

Marginal Stockholder Tax Effects
and Ex-Dividend-Day Price Behavior: Evidence from
Taxable versus Non-taxable Closed-End Funds[†]

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Abstract

Almost all research on the movement of stock prices on ex-dividend days has found that prices decline by less than the dividend. While this is consistent with tax effects, several papers have argued that this phenomenon could be caused by market microstructure effects. In this paper we make use of a natural experiment that provides support for the tax explanations of ex-dividend behavior. Some closed-end funds have taxable dividend distributions, while some have non-taxable dividend distributions. Both types are subject to taxes on capital gains.

The implication of this for ex-dividend-day price behavior is very different between these two types of funds if taxes matter. This paper demonstrates that the direction of ex-dividend-day price behavior is consistent with a tax explanation and that ex-dividend-day price behavior changes, as theory would suggest, with changes in the tax law.

JEL Classification: G0

In 1970 Elton and Gruber (hereafter E&G) showed that if taxes enter investors' decisions, then the fall in price on the ex-dividend day should reflect the post-tax value of the dividend relative to the post-tax value of capital gains on that day. Because dividends in most time periods are taxed more heavily than capital gains, the theory suggests that if taxes affect investors' choices, the fall in stock price should in general be less than the dividend, and the drop could be used to infer marginal tax rates.¹

Since 1970, numerous articles have appeared, either questioning or supporting the tax explanation of ex-dividend-day price behavior. These articles (some of which are discussed in more detail in the next section of this paper) generally fall into one of four categories. The first is replication of the E&G tests on non-U.S. markets or on U.S. markets in other time periods. Tests have been conducted using data from more than a dozen countries. A second group of articles reexamines the ex-dividend-day price behavior around changes in tax laws to see if the change in the ex-dividend-day price drop is related to changes in tax policy. The third group of articles admits to an ex-dividend day price change less than the dividend but says the price change is limited because of arbitrage by short-term traders. Finally, and perhaps most damaging to the tax explanation, there is a series of articles that attempt to show that even in the absence of differential taxes the price of common stocks should fall by less than the dividend on ex-dividend days because of market-microstructure characteristics. This argument is the most troublesome, for it suggests that in the 1970 E&G article and in much of the empirical work which followed, ex-dividend-day price behavior may, in fact, be unrelated to taxes, and much of the profession may have been misled.

In this article we test for ex-dividend effects on a sample that has not been previously examined: closed-end mutual funds. What makes this sample exciting is that it contains a set of

securities (municipal bond funds) for which the ex-dividend price drop should be greater than the dividend if taxes matter as well as a set of securities (taxable bonds) for which the drop should in general be less than the dividend.² As we show, the difference in the ex-dividend day effects for these two groups provides evidence for a tax explanation of ex-dividend behavior since microstructure arguments predict a price change less than the dividend for both groups. Furthermore, our sample period, 1988 to 2001, encompasses several large changes in the maximum tax rate on dividends and capital gains. Thus, the tax hypothesis can be further tested by examining ex-dividend day price behavior over these alternative tax regimes.

The shares in closed-end funds are like any other stock. They trade in organized capital markets, they pay dividends and capital gains. The only difference between these shares and the shares of industrial corporations is that they hold financial assets rather than real assets. This does not affect the way they trade, but it does have interesting implications for the effect of taxes.

We show that the behavior of price changes with respect to dividends on the ex-dividend day conforms to the theory that taxes determine the relative value of dividends *vis a vis* capital gains. This holds both for different types of closed-end funds and for the impact of changes in tax law within each type of fund. These results clearly show that taxes play an important role in determining the ex-dividend-day price behavior of common stocks.

This paper is organized as follows: In Section I we briefly review some of the discussion of ex-dividend-day price behavior that has appeared in the literature. We also present a discussion of why closed-end funds represent an excellent sample for examining the impact of taxes on ex-dividend-day price behavior. In Section II we present the methodology used in this paper. In Section III we discuss our sample and the tax regimes in effect during our sample

period. In Section IV we discuss the hypothesis that the different tax regimes imply. In Section V we present our empirical results. In Section VI we examine implied tax rates and clientele effects. Finally, in Section VII we summarize our results and present our conclusions.

I. Review of the Literature

The literature on the ex-dividend-day price behavior of common stocks overwhelmingly supports the fact that the drop in price on the ex-dividend day is less than amount of the dividend when ordinary income tax rates exceed capital gains tax rates. The tax argument states that this arises because for most common stocks the dividend is taxed as income, while the change in price is taxed as capital gains. Evidence supporting the presence of tax effects by examining the ex-dividend price behavior has been presented in several studies.³

While the existence of a price drop on the ex-dividend day less than the dividend has been widely documented, there have been two serious challenges. These concern whether the ex-dividend-day drop can be used to estimate taxes and the broader issue of whether the ex-dividend-day price movement is affected by taxes. The first challenge, originated by Kalay (1982, 1984), states that short-term arbitrageurs will engage in transactions around the ex-dividend day so that the ex-dividend-day drop in price will approach the size of the dividend. Under Kalay's argument, if transaction costs were zero, the ex-dividend-day price drop should exactly equal the dividend. However, with non-zero transaction costs, Kalay's argument implies that the ex-dividend-day price drop produces an underestimate of tax rates (see Elton, Gruber and Rentzler (1984)).⁴

A direct challenge to the tax explanation of ex-dividend price movements arises from microstructure arguments. Two articles have recognized the fact that prices fall by less than the dividend, but they have put forth explanations for this phenomenon that are not related to taxes.

The first of the microstructure arguments is presented by Bali and Hite (1998). They state that the drop in price less than the dividend is really due to discreteness in prices rather than taxes. They hypothesize that because of discreteness in prices the ex-dividend-day price should fall by an amount equal to or smaller than the amount of the dividend and that this has been mistakenly attributed to tax effects.

Another microstructure analysis is presented by Frank and Jagannathan (1998). They hypothesize that the collection and reinvestment of dividends is bothersome for individual investors but not for market makers. This means that individuals want to sell the stock before it goes ex-dividend and are anxious to buy it back after it goes ex-dividend. They argue that because of this that market makers can purchase stock at the bid price before the stock goes ex-dividend and sell at the ask price after it goes ex-dividend. They then state that in the absence of taxes this means that the fall in price on the ex-dividend date will be less than the dividend. They argue that this bid-ask bounce contributes to, if not totally explains, a phenomenon others attribute to tax effects.⁵

Both of these microstructure arguments would explain a price drop less than the dividend. However, the microstructure arguments described above do not explain a price drop *more* than the dividend. This is the expected ex-dividend price behavior for tax-exempt dividend payments if taxes are important. It is to analysis of these payments that we now turn.

II. Methodology

The expected ex-dividend day decline in price when the decline is affected by tax rates is easy to determine. If the investor is considering selling shares either before or on the ex-dividend date, the equilibrium choice is derived as follows. Let

1. P_c be the cost of a share

2. P_b be the price of a share the day before the stock goes ex-dividend
3. P_x be the price of the stock the day the stock goes ex-dividend
4. t_g be the capital gains tax rate
5. t_o be the tax rate on ordinary income

The investor is indifferent as to timing if

$$P_b - t_g(P_b - P_c) = P_x - t_g(P_x - P_c) + D(1 - t_o)$$

Rearranging the above equation, we obtain

$$\frac{P_b - P_x}{D} = \frac{1 - t_o}{1 - t_g} \quad (1)$$

Since for municipal bond funds dividends are not taxed, for these funds t_o is set equal to zero.

The issue is how to measure the left-hand side of the equation. The natural price to use for P_x is the opening price. However, the opening price is biased because when a stock goes ex-dividend all orders on the books are reduced by the amount of the dividend. Thus a market order will be executed at a price that is adjusted by the dividend. To allow time for the effect of this arbitrary adjustment to be eliminated, we, like many authors, use the close on the ex-dividend date. This introduces another issue, the need to adjust for market movements from open to close.

We adjust for market movements as follows: for each of the two types of funds in our sample (municipal bond and taxable bond) for each day we computed an equally weighted daily return index of similar type closed-end funds that didn't go ex-dividend on that day. This resulted in two indexes, one for each category. We then regressed each mutual fund's return on the index for its category using daily returns and the Dimson-Marsh (1983) correction for non-synchronous

trading. The Dimson-Marsh procedure produces three betas for each fund (lagged, coincident and lead).

There are two reasons why we utilized an index of similar funds rather than a market index. First, bond funds, unlike stock funds, are likely to have price movements heavily influenced by changes in the yield curve. Thus a stock price index is not appropriate for adjusting prices. Furthermore, a daily return index for bonds that exists over our full period is not available. Second, closed-end funds' premiums and discounts can change as a group without corresponding changes in market indexes (see Elton, Gruber and Busse (1998) and associated bibliography). Employing an index of other closed-end funds is a natural way to control for this.

To adjust for price movements during the ex-dividend day we compounded up the closing price before the ex-dividend date by one plus our estimate of the impact of market movements (expected return) from close to close. The estimate of a day's expected return for each fund is its three betas (lagged, coincident and lead) with the appropriate index times the corresponding daily index returns. In equation form our measure is⁶

$$\frac{P_b(1+r) - P_x}{D} = \frac{(1-t_o)}{(1-t_g)} \quad (2)$$

where r is the expected return if the closed-end fund didn't go ex-dividend.⁷

III. Sample

Our initial sample consisted of all stocks that CRSP listed as closed-end funds at any time during the interval January 4, 1988 through September 10, 2001. We did not start before 1988 because of the small number of closed end funds that existed in earlier years. We had data to the end of 2001, but chose to stop at 9/10/01 because of major market disruption after 9/11/01 and an uncertainty of how much data to exclude because of this.⁸ From this sample we selected all bond funds using CDA/Wiesenberger classification where available. Where CDA/Wiesenberger did

not classify a fund we used Morningstar classification, and where this failed we examined annual reports.⁹ As a final check we examined annual reports for funds with names that would suggest they were mis-classified. This eliminated a number of funds. We eliminated data on all funds in the first and last 65 days of their existence because of well-documented new-issue and ending effects for closed-end funds.

Before calculating our measures we eliminated ex-dividend observations where either the dividend was less than one cent, there was no trade on the ex-dividend date, or the price was under five dollars.

We eliminated the very few ex-dividend events with dividends of one cent or less because ex-dividend ratios can reach extreme values in these cases. In the few instances of a dividend equal to or less than one cent, other unusual activities were happening with the fund, and it is unlikely that investors would be worried about tax timing with such a small dividend.

Eliminating observations with fund prices below \$5 was motivated by a number of factors. First, for low-priced funds the bid/ask spread is sufficiently large relative to the dividend that it introduces a lot of randomness into our statistic. Second, prices below \$5 primarily occur for closed-end funds that are organized as trusts and are approaching their termination dates. This has three associated problems. First, examining the R^2 s from the return regressions shows that most of the funds with poor fits have low prices.¹⁰ Second, funds approaching the end of their lives tend to have low trading volumes. Finally, low-priced funds often report dividends that are inconsistent with adjacent dividends. That suggests that part of the dividend is a return of capital and it has been misclassified when it is designated as all ordinary income.¹¹ Thus the \$5 rule was a good proxy for eliminating a group of funds for which many dividends are likely

misclassified or where the estimate is highly erratic. The total number of observations by fund type in each period after these eliminations is shown in Tables 2 and 3.

Table 1 shows two estimates of the tax rates that were effective over our sample period. Columns 2 and 3 of Table 1 show the maximum capital gains and maximum ordinary tax rates that were in place during our sample period. The only remaining issue for these rates is whether investors could have known about the tax rates at the start of the periods shown. The tax rates in 1988-1990 were legislated in 1986, while the 1991-1992 tax rates were legislated in 1990 and therefore were clearly known entering the periods. The tax rates in the 1993 and 1997 changes were passed after the start of the year. Thus in using a single tax rate over those years we are assuming that the investors anticipated the passages of the rate changes. To the extent that the passages of the rate changes were not anticipated, the periods we utilize will have some effects from other tax regimes. Since this will work against our hypotheses, assuming investors anticipated rate changes before the year started seems preferable to arbitrarily guessing when the passages were fully anticipated.¹²

Columns 4 and 5 of Table 1 show estimates of the marginal tax rates as calculated by the NBER TAXSIM model. The NBER TAXSIM model calculates marginal tax rates by examining individual tax returns and computing the impact of a dollar increase in cost flow in each category and aggregating across individuals.

IV. Hypotheses

We will test several hypotheses. First, for the municipal bond funds where the dividend payments are tax-free, the ex-dividend price should drop by more than the dividend. This can be seen by examining the E&G measure (equation (2)). Since $t_g > 0$ and $t_o = 0$ for municipal

bond funds, if taxes affect investors' decisions, the price change divided by the dividend should be greater than one.¹³

As shown in Table 1, we have two maximum capital gains tax rates over our sample period, 28% from 1988 to 1996 and 20% from 1997 to 2001. Using marginal rates from the TAXSIM model also suggests a discrete break between 1988-1996 and 1997-2001. The higher the tax rate, the more the measure should exceed one for municipal bond funds. In summary, if taxes matter, for non-taxable distributions:

1. the E&G measure should be greater than one;
2. the E&G measure should be larger in the 1988 to 1996 period compared to the 1997 to 2001 period.

For taxable distributions, the E&G measure as shown in equation (2) depends on the relationship between capital gains and ordinary income tax rates. When capital gains and ordinary income tax rates are the same, this measure should be equal to one. When capital gains are less than ordinary rates, the E&G measure is less than one and the greater the difference in rates, the greater the difference from one.

Examining Table 1 shows that maximum capital gains and ordinary income tax rates and the estimated marginal rates from the NBER TAXSIM model were approximately the same in 1988-1990 and 1991-1992. Thus we will designate the period 1988-1992 as a period of equivalent rates. Examining Table 1 shows that for the period 1993-1996 maximum ordinary income tax rates were greater than maximum capital gains tax rates which would imply an E&G measure less than one. However, using estimates from the NBER TAXSIM model of marginal rates show that ordinary and capital gains rates are almost the same in this period and hence imply a ratio close to one. Finally, using either maximum or marginal rates if taxes matter we

would expect a ratio much less than one in 1997-2001. If taxes affect investors' decisions on ex-dividend dates, then we should observe for ordinary dividends:

1. for 1988-1992, the E&G measure should be insignificantly different from one;
2. for the period 1993-1996 the E&G measure should be less than one if the marginal investor is subject to maximum tax rates or not different from one if estimates are more appropriately represented by estimates of marginal rates from the TAXSIM model;
3. for 1997-2001 the E&G measure should be less than one;
4. the E&G measure should be smaller in 1997-2001 than in 1993-1996 and 1988-1992.

We will now analyze whether these hypotheses are supported by the data.

V. Results

In Sections II and IV above we discussed the methodology we employ in this paper and the hypotheses we test. Since several papers in the literature suggest that microstructure phenomena would cause the change in price to be smaller than the dividend, we start by examining the tax-free distributions of municipal bond funds. If taxes matter, the drop in price should be *larger* than the dividend on the ex-dividend date, for the tradeoff is between tax-free dividends and taxable capital gains. Table 2 presents the mean value for the E&G measure, as well as the p values for the difference from one for the E&G measure¹⁴. We do this for each of the two tax regimes.

The first point to note from Table 2 is that the fall in price divided by the dividend for each tax regime is larger than one and the difference is statistically significant (p -value = 6.8E-15 for period 1 and 0.0017 for period 2).

These results are consistent with tax effects. We gain even more confidence in the tax hypothesis when we examine the results across the alternative tax regimes. Recall that the tax

effect on the ex-dividend day is proportional to the reciprocal of one minus the capital gains tax rate. This means that the E&G measure should be lower in the second period. This is exactly what the data show, with the difference in the E&G ratios between periods statistically significant (p -value of $9.1E-5$).¹⁵

When we examine the taxable closed-end bond funds we again find results that are consistent with taxes affecting ex-dividend-day price behavior. The results are shown in Table 3. Here we have three tax regimes. In the first regime the stockholder should be indifferent between dividends and capital gains. In the second regime the stockholder may or may not have a preference for capital gains depending on whether the maximum tax rates or NBER estimates of marginal tax rates are more relevant. In the third regime the stockholder should have a strong preference for capital gains. Thus we should find that the E&G measure is equal to one in the first period, less than or equal to one in the second period, and much less than one in the third period. The results are consistent with our expectations. The E&G measure is very close to one in the first period, and as expected the difference is not statistically significantly different from one at any reasonable level of significance (p -value of 0.36). The result for period 2, namely an E&G measure close to and not statistically significantly different from 1 (p -value of 0.32) is consistent with the NBER estimate of effective tax rates rather than maximum tax rates affecting behavior. In the third period, the E&G measure is less than one and the different from one is statistically significant (p -value of $4.6E-09$).

We would expect that changes in the E&G measure would reflect the increases in taxes that occurred in 1997. As shown in Table 3, this hypothesis is borne out. The difference in the E&G measure from period 1 to 3 has the sign we would expect, and once again the difference is statistically significant (p -value of $1.8E-04$). The difference in the E&G measure from the second

to third period is statistically significant (p -value of $1.5E-04$). The change in the measures between periods one and two is small and not statistically significant different, consistent with the tax estimates from the TAXSIM model.

There is a final way to examine whether ex-dividend-day price behavior is consistent with tax effects. Whatever microstructure exists at a point in time is the same for both taxable and non-taxable closed-end funds. Thus, if there no tax effects or if microstructure dominates tax effects, we should observe no difference in ex-dividend day effects across the two types of funds. We test this for each of the tax regimes affecting both taxable and non-taxable dividends; the results are shown in Table 4. The differences in the ex-dividend-day price changes between taxable and non-taxable funds are significant at more than the 0.01 percent level in each tax regime. This is further evidence of the tax explanation of ex-dividend-day price behavior.

VI. Implied Tax Rates and Clientele Effects

We have shown that the ex-dividend-day movement of closed-end bond fund prices is consistent with tax effects. The next question to examine is whether we can infer tax rates from the ex-dividend-day behavior of closed-end bond fund prices.

Let's first examine taxable bond funds. Examination of Table 1 shows that there is little difference between the maximum capital gains tax rate and the marginal capital gains tax rate estimates from the NBER TAXSIM model. This is not surprising since most individuals who hold securities are at the maximum capital gains rate. We can take the NBER estimated capital gains tax rate and, using the E&G ratios reported in Table 3, estimate the ordinary tax rate on dividends. When we make this substitution, we get rates very close to the marginal tax rate on dividends as estimated by the NBER. The differences (as shown in Table 5) are not more than 2.4% in any period, and are never statistically significantly different from each other. When we

use the maximum capital gains tax rate to estimate the ordinary income tax rates, we get numbers even closer to the NBER estimates of tax rates on dividends. In addition, when we examine the changes across tax regimes in the implied dividend tax rate obtained using either maximum or NBER estimated capital gains tax rates, we generally find it changes in the same direction as the NBER estimated tax rate on dividends.¹⁶

The capital gains rates implied by the ex-dividend-day price behavior of non-taxable funds are unreasonably low. Finding rates which are lower than expected from municipal bond data is consistent with a large body of economics literature which finds that tax rates that justify the spread between taxable and non-taxable yields are much smaller than expected, particularly for long-term bonds, the principal type of bond held by mutual funds.¹⁷

There is one source of data errors in our sample that will cause estimates of tax rates to be too low for municipal bond funds. Unlike most empirical studies where random data errors introduce noise but don't bias the results, in this case errors in classifying dividends (e.g., classifying a capital gain or a combination of capital gain and tax-free dividend as a tax-free dividend, or mis-classifying the type of fund, will reduce the estimates of the implied tax rate. We found and eliminated several mis-classifications for a random sample of funds, using SEC filings of annual reports. To attempt to clean the sample would have meant examining over 5,000 annual reports, many of which are sufficiently old that they are no longer available. Furthermore, in many of the annual reports we checked, the division of the dividends between taxable and non-taxable was ambiguous. While these errors are not bothersome in testing the hypothesis that taxes affect ex-dividend day behavior because they bias the results against the conclusion, they do matter in estimating capital gains taxes, biasing estimates in a downward direction. While our

estimated rates are low, they do move in the same direction and by almost the same amount as changes in the maximum and NBER capital gains tax rates.

The extraction of tax rates from ex-dividend-day price behavior results in extremely plausible tax rates for taxable closed-end funds, and, for municipal bond funds, the estimated capital gains tax rate changes appropriately with changes in maximum and NBER tax rates. However, the capital gains tax rates extracted from municipal bonds are too low. Whether the lower rates are due to data errors or are just another example of the phenomenon that has been documented elsewhere or are due to some as-yet undiscovered phenomenon, we leave for future research.

The last issue we examined was the presence of clientele effects. We did not find any supporting evidence. This is not surprising for the following reasons. Dividends paid to investors in closed-end bond funds are the interest earned on the underlying portfolio less expenses. The dollar interest divided by the asset value should be very similar across funds since they are holding similar instruments. With little variation in dividends, clienteles should not exist. For example, when we calculated yearly dividend divided by beginning price for the tax-exempt funds in our sample, the 10% to 90% range was 5.13% to 7.28%. Even this small variation is likely to reflect different maturity choices and different expense ratios which can appeal to different investors for reasons separate from dividend choices.

As a direct test of whether there are clienteles, we regressed the change in price over dividends against dividends in each tax regime and across each type. None of the coefficients on dividends were even one standard deviation from zero. Thus, as expected, with little variation in dividends, clientele effects don't exist.

VI. Conclusion

Since 1970, over 100 articles have appeared in the leading journals of financial economics examining whether prices on ex-dividend days fall by less than the dividends and, if so, whether or not the phenomenon is due to tax effects. The microstructure argument is the most serious alternative to the tax argument.

The microstructure arguments presented in the literature of financial economics state that the fall in stock price should be less than the dividend. By testing ex-dividend effects on a sample of funds where dividends are tax-advantaged, we find that taxes should and do cause the fund price to fall by *more* than the amount of the dividend. This is consistent with a tax argument and inconsistent with the standard microstructure arguments. Examining the sample of tax-free dividends, we find that the E&G measure changes across the two tax regimes exactly as theory suggests they should if taxes mattered.

We then examine non-tax-advantaged closed-end bond funds. For these funds we should find the traditional ex-dividend-day tax effects: the fall in price on the ex-dividend date should be less than the dividend during periods when capital gains tax rates are less than ordinary income tax rates. This is what we find. Furthermore, the ex-dividend-day price behavior of these funds generally moves in the direction we would expect across changes in tax regimes. The taxable sample not only substantiates the tax effect, but it also demonstrates that the fall in price greater than the dividend for closed-end municipal bond funds was not due to some peculiar aspect of either our methodology or the closed-end fund industry.

Finally, for the taxable sample we are able to use ex-dividend-day price changes to estimate marginal tax rates that are sensible and consistent with estimates of others. When we

examine tax-free funds, estimates of taxes are lower than we would expect. However, estimated tax rates move appropriately with changes in maximum and marginal capital gains tax rates.

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¹ See Elton and Gruber (1978) for the implications of the tax hypothesis for optimal portfolio construction, and Elton, Gruber and Rentzler (1983) for the implications for long-term returns.

² Green and Rydqvist (1999) study a different investment class, Swedish bonds, that should also have an ex-dividend day drop greater than the dividend.

³ See, for example, Elton and Gruber (1970), Elton, Gruber and Rentzler (1984), Barclay (1987), Green and Rydqvist (1999), Gagnon and Suret (1991), McDonald (2001), Bell and Jenkinson (2002), Graham, Michaely and Roberts (2002), Poterba and Summers (1984 and 1985), Poterba (1986), and Green (2002)).

⁴ At the time of the E&G 1970 study this was not a problem because the presence of high fixed transaction costs and the prohibition from trading New York Stock Exchange stocks off the exchange meant that arbitrage-restricted price drops only in the most extreme case. The advent of negotiated transaction costs and the subsequent decrease in transaction costs make the actions of arbitrageurs more binding on price movements (see Elton, Gruber and Rentzler (1984)). For some articles examining short-term trading see Kaplanis (1986), and Karpoff and Walking (1990) and references cited therein.

⁵ Empirical analyses of this conjecture include Heath and Darrow (1988), Koski and Scruggs (1998) Lakonishok and Vermaelen (1986), Lasfer (1995), and Graham, Michaely and Roberts (2004).

⁶ We also ran all of the analyses discounting P_x at the expected return rather than compounding P_b . The results are virtually identical.

⁷ There are two alternative measures to equation 2 that have been proposed in the literature. The first uses return on the ex-dividend day minus the expected return. This measure was derived because of a concern that small dividends in the E&G measure would cause some ratios to blow up and thus would overweight firms with small dividends. Given the nature of the stocks we are using, dividends are fairly uniform, so this should not be an issue. However, we also employed this measure and found that the conclusions in the paper are unchanged. The second involves regressing return on dividend yield. Since there is very little variation in dividend yield for the municipal closed-end funds and the corporate bond funds (see Section 6), this is a very poor way to estimate tax rates.

⁸ We examined excluding two weeks and one month after 9/11/01 with no significant difference from the results reported in this paper. All these choices have an arbitrary quality, so we stopped at 9/10/01.

⁹ Nine funds were dropped because there was not enough information to properly classify them.

¹⁰ This is probably due to the lower diversification of the portfolio.

¹¹ For the more recent periods we were able to obtain annual reports and confirm our beliefs. For the earlier years we are unable to obtain independent verification.

¹² We did analyze some other break points for our periods such as passages of the rate changes by Congress, with little change in the results.

¹³ Note that the short-term-trading and dividend-capture arguments do not work in this case since the price drop is greater than the dividend and there is no comparative advantage in corporations capturing tax-free dividends.

¹⁴ One of the appealing characteristics of this sample is that it does not contain the extreme values observed in other studies. Thus, the mean is a meaningful measure.

¹⁵ All of the analyses in this section were also performed using betas estimated from monthly data without the Dimson-Marsh correction, and the results were essentially identical. Also we repeated the analyses eliminating the 20% of the ex-dividend dates with the smallest volume. The E&G measures were 1.135 and 1.072 respectively, both highly significantly different from one.

¹⁶ We can use the tax rates shown in Table 1 and directly calculate what we would expect the E&G ratio would be if either maximum rates or the marginal rates held. For taxable bonds the numbers are 0.9833 and 0.9944 in 1988-1992, 0.8389 and 0.9818 in 1993-1996, and 0.755 and 0.8847 in 1997-2001. The actual E&G ratio is not significantly different from the values that would occur if the NBER marginal rates were accurate, while they are significantly different in the second and third periods from the values assuming maximum tax rates. For municipal bond funds, E&G ratios implied by maximum and TAXSIM rates are 1.389 and 1.341 in 1999-1996 and 1.25 and 1.240 in 1997-2001. These ratios are significantly different from the actual E&G measures at the 1 percent level.

¹⁷ For a discussion of this phenomenon see Charmers (1998) and references cited therein.

Table 4

Differences in Non-Taxable and Taxable Ex-Dividend Behavior Measures Across Two Tax Regimes

This table shows, for the non-taxable and taxable funds in our sample, the differences between the non-taxable and taxable ex-dividend-day measures in each of two tax regimes along with the p -values of those differences. In each case, the difference is calculated as the non-taxable measure minus the taxable measure. The E&G measure is the ratio of the price drop (adjusted for market movement) to the dividend (equation (2) in the text). p -values are for differences from 0.

Tax Period	E&G Measure	1-Tail p -Value
1988 - 1996	0.1313	1.5E-06
1997- 2001	0.1631	1.8E-10

Table 3

Taxable Ex-Dividend Behavior

This table shows, for the taxable funds in our sample, the number of observations as well as the averages and p-values for the E&G measure. The E&G measure is the ratio of the price drop (adjusted for market movement) to the dividend (equation (2) in the text). p -values for the E&G measure are for differences from 1; p -values for differences across periods are for differences from 0.

Tax Period	Observations	E&G Measure	1-Tail p -Value
1. 1988 - 1992	2,359	1.0101	3.6E-01 ^a
2. 1993 - 1996	3,883	1.0134	3.2E-01 ^a
3. 1997 - 2001	4,282	0.8863	4.6E-09 ^a
Period 1 Minus Period 3		0.1238	1.8E-04 ^b
Period 1 Minus Period 2		-0.0033	4.7E-01 ^b
Period 2 Minus Period 3		0.1271	1.5E-04 ^b

Notes:

^a Based on difference from 1

^b Based on difference from 0

Table 2

Non-Taxable Ex-Dividend Behavior

This table shows, for the tax-exempt funds in our sample, the number of observations as well as the averages and p -values for the E&G measure. The E&G measure is the ratio of the price drop (adjusted for market movement) to the dividend (equation (2) in the text). p -values for the E&G measure are for differences from 1; p -values for differences across periods are for differences from 0.

Tax Period	Observations	E&G Measure	1-Tail p -Value
1. 1988 - 1996	11,562	1.1434	6.8E-15 ^a
2. 1997 - 2001	10,418	1.0493	1.7E-03 ^a
Period 1 Minus Period 2		0.0941	9.1E-05 ^b

Notes:

^a Based on difference from 1

^b Based on difference from 0

Table 1

Maximum Tax Rates in Various Periods

This table shows the maximum ordinary income and capital gain tax rates during our sample period and the corresponding estimates of marginal tax rates produced by the TAXSIM model of the NBER.

Years	Maximum Rates		TAXSIM Estimated Marginal Rates	
	Dividend Income	Capital Gain	Dividend Income	Capital Gain
1988 - 1990	28.00%	28.00%	25.03%	25.18%
1991 - 1992	31.00%	28.00%	25.39%	24.11%
1993 - 1996	39.60%	28.00%	27.60%	26.26%
1997 - 2001	39.60%	20.00%	28.67%	19.37%

Table 5
Estimated Marginal Tax Rates

Panel A							
Estimated Tax Rates On Dividends For Taxable Funds							
<u>Tax Period</u>	<u>TAXSIM Estimate</u>	<u>From E&G Measure Using Maximum Cap. Gains Rate</u>	<u>E&G Minus TAXSIM Rate</u>	<u>2-Tail p-Value of Difference</u>	<u>From E&G Measure Using TAXSIM Cap. Gains Rate</u>	<u>E&G Minus TAXSIM Rate</u>	<u>2-Tail p-Value of Difference</u>
1. 1988 - 1992	25.17% ^a	27.27%	2.10%	0.3053	23.99%	-1.18%	0.5806
2. 1993 - 1996	27.60%	27.04%	-0.56%	0.7893	25.27%	-2.33%	0.2773
3. 1997 - 2001	28.67%	29.10%	0.43%	0.7873	28.54%	-0.13%	0.9367
Period 1 Minus Period 2	-2.43%	0.24%			-1.28%		
Period 1 Minus Period 3	-3.50%	-1.82%			-4.55%		
Period 2 Minus Period 3	-1.07%	-2.06%			-3.27%		

Panel B			
Estimated Tax Rates On Capital Gains For Non-Taxable Funds			
<u>Tax Period</u>	<u>Maximum Rate</u>	<u>TAXSIM Estimate</u>	<u>From E&G Measure^c</u>
1. 1988 - 1996 ^b	28.00%	25.42%	12.54%
2. 1997 - 2001	20.00%	19.37%	4.70%
Period 1 Minus Period 2	8.00%	6.05%	7.84%

Notes:

^aThis rate is a weighted average of the TAXSIM dividend income tax rates shown for the first two periods in Table 1; similarly, the weighted averages of the maximum and TAXSIM capital gain tax rates shown for the first two periods in Table 1 are 28.00% and 24.75%, respectively.

^bRates shown in this row are weighted averages of the rates shown for the first three periods in Table 1.

^cThese estimates are significantly different from the maximum capital gains rates and the TAXSIM estimates.