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Capital Gains Taxes and Equity Trading: Empirical Evidence

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ABSTRACT

Individual investors have an incentive to defer selling appreciated stock until it qualifies for tax-favored, long-term capital gains treatment. Shackelford and Verrecchia [2002] show that these incentives can affect equity trading around public disclosures. This article provides some empirical support for their theory with evidence of price increases and equity constrictions around announcements of quarterly earnings and additions to the S&P 500 index. We find share returns rise and trading volume falls with the incremental taxes saved by deferring the sale of appreciated property. The price increases, however, are temporary, reversing in subsequent trading days. The results are consistent with buyers believing the compensation to sell before long-term qualification (through higher prices) is less costly than holding an inappropriately weighted portfolio. This finding—that personal capital gains taxes affect equity trading—adds to a growing literature that challenges longstanding assumptions that firm value is independent of shareholders and their taxes.

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1. Introduction

The purpose of this article is to investigate the extent to which personal capital gains tax incentives affect equity trading. Individuals generally have an incentive to hold appreciated stock for more than one year because long-term capital gains are currently taxed at no more than 20%. Sales of shares held for a shorter period (short-term capital gains) are taxed at up to 38.6% (under 2002 rates).

Shackelford and Verrecchia [2002] analyze the impact of such tax incentives on equity prices and trading volume around disclosures. Using a stylized model of trade, they show that capital gains taxes can restrain the portfolio rebalancing that would occur in their absence. If investors face tax-disfavored short-term capital gains on the sale of appreciated stock, they limit the supply of equity. To induce selling, buyers must compensate sellers through higher share prices for the incremental taxes associated with short-term capital gains.

In this article we attempt to determine whether these price and volume movements can be detected empirically. Guided by Shackelford and Verrecchia [2002], we investigate equity trading around two unrelated public disclosures that are known to trigger substantial portfolio rebalancing and thus potentially provide a sufficiently powerful setting to detect the impact of capital gains taxes on trading. The disclosures are quarterly earnings announcements and additions to the S&P 500 index. For each disclosure, we regress both abnormal returns and abnormal trading volume on a tax measure and numerous controls.

The tax measure estimates the incremental taxes triggered if appreciated property is sold before it qualifies for long-term treatment. It is the product of the spread between long-term and short-term capital gains tax rates (which range from 0% to 50% during the years examined) and the change in the firm's price during the requisite holding period (which ranges from 6 to 18 months). For example, using the current one-year holding period and the current spread between capital gains tax rates of 18.6% (38.6-20), a firm that had appreciated by 27% (e.g., from \$1 to \$1.27) in the 12 months preceding its disclosure would have an incremental tax of 5 cents ($18.6 * 0.27$).

The tax measure captures the taxes saved by deferring the sale of appreciated property for an individual precisely at the long-term/short-term cusp when a disclosure occurs. Obviously, few shareholders are actually at the cusp at any given moment so the tax measure is noisy. Consequently, if the tests fail to detect any tax effects, it will be difficult to rule out the possibility that the tax variable lacks sufficient power. On the positive side, because it varies across tax rate regimes and by the firm's appreciation during the holding period (which also varies over time), there should be few concerns about omitted correlated variables.

We find that the tax variable is a determinant of equity trading for appreciated stocks around both earnings announcements and additions to the

S&P 500 index. These findings are consistent with personal holding-period incentives affecting equity trading. Equity shrinks and prices rise in the tax measure, that is, the excess of short-term capital gains taxes over long-term capital gains taxes. The price movement is temporary, however, reversing in subsequent trading days. This reversal implies that preferential treatment for long-term capital gains increases stock market volatility.

The statistical significance of some findings is modest. However, this should not be surprising for at least three reasons. First, as mentioned earlier, the incremental tax measure is an imperfect aggregate. Second, capital gains tax effects, if they matter at all, are not dominant determinants of equity trading. Third, every day a few individuals face the short-term/long-term cusp. If holding-period incentives affect the timing of their sales, stock returns and trading volume could potentially be affected every day. As a result, our tests around earnings announcements and index changes only capture the relative increase in tax distortion (i.e., the extent to which personal capital gains taxes cause prices to move away from fundamentals). It does not measure the absolute impact of the holding-period incentives around the disclosures.

Overall, the evidence is consistent with the notion that individuals' capital gains taxes influence equity prices around earnings releases and index additions. We base this conclusion on (1) finding that both share returns and trading volume vary with the tax measure, (2) finding similar effects in two unrelated disclosures, and (3) an inability to construct alternative explanations for the results.

The results in this article appear to document a more general trading influence for personal holding-period incentives than previously reported. For example, both Poterba and Weisbenner [2001] and Reese [1998] document that distinctions between long-term and short-term classifications can affect share prices and trading volume. Both, however, investigate unusual trading circumstances and tax conditions that changed with the Tax Reform Act of 1986.

Poterba and Weisbenner [2001] link holding-period incentives to the January effect for depreciated shares from 1970 to 1976 and from 1985 to 1986.[1] Their findings imply that tax planning around those year-ends was important enough to move prices. However, they cannot assess whether shareholder tax effects matter at other times. We find holding-period influences throughout the year and across many years, most of which are since 1986.

Reese [1998] reports price pressure from 1976 to 1986 when initial public shareholders (those who buy at the initial public offering [IPO]) first qualify

[1] Poterba and Weisbenner [2001] find that turn-of-the-year returns for depreciated firms were greatest from 1970 to 1976 and in 1985 and 1986, years when half of any net long-term capital losses expired unused while short-term capital losses could be fully deducted, a provision that the Tax Reform Act of 1986 eliminated. They interpret this result as consistent with price reversal following a tax-induced, year-end sell-off intended to ensure short-term capital loss treatment.

for long-term treatment.[2] However, he cannot generalize to non-IPO firms. Companies in their first months of operation typically differ from other firms, with disproportionately heavy ownership by individuals and illiquid trading, both of which bias in favor of finding tax-induced price pressure. In this article we document tax-motivated price pressure for a diverse set of firms, including some of the oldest, largest, most closely followed, and most efficiently priced U.S. corporations.

In short, the findings in Poterba and Weisbenner [2001] and Reese [1998] are intriguing but difficult to generalize from because they investigate unique settings that were changed with the 1986 tax reform. We attempt to determine whether they have detected an important tax influence on trading or simply anomalies of limited importance. Our evidence is consistent with holding-period incentives having a broader implication for trading than could have been inferred from the previous studies.

This article contributes to the current debate about the extent to which equity prices impound shareholder taxes (see Landsman and Shackelford [1995], Erickson [1998], Erickson and Maydew [1999], Guenther and Willenborg [1999], Harris and Kemsley [1999], Collins and Kemsley [2000], Guenther [2000], Lang and Shackelford [2000], Shackelford and Shevlin [2001], Blouin, Raedy, and Shakelford [2002], Frank [2002], Ayers, Cloyd, and Robinson [2002], Dhaliwal, Erickson, Frank and Banyi [2003], Hanlon, Myers, and Shevlin [2003], Guenther and Sansing [2003], Blouin [2003], Ayers, Lefanowicz, and Robinson [2003], Dhaliwal, Li, and Trezevant [2003], and Hurtt and Seida [2003], among others). By providing some evidence of price pressure from a tax provision that only affects individuals, the findings in this article are consistent with personal capital gains taxes affecting share returns (at least around the investigated disclosures).

The remainder of the article develops in the following manner: Section 2 develops hypotheses that follow from Shackelford and Verrecchia [2002]. Section 3 lists additional necessary conditions for the holding period to affect equity trading. The subsequent four sections present the empirical investigation. Concluding remarks follow.

2. *Hypothesis Development*

2.1 SHACKELFORD AND VERRECCHIA [2002]

Shackelford and Verrecchia [2002] develop a three-period model of trade with two groups of investors and two investments: a risky, taxed asset and

[2] Reese [1998] reports that from 1976 to 1986 trading volume increased and prices fell for appreciated firms when their initial public shareholders first qualified for long-term capital gains tax treatment. This is consistent with a surge in selling pressure (when the lower rates first apply) that could not be met at the current market price. Conversely, for depreciated firms he finds that investors sold disproportionately immediately before qualification to ensure deductions at the high short-term rate. He adds that the relations do not hold for IPOs from 1989 to 1995, consistent with the incentive weakening after the Tax Reform Act of 1986 narrowed the spread between long-term and short-term capital gains tax rates.

a riskless, tax-free asset. The investors are identical, except that they are initially endowed with different shares of each asset. In the first period, both groups await a public disclosure. In the second period, when the information is disclosed, investors rebalance. In the third period, all assets are liquidated and consumed. Gains on sales during the second period are taxed (short-term capital gains) at a higher rate than gains on sales in the third period (long-term capital gains).

The disclosure is assumed to lead to homogeneous expectations about the uncertain value of the risky asset. In the absence of taxes, all investors gravitate toward an equilibrium in which the risks associated with holding the risky asset are optimally shared. Investors who were overweighted in the risky asset, compared with the optimal risk-sharing amount, unwind their positions by selling shares to underweighted investors. After a "good news" disclosure, the risky asset appreciates. Selling these appreciated investments ensures a certain profit and eliminates the risk of being overweighted in an asset whose future value is uncertain.

If the gain is taxed, the overweighted investor must choose between selling the shares at disclosure and paying the higher short-term capital gains tax on the certain profits or retaining the shares and paying the lower long-term tax on the profits at liquidation, if any. Thus, investors must choose between an optimal risk strategy and an optimal tax strategy.[3] Shackelford and Verrecchia [2002] show that under these circumstances investors will sell less at the disclosure than they would in the absence of taxes. To entice sellers, buyers must provide compensation in the form of higher sales prices.

In addition, the greater the appreciation the shareholder enjoys, the greater are the incremental taxes if he or she sells before long-term qualification. Thus, the investor's incentive to defer selling is increasing in the stock's appreciation. This creates the most pronounced sellers' strikes among the most appreciated firms. Furthermore, conditional on the appreciation, the wider the spread between short-term and long-term capital gains tax rates, the greater is the shareholder's incentive to defer selling. This leads to the first hypothesis, which is stated in alternative form:

H1: The incremental taxes from selling appreciated stock, which arise from the tax-disfavored treatment accorded short-term gains as compared with long-term gains, increase stock returns and decrease trading volume around public disclosures for appreciated firms.

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[3] An anecdote in the *Wall Street Journal* (July 10, 2000, p. A1) illustrates this dilemma, detailing the fateful sell-hold decision of a shareholder in a highly appreciated, Internet IPO: "Mr. Seiff realized that if he sold the bulk of his shares before April 13—a year and a day after he'd first exercised his options—he would have to pay the far higher tax rates for short-term capital gains. That would mean an additional $100,000 in taxes. Mr. Seiff would still be ahead so long as Scient's shares didn't fall far below $100 in the next two weeks. 'I was gambling,' he says, 'Wouldn't you wait two weeks for $100,000?'" Unfortunately, as this investor waited for the favorable long-term capital gains tax rates, his stock tumbled from $132 to $30 per share.

2.2 DEPRECIATED SHARES

Contrary to the incentives facing holders of appreciated property, individuals with depreciated shares have an incentive to sell before the holding period is completed, creating short-term capital losses that offset tax-disfavored short-term capital gains, which are currently taxed at 38.6%. Depreciated securities sold after long-term qualification are initially deducted against long-term capital gains, thus refunding only 20 cents for each dollar of loss under current law. Although the final version of Shackelford and Verrecchia [2002] does not address the reaction to a "bad news" disclosure, it is a straightforward exercise (as demonstrated in an earlier version of their paper) to show that unfavorable news causes shares to fall and that the selling of these depreciated shares before the qualification date expands equity, increases trading, and depresses prices.

If the loss is deductible at a higher tax rate in the second period than in the third period, the overweighted investor must choose between selling the depreciated shares at disclosure and reducing taxes at a higher rate immediately or retaining the shares and accepting less tax savings per dollar of loss at liquidation. Forced to choose between an optimal risk strategy and an optimal tax strategy, investors will sell more at the disclosure than they would in the absence of taxes. The greater the depreciation, the greater the additional tax savings, the greater the incentive to accelerate selling, and the greater the surge in selling, again increasing in the spread between short-term and long-term capital gains tax rates. To attract additional buyers, sellers must accept lower sales prices. Stated formally, the second hypothesis is:

H2: The incremental tax savings from selling depreciated stock, which arise from the tax-favored treatment accorded short-term losses as compared with long-term losses, decrease stock returns and increase trading volume around public disclosures for depreciated firms.

This symmetric analysis, however, presumes that gains and losses are treated identically. In fact, under current U.S. tax law, gains and losses are not treated the same. For example, investors generally have incentives to defer gains but have incentives to defer losses only when certain limitations do not apply. In particular, if total realized gains exceed total realized losses, individual investors are fully taxed on the difference. However, if total realized losses exceed total realized gains, individual investors can deduct only $3,000 of the net loss in that year.[4]

[4] Losses that are not deducted in the year of realization are carried forward indefinitely, offsetting gains in future years, albeit at a reduced immediate benefit due to the time value of money. The importance of the loss limitation is unclear. Poterba [1987] and Auerbach, Burman and Siegel [2000] report that the $3000 loss limitation is rarely binding; however, in response to claims that the constraint was binding, the United States House of Representatives in 2002 voted to increase the limit to $4000 and eventually $5000.

Moreover, if an individual wishes to sell a depreciated stock, he or she can sell at any time before the qualification date and receive tax-favored, short-term capital loss treatment. As a result, as the qualification date nears, investors may have already disposed of those depreciated stocks that they wished to sell before qualification. Conversely, investors cannot sell appreciated stock at the tax-favored, long-term capital gains tax rate until the requisite holding period has been met. Thus, at the qualification date, all appreciated stocks that investors intend to sell at long-term rates are still being held. Because we focus on trading around the disclosure, our measures are unable to capture the selling of depreciated securities in the previous days or months. However, they can capture the initial selling of appreciated shares under tax-favored, long-term capital gains treatment.

Finally, recent behavioral finance papers (e.g., Odean [1998]) report that investors are reluctant to sell depreciated stock despite tax incentives to do so. To the extent holders of depreciated securities exhibit such trading tendencies around the long-term/short-term cusp, we may find trading patterns that are not consistent with rational capital loss tax planning.

For these three reasons, we anticipate finding that capital gains tax planning influences equity trading more than capital loss tax planning around the disclosures. This leads to the final hypothesis:

H3: Capital gains tax planning for appreciated firms dominates capital loss tax planning for depreciated firms around the long-term qualification date.

3. Other Necessary Conditions

Before proceeding to the empirical tests, it is important to note three features of the U.S. taxation of individual capital gains and losses that Shackelford and Verrecchia [2002] exclude from their model. First, the model imposes conditions that force investment horizons to coincide with the long-term capital gains holding period. In reality, the investment horizons for many individuals differ substantially from the holding period. Some investors buy and hold shares for many years. Others churn much more rapidly (e.g., day traders).

Having said that, the investment horizon for stocks appears to approximate the requisite holding period that applied during most of the investigation period (one year). Burman and Ricoy [1997] report that 49% of the stock sold in 1993 had been held for more than one year. Perhaps the similarity in investment horizons and statutory holding periods reflects an influence of the tax incentives investigated in this study. However, even if the relation is simply coincidental, if investors tend to unload for nontax reasons around the long-term qualification date, taxes (as a secondary consideration) could affect the timing of substantial sales. In other words, if individuals pursue trading strategies that result in selling shares about one year after purchase, taxes could affect the timing of many sales with brief

delays to ensure long-term capital gain treatment for appreciated shares and slight accelerations to ensure short-term capital loss treatment for depreciated shares.

Second, the marginal tax rate applied to a capital gain and loss depends on complex rules concerning the netting of gains and losses. In his detail of these provisions (which are beyond the scope of this paper), Shackelford [2000] proves that, under current law, distinctions between long term and short term are relevant if and only if the selling shareholders' long-term capital gains equal or exceed their long-term capital losses and their short-term capital gains equal or exceed their short-term capital losses. Some individuals will not meet these conditions and thus face the same marginal tax rate, regardless of the holding period. However, the bull market during the 1980s and 1990s and inflation in earlier years (recall that taxes are assessed on nominal, not real, profits) have caused these conditions to hold for many investors during the investigation period. As an example, the Internal Revenue Service [1999a, 1999b] reports that in 1997 individuals in the maximum tax bracket (39.6%), who accounted for 61% of all net capital gains, reported $169 billion of long-term capital gains and only $5 billion of long-term capital losses, and $16 billion of short-term capital gains and only $8 billion of short-term capital losses.[5]

Third, a critical assumption throughout the model is that all investors are subject to the same tax. If the tax only applies to some investors, the outcome becomes unclear. Specifically, if the overweighted investors are not subject to tax, the holding-period incentive will not affect trading volume or share prices.

Currently in the United States, the personal tax is the only one with different capital gains tax rates depending on the holding period.[6] Thus, the long-term/short-term cusp is an ideal setting to investigate whether personal taxes affect equity trading because any tax reaction here must relate to individual taxes. However, it is difficult, if not impossible, to determine precisely the number of shares in a firm that are subject to the personal tax. The personal tax applies to the direct holdings of individuals and their investments in entities that flow through capital gains and losses, including mutual funds on personal account, partnership units, shares in S or limited liability corporations, and trusts in which the individual is a beneficiary. The personal tax does not apply to shares held by C corporations, pensions (including

[5] As an aside, the magnitude of these capital gains taxes serve as prima facie evidence rejecting claims that widespread tax evasion (see discussions in Poterba [1987] and Landsman, Shackelford, and Yetman [2002], among others) or tax avoidance (see discussions in Constantinides [1983, 1984], Stiglitz [1983], Shackelford [2000], Scholes et al. [2001], among others) renders capital gains taxes irrelevant for individual equity trading.

[6] Before 1987, corporations also enjoyed favorable long-term capital gains taxation. For example, from 1979 to 1986, the maximum statutory corporate long-term capital gains tax rate was 28% whereas other corporate taxable income was taxed at a maximum statutory tax rate of 46%.

individual retirement and 401(k) accounts), tax-exempt organizations, and foreign investors.

It is an empirical question whether the personal holding-period incentives are important enough in the aggregate to affect equity trading. However, it appears that among our sample firms enough shares are potentially subject to personal taxes that it is feasible to conjecture whether personal taxes affect trading. Among the earnings announcement (S&P 500) sample, we find that, on average, 38% (45%) of shares are held by institutions filing form 13-f: 24% (27%) by mutual funds, 8% (10%) by banks, 3% (4%) by insurers, and 3% (4%) by pensions.[7] Individuals presumably hold most of the remaining shares.

Moreover, as discussed later, because institutions are often holding shares for individual investors, the taxes triggered by institutional sales of stock often flow directly to personal income tax returns. Except for trades by pensions, which are never subject to capital gains taxation, institutional holdings that can be subject to personal taxation include street-name holdings, mutual funds, and trusts. Unfortunately, an inability to observe whether a firm's shares are subject to personal taxation thwarts attempts to incorporate the percentage of stock held by individuals as a discriminating factor in the analysis, a problem we revisit in section 7.

In summary, these three factors—the holding period approximates investment horizons, individuals' gains and losses mix in a way that creates a tax incentive, and personal taxes affect enough shares to matter—are additional necessary conditions for the holding-period incentive to affect equity trading. The data suggest that it is conceivable that all three conditions hold for a preponderance of investors and firms. However, if any of these conditions do not hold, we should not find a relation between holding-period incentives and equity trading.

4. Event Periods

We test the hypothesis that holding-period incentives affect equity trading using two unrelated public disclosures: quarterly earnings releases and additions to the S&P 500 index. By testing the hypotheses in two settings, we mitigate the possibility that the findings are spurious. If we find similar effects in both settings, our confidence in the results will be greatly enhanced. An advantage of these disclosures is that they have been studied extensively. The (nontax) determinants of equity trading around these disclosures are relatively well understood, which enables us to structure better tests.

The primary reason, however, that we focus on these two disclosures is that both are associated with extensive portfolio rebalancing. The unusually high level of trading activity and the well-documented tendency of prices to move

[7] All institutions managing more than $100 million in equity must file quarterly 13-f reports listing their equity holdings that are greater than 10,000 shares or $200,000 in market value.

in response to these disclosures should increase the pressure for individual investors to choose between an optimal risk strategy and an optimal tax strategy.

Unfortunately, no disclosure would provide a powerful event period for this study. Although trading surges are associated with both earnings releases and index changes, each day a few investors are at the short-term/long-term cusp. If capital gains tax incentives affect their trading decisions, they may accelerate or defer sales to reduce their taxes. Thus, some investor's holding-period incentive potentially drives prices away from fundamentals every day. Because any day's distortion is presumably temporary (i.e., prices revert toward fundamentals over time), prior days' tax effects affect today's price. If the influence is similar over all trading days, we could erroneously conclude that taxes do not matter, even if actual tax effects are material.

The opportunity that these two disclosures provide is the ability to specify *ex ante* unusually heavy trading days when tax effects might be greater than usual and thus detectable. However, any price movements attributed to capital gains taxes that we identify around these disclosures should be evaluated, relative to an ongoing, unobservable level of distortion, not as a measure of the absolute impact of holding-period incentives.

To summarize, if the holding-period incentives matter, they should affect prices and volume on all trading days. By looking at earnings announcements and index changes, we identify two events when these tax incentives should be particularly pronounced. However, any measure of tax distortion likely understates the actual impact because the measure is relative to an ongoing, unobservable level of distortion. As a result, this study could fail to find any influence because the added distortion from these disclosures is not sufficiently greater than the usual daily influences of capital gains taxes.[8]

5. *Quarterly Earnings Announcements Tests*

5.1 OVERVIEW

The empirical analysis begins with the earnings announcements, where we regress abnormal returns and abnormal volume on a measure of the

[8] An alternative approach would be to select a sample of trading days based on high volume and presume that information was released to the markets on those days. An advantage of this strategy is that although it would still face the same relative measurement problems, it ensures traders were active on the sample days and thus more likely to encounter risk-tax trade-offs. A disadvantage of this selection process is that it adds subjectivity to the sample selection. For example, if high volume were defined as the number of shares traded, the sample would include a disproportionate number of days with single, large institutional trades. If high volume were defined as the number of trades, the sample would include a disproportionate number of days with small, individual trades. To avoid these problems associated with identifying the sample based on *ex post* criteria, we choose the more objective, *ex ante* disclosure events. Another sample-selection approach would be to use high-volume trading days to identify the beginning of the holding period and then to investigate trading a year later (under current law) when a disproportionate number of investors presumably would face the short-term/long-term cusp. However, the same problems undermine this selection procedure.

difference in taxes under short-term treatment, compared with long-term treatment. When the dependent variable is abnormal returns, a positive coefficient on the incremental tax measure will be interpreted as evidence that the holding-period incentives increase stock returns when earnings are released. Consistent with expectations, we find a positive and statistically significant coefficient, although the significance level is modest given the large sample size.

When the dependent variable is abnormal volume, a negative coefficient on the incremental tax measure will be interpreted as evidence that the holding-period incentives decrease trading volume when earnings are released. Here we find a highly significant, negative coefficient, allaying some concerns about the return results. Further analysis shows that deferral of the sale of appreciated positions drives both price and volume findings.

5.2 SAMPLE

The sample begins with the 128,842 firm-quarters from 1984 to 1999 on the Center for Research in Security Prices (CRSP), Institutional Brokers Estimate System (IBES), and Compustat's industrial annual, full coverage, and research files that report the earnings announcement date. We delete firms from the final sample if data are missing (11,241), unexpected earnings are zero or the firm experienced no price change during the holding period (13,365), or earnings are negative (16,031).[9] We conduct the tests using the remaining sample of 88,205 observations.

5.3 VARIABLES

The dependent variable in the stock returns tests is a conventional measure in tests of price-earnings relations, the cumulative, buy-and-hold, market-adjusted return (*CAR*) for trading days $t-1$ and t, where day t is the earnings announcement date.[10] Table 1, which presents descriptive statistics for the primary regression variables, shows the mean (median) *CAR* is 0.38% (0.15%). The positive value for abnormal returns is likely attributable to unexpected earnings being positive, on average.

The dependent variable in the trading volume tests is abnormal volume (*AV*), which is actual trading volume less expected trading volume on days t and $t-1$. Actual trading volume on days t and $t-1$ is $\ln(1 +$ dollar volume on days t and $t-1)$ divided by $\ln(1 +$ dollar value of outstanding shares on days t and $t-1)$. Expected trading volume uses a similar ratio for the total market volume, adjusted with coefficients from a regression of firm i's actual

[9] The rationale for the screens is as follows: (1) Firms with zero unexpected earnings or neither appreciation nor depreciation during the holding period should have no price response and thus no tax distortion. (2) Hayn [1995] documents that profitable and loss firms have different earnings response coefficients and thus perhaps should not be evaluated together. However, results are qualitatively unaltered if these screens are ignored.

[10] Results are qualitatively unaltered when the dependent variable is the two-day, cumulative, buy-and-hold abnormal return using a market model where beta is estimated for the 100 days, ending 2 days before earnings are released.

TABLE 1

Descriptive Statistics for Selected Regression Variables Used in Tests of the Impact of Capital Gains on Stock Returns and Trading Volume Around 88,205 Quarterly Earnings Announcements from 1984 to 1999

Variable	Mean	Std Dev	1%	25%	Median	75%	99%
CAR	0.38	5.28	−14.12	−1.98	0.15	2.52	16.20
AV	1.67	5.73	−17.35	−0.89	1.35	4.09	17.89
DRATE ΔBASE*	0.025	0.096	−0.121	−0.006	0.003	0.038	0.361
DRATE	0.12	0.09	0.00	0.03	0.12	0.20	0.30
ΔBASE	0.20	0.61	−0.63	−0.11	0.10	0.35	2.36
HI_LTCG	0.67						
HI_LTCG ΔBASE*	0.13	0.46	−0.55	0.00	0.00	0.21	1.87
UE	0.05	0.70	−2.24	−0.13	0.04	0.19	3.70

CAR_{it} is 100 times firm i's two-day, cumulative, buy-and-hold, market-adjusted abnormal return, beginning on day $t-1$, where t is the day earnings are announced; AV_{it} is 100 times actual less expected trading volume on days t and $t-1$, where actual trading volume is the natural logarithm of 1 + the dollar volume on days t and $t-1$, divided by the natural logarithm of 1 + the dollar value of outstanding shares on days t and $t-1$, and expected trading volume uses a similar ratio for the market, adjusted with coefficients from a regression of firm i's actual trading volume on market volume for the 100 trading days immediately preceding day $t-1$ (see Ajinkya and Jain [1989], Lynch and Mendenhall [1997, p. 358]); $DRATE_t$ is the maximum statutory short-term capital gains tax rate less the maximum statutory long-term capital gains tax rate on day t; $\Delta BASE_{it}$ is the difference between firm i's stock price at day $t-2$, adjusted for stock splits and stock dividends, and its stock price at day $t-n$ where n is the number of days in the holding period on day t, divided by its stock price at day $t-n$; HI_LTCG_t is a categorical variable equaling 1 if day t is after 1986 and before May 7, 1997, and 0 otherwise; UE_{it} is 100 times the announced quarterly earnings for firm i on day t less the median IBES forecast within the 60 days before the earnings announcement, scaled by the share price at the end of the quarter for which earnings are released.

trading volume on market volume for the 100 trading days immediately preceding day $t-1$. (See Ajinkya and Jain [1989] and Lynch and Mendenhall [1997, p. 358] for a detailed discussion of the improved statistical properties associated with this measure of abnormal volume.) Mean (median) *AV* is 1.67% (1.35%).

A primary control variable is unexpected earnings (*UE*). Unexpected earnings are computed as reported quarterly earnings per share less the median forecast from the detailed IBES database within the 60 days preceding the release date, scaled by the firm's share price at the end of the quarter preceding the announcement.[11] Mean (median) *UE* is 0.05% (0.04%). A positive regression coefficient estimate is anticipated on *UE* in the returns regression, consistent with the well-documented positive correlation between abnormal returns and unexpected earnings.

5.4 TAX MEASURE

The ideal tax measure would capture the change in capital gains taxes, if any, that individual shareholders encounter if they sell shares when earnings are announced and face the short-term tax rate rather than sell in the future when the long-term rate applies. We cannot observe individual investors'

[11] Extreme values of *UE* are winsorized at the 1% and 99% levels to mitigate the influence of data errors.

TABLE 2
DRATE from 1978 to 1999

Date of Sale	Holding Period	Statutory Tax Rate for Gains on Sales of Shares Held Equal or Shorter Than Holding Period (A)	Statutory Tax Rate for Gains on Sales of Shares Held Longer Than Holding Period (B)	*DRATE*[a] (A)—(B)
1/1/78–10/31/78	12	70	35	35
11/1/78–6/9/81	12	70	28	42
6/10/81–12/31/81	12	70	20	50
1/1/82–12/23/84	12	50	20	30
12/24/84–6/22/85	6 or 12[b]	50	20	30
6/23/85–12/31/86	6	50	20	30
1987	6	38.5	28	10.5
1/1/88–1/1/89	6 or 12[c]	28	28	0
1/2/89–12/31/90	12	28	28	0
1991–1992	12	31	28	3
1/1/93–5/6/97	12	39.6	28	11.6
5/7/97–7/28/97	12	39.6	20	19.6
7/29/97–12/31/97	18	39.6	20[d]	19.6
1998–1999	12	39.6	20	19.6

[a]The change in marginal tax rate for an individual investor in the highest statutory tax rate when his investment qualifies for long-term capital gains tax treatment, if his total long-term capital gains exceed total long-term capital losses, and if his total short-term capital gains exceed total short-term capital losses.

[b]The holding period shifted from 12 to 6 months, effective for assets purchased after June 22, 1984. Thus, the holding period for property sold during this period varied depending on the acquisition date.

[c]The holding period shifted from 6 to 12 months, effective for assets purchased after December 31, 1987. Thus, the holding period for property sold during this period varied depending on the acquisition date.

[d]The long-term tax rate on property held more than 12 months, but less than 18 months, was 28%.

marginal tax rates, holding periods, or total portfolio of realized gains and losses, all of which are necessary to compute the ideal tax measure. Instead we employ a cruder measure, the product of a rate difference (*DRATE*) and a taxable base measure ($\Delta BASE$).

DRATE is the maximum federal short-term capital gains tax rate less the maximum federal long-term capital gains tax rate at disclosure.[12] Table 2 shows that *DRATE* is 30% from 1984 to 1987, 10.5% in 1987, 0 from 1988 to 1990, 3% from 1991 to 1992, 11.6% from 1993 to May 6, 1997, and 19.6% from May 6, 1997, through the investigation period.

$\Delta BASE$ is intended to capture the change in stock prices during the holding period. Specifically, it is the difference between the firm's stock price on day $t-2$, adjusted for stock splits and stock dividends, and its stock price

[12] Assuming individuals facing the holding-period incentive are in the top tax bracket seems reasonable based on the latest analysis of individual income tax returns (1997 returns) by the Statistics of Income (Internal Revenue Service [1999a, 1999b]). It finds that individuals in the maximum tax bracket (39.6%) accounted for 61% of all net capital gains (long-term and short-term capital gains less long-term and short-term capital losses). The percentage increases to 75% when individuals in the penultimate bracket (36%) are also considered.

at day $t-n$, where n is the number of days in the holding period on day t, divided by its stock price at day $t-n$. Table 2 shows that the holding period is one year throughout the investigation period, except June 23, 1985, through June 30, 1988, when it is 6 months, and July 29, 1997, through December 31, 1997, when it is 18 months.[13] For example, $\Delta BASE$ for earnings released on April 3, 1990, is a firm's stock price on April 1, 1990 (day $t-2$), less the stock price on April 3, 1989 (one year earlier), expressed as a percentage of the April 3, 1989, price.

This duration is selected because the difference between long-term and short-term rates is most relevant for investors who are nearest long-term qualification at the earnings announcement. Thus, $\Delta BASE$ is computed as though the marginal investor is an individual who has held the stock for precisely one day less than necessary to obtain long-term capital gains tax treatment. Such an individual would have the greatest incentive to postpone the sale of an appreciated stock to garner long-term capital gains treatment or accelerate the sale of a depreciated share to ensure short-term capital loss treatment. Mean (median) $\Delta BASE$ is 20% (10%) with a standard deviation of 61%. Of the sample, 62% report appreciation during the holding period.

The primary variable of interest in this study is the product of *DRATE* and $\Delta BASE$. Its mean (median) is 2.5% (0.3%) with a standard deviation of 9.6%. As mentioned in the introduction, this incremental tax cost measure has one major weakness and one major strength. Its weakness is that it is noisy with imprecise components that rely on various assumptions detailed earlier. Its strength is that it is unlikely to be correlated with any other determinant of the price-earnings relation. By interacting tax rate spreads that range across time from 0% to 30% with firm-specific changes in stock prices over the last 6 to 18 months, the tax measure should avoid specification concerns arising from omitted correlated variables. As a result, if the coefficient on the tax measure is statistically significant, it will be difficult to construct an alternative explanation for the results.

We predict a positive coefficient on $DRATE^{*}\Delta BASE$ when the dependent variable is abnormal returns. A positive coefficient suggests tax considerations boost (decrease) prices when shareholders are selling appreciated (depreciated) stock. A negative coefficient is expected for $DRATE^{*}\Delta BASE$

[13] Throughout the investigation period, the long-term capital gains holding period is determined by the date of sale, with one exception. The holding period is 6 months for assets purchased after June 22, 1984, and before January 1, 1988. Therefore, it is unclear whether investments sold from December 24, 1984, through June 22, 1985, face the new 6-month holding period or the prior 12-month holding period. We assume a 12-month holding period; however, results are qualitatively insensitive to assuming a 6-month holding period. Similarly, sales during the first half of 1988 may have faced either a 6-month holding period or a 12-month holding period. Because no sale during the first half of 1988 could have qualified for long-term treatment unless it had been purchased before 1988 and held for at least 6 months, we assume a 6-month holding period for all sales in the first half of 1988; however, results are qualitatively insensitive to assuming a 12-month holding period.

when the dependent variable is abnormal volume. A negative coefficient suggests equity constricts (expands) when shareholders are selling appreciated (depreciated) stock.

Both *DRATE* and $\Delta BASE$ are independently included in the regression without prediction for the sign of their coefficients to ensure that the coefficient on the interaction is not capturing a separate effect of either component. Without these controls, it is possible that the coefficient on the variable of interest (*DRATE*$^*\Delta BASE$) could be erroneously interpreted.

For example, prior studies (e.g., Lo and MacKinlay [1988], Jegadeesh and Titman [1993], and Raedy [2000]) document various microstructure effects, such as momentum and reversal, that link current and past returns. If the regression model excludes the separate variable of $\Delta BASE$ and only includes $\Delta BASE$ as part of the interaction, the coefficient on *DRATE*$^*\Delta BASE$ will capture these microstructure effects plus any tax effects. By including $\Delta BASE$ as a separate regressor, we ensure that the microstructure effects load on the $\Delta BASE$ coefficient and do not affect the interaction's coefficient.

Alternatively stated, by including both *DRATE* and $\Delta BASE$ in the regression, we allay concerns that an unspecified nontax trading effect that varies with changes in capital gains taxation or with recent price changes is an omitted correlated variable that affects the coefficient on *DRATE*$^*\Delta BASE$. If such nontax effects exist, their price or volume effects should load on the *DRATE* coefficient or on the $\Delta BASE$ coefficient. As a result, the coefficient on *DRATE*$^*\Delta BASE$ will only capture the incremental effects arising in the interaction of *DRATE* and $\Delta BASE$. In short, the research design rules out many possible omitted correlated variables and provides assurance that the interaction coefficient captures only tax effects.

5.5 ANOTHER TAX EFFECT

In Shackelford and Verrecchia's [2002] model, investors face two choices—sell in period 2 (short term) or liquidate in period 3 (long term). In reality, a third option is available to individual investors. Individuals could hold shares until death and avoid all capital gains taxes. Thus, investors can sell short term, sell long term, or not sell. *DRATE* is designed to capture the cross-temporal differences in tax rates between the two sale options. We now introduce another explanatory variable to the regression to control for the cross-temporal difference in tax rates between selling long term or holding until death.

During the period examined in this study, the tax rate at death is always zero and the long-term capital gains tax rate is either 20% or 28%. Thus, we employ a categorical variable (*HI_LTCG*) equaling 1 if the long-term capital gains tax rate is 28% (1987 through May 6, 1997) and 0 otherwise. Two-thirds of the observations are drawn from periods when the long-term capital gains tax rate is 28%. No prediction is advanced for the sign of the coefficient on *HI_LTCG*. Because the incentive to hold until death increases with appreciation, we also interact *HI_LTCG* with $\Delta BASE$. The coefficient

on this interaction is expected to be positive (negative) when the dependent variable is abnormal returns (abnormal volume), consistent with the notion that the incentive to hold stock until death is greater when the long-term capital gains tax rate is larger.

5.6 VARIOUS PRICE-EARNINGS DETERMINANTS

As mentioned earlier, we expect that $DRATE^{*}\Delta BASE$ is poorly correlated with other variables because of its unusual amalgamation of tax rates, past stock price movements, and holding-period durations. Nevertheless, to ensure the robustness of the results, some tests include additional control variables (which are listed later) drawn from the literature that relates prices and earnings.[14] Besides including the variables separately in the regression, each, except *NONLINEAR*, is also interacted with unexpected earnings (*UE*). As expected, they have minimal effect on the coefficient of interest. The additional control variables and their predicted signs when the dependent variable is abnormal returns are as follows:

- *NONLINEAR* is designed to address concerns that extreme values of unexpected earnings are less value relevant. It is computed as $UE^{*}|UE|$, consistent with Lipe, Bryant, and Widener [1998]. Its coefficient is predicted to be negative, implying extreme values are less value relevant.
- *PREDICT* is intended to control for Lipe's [1990] finding that firms with more predictable earnings patterns have higher earnings response coefficients. It is the mean of the absolute values of *UE* across the investigation period and constant across all years for a firm. The coefficient on $UE^{*}PREDICT$ is expected to be negative, consistent with less predictable earnings being less value relevant.
- *PERSIST* is motivated by findings that persistence explains cross-sectional differences in earnings response coefficients (e.g., Easton and Zmijewski [1989]). It is the autoregressive coefficient from Foster's [1977] time-series model and is constant across all years for a firm. When it interacts with *UE*, its coefficient is expected to be positive, consistent with market recognition that earnings shocks manifest themselves in the future.
- *MTB* is motivated by Collins and Kothari's [1989] report that share prices are increasing in anticipated earnings growth. It is market value divided by book value as of the last day of the preceding fiscal

[14] Besides robustness checks that segregate the sample between appreciated and depreciated firms, we employ no controls for behavioral effects concerning trading and security pricing that have been identified in recent finance studies (e.g., Odean [1998], Barber and Odean [2000], Shleifer [2000]). The fact that we find relations between equity trading and tax incentives provides some assurance that the deleterious effects of ignoring behavioral considerations are limited. We look forward to studies that integrate the behavioral finance papers that fail to find investor-tax rationality with studies, such as this one, that do find tax-rational behavior.

quarter. The coefficient on its interaction with *UE* is expected to be positive.

- *BETA* is designed to control for the effects of risk on the price-earnings relation. Consistent with Easton and Zmijewski [1989], it is the market model beta estimated over the 100 trading days that end 2 days before the announcement date. Its coefficient on its interaction with *UE* is expected to be negative.
- *SIZE* is included to be consistent with prior research (e.g., Atiase [1985], Easton and Zmijewski [1989]). It is the natural logarithm of the market value of equity at the end of the quarter preceding the earnings release. No sign is predicted for the coefficient on its interaction with *UE* because size serves as a proxy for various constructs in the literature.

When these additional price-earnings determinants are included in the regression analysis, data are missing for 10,815 firms, leaving a subset of 77,390 observations.

5.7 STOCK RETURN RESULTS

Table 3 presents summary statistics from regressions of abnormal returns on the tax measure and various controls. The first column in table 3 presents results from regressing abnormal returns on the tax measure and its components, *HI_LTCG* and its interaction, and *UE*.[15] As predicted, the coefficient on $DRATE^{*}\Delta BASE$ is positive (2.33) and statistically significant (*t*-statistic of 2.4).

The next three columns confirm expectations that the tax variable is robust to model specifications. The second column shows that the tax results are virtually unchanged when the 11 price-earnings determinants are included. The tax coefficient is 2.50 with a *t*-statistic of 2.5. When categorical variables for each year are included in the regression, the tax coefficient declines to 1.70 with a *t*-statistic of 1.7, as seen in the third column results. (*HI_LTCG* is dropped from this test to enable the matrix to invert.) However, when the price-earnings variables are added to the model with the year indicator variables, the coefficient on $DRATE^{*}\Delta BASE$ rebounds to 2.42 with

[15] Throughout the paper, if the null hypothesis of correct model specification under White's [1980] test is rejected at the .01 level, the reported standard errors are computed using White's consistent covariance matrix estimation to correct for an unspecified form of heteroskedasticity. However, the results are qualitatively unaltered if ordinary least squares standard errors are always used. In addition, the empirical results do not appear to suffer from cross-sectional dependence for two reasons. First, by examining returns from two-day windows, we avoid the cross-sectional dependence problems typically associated with long windows, such as one quarter or one year (Bernard [1987]). Second, cross-sectional dependence problems typically cluster in intra-industry analysis as opposed to inter-industry analysis (Bernard [1987]). The sample in this study includes 269 three-digit Standard Industrial Classification (SIC) codes; only 8 of which represent more than 2% of the sample. Furthermore, when we exclude firms that announce earnings on the same day as three or more firms in their three-digit SIC, results are qualitatively unchanged. On the other hand, tests indicate that multicollinearity is a slight econometric problem, causing inflated standard errors.

TABLE 3

Ordinary Least Squares Coefficient Estimates (t-statistics) for Tests of the Impact of Capital Gains on Stock Returns Around Quarterly Earnings Announcements from 1984 to 1999

Variable	Predicted	All Obs	All Obs	All Obs	All Obs	Apprec ($\Delta BASE > 0$)	Deprec ($\Delta BASE < 0$)
Intercept		1.00	1.79	−3.24	−1.88	0.52	0.48
		(10.3)	(12.3)	(−6.4)	(−3.5)	(3.8)	(2.1)
DRATE* ΔBASE	**(+)**	**2.33**	**2.50**	**1.70**	**2.42**	**1.47**	**5.05**
		(2.4)	**(2.5)**	**(1.7)**	**(2.3)**	**(1.2)**	**(1.1)**
DRATE		−2.73	−2.52	9.42	9.03	−1.58	−2.33
		(−7.6)	(−6.9)	(5.6)	(5.2)	(−3.0)	(−2.5)
ΔBASE		−0.55	−0.68	−0.48	−0.70	−0.16	−3.51
		(−2.7)	(−3.0)	(−2.3)	(−3.0)	(−0.6)	(−3.0)
HI_LTCG		−0.54	−0.56			−0.18	−0.29
		(−6.8)	(−6.7)			(−1.7)	(−1.4)
HI_LTCG ΔBASE*		0.50	0.42	0.44	0.41	0.24	2.07
		(3.3)	(2.5)	(2.8)	(2.4)	(1.3)	(2.2)
UE		1.24	4.37	1.24	4.29	1.27	1.21
		(34.9)	(21.5)	(35.0)	(21.1)	(29.1)	(22.3)
NONLINEAR			−0.90		−0.88		
			(−27.3)		(−26.5)		
PREDICT			−0.49		−0.25		
			(0.9)		(−0.5)		
PERSIST			0.0007		0.0014		
			(1.5)		(3.0)		
MTB			0.0026		0.0025		
			(3.2)		(3.2)		
BETA			0.21		0.22		
			(5.4)		(5.6)		
SIZE			−0.14		−0.16		
			(−10.4)		(−11.6)		
UE PREDICT*			0.15		0.11		
			(0.3)		(0.3)		
UE PERSIST*			0.0014		−0.0000		
			(0.0)		(−0.0)		
UE MTB*			0.0070		0.0068		
			(3.5)		(3.5)		
UE BETA*			0.30		0.30		
			(3.9)		(3.9)		
UE SIZE*			−0.25		−0.24		
			(−8.4)		(−8.2)		
Year dummies?		no	no	yes	yes	no	no
Adj R^2		0.03	0.05	0.03	0.05	0.03	0.03
N		88,205	77,390	88,205	77,390	55,061	33,144

Dependent variable is CAR_{it}, 100 times firm i's two-day, cumulative, buy-and-hold, market-adjusted abnormal return, beginning on day $t-1$, where t is the day earnings are announced. Explanatory variables are as follows: $DRATE_t$ is the maximum statutory short-term capital gains tax rate less the maximum statutory long-term capital gains tax rate on day t; $\Delta BASE_{it}$ is the difference between firm i's stock price at day $t-2$, adjusted for stock splits and stock dividends, and its stock price at day $t-n$, where n is the number of days in the holding period on day t, divided by its stock price at day $t-n$; HI_LTCG_t is a categorical variable equaling 1 if day t is after 1986 and before May 7, 1997, and 0 otherwise; $NONLINEAR_{it}$ is $UE_{it}{}^*|UE_{it}|$; $PREDICT_i$ is the average of the absolute values of UE for firm i across the investigation period; $PERSIST_i$ is the autoregressive coefficient from Foster's [1977] time-series model; MTB_{it} is firm i's market value divided by book value as of the last day of the fiscal quarter including day t; $BETA_{it}$ is firm i's market model beta estimated over the 100 trading days that end day $t-2$; $SIZE_{it}$ is firm i's natural logarithm of the market value of equity at the end of the quarter preceding day t; UE_{it} is 100 times the announced quarterly earnings for firm i on day t less the median IBES forecast within the 60 days before the earnings announcement, scaled by the share price at the end of the quarter for which earnings are released. A positive coefficient for the tax measure ($DRATE_{t+1}{}^*\Delta BASE_{it}$) is consistent with individual investors shifting to buyers their incremental capital gains taxes associated with selling property following an earnings announcement.

a *t*-statistic of 2.3. In short, the tax variable remains significant at the .05 level (one-tailed test) regardless of the set of control variables. This confirms our expectation that omitted correlated variables likely do not affect the magnitude and significance of the tax variable. For parsimony, we use the model in the first column of table 3 to conduct the remaining tests of share returns.

Although significant at conventional levels, the statistical significance of the tax coefficient is modest, given the sample size. Although this dampens inferences from these initial findings, it is not surprising that the result is less than overwhelming. As discussed earlier, the tax measure is noisy, taxes are not expected to be the dominant trading consideration, few investors stand precisely at the long-term/short-term cusp, and we measure relative (not absolute) tax distortion. However, because the tax measure is an unusual amalgamation of rates, price changes, and holding periods, it is difficult to construct an alternative explanation for the findings. Consequently, we cautiously conclude that these findings provide initial evidence that holding periods affect stock prices around earnings announcements and look to the remaining tests for assurances about this inference. (For example, the upcoming trading volume results are stronger and allay some of these concerns.)

The regression coefficients enable rough approximations of economic significance. For example, the product of the $DRATE^{*}\Delta BASE$ coefficient estimate of 2.33 (in the first column) and its mean value of 0.025 implies that capital gains tax effects account for abnormal returns of 0.058%, or 15% of the observed two-day *CAR*, on average. A one standard deviation increase in the tax variable increases two-day, cumulative abnormal returns by 0.22 percentage points, a 58% increase in abnormal returns for the mean firm.[16]

Examining the other regression coefficient estimates, we find the coefficient on *UE* is positive and highly significant, as expected. The coefficient on $HI\_LTCG^{*}\Delta BASE$ is positive, as predicted, consistent with the incentive to hold stock until death being greater when the long-term capital gains tax rate is larger. No predictions were advanced for the signs of the other coefficients. However, we find that the coefficients on *DRATE*, $\Delta BASE$, and *HI_LTCG* are negative. *DRATE* is sensitive to the model specification, switching signs when year indicator variables are used, which is not surprising because *DRATE* may capture some nontax differences across years, when the indicator variables are excluded.

The third hypothesis asserts that appreciated stock is more likely to be managed for capital gains purposes than depreciated stock for capital loss purposes. Reasons include capital loss deductions being limited to $3000 annually; investors being able to realize tax-favored, short-term capital losses at any time before the qualification date whereas tax-favored, long-term

[16] The 0.22 percentage points are the product of $DRATE^{*}\Delta BASE$'s standard deviation of 0.096 and its regression coefficient estimate of 2.33. The 58% is the 0.22 percentage points divided by the mean *CAR* of 0.38.

capital gains cannot be realized until qualification has occurred; and behavioral finance findings that shareholders are not tax rational with depreciated stock.

The final two columns in table 3 provide the regression results for appreciated and depreciated stock, respectively. Although the tax coefficient is larger for the depreciated stock regression (5.05 vs. 1.47), the statistical significance of the two coefficients is nearly identical (*t*-statistics of 1.2 for appreciated shares and 1.1 for depreciated shares).[17] Based solely on the market reaction around the earnings announcement, we have no evidence that investors undertake more extensive tax planning for appreciated stock than for depreciated stock.[18]

5.8 PRICE REVERSION

If prices move because holding-period incentives create a temporary equity constriction or expansion, prices should revert to original levels at some point. As prices revert, the tax coefficient should shrink to zero, indicating that the initial effects of capital gains tax incentives on prices have reversed. Failure to attain reversal would raise doubts that the findings in Table 3 are attributable to the hypothesized tax incentives. However, a reversal might not occur immediately because it may take time for investors to disentangle price movements attributable to capital gains tax distortion from price movements for other reasons at the earnings release.

Unable to specify *ex ante* the reversal period, we test for a rebound by reestimating the parsimonious model using cumulative abnormal returns from trading day $t-1$ through several days following the quarterly earnings announcement. Table 4 shows that the magnitude of the $DRATE^{*}\Delta BASE$ coefficient estimate for the cumulative abnormal returns peaks on the 4th trading day after the earnings announcement at 3.20 (*t*-statistic of 2.2). The following day is the last one in which the coefficient is significantly greater than zero (using a one-tailed test). By the 12th day after the earnings release, the coefficient is negative, though not significantly different from zero. We conclude from these results that prices reverse within the first couple of weeks following the earnings announcement. As an aside, this result implies that a consequence of the current capital gains tax policy is an increase in market volatility.

When we segregate the reversal tests between appreciated and depreciated shares, we find that the reversal pattern for the appreciated stocks is

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[17] Note that the sign of the tax coefficient for both regressions should be positive. If $DRATE^{*}\Delta BASE$ is positive, we predict positive abnormal returns. If $DRATE^{*}\Delta BASE$ is negative, we predict negative abnormal returns.

[18] We also computed a regression with all observations to test statistically the difference in these two coefficients. We used an indicator variable equal to 1 if the security was appreciated. We included the indicator variable in the model separately as well as interacted with $\Delta BASE$, $HI\_LTCG^{*}\Delta BASE$, and $DRATE^{*}\Delta BASE$. The tax variable coefficient is not significantly different between the appreciated and depreciated firms.

TABLE 4

Ordinary Least Squares Coefficient Estimates (t-statistics) from Tests of the Impact of Capital Gains on Stock Returns, Cumulative from the Last Trading Day Before Earnings Announcements from 1984 to 1999

Cumulative Trading Days $t-1$ Through:	Intercept	*DRATE*ΔBASE*	*(t-statistic)*	*DRATE*	*ΔBASE*	*HI_LTCG*	*HI_LTCG* ΔBASE*	*UE*
$t-1$	0.53*	**0.89**	**(1.4)**	−1.49*	−0.17	−0.30*	0.25*	0.49*
t	1.00*	**2.33**	**(2.4)***	−2.73*	−0.55*	−0.54*	0.50*	1.24*
$t+1$	1.22*	**1.87**	**(1.6)**	−3.27*	−0.49	−0.70*	0.33	1.60*
$t+2$	1.34*	**2.84**	**(2.2)***	−3.71*	−0.87*	−0.79*	0.48*	1.65*
$t+3$	1.31*	**2.42**	**(1.8)**	−3.67*	−0.93*	−0.80*	0.49*	1.64*
$t+4$	1.43*	**3.20**	**(2.2)***	−4.28*	−1.07*	−0.89*	0.52*	1.65*
$t+5$	1.37*	**2.78**	**(1.9)**	−4.08*	−1.00*	−0.82*	0.43	1.68*
$t+6$	1.38*	**1.93**	**(1.2)**	−3.98*	−0.87*	−0.81*	0.40	1.72*
$t+7$	1.36*	**1.15**	**(0.7)**	−3.81*	−0.68	−0.78*	0.25	1.76*
$t+8$	1.44*	**1.12**	**(0.7)**	−3.98*	−0.69	−0.84*	0.26	1.79*
$t+9$	1.47*	**0.77**	**(0.4)**	−4.15*	−0.55	−0.84*	0.14	1.84*
$t+10$	1.43*	**0.44**	**(0.2)**	−4.03*	−0.45	−0.78*	0.11	1.87*
$t+11$	1.44*	**0.44**	**(0.2)**	−4.10*	−0.40	−0.76*	0.07	1.89*
$t+12$	1.41*	**−0.09**	**(−0.0)**	−4.02*	−0.28	−0.72*	0.06	1.94*

Dependent variable is CAR_{it+m}, 100 times firm i's cumulative, buy-and-hold, market-adjusted abnormal return from day $t-1$ through day $t+m$, where t is the day earnings are announced and the m is the number of days before or after day t. Explanatory variables are as follows: $DRATE_t$ is the maximum statutory short-term capital gains tax rate less the maximum statutory long-term capital gains tax rate on day t; $\Delta BASE_{it}$ is the difference between firm i's stock price at day $t-2$, adjusted for stock splits and stock dividends, and its stock price at day $t-n$ where n is the number of days in the holding period on day t, divided by its stock price at day $t-n$; HI_LTCG_t is a categorical variable equaling 1 if day t is after 1986 and before May 7, 1997, and 0 otherwise; UE_{it} is 100 times the announced quarterly earnings for firm i on day t less the median IBES forecast within the 60 days before the earnings announcement, scaled by the share price at the end of the quarter for which earnings are released. A positive coefficient for the tax measure ($DRATE_{t+1}{}^*\Delta BASE_{it}$) immediately following an earnings announcement is consistent with individual investors shifting to buyers their incremental capital gains taxes associated with selling property. A coefficient for the tax measure ($DRATE_{t+1}{}^*\Delta BASE_{it}$) reverting toward zero in the days following an earnings announcement is consistent with temporary price pressure.

*Significant at the .05 level, using a two-tailed test.

similar to the reversal pattern reported in table 4 for all shares but that the reversal pattern for the depreciated stocks is different. For the appreciated shares only (results are not tabulated), the magnitudes of the coefficient increase in the days immediately following the earnings announcement, peaking at 1.98 on trading day $t+3$, although still not significant (t-statistic of 1.1). They then fall precipitously after trading day $t+5$ with a negative coefficient on *DRATE*ΔBASE* appearing first on trading day $t+8$.

Conversely, we detect no such attrition pattern for the depreciated securities. The coefficient on *DRATE*ΔBASE* never turns negative. In fact, it increases during most of the days following the announcement. Twenty days after the earnings announcement, the coefficient remains positive and is now significantly greater than zero. Although the initial reaction to the tax variables was similar for appreciated and depreciated securities (see table 3),

the reversal patterns are different. From these differences, we conclude that the returns regressions are not detecting a holding-period influence among the depreciated securities. Any tax effect in the returns regressions appears to arise from the deferral of the sale of appreciated shares until gains qualify for long-term capital gains treatment.

Finally, assume that we are detecting a rapid reversal to the compensation for incremental short-term capital gains taxes. Why do buyers purchase shares around the disclosure at a premium if prices reverse soon afterward? Why not wait until the reversal is complete and then buy the shares? We have pondered these questions ourselves and do not have a fully satisfactory answer. We can only infer from the findings that at least some buyers (enough to move the market) must believe that the compensation to attract sellers (i.e., higher prices) is less costly than holding an inappropriately weighted portfolio, even for a few days.

However, the price movements and trading behavior that we detect here are not unique. Besides Poterba and Weisbenner [2001] and Reese [1998], similar price pressures and reversal patterns are documented following large price declines (e.g., Bremmer and Sweeney [1991], Cox and Peterson [1994]), reports in the business press (e.g., Liang [1999]), changes in tax policy (e.g., Guenther [2000], Blouin, Raedy, and Shackelford [2002]), and additions to the S&P 500 index (e.g., Harris and Gurel [1986], Lynch and Mendenhall [1997]).

5.9 SENSITIVITY TESTS

The results are robust to a battery of tests. First, suppose the results for $DRATE^{*}\Delta BASE$ hold regardless of the holding period used to compute $\Delta BASE$. If this were the case (for some unspecified reason), the findings do not relate to the hypothesized tax effects. To test this possibility, we redefine $\Delta BASE$ as the change in price for the year preceding the applicable holding period (e.g., if the requisite holding period is one year, we use months $t-24$ through $t-13$) and reestimate the regression equations. Consistent with expectations, using this alternative specification, the coefficient on $DRATE^{*}\Delta BASE$ has the wrong sign, although not significantly different from zero (-1.42 with a t-statistic of -1.8). This compares with the coefficient of 2.33 with a t-statistic of 2.4 in the first column of table 3. This failure to replicate the results using price changes from a "wrong" period is particularly reassuring because the price movements during the holding period are the only ones that can be price relevant if hypothesized tax effects matter.

Second, we segregate the sample into three periods based on the spread between short-term and long-term capital gains tax rates—(1) when *DRATE* is 0 or 3 (1988–1992), (2) when *DRATE* is greater than 10 and less than 20 (1987, 1993–1999), and (3) when *DRATE* is 30 (1984–1986)—and limit the explanatory variables to $\Delta BASE$ and *UE*. If capital gains tax incentives affect returns, the coefficient on $\Delta BASE$ should be greater in regimes with

larger *DRATE*.[19] Consistent with this expectation, the coefficient on ΔBASE is only significant when *DRATE* is 30. Moreover, when *DRATE* is 30, the tax coefficient is ten-fold its value when *DRATE* is 0 or 3.[20]

Third, an individual's marginal tax rate for capital gains and losses is determined annually. Thus, tax planning could become more precise as individuals near year-end. Inferences, however, are qualitatively unchanged when disclosures in December are deleted from the study and when disclosures in October, November, and December are deleted from the study.

These sensitivity checks were conducted for all the tests in the study, including those detailed next. For brevity's sake, however, we do not discuss the results of those tests. Nevertheless, inferences hold throughout the paper using these alternative specifications.

5.10 TRADING VOLUME RESULTS

Recall that Shackelford and Verrecchia [2002] predict both a price response and a trading volume response to holding-period incentives. Failure to detect a volume response around earnings announcements will raise doubts about our interpretations of the results in tables 3 and 4.

Table 5 presents estimated coefficients from the trading volume regression. The regressions are structured identically to the returns regressions reported in table 3.[21] As expected and consistent with the stock return regression results, the first column in table 5 shows that the coefficient on $DRATE^{*}\Delta BASE$ is negative (−4.12) and significant (*t*-statistic of −5.1) using the parsimonious model. This finding suggests holding-period incentives cause individual shareholders to alter the supply of equity. The stronger statistical significance of the volume results allays concerns arising from the modest significance found in the share returns regressions. The regression coefficient estimate implies that a 1-standard-deviation increase in $DRATE^{*}\Delta BASE$ decreases two-day cumulative abnormal volume by 23% for the mean firm.[22]

The second, third, and fourth columns of table 5 report results using the price-earnings determinants and year indicator variables. When both

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[19] One reason this design could fail to detect a holding-period influence is that it ignores variation in the spread between long-term capital gains tax rates and tax exemption by holding shares until death (as addressed in the primary specification by including the interaction of $HI\_LTCG^{*}\Delta BASE$).

[20] We also tested all three periods in one model with indicator variables for the different periods. The coefficient on $\Delta BASE$ is significantly greater for the third period than for the other two periods.

[21] The price-volume relation is not as well understood as the price-earnings relation. Consequently, we generally rely on the price-earnings relation to guide our tests of trading volume. However, to test whether asymmetric volume responses to price increases versus price decreases (Karpoff [1987], Bamber and Cheon [1995]) affect the conclusions in this study, we add a categorical variable indicating the sign of the two-day raw return surrounding the earnings announcement as an explanatory variable to trading volume tests. Inferences are unaltered.

[22] The product of $DRATE^{*}\Delta BASE$'s regression coefficient estimate of −4.12 and its standard deviation of 0.096 divided by mean *AV* of 1.67 is 23%.

TABLE 5

Ordinary Least Squares Regression Coefficient Estimates (t-statistics) for Tests of the Impact of Capital Gains on Trading Volume Around Quarterly Earnings Announcements from 1984 to 1999

Variable	Predicted	All Obs.	All Obs.	All Obs.	All Obs.	Apprec ($\Delta BASE > 0$)	Deprec ($\Delta BASE < 0$)
Intercept		0.73	3.87	0.59	3.61	0.80	0.34
		(7.2)	(24.3)	(1.2)	(7.5)	(5.5)	(1.3)
DRATE* ΔBASE	**(−)**	**−4.12**	**−3.34**	**−3.07**	**−2.48**	**−4.70**	**−0.42**
		(−5.1)	**(−4.1)**	**(−3.7)**	**(−3.0)**	**(−4.6)**	**(−0.1)**
DRATE		2.39	1.69	3.25	2.28	2.37	3.45
		(5.9)	(4.2)	(2.0)	(1.5)	(3.9)	(3.4)
ΔBASE		1.15	1.18	0.91	0.97	1.21	0.00
		(6.9)	(6.9)	(5.4)	(5.6)	(5.7)	(0.0)
HI_LTCG		0.77	0.59			0.68	0.79
		(9.8)	(7.7)			(6.1)	(3.8)
HI_LTCG ΔBASE*		−0.13	−0.18	−0.01	−0.09	−0.12	−0.58
		(−1.2)	(−1.6)	(−0.1)	(−0.8)	(−0.9)	(−0.8)
UE		0.35	1.67	0.36	1.68	0.52	0.20
		(9.7)	(7.4)	(10.0)	(7.5)	(10.1)	(5.3)
NONLINEAR			−0.16		−16.9		
			(−5.2)		(−5.4)		
PREDICT			−0.14		−0.02		
			(0.3)		(−0.1)		
PERSIST			0.0003		0.0001		
			(0.5)		(0.2)		
MTB			0.0013		0.0014		
			(2.4)		(2.4)		
BETA			0.07		0.07		
			(2.3)		(2.0)		
SIZE			−0.48		−0.47		
			(−31.8)		(−30.5)		
UE PREDICT*			−0.42		−0.43		
			(−1.5)		(−1.6)		
UE PERSIST*			0.0003		0.0003		
			(0.4)		(0.3)		
UE MTB*			0.0026		0.0027		
			(1.9)		(1.9)		
UE BETA*			0.036		0.034		
			(0.6)		(0.6)		
UE SIZE*			−0.18		−0.18		
			(−6.3)		(−6.2)		
Year dummies?		no	no	yes	yes	no	no
Adj R^2		0.01	0.03	0.01	0.03	0.01	0.00
N		88,205	77,390	88,205	77,390	55,061	33,144

Dependent variable is AV_{it}, 100 times actual less expected trading volume on days t and $t-1$, where actual trading volume is the natural logarithm of 1 + the dollar volume on days t and $t-1$, divided by the natural logarithm of 1 + the dollar value of outstanding shares on days t and $t-1$, and expected trading volume uses a similar ratio for the market, adjusted with coefficients from a regression of firm i's actual trading volume on market volume for the 100 trading days immediately preceding day $t-1$ (see Ajinkya and Jain [1989], Lynch and Mendenhall [1997, p. 358]). Explanatory variables are as follows: $DRATE_t$ is the maximum statutory short-term capital gains tax rate less the maximum statutory long-term capital gains tax rate on day t; $\Delta BASE_{it}$ is the difference between firm i's stock price at day $t-2$, adjusted for stock splits and stock dividends, and its stock price at day $t-n$, where n is the number of days in the holding period on day t, divided by its stock price at day $t-n$; HI_LTCG_t is a categorical variable equaling 1 if day t is after 1986 and before May 7, 1997, and 0 otherwise; $NONLINEAR_{it}$ is $UE_{it}{}^*|UE_{it}|$; $PREDICT_i$ is the average of the absolute values of UE for firm i across the investigation period; $PERSIST_i$ is the autoregressive coefficient from Foster's [1977] time-series model; MTB_{it} is firm i's market value divided by book value as of the last day of the fiscal quarter including day t; $BETA_{it}$ is firm i's market model beta estimated over the 100 trading days that end day $t-2$; $SIZE_{it}$ is firm i's natural logarithm of the market value of equity at the end of the quarter preceding day t; UE_{it} is 100 times the announced quarterly earnings for firm i on day t less the median IBES forecast within the 60 days before the earnings announcement, scaled by the share price at the end of the quarter for which earnings are released. A negative coefficient for the tax measure ($DRATE_{t+1}{}^*\Delta BASE_{it}$) is consistent with equity constricting with the incremental capital gains taxes associated with individuals selling property following an earnings announcement.

additional control groups are used, the coefficient on *DRATE**Δ*BASE* declines to −2.48 but remains significant with a *t*-statistic of −3.0. Again, we conclude that the significance of the tax coefficient is not particularly sensitive to the other control variables in the regression.

The last two columns in table 5 are designed to test whether capital gains tax incentives differ between appreciated and depreciated securities. We anticipate that our tests will find that constriction of equity by holders of appreciated stock is more pronounced than equity expansion by depreciated stockholders for the reasons detailed earlier. Consistent with expectations, we find that the trading volume results are driven solely by appreciated stocks. The tax coefficient for the appreciated subset is −4.70 (*t*-statistic of −4.6), whereas the tax coefficient is only −0.42 (*t*-statistic of −0.1) for the depreciated subset.

It is possible that the coefficient on *DRATE**Δ*BASE* is always significant in the volume tests (for some unspecified reason). If so, we could erroneously infer that the findings are attributable to personal tax incentives. To test this possibility, we repeat the regression (specified in the first column) for individual trading days. Untabulated results indicate that the tax coefficient is −3.38 with a *t*-statistic of −3.3 on trading day *t*−1, and it is −4.80 with a *t*-statistic of −5.1 on trading day *t*. It then gradually decreases in magnitude and significance. *DRATE**Δ*BASE* coefficients (*t*-statistic) are −2.75 (−2.9) on trading day *t*+1, −2.60 (−2.7) on trading day *t*+2, and −1.90 (−2.0) on trading day *t*+3. This pattern is consistent with increased trading during the reversal period.

On trading day *t*+4, the tax coefficient is no longer significant, with a coefficient of −0.89 and a *t*-statistic of −0.9. *DRATE**Δ*BASE* coefficients (*t*-statistics) are −1.01 (−1.0) on trading day *t*+5, −0.94 (−0.9) on trading day *t*+6, and −0.58 (−0.6) on trading day *t*+7. These four days show that the *DRATE**Δ*BASE* coefficient is not always significant when abnormal trading is the dependent variable, providing some assurance that the tax variable is unusually relevant around the earnings announcement.

5.11 SUMMARY

The trading volume results in table 5 are consistent with capital gains tax incentives causing a seller's strike by holders of appreciated stock around earnings releases. The share returns results in tables 3 and 4 (interpreted in light of the different reversal patterns for depreciated and appreciated securities) appear to indicate that the seller's strike causes the prices of appreciated stock to rise temporarily and then to revert to prior levels over subsequent trading days. Together, these results suggest that personal capital gains tax planning affects equity trading for appreciated stocks around their earnings announcements. Conversely, we find no evidence of investors accelerating the sale of depreciated stock to ensure tax-favored, short-term capital loss treatment, which is consistent with investors recognizing losses as they occur, leaving no losses to accelerate around the disclosure.

We remain cautious, however, in these interpretations because the statistical significance of the returns regressions is not overwhelming and, in fact, never significant when we narrow the focus to the share returns for appreciated stocks only. Despite our assertions, buttressed with some empirical support, that the interpretations of the tax measure are not likely to be confounded by omitted correlated variables, it is possible that $DRATE^{*}\Delta BASE$ is capturing some unspecified flow of information around the release of earnings.

To address this concern and to determine whether results hold around a different disclosure, we analyze stock returns and trading volume around the announcement that a firm is joining the S&P 500. Finding that individual holding-period incentives matter with index additions should alleviate concerns that some unspecified information at earnings announcements explains the results in tables 3, 4, and 5. Furthermore, because the S&P 500 includes the largest U.S. corporations, tests of this disclosure can address any concerns that the earnings announcements results are driven by liquidity constraints of small, thinly traded firms.

6. S&P 500 Index Additions Tests

6.1 OVERVIEW

Harris and Gurel [1986] and Lynch and Mendenhall [1997] document that both share prices and trading volume soar when firms join the S&P 500 with positive abnormal returns of 3% to 4% typical on the first trading day after the disclosure. Their explanation for these price increases is upward price pressure created by a surge in demand from passive funds and other portfolio managers who track the 500 index.[23] When the rebalancing is completed, prices return to prior levels.

Our analysis focuses on the shareholders who sell to the index funds. If enough of these shareholders are individuals responding to holding-period incentives, personal tax considerations may play a role in the stock returns following an S&P disclosure. Consistent with this possibility, we find that share returns for firms joining the S&P 500 index are positively correlated with our tax measure ($DRATE^{*}\Delta BASE$) using a regression model specification similar to the one in the earnings announcements tests. Dichotomization between appreciated and depreciated shares reveals that the tax effect is limited to appreciated additions to the index. Therefore, we infer from the tests, which are detailed next, that individuals extract compensation for selling appreciated securities before long-term qualification.

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[23] Other explanations include long-run downward sloping demand curves (e.g., Shleifer [1986]), information effects arising from either the implied certification of a firm's financial strength associated with inclusion, (e.g., Jain [1987], Dhillon and Johnson [1991]) or investor awareness (Chen, Noronha, and Singal [2002]). See further discussion in Kaul, Mehrotra, and Morck [2000].

6.2 SAMPLE

We purchased from S&P a list of the 518 changes to the S&P 500 from 1978 to 1999. From the S&P list, we drop 70 additions attributable to restructurings of existing S&P 500 firms and 17 additions for which data are missing. The final sample includes 431 S&P 500 additions, of which 329 experienced appreciation during the holding period (i.e., $\Delta BASE$ is positive). Five firms are included twice in the sample. Annual additions range from 6 in 1992 to 35 in both 1998 and 1999. Of the 518 deletions, 270 cannot be examined because they merge out of existence immediately following their removal from the index. Data are also missing for another 38 deletions (primarily because of leveraged buyouts), leaving 210 deletions.

6.3 REGRESSION VARIABLES

The regression variables for the index tests are generally constructed the same as for the earnings announcement tests. For example, the market-adjusted return is used again to compute *AR* for trading day $t+1$.[24] The day following the announcement is used because throughout the investigation period S&P announced changes to the index after the market closed. Table 6 shows that *AR* for the 431 additions range from −12.88% to 22.14% with a mean (median) of 3.88% (3.53%), similar to estimates from other studies using S&P 500 additions. The descriptive statistics are virtually identical when restricted to the 329 appreciated additions. The 210 deletions have a mean (median) *AR* of −2.27% (−0.68%) on day $t+1$, consistent with a decline in demand when mutual funds unload their holdings.

AV is also computed for trading day $t+1$ and in the same manner as for the earnings release tests. Table 6 shows that volume surges the first trading day after the announcement, as expected. Mean (median) *AV* is 6.02% (6.46%) for the 431 additions and 6.66% (6.71%) for the 210 deletions.

The tax measure, $DRATE^{*}\Delta BASE$, also is computed the same as in the earnings announcements analysis with its components and *HI_LTCG* and its interaction continuing as explanatory variables. Table 6 shows that mean (median) $DRATE^{*}\Delta BASE$ is 7% (3%) for the additions. *DRATE* ranges from 0 (1988–1990) to 0.50 (second half of 1981) for the additions. $\Delta BASE$ ranges from −53% to 513% with a mean (median) value of 35% (20%) for the additions. $\Delta BASE$ is less for the deletions, with a mean (median) value of 13% (13%), indicating that exiting stocks have not performed as well in recent months as those joining the index.

As in the earnings announcements results, a positive coefficient is predicted on the tax measure. For appreciated firms, such a finding is interpreted as evidence that mutual funds compensate individual shareholders based on the incremental taxes associated with selling appreciated stock before long-term qualification. For depreciated firms, a positive coefficient is

[24] As with the earnings announcements, results are qualitatively unaltered when the dependent variable is computed using a market model where beta is estimated using the 100 days preceding trading day *t*.

TABLE 6

Descriptive Statistics for Regression Variables Used in Tests of the Impact of Capital Gains on Stock Returns for the Additions and Deletions to the S&P 500 Index from 1978 to 1999

Additions ($n = 431$)	Mean	Std Dev	Min	25%	Median	75%	Max
AR	3.88	3.44	−12.88	1.93	3.53	5.30	22.14
AV	6.02	5.99	−18.90	3.30	6.46	9.34	25.20
DRATE ΔBASE*	0.07	0.14	−0.18	0.00	0.03	0.09	1.01
DRATE	0.20	0.13	0.00	0.12	0.20	0.30	0.50
ΔBASE	0.35	0.61	−0.53	0.02	0.20	0.51	5.13
DEMAND	2.74	2.65	0.20	0.40	1.50	5.00	8.00
HI_LTCG	0.48						
HI_LTCG ΔBASE*	0.14	0.37	−0.37	0.00	0.00	0.18	2.99
Appreciated Additions ($n = 329$)							
AR	3.81	3.43	−4.51	1.76	3.40	5.18	22.14
AV	7.74	4.54	−17.45	4.80	7.72	10.03	22.55
DRATE ΔBASE*	0.10	0.15	0.00	0.01	0.05	0.13	1.01
DRATE	0.20	0.13	0.00	0.12	0.20	0.30	0.50
ΔBASE	0.51	0.61	0.01	0.14	0.30	0.69	5.13
DEMAND	2.88	2.67	0.20	0.40	2.00	5.80	8.00
HI_LTCG	0.48						
HI_LTCG ΔBASE*	0.21	0.39	0.00	0.00	0.00	0.26	2.99
Deletions ($n = 210$)							
AR	−2.27	7.23	−49.09	−3.34	−0.68	0.88	25.50
AV	6.66	5.48	−15.29	3.78	6.71	9.75	20.49
DRATE ΔBASE*	0.01	0.09	−0.25	−0.02	0.00	0.05	0.49
DRATE	0.15	0.11	0.00	0.11	0.12	0.20	0.42
ΔBASE	0.13	0.51	−0.99	−0.22	0.13	0.43	1.45
DEMAND	3.55	2.48	0.20	1.50	3.60	5.80	8.00
HI_LTCG	0.58						
HI_LTCG ΔBASE*	0.11	0.42	−0.99	0.00	0.00	0.23	1.45

AR_{it+1} is 100 times firm i's market-adjusted abnormal return on trading day $t+1$, where t is the day of the announcement that firm i is joining or exiting the S&P 500; AV_{it} is 100 times actual less expected trading volume on day $t+1$, where actual trading volume is the natural logarithm of 1 + the dollar volume on day $t+1$, divided by the natural logarithm of 1 + the dollar value of outstanding shares on day $t+1$, and expected trading volume uses a similar ratio for the market, adjusted with coefficients from a regression of firm i's actual trading volume on market volume for the 100 trading days immediately preceding day t (see Ajinkya and Jain [1989], Lynch and Mendenhall [1997, p. 358]); $DRATE_{t+1}$ is the maximum statutory short-term capital gains tax rate less the maximum statutory long-term capital gains tax rate on day $t+1$; $\Delta BASE_{it}$ is the difference between firm i's stock price at day t, adjusted for stock splits and stock dividends, and its stock price at day $t+1-n$ where n is the number of days in the holding period on day $t+1$, divided by its stock price at day $t+1-n$; $DEMAND_{t+1}$ is the percentage of equity mutual fund assets held in index funds on day $t+1$; HI_LTCG_t is a categorical variable equaling 1 if day t is after 1986 and before May 7, 1997, and 0 otherwise. If $\Delta BASE_{it} > 0$, a firm is classified as appreciated.

interpreted as evidence that mutual funds and individual shareholders share in the latter's tax savings from selling depreciated stock before long-term qualification.

The only new regression variable in the index tests is added to control for changes in the demand by index funds over the investigation period. *DEMAND* is the percentage of equity mutual fund assets held in index funds, as shown in Bogle's [1999] Exhibit V, *Money* [April 1999, p.102], and

Brennan [1999].[25] Consistent with a dramatic increase in the number and holdings of S&P 500 index funds during the investigation period, *DEMAND* increases steadily from 0.2% in 1978 to 8.0% in 1999.[26] The percentage decreased in only two years, 1983 and 1986. As index funds have become more active in the equity markets, the demand for shares when firms join the S&P 500 should have increased accordingly. If increased demand for shares creates upward price pressure, a positive coefficient is expected on *DEMAND* in the returns regressions.

6.4 STOCK RETURN RESULTS

The first column of table 7, panel A, provides regression coefficient estimates for the 431 additions when abnormal returns are computed for the first trading day following announcement of an inclusion to the S&P 500 (trading day $t+1$). As anticipated, the regression coefficient estimate on $DRATE^{*}\Delta BASE$ is positive (4.95). It is significant at the .05 level using a one-tailed test (t-statistic of 1.9). This finding suggests the holding-period incentives for individual investors affect returns when S&P announces an addition to its 500 index.

Review of the other coefficients on trading day $t+1$ reveals that, as expected, the coefficient on *DEMAND* is positive (t-statistic of 6.4), consistent with the price pressure increasing as index funds become larger market participants.[27] The coefficient on $\Delta BASE$ is negative (t-statistic of -2.9).[28] No other variables are significantly different from zero.

The other columns in table 7, panel A, report results from testing for a price reversal. Harris and Gurel [1986] and Lynch and Mendenhall [1997] document that the nontax price boost when a firm joins the S&P 500 quickly reverses, which is consistent with the inclusion announcement having no effect on the firm's underlying fundamentals. Likewise, we expect that prices

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[25] Results for the variable of interest are qualitatively unaltered if *DEMAND* is dropped from the regression or if alternative measures of demand from index funds are used, including Vanguard's number of index funds, Vanguard's percentage of assets in index funds, and natural logarithm of Vanguard's index fund assets, all as reported in Bogle [1999].

[26] Besides capturing the intended increase in demand from S&P 500 index funds over time, the coefficient on *DEMAND* may capture other unspecified intertemporal changes. The only intertemporal institutional change that we are aware of is that before October 1989, S&P 500 announcement and addition dates for index changes were identical. Since then, the announcement has preceded the addition by seven days, on average.

[27] As an aside, this result is not consistent with the hypothesis that S&P 500 announcement returns are driven by information effects, as discussed by Jain [1987] and Dhillon and Johnson [1991], among others.

[28] The negative coefficient is consistent with investors buying stocks that they anticipate will be added to the index (*New York Times,* May 21, 1986). *Ceteris paribus,* firms with the most speculative buying should have the largest pre-announcement price change, which will increase $\Delta BASE$. To the extent the stock price reaction to joining the index occurs before the announcement, $\Delta BASE$ increases and *AR* declines, causing a negative coefficient on $\Delta BASE$. More important for this study, to the extent the price increase is pre-announcement, the power of the tests to detect tax effects is diminished.

TABLE 7

Ordinary Least Squares Coefficient Estimates (t-statistics) from Tests of the Impact of Capital Gains on Stock Returns, Cumulative from the First Trading Day Following the Announcement that a Firm Is Being Added or Deleted from the S&P 500 Index from 1978 to 1999

Cumulative trading days t+1 Through:	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9	t+10
Panel A: Additions ($n = 431$)										
Intercept	2.91*	2.82*	3.03*	3.08*	3.20*	2.79*	2.88*	2.71	2.59	3.05*
DRATE* Δ***BASE***	**4.95**	**4.52**	**5.55**	**8.98***	**7.96**	**4.22**	**2.02**	**3.95**	**3.07**	**1.90**
	(1.9)	**(1.5)**	**(1.6)**	**(2.3)**	**(1.6)**	**(0.9)**	**(0.4)**	**(0.7)**	**(0.5)**	**(0.3)**
DRATE	0.07	−0.01	−1.06	−1.67	−2.75	−1.59	−1.31	−0.92	−0.69	−1.56
Δ*BASE*	−1.93*	−1.57*	−1.07	−1.81	−1.36	−0.35	0.20	−0.39	−0.07	0.41
DEMAND	0.47*	0.47*	0.53*	0.55*	0.62*	0.63*	0.61*	0.62*	0.57*	0.43*
HL_LTCG	−0.15	0.22	0.22	0.24	0.40	0.44	0.59	0.70	0.64	0.21
*HL_LTCG** Δ*BASE*	0.42	0.18	−0.89	0.16	0.16	−0.24	−0.20	−0.23	−0.52	−0.30
Adj R^2	0.10	0.07	0.08	0.07	0.06	0.06	0.05	0.05	0.03	0.02
Panel B: Additions less outlier ($n = 430$)										
Intercept	3.18*	2.99*	3.24*	3.26*	3.37*	2.99*	3.08*	2.92*	2.84*	3.25*
DRATE* Δ***BASE***	**5.93***	**5.13**	**6.28**	**9.64***	**8.59**	**4.93**	**2.73**	**4.71**	**3.93**	**2.61**
	(2.4)	**(1.8)**	**(1.8)**	**(2.4)**	**(1.7)**	**(1.0)**	**(0.5)**	**(0.9)**	**(0.7)**	**(0.5)**
DRATE	−0.80	−0.55	−1.71	−2.26	−3.31	−2.22	−1.94	−1.59	−1.45	−2.20
Δ*BASE*	−2.14*	−1.70*	−1.22	−1.95	−1.50	−0.50	0.05	−0.55	−0.25	0.26
DEMAND	0.45*	0.46*	0.51*	0.54*	0.60*	0.62*	0.60*	0.61*	0.56*	0.42*
HL_LTCG	−0.14	0.23	0.24	0.25	0.42	0.45	0.60	0.72	0.65	0.23
*HL_LTCG** Δ*BASE*	0.28	0.09	−1.00	0.07	0.07	−0.34	−0.30	−0.33	−0.64	−0.40
Adj R^2	0.11	0.07	0.09	0.07	0.06	0.06	0.05	0.05	0.03	0.02

Panel C: Appreciated additions ($n = 329$)										
Intercept	3.69*	3.40*	3.23*	3.13*	3.17*	2.72	2.87	2.84	2.87	2.94
DRATE**Δ*BASE	**7.70***	**6.07**	**5.88**	**7.96**	**5.93**	**2.61**	**0.37**	**3.28**	**3.79**	**1.79**
	(2.6)	**(1.8)**	**(1.4)**	**(1.7)**	**(1.0)**	**(0.4)**	**(0.1)**	**(0.5)**	**(0.6)**	**(0.3)**
DRATE	−2.48	−2.00	−2.19	−1.85	−2.19	−1.11	−0.78	−0.95	−0.65	−0.14
Δ*BASE*	−2.70*	−1.98*	−0.90	−1.37	−0.77	0.18	0.54	−0.41	−0.86	−0.43
DEMAND	0.47*	0.45*	0.47*	0.47*	0.54*	0.56*	0.57*	0.63*	0.70*	0.62*
HI_LTCG	−0.85	−0.64	−0.12	−0.02	0.04	0.38	0.06	0.14	−0.16	−0.53
*HI_LTCG**Δ*BASE*	1.14	1.12	−0.51	0.39	0.49	−0.24	0.37	0.44	0.50	0.75
Adj R^2	0.12	0.07	0.07	0.05	0.04	0.04	0.04	0.04	0.04	0.03
Panel D: Deletions ($n = 210$)										
Intercept	−2.90	1.06	0.89	2.08	1.33	0.70	2.56	1.42	0.73	−1.49
***DRATE*$_{t+1}$*Δ*BASE*$_{it}$**	**−13.32**	**8.49**	**10.24**	**19.53**	**16.91**	**6.16**	**6.43**	**7.18**	**6.86**	**−0.27**
	(−1.2)	**(0.7)**	**(0.8)**	**(1.0)**	**(0.6)**	**(0.3)**	**(0.3)**	**(0.3)**	**(0.3)**	**(−0.0)**
$DRATE_{t+1}$	6.23	−8.75	−8.23	−13.91	−10.34	−6.26	−12.60	−14.11	−13.81	−5.34
$\Delta BASE_{it}$	5.94	1.13	−0.29	−6.38	−8.71	−2.99	−0.14	−1.96	−3.65	−2.23
$DEMAND_{t+1}$	−0.01	−0.20	−0.09	0.16	0.46	0.24	−0.10	0.21	0.42	0.56
HI_LTCG	−1.60	−3.01	−3.52	−5.13	−6.39	−5.10	−4.26	−3.87	−3.90	−3.36
*HI_LTCG**Δ*BASE*	0.54	1.04	−2.01	7.33	11.26	5.20	−0.19	1.53	3.59	3.67
Adj R^2	0.11	0.02	0.02	0.00	0.01	0.00	−0.01	−0.01	−0.01	−0.00

The dependent variable is CAR_{it+m}, which is 100 times firm *i*'s cumulative, buy-and-hold, market-adjusted abnormal return on trading day $t+1$, where t is the day of the announcement that firm *i* is joining or exiting the S&P 500 and m is the number of days following the announcement. The explanatory variables include the following: $DRATE_{t+1}$ is the maximum statutory short-term capital gains tax rate less the maximum statutory long-term capital gains tax rate on day $t+1$; $\Delta BASE_{it}$ is the difference between firm *i*'s stock price at day t, adjusted for stock splits and stock dividends, and its stock price at day $t+1-n$ where n is the number of days in the holding period on day $t+1$, divided by its stock price at day $t+1-n$; $DEMAND_{t+1}$ is the percentage of equity mutual fund assets held in index funds on day $t+1$; HI_LTCG_t is a categorical variable equaling 1 if day t is after 1986 and before May 7, 1997, and 0 otherwise. A positive coefficient for the tax measure ($DRATE_{t+1}$*$\Delta BASE_{it}$) in panels A, B and C immediately following announcement of an addition is consistent with individual investors shifting to mutual funds their incremental capital gains taxes (tax benefits) associated with selling appreciated (depreciated) property. A coefficient for the tax measure ($DRATE_{t+1}$*$\Delta BASE_{it}$) in panels A, B, and C reverting toward zero in the subsequent days is consistent with temporary price pressure. The coefficient for the tax measure ($DRATE_{t+1}$*$\Delta BASE_{it}$) in panel D is not expected to be significantly different from zero, consistent with taxes not affecting the selling decisions surrounding deletions from the index.

*Significant at the .05 level, using a two-tailed test.

revert quickly to original levels. To test for reversal, we reestimate the regression equation with the dependent variable being cumulative abnormal returns, computed from trading day $t+1$ through subsequent trading days. As prices reverse, the tax coefficient should shrink to zero, indicating that the initial effects of capital gains tax incentives on prices have reversed.

The reversal pattern is similar to the one in the earnings announcements analysis. The magnitude of the coefficient peaks on trading day $t+4$ at 8.98 (t-statistic of 2.3) and becomes insignificant the following trading day at the .05 level using a one-tailed test. These findings are consistent with a reversal of the initial tax effects about one or two weeks after the index announcement. The results suggest that index fund managers (or at least enough to move the market) believe that the compensation to attract sellers who face incremental short-term capital gains is less than the cost of imperfect alignment with the S&P 500 index for even a few days. This is consistent with index funds compensating their managers for tracking the index.

Diagnostic tests indicate that one depreciated addition has substantial influence on the tax coefficient. After trading on May 5, 1988, Standard & Poor's announced that Marion Laboratories was joining the 500 index. The following day Marion's stock fell 12.9%. This compares with a 4.5% tumble for the addition, with the second largest price decline on trading day $t+1$. The business press attributed the slide to news that Bolar Pharmaceutical was producing a generic to compete with the cardiovascular drug that accounted for almost 60% of Marion's revenues. The subsequent day (trading day $t+2$), Marion announced intentions to repurchase shares of its stock, and the price rebounded 7%. Because these price movements appear unrelated to the stock's addition to the index, we repeated the regression excluding this single observation. Table 7, panel B, shows that without Marion in the sample, the tax coefficient on trading day $t+1$ increases to 5.93 with a t-statistic of 2.4 and remains more positive in subsequent trading days, though following the same attrition pattern throughout the reversal period.

6.5 APPRECIATED ADDITIONS

Further analysis reveals that the tax effects are localized among the appreciated additions. Table 7, panel C, shows that when the regression is restricted to the 329 appreciated additions, the $DRATE^{*}\Delta BASE$ coefficient on trading day $t+1$ is 7.70 (t-statistic of 2.6). The coefficient's magnitude peaks three days later at 7.96 (t-statistic of 1.7), becomes insignificant the following day, falling quickly to 0.37 (t-statistic of 0.1) by trading day $t+7$.

In contrast, untabulated results indicate that on the first trading day after the index announcement, the 102 additions that lost value during the holding period produce a negative tax coefficient (i.e., the wrong sign), though insignificant. The coefficient approaches zero (-0.38 with a t-statistic of -0.0) when the first two days are combined and remains near zero throughout subsequent trading days. If Marion Laboratories, the influential depreciated addition, is excluded from the regressions, the tax coefficient continues

to have the wrong sign on trading day $t+1$ but then turns positive, although insignificant (t-statistic of 0.5).

In brief, the results for the depreciated additions provide no evidence consistent with capital gains tax incentives affecting share returns. We conclude that the results in panels A and B are solely attributable to the appreciated shares, consistent with our expectations that, around the disclosure, investors are more likely to defer sales of appreciated property than to accelerate sales of depreciated property.

The tax coefficient enables rough estimates of economic significance. For example, the product of the *DRATE**Δ*BASE* coefficient estimate of 7.70 in the first column of table 7, panel C (appreciated additions), and its mean value of 0.10 (from table 6) implies that the tax premium accounts for one-day abnormal returns of 0.77%, on average. This compares with a mean abnormal return of 3.81 (from table 6) on the day following the S&P announcement. In other words, the regression coefficient estimate on *DRATE**Δ*BASE* implies that compensation for incremental capital gains taxes accounts for 20% of the abnormal return on the announcement day.

6.6 DELETIONS

When a firm is dropped from the S&P 500 index, index funds completely liquidate their position. Thus, even if individuals subject to capital gains taxes hold the fund, they will not be able to extract compensation from the buyers for any unanticipated taxes. Therefore, tax considerations should have no effect on sales following deletions from the index. If we repeat the regression using stock price responses for firms being deleted from the index and the coefficient on *DRATE**Δ*BASE* remains positive, we must question the prior interpretations.

Table 7, panel D, shows that the tax coefficient for the 210 deletions has the wrong sign (i.e., negative) on the first trading day following announcement, though not significantly less from zero (t-statistic of -1.2). The tax coefficient turns positive over the first 2 days, but it is never significantly different from zero during the 10-day investigation period. The failure to detect a positive coefficient on the tax coefficient for the index deletions provides some assurance that the results for the additions are correctly interpreted as evidence of tax incentives.

In addition to these separate analyses, we estimate a regression with all observations. We include two indicator variables: one if the firm is a depreciated addition and one if it is an appreciated addition. We include these indicator variables separately as well as interacted with Δ*BASE*, *DEMAND*, *HI_LTCG**Δ*BASE*, and *DRATE**Δ*BASE*. Consistent with the results discussed earlier, the coefficient on the tax variable for deletions is -10.2 but is not significant. Depreciated additions are not significantly different from the deletions (the coefficient equals -19.3 but is insignificant). However, as expected, the appreciated additions have a coefficient of 14.6, which is significant and positive.

6.7 TRADING VOLUME RESULTS

Similarly, we do not expect trading volume to move inversely with the tax measure for either additions or deletions. Because index fund managers are contractually bound to acquire shares of an added firm (or at least behave as though they are), their demand should be price inelastic. As a result, prices rise until sufficient shares are offered for sale to meet fund managers' "fixed" demand. Thus, trading volume should increase following an addition without regard to any effect that sellers' taxes have on prices. This contrasts with the earnings announcement setting where we anticipated both an increase in prices and a reduction in trading because the tax-induced seller's strike would be mitigated, but not eliminated, by a price increase. Consequently, finding a negative coefficient on the tax coefficient, when the dependent variable is abnormal volume, would cause us to reevaluate our earlier conclusions.

The first column in table 8 shows the regression coefficient estimates for all additions, when the dependent variable is abnormal volume for trading day $t+1$. As predicted, the coefficient on $DRATE^{*}\Delta BASE$ is not significantly less than zero. In fact, it is positive (6.83) with a t-statistic of 2.0. When the sample is restricted to appreciated additions in the second column, the coefficient increases to 9.82 with a t-statistic of 2.5. The non-negative status of the coefficient provides assurance about our prior interpretations of the results.

Finally, when a firm leaves the index, fund managers should sell their shares without regard to tax implications because rebalancing (i.e., complete liquidation of that holding) dominates any tax considerations. Consistent with this prediction, the third column in table 8 shows that trading volume for firms leaving the index is not negatively correlated with the tax measure.

7. *Extensions*

We close with preliminary findings from two extensions. Strong results from these two tests would provide further assurance about the inferences drawn from this study. Neither extension, however, produces evidence consistent with predictions. In the spirit of encouraging research in this area, we present these initial findings and, perhaps more valuably, detail the measurement problems that future work must overcome.

First, as discussed earlier, Shackelford and Verrecchia [2002] assume that all investors are subject to the holding-period incentives. If this is not the case, it is unclear whether taxes will affect returns and volume. Thus, the research design in the study is a joint test of whether holding-period incentives matter *and* whether enough shares are subject to personal tax so that taxes matter. This leads to a testable hypothesis—the impact of holding-period incentives should be increasing in the shares subject to personal taxation.

TABLE 8

Ordinary Least Squares Coefficient Estimates (t-statistics) for Tests of the Impact of Capital Gains on Trading Volume on the Day Following the Announcement that a Firm Is Joining or Has Been Deleted from the S&P 500 Index from 1978 to 1999

	Additions	Appreciated Additions	Deletions
Intercept	13.1	14.3	−0.85
	(14.5)	(13.7)	(−0.4)
DRATE* ΔBASE	**6.83**	**9.82**	**30.7**
	(2.0)	**(2.5)**	**(3.0)**
DRATE	−15.8	−18.8	11.2
	(−6.3)	(−6.0)	(1.8)
ΔBASE	−2.10	−3.12	−9.95
	(−2.3)	(−3.1)	(−3.4)
HI_LTCG	−2.69	−2.34	3.00
	(−4.2)	(−3.1)	(2.1)
HI_LTCG ΔBASE*	0.18	−0.57	2.09
	(0.2)	(−0.6)	(0.8)
DEMAND	−0.30	−0.32	0.43
	(−3.0)	(−2.9)	(2.1)
Adj R^2	0.09	0.15	0.19
N	425	324	209

Dependent variable is AV_{it}, which is 100 times actual less expected trading volume on day $t+1$, where actual trading volume is the natural logarithm of 1 + the dollar volume on day $t+1$, divided by the natural logarithm of the dollar value of 1 + outstanding shares on day $t+1$, and expected trading volume uses a similar ratio for the market, adjusted with coefficients from a regression of firm i's actual trading volume on market volume for the 100 trading days immediately preceding day t (see Ajinkya and Jain [1989], Lynch and Mendenhall [1997, p. 358]). The explanatory variables are the following: $DRATE_{t+1}$ is the maximum statutory short-term capital gains tax rate less the maximum statutory long-term capital gains tax rate on day $t+1$; $\Delta BASE_{it}$ is the difference between firm i's stock price at day t, adjusted for stock splits and stock dividends, and its stock price at day $t+1-n$ where n is the number of days in the holding period on day $t+1$, divided by its stock price at day $t+1-n$; $DEMAND_{t+1}$ is the percentage of equity mutual fund assets held in index funds on day $t+1$; HI_LTCG_t is a categorical variable equaling 1 if day t is after 1986 and before May 7, 1997, and 0 otherwise. A negative coefficient for the tax measure ($DRATE_{t+1}{}^*\Delta BASE_{it}$) is *not* predicted because managers of funds that track the S&P 500 index are expected to have to purchase shares (regardless of price), preventing the possibility of a seller's strike. This contrasts with the prior tests of trading volume responses to earnings announcements, whose results are reported in table 4, where a negative coefficient for the tax measure ($DRATE_{t+1}{}^*\Delta BASE_{it}$) is consistent with equity constricting with the incremental capital gains taxes associated with individuals selling property following an earnings announcement.

Ideally, we would stratify firms based on the percentage of their shares subject to personal taxes. Unfortunately, it is difficult to estimate these percentages with any precision. In fact, private discussions with some large U.S. corporations indicate that the managers themselves do not know the percentage of their shares that is subject to individual taxation.

To illustrate the problem, consider mutual funds, which constitute approximately half of all institutional stockholdings. According to the Investment Company Institute, households held 81% of all mutual fund investments in 1999. Two-thirds of these holdings were retail accounts, with the gains and losses flowing directly to individual tax returns and thus subject to holding-period incentives. The other one-third of household investments

was employer pension plans, individual retirement accounts, and variable annuities, which are not subject to immediate personal taxation and thus unaffected by differences in long-term and short-term capital gains tax rates.

Fiduciaries (banks and individuals serving as trustees, guardians, and administrators), business organizations (including corporations, retirement plans, insurance companies, and other financial institutions), nonprofit organizations, and other institutional investors hold the remaining 19% of mutual fund investments. Some of the gains and losses from these mutual fund investments also flow directly to personal tax returns through trusts, S corporations, limited liability corporations, or other entities that pass through gains and losses. Thus, it is difficult, if not impossible, to determine for any firm the proportion of its shares that are subject to holding-period incentives.

Even access to a firm's shareholder records is inadequate for determining whether stocks face personal taxation. For example, one of the authors has access to RJR Nabisco's actual shareholder records around its 1989 leveraged buyout.[29] However, it remains difficult to estimate the percentage of its shares subject to personal taxation. For instance, the name of the largest individual RJR Nabisco stockholder does not appear in the shareholder records. His shares are held through a closely held corporation, from which gains and losses flow directly to his personal tax return. In addition, the name of the largest shareholder in the records is a bank, which is prohibited by securities laws from holding equity in a manufacturer. The shareholder records aggregate large blocks of stock that the bank holds in trust for the founder's descendants (which are subject to individual taxation), foundations (which are tax exempt), and pension plans (which are subject to individual taxation when distributed to retirees, but at ordinary, not capital gains, rates). Furthermore, many individual shares are held in street name with brokerage houses listed as the shareholder.

In light of these data limitations, we doubt any publicly available data source can provide the precision we need to conduct this extension properly.[30] However, rather than abandon these tests entirely, we use a measure of holdings by the largest institutional investors (13-f filings as reported by Spectrum) to approximate the extent to which a firm's shares are subject to individual taxation. Recognizing that the gains and losses of many of these institutional investments flow directly to personal tax returns, we still anticipate that individual tax effects diminish in the extent to which a firm is held by 13-f filing institutions. The median percentage of shares included in 13-f filings is 42 (45) for the earnings announcement (index) sample.

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[29] See Landsman and Shackelford [1995] and Landsman, Shackelford, and Yetman [2002] for a more detailed discussion of this database.

[30] Despite our skepticism, a few studies (e.g., Ayers, Cloyd, and Robinson [2002], Ayers, Lefanowicz, and Robinson [2003], Dhaliwal, Li, and Trezevant [2003]) use these data to identify institutional ownership, and they report success at discriminating between shareholder clienteles.

We reestimate the regressions including a categorical variable, equaling 1 if the firm is below the median 13-f percentage and 0 otherwise, and an interaction of this categorical variable with $DRATE^{*}\Delta BASE$. When the dependent variable is share returns, a positive coefficient on the new interaction is interpreted as consistent with a more pronounced holding-period response by firms held predominantly by individuals. We find no such evidence. Neither the categorical variable nor the new interaction is significantly different from zero. For example, the coefficient on the new interaction is 0.72 (with a *t*-statistic of 0.2) when the sample is appreciated additions to the S&P 500 index. We conclude that our inability to observe whether holdings are subject to personal taxation undermines the power of these tests. However, we cannot rule out the possibility that the failure to detect a relation indicates problems with the prior inferences.

Hurtt and Seida's (2003) extension of this study confirms our failure to differentiate between institutions and individuals. They use actual trades, tracked by the Institute for the Study in Securities Markets, to test for a difference between individual and institutional trading around quarterly earnings announcements from 1983 to 1992. They define institutional sales as market sell orders of more than 1,000 shares. Smaller lots (900 or less and 200 or less) are considered sales by individuals. They find that sales and trading volume are decreasing in their tax measure (which is similar to $DRATE^{*}\Delta BASE$), consistent with the findings in this study. However, as in this study, they find no significant difference between individual and institutional trading.

The second extension faces similar challenges and reaches similar conclusions. The importance of the long-term qualification date on equity trading should be diminishing in the extent to which investors sell their shares before the holding period completes. To test this proposition, ideally we would measure the number of shares subject to personal taxation that are still being held as the qualification date approaches. Unfortunately, for the reasons detailed earlier, such data do not exist. Thus, we resort to a less precise measure of turnover based on the firm's median trading volume during the holding period. Besides the previous data limitations, this measure ignores cross-sectional variation in shareholders' investment horizons and differences, if any, between the tendency of individuals and other investors to churn.

We again reestimate the equations with two additional regressors: a categorical variable, equaling 1 for firms with above-median turnover, and an interaction of the indicator measure with $DRATE^{*}\Delta BASE$. We predict that the coefficient on the new interaction variable will be negative, indicating that the relevance of taxes on equity prices diminishes with trading. We find the new interaction is not significantly different from zero. Using the earnings announcements, when the dependent variable is abnormal returns, the coefficient on the new interaction is -0.26 with a *t*-statistic of -0.5. Results are more encouraging for the S&P 500 additions but still insignificant, with a coefficient on the new interaction of -4.12 and a *t*-statistic of -1.4. In

both cases the coefficient on $DRATE^{*}\Delta BASE$ remains significantly greater than zero, as expected.

As in the previous extension, we conclude that the new variables are too noisy. However, we cannot reject the possibility that the earlier inferences are erroneous. The primary conclusion, however, that we draw from these extensions is that advances in this area will depend heavily on constructing better measures of shareholder composition.

8. Closing Remarks

In this article we analyze equity trading around two unrelated disclosures associated with extensive portfolio rebalancing: quarterly earnings releases and S&P 500 index changes. Conclusions are remarkably similar in both settings. The findings are consistent with individual investors deferring sales of appreciated stock until they qualify for long-term capital gains tax treatment. The withdrawal of appreciated securities constrains the supply of equity, temporarily boosting equity prices. We find no evidence that individuals sell depreciated shares around the disclosures to ensure short-term capital loss treatment.

Although the statistical significance of some of the regression coefficient estimates is not overwhelming and the two closing extensions are unable to provide further confirmation, the preponderance of the evidence suggests the study's measure of individual tax considerations are a determinant of trading for appreciated stock around the two disclosures. Unable to conjecture any alternative explanation for this result, we conclude that holding-period incentives induce price pressure in the equity markets, consistent with the predictions in Shackelford and Verrecchia [2002].

Poterba and Weisbenner [2001] and Reese [1998] show that the marginal investor could face different tax rates on short-term and long-term capital gains and losses. However, both studies examine unusual settings before policy changes in the 1986 tax reform. We document that the price effects of shareholders' deferring sales of appreciated securities occur throughout the year (i.e., as do quarterly earnings announcements and index additions), among the largest, most closely followed U.S. public corporations, (e.g., members of the S&P 500), and have continued at least until 1999 (the end of the investigation period). This documentation of the pervasiveness and recency of holding-period incentives is a primary contribution of the article.

Besides the aforementioned studies, this study joins several others (e.g., Guenther and Willenborg [1999], Collins and Kemsley [2000], Lang and Shackelford [2000], Klein [2001]) in providing evidence that personal capital gains taxes affect share prices. Together, these findings challenge the shareholder tax irrelevance assumption (see Miller and Scholes [1978, 1982]) that underpins some of the basic theoretical pricing models in accounting, finance, and economics. If nuances of the capital gains tax policy, such as changes in rates around the long-term qualification date, affect a

firm's returns, it seems reasonable that equity prices may change as shareholders change, as shareholder taxation changes, and as the tax status of current shareholders change. Substantial work, however, is needed before we can conclusively state that shareholder taxes are an important determinant of stock prices. The closing extensions in this study suggest that data limitations are a primary barrier to addressing these questions of interest to both the valuation and tax communities.

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