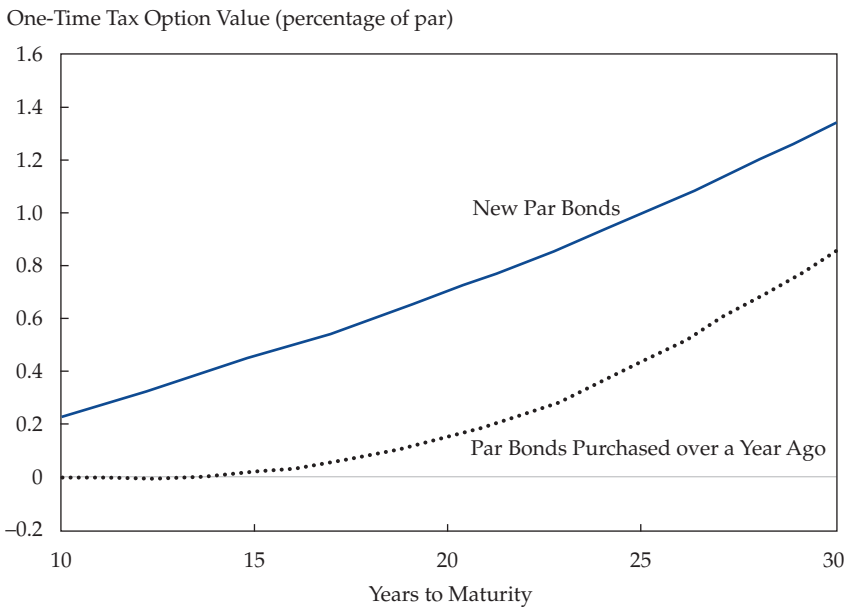
## Opportunity Overlooked in a One-Time Sale

The objective of a one-time sale is to maximize cash flow benefit without considering reinvestment. It can be envisioned as a serendipitous event, rather than as an integral part of a comprehensive tax strategy. By ignoring the tax option acquired upon reinvestment, one may miss subsequent opportunities to improve performance. This is illustrated in the example that follows, which is motivated by the larger tax benefit of a short-term loss over that of a long-term loss. In the case of a short-term loss, the applicable tax rate is roughly 40%, whereas in the case of a long-term loss, it is 20%.

Consider a bond purchased more than a year ago at par whose current price is also par (or, more generally, whose current price is equal to its tax basis). How about selling it and purchasing a similar bond at a slightly higher price? This seemingly absurd idea can, in fact, be beneficial.

**Figure 2** displays how the values of one-time tax options of par bonds of various maturities depend on the ability to write off a loss at the short-term tax rate. The short-term loss tax options can be acquired today by purchasing new bonds at par; the "long-term loss" tax options were acquired more than a year ago. Clearly, the former are more valuable because during the next year, a loss can be deducted at a higher rate—40% rather than 20%. After the first year, the options would be identical. As shown in Figure 2, the added value of writing off a loss at the short-term rate can be significant. For example, the respective option values of a 20-year bond are

**Figure 2. Potential Short-Term Loss Raises Value of Tax Options**



roughly 0.70% and 0.15% of par. Assuming a 0.25% transaction cost (or 0.20% after tax), the trade would result in acquiring roughly 0.35% of incremental option value (0.70% – 0.15% – 0.20%).

Although one may legitimately argue that the added option value is a "bird in the bush," nobody would challenge the assertion that, ceteris paribus, a short-term loss option is a source of additional value; the only question is how much. Trading bonds for the sake of increasing option value (as in the previous example) is obviously speculative. For the typical muni investor, I would advocate a more conservative approach. Accordingly, in the remainder of this article, we will consider selling only if it would result in a cash flow benefit. Nevertheless, it is important to recognize that option value acquired upon reinvestment changes the economics of the sale decision.

## Optimal Exercise of the One-Time Option

The important practical consideration is how far the price needs to drop below the basis to warrant selling. **Figure 3** displays the economics of a one-time sale for a 5% bond with 20 years remaining to maturity whose current tax basis is 110. The figure shows, over a range of prices, the cash flow benefit and the value of a one-time option. For example, at a market price of 104, the benefit and the option value would be roughly 2% and 2.5%, respectively. **Figure 4** shows the corresponding efficiencies of selling—efficiency being the ratio of benefit to option value (Kalotay 2014b). According to Figure 4, 100% efficiency, which is a recommendation to sell, is reached when the market price drops to 95.60. As we will shortly see, under dynamic management, this bond should be sold earlier—that is, with less of a price decline.

## The Tax Option under Dynamic Management

Now, let us turn to the central topic of this article: the valuation of the tax option under dynamic tax management. The distinguishing consideration is the option acquired upon reinvestment; the ultimate objective is to determine the optimal time to transact.

To set the stage, note that if the new bond itself is sold, second-generation reinvesting creates further optionality, and so on. Thus, we need to consider a chain of possible sales and reinvestments, each with its corresponding "nested" tax option. As discussed earlier, in the absence of a constraint on reinvestment, there may be an incentive to purchase bonds with the longest duration because they provide maximum price volatility. In order to avoid this, we reinvest only in bonds whose duration is the same as that of the one being sold. For demonstration purposes, I assume that the new bond is actually identical to the one being sold. In practice, there may be better reinvestment alternatives.

The tax option is a source of superior performance over buy-and-hold investing. Whether the added value should be attributed to the security or to manager skill is an interesting question. As a

**Figure 3. Cash Flow Benefit Approaches "One-Time" Tax Option Value as Price Declines**
(20-year 5% bond, basis of 110, 0.25% transaction cost, recent purchase)

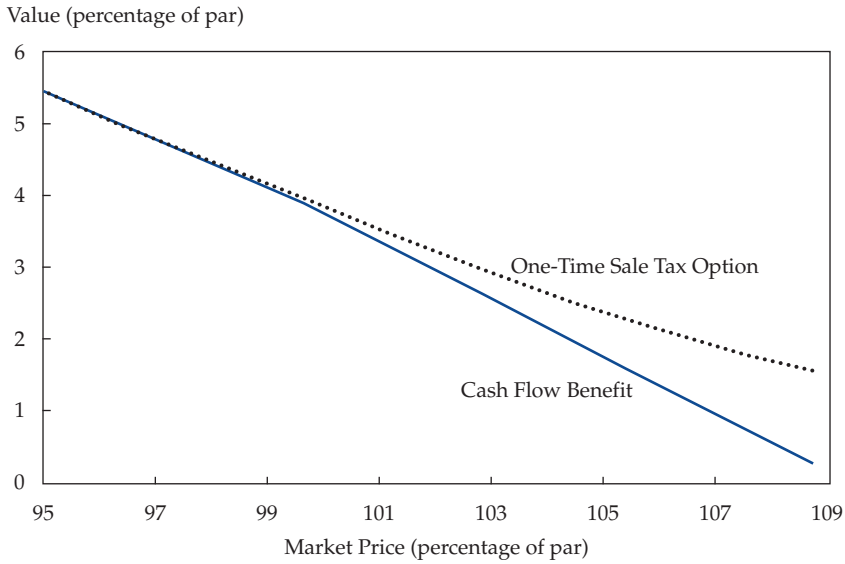
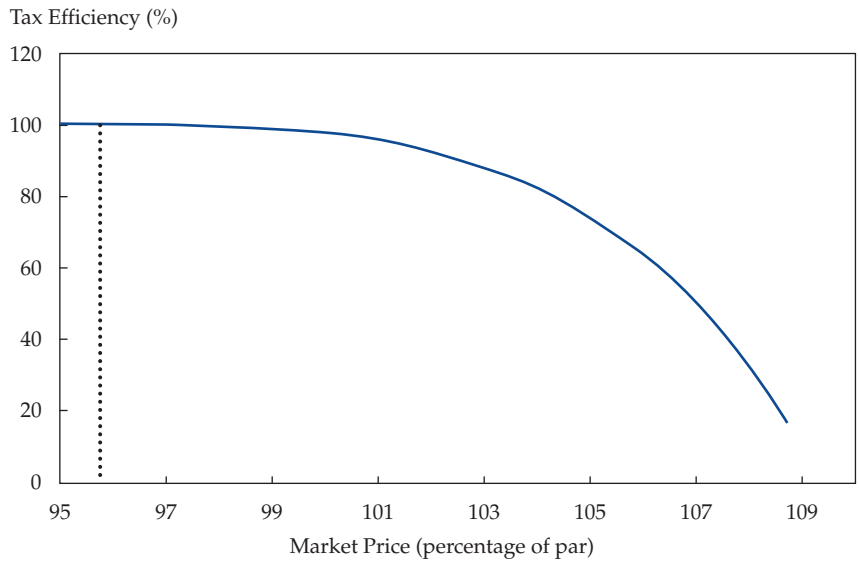


**Figure 4. 100% Efficient "One-Time" Tax Sale Requires Significant Loss**
(20-year 5% bond, basis of 110, 0.25% transaction cost, recent purchase)




practical matter, however, the choice is irrelevant; the proof of the pudding is after-tax performance. Sound utilization of the tax option will be manifested in superior long-term return (Kalotay 2015).

**Figure 5** displays the value of the tax option under dynamic management for new par bonds of various maturities, along with the values of the one-time option from Figure 2. Not surprisingly, dynamic management has the potential of creating considerably more value. For example, in the case of a 20-year bond, the value of the dynamic option is about 2.25% of par, whereas the one-time option is worth only about 0.7%.

## Efficient Transacting under Dynamic Management

In this section, I discuss the optimal time to transact assuming dynamic management. Selling forfeits the tax option in the bond being sold; it is justifiable only if the resulting benefit provides sufficient compensation.

In a one-time sale, as discussed earlier, the benefit consists entirely of cash flow savings. In that case, the obvious measure of the efficiency of the sale (i.e., option exercise) is the ratio of the cash flow benefit to the option value. Under dynamic management, however, the trade-off is more complicated because the benefit has two components: cash flow savings and the value of the new option. (As discussed earlier, a trade could be beneficial even if it resulted in a cash flow loss; however, such cases will not be considered.)

The relevant quantities are the current option value ($OV_{old}$), the cash flow benefit (CFB), and the new option value ($OV_{new}$). **Figure 6** displays these quantities for the same 5% bond featured in Figure 3. The cash flow benefit is unaffected by the new bond; it is the same as in Figure 3. Under dynamic management, however, the value of the "old" option is much greater because it incorporates the value of the new option. As before, the lower the current price, the greater the savings and the greater the value of the old option. The value of the new option declines with the market price. Note that if the current price is par, the value of the new option is slightly over 2%, roughly the same as in Figure 5. Finally, let us look at the extremes. When the price is low, most of the value of the old option is attributable to the cash flow benefit. When the price is high, however, the cash flow benefit is negligible and the value of the old option is essentially that of the new one.

In general, $OV_{old} \geq CFB + OV_{new}$ because the right side is simply the exercise value of the old option. At equality, it is time to transact. But what if there is a small difference? How should we extend the tax efficiency concept to the case that entails a new option?

One may be tempted to use the measure $(CFB + OV_{new})/OV_{old}$. But this measure gives a very misleading signal if CFB is small relative to $OV_{new}$, in which case the efficiency would be dominated by the ratio of $OV_{new}$ to $OV_{old}$, more appropriate for trading options. This problem is similar to the call decision for a bond where the refunding bond is also callable, for which the solution is the so-called generalized refunding efficiency (Kalotay, Yang, and Fabozzi 2007). The same idea can be used to define generalized tax efficiency:

**Figure 5. Tax Option Values of New Par Bonds**

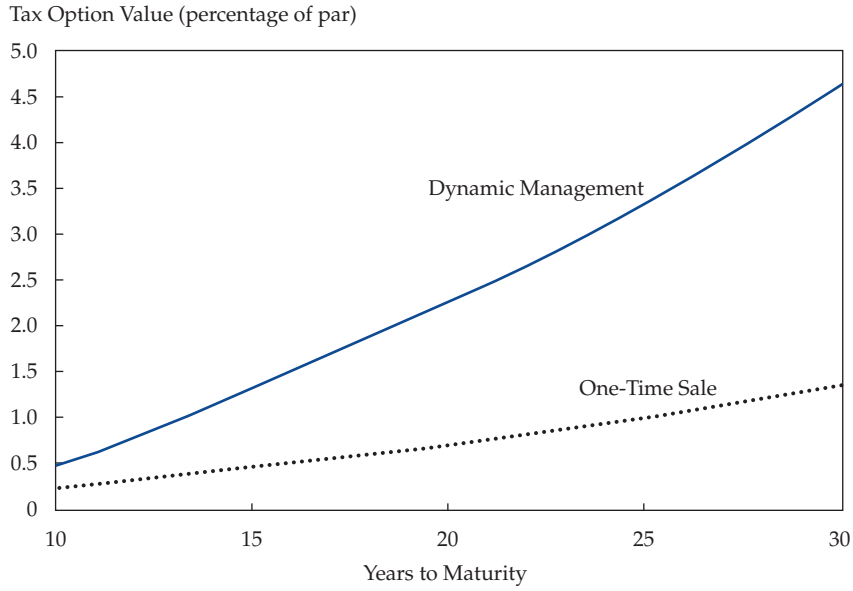
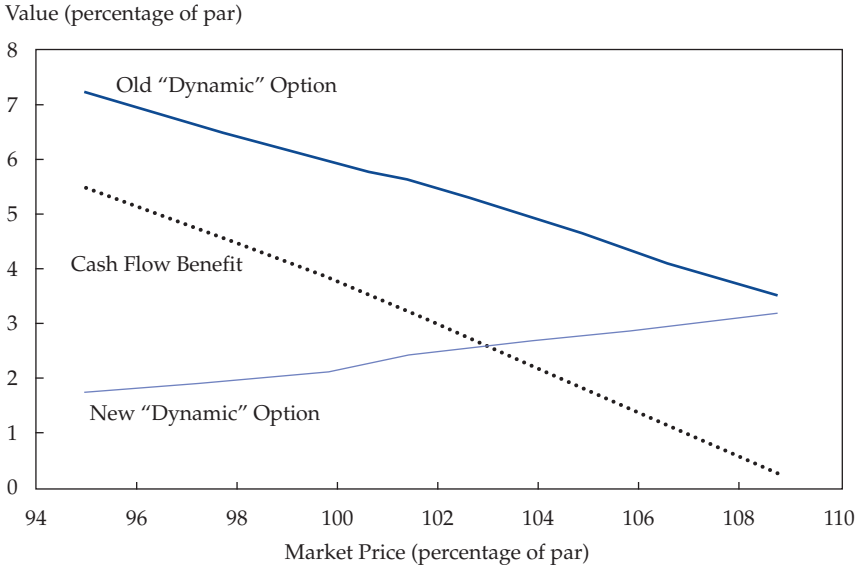



**Figure 6. The Effect of Market Price on Cash Flow Benefit and Option Values**
(20-year 5% bond, basis of 110, 0.25% transaction cost, recent purchase)



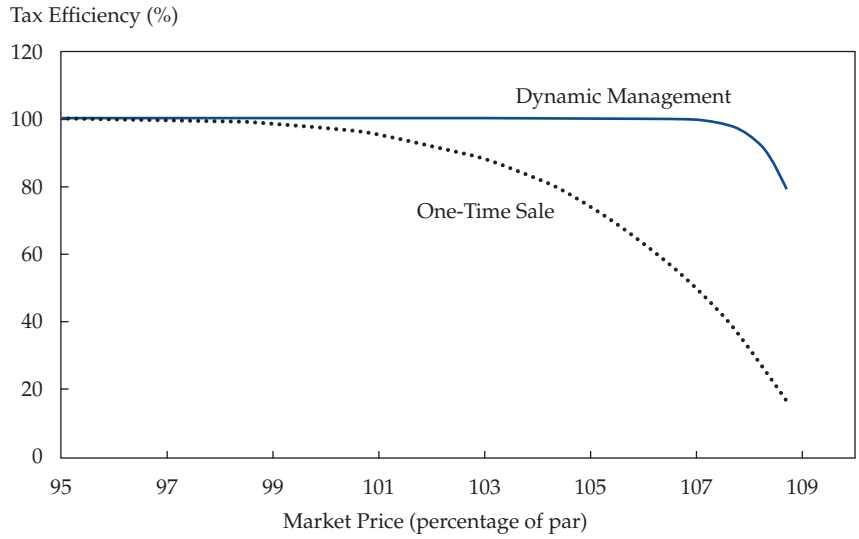

$$\text{Generalized tax efficiency} = \frac{\text{CFB}}{\text{OV}_{old} - \text{OV}_{new}}.$$

Note that in the case of a one-time sale, generalized efficiency reduces to CFB/OV.

**Figure 7** shows the efficiency of trading under dynamic management, along with the efficiency of a one-time sale from Figure 4. It is evident that under dynamic management, there is an obvious incentive to transact sooner (when the price declines to 107, where the cash flow savings equals the loss of option value). In addition to cash flow benefit, the seller acquires a new option with considerable time value. In contrast, under a one-time strategy, the price has to decline much further (to around 99) for full tax efficiency.

Some of this value is due to the benefit of the high short-term capital gain/loss rate, which is roughly twice as high as the long-term rate. What happens in the decision process if there is no offsetting short-term gain (or if we simply disregard the availability of short-term gains)? **Figure 8** provides the answer. The market price required to reach 100% efficiency is roughly 104.00 (6 points below

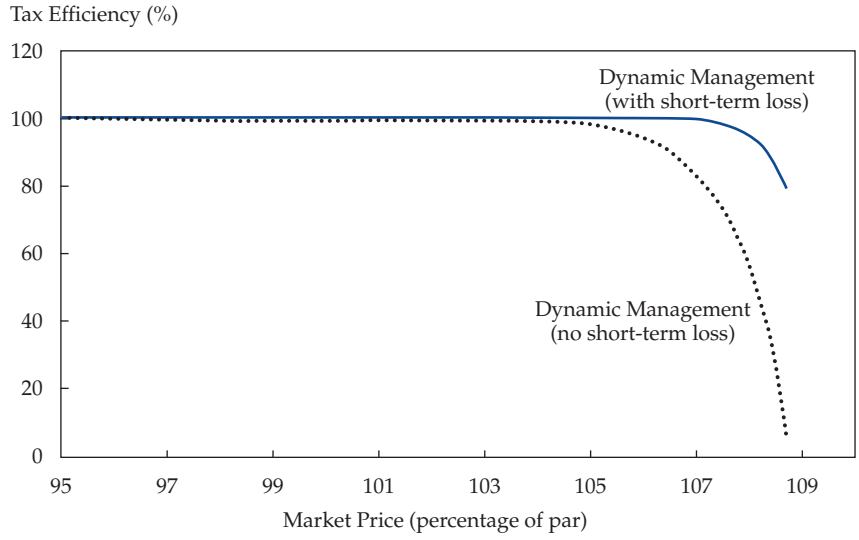
**Figure 7. Under Dynamic Management, Optimal Sale Occurs Sooner**
(20-year 5% bond, basis of 110, 0.25% transaction cost, recent purchase)




the current tax basis), considerably lower than the 100% efficient point in Figure 7 (around 107.00). Conservative managers may opt to assume no offsetting short-term gains and use only the value of the long-term loss tax option as the gauge for deciding when to trade.

The optimum policy depends on several factors other than tax rates. These factors include the cost of transacting—assumed to be 0.25% in this article. A higher transaction cost would obviously reduce the incentive to transact. Another consideration is interest rate volatility. In the case of a one-time sale, higher volatility increases the option value without affecting the benefit, and therefore, a greater benefit (lower market price) would be required to sell. Under the dynamic strategy, the benefit includes the new tax option, whose value is also volatility dependent. Not surprisingly, the *difference* between these option values depends very weakly on volatility. Because this difference is the denominator of the efficiency formula, under dynamic management, the optimum policy is virtually unaffected by volatility.

**Figure 8. Without Short-Term Loss, Optimal Trade Occurs Later**
(20-year 5% bond, basis of 110, 0.25% transaction cost, 40% short-term rate, 20% long-term rate)



## Conclusion

I have examined the optimal trading strategy for municipal bonds under dynamic tax management. The critical consideration is that an asset purchased for a taxable account provides the investor with an option to take advantage of potential tax-beneficial selling opportunities. This option is an automatic result of the purchase, and it is entirely free. Reinvestment of the proceeds from sale provides additional free optionality, whose value can be incorporated into a dynamic strategy that attempts to maximize after-tax performance.

An important consideration in dynamic management is the tax treatment of short-term capital losses. The applicable tax rate is significantly higher than that for long-term capital losses, which enhances the value of a tax option acquired upon reinvestment. In the case of municipal bonds, using tax-neutral analytics, we can determine the cash flow benefit from selling and the values of the forfeited and newly acquired tax options and calculate the generalized tax efficiency. Transacting is recommended only if the efficiency is adequate. Under dynamic tax management, trades should be executed much earlier (i.e., at a smaller cash flow benefit than that of a one-time sale). Finally, consideration should be given to maintaining the same interest rate exposure when choosing bonds for reinvestment after a sale.



## Notes

1. By extension of this argument, one could claim that market prices in general are inflated by the value of the tax option, but no supporting empirical evidence exists.
2. "Market discount" refers to the amount by which a secondary market purchase price is below par for a non-OID bond or below the bond's OID basis if it was issued at a discount. The discussion here is not exhaustive. For example, both market discount and OID can be *de minimis*, in which case the tax basis calculation and the tax treatment are different.

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