

DIVIDEND DISTRIBUTIONS AND CLOSED-END FUND DISCOUNTS

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Abstract

The unrealized capital gains hypothesis of Malkiel (1977) is one of the most important explanations for the level of closed-end fund discounts. However, empirical tests of this hypothesis have provided conflicting results. This may be due to the fact that the timing of future realizations of capital gains is uncertain, making their impact on discounts difficult to assess. This paper takes an alternative approach to examining the impact of unrealized capital gains on closed-end fund discounts. We argue that since dividend distributions by closed-end funds often include cash flows generated by the realization of previously unrealized capital gains, the magnitude of quarterly dividend distributions will tend to be associated with changes in the level of unrealized capital gains embedded in the prices of closed-end shares. Therefore, the tax liability hypothesis implies that dividend distributions will be associated with changes in closed-end fund discounts. Using an event study approach to examine the behavior of closed-end fund discounts around dividend distributions, we show that the periodic dividend distributions by closed-end funds explain a significant portion of the short-run fluctuations in discounts.

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1. Introduction

Since Pratt's (1966) finding on closed-end fund discounts, much research has been devoted to understanding why the shares of closed-end mutual funds often trade at a discount of 10 percent or more to their net asset value (NAV). Although a variety of explanations (both rational and irrational) for this phenomenon have been offered, the observed discounts on closed-end funds have never been fully explained. One important explanation is related to how closed-end funds distribute income to shareholders. The Investment Company Act of 1940 requires that closed-end funds pay out at least 90% of realized capital gains and dividend income to shareholders on a regular basis as dividend distributions. Compliance with this provision permits closed-end funds to pass their tax liabilities through to investors, thereby avoiding double taxation of investment income. However, the unrealized capital gains that a fund carries at any given time represent a potential tax liability for future investors in the fund. Thus, the existence of unrealized capital gains implies that a fund's policies regarding the realization of capital gains and the timing of distributions may affect discounts.

The overhanging tax liability for unrealized capital gains is one of the earliest and most important explanations for the *level* of discounts. This hypothesis is based on the observation that investors acquire a contingent capital gains tax liability by purchasing shares of closed-end funds holding securities that have appreciated in value. If the fund realizes and distributes these gains, shareholders must pay capital gains taxes. Since new investors do not benefit from the capital gains that accrued during prior periods, the tax liabilities arising from the realization of these gains are a deadweight loss. Consequently, investors should price closed-end funds with overhanging tax liabilities at a discount to NAV.

Empirical evidence regarding the unrealized capital gains hypothesis is mixed. Malkiel (1977) and Fredman and Scott (1991) find that unrealized capital gains are positively correlated with the discounts for closed-end funds. However, studies such as Pratt (1966), Lee, Shleifer and Thaler (1991), and Pontiff (1995) find no evidence that unrealized capital gains have any impact on the discounts for closed-end funds. Moreover, the unrealized capital gains hypothesis is irrelevant for funds traded in some non-US financial markets. For example, closed-end funds in Great Britain are not permitted to distribute capital gains to their shareholders. Consequently, unrealized capital gains should have fewer tax consequences for investors who purchase shares in British closed-end funds. Similarly, Chen, Oliver and Xu (2004) note the Chinese government does not impose a tax on capital gains. Despite these differences in tax policy, the discounts on closed-end funds in non-US financial markets are remarkably similar to their American counterparts. Of course, other non-tax related factors could have played a more significant role in causing the discounts.

The inconclusive nature of the empirical findings regarding the impact of unrealized capital gains may be due to the capital-gains lock-in effect proposed by Klein (2001). Klein argues that investors who hold stocks that have appreciated in value will be reluctant to sell their shares, preferring to avoid the realization of taxable capital gains. This reluctance creates a scarcity in the supply of such stocks, forcing investors who wish to purchase these stocks to pay a premium, other things being equal. When this argument is extended to closed-end funds, it is unclear whether the lock-in effect or the overhang of unrealized capital gains has the dominant impact in equilibrium. Thus, the impact of unrealized capital gains on the *magnitude* of discounts of closed-end funds remains an open question.

This paper develops an alternative approach to test the tax liabilities hypothesis by focusing on changes in closed-end fund's future tax liabilities and the associated impact on the dynamics of closed-end fund discounts. Although the literature on closed-end fund discounts has focused on the level of the discount, understanding why closed-end fund discounts fluctuate over time is of equal importance. Our analysis is based on the premise that the magnitude of quarterly dividend distributions is correlated with changes in the level of unrealized capital gains embedded in the prices of closed-end fund shares. Since the potential future tax liabilities of closed-end funds depend on the level of unrealized capital gains, dividend distributions will tend to be associated with changes in closed-end discounts if the tax liability hypothesis has empirical validity.¹ We implement this approach using an event study approach that examines the discount patterns around the periodic dividend distribution events by closed-end funds. By converting dividend distributions by closed-end funds to a common time scale, we are able to link a significant portion of the short-run fluctuations in closed-end discounts to periodic dividend distributions. In particular, our empirical results suggest that 70% of the variation in discounts can be explained by the changes in closed-end fund's overhanging tax liability associated with dividend distributions.

The paper is organized as follows. In the next section, we apply both the Malkiel and Klein models to closed-end dividend distributions in order to provide a framework for discussing short-term fluctuations in closed-end fund discounts. We also discuss the possibility that the dynamics of closed-end fund discounts are related to the investment opportunities forgone while closed-end funds hold the dividends that accumulate between

¹ From a tax-saving perspective, the embedded losses should have an opposite effect on closed-end fund discounts. However, not like capital gains which are required to be distributed to investors, capital losses can either be used to offset capital gains of a fund, or carried over by the fund if not used up. Therefore, we focus on the net effect when a fund distributes income.

distributions. Section 3 discusses the sources of the data that we use and identifies three testable implications of our model. The empirical results based on our event study analysis of the relation between dividend distributions and closed-end fund discounts are presented in section 4. Section 5 concludes the paper.

2. Understanding Short-term Discount Dynamics

Malkiel's (1977) model of closed-end discounts focuses on the demand by investors to purchase shares of closed-end funds, providing an approximation for the impact of the expected future present value of the tax payments due to unrealized capital gains and losses on the discount to NAV at which a closed-end fund should trade.² On the supply side, Klein's (2001) argument implies that the shareholders of closed-end funds whose prices have appreciated due to the unrealized capital gains on the underlying portfolio will require a premium to sell their shares due to the tax liability created by the realization of a taxable gain, thereby reducing the total discount to NAV for closed-end funds that have appreciated in value. The common feature of these two models is the contingent tax liability associated with future realizations of unrealized capital gains. However, the timing of these future realizations is uncertain, making an assessment of their precise impact on closed-end discounts difficult. This timing uncertainty may explain the conflicting nature of the empirical results found in the literature.

The impact of uncertainty about the timing of future capital gains realizations on the empirical analysis of closed-end discounts may be substantially reduced by focusing on the relation between dividend distributions and changes in discounts. Since the Investment Company Act mandates that closed-end funds distribute 90% of their income, closed-end funds must make regular distributions of both dividends and realized capital gains if they decide to realize gains. For this reason, the magnitude of cash distributions by closed-end funds will be strongly correlated with short-run changes in the level of unrealized capital

² Embedded losses are valuable to future fund investors because of tax benefits. However, closed-end funds report their unrealized capital gains net of capital losses. In addition, if a fund cannot distribute realized losses, realizing or not realizing capital losses have not direct impact to investors. Therefore, as we focus on *changes* in unrealized capital gains, we will not separately investigate the impact of gains versus losses.

gains. Therefore, the analysis of the relation between changes in closed-end fund discounts and the distribution of dividends may provide new evidence on the validity of the tax liability hypothesis. By contrast, trying to tie the level of discounts to total unrealized capital gains is problematic. Capital gains accumulating during future holding periods may be realized prior to today's unrealized capital gains when current buyers happen to be the future sellers. In this case the current buyers should have no tax disadvantages. By focusing on the time series of cash distributions and the dynamics of the discount during the event window surrounding the distribution of closed-end fund dividends, we circumvent the need to address the simultaneous impact of current and anticipated future tax liabilities on demand and supply.

The data that we use to implement this approach includes a subset of the data used by Chay, Choi and Pontiff (2006) to examine the value of tax-timing options that are dissipated when capital gains are distributed directly to shareholders. However, whereas Chay et. al. infer the value of tax timing options by examining the ex-dividend day behavior of share prices, we focus on the dynamics of closed-end discounts as the overhanging unrealized capital gains are reduced by distributing the accumulated capital gains to shareholders.

2.1. Another look at the Malkiel model

Although we focus on changes in discounts, the unrealized capital gain model of Malkiel (1977) helps us to understand the general direction of the tax effects. Based on the assumption that buyers determine the prices of closed-end fund shares, he developed a model focuses on the tax disadvantage to a buyer who purchases shares with unrealized capital gains. In particular, he assumed a constant net asset value V ,³ with the tax basis of the fund's

³ The potential growth opportunities of a fund are irrelevant since future growth will affect only the capital gains that may be realized after the purchase of the shares.

portfolio being B , the capital-gains tax rate of τ , and the discount rate of r . If the fund realizes the overhanging capital gains of $(V-B)$ evenly over the next n_d periods, the present value of the associated tax liability is $TL = \tau \sum_{i=1}^{n_d} \frac{(V-B)/n_d}{(1+r)^i}$. Given that the fund price is P , there will be a capital loss of $(V-B) [=P - (P - (V-B))]$ when the shares of the fund are sold in n_s ($>n_d$) periods. At this time the investor will receive a tax deduction that has a current present value of $TC = \frac{\tau(V-B)}{(1+r)^{n_s}}$. The price an investor is willing to pay should reflect the present value of the anticipated tax liability, so that the current price should be, $P = V - (TL - TC)$. Therefore, the percentage discount $(V - P) / V$ that will be required for the buyer to be willing to purchase the close-end fund shares is

$$\delta = \frac{V-P}{V} = \tau(V-B) \left[\frac{1}{n_d r} \left(1 - \frac{1}{(1+r)^{n_d}} \right) - \frac{1}{(1+r)^{n_s}} \right] > 0, \text{ if } n_d < n_s \neq 1. \quad (1)$$

In other words, an investor who decides to purchase shares of a closed-end fund will insist on a discount to the underlying net asset value.⁴ Equation (1) suggests that the magnitude of this discount will depend on both the amount of built-in unrealized capital gains $(V-B)$ and the policies of the fund regarding the realization and distribution of these gains during future periods, as well as a marginal investor's expected holding period.

The Malkiel model does not explicitly account for the fact that the prices of closed-end shares are jointly determined by the supply and demand for shares. The impact of unrealized capital gains on potential sellers (the current fund shareholders) must be considered as well. For simplicity, assume that the current shareholders of the fund enjoy the

⁴ The price differential does not constitute an arbitrage opportunity except for investors who do not pay any taxes.

capital gain of $(V-B)$. Any sale of these appreciated shares will cause existing shareholders to immediately incur a personal tax liability for the realization of a capital gain of $(V-B)$. It is easy to show that the taxes from such an immediate sale of closed-end shares would exceed the expected present value of the taxes that would be paid if either the shares were sold at a later date, or if the fund were to realize and distribute the overhanging capital gains before shares are sold.⁵ Consequently, Klein (2001) argues that the shareholders in the fund will prefer to avoid an immediate realization of a taxable gain unless they are paid a premium price for their shares. That is, a fund's existing shareholders are in a sense 'locked-in' to holding the fund's shares by their aversion to the realization of a taxable gain.

The overhanging tax liability will shift the demand curve for a closed-end fund downwards, while the 'lock-in' effect will push the corresponding supply curve to the left. The net effect on the price of the fund and therefore the fund's discount depends on the relative magnitudes of these shifts. The prevalent view in the literature is that the effect of the overhanging tax liability is stronger than the 'lock-in' effect, given that the stocks held by close-end funds are also subject to the 'lock-in' effect. However, the relative strength of these two competing effects is ultimately an empirical question. In order to avoid the ambiguity, we focus on discount changes due to changes in the unrealized capital gains lead by dividend events instead of on discount levels.

2.2. Closed-end discount dynamics and changes in overhanging tax liabilities

The Malkiel and Klein models share the intuitive logic that the *level* of the discount for a closed-end fund is related to the level of unrealized capital gains. Since in general we are unable to observe either the accumulation of unrealized capital gains or the timing with

⁵ In this case, the present value of the tax liability (TL) is identical to that for new buyers.

which closed-end funds realize and distribute these gains, obtaining precise estimates of the relation between the closed-end discounts and the level of unrealized capital gains is a challenge. Moreover, the net impact from these two competing effects is difficult to predict a priori. At the same time, a comparative static analysis of equation (1) suggests that changes in a fund's unrealized capital gains will be accompanied by a change in the discount at which the fund trades. Given that closed-end funds regularly distribute dividends from realized capital gains for various reasons and/or dividends from the underlying assets, the total amount of unrealized capital gains will change over time as the fund distributes these cash flows to shareholders.

There are at least three factors that might affect discounts on the ex-dividend day. First, other things being equal, there should be a tendency for changes in unrealized capital gains to be associated with the accumulation and distribution of closed-end dividends. Therefore, when equation (1) holds, there is a tax overhang effect in that a dividend distribution reduces the unrealized gains, which translates into a drop in the discount. Second, the discount could widen mechanically. On the ex-dividend day for a closed-end fund, the net asset value of the fund (V) will mechanically drop by the dividend amount D . Other things being equal, if the fund's price falls by the full amount of the dividend, the discount on the fund should rise mechanically since $\frac{(V - D) - (P - D)}{V - D} > \frac{V - P}{V}$. Finally, in the presence of Klein's tax 'lock-in' effect, the fund price will not drop by the full dividend amount of D on the ex-dividend day,⁶ which attenuates the potential increase in discounts,

⁶ Of course, if the realized gains do not belong to the majority current shareholders of the fund, the 'lock-in' effect will be weaker. Also, for an existing investor even with embedded losses, she will be indifferent to sell shares before or after dividend distribution if dividend taxes and capital gains taxes are similar or there is tax 'lock-in' effect.

making the mechanical effect less significant. In this case, both the tax ‘lock-in’ effect and the tax overhang effect work in the same direction on the ex-dividend day changes in discounts.

The preceding discussion implies that closed-end fund discounts should decline on the ex-dividend day whenever the tax overhang and ‘lock-in’ effects dominate the mechanical effect of the reduction in the fund’s NAV caused by the dividend distribution. In other words, the condition,

$$\delta_{pre} = \frac{V - P}{V} > \delta_{post} = \frac{(V - D) - [P - (1 - L)D + \kappa D]}{V - D} = \frac{(V - P) - (L + \kappa)D}{V - D},$$

holds if and only if,

$$\delta_{pre} < L + \kappa,$$

where δ_{pre} , δ_{post} , L , and κ are the pre- and post-dividend discount rate, the percentage ‘lock-in’ effect, and the percentage tax overhang effect, respectively. If there are no tax effects ($L = \kappa = 0$), the above condition fails which implies that discounts should actually increase on the ex-dividend day. In practice, however, this condition is easily satisfied given the average closed-end discount of 10% and the sizable ‘lock-in’ effect noted in Klein (2001). These considerations motivate the following hypothesis:

Hypothesis 1: *Closed-end discounts fall on the ex-dividend date to the lowest level of the quarter.*

Discounts might also change during the dividend accumulation period. Consider a simple case where a fund with a quarterly required return of r pays a dividend of D each quarter. If we ignore the impact of taxes for the moment, the simple Gordon model suggests that the price of the fund will be constant at,

$$V = \frac{D}{r}. \quad (2)$$

Equation (2) gives the ex-dividend price of the fund at the end of each quarter following the payment of the quarterly dividend of D . During each quarter, the price of the fund should increase steadily at a rate of r as the payment of the end of quarter dividend draws nearer. In other words, the fund price should rise to $(V+D)$ at the end of each quarter just prior to the payment of the quarterly dividend.

Due to continuously compounding returns, the Gordon model in equation (2) implies that there should be a *gradual* accumulation of unpaid dividends during the period prior to the ex-dividend day. For investors considering the purchase of the shares prior to the ex-dividend day, these unpaid dividends represent unrealized gains in the same sense as unrealized capital gains. The overhanging tax liability associated with this accumulation of unpaid dividends will contribute to a gradual increase in the discount as the ex-dividend date approaches. Thus, closed-end discounts should increase from the beginning to the end of a quarter.

To be consistent we should consider whether Klein's tax 'lock-in' effect might have any systematic impact on closed-end fund discounts during the period leading up to the ex-dividend date. Due to their institutional characteristics, closed-end funds collect and hold dividend distributions from the assets held in their portfolios. In the presence of a 'lock-in' effect, the fund's NAV, which equals to the market prices of the underlying assets plus the undistributed dividends, should be even higher than would otherwise be the case⁷ when an

⁷ The price of closed-end shares should have also been altered by the 'lock-in' effect if investors had perfect information about the portfolio composition of the fund at every moment. Unfortunately, this information is only available once every quarter.

underlying asset of a fund goes ex-dividend. Thus, discounts should tend to rise from the beginning of the quarter through to the end even in the presence of a ‘lock-in’ effect⁸. This proposition regarding the time series behavior of discounts can be stated as the following hypothesis:

Hypothesis 2: *Closed-end discounts increase from ex-dividend date until just prior to the ex-dividend date for the next distribution.*

Our analysis and equation (1) also suggest that the discount level depends on the level of unrealized capital gains. In other words, changes in discounts should be proportional to changes in unrealized gains—which essentially equal to the amount of the dividend given the overhanging tax liability triggered by the distribution. One caveat is that not all the gains distributed by a fund are taxable. For example, a fund that follows a strict dividend distribution policy might on occasion liquidate assets in order to pay a dividend. Fortunately, over 97% of the dividend events in our sample are taxable.⁹ Therefore, we will ignore this problem in our empirical analysis. A more significant issue with respect to tax liabilities is the taxation of dividends paid by international funds, which will be treated more carefully in the next section.

The magnitude of changes in discounts might also be related to fund returns through the potential loss of the investment opportunities. In practice, the stocks held by mutual funds distribute their dividends prior to distributions by the fund, so that when one of the stocks in the fund’s portfolio distributes a dividend, the fund’s holdings of cash increase. This interim accumulation of cash by the fund forces investors to forgo the investment

⁸ A similar argument has been used made by Pontiff (1995) to explain the predictability of discounts.

⁹ Our sample includes 2364 distribution events, of which 2300 represent taxable distributions, including 1692 ordinary dividend distributions and 608 capital gains distributions.

opportunities they would be afforded if they held the same investment in individual stocks directly in their personal accounts. For this reason, rational investors will demand a discount to compensate for the loss of liquidity and potential investment opportunities. For simplicity, assume there are N stocks that make dividend distributions at one of N evenly spaced points within each quarter. If each stock distributes a dividend of $d(=D/N)$, at point n , the total forgone gain at the end of each quarter is,

$$FO_N = \sum_{n=1}^N d[(1+r/N)^{N-n} - 1] = \left[\frac{1}{r/N} [(1+r/N)^N - 1] - N \right] \frac{D}{N} \approx \frac{D}{2} r. \quad (3)$$

Note that in the expression above we assume that the investors' opportunity cost is equal to the fund's expected return, which can be estimated by, for example, the CAPM model. Equation (3) implies that the magnitude of changes in discounts should also be related to fund expected returns. These considerations suggest the following hypothesis:

Hypothesis 3: *The ex-dividend day decline in closed-end discounts is positively correlated with both closed-end funds' expected returns and the size of the dividend distribution.*

Hypothesis 3 provides a novel approach to examining the determinants of the changes in discounts for individual funds. In particular, these predictions differ from Pontiff (1996), who argues that closed-end fund discounts are a manifestation of mispricing based on his finding that the negative correlation between discounts and future returns cannot be fully explained by a variety of proxies for closed-end funds' liquidity and risk. To the extent that closed-end discounts are due to mispricing, the absolute value of discounts should be positively related to the costs of arbitrage, including any holding costs. Pontiff (2006) notes that holding costs are negatively related to the dividends on a security, which implies that

there should be a negative relation between the absolute level of discounts and the size of the dividend distribution at any given time, in contrast to the predictions of Hypothesis 3.

We use the event study approach to study the first two hypotheses on the aggregate level. In contrast, given that *Hypothesis 3* focuses on the correlation between dividend distributions (or past returns) and the magnitude of closed-end discounts, we examine this hypothesis at the individual fund level. Note that both equations (1) and (3) suggest that changes in closed-end discounts from the beginning of a quarter to the end are related to both the amount of the dividends paid and the returns to the closed-end fund.

In this study, we emphasize the impact of the timing of the tax liability related to dividend distributions rather than the level of unrealized capital gains that has been the focus of much of the previous research on closed-end discounts. The rationale for our approach is the fact that there can be no tax liability until the capital gains are realized. In reality, investors are not necessarily averse to funds with large unrealized capital gains. If a fund never distributes these unrealized capital gains, the fund's investors will never be subject to taxes on any of the gains that accrued prior to the purchase of their shares in the fund. Moreover, a fund's operation is continuous. In addition to unrealized capital gains that may have accumulated during past periods, shareholders expect capital gains to accumulate during future periods as well. By focusing on the dynamics of closed-end discounts, we have no need to determine whether the realization of gains in any given period represents a realization of capital gains from prior periods or a realization of capital gains from the current period. For this reason, it is more fruitful to study the impact of dividend distribution on closed-end fund discounts rather than unrealized capital gains.

As is the case for mature corporations, closed-end funds usually prefer a smooth dividend distribution policy, adjusting their payout ratios based on the expectation of future dividends relative to the magnitude of prior dividend distributions. If discounts vary with dividend accumulation and distribution, then closed-end discounts should be persistent. This implication is consistent with the existing literature that finds discounts to be mean-reverting. In the following section we describe the data and methodology that we use to test the implications of our arguments regarding the dynamics of closed-end fund discounts.

3. Data and Testing Methodology

The analysis presented in the previous section suggests that the timing of the dividend distributions from closed-end funds can be used to study the dynamics of closed-end funds' discounts. This follows from the fact that the realization of formerly unrealized capital gains is tied to dividend distributions by the requirement that mutual funds distribute 90 percent of all income to shareholders. Further, irrespective of the existence of unrealized capital gains, our analysis implies that the delay in distributing dividends from the stocks held in closed-end portfolios will have a non-negligible effect on closed-end discounts. Thus, we propose to examine the relation between the time series of weekly fluctuations in the discounts for closed-end funds and the accumulation and distribution of dividends from the underlying closed-end fund portfolios.

The “dynamics” of discounts we focus on are somewhat unconventional. Rather than focusing on lead-lag relationships and the persistence of the discounts, we try to understand why discounts fluctuate in the first place. From a theoretical perspective, the two driving forces identified in the previous section are the potential tax liability for the realization of capital gains and forgone investment opportunities. We should observe both of these effects around the dividend distribution events. Our first hypothesis is intended to test whether dividend distributions have a significant impact on closed-end fund discounts. In order to understand the discount fluctuations observed in weekly data, we have argued that dividend accumulation and distribution should co-move with discounts over time, which is our second hypothesis. These two hypotheses can be investigated in detail using the event study approach. Our third hypothesis focuses on the discount fluctuations on individual fund level. The remainder of this section describes the research design for testing our hypotheses.

3.1. Methodology

Our first two hypotheses predict that discounts will change as a result of dividend distribution events. In aggregate, the changing pattern of the discounts during the period surrounding dividend distributions can be analyzed using an event study methodology. To implement this approach, we identify each dividend distribution date for all funds in our sample. As is standard in the event study literature, we denote each ex-dividend week as $t = 0$, with the weeks immediately prior and subsequent to the ex-dividend week denoted respectively as $t = -1$ and $t = 1$, and so on. This conversion of the time series of weekly fund discounts to an event time defined relative to the ex-dividend date for distributions permits us to examine the dynamic of discounts over an event window running from $t = -26$ to $t = 26$.¹⁰

If discounts are largely determined by the embedded capital gains liability, dividend distribution events should have greater impact to funds with large discounts, other things being equal. In other words, the magnitude of discounts can serve as a proxy for the size of unrealized capital gains. Quantitatively, we can examine the statistical significance of the relation between changes in closed-end discounts around distribution events relative to their pre-event level of discounts by running the regression:

$$\delta_{drop,i} = \alpha + \beta\delta_{-2,i} + \varepsilon_i, \quad (4)$$

where δ_i = discount level of the i -th fund at dividend distribution week,

$\delta_{-2,i}$ = discount level of the i -th fund two weeks before dividend distribution,

$\delta_{2,i}$ = discount level of the i -th fund two weeks after dividend distribution,

¹⁰ It will not affect the event study results whether a fund makes quarterly or semi-annual distributions. However, the discount pattern at $t = -13$ or $t = 13$ will not repeat that of at $t = 0$ since not all the funds have quarterly distribution events.

$$\delta_{\text{drop}} = \delta_{-2,i} - \delta_i \text{ or } \delta_{\text{drop}} = \delta_{-2,i} - \delta_{2,i}.$$

In this case, the coefficient β in equation (4) should be positive from above discussion.

The regression specification above relates changes in closed-end discounts during the two-week period prior to the ex-dividend date to the level of the discount. Note that since the NAVs used to estimate closed-end fund discounts are reported at weekly intervals, it is possible that in some cases the NAVs reported at $t = -1$ may already reflect an adjustment for the dividend to be paid to the shareholders of record on the ex-dividend date. To capture the impact of any such adjustments, we use the decline in the discount from $t = -2$ to date $t = 0$ as the dependent variable in the regression specification above.

The event study approach permits us to identify the general response pattern with which discounts adjust to changes in the unrealized capital gains that we conjecture to be associated with dividend distributions. Equally important is the determination of whether differences in the amount of dividend distributions affect the magnitude of discount changes, which is the *Hypothesis 3*. This provides one additional step in further understanding the importance of the potential future tax liabilities related to unrealized capital gains. To test our hypothesis, we can study the relation of drops in discounts to dividend yields and fund returns through the following regressions:

$$\delta_{\text{drop},i} = \alpha + \beta_{DP} \frac{D_i}{P_{-2,i}} + \varepsilon_i, \text{ and} \quad (5)$$

$$\delta_{\text{drop},i} = \alpha + \beta_R R_{P,i} + \varepsilon_i, \quad (6)$$

$$\delta_{\text{drop},i} = \alpha + \beta_{DP} \frac{D_i}{P_{-2,i}} + \beta_R R_{P,i} + \varepsilon_i, \text{ and} \quad (7)$$

where $R_{P,i}$ = the i -th fund's quarterly return before dividend distribution,

$P_{-2,i}$ = price level of the i -th fund at two weeks before dividend distribution.

Given the regression specification above, we run cross-sectional regressions for each quarter. The time series of estimates for the beta coefficients in these regressions is then used to provide an additional test of our hypotheses.

3.2. Description of data

There are two general classes of closed-end funds: Equity Funds and Bond Funds. Like most research on closed-end funds we examine only equity funds. More specifically, we study funds that invest predominantly in common stocks. The underlying assets of those funds are well diversified. Thus, problems associated with the estimation of non-market risk are reduced.

Equity funds can be further classified into Domestic Equity Funds, which invest primarily in the U.S. equity market, and World Equity Funds, which focus on foreign equity markets. Depending on the investment objectives, the universe of U.S. equity funds includes:

- (a) General Equity funds investing predominantly in US diversified stocks;
- (b) Specialized Equity funds invest in specific industry sectors of the US market such as petroleum and real estate;
- (c) Income and Preferred Stock funds investing in high yield common and preferred stocks;
- (d) Convertible Securities funds that invest in convertible securities.

The use of these objective classifications as the basis for the selection of the sample of equity mutual funds used to test our hypothesis presents several problems. For example,

funds included in categories such as Income and Preferred Stock, and Convertible Securities may sometimes invest in common stocks, even though their stated objectives are very similar to those for bond funds. Further, funds categorized as the General Equity Funds may at times invest a majority of their assets in fixed income securities. For these reasons, our primary sample selection criterion is that the fund invests predominantly in common stocks. In particular, we adopt the following sample selection criteria:

- (1) Invest more than seventy percent of assets in common stocks;¹¹
- (2) Have a performance history longer than six months during the 1993-2002 period;
- (3) Have a ticker or CRSP permanent identification number (PERMNO);
- (4) Make either quarterly or semi-annual dividend distributions.¹²

Based on these criteria, we were able to create a sample of 124 closed-end funds including 78 World Equity funds and 46 U.S. equity funds.

Morningstar provides weekly NAV and market price data.¹³ To assure the integrity of our data, we compare the NAV reported by Morningstar with NAV data collected from the WSJ. Further, we compare the market prices reported by Morningstar with the price data included in the CRSP mutual fund database. These checks on the data enable us to correct for occasional errors and to adjust the fund NAV's for stock splits and distributions. These data are used to calculate the returns based on NAV, returns based on fund prices and the respective fund discounts.

¹¹ Most of these funds are under the categories of General Equity Funds and World Equity in the WSJ report. However, some specialized funds, such as preferred funds and convertible funds that invest predominantly in US equity, are also added into our sample.

¹² Funds with monthly dividend distributions that have characteristics of bond funds are deleted.

¹³ We are grateful to Morningstar for making the data available to us.

Closed-end funds usually begin trading at a premium before subsequently trading at a discount to NAV as the fund becomes more seasoned. When funds are terminated through either liquidation or open-ending, their share prices rise and any discount is eliminated. Therefore, to avoid any bias in our analysis of discounts, we exclude both the six months of data following the inception of the fund and the last six months of data prior to the fund's termination.

4. Empirical Results

In this section we first describe the characteristics of our sample to show that our data is comparable to that used in other studies. We then discuss our empirical results, which are based on the changes in closed-end discounts during the event window surrounding dividend distributions. Finally, we discuss the implications of the results of a variety of cross-sectional regressions of closed-end discounts and test the robustness of our results.

4.1. The characteristics of the closed-end fund sample

Our sample consists of 124 domestic and international equity funds for the ten-year sample period from 1993 to 2002. The summary statistics presented in Table 1 show that the average discount for the closed-end funds included in our sample was 11.0%, which is slightly greater than the historical average of 10%. The median for the average discount on the funds in our sample is 13.1%, indicating that most of these funds traded at discounts rather than premiums. Note that discounts fluctuated considerably during the sample period, as evidenced by the fact that the average standard deviation of the discount on the funds in our sample is 9.4%, with a median discount of 7.9% indicating that the distribution of discount volatility for our fund sample is skewed to the left.

Insert Table 1 approximately here

The average weekly returns for the funds in our sample are similar in magnitude to the average returns computed using changes in the NAV for the underlying assets, with an average weekly return of roughly 0.066%. The similarity between NAV-based returns and the returns based on closing prices suggests persistence in closed-end fund discounts, which in turn implies that the standard deviations for the discounts of individual closed-end funds

should be proportional to the standard deviation of the innovations in the discount that are the focus of our analysis. Further, as should be expected given the volatility of the discounts for our sample of funds, the weekly fund returns based on closing prices, with an average standard deviation of 3.9%, are more volatile than the returns computed from the NAVs for the respective funds, which have an average weekly standard deviation of 3.2%. Pontiff (1997) has referred to this empirical finding as the “excess volatility” in the closed-end fund market. Note that since the median fund return exceeds the mean fund return, the returns for the funds in our sample are negatively skewed.

The average number of dividend distribution events for our fund sample is 15, ranging from 4 to 40. The average dividend yield is 4.48%, with an average yearly cash distribution is \$0.74, including \$0.43 of special dividends. The average fund has an NAV of \$14.21 per share and an average size of \$12 million. These sample characteristics are similar to those for the samples used by most of the frequently cited studies of closed-end funds.

4.2. Understanding the pattern changes in closed-end fund discounts

Hypothesis 1 states that the ex-dividend date should coincide with a decline in closed-end fund discounts to their lowest level during the quarter, while *Hypothesis 2* states that closed-end fund discounts will increase from the ex-dividend date until just prior to the ex-dividend date for the next distribution. To test these two hypotheses, we compute an aggregate discount for the 124 funds in our sample during the event window surrounding their respective dividend distribution events. The event-time behavior for the weekly mean, median and the cross-sectional standard deviation for the percentage discounts of the funds in our sample are plotted in Figure 1.

A careful examination of Figure 1 supports Hypothesis 1. As predicted, the aggregate discount shown in Panel A of Figure 1 declines during the event window surrounding dividend distributions, with the cross-sectional average discount reaching its maximum of *10.1%* roughly two weeks before the ex-dividend week. Panel A of Table 2 reports that the average discount then falls to 9.3% during the ex-dividend week, and continues to drop for two weeks following the ex-dividend week to a low of 8.6%. The 15% decline in the aggregate discount for our sample supports Hypothesis 1. Such a change is statistically significant as shown later in this section. Note also that the decline in the aggregate discount is net of mechanical effect. In fact, the mechanical effect should cause the aggregate discount to rise by 4.5% on ex-dividend day using the summary statistics in Table 1. The event window behavior of the median discount for our sample depicted in Panel B of Figure 1 exhibits a similar pattern, suggesting that the event window decline in the discount cannot be attributed to the variation in the discounts for a small subset of our sample.

Note that since the NAVs used in estimating closed-end fund discounts are reported at weekly intervals, it is possible that the event week NAVs reported by some of the funds in our sample were adjusted to reflect dividend payments occurring prior to the ex-dividend day. For this reason, our sample may exhibit an artificial tendency for the average discount to begin declining during the week prior to the ex-dividend week. However, the continuation of the decline in the discount during the two-week period following the event week suggests a delayed reaction in the prices of closed-end funds. Note that the observed variation in discounts cannot be mechanically attributed to gradual changes in fund NAVs. If changes in fund NAVs were responsible for the observed pattern, the average discount would show a

steady but gradual decline instead of the rather precipitous pattern observed in Panel A of Figure 1.

Insert Figure 1 approximately here

The event window behavior of discounts is also consistent with Hypothesis 2 in that the average discount gradually increases following the event date, exactly as predicted. This supports our argument that following a dividend distribution each fund begins to accumulate dividends again because of continuously compounded returns. Since one can consider these unpaid dividends as the unrealized capital gains, the average closed-end discount begins to increase again.

The final panel displayed in Figure 1 (Panel C) shows that the cross-sectional dispersion of discounts increases during the distribution week as the average discount declines. From tax perspective, this phenomenon is consistent with the risk sharing story of Dai, Shackelford, and Zhang (2007). One can consider that having tax liability is just like sharing part of the income risk with the government. After dividend distribution, risk sharing reduces which increases the relative risk of individual investors. Such a finding could also be purely mechanical if closed-end discounts reflected a constant dollar difference between fund prices and NAVs, as would be the case if discounts were determined by the present value of a fund's future management fees. However, if the dollar value of discounts remained constants, then closed-end discounts would increase as fund prices and NAV's declined during the distribution week. Thus, our finding that the average closed-end discount declines during the distribution period suggests that the increased dispersion of closed-end discounts is related to some fundamental economic force. For example, an increase in the dispersion of discounts might be consistent with the fact that U.S. investors

believe that closed-end funds holding foreign stocks are subject to greater uncertainty. Therefore, dividend distributions might convey information that is reflected in the relatively greater variation in the discounts for these funds. That is, the cross-sectional variation in discounts might be driven by the non-U.S. equity funds in our sample. We address this issue by examining discounts for non-U.S. and domestic closed-end funds separately. Our results, which are not reported here, show increased volatility for the discounts for non-U.S. funds but not for U.S. funds.

The quarterly frequency of distributions by companies that pay dividends raises a question regarding whether the average closed-end discount should be expected to revert to the same level every 13 weeks, in contrast to the pattern displayed in Panel A of Figure 1 showing that the average discount falls to a low point every 52 weeks. The magnitude and significance of the week 0 decline in the discount relative to the decline that we find at either $t = -13$ or $t = +13$ is due to the distribution policies followed by mutual funds. In particular, most of the funds in our sample make only semi-annual or in some cases annual distributions. Since these less frequent distributions that include a large capital-gain-related component are less likely to be preceded or followed by a distribution including a capital-gain-related component of a similar magnitude, the decline in the discount at both $t = -13$ and $t = +13$ is guaranteed to be less pronounced than the decline observed at date 0.

We examine the relative impact of clustering capital gains distributions and the infrequent dividend effect by plotting the event-time behavior of the average discounts for the subset of funds that pay quarterly dividends. The results are plotted in Figure 2 for three subsets of closed-end funds in our sample: the 15 funds making quarterly dividend distributions, the 12 US funds that make quarterly dividend distributions, and all 46 U.S.

closed-end funds. The event-time pattern of fluctuations in the average discount for the 15-fund and 12-fund sub-samples depicted in Panels A and C of Figure 2 are similar to those for the overall sample shown in Figure 1. The percentage declines in the average discount during four-week period surrounding the event week are respectively 10.3% and 12.7% for the 15-fund and 12-fund sub-samples. These results are respectively reported in Panel B and Panel D of Table 2. Note that the average discount of 3.82% for U.S. closed-end funds making quarterly cash distributions is less than half the average discount of 7.80% for 46 U.S. closed-end funds in our sample reported in Panel C of Table 2. This result may be attributable to a tendency for funds making more frequent distributions to either realize capital gains on a more regular basis, or to cater to a shareholder clientele willing to pay a relative premium for more frequent distributions. Alternatively, frequent income distributions might be associated with a lesser degree of information asymmetry if the distribution event conveys information. Since this is not the focus of the paper, we will not explore further.

Insert Figure 2 approximately here

Compared to the overall sample, the subset of closed-end funds making quarterly distributions exhibit a more pronounced decline in their average discount at weeks $t = -13$ and $t = +13$. However, while there appears to be a 13-week periodicity to fluctuations in the average discount for funds making quarterly distributions, the low point for the average discount just subsequent to the event week at $t = 0$ appears to be significantly less than the corresponding low point for the average discount relative to weeks $t = -13$ and $t = 13$. Further, although the decline in the average discount at dates $t = -13$ and $t = +13$ appear to be more pronounced than the corresponding declines in the average discount for the

complete sample, the low point to the periodic cycle for the average discount continues to occur two weeks following the distribution week at $t = 2$. This finding is most likely due to the concentration of capital gain distributions at the event week resulting from the conversion of each distribution date to event time as was noted previously.¹⁴

The tax liability explanation that we propose to explain the short-run variation in the discounts for closed-end funds has greater relevance for funds that trade in the U.S. market. Further, since most previous research on closed-end fund discounts has focused on domestic funds, we perform a separate analysis of the discount pattern for the U.S. equity funds. The event-time behavior of the average discount for U.S. equity funds is plotted in Panel B of Figure 2. The pattern surrounding the ex-dividend week is very similar to that shown in Panel A of Figure 1 for the full sample. However, although the percentage decline in the average discount for U.S. funds is only *10.8%*, compared to a percentage decline in the discount of *14.9%* for the overall sample, the decline in the average discount for U.S. funds during the two weeks following the distribution week appears to be much smaller than that for the overall sample. That is, any delay in the reaction to closed-end distributions appears to be confined primarily to the foreign close-end funds in our example. In addition, we see a much clearer up and down pattern for the preceding and subsequent thirteen-week quarters. This result represents a strong piece of evidence in support of our second hypothesis.

We have argued that an important component to the distribution-week decline in the average closed-end discount is the impact of the distribution of previously unrealized capital gains. To support this conjecture we perform several additional experiments. Since our

¹⁴ Presumably, using daily data will help. However, NAV information is only available on weekly frequency. This phenomenon might also be related to dividend declaration date.

arguments regarding the relation between closed-end discounts and dividend distributions both rely on the magnitude of the cash distribution, we first investigate whether the decline in the average discount during the event window is related to the magnitude of cash distributions. In general, closed-end funds make two types of cash distributions—ordinary dividend and special dividend distributions, special distributions being two to five times larger than dividend distributions in most cases. Since U.S. equity funds make more regular quarterly dividend distribution and more annual special dividend distributions than their foreign counterparts, we focus our analysis on the U.S. equity funds.¹⁵

A plot of the average closed-end discount during the event period surrounding special dividend distributions is presented in Panel A of Figure 3. Panel B of Figure 3 plots the average closed-end discount during the event window surrounding the distribution week for ordinary dividends. A comparison of these plots shows that the distribution-week decline in the discount associated with special dividend distributions is more than twice as large as the decline associated with ordinary dividend distributions. The results presented in Panels E and F of Table 2 show that this finding is due in part to the fact that the average discount of *14.9%* for funds whose distributions are limited to special dividends is nearly twice as large as the average discount of *7.6%* for funds that make only ordinary distributions. However, the fact that the relative decline in the discount for funds making special distributions is *11.1%*, compared to a *9.8%* relative decline for funds making ordinary distributions shows that special distributions tend to have both a larger absolute and a larger percentage impact on the discount, consistent with our arguments regarding the importance of changes in

¹⁵ Ordinary dividends are usually income distributions which are distributed quarterly, while most special dividends are capital gains distributions that are usually distributed annually.

unrealized capital gains in explaining fluctuations in closed-end discounts. Such sizable differences are unlikely to be associated with factors other than the dividend-related issues that we have suggested.

Insert Figure 3 approximately here

The fact that special dividend distributions occur once a year implies that there should be no repetition of the sharp decline in the average discount either 13 weeks prior or 13 weeks subsequent to the special distribution week, as we have found for funds that pay quarterly dividends. Instead, we should observe a gradual increase in the average discount throughout the year, precisely as shown in the Panel A of Figure 3. In contrast, the decline in the average discount following ordinary dividend distributions is repeated every quarter, with relatively smooth increases in the average discount followed by a relatively sharp decline during the period surrounding the distribution week, as shown by the Panel B in Figure 3. If the pattern in the discount that we have noted were related to factors other than dividend distributions, these factors would be reflected in the pattern of the discounts shown in the first panel of Figure 3 at dates $t = -13$ and $t = +13$, which does not appear to be the case.

4.2. The cross-sectional regression results for changes in closed-end fund discounts

A cross-sectional regression analysis permits us to rigorously test *Hypothesis 3* by exploring the role of both returns and the level of dividends in explaining the ex-dividend day decline in discounts that we have documented empirically. The rationale for our tests of *Hypothesis 3* is the fact that dividend announcements by closed-end funds may have high information content, reducing the asymmetry in information between investors in the underlying assets relative to investors in the fund following the announcement date. That is, the information

conveyed to a fund's investors by the dividend declaration could potentially reduce a fund's discount to NAV. Note that there are usually more than fourteen days between the dividend declaration date and the ex-dividend date. Further, it is important to note that the tax regulations and tax rates that are imposed on international funds and their investors differ from those that apply to investors in U.S. funds. Therefore, we might expect to observe a somewhat different pattern in the discounts for international funds during the event window surrounding distributions. For this reason, the regression specification that we use to test *Hypothesis 3* includes a dummy variable "Dy" to capture the incremental impact of differences in foreign tax rules on the discount pattern for international funds.

The average closed-end discount should in theory reach a low point during the ex-dividend week. However, Figures 1 through 3 reveal that the average discount declines to its lowest level roughly two weeks following the dividend distribution. This could be due to the fact that investors who sold the fund two weeks prior to the distribution week to avoid the decline in the discount are subject to the anti-wash sale rule.¹⁶ For this reason, we measure the decline in the discount using both the two-week decline of $(\delta_{.2} - \delta)$ and the four-week decline of $(\delta_{.2} - \delta_2)$. The results of our analysis are reported in Table 3.

Insert Table 3 approximately here

Panel A of Table 3 shows that the decline in the average discount based on the two-week and four-week measures are respectively 0.70% and 0.96% for domestic funds. When compared to the average discount for U.S. equity funds of 8.5%, the decline in the average discount is substantial, providing direct support for *Hypothesis 1*. Consistent with the analysis of Figures 1 and 2, the decline in the average discount is significantly greater for

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international funds than for domestic funds, with the dummy variable for regression specifications 1 and 2 reflecting a differential two-week and four-week declines in the average discount for international funds relative to domestic funds of 0.38% and 1.52%. This result is partly due to the fact that international funds make more special dividend distributions, which are usually much larger than ordinary dividend distributions, which implies that we should observe a larger decline in the average discount for international funds, other things being equal.

Given the average change in the discount for closed-end equity funds, we can examine the role of the overhanging capital gains liability in explaining the distribution-week decline in discounts by regressing the decline in the discount on the level of the discount as of two weeks prior to the distribution date, as given by the regression specification in equation (4). These results are reported in Panel B of Table 3. The respective estimates of the cross-sectional regression coefficients for the level of the discount in explaining the two-week and four-week declines in the discount are respectively 0.049 and 0.084, which are both significant at the 1% level for domestic funds. To put these estimates in perspective, the estimated regression coefficients imply that the discount for a fund whose discount equals the average of 8.5% for U.S. closed-end equity funds would have conditional expected two-week and four-week declines of 0.42% and 0.71%, respectively accounting for more than 50% of the average two- and four-week declines in the discount, which provides further support for *Hypothesis 1*.

The estimated coefficient for the interaction variable representing the differential impact of the pre-distribution level of the discount for international funds provides an estimate of the incremental impact of the level of the discount on the respective decline in the

average discounts for international and domestic funds. As shown in Panel B of Table 3, both regression coefficients are negative and statistically significant at the 1% level. Further, note that the relative magnitude of the estimated coefficients for the level of the discount and the interaction term for international funds suggests that that the domestic funds having larger pre-distribution discounts have a larger decline in their discounts while the reverse appears to be true for foreign funds. This suggests that the decline in the discount for international funds has a strong mechanical component, once we control for the level of the discount.

We also test whether changes in discounts are related to dividend yield, as measured by the ratio of fund dividends to share price using the regression specifications in equations (5) and (6). Our results reveal a direct link between the magnitude of the decline in the discounts for individual funds and their dividend yields, just as predicted by *Hypothesis 3*. The results in Panel C of Table 2 show that the drop in the discount has significant positive correlation with the dividend yield, with estimated regression coefficients for the respective two-week and four-week changes in discounts on the respective dividend yields of 0.16 and 0.14 for domestic funds. Thus, a one percent difference in a fund's dividend yield is consistent with a roughly 15 basis point difference in the change in the discount by the end of the distribution period. Moreover, the dividend effect is stronger for domestic funds than for international funds as indicated by the negative coefficient in the interaction term. This is due to the fact that taxes are deducted from the dividend distributions for international funds, although a tax credit can be claimed when the investor's tax return is filed.

The lost investment opportunities hypothesis that we suggest implies that past returns proxy for the opportunity cost of the investment opportunities lost while accumulations of

the dividend-related cash flows are held by closed-end funds. Thus, the discounts for funds having greater past returns should exhibit greater percentage declines during the dividend event window. We test this hypothesis by using equation (3) to regress both the two-week and four-week measures for changes in discounts on the cumulative returns from week $t = -13$ to week $t = -2$, where the event-window returns are excluded from the computation of the past returns that we use as a proxy for opportunity costs to avoid spurious correlation between our proxy for opportunity costs and the change in the discount.

The results reported in Panel D of Table 3 show that the relation between the prior returns and both the two-week and four-week measures for the decline in the discount are weak for domestic funds. This could also be due to the fact that fund performance is not persistent. Moreover, the incremental impact of our proxy for shareholders' opportunity cost is negative for international funds. The respective coefficient estimates for these regressions of -0.0365 and -0.0973 are both statistically significant at the 1% level, indicating that smaller past returns are associated with larger percentage declines in closed-end discounts, which runs counter to *Hypothesis 3*. This result is consistent with the argument that negative returns are costly for investors in international funds who are unable to realize losses by trading the individual shares held by the funds. When an international fund has low to negative returns, investors in international funds will have an incremental cash outflow due to the automatic tax deductions at the time of the dividend distribution. Alternatively, it could be due to investors selling shares to take tax losses. However, to the extent that closed-end funds are reluctant to realize losses or when such losses are treated asymmetrically under foreign tax rules, investors in international closed-end funds may be unable to offset these

taxes by realizing capital losses, generating an incremental increase in the discount relative to domestic funds around distribution events.

The mechanisms by which dividend yields and fund returns affect changes in discounts are very different. However, these two variables could potentially reflect the same underlying effect. We control for this possibility by using a multivariate cross-sectional regression to assess the simultaneous effects of these two variables. The results are reported in Panel E of Table 3. Except for small changes in the estimated coefficients, these results are very similar to those from the corresponding univariate regressions. Thus, the evidence is consistent with *Hypothesis 3*. Note that based on the coefficient estimates reported in Panel F of Table 3 and the magnitudes of the respective means and medians for the explanatory variables reported in Table 1, the tax effect appears to be relatively more important than lost investment opportunities in explaining the decline in the discount.

One competing explanation for the changes in the closed-end discounts that we have examined is related to the possibility that closed-end fund shares are mispriced. To the extent that closed-end discounts and premia are due to mispricing, the magnitude of the apparent arbitrage opportunity will be directly related to the associated holding costs. However, given that holding costs will be reduced by the dividend yields on the funds associated with the respective discounts, Pontiff argues that the size of the discount should be negatively correlated with dividend yield.

We examine the empirical validity of this alternative explanation by running a cross-sectional regression of the discount on the dividend yield for the respective funds. These results are reported in Panel F of Table 3. Note that since this alternative explanation bears no direct link to the tax liability hypothesis, the hypothesized cross-sectional relation should

be stable across domestic and international funds. Based on the full sample of 124 closed-end funds, we find that the absolute value of the discount is positively correlated with dividend yields, with an estimated coefficient estimate of 0.2118, which is significant at the 1% level. The finding that closed-end discounts are positively related to dividend yield suggests that the decline in the discount following dividend distributions is not primarily attributable to the pre-distribution mispricing of the respective funds. We can examine the cross-sectional stability of this relation across domestic and international funds using a regression specification that includes an interaction term to capture the differential impact of dividend yield on the discounts for international funds. Although the inclusion of this interaction term reduces the significance of the estimated regression coefficient for dividend yield to the 10% level, the magnitude of the interaction term is small and statistically insignificant. The change in the significance of the dividend yield coefficient is likely due to the difference in the average value of the discounts for the international and domestic funds in our sample, which is captured by the dummy variable that indicates whether a fund is domestic or international. Our finding that the pre-distribution magnitude of closed-end discounts is positively related to closed-end dividend yields is not consistent with the relation between holding costs and closed-end discounts implied by the mispricing hypothesis. Thus, the evidence that we provide in support of the tax liability hypothesis appears to be robust to alternative explanations.

5. Concluding Comments

Closed-end investment companies have survived as an investment vehicle for more than a century. However, despite the speed of innovation in financial markets, the discounts in the pricing of closed-end funds have remained relatively constant. While many explanations for this phenomena, both economic and behavioral, have been offered over the years, the discounts for closed-end funds remain a puzzle to both academia and industry practitioners.

The most plausible explanation for closed-end discounts seems to be Malkiel's insight that discounts should be related to the expected tax liabilities associated with unrealized capital gains. However, empirical support for this hypothesis is weak or conflicting. This research has implemented an alternative approach to testing the validity of the Malkiel model. In particular, we argue that the lack of empirical support for Malkiel's unrealized capital gains model may be due to the inability to estimate the expected present value of the capital gains taxes that will ultimately be paid on closed-end funds' unrealized capital gains. Given the difficulties inherent in constructing adequate proxies for the expected present value of this overhanging tax liability, we argue that it is more fruitful to examine the relation of dividend distributions and closed-end fund discounts. Since the magnitude of quarterly dividend distributions will tend to be positively correlated with reductions in the unrealized capital gains embedded in closed-end portfolios, quarterly dividend distributions should tend to be associated with short-run declines in the discounts on closed-end funds.

Our approach differs from those in the existing literature, which examine the correlation between the respective levels of discounts and dividends in that we use an event study approach to study the dynamics of closed-end discounts. By matching the time-series

of discounts for individual closed-end funds with the associated time series of dividend distributions, we are able to link changes in discounts to cash distributions and the implicit changes in the funds' overhanging tax liability on unrealized capital gains. Our results suggest that a significant portion of the short-run fluctuations in closed-end discounts is related to cash distributions. In particular, we have shown that there is a significant decline in closed-end discounts during the event window surrounding cash distributions, followed by a gradual increase in the discount to a peak that occurs just prior to the subsequent distribution.

We find similar discount patterns during the event windows leading up to both ordinary and special distributions. However, our results show a greater relative change in the average discount following special distributions, consistent with the observation that special distributions reduce the funds' overhanging liability for capital gains taxes by distributing larger amount of previously unrealized capital gains. However, we also find that changes in discounts are positively correlated with the magnitude of dividend yield across funds, consistent with the proposition that dividend announcements reduce the asymmetry in information between investors in the underlying assets relative to investors in the fund, thereby reducing closed-end fund discounts. Finally, we have shown that the decline in the discount is positively related to past fund returns, consistent with our argument that some small portion of closed-end discounts is related to the opportunity cost of the investment opportunities lost while accumulations of the dividend-related cash flows are held by closed-end funds.

Our results provide new evidence on the importance of the anticipated tax liability for unrealized capital gains in explaining the discounts for closed-end funds. Further, the

method that we use to examine short-run fluctuations in discounts permits us to examine the significance of several additional factors that appear to be useful in explaining the discounts on closed-end funds, shedding additional light on the role of dividends in explaining the discounts for closed-end funds.

Table 1. Summary Statistics for the Closed-end Fund Sample

This table reports the summary statistics for the closed-end funds in our sample. $\sigma(x)$ stands for the standard deviation of variable x . R_p and R_v are returns calculated from the close-end funds' prices and NAVs, respectively.

Variable	Mean	10%	Median	90%
Discount δ (%)	11.034	-1.075	13.105	18.836
$\sigma(\delta)$	9.437	4.987	7.912	15.624
R_p	0.0664	-0.1338	0.0902	0.2405
$\sigma(R_p)$	3.917	2.290	3.715	5.430
R_v	0.0658	-0.1118	0.0817	0.2256
$\sigma(R_v)$	3.209	1.843	3.007	5.160
Dividend amount	0.7349	0.1452	0.5405	1.3582
Ordinary dividend amount	0.3020	0.0568	0.2198	0.7289
Dividend Yield	0.0448	0.0163	0.0387	0.0784
Ordinary Dividend Yield	0.0202	0.0055	0.0164	0.0455
Number of dividend events per fund	15.21	4	11	40
P	14.21	8.46	11.83	20.27
NAV	15.85	8.83	13.64	22.88
Size	11.6367	10.6346	11.5194	13.1197

Table 2. Discount during Dividend Distribution Period

This table reports the discount level and change during the dividend distribution period. δ denotes the discount level at the Ex-dividend week, while δ_{-2} and δ_2 represent the discount level three weeks before and two weeks after the dividend distribution, respectively. All numbers are in percentage.

	Average Level of Discounts					Change $\delta_{-2} - \delta_2$	Relative Change $(\delta_{-2} - \delta_2) / \delta_{-2}$
	δ_{-2}	δ_{-1}	δ_0	δ_1	δ_2		
	Panel A: All 124 funds						
Mean Discount	10.09	9.66	9.31	9.13	8.59	1.506	14.93
Media Discount	11.58	11.29	10.86	10.66	10.14	1.433	12.38
Discount Volatility	11.76	11.74	12.15	12.19	12.23	-0.473	
	Panel B: 15 Funds With Quarterly Dividend Distributions						
Mean Discount	5.71	5.49	5.27	5.32	5.12	0.588	10.30
	Panel C: All 46 U.S. Funds						
Mean Discount	8.45	8.08	7.80	7.81	7.54	0.909	10.75
	Panel D: 12 U.S. Funds with Quarterly Dividend Distributions						
Mean Discount	4.29	4.02	3.82	3.86	3.74	0.545	12.70
	Panel E: U.S. Funds with Special Dividend Distributions						
Mean Discount	14.85	13.71	13.42	13.79	13.21	1.645	11.08
	Panel F: U.S. Funds with Ordinary Dividend Distributions						
Mean Discount	7.57	7.33	7.05	7.12	6.83	0.738	9.75

Table 3. Testing the Significance of Discount Change during Dividend Distribution Period

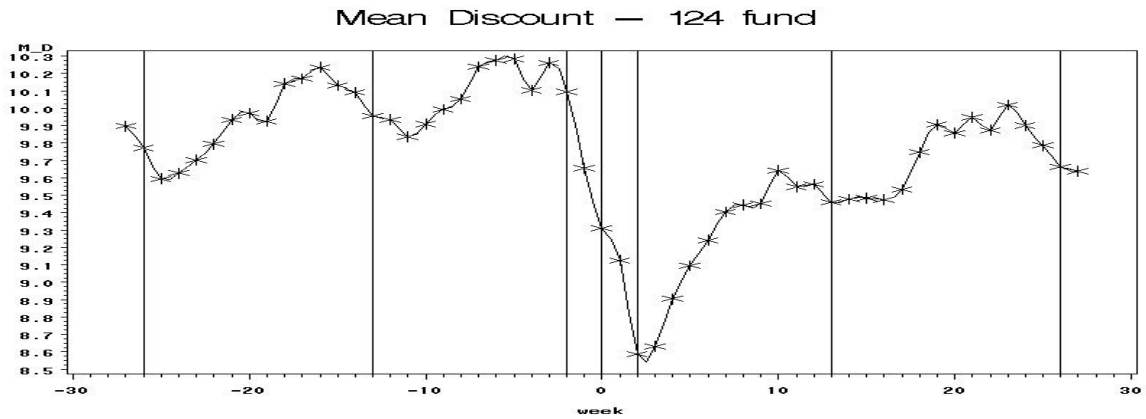
This table reports the significance in discount change during the dividend distribution period in terms of the pure level change, the relative change, and in relation with dividend yield. δ denotes the discount level at the Ex-dividend week, while δ_{-2} and δ_2 represent the discount level two weeks before and two weeks after the dividend distribution, respectively. $\delta_{-2} - \delta$ and $\delta_2 - \delta$ thus are different measure of drops in discounts. Dividend yields (D/P_{-2}) are calculated as dividend amount D over the fund price two weeks before the Ex-dividend week. Fund return R_p is the cumulative return from week (-13) to week (-2). “Dy” is a dummy variable that equals one for international funds.

Equation No.	Dependent Variable	Independent Variable							
		Const.	Dy	δ_{-2}	$\delta_{-2} * Dy$	$(D/P)_{-2}$	$(D/P)_{-2} * Dy$	R_p	$R_p * Dy$
Panel A: Testing discount changes									
1	$\delta_{-2} - \delta$ <i>t-ratio</i>	0.7061 5.99	0.3798 2.05						
2	$\delta_2 - \delta_2$ <i>t-ratio</i>	0.9622 6.61	1.5214 6.63						
Panel B: Testing relative discount changes									
3	$\delta_{-2} - \delta$ <i>t-ratio</i>	0.2772 1.80	1.1963 4.73	0.0486 4.29	-0.0781 -4.98				
4	$\delta_2 - \delta_2$ <i>t-ratio</i>	0.2218 1.17	2.5489 8.17	0.0837 6.04	-0.1056 -5.49				
Panel C: Explaining discount drops by dividend yield									
5	$\delta_{-2} - \delta$ <i>t-ratio</i>	0.1561 1.02	0.6364 2.72			0.1633 5.57	-0.0994 -2.66		
6	$\delta_2 - \delta_2$ <i>t-ratio</i>	0.4735 2.51	1.4461 4.98			0.1446 4.01	-0.0238 -0.52		
Panel D: Explaining discount drops by return									
7	$\delta_{-2} - \delta$ <i>t-ratio</i>	0.6976 5.85	0.3620 1.95					0.0056 0.42	-0.0421 -2.62
8	$\delta_2 - \delta_2$ <i>t-ratio</i>	0.9694 6.74	1.4220 6.32					-0.0047 -0.29	-0.1020 -5.28
Panel E: Explaining discount drops by dividend yield and R_p									
9	$\delta_{-2} - \delta$ <i>t-ratio</i>	0.1529 1.00	0.6545 2.80			0.1630 5.58	-0.1079 -2.89	0.0025 0.19	-0.0371 -2.33
10	$\delta_2 - \delta_2$ <i>t-ratio</i>	0.4825 2.61	1.4656 5.16			0.1453 4.13	-0.0497 -1.10	-0.0074 -0.46	-0.0959 -5.00
Panel F: Testing the mispricing hypothesis									
9	$ \delta $ <i>t-ratio</i>	8.8953 24.57				0.2118 3.69			
10	$ \delta $ <i>t-ratio</i>	7.5436 15.67	3.7321 5.08			0.1712 1.86	-0.0057 -0.05		

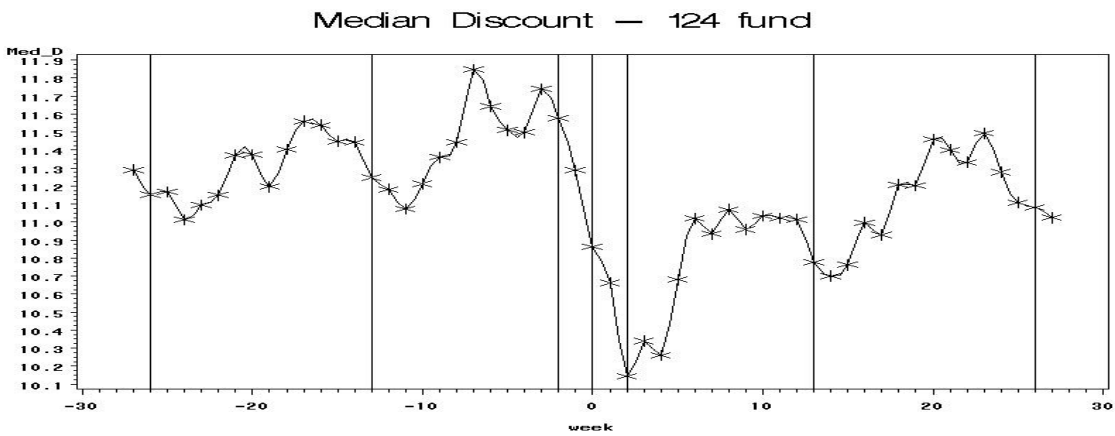
Figure 1. Dynamics of Discount Centered By Ex-Dividend Date

The event time behavior of the average discount for the 124 funds in our sample is plotted in Panel A, while the event time behavior for the median discount plotted in Panel B. The corresponding event-time behavior of the cross-sectional standard deviation of the discount for our fund sample is plotted in Panel C.

Panel A



Panel B



Panel C

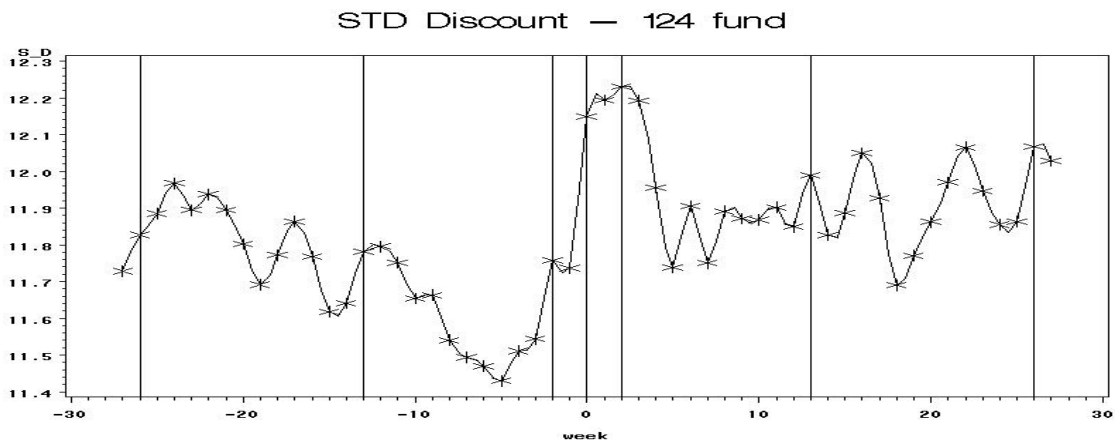
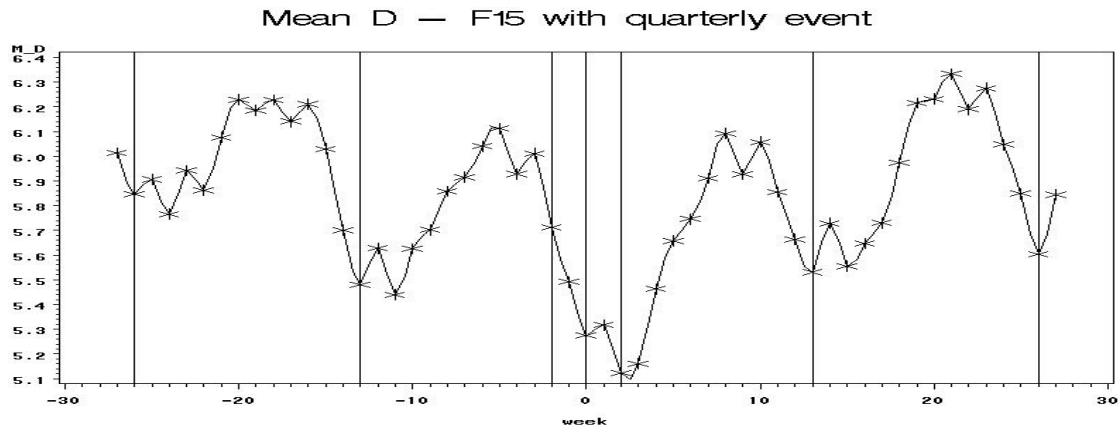


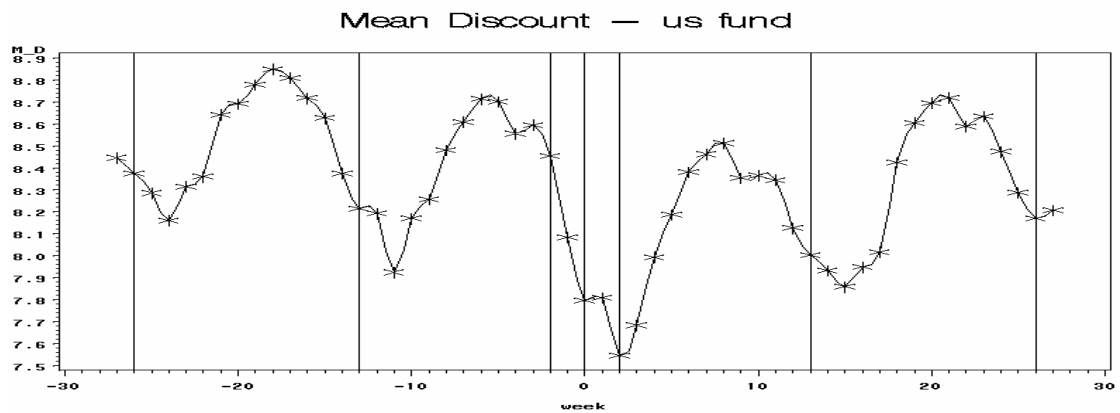
Figure 2. Event Time Dynamics of the Average Discount for Various Sub-Samples

The event time behavior of the average discount for the 15 funds in our sample making quarterly dividend distributions is plotted in Panel A, while the average discount for the 46 US closed-end funds in our sample is plotted in Panel B. Panel C plots the average discount for the 12 US funds in our sample making quarterly dividend distributions.

Panel A



Panel B



Panel C

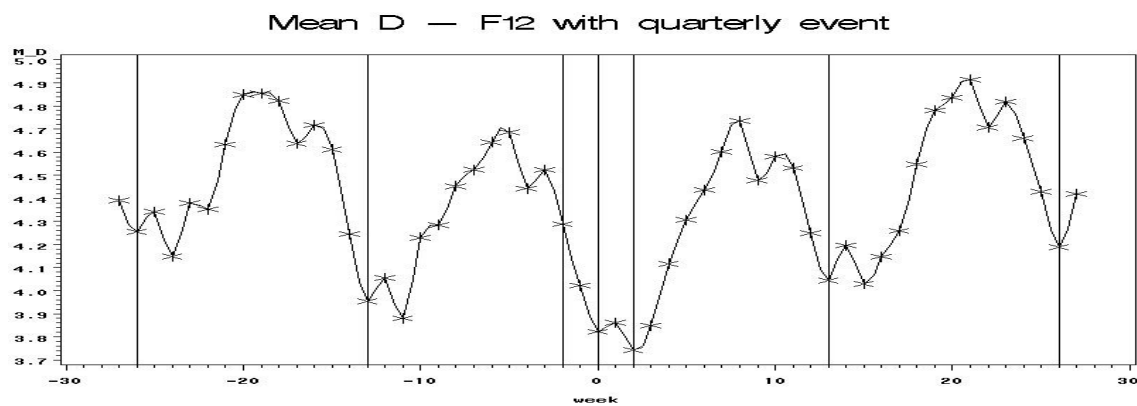
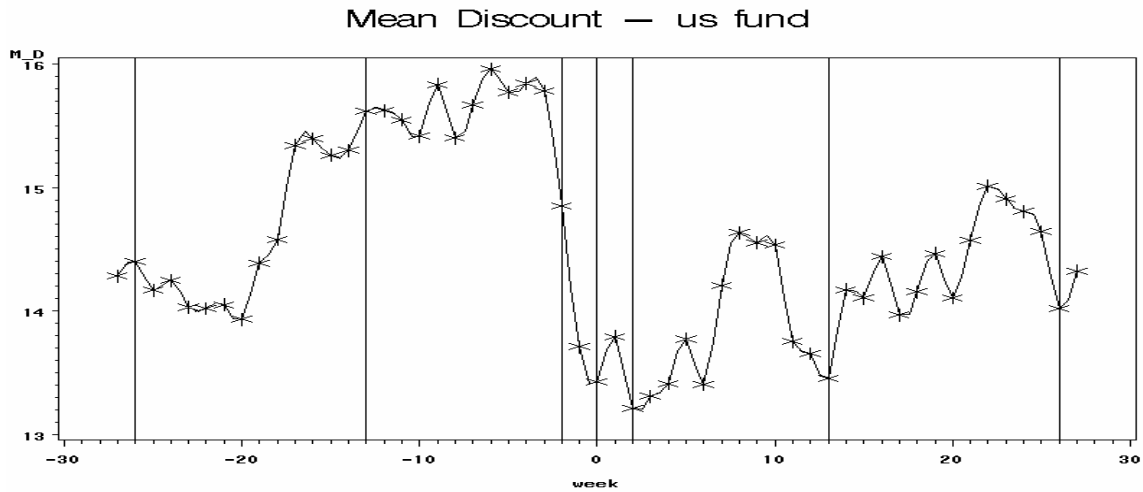


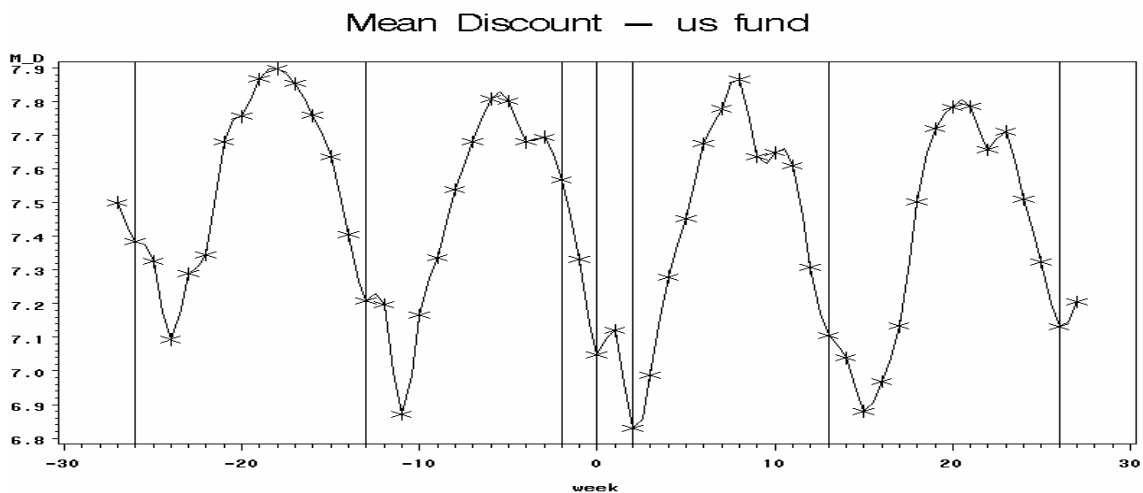
Figure 3. Dynamics of Discounts—Capital Gains versus Dividend Distributions

Panel A plots the time series behavior of the average discount for the domestic funds in our sample during the event window surrounding special dividend distributions. Panel B plots the time series behavior of the average discount for the domestic funds in our sample during the event window surround the distribution of ordinary dividends.

Panel A:



Panel B:



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