

Marginal Stockholder Tax Effects
and Ex-Dividend Day Behavior-
Thirty-Two Years Later[†]

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Abstract

Since Elton and Gruber's (E&G) original article on taxes and ex-dividend price behavior was published in 1970, over 100 articles have appeared in the leading journals of financial economics examining whether prices fall by less than the dividends and, if so, whether or not the phenomenon is due to tax effects, market microstructure effects, or some other effect. The microstructure argument is the most serious alternative to the tax argument.

All of the microstructure arguments state that the fall in stock price should be less than the dividend, regardless of whether the dividend is taxable or tax-advantaged. By testing ex-dividend effects on a sample of closed-end 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 a microstructure argument. Examining the sample of tax-free dividends, we find that the E&G and return measures change across two tax regimes exactly as theory suggests they should if taxes mattered.

We then examine non-tax-advantaged closed-end funds. For these funds we should find the traditional ex-dividend tax effects: the fall in price on the ex-dividend date should be less than the dividend during periods when capital gains taxes are less than income taxes. This is what we find. Furthermore, the ex-dividend behavior of these funds generally moves in the direction we would expect across two changes in tax regimes. The taxable sample not only substantiates the tax effect, 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.

Thirty-two years after E&G's original study, we find new and compelling evidence that taxes play an important part in affecting share price changes.

In 1970 Elton and Gruber (hereafter E&G) started an industry by studying the impact of taxes on investor decisions using the behavior of share prices around the ex-dividend date. 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 investor's choices, the fall in stock price should in general be less than the dividend.¹

Since 1970 more than 100 articles have appeared, either questioning or supporting the original E&G findings. These articles (some of which are discussed in more detail in the next section of this paper) generally fall into one of four categories. 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 Canadian, Chinese, Danish, German, Greek, Hong Kong, French, Italian, Japanese, New Zealand, Spanish, Swedish and U.K. data.² A second group of articles reexamines the E&G measure around changes in tax laws to see if the change in the ex-dividend day drop is related to changes in tax policy.³ The third group of articles admits to a fall less than the dividend but says the fall is unrelated to tax rates because of arbitrage by short-term traders. Finally, and perhaps most damaging to the tax explanation, 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

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 See for Canada Athanassakos (1996), Athanassakos and Fowler (1993), Booth and Johnson (1984), Bauer, Beveridge, and Sivakumar (2002); for China Milonas, Tan, Travlos and Xiao (2002); for Denmark Florentsens and Rydqvist (2002); for Germany McDonald (2001); for Greece Milonas and Travlos (2001); for France (Desbrieres (1988), Roman (2000)); for Hong Kong Kadapakkam (2000), Boyd and Jagannathan (1994); for Italy Michaely and Murgio (1995); for Japan Hayashi and Jagannathan (1990), Kato and Loewenstein (1995); for New Zealand Bartholdy and Brown (2002); for Spain Gardeazabal and Regulez (2002); for Sweden Daunfeldt (2002), Green and Rydqvist (1999), de Ridder and Sodersten (1999); for United Kingdom Ang, Blackwell and Megginson (1991), Chui, Strong and Cadle (1992), Menyah (1993), and Poterba and Summers (1984 and 1985).

ex-dividend days because of market microstructure characteristics. This argument is the most troublesome, for it suggests that in our 1970 article and in much of the empirical work which followed, ex-dividend 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 bond and domestic common stock funds) for which the drop should in general be less than the dividend.⁴ The difference in the ex-dividend day effects for these two groups allows us to differentiate tax effects from microstructure effects. Furthermore, our sample period, 1988 to 2001, encompasses two major changes in the post-tax value of dividends relative to capital gains for funds with dividends subject to tax , and one major change for the value of tax-free dividends. 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 the assets are financial rather than real assets. This does not affect the way they trade but does have interesting implications for the effect of taxes.

We show that the behavior of price changes with respect to dividends on the ex-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

³ See Athanassakos (1996), Gammie (1997), Grammatikos (1989), Han (1994), Koski (1996), Lamdin and Hiemstra (1993), Lakonishok and Vermaelen (1983), Michaely (1991), Poterba and Summers (1984), Robin (1991), Skinner (1993), Wu Han Hsu (1996), and Zodrow (1991).

within each type of fund. These results clearly show that taxes play an important role in determining the ex-dividend behavior of common stocks.

This paper is organized as follows: In Section I we briefly review some of the discussion of ex-dividend 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 behavior. In Section II we present the methodology used in this paper. In Section III we present our sample. In Section IV we discuss tax policy over our period and the hypothesis that the different tax policy implies. In Section V we present our empirical results. Finally, in Section VI we summarize our results and present our conclusions.

I. Review of the Literature

The literature on the ex-dividend behavior of common stock 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 behavior has been presented in several studies (see, for example, Elton and Gruber (1970), Elton, Gruber and Rentzler (1984), Barclay (1987), Green and Rydqvist (1999), Bhardwaj and Brooks (1999), Gagnon and Suret (1991), McDonald (2001), and Bell and Jenkinson (2002), Graham, Michaely and Roberts (2002), Poterba and Summers (1984 and 1985), Poterba (1986), and Green (2002)).

⁴ Green and Rydqvist (1999) study a different investment class, Swedish bonds, that should also have an ex-dividend day drop greater than the dividend.

While the existence of a price drop on the ex-dividend day less than the dividend has been widely documented, there have been two challenges to the theory that this is evidence of tax effects. 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. Kalay's approach cannot explain why the preponderance of evidence finds the ex-dividend-day drop in price less than the dividend. However, the presence of short-term arbitrages can put an upper and lower bound on the movement in price relative to the dividend and may lead to an underestimate of taxes computed from more contemporary data (see Elton, Gruber and Rentzler (1984)).⁵

A more serious challenge to the tax explanation of ex-dividend price movements is based on 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 which 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-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. Because of this, market makers tend to buy before a stock

⁵ 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

goes ex-dividend and then to sell on the ex-date. They interpret this as meaning that most transactions occur at the ask price before the stock goes ex-dividend and at the bid 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-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.⁶

Both of these microstructure arguments would explain a price drop less than the dividend. However, the microstructure arguments cannot 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. First consider an investor in a tax-exempt municipal bond closed-end fund. For a municipal tax-exempt fund the interest paid out is exempt from federal tax. If the investor is considering selling shares before or on the ex-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 the capital gains tax rate

and Rentzler (1984)). For some articles examining short-term trading see Kaplanis (1986), and Karpoff and Walking (1988a, 1988b and 1990).

⁶ Empirical analyses of this conjecture include Heath and Darrow (1988), Hess (2002) Jacob and Ma (2002) Dubofsky (1992), Dubofsky and Kannan (1993 and 2001) Koski and Scruggs (1998) Lakonishok and Vermaelen

5. t_o the tax rate on ordinary income

The investor is indifferent as to timing if

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

Simplifying⁷

$$\frac{P_b - P_x}{D} = \frac{1}{1 - t_g}$$

Likewise, as shown in Elton and Gruber (1970), if the dividend is taxable at ordinary rates the investor would be indifferent as to timing if⁸

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

The issue is how to measure the left-hand side of the equation. In E&G (1970) we computed this statistic directly by taking the value of the price change on the ex-dividend date as defined below divided by the dividend; this quantity was then averaged across all stocks in the sample. 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.

(1986), Lasfer (1995), Michaely and Vila (1995, 1996), Michaely, Vila and Wang (1997), and Graham, Michaely and Roberts (2002).

⁷ Both capital gains and tax-exempt interest may be taxed at state levels. Since for many states they are treated equally and thus the impact is zero, and for the other states the rates are low, we will ignore these effects.

⁸ We follow the normal assumption in the literature that capital gains are taxed at the long-term rather than the short-term capital gains rate.

In the original study, E&G controlled for market movements in two ways: by carefully selecting the period and by adjusting by the market movements. The period E&G used was a period where the market started and ended at the same value and the distribution of price movements weighted by stocks that go ex-dividend was near zero. In the more recent period used in this study, we are not so fortunate. The market had substantial changes in some of our sub-periods. We adjusted for market movements as follows: for each of the four types of funds in our sample (municipal bond, taxable bond, growth, and growth and income) 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.⁹ This resulted in four 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, two of our types of closed-end funds (taxable bonds and municipal bonds) are likely to have price movements heavily influenced by changes in the yield curve, and we are unaware of a daily return index for bonds that exists over our full period that would capture this. Second, closed-end funds' premiums and discounts can change as a group without corresponding changes in market indexes (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

⁹ We also constructed an equally weighted index of all funds in the group; when we employed this alternative index, the final results were essentially unchanged.

each fund is its three betas (lagged, coincident and lead) with the appropriate index times the corresponding daily index returns. In equation form our first measure is¹⁰

$$\frac{P_b(1+r) - P_x}{D}$$

From equation (1) we see that for tax-free dividends

$$\frac{P_b(1+r) - P_x}{D} = \frac{1}{1-t_g} \quad (3)$$

While for taxable dividends

$$\frac{P_b(1+r) - P_x}{D} = \frac{(1-t_o)}{(1-t_g)} \quad (4)$$

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

The simple statistic E&G used has come under some criticism. The essence of the criticism is that the E&G statistic can be severely affected by stocks with small dividends and thus the average is more heavily affected by small-dividend stocks. For the municipal bond closed-end fund sample this isn't an issue. Since interest earned is fairly similar across funds, the size of the dividends is very uniform across the funds. A pattern of relatively uniform dividends also exists across corporate bond funds. However, our sample of dividends subject to ordinary tax includes corporate bond, growth, and growth and income closed-end funds. Across the three categories there is a substantial variation in dividends. So that our results are not so sensitive to the scale of dividends, we also estimated tax effects by comparing the returns on the funds that go ex-dividend with the expected returns if they didn't go ex-dividend.¹¹ If the fund price drops

¹⁰ We also ran all of the analyses discounting P_x at the expected return rather than compounding P_b . The results are virtually identical.

¹¹ See Graham, Michaely and Roberts (2002) for a discussion of the history of this measure. Their paper takes a different approach to studying the validity of the microstructure arguments.

by less than the dividend, then the differences in returns should be positive. If the fund price drops by more than the dividend, the difference in returns should be negative.¹²

Our second measure in equation form is

$$\frac{P_x - P_b + D}{P_b} - r \quad (5)$$

Rearranging equation (3) we see that equation (5) for tax-free bonds is equal to

$$\frac{D}{P_b} \left(\frac{-t_g}{1-t_g} \right) \quad (6)$$

In the case where dividends are taxable, equation (4) can be rearranged to show that equation (5) is equal to

$$\frac{D}{P_b} \left(\frac{t_o - t_g}{1-t_g} \right) \quad (7)$$

While the return measure is similar in spirit to the E&G measure as explained above, it may produce slightly different results.

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 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.¹³ From this sample we eliminated all funds where we would have difficulty estimating normal price movements on the ex-dividend date. These

¹² There is a third measure that has been used based on 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, this is a very poor way to estimate tax rates in this context.

¹³ 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 the easiest was to stop at 9/10/01.

included funds with substantial overseas investments, REITs and specialty funds (typically venture capital, single company or energy funds).¹⁴ We used CDA/Wiesenberg classification where available. Where CDA/Wiesenberg did not classify the fund we used Morningstar classification, and where this failed we examined annual reports.¹⁵ Examining annual reports for funds with names that would suggest they were something different from how they had been classified revealed that there were a number of funds with holdings and objectives that did not fit the way CDA/Wiesenberg or Morningstar had classified them. We reclassified these 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. The number of funds in each category is shown in Table 1.

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 less than one cent because ex-dividend ratios can reach extreme values in these cases. In the few instances of a dividend 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

¹⁴ For funds with substantial overseas investments, the problem is estimating a suitable model of price movements. For the other groups the sample was too small to construct a meaningful index.

that most of the funds with poor fits have low prices.¹⁶ 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.¹⁷ 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 1, 3 and 4.

Before ending this section, we should recognize one source of bias in our sample. While the CRSP database is an excellent database, it is not free from error. Prices are recorded very accurately, but there are occasional mistakes in clarifying dividends as to type. This is particularly acute in closed-end funds where dividends can be tax-free, taxable, taxable at the capital gains tax rate, or some combination of the above. For many studies, errors of misclassification are random and so their impact is to increase the standard error. Misclassification errors in our study bias our results against finding tax effects. For example, a taxable dividend or capital gain misclassified as a tax-free distribution would bias the E&G statistic toward one for a tax-free distribution. Similarly, for the taxable dividend sample, the misclassification of a capital gain or return of capital as an ordinary dividend would bias our measure toward one.

¹⁵ Nine funds were dropped because there was not enough information to properly classify them.

¹⁶ This is probably due to the lower diversification of the portfolio.

¹⁷ 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.

IV. Tax Regimes

Table 2 shows the maximum capital gains and maximum ordinary tax rates that were in place during our sample period. The only remaining issue 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, it seems preferable to arbitrarily guessing when the passages were fully anticipated.¹⁸

What are the 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: if taxes affect investors' decisions, then for non-taxable dividends as shown in equation (3)

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

Since $t_g > 0$, if taxes affect investors' decisions, the price change divided by the dividend should be greater than one.¹⁹

¹⁸ 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.

¹⁹ 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.

If taxes matter the return for municipal bond funds on the ex dividend day should be less than the return that would have been expected for a non-ex-dividend date, thus our second measure should be negative.

As shown in Table 2, we have two capital gains tax rates over our sample period, 28% from 1988 to 1996 and 20% from 1997 to 2001. The higher the tax rate, the more the measure should exceed one and the more negative should be the return measure. In summary, for non-taxable distributions:

1. The E&G measure should be greater than one and the return measure should be negative.
2. The E&G measure should be larger and the return measure a larger negative number in the 1988 to 1996 period compared to the 1997 to 2000 period.

For taxable distributions the E&G measure as shown in equation (4)

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

When capital gains and ordinary 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, the greater the difference from one.

Examining the return measure if capital gains and ordinary tax rates are the same, we would expect that the return on ex-dividend days would be the same as the expected return if it were a non-ex-dividend date. If capital gains are less than ordinary income tax rates, then the price change should be less than the dividend and the return on the ex-dividend date should be higher than what would be expected on a non-ex-dividend date, and the greater the difference the higher the return. Examining Table 2 shows that the capital gains and ordinary income tax rates were approximately the same in 1988-1990 and 1991-1992. Thus we will designate the period

1988-1992 as a period of equivalent rates. 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 and the return measure should be insignificantly different from zero.
2. For 1993-1996 and 1997-2001 the E&G measure should be less than one and the return measure should be positive.
3. The E&G measure should be smaller and the return measure more positive in 1997-2001 than in 1993-1996 and 1988-1992.
4. The E&G measure should be smaller and the return measure more positive in 1993-1996 than it is in 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 3 presents the mean value for each of our measures, the E&G measure and the return measure, as well as the p values for the difference from one for the E&G measure and for the difference from zero for the return measure. We do this for each of the two tax regimes.

The first point to note from Table 3 is that the fall in price divided by the dividend for each tax regime is larger than one and the difference is statistically significant ($p = 0.0000$ for period 1 and 0.0017 for period 2). The return measure we use is the actual return on the ex-dividend date minus the expected return. If taxes matter, theory implies that the return measure should be negative, and examining Table 3 shows it has the appropriate sign. Once again the difference (in this case from zero) is statistically significant (p value of 0.0000 in period 1 and 0.0068 for period 2).

These results cannot be due to the microstructure arguments put forth by Bali and Hite (1998) and Frank and Jagannathan (1998), but 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 while the return should be higher (less negative). This is exactly what the data show with both the hypothesized changes statistically significant (p value of 0.0001 for each measure).²⁰

When we examine the taxable closed-end bond funds we find different ex-dividend-day behavior, but behavior that is consistent with tax theory. The results are shown in Table 4. 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 should have a preference for capital gains, and 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 one in the second period, and much less than one in the third period. Similarly, the return measure should be equal to zero in the first period, positive in the second period, and strongly positive in

²⁰ 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.

the third period. The results are generally consistent with our expectations. The E&G measure is slightly less than one in the first period and the expected return measure is slightly greater than 0, but as expected the differences are not statistically significantly different from one and zero respectively at any reasonable level of significance (p values are 0.4054 and 0.2225 respectively). In the third period, the E&G measure is less than one and the difference from one is statistically significant (p value of 0.0000). Similarly, in the third period the return measure is greater than zero and the difference is statistically significant (p value of 0.0000). Furthermore the differences in both the E&G and the return measure from period 1 to 3 have the signs we would expect, and once again the differences are statistically significant (p values of 0.0070 and 0.0191 respectively). The result which is not as strong involves period two. The E&G measure is less than one as the theory would suggest, and the return measure is greater than one as the theory would suggest, but only the expected return measure is statistically significantly different from zero (p value of 0.0100).

We would expect that changes in the E&G and return measures would reflect the increases in taxes that occurred in 1993 and 1997 as shown in Table 2. All of our hypotheses are borne out with respect to period two versus period three. The E&G measure goes down in the third period and the return measure goes up just as the tax theory would suggest, and the results are at or near statistical significance (p values of 0.0027 and 0.0612 respectively). The change in the measures between periods one and two is not statistically significant, and while the change in the return measure is in the hypothesized direction, the change in the E&G measure, while very small and statistically insignificant from zero, is not in the right direction.

There is a final way to examine whether ex-dividend-day behavior is determined by microstructure effects. Whatever microstructure exists at a point in time is the same for both

taxable and non-taxable closed end funds. Thus, if microstructure dominates we should observe no difference in ex-dividend day effects. We test this for each of the tax regimes affecting both taxable and non-taxable dividends; the results are shown in Table 5. The ex-dividend-day changes are significant at more than the 0.01 percent level in each tax regime.²¹ This is further evidence of the tax explanation of ex-dividend day behavior.

²¹ Throughout this paper, when testing the difference between two sample means, the p -values were computed assuming unequal variances.

VI. Conclusion

Since our original article on taxes and ex-dividend behavior published in 1970, over 100 articles have appeared in the leading journals of financial economics examining whether prices 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.

All of the microstructure arguments 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 a microstructure argument. Examining the sample of tax-free dividends, we find that the E&G and return measures change across the two tax regimes exactly as theory suggests they should if taxes mattered.

We then examine non-tax-advantaged closed-end funds. For these funds we should find the traditional ex-dividend tax effects: the fall in price on the ex-dividend date should be less than the dividend during periods when capital gains taxes are less than income taxes. This is what we find. Furthermore, the ex-dividend behavior of these funds generally moves in the direction we would expect across two changes in tax regimes. The taxable sample not only substantiates the tax effect—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.

Thirty-two years after our original study, we find new and compelling evidence that taxes play an important part in affecting share price changes.

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Table 1

Sample Sizes

This table shows the types of funds used in our study, along with the number of funds and number of single-distribution days by type of fund. The sample period covers January 4, 1988 through September 10, 2001.

Type of Fund	Number of Funds	Number of Single-Distribution Days
A. Taxable		
1. Bond	127	10,524
2. Growth	28	1,104
3. Growth and Income	27	1,752
B. Non-Taxable		
1. Municipal Bond	302	21,980

Table 2

Maximum Tax Rates in Various Periods

This table shows the maximum ordinary income and capital gain tax rates during our sample period.

Years	Ordinary Income	Capital Gain
1988 - 1990	28.0%	28.0%
1991 - 1992	31.0%	28.0%
1993 - 1996	39.6%	28.0%
1997 - 2001	39.6%	20.0%

Table 3

Non-Taxable Ex-Dividend Behavior

This table shows, for the tax-exempt funds in our sample, the averages and p-values for the measures we use to examine the relationship between the price drop on the ex-dividend day and the dividend. The E&G measure is the ratio of the price drop (adjusted for market movement) to the dividend (equation (3) in the text); the return measure is the the ex-dividend-day return minus the expected daily return if the fund had not gone ex dividend (equation (6) in the text). p-values for the E&G measure are for differences from 1; p-values for the return measure and for differences across periods are for differences from 0.

Tax Period	Observations	E&G Measure	1-Tail p-Value	Return Measure	1-Tail p-Value
1. 1988 - 1996	11,562	1.1434	0.0000 ^a	-0.0007	0.0000 ^b
2. 1997 - 2001	10,418	1.0493	0.0017 ^a	-0.0002	0.0068 ^b
Period 1 Minus Period 2		0.0941	0.0001 ^b	0.0005	0.0001 ^b

Notes:

^a Based on difference from 1

^b Based on difference from 0

Table 4**Taxable Ex-Dividend Behavior**

This table shows, for the taxable funds in our sample, the averages and p-values for the measures we use to examine the relationship between the price drop on the ex-dividend day and the dividend. The E&G measure is the ratio of the price drop (adjusted for market movement) to the dividend (equation (4) in the text); the return measure is the the ex-dividend-day return minus the expected daily return if the fund had not gone ex dividend (equation (7) in the text). p-values for the E&G measure are for differences from 1; p-values for the return measure and for differences across periods are for differences from 0.

Period	Observations	E&G Measure	1-Tail p-Value	Return Measure	1-Tail p-Value
1. 1988 - 1992	3,048	0.9932	0.4054 ^a	0.0002	0.2225 ^b
2. 1993 - 1996	4,819	0.9979	0.4670 ^a	0.0004	0.0100 ^b
3. 1997 - 2001	5,513	0.9099	0.0000 ^a	0.0008	0.0000 ^b
Period 1 Minus Period 3		0.0833	0.0070 ^b	-0.0006	0.0191 ^b
Period 1 Minus Period 2		-0.0046	0.4512 ^b	-0.0002	0.2221 ^b
Period 2 Minus Period 3		0.0880	0.0027 ^b	-0.0004	0.0612 ^b

Notes:

^a Based on difference from 1

^b Based on difference from 0

Table 5

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 (equations (3) and (4) in the text); the return measure is the the ex-dividend-day return minus the expected daily return if the fund had not gone ex dividend (equations (6) and (7) in the text); p-values are for differences from 0.

Tax Period	E&G Measure	1-Tail p-Value	Return Measure	1-Tail p-Value
1988 - 1996	0.1473	0.0000	-0.0010	0.0000
1997- 2001	0.1394	0.0000	-0.0010	0.0000