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Market Valuation of Tax-Timing Options: Evidence from Capital Gains Distributions

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ABSTRACT

We examine a distribution that is taxed as a capital gain rather than as a dividend. Since the distribution induces a realized capital gain while the price change is an unrealized gain, ex-day return behavior provides evidence of the value of tax-timing capital gains. We show that investors are compensated 7¢ in unrealized gains for each dollar of realized capital gains, that is, $1 of realized capital gains is equivalent to 93¢ of unrealized gains. An investor with a tax rate on realized gains of 15% has an effective tax rate on unrealized capital gains of 8.6%.

CAPITAL GAINS TAXES CAN BE DEFERRED UNTIL ASSETS ARE SOLD. This feature provides the investor who purchases a security with an option regarding the timing of the realization of capital gains and losses. This option can be used to lower one's expected tax liability. Even if capital gains tax rates remain constant for different holding periods, an investor who delays the realization of a gain effectively enjoys compound returns on the postponed taxes. If capital losses are tax deductible (or partially tax deductible), tax-timing is even more valuable, since investors can follow the strategy of selling stocks with capital losses early while postponing the sale of winners. Recent evidence lends support to the contention that some investors respond to this tax-timing option. For example, Odean (1998) shows that U.S. investors are more likely to sell losers in December than other months. Similarly, Grinblatt and Keloharju (2002) show that at the end of the tax year, Finnish investors are more likely to realize losses than gains. This type of tax-motivated trade seems to affect market returns, as shown by Poterba and Weisbenner (2001) who demonstrate that end-of-year tax loss selling is related to return variation in the month of January.

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Tax-timing benefits are greatly enhanced if their realization can be timed to achieve a lower nominal tax on the gain (Constantinides (1983, 1984)). Various mechanisms enable one to enjoy a lower tax rate on future asset sales than current sales. First, in recent history, the U.S. tax code has typically made a distinction between long-term and short-term capital gains, which has led to lower nominal rates for longer holding periods. Second, investors may respond to both changes and anticipated changes in tax codes. This idea is advanced by Auerbach (1988), who attributes vast realizations of capital gains to expected tax code changes. Third, an investor may choose to realize gains when individual-specific situations limit the burden of capital gains taxation. This will occur if investors realize gains in order to better utilize tax benefits of capital losses. Individuals may also realize capital gains when their personal tax rates are lower, such as during retirement. An extreme example is death: Upon death, the basis of all assets is stepped up, effectively making the marginal tax rate on capital gains zero.

Although the advantage of delaying the realization of capital gains is apparent (as we show in footnote 4), the equilibrium magnitude of the advantage is cumbersome to solve. A closed-form solution is typically impossible to derive, thus numerical methods are needed (as shown first by Dammon, Dunn, and Spatt (1989) and more recently by Dammon, Spatt, and Zhang (2001) and Green and Hollifield (2003)).

Our approach is to determine the empirical importance of the tax-timing option.[1] This issue is important since it sheds light on the impact of capital gains taxes on securities pricing, and many financial decisions involve the consideration of taxes. In regards to corporate financial decisions, for example, two important choices are the choice between equity and debt financing and the choice between repurchases and dividends. Both of these decisions require that one should take into account the consideration of the tax burden associated with capital gains.[2]

In regards to financial investments, understanding the cost of capital gains taxation is important for understanding the performance of various investments. Accordingly, a recent trend favors evaluations of investment management performance that account for the impact of taxation on returns. In fact, a Securities and Exchange Commission rule (see Smith (2001)) requires mutual

[1] The empirical importance of tax-timing options remains an unresolved issue. Investors do seem to respond in the short-term to changes in capital gains tax rates by shifting realization to years when the tax rate is lower (Auerbach (1988)). Seyhun and Skinner (1994) document that investors' trades appear consistent with simple tax-reduction strategies such as realizing losses short-term and deferring gains. However, they find that only 5–7% of investors trade to reduce their tax payments and that 90% buy and hold. None of these papers assess the monetary value of the tax-timing option.

[2] For example, Green and Hollifield (2003) specifically analyze the repurchase decision. Through simulations they show that if investors delay the realization of gains, the tax benefit from a corporation repurchasing stock is substantial. Our paper sheds light on Green and Hollifield's key assumption that investors value the benefit of tax-timing capital gains.

funds to disclose after-tax returns in their prospectuses. In order to calculate after-tax performance, an effective tax rate must be assigned to unrealized price appreciation. Some mutual fund evaluation services, such as Morningstar, avoid picking a single tax rate on unrealized appreciation and instead report performance assuming both that the unrealized gain is taxed at the long-term rate, and that the unrealized gain is untaxed. In addition to regulatory concerns, tax burdens appear to affect investor behavior. Bergstresser and Poterba (2002a) find that fund flows respond to cross-sectional differences in tax burdens. Also, fund managers appear to manage tax liabilities in order to attract new investors (Barclay, Pearson, and Weisbach (1998)). More recently, Jin (2005) provides evidence that tax-sensitive investors delay selling stocks that have incurred large capital gains.

In this paper we estimate the market value of tax-timing options by using a unique type of capital gain that is distributed to shareholders in the form of a cash dividend. The tax status of a capital gains distribution is identical to a capital gain in all respects, except that the capital gains distribution is taxable when it is paid to shareholders. Thus, the distribution is taxed as a capital gain, but the shareholder does not enjoy a tax-timing option. This provides us a rare opportunity to examine the market valuation of tax-timing options. We infer the value of the option by comparing the ex-distribution day price decline, which corresponds to the equivalent value of unrealized capital gains (with a tax-timing option), to the value of the capital gains distribution (without a tax-timing option). If the marginal trader does not attach any value to the tax-timing option (implying that the effective capital gains rate equals the nominal capital gains rate), the price drop on the ex-day will equal the capital gains distribution. If the marginal trader views the tax-timing option as sufficiently valuable to eliminate all future capital gain taxes (implying that the effective capital gains rate is zero), the price will fall by the after-tax amount of the capital gains distribution.[3]

Focusing on data after the Tax Reform Act (TRA) of 1986 we estimate the market value of the tax-timing option from the ex-distribution day price reactions. Our findings imply that tax-timing options are both statistically and economically significant. We show that the shareholders in these firms are more likely to be fully taxed than the shareholders in matched samples, which lends support to the interpretation of a tax-influenced price reaction to the distribution. Our results show that \$1 of realized capital gains is equivalent to 93¢ of unrealized gains. For an effective tax rate on realized capital gains of 28%—the capital gains rate during most of the post-TRA time period—this result implies that the effective rate on unrealized gains is 22.6%. For an effective tax rate on realized capital gains equal to the current rate of 15%, this result implies that the effective rate on unrealized gains is 8.6%. We show that the size of the

[3] Our ex-day experiment is similar to that used by the literature that examines the differential value of dividends and capital gains on ex-dividend days. See, for example, Elton and Gruber (1970), Kalay (1982), Barclay (1987), Michaely (1991), and Boyd and Jagannathan (1994).

distribution does not appear to impact the implied tax-timing option. Since our results hold for large distributions, our findings are consistent with a tax-based interpretation, similar to Green and Rydqvist (1999), Graham, Michaely, and Roberts (2003), and Elton, Gruber, and Blake (2004), and are inconsistent with microstructure interpretations such as Frank and Jagannathan (1998) and Bali and Hite (1998).

Despite the apparent importance of tax-timing options, there exists very little, if any, evidence of the valuation of these options. With the exception of Protopapadakis (1983) our findings represent the first estimate of the market value of tax-timing options. Protopapadakis uses Internal Revenue Service (IRS) data on capital gains realizations between 1960 and 1978. Coupling this data with estimates of holding periods, he infers effective capital gains tax rates in the general range of 4–6%, while he estimates marginal capital gains rates between 11% and 15%. Protopapadakis's results imply, as do ours, that compared with the apparent statutory burden of capital gains taxes, tax-timing options drastically reduce the effective burden of capital gains taxes. However, Protopapadakis's results focus exclusively on the time period before the 1986 TRA, whereas we present estimates based on post-TRA data.

We also examine capital gains dividends before the 1986 TRA. Our findings are consistent with a loophole in the tax code that permitted tax arbitrage activity that was used to turn tax-disadvantaged short-term gains into tax-advantaged long-term gains. During this period, we find evidence that stock prices drop by more than the distribution amount. This finding poses an additional challenge to such market microstructure models as Frank and Jagannathan (1998) and Bali and Hite (1998) that suggest there is mechanical underreaction in ex-day pricing.

Volume data is used to supplement our understanding of tax-timing and capital gains distributions. Consistent with our model of dividend capture activities, we show that before the 1986 TRA, abnormal volume is conspicuous in the cum-distribution period. After the 1986 TRA, we find that this volume tends to shift to the ex-distribution period. Although our model explains the change in volume pre- and post-TRA, it does not explain high post-TRA cum-distribution volume. Models such as Michaely and Vila (1995) or Lakonishok and Vermaelen (1986) predict distribution-related trading based on variations in investors' comparative tax rates. For capital gains distributions, all investors face the same tax rate on capital gains distributions that they would face on a realized capital gain. Because of this, neither the shift in pre- and post-1986 volume nor the high levels of post-1986 ex-distribution volume can be explained by previous models of volume and dividend capture.

The paper is organized as follows. In Section I we discuss the tax environment that affects capital gains and capital gain distributions, including the 1986 TRA. Using the fundamental features of the U.S. tax code, we develop a model that is based on the activities of tax-motivated traders, namely, one-way purchasers, one-way sellers, and two-way arbitrageurs. This model produces

arbitrage bounds on ex-dividend returns and drop-off ratios (DOR). Section II describes the data used in the paper. Section III discusses the calculation of ex-distribution day returns and DORs. Motivated by the framework in Section I, Section IV presents evidence regarding the market value of tax-timing options. Section V uses volume data to test the trading implications of the model. Section VI concludes.

I. The Framework

A. Capital Gains Distributions

Our study utilizes a unique type of cash dividend that receives rare tax treatment: a capital gains distribution that is taxed at the long-term capital gains tax rate rather than at the ordinary income tax rate. This type of cash dividend is paid out by corporations that qualify for tax-exempt status through the Internal Revenue Code. The intent of the Code is to avoid double taxation of corporations that serve as investment conduits for investors. Both open- and closed-end funds qualify under the Code, as well as real estate investment trusts (REITs) and some holding companies. In order to preserve their tax status, these companies must annually distribute their realized capital gains, as well as virtually all of their investment income to shareholders. Both of these distributions take the form of dividends. The capital gains distribution is made from the net capital gain that is realized as a result of the investment activities of the corporation. The shareholder must pay tax on the capital gain distribution as though the shareholder realized the gain.

B. Overview of Tax Status

Table I summarizes the relative tax rates for dividend income and both long- and short-term capital gains income from 1970 to 2002. During this period, short-term capital gains were usually taxed as ordinary income. Long-term gains were usually taxed at the ordinary income rate, up to a maximum rate that was lower than the ordinary income tax rate that affected moderate-income tax payers. Because of this, the nominal short-term capital gains tax rate was always equal to or higher than the nominal long-term rate. The rate on dividend income was always equal to or greater than the rate on short-term capital gains.

During 1997, a medium-term holding period existed (for stocks sold after being held between 12 and 18 months). In 1998, the federal government discontinued the medium-term rate and reverted to the previous two-tier holding period system.

Although tax rates changed frequently during this 33-year period, there existed a tax-timing option throughout. Long-term capital gains were never taxed at higher nominal rates than short-term gains, thus, effective long-term

Table I
Overview of Investment Tax Implications

This table summarizes the U.S. federal taxation of investment income for individual investors from 1970 to 2002. During this time period, the holding period length for short-term capital gains ranged from 6 months to 12 months, and the holding period length for long-term gains ranged from greater than 6 months to greater than 18 months. During 1997, a medium-term rate for holding periods of greater than 12 months and less than 18 months was temporarily instituted. The information for the table comes from Shackelford (2000) and Barclay, Holderness, and Sheehan (2003).

	1970–1986	1987–1996	1997	1998–2002
Max. ordinary income rate	1970: 71.75% 1971–1981: 70% 1982–1986: 50%	1987: 38.5% 1988–1990: 28% 1991–1992: 31% 1993: 36% 1994–1996: 39.6%	39.6%	1998–2001: 39.6% 2002: 38.6%
Dividends	Ordinary income	Ordinary income	Ordinary income	Ordinary income
Long-term capital gain/loss	1970–1978: Ordinary income minus 50%	28% max.	28% max. before or on May 6.	20% max.
	1979–1986: Ordinary income minus 60%		20% max. after May 6.	2001–2002: 20% or 18% for 5-year holding periods.
Medium-term capital gain/loss	None	None	28%	None
Short-term capital gain/loss	Ordinary income	1987: Ordinary income 1988–1990: 28% max. 1991–1992: 31% max. 1993–1996: Ordinary income	Ordinary income	Ordinary income

rates were always lower than short-term rates and effective long-term rates decreased in the length of the holding period.[4]

[4] This can be illustrated with the following example. Let r denote the expected return from an asset, and t be the tax rate on realized capital gains. For an investor with $ 1 of current wealth who realizes capital gains every period, the investor's expected terminal wealth after n periods, W_{real}, will be,

$$W_{\text{real}} = (1 + r(1-t))^n.$$

This can be rewritten as

$$W_{\text{real}} = \sum_{i=0}^{n} \binom{n}{i} (r^i)(1-t)^i.$$

For an investor who defers realization, terminal wealth W_{def} will be

$$W_{\text{def}} = (1+r)^n - t((1+r)^n - 1)$$

or,

$$W_{\text{def}} = t + \sum_{i=0}^{n} \binom{n}{i} (r^i)(1-t).$$

The expected value of the difference between these two strategies is

$$W_{\text{def}} - W_{\text{real}} = t + \sum_{i=0}^{n} \binom{n}{i} (r^i)((1-t) - (1-t)^i).$$

For $n > 1$ and $0 < t < 1$, this difference will be positive, and thus, deferring capital gains realization will produce higher levels of expected wealth.

Despite the fact that during the time period of our sample tax-timing options were always valuable, they were not always manifest in the price reaction to capital gains distributions. Before 1987, a higher nominal tax rate on short-term gains than long-term gains permitted tax arbitrage activity such that a trader could purchase a security cum-capital gains distribution, sell the security ex-distribution, and effectively reduce the tax liability from short-term gains to the lower, long-term rate. Concurrent with the TRA of 1986, the tax code was revised to eliminate this opportunity. Section 852(b)(4) of the federal tax code stipulates that shareholders who hold a regulated investment company for less than 6 months and realize a capital loss (by purchasing the stock cum-dividend and selling it ex-dividend) must recognize the portion of the loss that is attributable to the capital gains dividend as a long-term loss rather than a short-term loss. At that time, the prohibition was redundant since the TRA equalized long- and short-term tax rates, thereby eliminating the tax advantage of this strategy. In 1998, differential long- and short-term tax rates were reintroduced, thus this section of code currently prevents such tax arbitrage.

C. Trading Strategies Around Ex-Days of Capital Gains Distributions

In the spirit of Elton and Gruber (1970), this section discusses trading motives around the ex-days of capital gains distributions for three groups of risk-neutral investors, namely, one-way purchasers who have already decided to buy shares in the firm, one-way sellers who have decided to sell shares in the firm, and two-way traders who trade for arbitrage or tax-induced profits. We assume that one-way purchasers and sellers hold or expect to hold the security for more than 1 year, which subjects them to the long-term capital gains rate, and that two-way traders hold positions for less than a year. We assume that two-way traders are subject to the short-term rate before the 1986 TRA. After the 1986 TRA, whether or not they are subject to the short-term rate has no impact on their behavior since short-term losses realized in the process of capturing long-term capital gains distributions are taxed as long-term losses. Given the tax rates, the trading decisions of these investors are affected by three factors: the size of the distribution, the ex-distribution day return, and the round-trip transaction cost. One-way purchasers and sellers have decided to buy or sell the stock for reasons unrelated to the capital gains distributions per se. These investors do not decide whether or not to trade, but only whether to trade before or after the ex-distribution day. Consistent with Koski (1996), we assume that transaction costs are sunk costs for these investors. Thus, their decision to trade does not depend on transaction costs.

D. One-Way Purchasers

One-way purchasers are investors who have already decided to purchase the stock. A cost of purchasing the stock before the capital gains distribution is that the distribution is taxed at the long-term capital gains tax rate. If the stock

is bought after the distribution, the amount of future taxes that the investor expects to pay upon selling the position is greater since the investor purchases the stock at the ex-distribution day price, P_{ex}, which is typically lower than the cum-distribution day price, P_{cum}. The implicit capital gains tax rate based on the present value of the future tax liability is denoted by $T_{imp,}$ where T_{imp} reflects the investor's ability to time the realization of capital gains, either by delaying the gain and enjoying effective compound interest on the tax liability (footnote 4) and/or by realizing the gain at a future marginal tax rate that is lower than the current capital gains rate. The difference between the nominal capital gains rate, T_c, and implied rate, T_{imp}, reflects the tax-timing option.

For a given expected sale price, L, and T_{imp}, the one-way purchaser will purchase the stock cum-distribution if the after-tax payoff is greater than that of purchasing the stock ex-distribution, or

$$(L - P_{cum})(1 - T_{imp}) + \text{CGDIV}(1 - T_c) > (L - P_{ex})(1 - T_{imp}), \tag{1}$$

where CGDIV is the capital gains distribution and T_c is the tax rate on the long-term capital gains.[5] Our analysis focuses on dividend drop-off ratios (DORs). For the above case of a capital gains distribution, the drop-off ratio is defined as $\text{DOR} = (P_{cum} - P_{ex})/\text{CGDIV}$. Using this definition, dividing equation (1) by DOR allows us to express the condition required for the one-way purchaser to buy the stock cum-dividend as

$$\text{DOR} < (1 - T_c)/(1 - T_{imp}). \tag{2}$$

Similarly, one-way purchasers will buy the stock ex-distribution if

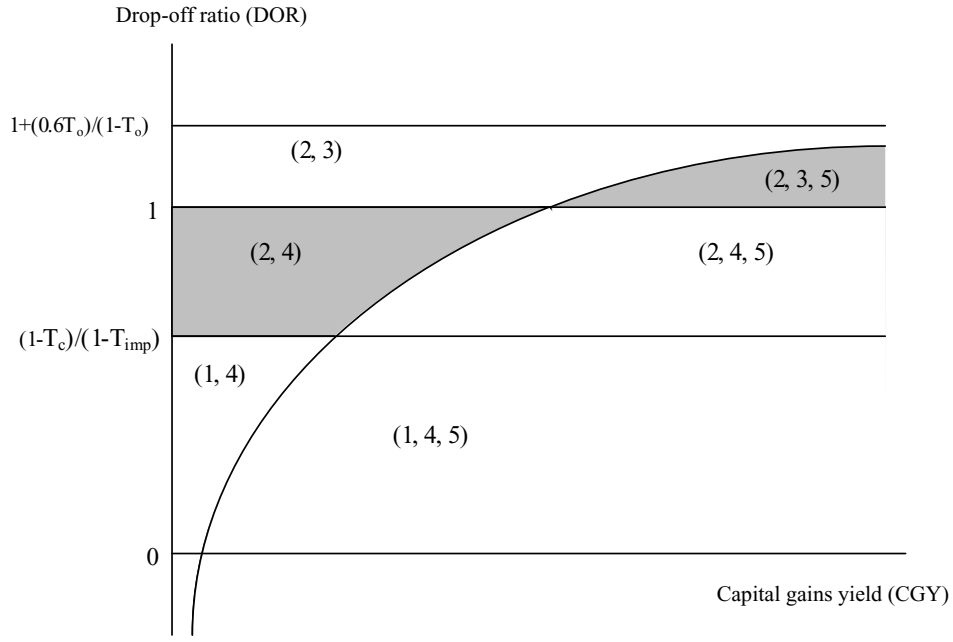
$$\text{DOR} > (1 - T_c)/(1 - T_{imp}). \tag{3}$$

The relation between the DOR and the capital gains distribution yield (CGY) can then be shown graphically on the DOR-yield plane. Figures 1 and 2 plot the trading activity of the one-way purchasers based on the expected DOR and the CGY. The purchasers will buy the security cum-distribution if the DOR is less than $(1 - T_c)/(1 - T_{imp})$, as highlighted in Figures 1 and 2 in the regions with the code of "1." On the other hand, these purchasers will buy the security ex-distribution if the DOR is greater than the DOR implied by this line. The regions with the code of "2" in Figures 1 and 2 belong to the latter trading category.

E. One-Way Sellers

One-way sellers decide on whether to sell the stock with or without the distribution. Like one-way purchasers, these investors view transaction costs as a sunk cost since they are incurred regardless of the timing of their sale. The

[5] This analysis assumes that the optimal liquidation price is independent of the purchase price. This may not hold if future tax-timing options affect optimal liquidation.



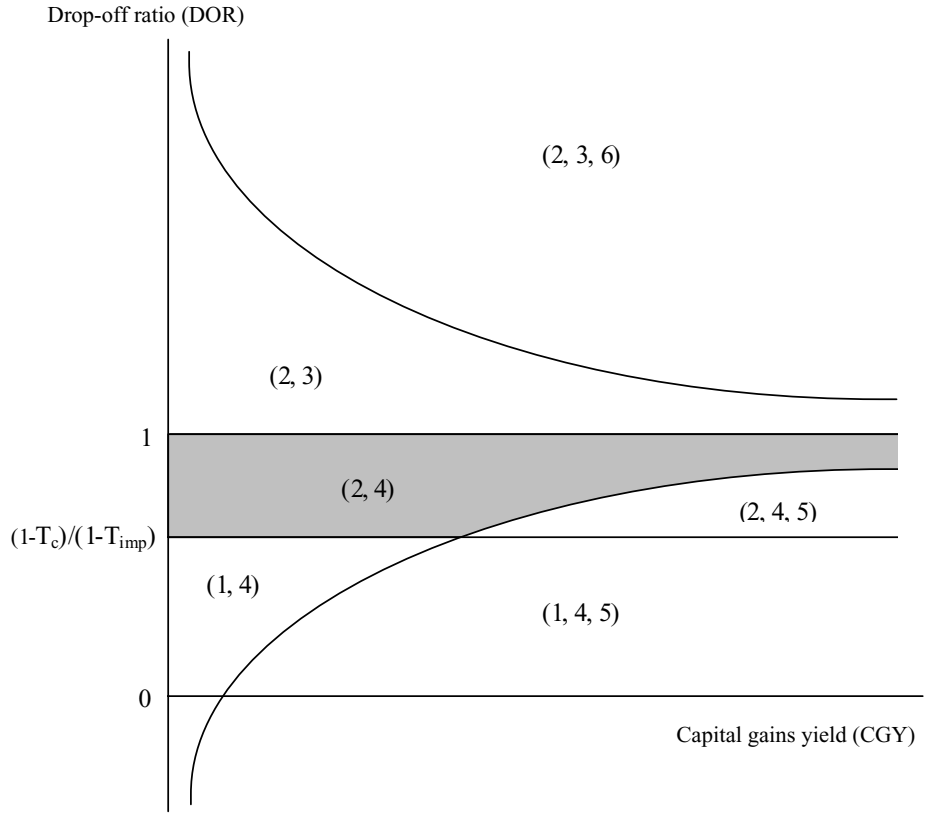
Region	Cum-Dividend Trading	Ex-Dividend Trading	Equilibrium
(1, 4)	Purchase by 1-way buyers	Sale by 1-way sellers	No
(1, 4, 5)	Purchase by 1-way buyers	Sale by 1-way sellers	No
	Purchase by 2-way traders	Sale by 2-way traders	
(2, 3)	Sale by 1-way sellers	Purchase by 1-way buyers	No
(2, 3, 5)	Sale by 1-way sellers	Purchase by 1-way buyers	Yes
	Purchase by 2-way traders	Sale by 2-way traders	
(2, 4)		Sale by 1-way sellers	Yes
		Purchase by 1-way buyers	
(2, 4, 5)	Purchase by 2-way traders	Sale by 1-way sellers	No
		Purchase by 1-way buyers	
		Sale by 2-way traders	

Figure 1. Pre-TRA 1986 trading behavior. The figure graphs the equilibrium regions based on the following inequalities whose numbering codes define various trading regions:

(1) One-way buyers purchase cum-dividend if DOR $< (1 - T_c)/(1 - T_{imp})$.
(2) One-way buyers purchase ex-dividend if DOR $> (1 - T_c)/(1 - T_{imp})$.
(3) One-way sellers sell cum-dividend if DOR > 1.
(4) One-way sellers sell ex-dividend if DOR < 1.
(5) Two-way traders buy cum-dividend and sell ex-dividend if

$$\text{DOR} < \left(\frac{1 - T_c}{1 - (T_c/0.4)}\right) - (\text{FC/CGY}).$$

The DOR is defined as $(P_{cum} - P_{ex})/\text{CGDIV}$, where P_{cum} is the cum-distribution day price, P_{ex} is the ex-distribution day price, and CGDIV denotes the capital gains distribution. The nominal capital gains tax rate is denoted by T_c, while the implicit capital gains tax rate (based on the present value of the future tax liability) is denoted by T_{imp}. The variable FC is defined as the transaction cost as a fraction of the cum-distribution stock price. The capital gains distribution yield CGY is defined as CGDIV/P_{cum}.



Region	Cum-Dividend Trading	Ex-Dividend Trading	Equilibrium
(1, 4)	Purchase by 1-way buyers	Sale by 1-way sellers	No
(1, 4, 5)	Purchase by 1-way buyers	Sale by 1-way sellers	No
	Purchase by 2-way traders	Sale by 2-way traders	
(2, 3)	Sale by 1-way sellers	Purchase by 1-way buyers	No
(2, 3, 6)	Sale by 1-way sellers	Purchase by 1-way buyers	No
	Sale by 2-way traders	Purchase by 2-way traders	
(2, 4)		Sale by 1-way sellers	Yes
		Purchase by 1-way buyers	
(2, 4, 5)	Purchase by 2-way traders	Sale by 1-way sellers	No
		Purchase by 1-way buyers	
		Sale by 2-way traders	

Figure 2. Post-TRA 1986 trading behavior. The figure graphs the equilibrium regions based on the following inequalities whose numbering codes define various trading regions:

(1) One-way buyers purchase cum-dividend if DOR $< (1 - T_c)/(1 - T_{imp})$.
(2) One-way buyers purchase ex-dividend if DOR $> (1 - T_c)/(1 - T_{imp})$.
(3) One-way sellers sell cum-dividend if DOR > 1.
(4) One-way sellers sell ex-dividend if DOR < 1.
(5) Two-way traders buy cum-dividend and sell ex-dividend if DOR $< 1 -$ FC/CGY.
(6) Two-way traders sell cum-dividend and buy ex-dividend if DOR $< 1 +$ FC/CGY.

The DOR is defined as $(P_{cum} - P_{ex})$/CGDIV, where P_{cum} is the cum-distribution day price, P_{ex} is the ex-distribution day price, and CGDIV denotes the capital gains distribution. The nominal capital gains tax rate is denoted by T_c, while the implicit capital gains tax rate (based on the present value of the future tax liability) is denoted by T_{imp}. The variable FC is defined as the transaction cost as a fraction of the cum-distribution stock price. The capital gains distribution yield CGY is defined as CGDIV/P_{cum}.

seller will sell the stock cum-distribution if the after-tax payoff of doing so is greater than the after-tax payoff of selling the stock ex-distribution, or

$$(P_{\text{cum}} - \text{BASIS})(1 - T_{\text{c}}) > (P_{\text{ex}} - \text{BASIS})(1 - T_{\text{c}}) + \text{CGDIV}(1 - T_{\text{c}}), \quad (4)$$

where BASIS is the price at which the stock was originally purchased. This expression reduces to, DOR $>$ 1. Similarly the seller will sell the stock ex-distribution if DOR $<$ 1.

The activity of one-way sellers is plotted in Figures 1 and 2. The sellers will sell the stock cum-distribution if the expected ex-day DOR is greater than one (regions with the code "3") and will sell the security ex-distribution if the ex-day expected DOR is less than one (regions with the code "4").

F. Two-Way Tax Traders Before the 1986 TRA

Before the 1986 TRA, a trader with short-term capital gains could purchase the stock cum-distribution and sell it ex-distribution. The trader would capture the long-term capital gains distribution, which is taxed at a lower rate than the short-term capital gains, and incur a short-term capital loss from the ex-distribution day price drop, which can be deducted from short-term capital gain on another position. This strategy enabled the trader to effectively turn tax-disadvantaged short-term capital gains into tax-advantaged long-term capital gains. This strategy is profitable as long as the net after-tax payoff is positive,

$$\text{CGDIV}(1 - T_{\text{c}}) + (P_{\text{ex}} - P_{\text{cum}} - C)(1 - (T_{\text{c}}/0.4)) > 0, \quad (5)$$

where $T_{\text{c}}/0.4$ is the short-term rate (i.e., the exclusion implies that the long-term rate is equal to 0.4 times the short-term rate), and C is the round-trip transaction cost. This cost includes commissions, market impact, and bid-ask spreads. The first term of the inequality is the after-tax cash flow from the capital gains distribution. The second term reflects the after-tax amount of the short-term capital loss from an ex-day price drop and the transaction cost (assuming that the investor can deduct the short-term capital losses and transaction costs against ordinary income). The inequality (5) shows that the tax arbitrageur's willingness to trade the stock increases in the stock's CGY and decreases in the stock's fractional transaction costs. Defining FC as the transaction cost as a fraction of the cum-distribution stock price and dividing each side by CGDIV$(1 - T_{\text{c}})$, we get

$$\text{DOR} < \left(\frac{1 - T_{\text{c}}}{1 - (T_{\text{c}}/0.4)}\right) - (\text{FC}/\text{CGY}). \quad (6)$$

Figure 1 plots the actions of the two-way tax traders before the 1986 TRA based on the inequality (6). If the DOR is less than that indicated by the upward-sloping curve, then these traders will buy the stock cum-distribution and sell

it ex-distribution (as indicated by the regions with code "5"). Otherwise, these traders will be inactive.

G. Two-Way Arbitrage Traders after the 1986 TRA

After the 1986 TRA, a two-way trader would purchase the stock cum-distribution and sell it ex-distribution if[6]

$$(\text{CGDIV} + P_{\text{ex}} - P_{\text{cum}} - C)(1 - T_{\text{c}}) > 0. \tag{7}$$

This condition holds if

$$\text{DOR} < 1 - \text{FC/CGY}. \tag{8}$$

Likewise, the two-way trader would sell the stock short before the ex-day and buy the stock back after the ex-day if

$$(P_{\text{cum}} - P_{\text{ex}} - \text{CGDIV} - C)(1 - T_{\text{c}}) > 0. \tag{9}$$

This short seller realizes a short-term capital gain of $P_{\text{cum}} - P_{\text{ex}}$ and pays the dividend to the lender of the stock, which is deductible from ordinary income. Rearranging (9), we obtain

$$\text{DOR} > 1 + \text{FC/CGY}. \tag{10}$$

Figure 2 shows the DOR-capital gains regions in which these traders are active. The regions with code "5" indicate a cum-distribution purchase followed by an ex-distribution day sale, whereas the region with code "6" represents a cum-distribution short-sale followed by an ex-distribution purchase.

H. Equilibrium

An equilibrium occurs for the DOR and CGY pairings in which there exist either (1) both buyers and sellers, or (2) neither buyers and sellers. An equilibrium of "buyers only" or "sellers only" is impossible, since the ex-day DOR will change until the original investor is either unwilling to trade, or another investor is willing to conduct the offsetting trade.

Before the 1986 TRA, an equilibrium occurs in two regions of the DOR-CGY space (shaded areas of Figure 1), either in region (2, 4), in which no cum-distribution trading occurs but ex-distribution trade occurs between one-way traders, or for larger capital gains distributions, in region (2, 3, 5), in which two-way tax traders purchase the stock cum-dividend from one-way sellers and sell ex-dividend to one-way purchasers.

After the 1986 TRA, equilibrium only occurs in region (2, 4) of the DOR-CGY space (shaded area in Figure 2). In this region no cum-dividend trading occurs, but ex-dividend trading occurs between one-way traders. The ability of two-way traders to enter the market prevents the DOR to the capital gains distribution

[6] Consistent with Section 852(b)(4) of the tax code, we assume that both the distribution and the capital loss are taxed at the same long-term rate.

from being too low. This is similar to the observation made by Kalay (1982) in regards to regular dividends.

II. Data and Sample Description

Using data from the Center for Research in Security Prices (CRSP), our sample is constructed from 3,283 capital gains distributions between January 1970 and December 2002, which represents 669 different firms. Of these firms, 97.31% (664) have a one-digit Standard Industry Code (SIC) of 6, and 92.3% (622) have a two-digit SIC of 67. This industry includes closed-end investment companies and REITs.[7]

From this data we remove any suspect distributions. We eliminate distributions for which CRSP reports missing declaration or payment dates. We also eliminate firms with a declaration or record date that was equal to or after the ex-dividend date, and we also eliminate firms for which the declaration or record date was more than 100 days before the ex-dividend date. If CRSP recorded the dividend payment date before the ex-dividend date or more than 60 days after the ex-dividend date, the observation is eliminated. Some capital gains distributions are paid in association with liquidation. In order to avoid errors associated with delisting returns, we also delete all capital gains distributions that are paid in the same month as delisting. We also eliminate one observation that was associated with a payment of a capital gains receipt.

From the remaining sample, we determine that many of the firms are municipal bond closed-end funds or closed-end funds that focused on foreign markets. These funds often pay out dividends with an unusual tax status. In order to isolate the effect of capital gains distributions we only include data from these types of firms if the capital gains distribution is the sole distribution on that day.

Many of these firms pay dividends that are nontaxable. This distribution often occurs when a closed-end fund promises a fixed dividend payment, regardless of whether the fund generates sufficient dividends or capital gains from its portfolio. The extra distribution amount that is needed to meet the promised dividend is considered a nontaxable return of capital. In order to eliminate any impact from these distributions, we eliminate all distributions that occur on the same day as a nontaxable distribution.

Last, we eliminate observations for which there is no trading volume on the ex-date or day before. Our final sample of 322 firms represents 1,375 capital gains distributions.[8]

Firms that pay capital gains distributions can also pay dividends that are taxed as normal dividends. In the case of closed-end funds, portfolio dividend income must be distributed as a separate dividend that is taxed as though the

[7] Gentry, Kemsley, and Mayer (2003) also use a sample of real estate investment trusts in a tax experiment. Their focus, however, is on the effects of tax basis, a special feature of their sample firms, which lowers future dividend taxes.

[8] Previous versions of the paper include distributions for which no trading occurred around the distribution date. For this case, the return is determined using bid-ask midpoints. This has no material impact on our findings.

shareholder held the closed-end fund's underlying portfolio. These distributions are typically called "income dividends." Between 1970 and 2002, the 337 firms in our sample paid out a total of 14,209 income dividends.

A. Institutional Ownership Subsample

To assess the shareholder composition of our sample, we collect institutional ownership data for a subset of our main sample. Our goal is to address the extent to which capital gains taxation is likely to affect the shareholders of companies that pay these distributions. We obtain institutional equity holdings data from Thomson Financial, which compiles these holdings from institutional investors' 13-f filings with the SEC. Since we only gain access to current 13-f filings data as of the end of September 2001, we focus on a subset of the main sample that consists of 61 firms representing all firms that paid a capital gains distribution between January 1999 and December 2002.[9]

We also create two matched samples (each also with 61 firms). The first sample is matched based on market capitalization, stock price level, and the exchange listing. The second is based on average dollar volume of trade, stock price level, and the exchange listing. All securities are placed in 29 market capitalization groups, 18 average volume groups, 3 exchange groups (NYSE, AMEX, and Nasdaq), and 3 price level groups.[10] Each firm in the market capitalization- (average dollar volume-) matched sample is picked by randomly selecting a security in the same market capitalization (average dollar volume) group, in the same exchange group, and in the same price group as each capital gains distribution firm. We match on exchange listing since this may affect the convention used to report volume. Joint matching by price and dollar trading volume helps find a matched firm with similar trading share volume. Since most capital gains distributions are paid by investment companies with two-digit SIC codes of 67, we eliminate from both matched samples firms with this two digit-code (as well as firms that paid capital gains distributions).

Table II reports aggregate institutional share ownership information for all three samples. The institutional ownership data as of the end of September 2001 is retrieved from Thomson Financial's 13-f filings database.[11] Firms that pay

[9] Three additional firms belong to this subset but we exclude them from our analysis because two were not listed until after September 2001 and one was delisted before September 2001.

[10] The number of initial capitalization groups and the number of initial volume groups are determined by picking the largest number that ensures at least one potential match for each firm in our sample.

[11] Thomson Financial's institutional ownership data is extracted from 13-f reports filed with the SEC. The 1975 revision to the Securities Exchange Acts requires all institutional investment managers with $100 million or more in exchange-traded or NASDAQ-quoted equity securities under management to file 13-f reports within 45 days of the end of each calendar quarter. Institutions are required to report all equity positions greater than either 10,000 shares or $200,000 in market value. Thomson Financial classifies each institution as one of five types according to Standard and Poor's definition of the institution's primary line of business. Banks consist of large bank holding companies. Investment advisors include investment banks or other financial institutions. Insurance companies and investment companies are self-described. Other managers include foundations, ESOPs, and agents who invest others' money and are not otherwise categorized.

Table II
Institutional Ownership

This table summarizes institutional ownership (as of the end of September, 2001) obtained from Thomson Financial's 13-f filings database. Column (A) lists statistics for the firms that pay out capital gains distributions and thus form our sample. Columns (B) and (C) pertain to the "market cap-matched" control sample and the "dollar trading volume-matched" control sample, respectively. *SD* is standard deviation.

	Firms That Pay Out Capital Gains Distributions (A)	Market Cap-Matched Control Sample (B)	Dollar Trading Volume-Matched Control Sample (C)
No. of Firms	61	61	61
Institutional Ownership (%)			
Mean	11.76	45.75	39.37
(*SD*)	(14.06)	(23.69)	(20.23)
Median	4.20	46.62	40.33
Maximum	52.86	85.43	84.55
75%	22.85	65.77	54.65
25%	1.42	30.57	26.30
Minimum	0.17	0.00	0.13
Test of Difference (B − A)		*t*-Statistic: 9.64 (*p*-value) (<0.0001)	
Test of Difference (C − A)		*t*-Statistic: 8.75 (*p*-value) (<0.0001)	

capital gains distributions have drastically lower institutional ownership—on average 11.76% versus over 39% for both matched samples. Both of these differences are statistically significant at all conventional levels. These differences in institutional ownership reinforce the suitability of our sample to address capital gains taxation at the personal level.[12] Table III presents a breakdown of the various types of institutions (based on a classification procedure determined by Thomson Financial).

Using statistics from recent publications, we estimate that 90.0% of all noninstitutional shares are held in taxable accounts.[13] Given the differences of

[12] Previous versions of this paper utilize a sample that does not include foreign and muni-bond closed-end funds. The current results are essentially identical to the previous results.

[13] Using statistics from Bergstresser and Poterba (2002b) and the Investment Company Institute (1999, 2002), it is possible to estimate the proportion of noninstitutional shares that invested in taxable versus nontaxable accounts. Bergstresser and Poterba report that in 1998, equity (held directly as stock or indirectly through a mutual fund) comprises 67.7% of tax deferred individual accounts and 70.8% of individual taxable accounts. Bergstresser and Poterba's summary statistics imply a total value of tax deferred assets of $4.44 trillion, and a total value of nontax deferred assets of $22.78 trillion. The Investment Company Institute reports that in 1998, equity mutual funds' holdings in tax deferred accounts amounted to $1.398 trillion and that equity mutual funds in taxable accounts were valued at $1.580 trillion. These results imply that individuals hold $1.61 trillion of direct shares in nontaxable accounts and $14.55 trillion in taxable accounts, and that 90.0% of individual-owned stock is held in a taxable account.

Table III
Institutional Ownership by Investor Type

This table summarizes institutional ownership by the type of investors (as of the end of September, 2001) obtained from Thomson Financial's 13-f filings database. Column (A) lists statistics for 61 firms that pay out capital gains distributions. Columns (B) and (C) pertain to the "market cap-matched" control sample and the "dollar trading volume-matched" control sample, respectively. *SD* is standard deviation.

	Institutional Ownership (%)											
	Firms That Pay Out Capital Gains Distributions (A)				Market Cap-Matched Control Sample (B)				Dollar Trading Volume-Matched Control Sample (C)			
Investor Type	Mean	*SD*	Min	Max	Mean	*SD*	Min	Max	Mean	*SD*	Min	Max
Banks	2.08	5.86	0	42.75	3.99	3.74	0	18.80	3.09	3.50	0	18.80
Investment advisors	1.02	1.90	0	10.12	3.69	4.79	0	33.36	2.26	1.87	0	6.99
Insurance companies	0.06	0.29	0	2.01	0.01	0.10	0	0.78	0.06	0.29	0	2.11
Investment companies	0.01	0.07	0	0.53	2.09	4.05	0	26.62	1.41	2.28	0	10.98
Other Managers	8.59	11.64	0	40.10	35.97	19.80	0	72.37	32.55	16.81	0.13	70.38

institutional ownership reported in Table II, this estimate implies that, compared with other corporations, firms that pay capital gains distributions are more likely to have shareholders that are subject to the capital gains tax.

III. Ex-distribution Day Abnormal Returns and DOR

The return, RET, is defined as

$$\text{RET} = [(P_{\text{ex}} - P_{\text{cum}}) + \text{DIV}]/P_{\text{cum}}. \tag{11}$$

DIV is the total cash distribution that the firm pays to shareholders during the return interval. To purge the ex-day price change of market-wide effects, we also compute the ex-day return net of the market model adjustment, that is, the ex-day abnormal return. In the absence of the systematic arrival of new information on ex-days, this abnormal return measure captures the ex-day distortions due to the market's pricing of distributed capital gains and dividends relative to unrealized capital gains. We use the CRSP BXRET variable as our abnormal return measure. This variable is calculated by computing market beta for each CRSP security. Each security is placed in one of 10 beta-ranked portfolios. In the following year, BXRET is computed by subtracting the return of its respective beta portfolio from each security's return. When BXRET is not available (for example, in the case of newly listed companies), we calculate our abnormal return measure with a simple market adjustment by subtracting

the CRSP value-weighted market index from the stock's return.[14] We denote the adjustment return, whether it is the return of the beta-ranked portfolio or the CRSP value-weighted index, as ER. We can express our abnormal return measure, BXRET, as

$$\text{BXRET} = [P_{\text{ex}} + \text{DIV} - (1 + \text{ER})P_{\text{cum}}]/P_{\text{cum}}. \tag{12}$$

A zero abnormal return on the ex-day implies that a dollar of cash distribution is valued the same as a dollar of unrealized capital gains. If the market value of a dollar of cash distribution is less than the market value of a dollar of unrealized capital gains, the adjusted ex-day price drop $((1 + \text{ER})P_{\text{cum}} - P_{\text{ex}})$ will be less than the cash distribution (DIV), yielding a positive ex-day return. Similarly, a negative abnormal ex-day return indicates that a dollar of cash distribution is valued greater than a dollar of unrealized capital gains.

We also report DOR. This measure describes the premium associated with a given distribution, and is defined as

$$\text{DOR} = \frac{P_{\text{cum}} - \dfrac{P_{\text{ex}}}{1 + \text{ER}}}{\text{DIV}}. \tag{13}$$

Following Michaely (1991) we discount the ex-day prices by our return proxy, ER, to control for market movements. Under this specification, the DOR should more closely reflect the firm-specific dividend reaction. This statistic is likely to suffer from heteroskedasticity related to both the dividend level and stock-specific volatility. Because of this, we use the method of Michaely (1991) and calculate all t-statistics involving this variable by weighting observations proportional to $\frac{\text{DIV}^2}{\sigma^2}$, where σ^2 is the security's abnormal return variance computed from daily data in the same calendar year that the distribution was paid.

Since the DOR compares the price response per unit of distribution amount, it can be interpreted as a marginal rate of substitution. For the marginal buyer of the security that is about to pay a capital gains distribution, indifference between buying the security cum-distribution versus ex-distribution [equation (2)] implies that $\text{DOR} = \frac{1 - T_c}{1 - T_{\text{imp}}}$. Reorganizing this expression yields $T_{\text{imp}} = 1 - (\frac{1 - T_c}{\text{DOR}})$. Thus, this formulation allows us to couple empirical estimates of DOR with assumptions of the tax rate of realized capital gains, producing an estimate of the implied tax rate on unrealized gains for the marginal buyer of the security.

IV. Evidence

Table IV shows distribution yields and average price reactions to distributions for samples classified by the type of distributions and by the tax regime,

[14] Previous versions of the paper utilize more elaborate abnormal return specifications which incorporate a multivariate Dimson (1979) factor model. The results of this specification are virtually identical to the current specification.

Table IV
Summary Statistics of Distribution Yield and Ex-distribution Day Abnormal Returns before and after the 1986 Tax Reform Act (TRA)

Type of Distribution	Number of Observations	Avg. Ex-day % Distribution [Median]	Avg. Ex-day % Raw Return [Median] (*t*: zero null)	Avg. Ex-day % Abnormal Return [Median] (*t*: zero null)	Average Ex-day Drop-Off Ratio [Median] (*t*: unit null)
Before the 1986 TRA (January 1970–December 1986)					
Pure capital gains distributions	91	4.86 [4.01]	0.01 [0.00] (0.03)	−0.33 [−0.33] (−1.33)	1.08** [1.09] (2.72)
Concurrent distributions	442				
Capital gains		2.31 [0.84]	0.16 [0.20] (1.61)	0.06 [0.13] (0.58)	0.97 [0.97] (−1.83)
Income		1.74 [1.69]			
Income dividends	3,736	1.70 [1.51]	0.08* [0.04] (2.48)	0.03 [0.02] (0.80)	0.95** [0.97] (−3.48)
After the 1986 TRA (January 1987–December 2002)					
Pure capital gains distributions	377	4.68 [2.57]	0.68** [0.53] (5.39)	0.53** [0.26] (4.39)	0.93** [0.96] (−5.24)
Concurrent distributions	465				
Capital gains		3.22 [1.41]	0.59** [0.60] (8.37)	0.50** [0.49] (7.25)	0.92** [0.94] (−6.99)
Income		1.22 [0.86]			
Income dividends	9,566	1.28 [0.87]	0.17** [0.15] (10.72)	0.12** [0.10] (7.63)	0.89** [0.88] (−13.74)
Difference between Pre-1986 TRA and Post 1986-TRA Returns and Drop-Off Ratios					
Pure capital gains distributions			−0.67* (−2.34)	−0.87** (−3.15)	0.15** (4.89)
Concurrent distributions			−0.43** (−2.66)	−0.44** (−3.74)	0.05** (2.87)

Drop-off ratio standard errors are calculated using the method of Michaely (1991).
*Significant at the 0.05 level (two-tailed test).
**Significant at the 0.01 level (two-tailed test).

both before and after the 1986 TRA. Data are presented for pure capital gains distributions, concurrent income and capital gains distributions, and pure income dividends.

A. Distribution Yields

The pure capital gains distributions have high average yields in both subsamples: 4.86% before the 1986 TRA and 4.68% after the 1986 TRA. The size of the income dividends ranges from 1.22% to 1.74%. The size of capital gains distributions tends to be 1–2% lower when paid concurrent with income distributions, whereas the size of income distributions appears to be invariant to

whether capital gains dividends are paid concurrently. Post-1986 TRA, the level of income dividend yields fell by about four-tenths to one half of a percent. Our sample firm's distributions are significantly larger than the typical distributions found in other studies. For example, Boyd and Jagannathan (1994) find an average yield of 1.0% over the period of 1962–1987. They separate their data into 20 dividend yield portfolios and find that the average yield of the highest portfolio is 2.69%, which is nearly 2% lower than the average capital gains yield in our sample.

B. Pre-TRA Results

Focusing initially on the pure capital gains distribution results for the pre-TRA period, we find that the average ex-day abnormal return for this sample is slightly negative, the raw return is slightly positive, and the DOR is statistically significantly greater than one at the 1% level. This finding is not surprising given Figure 1, which shows that DORs may be greater than one. This result differs from the typical finding that average DORs are significantly less than one (see, for example, Elton and Gruber (1970), Kalay (1982), Eades, Hess, and Kim (1984), Barclay (1987), and Karpoff and Walkling (1988)).[15] This finding is broadly consistent with tax-based arbitrage in which the arbitrageur values the dividend more than unrealized appreciation, since this dividend capture can be used to convert tax-disadvantaged short-term capital gains into tax-advantaged long-term capital gains.

For the concurrent distributions sample, we find a positive but statistically insignificant ex-day return. The DOR is less than unity but the difference between our estimate and unity is statistically insignificant.

For pure income dividends, we continue to find positive returns, although only the raw return is statistically significant. The DOR is significantly less than unity, consistent with the dividend literature that shows positive price reactions on ex-dividend days.

Comparing our results across distribution categories, the general message is that ex-day price behavior is consistent with the market treating capital gains as the most favorable distribution, a mixture of capital gains and income dividends as less favorable than a pure capital gain distribution, and pure income distributions as the least favorable. This finding is consistent with a tax interpretation of the results.

C. Post-TRA Results

The existence of tax arbitrage precludes us from using pre-TRA results to make inferences about the value of tax-timing capital gains. Thus, we turn our focus to the post-TRA results. For the period subsequent to the TRA, the average ex-day abnormal return for the sample of pure capital gains distributions is

[15] An exception is Elton, Gruber, and Blake (2004), who find that DORs associated with tax-free distributions are greater than one. They attribute their results to tax effects.

positive and the DOR is less than unity. These results are significant at all conventional levels, consistent with the prediction of the model that post-1986 DORs should be strictly less than zero. The DOR of 0.93 tells us that investors are compensated with 7¢ of unrealized price appreciation for each dollar of realized capital gains dividend. If the tax rate on realized capital gains is 28%, this implies that unrealized gains have an effective tax rate of 22.6%, and that the tax-timing option reduces the effective tax burden by 19.3%.[16] A capital gains tax rate of 15% implies an effective rate on unrealized gains of 8.6% and a tax-timing option that reduces the tax burden by 57.3%.

Table IV also provides cross-sectional evidence that is broadly consistent with the message that realized capital gains command compensation relative to unrealized gains, and that income dividends command compensation relative to both realized and unrealized gains. The rank ordering of the levels of the DORs corresponds with the tax burden; capital gains distributions are associated with the highest DORs, followed by concurrent distributions' DORs, in turn followed by pure income distributions' DORs. The average DOR for pure income dividend distributions, 0.89, is significantly lower than both the average DOR for pure capital gains distributions, 0.93 (t-statistic, 2.45) and the DOR for concurrent distributions, 0.92 (t-statistic, 2.70). The difference between the DORs of pure capital gains distributions and concurrent distributions fails to achieve significance. The ability of our test to reject the null is compromised by the fact that concurrent distributions contain a disproportionate amount of yield from capital gains (3.22%) as compared to the income yield amount (1.22%). If the DOR from a mixed distribution were the weighted average of the pure distribution, we would expect a DOR of 0.91, which is also insignificantly different from our finding of 0.92.

D. Comparison of Pre- versus Post-TRA Results

The last section of Table IV tests the difference in ex-day returns and DORs of the pre- and post-TRA for both pure capital gains distributions and concurrent distributions. The framework constructed in Section I predicts larger market compensation in the form of higher ex-day returns (lower DORs) for capital gains distributions post-TRA. The comparison presented is supportive of the predicted structural change between pre- and post-1986. Market compensation increased post-TRA. The changes are statistically significant for all six measures.

This evidence is at odds with microstructure explanations for ex-distribution behavior such as Frank and Jagannathan (1998) and Bali and Hite (1998). Since these theories are not tax-based, they do not predict differences due to tax changes. If anything, these theories would predict lower market compensation for distributions post-1986, since there has been a trend of lower bid-ask spreads and transaction costs.

[16] These estimates are computed by setting equation (2) as an equality and solving for the implied tax rate.

E. Post-1986 Subsample Comparison

In this subsection, we examine how tax rate changes affect the variation of post-TRA market compensation for capital gains distributions. From Table I, post-1986 there has been a general decline in marginal long-run capital gains tax rates, from a 28% maximum rate to a more recent 20% rate. Starting in 2003, Congress further decreased the maximum capital gains rate to 15%. On theoretical grounds, whether or not the tax-timing option increased or decreased during this period is unclear. From footnote 4, the value of the tax-timing option increases in the tax rate, thus the lower rates later in the sample imply that, more recently, a tax-timing option would be less valuable. Part of the value of the tax-timing option can be attributed to investors' anticipation of future trends, which is difficult to quantify. Other difficulties in quantifying changes may have contributed to a more valuable timing option. For example, technological innovations in record-keeping may have improved the IRS's ability to enforce investment tax laws, and investors' tax astuteness may have increased.

Table V presents DORs for all three post-TRA subperiods. For pure capital gains distributions, DORs have been remarkably stable, decreasing from 0.94 in the first subperiod to 0.92 in following subperiods. The difference between these estimates is statistically insignificant. Combining this evidence with the findings from Table IV, the message seems to be that the changes between pre- and post-TRA have greater implications for the pricing of capital gains

Table V
Time Variation in Drop-Off Ratios after the 1986 Tax Reform Act (TRA)

	Average Ex-Day Drop-Off Ratio [Median] (*t*: unit null) Number of Observations		
Type of Distribution	1987–1996	1997	1998–2002
Pure capital gains distributions	0.94	0.92	0.92
	[0.93]	[0.95]	[0.97]
	(3.67)**	(2.04)*	(2.76)**
	255	31	91
Concurrent distributions	0.91	0.93	0.94
	[0.91]	[0.96]	[0.96]
	(6.36)**	(2.23)**	(2.51)**
	320	36	109
Income dividends	0.89	0.84	0.91
	[0.90]	[0.87]	[0.94]
	(9.81)**	(7.24)**	(6.51)**
	5,594	737	3,235

Drop-off ratio standard errors are calculated using the method of Michaely (1991).
*Significant at the 0.05 level (two-tailed test).
**Significant at the 0.01 level (two-tailed test).

distributions than the changes in marginal rates that we observe within the post-TRA time period.

For each of the three periods, the average DORs for pure capital gains distributions and concurrent distributions are higher than the DOR for pure income distributions. This relation is consistent with both a tax-timing option and realized capital gains being tax-advantaged relative to dividends. Other results from Table V are difficult to reconcile with a tax-based theory. For example, DORs for concurrent distributions for the second and the third subperiod are higher than those for pure capital gains distributions. In addition, the DOR for income dividends is very similar to the DOR for pure capital gains distributions in the third subperiod. We suspect that the small sample size reduces statistical power in these subperiod tests.

With the above caveats in mind, these statistics can still be used to provide a current estimate of the effective rate on the capital gains tax. Using the average DOR estimate of 0.92 for the 1997–2002 period and the maximum nominal capital gains rate of 20%, we can calculate an implied effective capital gains rate of 13.0%. If 0.92 continues to be a reasonable estimate of DORs, the current 15% nominal gains rate implies an effective rate of 7.6%.

F. Comparison of Differences in Market Compensation Based on Distribution Size

In this subsection, we examine whether estimates of post-TRA market compensation for capital gains distributions differ depending on the size of the distribution. Distribution size may have an impact on our estimate of the value of tax-timing options for two possible reasons. First, if the distribution size is small, our estimates of tax-timing options may be distorted by microstructure effects such as bid-ask bounce or discreteness of stock prices. Second, if the distribution size is larger than transaction costs, two-way traders are likely to be attracted to short-term dividend capture activities. In this case, an ex-day stock price reaction would tend to reflect two-way traders' arbitrage activities rather than the value of tax-timing options. We examine these issues by focusing on pure capital gains distributions since our findings will not be hampered by contemporaneous income dividends.

Table VI measures post-TRA market compensation for pure capital gains distributions, depending on whether the size of the distribution is higher or lower than the median pure capital gains distribution ($0.30), or whether the yield is higher or lower than the median pure capital gains yield (2.57%). Either sorting criterion produces two subsamples that are clearly distinguishable in both the capital gains yield and the magnitude of capital gains distribution. Regardless of the sorting criterion, the differences between the percentage capital gains yields in the two subsamples are over 7%, and the difference between the average dividend levels is over a full dollar.

The interpretation of Table VI is unaffected regardless of whether the sample is separated into high and low capital gains yields or into high- and low-dividend amounts. For both criteria, larger distributions are associated with

Table VI

Post-1986 TRA Relation between the Size of the Capital Gains Distribution and Market Reactions

The post-1986 pure capital gains distribution sample is separated into higher and lower than median capital gains distributions, and higher and lower than median capital gains yield. *t*-statistics are calculated for a zero null, except for *t*-statistics for drop-off ratio levels that are calculated for a unit null. The reported *t*-tests on the difference assume both samples have equal variances.

Sample	Variable	Lower than Median Capital Gains Distr.; 189 Observations (*t*-Statistic)	Higher than Median Capital Gains Distr.; 188 Observations (*t*-Statistic)	Difference, Higher Minus Lower (*t*-Statistic)
	Capital gain distr. % yield	1.16	8.21	7.04
	Capital gain distr. $ amount	0.12	1.33	1.21
Distribution level groups	Ex-day raw % return	0.36*	1.00**	0.63**
		(2.44)	(4.95)	(2.53)
	Ex-day abnormal % return	0.19	1.03**	0.68**
		(1.03)	(4.63)	(2.55)
	Drop-off ratio	1.06	0.87**	−0.19
		(0.15)	(−3.82)	(−0.48)
Sample	Variable	Lower than Median Capital Gains Yield.; 188 Observations (*t*-Statistic)	Higher than Median Capital Gains Yield.; 189 Observations (*t*-Statistic)	Difference, Higher Minus Lower (*t*-Statistic)
	Capital gain distr. % yield	0.99	8.33	7.34
	Capital gain distr. $ amount	0.13	1.31	1.18
Distribution yield groups	Ex-day raw % return	0.23*	1.13**	0.90**
		(1.98)	(5.14)	(3.62)
	Ex-day abnormal % return	0.07	1.00**	0.93**
		(0.59)	(4.75)	(3.93)
	Drop-off ratio	1.03	0.93**	−0.10
		(0.37)	(−4.64)	(−1.31)

*Significant at the 0.05 level (two-tailed test).
**Significant at the 0.01 level (two-tailed test).

statistically significant larger returns. Similarly, the DORs tend to be lower for the higher distribution subset, implying that our estimate of 0.93 for the DOR for the post-TRA period is not driven by the smaller distributions. These results suggest that our estimate of the value of tax-timing options is not likely to be adversely affected by market microstructure effects. Since the small distribution subsample has less power, the difference between the subsamples is not statistically significant.

On the surface, these results seem to contradict the model's prediction regarding the impact of two-way traders on equilibrium returns. Two-way traders

are more likely to be active around larger distributions. From equation (7), if two-way traders are indifferent to dividend capture around the ex-dividend date, then DOR = 1 − FC/CGY. As Table VI shows, the subsample with observations whose capital gains distribution levels are higher than median are associated with an 8.21% CGY and a DOR of 0.87. These estimates imply a round-trip trading cost estimate of 1.07%. In other words, given these conditions, two-way traders will try to capture dividends only when their round-trip trading cost is below 1.07%. Taken as a whole, these results suggest that actual trading costs are likely to be prohibitive to two-way traders.[17] This level of transaction costs is lower than estimated transaction costs on virtually all stocks. Using data from 1960 to 1979, Stoll and Whaley (1983) estimate round-trip transaction costs (bid-ask spread plus two times commissions) of 2.7% for the highest NYSE market capitalization decile and 6.8% for the lowest decile. Using data from 1963 to 1990, Lesmond, Ogden, and Trzcinka (1999) produce maximum likelihood round-trip trading cost estimates that range from 1.2% for the highest market capitalization decile to 10.3% for the lowest. In conclusion, the results reported in Table VI imply that ex-day DORs reflect the value of tax-timing options rather than microstructure effects or short-term traders' arbitrage activities.

V. Trading Volume Test of the Model

In this section we discuss the trading volume implications of the framework in Section I, and we provide empirical evidence of the framework's ability to explain trading.

A. Capital Gains Distributions before the 1986 TRA

For low levels of capital gains yields [region (2, 4) in Figure 1], no trading occurs before the ex-distribution day but there will be trades between one-way sellers and buyers after the ex-day. In this region, due to transaction costs, both buyers and sellers prefer to postpone trading to the ex-day. For high levels of capital gains yields [region (2, 3, 5) in Figure 1], positive abnormal trading volumes are observed both before and after the ex-day. Two-way tax traders buy shares from one-way sellers cum-distribution and sell the shares to one-way buyers ex-distribution.

B. Capital Gains Distributions after the 1986 TRA

As described in Figure 2, the equilibrium region (2, 4) implies no trading activities before the ex-days for the capital gains distributions after the 1986 TRA.

[17] For the distributions that are higher than median in the pre-TRA period, we find average distribution yields of 6.2% and average DORs of 1.08. Two-way traders will be indifferent to dividend capture if DOR $= (\frac{1-T_{\mathrm{ic}}}{1-(T_{\mathrm{c}}/0.4)}) - (\mathrm{FC/CGY})$. Assuming a long-term capital gains rate of 25%, traders are indifferent between trading and not trading if round-trip transaction costs are 5.7%.

Table VII

The Impact of the Capital Gains Distributions on Trading Volume

Estimates of average abnormal volume before, $ABVOL_{cum}$, and after, $ABVOL_{ex}$, pure capital gains distributions. ABVOL is the log deviation of the security's volume relative to the NYSE volume, minus the average log deviation of this measure in the same calendar year. Heteroskedastic-consistent means and *t*-statistics are calculated by weighting each observation by the inverse of the standard deviation of each security's daily log relative volume. (*t*-statistics in parentheses, zero null). The reported *t*-tests on the difference assume both samples have equal variances.

Pre-TRA 86, Pure Capital Gains Distributions, 109 Observations:			
$ABVOL_{cum}$	1.54**	$ABVOL_{ex}$	0.43*
	(5.49)		(2.08)
Post-TRA 86, Pure Capital Gains Distributions, 378 Observations:			
$ABVOL_{cum}$	0.69**	$ABVOL_{ex}$	1.22**
	(5.61)		(8.96)
Change in Abnormal Volume Pre- and Post-TRA:			
$ABVOL_{cum}$	−0.85**	$ABVOL_{ex}$	0.79**
	(−3.11)		(2.87)

*Significant at the 0.05 level (two-tailed test).
**Significant at the 0.01 level (two-tailed test).

However, there will be increased trading volume during the ex-distribution periods because of the trades between one-way sellers and one-way buyers. Capital gains distributions induce market participants to delay trading until after the distribution. Since the size of the distribution is proportional to the benefit of waiting, we expect that larger distributions should be associated with larger shifts of trade from before the distribution to after.

C. Volume Tests

Table VII reports the results for the relation between an abnormal volume measure and CGY. The sample used in the tests of ex-day returns omits observations with no trading on either the ex- or cum-distribution day. We avoid potential selection biases by including these observations for the estimation of Table VII. This increases the number of pre-TRA observations by 18, and the number of post-TRA by one.

In order to measure abnormal share trading volume, we start by computing a measure of typical trading volume. Using the NYSE firms on the CRSP daily stock file, we compute the aggregate trading volume of NYSE shares. For each firm in the pure capital gains distributions sample, we first compute the log-relative volume by subtracting the natural log of the NYSE aggregate trading volume from the natural log of its own trading volume. As is typical in empirical work that studies volume (e.g., Ying (1966)), the natural log is used to reduce the skewness that is inherent in volume data. Firms with zero trading volume are assigned trading volumes equal to one share, insuring that the log transformation can be used on all data. The calendar-year

average of the log-relative volume is used as the benchmark for each firm's normal volume. Abnormal volume on a specific day is the firm's log-relative volume on that day minus the firm's benchmark. Our abnormal volume measure for the cum-period ($ABVOL_{cum}$) is the sum of the abnormal volumes over the 5-day cum-period; similarly, the analog for the ex-period ($ABVOL_{ex}$) is the sum of the abnormal volumes over the 5-day ex-period. These abnormal volume measures have the advantage of controlling for both volume changes that are associated with market-wide volume, as well as cross-sectional differences in volume.

Table VII presents average cum-distribution and ex-distribution volumes before and after the 1986 TRA; *t*-statistics are calculated by weighting each observation by the standard deviation of the firm's daily log-relative volume (calculated in the same calendar year as the distribution). Table VII reports results that are consistent with the broad implications of the model. The cum-period abnormal volume fell by 85% and the ex-period abnormal volume rose by 122% following the TRA in 1986. Both changes are statistically significant at the 1% level. The results are consistent with the prediction of our model that two-way tax arbitrage traders captured the dividend before 1986, but did not conduct this activity after 1986, when the IRS prevented short-term trades from enjoying differential rates on the dividend and the price depreciation. Similarly, for the post-TRA period, the high ex-distribution abnormal volume is consistent with one-way buyers avoiding capital gain dividends by delaying purchase until the ex-date. These results are inconsistent with other models that are designed to explain trading volume around dividends, such as Michaely and Vila (1995) or Lakonishok and Vermaelen (1986). These models rely on relative differences in various traders' exposures to dividend and capital gains taxation.

Although the pre- and post-1986 change in abnormal volume is consistent with the model, one fact of the volume data that the model does not explain is the remaining high cum-dividend volume that is evident after the TRA. Again, this result cannot be explained by Michaely and Vila (1995) or Lakonishok and Vermaelen (1986). Focusing on changes between cum- and ex-distribution abnormal volumes makes this anomalous finding more sensible: Ex-distribution volume is 53% larger than cum-distribution volume ($1.22 - 0.69$). Whether or not a cohesive model of trading can explain the level of cum-distribution volume is left to further research.

VI. Summary and Concluding Remarks

We examine a unique type of cash dividend that is taxed at the long-term capital gains tax rate rather than at the ordinary income tax rate. Because these distributions are larger than typical dividends and because the shareholders in these corporations are less likely to be institutions, the ex-dividend day behavior of these securities provides a novel environment to study the impact of capital gains taxation. Our findings are consistent with recent work by Green and Rydqvist (1999), Graham et al. (2003), and Jakob and Ma (2004) that casts doubt

on the microstructure explanations of dividend reactions and lends support to tax-based explanations.

Before the 1986 TRA in the United States, short-term capital gains were taxed at higher rates than long-term capital gains. Since capital gains distributions were taxed at a lower long-term rate, a trader with short-term capital gains could engage in a dividend capture strategy that effectively turned tax-disadvantaged short-term capital gains into tax-advantaged long-term capital gains. Using a simple framework, we show equilibrium relations between the expected ex-day return and the CGY. Our empirical findings from the ex-day price and volume data before the 1986 TRA are consistent with the hypothesis that taxes matter in determining ex-day stock prices.

After the 1986 TRA, the tax advantage of capital gains distributions disappeared and so did the dividend capture opportunities. After 1986, cum-distribution shareholders received a dividend with the same tax implications as a realized capital gain, which resulted in an ex-day price decline. Because of this, the stock price movements around the ex-days of capital gains distributions provide a laboratory setting in which we can infer the market value of the tax-timing option. Our empirical estimate suggests that the ability to tax-time a dollar of capital gains is worth about 7¢ in unrealized capital gains. This finding is both economically and statistically significant: A marginal trader with an effective tax rate on realized capital gains of 28% has an effective tax rate on unrealized capital gains of 22.6%; a marginal trader with an effective tax rate of 15% has an effective tax rate on unrealized gains of 8.6%.

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