Capital Gains Taxes and Asset Prices: Capitalization or Lock-in?

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Abstract

This paper examines the impact on asset prices from a reduction in the long-term capital gains tax rate using an equilibrium approach that considers both buyers' and sellers' responses. We demonstrate that the equilibrium impact of capital gains taxes reflects both the capitalization effect (i.e., capital gains taxes decrease demand) and the lock-in effect (i.e., capital gains taxes decrease supply). Depending on time periods and stock characteristics, either effect may dominate. Using the Taxpayer Relief Act of 1997 as our event, we find evidence supporting a dominant capitalization effect in the week following news that sharply increased the probability of a reduction in the capital gains tax rate and a dominant lock-in effect in the week after the rate reduction became effective. Non-dividend paying stocks (whose shareholders only face capital gains taxes) experience higher average returns during the week the capitalization effect dominates and stocks with large embedded capital gains and high individual ownership exhibit lower average returns during the week the lock-in effect dominates. We also find that the tax cut increases the trading volume in non-dividend paying stocks during the dominant capitalization week and in stocks with large embedded capital gains and high individual ownership during the dominant lock-in week.

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I. Introduction

This paper jointly models and tests two effects of capital gains taxation on equity trading: a demand-side capitalization effect and a supply-side lock-in effect. Previous studies have separately identified and tested these effects, but, to our knowledge, this is the first study to evaluate them jointly and empirically document the relative dominance of each effect surrounding an event of a tax rate change. Employing an equilibrium approach, we show that in general their net tax effect on asset prices is ambiguous. Evaluating returns and trading volume around the 1997 reduction in the capital gains tax rate, we find evidence of the capitalization and the lock-in effects jointly affecting trading. In particular, the capitalization effect dominates the lock-in effect in the week following news that sharply increased the probability of a reduction in the capital gains tax rate, as buyers respond to information that future capital gains tax rates will be lower. The lock-in effect, on the other hand, dominates the capitalization effect after the rate reduction became effective.

Taxation is one of the most prevalent market frictions in financial markets. It affects investors' decisions and distorts the valuation of assets. Capital gains taxes, in particular, play an important role in determining an investor's trading strategies and ultimately influencing asset prices. Because investors endogenously respond to the imposition of capital gains taxes, the tax effect on asset prices can be complicated and difficult to measure. In his review of taxes in the finance literature, Graham (2003) concludes that "Though intriguing in theory, the profession has made only modest progress in documenting whether investor taxes affect asset prices…we need more

evidence about the importance of personal taxes affecting asset prices…" To date, research on the effects of investor level capital gains taxes on asset prices has produced conflicting results. Several studies report that the presence of capital gains tax reduces stock price and current stock return (see Guenther and Willenborg (1999), Lang and Shackelford (2000), Ayers, Lefanowicz, and Robinson, (2003), among others), while other studies document that imposing capital gains tax increases stock price and current stock return (see Feldstein, Slemrod, and Yitzhaki, (1980), Landsman and Shackelford (1995), Reese (1998), Poterba and Weisbenner (2001), Klein (2001), Blouin, Raedy, and Shackelford (2003), Jin (2005), among others). The former is referred to as the *capitalization effect* of taxes and is often justified by the argument that investors would demand a lower price to buy the assets if they have to pay capital gains taxes in the future. The latter is referred to as the *lock-in effect* and is attributed to investors requiring higher prices to sell assets if they have to pay taxes on selling them. Recognizing that the two effects work in opposite directions, the purpose of this paper is to understand the interaction of the two effects and the circumstances under which one effect dominates the other surrounding a tax rate change.

Theoretical studies on taxes and asset pricing have been scarce and often focus on trading strategies for investors to avoid paying capital gains taxes and their impact on asset prices when investors face embedded capital gains on their asset holdings. For example, Constantinides (1983) shows that investors can rebalance their portfolios without triggering capital gains taxes if they are allowed to sell short assets in which they have embedded gains. This allows investors to separate their optimal liquidation of assets from their optimal consumption and investment policies. Klein (1999) introduces a

general equilibrium model of asset pricing with capital gains taxes when investors face short sale constraints so that they cannot rebalance their portfolio without triggering capital gains taxes liability. He makes predictions on the effects on asset prices of capital gains taxes without explicitly solving for the equilibrium price. Shackelford and Verrecchia (2002) develop a trading model where the long-term and short-term capital gains tax rates differential creates a trade-off between optimal risk-sharing and optimal tax-related trading strategy. They show that sellers are reluctant to sell appreciated assets sooner because they are subject to higher capital gains taxes. To entice sellers, buyers must provide compensation in the form of higher sales prices.

In this paper, we develop a simple equilibrium model of stock markets to analyze the effects of capital gains tax on prices that jointly considers the capitalization effect and the lock-in effect. Intuitively, the capitalization argument approaches the tax effect from buyers' perspective (demand side), while the lock-in effect views the tax impact from sellers' perspective (supply side). A more complete analysis of the capital gains tax effects must simultaneously allow for demand and supply to interact. In equilibrium, the net effect on stock markets of the capital gains tax will be the combination of both effects. Our study provides such a unified framework and offers predictions for the capital gains tax effect on security markets.

Our model suggests that a change in capital gains tax influences asset prices by shifting both the demand for assets and the supply of assets. Specifically, when the capital gains tax is increased, the demand curve for assets is shifted down, reflecting the decline in prices required to attract buyers. An increase in the capital gains tax also shifts the supply curve up, reflecting the boost in prices required to entice current owners to

sell. The equilibrium net tax effect on asset prices is ambiguous, depending on which effect dominates. An increase in capital gains taxes unambiguously reduces the float of assets (number of shares actively traded). In the event of a capital gains tax cut, the demand curve for the assets shifts up and the supply curve shifts down. The equilibrium net tax effect on asset price is still ambiguous, but the float of assets is unambiguously increased.

To detail the predictions of our model, suppose the capital gains tax rate is reduced. If the capitalization effect dominates the lock-in effect, stock prices will increase leading to higher current stock returns. Furthermore, the future returns to growth stocks (i.e., stock whose valuation depends largely on future dividend growth) are more likely to face capital gains taxes than the future returns to income stocks (i.e., those stocks currently distributing dividends). Consequently, when the capital gains tax rate is cut, growth stocks should experience even higher returns than income stocks.

Conversely, if the lock-in effect dominates the capitalization effect, we predict that stock prices will decrease and lower current stock returns. These reactions will be particularly pronounced for stocks with large price appreciation in the past. With these firms, the lock-in effect will dominate, leading to lower current returns.

Although the capitalization effect and the lock-in effect co-exist at all times, the relative importance of the two effects should vary around the timing of a capital gains tax rate change. Specifically, if there is a capital gains tax cut, the capitalization effect (price increase caused by demand shift upward) will be stronger than the lock-in effect *before* the tax cut becomes effective and the lock-in effect (price decrease caused by supply shift downward) will dominate the capitalization effect *after* the tax rate cut effective date. The

reason for the timing difference is that investors react to changes in the probability of a capital gains tax rate cut before the rates actually fall. In other words, buyers could purchase stocks in response to the news of future tax cut before the stock prices fully incorporate the new lower rate. Conversely, because capital gains are taxed upon realization, current stockholders likely will not sell shares with embedded gains until the capital gains tax rate cut becomes effective. Consequently, we select different event windows for a dominant capitalization effect and a dominant lock-in effect in our empirical investigation. Different event windows are critical for identifying the relative dominance of capitalization and lock-in. We perform the empirical tests of the model predictions by examining return and volume responses to the 1997 capital gains tax cut on stocks included in the CRSP dataset for the periods between January 1, 1995 and December 31, 1997. Our empirical analysis confirms that while both the capitalization and the lock-in effects jointly influence asset prices, the magnitude of each effect differs across the timing of the tax cut and stocks with different characteristics.

The 1997 capital gains tax rate reduction provides a rare opportunity to jointly investigate the effects of capitalization and lock-in on asset prices. In late April, 1997, information leaked that the Democratic White House and the Republican Congressional leadership had reached an accord to reduce the capital gains tax rate. This news preceded the actual effective tax rate by about one week. During that interim week, we find that the capitalization effect dominated the lock-in effect. This is consistent with individuals (the only shareholders benefiting from reduced rates) buying shares on the increased probability of lower capital gains tax rates when they sell the shares in the future. Conversely, we find that the lock-in effect dominated the capitalization effect during the

week following the effective date of the tax cut. This is consistent with individual investors (i.e., again, the only shareholders benefiting from the lower rates) selling stocks with large embedded gains after the tax cut became effective.

Although consistent with the model, broad market movements surrounding the effective date may reflect other factors moving the markets during those two weeks. Our cross-sectional analyses, however, do provide compelling evidence about the effects of capitalization and lock-in. Specifically, we find that:

- Non-dividend paying stocks experienced a stronger capitalization effect than dividend-paying stocks during the week the capitalization effect dominated.

- Stocks with large price appreciation in the past and high individual percentage ownership experienced stronger lock-in effect and earned lower immediate returns during the week the lock-in effect dominated.

- Trading volume was higher for non-dividend paying stocks during the week the capitalization effect dominated and for stocks with large embedded capital gains and high percentage of individual ownership during the week the lock-in effect dominates.

Since constructing alternative explanations for these cross-sectional findings is difficult, we infer from these results that capitalization and lock-in effects jointly affect market returns in the predicted manner.

The paper is organized as follows. Section 2 describes the model and discusses its empirical implications. Section 3 lays out the empirical methodology and section 4 provides empirical analysis and discussions. Finally, section 5 concludes.

II. The model and its empirical implications

Investors in the economy trade multiple stocks indexed by *i*. To facilitate our exposition, we introduce the following notations. Let P_{it} be the time *t market price* of stock *i*, D_{it} be the dividend distributed in period *t* on stock *i*, B_{it} be the time *t* tax basis of the *marginal investor* who currently owns stock *i*, τ_g be the capital gains tax rate, and τ_d be the dividend tax rate. To facilitate our discussion, we denote P_{it}^D as the *price willing to pay* for a share of stock *i* by buyers at time *t* and P_{it}^S as the *price willing to accept* for a share of stock *i* by sellers at time *t*.

The price a typical tax sensitive *marginal* investor is willing to pay is determined by the expected payoff as follows:

$$P_{it}^D = E_t\left[\frac{P_{it+1} + D_{it+1}(1-\tau_d) - G_{it+1}\tau_g}{1+r_i}\right] \tag{1}$$

where r_i is the discount rate applied to the cash flow of stock *i* and G_{it+1} represents the investors' anticipated capital gain realization. We assume that the anticipated capital gain realization takes the following form:

$$G_{it+1} = \alpha_i (P_{it+1} - P_{it}), \tag{2}$$

where $\alpha_i \in (0,1]$. This specification takes into account that investors who purchase the shares have to pay the market price, which serves as the basis for computing buyers' capital gains taxes when they sell in the following period.[1] Moreover, parameter α_i is

[1] This will be the case if the investor uses the last-in and first-out (LIFO) rule in calculating his tax liability.

used to allow investors to use tax efficient trading strategies to reduce their realized capital gains.[2]

On the other hand, a typical tax sensitive *marginal* shareholder with embedded capital gains, who contemplates selling, will require a price high enough to compensate him for his tax liability. This implies:

$$P_{it}^{S} = \rho_i P_{it} + (P_{it} - B_{it})\tau_g \tag{3}$$

where $\rho_i P_{it}$ represents the seller's net-of-tax reservation value for a share of stock *i* and $(P_{it} - B_{it})\tau_g$ is the seller's capital gains tax. We assume that the seller's net-of-tax reservation value is less than the market price $(0 < \rho_i \leq 1)$ because the tax burden is borne by both sellers and buyers in equilibrium.[3]

In equilibrium, the demand for the company shares equals the supply of the shares, and the price paid by the buyer equals the price received by the seller (including taxes), i.e.,

$$P_{it}^{D} = P_{it}^{S} \tag{4}$$

Substituting (2) into (1) and using the market clearing condition (4), we arrive at the following equilibrium price for stock *i* in the presence of taxes

$$P_{it} = E_t\left[\frac{P_{it+1}(1-\alpha_i\tau_g) + D_{it+1}(1-\tau_d) + (1+r_i)\tau_g B_{it}}{(1+r_i)(\rho_i+\tau_g) - \alpha_i\tau_g}\right]. \tag{5}$$

Rewriting equation (5) recursively, we obtain the price of stock *i* at time *t* as follows:

[2] This also allows sellers to have tax basis different from the current price.
[3] $\rho_i = 1$ only when the capital gains tax rate is zero.

$$P_{it} = E_t\left[\sum_{j=t+1}^{\infty}\left(\frac{1-\alpha_i\tau_g}{(1+r_i)(\rho_i+\tau_g)-\alpha_i\tau_g}\right)^{j-1}\frac{D_{ij}(1-\tau_d)+(1+r_i)\tau_g B_{ij-1}}{(1+r_i)(\rho_i+\tau_g)-\alpha_i\tau_g}\right]. \quad (6)$$

Assuming that the dividend D_{ij} grows at a constant rate d_i and the tax basis B_{ij} grows at rate b_i, we have the following simplified expression for the price of stock *i* at time *t*:

$$P_{it} = \frac{D_{it+1}(1-\tau_d)}{[(1+r_i)\rho_i - d_i]+(1+r_i-\alpha_i+\alpha_i d_i)\tau_g} + \frac{(1+r_i)\tau_g B_{it}}{[(1+r_i)\rho_i - b_i]+(1+r_i-\alpha_i+\alpha_i b_i)\tau_g}. \quad (7)$$

Denote the first term in equation (7) as "X_i" and the second term as "Y_i". Taking the first derivative of "X_i" and "Y_i" with respect to τ_g, respectively, yields:

$$\frac{\partial X_i}{\partial \tau_g} = -\frac{(1+r_i-\alpha_i+\alpha_i d_i)}{[(1+r_i)\rho_i - d_i+(1+r_i-\alpha_i+\alpha_i d_i)\tau_g]^2} D_{it+1}(1-\tau_d), \quad (8)$$

$$\frac{\partial Y_i}{\partial \tau_g} = \frac{(1+r_i)\rho_i - b_i}{[(1+r_i)\rho_i - b_i+(1+r_i-\alpha_i+\alpha_i b_i)\tau_g]^2}(1+r_i)B_{it}. \quad (9)$$

Equation (8) is unambiguously negative and we call this capitalization effect of the capital gains tax because the term *X* includes dividend and dividend growth which concern a potential buyer. Furthermore, the cross derivative of $\frac{\partial X_i}{\partial \tau_g}$ with respect to dividend growth d_i, $\frac{\partial^2 X_i}{\partial \tau_g \partial d_i}$, is also negative. Hence, the magnitude of the capitalization effect becomes larger as the dividend growth rate of a company (d_i) increases and the dividend tax rate (τ_d) decreases. This implies that in the event of a tax cut growth stocks will experience larger price increase than income stocks.

The sign of Equation (9) depends upon the size of the investors' embedded capital gains over time. We have a positive lock-in effect if the following condition holds:

$$\frac{(1+r_i)\rho_i}{b_i} > 1. \tag{10}$$

The above inequality suggests that the lock-in effect depends positively on stock *i*'s discount (or capitalization) rate and the marginal investor's net-of-tax reservation price but is inversely related to the rate at which investors' tax basis grows. If we interpret the capitalization rate as the average appreciation rate of the stock price, then the left-hand-side measures the size of embedded capital gains. If the appreciation rate is high and the marginal investor demands a high reservation price relative to the tax basis growth rate, the embedded capital gains are large and inequality (10) will be satisfied. In this case, there is a positive lock-in effect. On the other hand, if the appreciation rate is low and the marginal investors demand a very low reservation price relative to the tax basis growth rate, the investors will have little embedded capital gain or even a capital loss and there will be no lock-in effect. To empirically identify a dominant lock-in effect, we need to focus on stocks with large embedded capital gains for tax-sensitive investors.

The combined effect of capital gains tax on stock price is given by

$$\frac{\partial P_{it}}{\partial \tau_g} = \frac{\partial X_i}{\partial \tau_g} + \frac{\partial Y_i}{\partial \tau_g}. \tag{11}$$

Overall, because the capitalization effect ($\partial X_i / \partial \tau_g < 0$) and the lock-in effect ($\partial Y_i / \partial \tau_g > 0$) work in opposite direction, the net effect of capital gains tax on stock price is ambiguous. If the capitalization effect dominates, the net effect of capital gains

tax on stock price will be negative; if the lock-in effect dominates, the net effect of capital gains tax is positive.

Figure 1 illustrates the interaction between the two opposing forces. At first, suppose that there are no capital gains taxes. The demand and the supply for any particular stock are depicted as D and S in the graph and the intersection determines the equilibrium price P_0 and float of shares Q_0. Now, we introduce capital gains taxes. The demand curve shifts to the left from D to D' due to the capitalization effect. At the same time the supply curve also shifts to the left from S to S' due to the lock-in effect. In equilibrium, the new demand and supply curves interact with each other at new equilibrium price P_1 and new float of shares Q_1. It is obvious that new price could be higher or lower depending upon which effect dominates. However, float of shares is clearly decreased. In the event of a capital gains tax cut, the shift in demand and supply is reversed. Consequently, the float of shares is unambiguously increased. However, the change in equilibrium price remains ambiguous depending on which effect dominates: the capitalization or the lock-in.

Our analysis above has the following empirical implications. First, when the capitalization effect dominates the lock-in effect, a reduction in the capital gains tax will cause an increase in the stock price leading to higher stock returns. This will arise when potential buyers are more responsive to an imminent capital gains tax cut than are current shareholders. Conversely, when the lock-in effect dominates the capitalization effect, a reduction in the capital gain tax rate will cause a decrease in the stock price leading to lower stock returns. This will happen if current shareholders are more responsive to the capital gains tax cut than are potential buyers. Second, the float of shares is inversely

related to the capital gains taxes. When the capital gains tax is reduced, both the capitalization and the lock-in effects reinforce each other to increase the number of shares actively traded. The above implications apply to all stocks with embedded capital gains and thus represent market wide reactions to capital gains tax rate change.

Our theoretical analysis also suggests that growth stocks will experience a greater price increase and higher returns than other stocks in the event of a capital gains tax cut. In general, dividend-paying stocks are more likely to be income stocks while non-dividend paying stocks are more likely to be growth stocks. This means that for the capitalization effect the stock returns are predicted to be higher for non-dividend paying firms than dividend paying firms. Further, for stocks with high percentage of tax sensitive individual ownership, the lock-in effect is stronger for larger embedded capital gains because condition (10) is more easily satisfied when the tax basis growth rate is lower relative to stock price appreciation rate. This implies that in the event of a capital gains tax cut, these stocks will experience a larger price decline than will other stocks. These implications pertain to individual stock characteristics. We thus call them cross-sectional effects of a capital gains tax rate change. In the next section, we empirically test both the market wide and cross-sectional effects of a capital gains tax change by jointly considering the capitalization and the lock-in effects.

III. Empirical Methodology

To empirically test the above implications, we use the Taxpayer Relief Act of 1997 (TRA97) capital gains tax reduction as our event. The TRA97 lowered the top tax rate on capital gains due to appreciation from 28 percent to 20 percent for assets held

more than 18 months. TRA97 is particularly attractive as an event because the tax cut was both large and unexpected. Often tax legislation follows a protracted process with gradual changes in the probability of a particular bill becoming a law. In TRA97, however, Congress provided researchers with an attractive research setting by coming to rapid agreement on a large, unexpected reduction in capital gains tax rates.

Having a well-defined event is particularly important in this study because we need to define separate event windows for two opposing effects. The key to jointly identify the capitalization effect and the lock-in effect is to understand that the potential buyers and current shareholders perceive the expected capital gains tax cut differently as we discussed above.[4] They differ not only from required rate of return or valuation, but also from when they react to the news/event.

A potential buyer, in order to capture the expected tax cut benefit, will react to the capital gains tax cut information *before* the tax cut becomes effective. On the other hand, a current shareholder who is subject to capital gains taxes will more likely sell shares with embedded capital gains to rebalance his portfolio when the uncertainty on tax cut is largely resolved. As a result, the capitalization effect is more likely to dominate before the tax cut announcement and the lock-in effect is more likely to dominate after the tax cut becomes effective.

For the Taxpayer Relief Act of 1997 (TRA97), little information was released until Wednesday April 30, 1997 when the Congressional Budget Office (CBO) surprisingly announced that the estimate of 1997 deficit had been reduced by $45 billion.

[4] If an investor has to rebalance his portfolio by adding positions in some stocks and reducing positions in other stocks around the capital gains tax cut period, he is more likely to add the positions when the tax rate cut announcement is imminent, and delay his selling until the tax rate cut is effective if he has embedded capital gains on the positions.

Two days later on May 2, the President and Congressional leaders announced an agreement to balance the budget by 2002 and, among other things, reduce the capital gains tax rate. These announcements provide positive signals about the possible tax cut. Investors could start to react to the possibility of capital gains tax cut. On Wednesday May 7, 1997, Senate Finance Chairman William Roth and House Ways and Means Chairman William Archer jointly announced that the effective date on any reduction in the capital gains tax rate would be May 7, 1997.[5]

Given the above background, we choose Wednesday, April 30 to Tuesday, May 6, 1997 as the week that we expect the capitalization effect (WK_C) to dominate as potential buyers react to the possibility of capital gains taxes cut. The same event window is used in Blouin, Hail, and Yetman (2005). Lang and Shackelford (2000) use a similar event window (April 29 to May 5, 1997). We then choose Wednesday May 7 to Tuesday May 13, 1997 as the week that we expect the lock-in effect (WK_L) to dominate as current shareholders sell their appreciated stocks to rebalance their portfolios.

Another important factor is that capital gains taxes only affect income that is reported on personal tax returns, i.e., capital gains from the selling of shares held directly by individuals or flow-through entities, such as mutual funds, partnerships, trusts, S corporations, or limited liability corporations that pass dividend income to investors' personal tax returns. Capital gains taxes are not levied on tax-deferred accounts (e.g., qualified retirement plans, including pensions, IRAs and 401(k)), tax-exempt organizations, and foreigners. Corporations pay capital gains taxes; however, the rate

[5] See Lang and Shackelford (2000) for more detail about the legislative history of TRA97.

reduction in TRA97 did not apply to corporations. Thus, the ensuing tests predict variation in returns based on the amount of holdings by individual investors.

To capture the group of investors who are the most sensitive to the capital gains taxes, we construct a proxy for the percentage of individual ownership of a stock using the shares outstanding and shares owned by institutional investors. The data on the institutional investors' ownership are obtained from their quarterly filings with the U.S. Securities and Exchange Commission (known as Form 13F).

Let R_{it} be firm *i*'s stock return at time *t.* To test the effect of a capital gains tax rate cut on stock returns, we formulate the basic empirical regression equation on firms with positive embedded capital gains as follows:[6]

$$R_{it} = \alpha + \beta_1 WK_C + \beta_2 WK_L + \beta_3 WK_C * Div_i + \beta_4 WK_L * Gains_i * IND_i + \gamma Controls + \varepsilon_{it} \quad (12)$$

where WK_C represents the dummy variable for the week when we expect the capitalization effect to dominate (hereafter, we call WK_C the capitalization week for brevity), WK_L represents the dummy variable for the week when we expect the lock-in effect to dominate (hereafter we call WK_L the lock-in week for brevity), Div_i is the dummy variable which takes the value of 1 if there was no dividend distribution in year 1996 and 0 otherwise, $Gains_i$ is the measure of embedded capital gains, IND_i is the percentage of shares of stock *i* owned by individual investors as of 3/31/1997, and *Controls* refer to all other variables which may affect stock returns.

[6] We extend the regression analysis to include firms with no positive embedded capital gains in subsection IV. C.

Our specification above considers both the broad stock market reactions to the capital gains tax cut and the cross-sectional differences in the tax effect for different stocks with diverse characteristics. Intuitively, for a tax-sensitive investor who is indifferent between buying and not buying a stock, a capital gain tax cut will induce the investor to buy the stock. This applies to all stocks and thus constitutes the market-wide effect. Thus, in the event of a capital gains tax cut, the coefficient of the capitalization week dummy (WK_C) will be positive ($\beta_1 > 0$).

Similarly, for existing tax sensitive shareholders contemplating selling shares with embedded capital gains, a tax cut will induce them to sell the stock to rebalance. This applies to all stocks with embedded capital gains. When the lock-in effect dominates the capitalization effect, a tax rate cut will lead to lower returns on stocks with embedded capital gains resulting in a negative sign for the lock-in week dummy variable ($\beta_2 < 0$).

Because firms differ in their dividend policy and growth potential and consequently future capital gains tax liability, the magnitude of reaction to the capital gains tax cut will likely vary with firms' characteristics. Our analysis in the previous section suggests that in the event of a capital gains tax cut, the impact from demand side on stock return will be larger for growth stocks than for income stocks. This implies a cross-sectional effect of a capital gains tax cut and is captured by a positive interaction term (WK_C*Div_i), indicating a larger price increase for growth stocks than income stocks during the capitalization week ($\beta_3 > 0$).

On the other hand, for a current shareholder who faces a capital gains tax liability, a capital gains tax reduction offers a strong incentive for him to sell shares with large embedded capital gains to rebalance, consequently leading to a large lock-in effect on the

stock returns. Therefore during the week the lock-in effect dominates the capitalization effect, stocks with larger embedded capital gains and higher percentage of tax sensitive individual ownership will experience lower stock returns. In our specification above, this is captured by a negative ($\beta_4 < 0$) interaction of three variables (WK_L*$Gains_i$*IND_i): the lock-in week dummy variable, the embedded capital gains on the stock, and the percentage of shares of the stock owned by individual investors, the sole shareholders directly affected by TRA97.

To test the prediction on the effect of the capital gains tax cut on the float of shares, we need to first provide a measure for the float of stock. Unlike the shares outstanding, the float of shares measures the number of shares actively traded and is usually less than shares outstanding. For example, shares owned by insiders sometimes are subject to certain restrictions and cannot be quickly sold in the market thus not included in the float; some long-term buy-and-hold investors are also less inclined to churn their portfolio for short-term price fluctuation. Their holdings are not included in the float during normal time.

However, for a major event, such as a capital gains tax cut, an investor may find it optimal to buy additional stocks and/or to sell some stocks with a large price appreciation to rebalance his portfolio. Trading from these investors is likely to temporarily increase trading volume. In particular, the increase in trading volume caused by the capital gains tax cut is likely to be concentrated in the few weeks when the tax cut is announced. We use trading volume as a proxy for the float of shares of stocks.

Let v_{it} be stock i's logarithmic weekly trading volume. We formulate our regression equation on the tax effect on the float of shares as follows:

$$v_{it} = \alpha + \beta_1 WK_C + \beta_2 WK_L + \beta_3 WK_C * Div_i + \beta_4 WK_L * Gains_i * IND_i + \gamma Controls + \varepsilon_{it},$$

(13)

where the week dummies are defined the same as above and the controls are discussed in next section.

Our prediction for stock float suggests that the coefficients for both interaction terms ($WK_C * Div_i$) and ($WK_L * Gains_i * IND_i$) will be positive because there should be more individual investors buying shares of stocks with growth potentials during the week the capitalization effect dominates and more individual investors selling their holdings with large embedded capital gains to rebalance their portfolios during the week the lock-in effect dominates.[7]

IV. Empirical analysis

A. Sample and Summary Statistics

We use stocks included in the CRSP dataset with observations for the entire period between January 1, 1992 and December 31, 1997. Following Lang and Shackelford (2000) we focus on weekly returns. Explanatory variables include dividend dummy, embedded capital gains, the percentage of individual ownership of a stock, week dummies defined to identify the event period, and various interaction terms to identify the

[7] Note that during the lock-in week, the interaction includes a measure of current individual ownership because current individual shareholders are the only sellers affected by the legislative change. Conversely, during the capitalization week, the interaction does not include a measure of current individual ownership because the composition of the buyers affected by the rate reduction need not bear any relation to the current percentage of shares owned by individuals..

tax effect. Dividend dummy is defined based on a firm's dividend distribution in 1996. It takes a value 1 if a firm did not pay any dividends for the year 1996 and 0 otherwise.[8]

We calculate the weekly return as follows

$$R_{it} = \sum \log(r_{it}^{d} + 1) \tag{14}$$

where r_{it}^{d} is the daily return and *t* runs from Wednesday to the following Tuesday to be consistent with the event windows. The logarithmic weekly volume is similarly calculated as

$$v_{it} = \sum \log(Vol_{it}^{d}) \tag{15}$$

where Vol_{it}^{d} is the daily trading volume of stock *i* on day *t* and the summation runs from Wednesday to the following Tuesday. We use both volumes in shares traded and in dollar amount for our empirical tests.

We obtain daily stock returns and trading volume from the daily CRSP data set. Dividend, stock price, and shares outstanding are extracted from the monthly CRSP data set. To obtain the percentage of shares of each stock owned by individual investors, we extract institutional investors' ownership as of March 31, 1997 from Form 13F submitted to the SEC by investment management companies.[9] We then compute the percentage of individual ownership on stock *i* as follows

IND_i = 1 – Percentage of shares owned by institutional investors.

[8] Since we try to capture the stock appreciation potential using dividend variable, the dividend dummy takes value of 1 when there is high appreciation potential (or when dividend distribution was zero in year 1996) and zero when there is low potential (or when the firm distributed dividend in year 1996).

[9] We thank Ozer Asdemir for providing the institutional stock ownership data. Ayers, Lefanowicz and Robinson (2003), Dhaliwal and Li (2006), and Dhaliwal, Krull, Li and Moser (2005), among many others, also use this measure to capture the extent to which individuals hold shares in the firm.

We exclude non-common shares such as preferred stocks from our analysis. Firms with missing observations are also removed. Following Klein (1999, 2001), we define the embedded capital gain as the price appreciation in the last five years. Specifically, the five year embedded capital gain is calculated as the price appreciation from 3/31/92-3/31/97 (5-year holding gains) for each stock. We require that a firm has at least 5 years of uninterrupted data (from January 1, 1992 to December 31, 1997) to be included in our sample.

For the empirical tests, we use weekly returns in the last three years (1995, 1996 and 1997). Our control variables for the weekly return regression include the dividend distribution dummy, the percentage of individual ownership, the embedded capital gains for the past five years, the interaction terms $WK_L*Gains_i$, WK_L*IND_i, $WK_C*Gains_i$, WK_C*IND_i, $Gains_i*IND_i$, IND_i*Div_i, the size of the firm measured by the logarithm of firms' market capitalization, and the calendar effect represented by month and annual dummies. For the volume regression, we only use the firm size and the calendar effect as control variables. We also check the robustness of our results to the inclusion of loss firms and the market returns later in the section.

Table 1 presents the basic summary statistics for variables used in our regression analysis for both the subsample of firms with positive embedded capital gains and the entire sample including firms with embedded capital losses. Each variable is defined at the bottom of the table. The subsample consists of information on 1,747 firms with positive embedded gains for the past five years and a total of 275,564 observations. The average weekly return for firms with positive embedded capital gains is 0.43 percent with a standard deviation of 6.49 percent. In the meantime, the full sample including firms

with embedded capital losses consists of 496,809 observations and has a lower average weekly return of 0.26 percent and a slightly higher standard deviation of 7.25 percent. On average, half of the firms in the gains subsample and 54 percent of all firms in the entire sample paid dividends in 1996. The average five-year price appreciation for the gains subsample is 168 percent with a standard deviation of 655 percent. The five year price appreciation is much lower at 75.7 percent with a standard deviation just above 500 percent for the full sample. The five-year embedded capital gain is highly skewed with half of the firms gaining less than 69 percent for the gains subsample and less than 9.2 percent for the full sample as indicated by the median. The average percentage of shares owned by individual investors is 63 percent with a standard deviation of 26 percent for the gains subsample and almost identical mean and standard deviation for the full sample.

The trading volume for the gains subsample has a mean of 11.6 and a standard deviation of 2.2 when measured in logarithmic shares. The statistics are slightly higher at 14.3 for the mean and 2.7 for the standard deviation when measured in logarithmic dollar volume. The summary statistics for the trading volume for the entire sample including both the gains and loss firms are almost identical to that of the gains subsample. The number of observations for the volume is slightly smaller than for the returns. The smaller sample size for volume data is caused by the merge of weekly volume with the institutional ownership data.

B. Return Tests for Joint Tax Capitalization and Lock-in Effects

We use generalized least squares to estimate our regression model in order to account for possible heteroscedasticity. Our first set of regression results is based on

equation (12) and reported in Table 2. Consistent with our model predictions, the coefficient estimates associated with WK_C and the interaction term (WK_C*Div) are both positive and highly statistically significant with p-values less than 1 percent. The results indicate that the market reacted positively to the possibility of a capital gains tax cut. The weekly return for the capitalization week is 5.78 percent higher than the average weekly returns. Moreover, non-dividend paying stocks yield 1.58 percent higher returns on average during the capitalization week than do dividend-paying stocks for the same period.

The coefficient estimate associated with the interaction term (WK_L*$Gains_i$*IND_i) is negative at -0.23 percent and statistically significant at the conventional five percent level. This suggests that stocks with large embedded capital gains and high individual investor ownership have lower returns during the lock-in week. The coefficient implies that for firms with the average percentage of individual ownership, a one standard deviation increase in the five year embedded capital gains will yield 93 basis points $(-0.226\% \times 655\% \times 62.9\%)$ lower weekly returns during the lock-in week. For firms with an average five year embedded capital gains, a one standard deviation increase in the percentage of individual ownership leads to 10 basis points $(-0.226\% \times 168\% \times 26.2\%)$ lower weekly returns during the lock-in week.

The above findings are consistent with both potential buyers anticipating the possible tax rate cut and trading before the effective date and potential sellers withholding their shares until after the effective date. Investors respond by increasing their demand for stocks and driving up prices during the capitalization week. This is particularly evident for non-dividend paying growth stocks, whose returns are more likely

to face capital gains taxation. After the lower tax rate became effective, individual investors sensitive to capital gains tax liabilities were more inclined to sell positions with large embedded capital gains to rebalance their portfolios. This leads to a lower price for stocks with large embedded capital gains and a higher percentage of individual stock ownership during the lock-in week.

While we have documented a strong general market reaction during capitalization week (β_1=5.52 with P-value of 0.0001), the evidence for a dominant lock-in effect is weaker for the broad market. The estimate for WK_L is -0.4 percent and is insignificant statistically. There are two potential explanations for this result. First, once the capital gains tax rate is reduced, current shareholders do not have to react immediately to lock in the lower tax liability unless they believe that the government is going to raise the tax rate again soon. In other words, the lock-in reaction from current shareholders will likely be spread out over time. Secondly, since this estimate is for the overall market reaction to the tax cut, unless the sellers are moving their proceeds out of the stock market, we may not observe an overall negative return response. For example, shareholders may sell appreciated stocks to take advantage of the lower tax rate. However, they might use the proceeds to buy back stocks so that their new shares will have higher basis. This will generate higher restart options value as suggested in Constantinides (1984) and Dammon and Spatt (1996).

Our findings suggest that a dominant lock-in effect appears to be concentrated in a subset of stocks that have both large embedded capital gains and high individual ownership in the week after the announcement of the effective date of the tax cut. Given that TRA97 directly affects individual investors with large embedded capital gains, this

finding is consistent with our prediction on the relation between stock price and capital gains taxes.

Our regression analysis also provides the following findings. Non-dividend paying stocks earn slightly lower weekly return on average than dividend paying stocks. This suggests the possible existence of value premium for this time period. Stocks with higher individual ownership experience higher weekly returns on average. The interaction between WK_L and the embedded capital gains is significantly positive. There are two possible explanations. First, institutional investors not subject to capital gains tax could be buying these stocks. Second, it could reflect momentum trading by some investors. Both phenomena tend to drive the prices further up.

Size is positive and statistically significant but small in magnitude. This indicates the superior performance of large cap stocks relative to small cap stocks for this time period. The annual returns to large stocks and small stocks are 37.71 percent versus 33.21 percent for 1995, 23.07 percent versus 16.5 percent for 1996, and 33.17 percent versus 22.4 percent for 1997. Stocks with higher individual ownership experience a lower average weekly return during the capitalization week. Non-dividend paying stocks with higher individual ownership also yield a lower weekly return on average.

Although not reported in the table, we find that the annual dummy is highly statistically significant for year 1995 but not for year 1996. The monthly dummies on the other hand are all statistically significant indicating the existence of monthly return variation. Given our panel data, firm characteristic variables (gain, dividend, size and individual ownership) also act as controls for the fixed effect in the test.

C. Return Tests with all Firms and Market Returns

Our basic specification for the return test focuses on firms with positive five year embedded capital gains. The reason for this is that our model makes explicit predictions regarding the lock-in effect for firms with embedded capital gains. For firms without embedded capital gains, the lock-in will not likely have a significant effect on stock returns in the week after the tax cut announcement. However, tax-sensitive investors may sell their holdings with embedded capital losses before the tax cut becomes effective so that they can benefit from the higher tax rebate under higher tax rate.[10] If so, firms with embedded capital losses and individual ownership will experience some downward price pressure during the week before the tax cut announcement. Since these stocks are also subject to the capitalization effect, which increases the demand from investors who have no existing positions in them and investors who are not subject to taxation, the net effect on these stocks is ambiguous.

On the other hand, because there is no lock-in effect on individual holdings of stocks with embedded capital losses after the tax cut announcement, the selling pressure on these stocks will likely be small while the capitalization effect remains for these stocks. While these hypotheses are not directly implied by our model, they are consistent with our general intuition of the tax effect on asset prices. To check the robustness of our findings on the return tests on joint capitalization and lock-in effects and to test the hypotheses on firms with embedded capital losses, we extend our specification in (12) to

[10] Complex netting provisions, which are beyond the scope of this paper, govern the taxation of capital gains and losses (see Shackelford, 2000). Having said that, our predictions about the incentives to sell stocks with embedded capital losses before the rate fell assume that the investors can utilize the capital losses. More specifically, we assume a net capital gain position, i.e., total capital gains exceed total capital losses.

incorporate two additional terms: (WK_C*$Gains_i$*IND_i*L_i) and (WK_L*$Gains_i$*IND_i*L_i), where L_i is a dummy variable which takes a value of 1 if firm *i* has an embedded capital loss and 0 otherwise. The extended specification is given by

$$R_{it} = \alpha + \beta_1 WK_C + \beta_2 WK_L + \beta_3 WK_C * Div_i + \beta_4 WK_L * Gains_i * IND_i * (1 - L_i) + \beta_5 WK_C * Gains_i * IND_i * L_i + \beta_6 WK_L * Gains_i * IND_i * L_i + \gamma Controls + \varepsilon_{it} \quad (14)$$

Our discussions above suggest that the coefficient for the interaction term $(WK_C * Gains_i * IND_i * L_i)$ will likely be statistically insignificant ($\beta_5 = 0$) because the selling pressure may offset the capitalization effect, and the coefficient for the interaction term $(WK_L * Gains_i * IND_i * L_i)$ will be negative ($\beta_6 < 0$) because $Gains_i < 0$ for firms with embedded capital losses. A negative coefficient will yield a higher return for firms with larger embedded losses in the week immediately after the tax cut announcement.

Table 3 reports the regression results with the two additional interaction terms. Both the signs and magnitude of the effects of key variables are similar to those using the observations on firms with positive embedded capital gains only. Specifically, the coefficient for the capitalization week is 5.5 percent with a p-value less than 1 percent. The coefficient for the lock-in week is -0.3 percent but is insignificant. Regarding the cross-sectional effect of the tax cut, we find that firms distributing dividends earn 1.54 percent higher average weekly returns during the week the capitalization effect dominates, almost identical to the estimate using firms with positive embedded capital gains only. The estimate indicating a dominant lock-in effect is negative at -0.23 percent, which is almost identical in magnitude to in the case with gains firms only and remains significant at the conventional 5 percent test level.

For the firms with embedded capital losses, the coefficients are consistent with our predictions. Specifically, firms with embedded capital losses and high individual ownership earn lower weekly average returns than other firms during the week before the tax cut became effective. However, the effect is statistically insignificant at the conventional test level (p-value is 17 percent). Firms with embedded capital losses also earn higher average weekly returns during the week after the tax cut takes effect. For every 10 percent additional embedded capital losses, the average weekly return is about 14 basis points higher during the week after the tax cut became effective, statistically significant at a p-value less than 5 percent.

Besides including firms with embedded capital losses, another important control variable is the overall market return. The capital asset pricing model suggests that individual stock returns are determined by their exposure to the systematic risk represented by the return to the market portfolio. Given that a tax cut is a market-wide event, the return to the market portfolio will also likely respond to the tax rate change. Because stocks with different characteristics may have different exposure to the market return risk, the asset pricing effect of a tax cut may also be affected by including the market return in our analysis.

To address the potential effect of the market return, we further extend equation (14) by adding the value-weighted returns on all stocks included in the CRSP dataset as an additional control variable. Table 4 reports the results after we control for the value-weighted market return. The market return is positive and highly statistically significant indicating positive exposure of individual stock returns to the systematic risk represented by the market return. The cross-sectional effects of the tax cut remain when we control

for the market return. Both the interaction terms (WK_C*Div) and (WK_L*$Gains$*IND) remain significant in the predicted directions.

Once we control for the market return, the magnitude of market-wide effect from the tax cut in the capitalization week is decreased from 5.5 percent to 2.6 percent. This is consistent with a temporarily increase of market risk caused by the uncertainty surrounding the tax cut before the effective date. A fraction of the increase in individual stock return in that week is a reward for bearing a higher systematic risk. After the tax cut becomes effective, the uncertainty is resolved and we observe the normal relation between individual stock returns and the market returns. While not reported in the table, we also find that the annual dummies are no longer statistically significant with the market returns included.

D. Trading Volume Tests for Joint Tax Capitalization and Lock-in Effects

Next, we test the impact of the tax cut on trading volume. Table 5 shows the results of the regression analysis for firms with positive embedded capital gains only. Consistent with predictions from our model, both the interaction term WK_C*Div and the interaction term WK_L*$Gains$*IND are positive and highly statistically significant with p-values less than 1 percent. When measured in logarithmic shares, the trading volume for non-dividend paying stocks is on average 0.94 higher than the trading volume for dividend paying stocks, during the week after the market receives news of the rate reduction before it becomes effective. This is consistent with investors buying shares of stocks with high future growth potential, anticipating an imminent capital gains tax cut, leading to increased float of shares.

Stocks with large embedded capital gains and high individual ownership also experience higher trading volume during the lock-in week. A one standard deviation increase in five year embedded capital gains leads to 0.13 $(0.032 \times 655\% \times 62.9\%)$ higher trading volume on the logarithmic scale during the lock-in week for firms with average percentage of individual ownership. For firms with the average five-year embedded capital gains, a one standard deviation increase in the percentage of individual ownership increases the trading volume by 0.014 $(0.032 \times 168\% \times 26.2\%)$ on the logarithmic scale during the lock-in week. This is consistent with investors selling shares of stocks with large accumulated capital gains to rebalance their portfolio after the lower capital gains tax takes effect.

In Column B of Table 3, we perform a robustness check using the trading volume in dollars.[11] The results are qualitatively similar. Both interaction terms are positive and highly statistically significant. The dollar volume goes up by 0.48 on average on the logarithmic scale for non-dividend paying stocks relative to the dividend paying stocks. During the lock-in week, a one standard deviation increase in the five year embedded capital gains or the percentage of individual ownership increases dollar volume by 0.12 and 0.012 on the logarithmic scale, respectively. Both are consistent with the results based on the trading volume measured in number of shares.

In Table 6, we report the results for the trading volume tests including firms with five year embedded capital losses. As in the return tests, we extend the basic trading volume regression to incorporate two additional interaction terms: (WK_C*$Gains$*IND_i*L_i) and (WK_L*$Gains$*IND_i*L_i). As we discussed in the return tests with loss firms, investors

[11] We also performed the analysis with a fix effect, the results are very similar as reported in table 3 and not presented in the paper for brevity.

may sell shares with embedded capital losses before the tax cut to benefit from higher tax rebate under higher tax rate. Therefore, the coefficient for (WK_C*$Gains$*IND_i*L_i) will likely be negative because the *Gains* is less than zero for loss firms. After the tax cut becomes effective, because there is no lock-in effect on firms with embedded capital losses, the capitalization effect is likely to increase the demand and the coefficient for (WK_L*$Gains$*IND_i*L_i) will also likely be negative.

As in Table 5, the main findings on the joint effects of capitalization and lock-in on trading volume remain strong. For non-dividend paying firms, the trading volume is statistically significantly higher on average than that for dividend paying firms during the week the capitalization effect dominates. The trading volume is also higher for firms with larger embedded capital gains and higher individual percentage ownership. For both measures of the trading volume, the magnitude of the effects is slightly lower than that when only positive embedded capital gains firms are used. Our results suggest that trading volume for firms with embedded capital losses are higher when measured in logarithmic shares. However, when measured in dollars on a logarithmic scale, trading volume is lower for loss firms in the week before the tax cut becomes effective and is not significantly affected in the week after the tax cut becomes effective.

Our findings on the effect on the trading volume of a capital gains tax cut is consistent with the results reported in Blouin, Raedy, and Shackelford (2003). Using announcements of quarterly earnings and additions to the Standard and Poors 500 index as their events, they document that trading volume falls with the incremental taxes saved by deferring the sale of appreciated asset values. In our case, as the capital gains tax is reduced, the incremental taxes saved will decrease. This will lead to an increase in

trading volume. In other words, in their case holding period incentive causes current shareholders to restrain from selling shares, which shifts supply to the left. In our setting, current shareholders sell some stocks with embedded gains to rebalance their portfolios, leading to the supply curve shifted to the right.

V. Conclusions

We analyze the effect of capital gains taxes on returns and trading volume using an equilibrium approach that incorporates both the capitalization effect and the lock-in effect. Extant studies separately model and test the capitalization effect and the lock-in effect. To our knowledge, this is the first to jointly model and test both effects. Our model predicts that in the presence of capital gains taxes, the net effect on asset prices is ambiguous. If the capitalization effect dominates (is dominated by) the lock-in effect, the stock price decrease (increase). The relative strength of the capitalization effect and the lock-in effect depends on the time period surrounding a tax rate change and firm characteristics, such as dividend policy, growth potential, and the percentage of tax-sensitive individual ownership. The number of shares actively traded increases (decreases) as the capital gains tax rate decreases (increases).

We empirically test our model predictions using weekly returns and trading volume from January 1, 1995 to December 31, 1997, focusing on the 1997 capital gains tax rate cut. Consistent with our predictions, we find evidence of both the capitalization and the lock-in effect. In particular, the capitalization effect dominates the lock-in effect the week between news of the rate reduction and the effective date of the rate cut, (4/30/1997-5/6/1997), reflecting anticipation of the proposed tax cut making it into law.

Weekly stock returns are on average higher during the capitalization week. Moreover, non-dividend paying stocks have higher stock returns during the capitalization week (about 1.6 percent) than dividend paying stocks.

In contrast, the lock-in effect dominates the capitalization effect during the first week after the rate reduction becomes effective (5/7/1997-5/13/1997). The weekly stock returns are on average 0.4 percent lower during the lock-in week. Stocks with large embedded capital gains and high individual percentage ownership experience lower returns on average during the lock-in week. A one standard deviation increase in the five year embedded capital gains leads to 93 basis points lower weekly returns during the lock-in week for firms with average percentage individual ownership.

Non-dividend paying stocks experience higher trading volume during the capitalization week, which is consistent with increased demand for these stocks. Stocks with large embedded capital gains for the past five years and high individual ownership also show higher trading volume, consistent with increased supply for these stocks. The results are robust for both measures of volume in shares and in dollar amount. All these findings are consistent with our model predictions.

This paper joins an emerging literature in financial economics (see Reese [1998], Guenther and Willenborg [1999], Poterba and Weisbenner [2001], and Klein [2001], among others) in providing evidence that personal capital gains taxes affect equity trading. Together, these papers challenge a common assumption in financial economics that shareholder taxes are irrelevant in pricing stocks. Although the inferences that can be drawn from these papers are limited to the settings that they examine, their findings

call for additional research to examine whether equity prices vary as shareholder taxes change and with the mix of taxable and non-taxable shareholders.

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Table 1: Summary Statistics

Variable	N	Mean	Median	Std.	Min.	Max.
			Panel A: Firms with Positive Embedded Gains			
Wret (%)	275564	0.430	6.8E-8	6.490	-181.45	129.93
Vol	272486	11.610	11.678	2.211	4.605	19.154
$Vol	272486	14.304	14.245	2.743	2.526	23.708
Size	275564	12.248	12.049	2.061	6.920	18.908
Div	275564	0.497	0.000	0.500	0.000	1.000
Gains	275564	1.681	0.685	6.551	0.000	227.00
IND	275564	0.629	0.651	0.262	0.004	1.000
			Panel B: All Firms			
Wret (%)	496233	0.256	1.3E-8	7.247	-188.87	179.17
Vol	491749	11.749	11.834	2.142	4.605	19.154
$Vol	491749	14.204	14.115	2.701	2.238	23.708
Size	496809	12.030	11.794	2.110	6.920	18.908
R_M	496809	0.483	0.703	1.605	-5.684	4.606
Div	496809	0.543	1.000	0.498	0.000	1.000
Gains	496809	0.757	0.092	5.007	-0.984	227.00
IND	496809	0.643	0.671	0.255	0.002	0.999

Wret is the weekly stock return calculated as $R_{it}^{w} = \sum \log(r_{it}^{d} + 1)$ and r_{it}^{d} is the daily return and *t* runs from Wednesday to the following Tuesday; *Vol* is the sum of daily logarithmic volume running from Wednesday to the following Tuesday; R_M is weekly market return calculated using value-weighted daily returns; *Size* is the logarithm of the market value as of the end of year 1996; *$Vol* is the sum of daily logarithmic dollar volume running from Wednesday to the following Tuesday; *Div* is a dummy variable which takes value of one if the company did not pay any dividend for year 1996, zero otherwise; *Gains* is calculated as holding gains from 3/31/92 to 3/31/97; and *IND* is the percentage of individual ownership calculated as one minus the percentage of shares held by institution investors filed on 3/31/97.

Table 2: Return Tests for Tax Capitalization and Lock-In

Variables	Predicted sign	Estimates	p-value
WK_C	+	5.779***	(0.00)
WK_L	-	-0.401	(0.34)
WK_C*Div	+	1.578***	(0.00)
WK_L*Gains*IND	-	-0.226**	(0.04)
Div	?	0.142**	(0.03)
IND	?	0.292***	(0.00)
Gains	?	0.003	(0.58)
Size	?	0.041***	(0.00)
WK_L*Gains	?	0.147***	(0.01)
WK_L*IND	?	0.445	(0.48)
WK_C*Gains	?	-0.010	(0.66)
WK_C*IND	?	-5.277***	(0.00)
Gains*IND	?	0.006	(0.47)
IND*Div	?	-0.454***	(0.00)
N	275,564		
Adj. R^2	0.0053		

Div is set at one if the firm did not pay any dividend in year 1996, zero otherwise; *Gains* is the 5-year holding gains from 3/31/92-3/31/97; WK_C is the week from 4/30/97-5/6/97; WK_L is the week from 5/7/97-5/13/97; *IND* is the percentage of individual ownership calculated as one minus the percentage of shares held by institutional investors filed on 3/31/97; and *Size* is the logarithm of firms' 1996 year-end market capitalization. The numbers in parentheses are p-values. The year dummies and month dummies are included in the above regression and the inclusion of those dummies does not change the results. The parameter estimates are expressed in percentage. ***--at or below 1% significance; **--at or below 5% significance; *--at or below 10% significance.

Table 3: Return Tests for Tax Capitalization and Lock-In Effects for All Firms

Variables	Predicted sign	Estimates	p-value
WK_C	+	5.515***	(0.00)
WK_L	-	-0.301	(0.40)
WK_C*Div	+	1.542***	(0.00)
WK_L*Gains*IND	-	-0.231**	(0.05)
Div	?	0.141**	(0.01)
IND	?	0.292***	(0.00)
Gains	?	-0.007	(0.17)
Size	?	0.060***	(0.00)
WK_L*Gains	?	0.140**	(0.03)
WK_L*IND	?	0.242	(0.66)
WK_C*Gains	?	-0.016	(0.56)
WK_C*IND	?	-4.693***	(0.00)
Gains*IND	?	0.042***	(0.00)
IND*Div.	?	-0.567***	(0.00)
WK_C*Gains*IND*L	?	0.914	(0.17)
WK_L*Gains*IND*L	-	-1.445**	(0.03)
N	496,233		
Adj. R^2	0.0058		

Div is set at one if the firm did not pay any dividend in year 1996, zero otherwise; *Gains* is the 5-year holding gains from 3/31/92-3/31/97; Dummy variable *L* equals one if *Gains<0*, zero otherwise; WK_C is the week from 4/30/97-5/6/97; WK_L is the week from 5/7/97-5/13/97; *IND* is the percentage of individual ownership calculated as one minus the percentage of shares held by institutional investors filed on 3/31/97; and *Size* is the logarithm of firms' 1996 year-end market capitalization. The numbers in parentheses are p-values. The year dummies and month dummies are included in the above regression and the inclusion of those dummies does not change the results. The parameter estimates are expressed in percentage. ***--at or below 1% significance; **--at or below 5% significance; *--at or below 10% significance.

Table 4: Return Tests for Tax Capitalization and Lock-In Effects for All Firms Controlling for Market Return

Variables	Predicted sign	Estimates	p-value
R_M	+	71.18***	(0.00)
WK_C	+	2.589***	(0.00)
WK_L	-	-0.296	(0.41)
WK_C*Div	+	1.542***	(0.00)
WK_L*Gains*IND	-	-0.231**	(0.05)
Div	?	0.141***	(0.01)
IND	?	0.292***	(0.00)
Gains	?	-0.007	(0.16)
Size	?	0.060***	(0.00)
WK_L*Gains	?	0.140**	(0.03)
WK_L*IND	?	0.240	(0.66)
WK_C*Gains	?	-0.016	(0.55)
WK_C*IND	?	-4.693***	(0.00)
Gains*IND	?	0.042***	(0.00)
IND*Div	?	-0.567***	(0.00)
WKc*Gains*IND*L	?	0.914	(0.17)
WK_L*Gains*IND*L	-	-1.445**	(0.03)
N	496,233		
Adj. R^2	0.0285		

R_M is weekly market return calculated using value-weighted daily market return; *Div* is set at one if the firm did not pay any dividend in year 1996, zero otherwise; *Gains* is the 5-year holding gains from 3/31/92-3/31/97; Dummy variable *L* equals one if *Gains<0*, zero otherwise; WK_C is the week from 4/30/97-5/6/97; WK_L is the week from 5/7/97-5/13/97; *IND* is the percentage of individual ownership calculated as one minus the percentage of shares held by institutional investors filed on 3/31/97; and *Size* is the logarithm of firms' 1996 year-end market capitalization. The numbers in parentheses are p-values. The year dummies and month dummies are included in the above regression and the inclusion of those dummies does not change the results. The parameter estimates are expressed in percentage. ***--at or below 1% significance; **--at or below 5% significance; *--at or below 10% significance.

Table 5: Trading Volume Tests for Tax Capitalization and Lock-In for firms which had positive embedded gains

	Column A		Column B	
Variables	Estimates (volume)	p-value	Estimates ($ volume)	p-value
WK_C	-0.3366***	(0.00)	-0.1390***	(0.00)
WK_L	-0.0896*	(0.03)	-0.1503***	(0.00)
WK_C*Div	0.9367***	(0.00)	0.4774***	(0.00)
WK_L*Gains*IND	0.0321***	(0.00)	0.0282***	(0.00)
Size	0.7385***	(0.00)	1.1323***	(0.00)
m1	-0.2876***	(0.00)	-0.4446***	(0.00)
m2	-0.1487***	(0.00)	-0.2775***	(0.00)
m3	-0.1720***	(0.00)	-0.3036***	(0.00)
m4	-0.1693***	(0.00)	-0.2981***	(0.00)
m5	-0.1277***	(0.00)	-0.2031***	(0.00)
m6	-0.0831***	(0.00)	-0.1472***	(0.00)
m7	-0.0715***	(0.00)	-0.1343***	(0.00)
m8	-0.2036***	(0.00)	-0.2391***	(0.00)
m10	-0.0049	(0.75)	-0.0062	(0.64)
m11	-0.1058***	(0.00)	-0.1149***	(0.00)
m12	-0.1468***	(0.00)	-0.1651***	(0.00)
Year95	-0.4163***	(0.00)	-0.7390***	(0.00)
Year96	-0.1685***	(0.00)	-0.3056***	(0.00)
N	272,485		272,485	
Adj. R^2	0.4775		0.7325	

Div is one if the firm did not pay any dividend in year 1996, zero otherwise; *Gains* is the 5-year holding gains from 3/31/92-3/31/97; WK_C is the week from 4/30/97-5/6/97; WK_L is the week from 5/7/97-5/13/97; *IND* is the percentage of individual ownership calculated as one minus the percentage of shares held by institutional investors filed on 3/31/97; and *Size* is the logarithm of firms' 1996 year-end market capitalization. The numbers in parentheses are p-values. Monthly dummies are included in both Column A and Column B regressions. ***--at or below 1% significance; **--at or below 5% significance; *--at or below 10% significance.

Table 6: Trading Volume Tests for Tax Capitalization and Lock-In for all firms

	Column A		Column B	
Variables	Estimates (volume)	p-value	Estimates ($ volume)	p-value
WK_C	-0.4421***	(0.00)	-0.0993***	(0.01)
WK_L	-0.3331***	(0.00)	-0.1872***	(0.00)
WK_C*Div	0.8001***	(0.00)	0.4435***	(0.00)
WK_L*Gains*IND	0.0267***	(0.00)	0.0268***	(0.00)
WK_C*Gains*IND*L	-1.0314***	(0.00)	0.5811***	(0.00)
WK_L*Gains*IND*L	-1.8220***	(0.00)	0.0122	(0.92)
Size	0.6574***	(0.00)	1.0848***	(0.00)
m1	-0.2739***	(0.00)	-0.3894***	(0.00)
m2	-0.1469***	(0.00)	-0.2411***	(0.00)
m3	-0.1581***	(0.00)	-0.2626***	(0.00)
m4	-0.1766***	(0.00)	-0.2867***	(0.00)
m5	-0.1160***	(0.00)	-0.1725***	(0.00)
m6	-0.0674***	(0.00)	-0.1161***	(0.00)
m7	-0.0809***	(0.00)	-0.1363***	(0.00)
m8	-0.2001***	(0.00)	-0.2311***	(0.00)
m10	-0.0161	(0.16)	-0.0263***	(0.01)
m11	-0.0954***	(0.00)	-0.1248***	(0.00)
m12	-0.0887***	(0.00)	-0.1359***	(0.00)
Year95	-0.3235***	(0.00)	-0.4565***	(0.00)
Year96	-0.1069***	(0.00)	-0.1583***	(0.00)
N	496,809		491,749	
Adj. R^2	0.4216		0.7209	

Div is one if the firm did not pay any dividend in year 1996, zero otherwise; *Gains* is the 5-year holding gains from 3/31/92-3/31/97; WK_C is the week from 4/30/97-5/6/97; WK_L is the week from 5/7/97-5/13/97; *IND* is the percentage of individual ownership calculated as one minus the percentage of shares held by institutional investors filed on 3/31/97; *L* is a dummy variable which takes value of one if *Gains* is less than or equal to zero and takes a value of zero otherwise; *Size* is the logarithm of firms' 1996 year-end market capitalization. The numbers in parentheses are p-values. Monthly dummies are included in both Column A and Column B regressions. ***--at or below 1% significance; **--at or below 5% significance; *--at or below 10% significance.

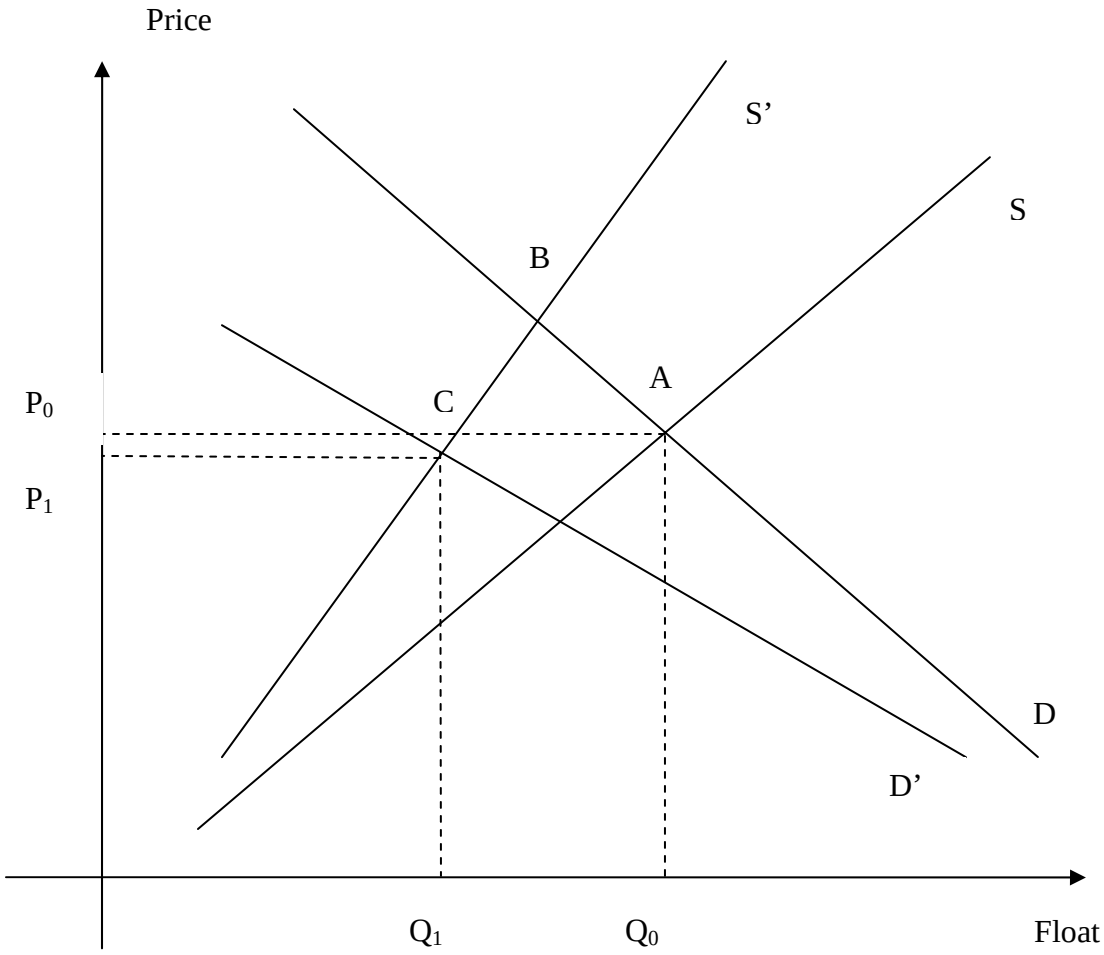


Figure 1: Effects of capital gains taxes on asset price and share float. (P_0, Q_0) is the equilibrium price and quantity before the capital gains taxes and (P_1, Q_1) is the equilibrium price and quantity after the capital gains taxes.