Capital Gains Lock-in and Share Repurchases

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Abstract

I investigate how capital gains taxes affect the number of shares a firm repurchases. I predict that tax-sensitive investors' reluctance to sell stocks in which they have unrealized capital gains (capital gains lock-in) reduces the supply of shares available in the market, and consequently raises the price at which a firm can repurchase its shares. Consistent with this hypothesis, I find that firms repurchase fewer shares the greater the unrealized capital gains of their tax-sensitive investors relative to those of their tax-insensitive investors. Moreover, firms with greater capital gains lock-in spend significantly more on capital expenditures and research and development, suggesting that firms experiencing capital gains lock-in substitute investments for repurchases. Finally, the negative effect of capital gains lock-in on share repurchases and the positive effect on investment are both stronger when the capital gains tax rate is higher.

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I. Introduction

Many factors drive corporate share repurchase decisions. Chief among them is price. A survey of corporate financial executives finds that a firm's current stock price is the single most important factor in its share repurchase decisions (Brav et al. 2005).[1] The price at which a company can repurchase its shares is determined by shareholders' willingness to sell them. If shareholders are willing to supply an unlimited quantity of a firm's shares at a single price that reflects the firm's fundamental value – that is, if the supply of a firm's shares is perfectly-elastic – then supply considerations should not impact repurchases. However, there is substantial evidence that supply and demand in the market for corporate shares are not perfectly-elastic.[2] This raises an important question: Given the price sensitivity of firms when repurchasing their shares, do limits to the supply of a company's shares cause it to repurchase fewer shares than it otherwise would?

I address this question by examining the effect of a well-documented tax-based constraint on the supply of shares. An investor's gain on a stock is subject to taxation only when the investor realizes the gain by selling the stock. This gives taxable investors an incentive to delay selling stocks for which they have unrealized gains.[3] Consistent with this argument, prior studies find that taxable investors refrain from selling shares when they would face large capital gains tax bills upon doing so, an effect typically referred to as capital gains "lock-in."[4] This withholding of shares with unrealized gains reduces the supply of shares available in the market. If limits to supply are

[1] See, for example, Dann (1981), Vermaelen (1981), Bartov (1991), Comment and Jarrell (1991), Ikenberry, Lakonishok and Vermaelen (1995), Stephens and Weisbach (1998), and Dittmar (2000).

[2] For evidence that supply of/demand for firms' shares is inelastic, see Scholes (1972), Shleifer (1986), Holthausen, Leftwich and Mayers (1987), Loderer, Cooney and Drunen (1991), Kandel, Sarig and Wohl (1999), Kaul, Mehrotra and Morck (2000), Kalay, Sade and Wohl (2004), Schultz (2008), and Ahern (2010).

[3] Delaying the realization of gains is potentially beneficial because unrealized gains are set to zero upon the death of the investor, because the investor can offset gains with any future capital losses, and because short-term gains are typically taxed at a higher rate than long-term gains.

[4] See, for example, Feldstein, Slemrod and Yitzhaki (1980), Landsman and Shackelford (1995), Reese (1998), Klein (2001), Ayers, Lefanowicz and Robinson (2003), Blouin, Hail and Yetman (2009), Ivkovic, Poterba and Weisbenner (2005), Jin (2006), Ayers, Li and Robinson (2008), and Dai, Maydew, Shackelford, and Zhang (2008).

an important driver of repurchase decisions, then a supply reduction driven by capital gains lock-in should have a negative effect on repurchases. I test this prediction by examining the relation between a firm's repurchases and the unrealized capital gains of its shareholders, and find broadly supportive evidence. I conservatively estimate that firms would have repurchased 2.2 percent, or $72 billion, more of their shares between 1995 and 2015 absent the lock-in effect.

If firms respond to a lock-in-driven supply constraint by repurchasing fewer shares, then tax-sensitive investors' unrealized gains should have a negative effect on share repurchases. However, repurchases could be related to investors' unrealized gains for reasons other than the effect of capital gains lock-in on the supply of shares. For instance, investors with large unrealized gains may have an impetus to sell shares in order to rebalance their portfolios. In addition, investors could exhibit the "disposition effect," defined as the tendency to realize gains at a quicker rate than losses (Shefrin and Statman 1985).[5] Either of these effects could increase the supply of a firm's shares if the shares have appreciated and therefore have a positive effect on repurchases. In other words, these effects bias against finding the predicted negative relation between capital gains lock-in and shares repurchases.

To isolate the capital gains lock-in effect, I exploit the difference in the tax-sensitivity of institutional investors. I use the classification of tax-sensitive and tax-insensitive institutional investors derived by Blouin, Bushee, and Sikes (2017) to implement the tests. Only tax-sensitive investors should exhibit the lock-in effect in their decisions of whether to sell a stock. Consistent with this argument, Jin (2006) shows that tax-sensitive institutions are less likely than tax-insensitive institutions to realize capital gains. Moreover, Blouin et al. (2017) find that tax-

[5] Prior empirical studies find that even sophisticated investors are subject to the disposition effect (Grinblatt and Keloharju 2001; Shapira and Venezia 2001; Garvey and Murphy 2004; Locke and Mann 2005; Frazzini 2006; Jin and Scherbina 2006), although to a lesser extent than individual investors (Grinblatt and Keloharju 2001; Shapira and Venezia 2001; Feng and Seasholes 2005).

sensitive institutions “unlock” more gains than tax-insensitive institutions following the reduction in the maximum statutory capital gains tax rate enacted by the Taxpayer Relief Act of 1997. Thus, any effect of unrealized capital gains on repurchases due to capital gains lock-in should exist only for unrealized gains of tax-sensitive investors and not for unrealized gains of tax-insensitive investors.

Consider a dollar of unrealized capital gains in the holdings of an investor in a firm that is considering a stock repurchase. If these unrealized gains are in the holdings of a tax-insensitive investor, then the gains could be positively related to the firm’s repurchases for reasons such as portfolio rebalancing or the disposition effect. On the other hand, if the unrealized gains are in the holdings of a tax-sensitive investor, they should, at a minimum, be less positively related to repurchases if capital gains lock-in has a negative effect on repurchases.

I estimate every institutional investor’s quarter-end unrealized capital gain in each stock that it holds. Consistent with capital gains lock-in negatively impacting share repurchases, I find that the relation between shares repurchased and unrealized capital gains of tax-sensitive investors is negative and statistically significant, whereas the relation is positive and significant for unrealized gains of tax-insensitive investors. The difference between the two effects is also significant. The results are robust to controlling for, among other things, recent returns on a firm’s stock and the holdings of tax-sensitive and tax-insensitive investors in the stock, both of which are likely to be related to unrealized capital gains in the stock. My estimate that firms would have repurchased approximately $72 billion more of their stock between 1995 and 2015 absent the lock-in effect is conservative, since it is based only on the unrealized capital gains of the tax-sensitive institutional investors in the sample, who represent only a fraction of all tax-sensitive investors (it does not

capture individual investors). Thus, the aggregate impact of capital gains lock-in on share repurchases over the sample period is likely greater than $72 billion.

My interpretation of these results rests on the assumption that any relation between repurchases and unrealized gains other than the one driven by capital gains lock-in does not depend on whether the gains are in the holdings of tax-sensitive or tax-insensitive investors. A potential concern, however, is that the two groups of investors differ on dimensions other than their tax sensitivity, and that these differences, rather than the locking in of capital gains, are responsible for my findings. Blouin et al. (2017) find that the tax-sensitive and tax-insensitive institutional investors differ in ways other than their tax-sensitivity. For example, tax-sensitive institutions hold smaller portfolios with fewer stocks in them and turn over a smaller percentage of their portfolio each quarter. I address the possibility that differences between the two groups of investors other than their tax-sensitivity drive the results by exploiting an exogenous change in the long-term capital gains tax rate during the sample period.

Taxable investors' incentive to delay the realization of capital gains is stronger when the capital gains tax rate is higher. Thus, I predict that the relation between repurchases and unrealized gains of tax-sensitive investors is more negative when the tax rate is higher. I conduct a difference-in-difference analysis where I examine the relation between repurchases and unrealized capital gains of the two investor groups in the period immediately surrounding the second quarter of 1997, when the long-term capital gains tax rate was cut sharply from 28 percent to 20 percent. Consistent with the lock-in effect driving the results, I find that the relation between repurchases and the unrealized gains of tax-sensitive investors decreases significantly from the two years prior to the tax rate cut to the quarter of the tax rate cut.

Blouin et al. (2017) find that the tax-sensitive institutional investors in my sample realized significantly more capital gains in the second quarter of 1997 relative to prior quarters and relative to tax-insensitive institutional investors. My finding of a significantly diminished negative relation between repurchases and unrealized gains of tax-sensitive investors in the second quarter of 1997 is consistent with the "unlocking" of gains by tax-sensitive institutions in this quarter increasing the supply of shares available for repurchase. No such change in relation is observed for the unrealized gains of tax-*in*sensitive investors. While I cannot completely rule out the possibility that differences in investor characteristics other than their tax-sensitivity are responsible for the results, it seems unlikely that these differences would change so dramatically over such a short period of time.

The explanation I offer for why capital gains lock-in reduces the number of shares that firms repurchase is that the supply constraint induced by capital gains lock-in results in firms having to purchase their shares at a price that his higher than what they want to pay. To further support this conclusion, I identify a set of firms for whom price is a less important determinant in their repurchase decisions—firms that repurchase shares in order to meet or beat an earnings target. These firms are more concerned with the number of shares that they repurchase than the price they have to pay. Therefore, I expect capital gains lock-in to have a weaker (or no) effect on these firms' repurchase decisions. I separate firms into two groups: (1) firms whose actual EPS meets or beats analysts' EPS forecast but whose EPS would have fallen short of the forecast had the firm not repurchased shares; and (2) all other firms. Consistent with my prediction, I only find a significant negative relation between capital gains lock-in and share repurchases in the latter sample.

Although I control for a firm's level of cash and cash flow, to rule out any lingering concern that firms with larger unrealized gains among their tax-sensitive have less cash available to allocate

to repurchases, I examine a sample of firms that experience a positive cash-flow shock. Specifically, I narrow the sample to firms that repatriated foreign earnings under the provisions of the American Jobs Creation Act of 2004 (AJCA), which provided a temporary tax holiday on repatriations in 2004 and 2005, and examine their repurchase behavior in 2005.[6] Prior research finds that although share repurchases were not one of the approved uses of repatriated funds, repatriating firms significantly increased their repurchases in 2005 (e.g., Blouin and Krull 2009). I show that the unrealized gains of tax-sensitive investors are significantly negatively related to the number of shares repurchased by repatriating firms in 2005, whereas there is no relation between share repurchases and the unrealized gains of tax-insensitive investors. Moreover, the difference between the gains of the two types of investors is significantly negatively related to share repurchases. In addition to addressing the concern that firms that experience capital gains lock-in have less cash available to allocate to share repurchases, this finding contributes to the literature that seeks to understand the variation in firms' decisions of how to use the repatriated funds from tax holidays.

In summary, the evidence supports my hypothesis that capital gains lock-in causes firms to repurchase fewer shares. Next I examine whether firms anticipate the effect of capital gains lock-in on their ability to repurchase shares. I compare the percent of shares sought in a repurchase to the percent of shares actually repurchased. If firms do not anticipate the lock-in effect, then the difference between the percent of shares sought and the percent of shares repurchased should be greater for firms with larger unrealized gains among their tax-sensitive investors relative to their tax-insensitive investors. However, consistent with firms anticipating the effect, I find that the difference between the percent of shares sought and the percent repurchased is not significantly

[6] AJCA temporarily reduced the U.S. tax rate on repatriations from foreign subsidiaries from 35% to 5.25%.

related to the difference between the unrealized gains of tax-sensitive and tax-insensitive investors. Furthermore, if firms anticipate the effect, then one might expect capital gains lock-in to reduce the likelihood of repurchase and not just the number of shares repurchased. This is indeed what I find in additional analysis.[7]

Finally, I examine what firms subject to capital gains lock-in do with the cash that they might otherwise use to repurchase shares. I find that firms with greater capital gains lock-in spend significantly more on capital expenditures, and that this effect is significantly stronger prior to the 1997 capital gains tax rate cut than immediately after. Similarly, I provide evidence that unrealized capital gains of tax-sensitive investors are more positively related to research and development expenses (R&D) prior to the 1997 capital gains tax rate cut than after. Prior studies show that tax-sensitive investors unlocked their gains immediately following this tax rate cut (e.g., Blouin et al. 2017). Thus, my findings are consistent with firms cutting capital expenditures and R&D following the tax rate cut in order to free up cash flow and take advantage of the increased supply of shares available for repurchase. Together, these results suggest that firms view repurchases as a substitute for investment and that, as a result, capital gains lock-in has real consequences. Moreover, these results suggest that a higher capital gains tax rate could lead to more corporate investment. This contrasts with prior studies that argue that higher personal tax rates weaken firms' incentives to invest due to their negative effect on after-tax investor returns (see, e.g., Poterba and Summers 1983).

The remainder of the paper proceeds as follows. In Section II, I review the relevant literature. Section III includes a summary of the data and empirical measures and a discussion of the research

[7] In addition to finding that capital gains lock-in reduces the extensive margin to repurchase, I find that it reduces the intensive margin. (i.e., given that a firm repurchases shares, it repurchases fewer shares the greater its capital gains lock-in).

design for the share repurchases analyses. In Section IV, I discuss the results of the share repurchases analyses. In Section V, I discuss the research design for the investment analyses as well as discuss the results. In Section VI, offer concluding remarks.

II. Background

Over the past thirty years, share repurchases have become an increasingly popular method of paying out cash to shareholders. Grullon and Michaely (2002) report that expenditures on share repurchase programs (relative to total earnings) increased from 4.8 percent in 1980 to 41.8 percent in 2000. Skinner (2008) reports that aggregate repurchases exceeded aggregate dividends for the first time in 1998 and have continued to do so. Given firms' increased use of share repurchases, it is important to understand the factors that influence firms' repurchase decisions.

Some explanations for why firms repurchase shares are to distribute excess cash flow (Easterbrook 1984; Jensen 1986; Dittmar 2000), to signal or take advantage of undervaluation (Vermaelen 1981; Dittmar 2000), to alter leverage ratios (Bagwell and Shoven 1988; Hovakimian, Opler and Titman 1996; Dittmar 2000), to fend off takeover attempts (Bagwell 1991; Stultz 1988; Dittmar 2000), to counter the dilutive effects of stock options (Dunsby 1994; Jolls 1996; Fenn and Liang 1997; Dittmar 2000) to manage reported earnings (Bens, Nagar, Skinner, and Wong 2003; Hribar, Jenkins, and Johnson 2006), and to better align the interests of management with those of outside shareholders, assuming management either owns stock or has stock options (Allen and Michaely 2003). I offer a tax explanation for why certain firms might *not* repurchase shares.

This paper adds to prior studies that examine how capital gains lock-in affects corporate payout policy. Lie and Lie (1999) and Moser (2007) find that the proportion of a firm's distributions that are repurchases (rather than dividends) decreases with proxies for unrealized gains of investors and increases with the magnitude of the dividend tax penalty and with ownership by tax-sensitive

investors, respectively.[8] Brown and Ryngaert (1992) find that tendering rates in fixed-price self-tender offers are negatively related to proxies for shareholders' unrealized capital gains.[9] Anderson and Dyl (2004) find that premiums offered by firms in fixed-price self-tender offers are positively related to proxies for shareholders' capital gains taxes. Kadapakkam and Seth (1997) find that tender prices in Dutch auctions increase with the capital gains of the marginal tendering shareholder.[10]

Similar to my paper, these papers suggest that capital gains lock-in can affect payout policy decisions by altering the supply of a firm's shares. However, in contrast to my paper, none of these papers asks whether capital gains lock-in actually affects the number of shares that a firm repurchases. In examining the proportion of cash paid out through repurchases rather than dividends, Lie and Lie (1999) and Moser (2007) implicitly assume that repurchases and dividends are substitutes. However, they need not be. A firm may choose to pay out more via repurchases and dividends simultaneously. Brown and Ryngaert (1992), Anderson and Dyl (2004), and Kadapakkam and Seth (1997) examine how lock-in affects pricing and shareholders' tendering behavior in repurchases, but do not look at how it affects the number of shares that a firm repurchases. Indeed, self-tender offers and Dutch auctions tend to be over-subscribed (Allen and Michaely 2003). As a result, it is unclear whether one should expect capital gains lock-in to affect the size of these repurchases.[11]

[8] The dividend tax penalty equals the investor-level tax rate on dividend income less the investor-level tax rate on capital gain income.

[9] In a fixed-price self-tender offer, the firm offers to repurchase a specific number of shares at a pre-specified price per share.

[10] In a Dutch auction repurchase, the firm specifies the number of shares that it will repurchase. The price per share is then determined by shareholder bidding, within a price range specified by the firm.

[11] Fixed price tender offers and Dutch auction repurchases also represent only a small proportion of total share repurchases, the majority of which take place in the open market. Grullon and Ikenberry (2000) report that in 1999, 96 percent of all repurchases (both in terms of the number of repurchases and in terms of the dollar amount repurchased) were open market repurchases. Banyi, Dyl and Kahle (2008) also find that the majority of repurchases

All of the papers mentioned above use recent stock price appreciation to proxy for shareholders' unrealized capital gains. In contrast, I measure the unrealized gains of actual investors using data on their holdings. In addition to providing a more accurate measure of unrealized gains, this approach offers two important advantages. First, it allows me to disentangle unrealized gains from recent returns. This is important because substantial evidence suggests that recent returns have a direct effect on repurchase decisions. Second, I am able to measure tax-sensitive and tax-insensitive investors' unrealized gains separately. Examining how the relation between repurchases and unrealized gains differs according to whether the unrealized gains belong to tax-sensitive or to tax-insensitive investors allows me to more cleanly identify the effect of capital gains lock-in, since only tax-sensitive investors should exhibit the lock-in effect.

Finally, my paper contributes to the literature showing that the contraction in supply due to capital gains lock-in affects prices. Blouin, Raedy and Shackelford (2003) find temporary price increases around quarterly earnings announcements and additions to the S&P 500 Index caused by investors deferring sales of appreciated stocks until their capital gains qualify for preferential long-term capital gains tax treatment.[12] Jin (2006) finds that for stocks held primarily by tax-sensitive institutional investors, tax-related underselling by tax-sensitive investors with large unrealized capital gains impacts stock prices during large earnings surprises. My paper provides evidence that the price effects of capital gains lock-in are important and have real effects. Specifically, I show that capital gains lock-in is negatively related to the likelihood of share repurchases and to the number of shares repurchased and positively related to capital expenditures and R&D expense.

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are open market repurchases. They report that 69 percent of all repurchases are open market repurchases. I examine all repurchases, including those taking place in the open market.

[12] Blouin, Raedy and Shackelford (2003) empirically test the predictions from Shackelford and Verrecchia's (2002) theoretical model of intertemporal tax discontinuities.

III. Data and Methodology

A. Data

Institutional investment managers who exercise investment discretion over $100 million or more of Section 13(f) securities must report to the Securities and Exchange Commission (SEC) holdings of more than 10,000 shares or holdings valued in excess of $200,000. Blouin et al. (2017) classify 13F filing institutions between 1995 and 2015 as either tax-sensitive or tax-insensitive based on their trading behavior and portfolio characteristics. I use their classification. The Blouin et al. (2017) classification offers several advantages over measures of tax-sensitive institutional ownership used in prior studies. First, unlike prior measures that classify institutions according to their legal type (e.g., all investment companies as tax-sensitive and all pensions as tax-insensitive), the Blouin et al. (2017) classification recognizes that there is heterogeneity with respect to tax-sensitivity within legal types. In this way, it is a more precise measure of tax-sensitivity than prior measures based on legal type. Second, unlike prior measures that recognize heterogeneity within legal types but are only able to classify a small subset of institutions (pensions and investment advisers whose clienteles are provided on Form ADV), the Blouin et al. (2017) measure classifies all institutional investors and thus provides a more powerful measure of tax-sensitive institutional ownership.

My objective is to measure the effect of capital gains lock-in on repurchases. Capital gains by definition reflect stock price appreciation, which can be related to repurchases for many reasons. Substantial price appreciation (i.e., a high positive stock return) might indicate that a firm is overvalued, making management reluctant to repurchase the firm's stock (e.g., Dittmar 2000). Thus, I control for recent stock returns. Moreover, the "disposition effect," which describes the tendency of investors to sell stocks that have appreciated in value and to hold stocks that have

fallen in value (Shefrin and Statman 1985), works in the opposite direction of the lock-in effect. Similarly, investors' realization of gains to rebalance their portfolios works in the opposite direction of the lock-in effect. If the shareholders of the sample firms exhibit the disposition effect or realize gains in order to rebalance their portfolios, such actions could increase the supply of shares available on the market after stock price appreciation and thus reduce the firm's cost of repurchasing its shares. If this is the case, it will bias against finding the predicted negative relation between capital gains lock-in and repurchases. To disentangle the capital gains lock-in effect from non-tax explanations for an association between unrealized capital gains and repurchases, I examine the difference between the effect of unrealized capital gains of tax-sensitive investors and the effect of unrealized capital gains of tax-insensitive investors on repurchases. If investors in my sample differ only in their tax-sensitivity, then this difference will capture the effect of capital gains lock-in.

However, Blouin et al. (2017) show that the institutions that they classify as tax-sensitive differ from the institutions that they classify as tax-insensitive in ways other than just tax-sensitivity. In terms of tax preferences, the institutions that they classify as tax-sensitive realize significantly more losses in the fourth quarter than in the other three calendar quarters and significantly more gains in the first quarter, consistent with year-end tax-loss-selling (Sikes 2014). They also tend to hold stocks with lower dividend yields. They manage smaller portfolios and hold fewer stocks in their portfolios, consistent with a higher expected cost associated with managing a portfolio in a tax-sensitive way. Tax-sensitive institutions turn their stocks over less frequently and hold larger positions, in line with their reluctance to realize capital gains. Finally, tax-sensitive institutions tend to hold less risky stocks. In order to address the possibility that these differences between the tax-sensitive and tax-insensitive institutional investors in my sample contaminate the results, I

incorporate an exogenous change in the capital gains tax rate into the analysis, which I explain in more detail in Section III of the paper.

B. Measures of Unrealized Capital Gains

Using quarterly holdings data from Thomson Reuters and stock price data from the Center for Research in Security Prices (CRSP), I estimate the unrealized capital gain or loss by institutional investor, by firm, by quarter. I assume that a quarterly increase in the number of shares held by an institutional investor reflects a purchase of that many shares in the current quarter. I estimate the purchase price as the average of the three month-end prices of the stock in the quarter, which becomes the institutional investor's tax basis for these shares. I use quarterly holdings data starting in 1980, which is the first year that Form 13F reports are available, to determine the tax basis of shares held. I assume that shares held at the end of the first quarter of 1980 were purchased during that quarter. When the number of shares that an institution owns in a stock decreases in a quarter, I treat this as a sale and set the sales price equal to the average of the three month-end prices in the quarter. If the institutional investor owns multiple lots of the same stock that were purchased at different prices, then I assume that the institutional investor uses highest-in first-out (HIFO) in calculating realized gains/losses on sales.[13] I adjust stock prices and the quarterly holdings data for stock splits.

C. Empirical Methodology

As previously mentioned, unrealized capital gains could be related to repurchases for reasons unrelated to taxes (e.g., the disposition effect, portfolio rebalancing). These non-tax factors are

[13] Under U.S. tax law, an institution can designate the lot of stocks to be sold. With highest-in, first-out, an institution sells shares that it purchased at the highest price first in order to minimize capital gains or maximize capital losses. Prior studies measure unrealized and realized gains and losses similarly (Huddart and Narayanan 2002; Jin 2006; Sikes 2014; Blouin et al. 2017).

likely to impact both tax-sensitive and tax-insensitive investors. To capture the effect of the capital gains lock-in on firms' repurchases, I focus on how the relation between repurchases and unrealized gains differs depending on whether the gains belong to tax-sensitive or to tax-insensitive investors. I estimate the following Ordinary Least Squares (OLS) regression:

$$\text{Log}(0.001+\text{Repurchases/MarketCap}) = \alpha + \beta_1\text{CapGains(TaxSensitive)} + \beta_2\text{CapGains(TaxInsensitive)} + \Sigma\beta_{3\text{-}20}\text{Controls} + \text{Year-Quarter Fixed Effects} + \text{Firm Fixed Effects} + \varepsilon \quad (1)$$

The observations are firm-quarters over the period 1995-2015. The dependent variable is measured in quarter *q* and all explanatory variables except *EPS_Diff*, defined below, are measured in quarter *q*-1.

The identifying assumption is that any relation between repurchases and shareholders' unrealized gains other than one driven by capital gains lock-in does not depend on whether the unrealized gains belong to tax-sensitive or tax-insensitive shareholders. Since capital gains lock-in does not affect tax-insensitive shareholders, β_2 identifies the magnitude of the non-lock-in relation between unrealized gains and repurchases. I therefore subtract β_2 from β_1 to isolate the capital gains lock-in effect on repurchases. Under the null hypothesis that capital gains lock-in does not affect repurchases, $\beta_1 - \beta_2 = 0$. If capital gains lock-in reduces repurchases, then I should observe $\beta_1 - \beta_2 < 0$.

To calculate the dependent variable, I first divide repurchases during the quarter by market capitalization at the beginning of the quarter and multiply the ratio by 100 (*Repurchases/MarketCap*). I log transform *Repurchases/MarketCap* because the bounding of repurchases at zero results in a highly-skewed distribution. Specifically, I use ln(0.001+ *Repurchases/MarketCap*) as the dependent variable in the OLS regression. Following Dittmar

(2000), Grinstein and Michaely (2005), and Kahle (2002), among others, I measure repurchases as total expenditure on the purchase of common and preferred stocks (computed from Compustat quarterly item *prstkcy*) minus any reduction in the redemption value of preferred stock outstanding (Compustat item *pstkq*).[14] Since *prstkcy* is reported each quarter on a year-to-date basis, for the second through fourth quarters of the year, I subtract the value of *prstkcy* in the prior quarter from the value of *prstkcy* for the current quarter to compute the purchase of common and preferred shares during the current quarter.[15]

The variables *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* equal the unrealized capital gains of tax-sensitive and tax-insensitive institutional investors, respectively, in a firm's stock divided by the firm's market capitalization at the end of the prior quarter. I also control for the possibility that unrealized gains simply capture information about investors' holdings of different stocks, which could be related to catering or clientele effects, by including the variables *Holdings(TaxSensitive)* and *Holdings(TaxInsensitive)*. The "catering" hypothesis holds that firms set their payout policies to accommodate the tax preferences of their investors (e.g., Perez-Gonzalez 2002). The "clientele" hypothesis holds that investors select stocks based in part on the personal tax cost associated with firms' payout policies (e.g., Strickland 1996; Grinstein and Michaely 2005; Graham and Kumar 2006; Desai and Jin 2011). The holdings variables also control for any preferences unrelated to taxes to hold shares in firms that repurchase shares. *Holdings(TaxSensitive)* and *Holdings(TaxInsensitive)* equal the dollar value of holdings of tax-

[14] Jagannathan, Stephens and Weisbach (2000) use a similar measure except that their measure is not adjusted to remove repurchases of preferred stock.

[15] In one percent of the observations, this calculation results in a negative value for quarterly repurchases due to errors in Compustat's year-to-date repurchase variable. I set the negative values to zero since repurchases cannot be negative. The results are robust to instead dropping these observations.

sensitive and tax-insensitive institutional investors, respectively, divided by the firm's market capitalization measured at the end of the prior quarter.

I choose the remaining control variables, with the exception of *Volatility* and *EPS_Diff*, based on Dittmar (2000), who investigates various motives for share repurchases put forth in prior literature (e.g., distributing excess cash flow, signaling undervaluation, altering leverage ratios, fending off takeover attempts, countering the dilutive effects of stock options). The undervaluation hypothesis predicts that firms repurchase their shares when their stock is undervalued. While one cannot determine with certainty if a firm is undervalued, a history of low returns has been interpreted as one possible indication of undervaluation. Thus I control for prior stock market performance. The variables *Return_Lag1, Return_Lag2, Return_Lag3,* and *Return_Lag4* equal the abnormal holding period return on the firm's stock, defined as the raw return less the CRSP value-weighted average return in the same quarter, and are lagged one, two, three, and four quarters, respectively.

In a survey of 384 financial executives, Brav et al. (2005) find that firms repurchase shares when they have residual cash flow after investment spending. The variable *CashFlow/MarketCap* equals the ratio of income before extraordinary items plus depreciation and amortization to market capitalization. The variable *Cash/MarketCap* equals the ratio of cash and equivalents to market capitalization. If a firm's need to distribute excess capital significantly affects its repurchase decision, then *CashFlow/MarketCap* and *Cash/MarketCap* will be positively related to aggregate repurchases, holding investment opportunities constant. The variable *Market/Book* controls for a firm's investment opportunities and equals the market value of equity plus the book value of debt, divided by the book value of assets.

I include the variable *Dividends/MarketCap* to control for the possibility that firms that pay fewer dividends are more likely to repurchase shares (Skinner 2008). It equals the ratio of common dividends to market capitalization. I include the natural log of a firm's total assets, *Ln(Assets)*, to control for information asymmetry. The undervaluation hypothesis holds that one reason that a firm repurchases shares is to signal to investors that the firm is undervalued. In order for the undervaluation hypothesis to hold true, there must be information asymmetry between managers and investors. According to Vermaelen (1981), information asymmetry is likely to be greater among smaller firms since analysts and the popular press are less likely to follow smaller firms.

The leverage hypothesis predicts that a firm repurchases shares when the firm's leverage ratio is less than the firm's target leverage ratio. To control for this possibility, I include the variable *Leverage-TargetLeverage*, which equals the difference between a firm's net debt-to-asset ratio (where debt is measured as debt minus cash and equivalents) and the firm's target net leverage ratio. Following Dittmar (2000), I measure a firm's target leverage ratio as the median net debt-to-asset ratio of all firms with the same two-digit SIC code. A negative coefficient on *Leverage-TargetLeverage* will support the leverage hypothesis.

The variable *Volatility* is the standard deviation of the daily stock return for the quarter. A firm facing higher volatility may pay out less cash in general to reduce expected future distress costs. This could have a negative effect on repurchases. On the other hand, a firm facing higher volatility might prefer to pay out excess cash through repurchases rather than dividends, since cutting dividends in the future is likely to be costly. This could have a positive effect on repurchases. Thus, I do not make a directional prediction for the relation between repurchases and volatility.

One motivation to repurchase shares is to increase earnings per share (EPS) (Bens et al. 2003; Hribar et al. 2006). Thus I control for the difference between what EPS would have been had a

firm not repurchased and what analysts forecasted EPS to be. To calculate *EPS_Diff*, I first calculate the difference between what EPS would have been had a firm not repurchased shares in the quarter and the mean of the first consensus EPS forecast following the announcement of the prior quarter's earnings where I require forecasts from at least two analysts. I then scale the difference by the product of 100 and the firm's average price over the quarter.

I also estimate equation (1) including an additional control variable, *ExecOptions/MarketCap*. I control for executive stock options since firms repurchase shares to prevent the dilutive effects of stock options. ExecOptions is the estimated value of in-the-money unexercised exercisable options owned by the firm's top five executives, which I collect from the Execucomp database. This variable is only available on an annual basis. Thus, I apply the same annual value to each quarter of the year.

Equation (1) includes year-quarter fixed effects as well as firm fixed effects. I winsorize all of the explanatory variables at the 1st and 99th percentiles to mitigate the effects of possible outliers. I cluster standard errors by firm and by year-quarter (Petersen 2009; Gow, Ormazabal, and Taylor 2010).

Because repurchases are zero for the majority of observations in the sample, inconsistency of estimates of equation (1) obtained using OLS could be a problem (Wooldridge 2002, pp. 524-525). Thus in addition to estimating the above OLS regression, I estimate equation (1) using a Tobit specification where the dependent variable is *Repurchases/MarketCap*, defined above.[16] A

[16] Repurchases can never fall below zero. An underlying model that generates outcomes for the dependent variable that are restricted to be below or above some level is typically called a "censored regression model." Wooldridge (2002, p. 518) argues that a more appropriate name for such a model is "corner solution model," since values of the dependent variable at the minimum or maximum possible value reflect a corner solution to the agent's optimization problem. Some authors advise against using the Tobit model when dealing with corner solution outcomes (e.g., Maddala 1991, p.796), while others consider the Tobit model to be appropriate (e.g., Woolridge 2002, p. 518). Maddala (1991) argues that the Tobit model is inappropriate for corner solution problems because the standard Tobit model assumes that the dependent variable is censored at zero and can, in principle, take on negative values. Because repurchases cannot take on negative values, Maddala's (1991) argument suggests that the Tobit model is inappropriate

drawback of the Tobit model is that it does not allow for the inclusion of firm fixed effects. A significant issue in establishing the casual impact of unrealized gains on repurchases is the omitted variable problem. In other words, some unobserved explanatory variable can potentially affect both unrealized gains and repurchases. Since firm fixed effects can alleviate this concern (though they do not represent a full solution), I use OLS with firm fixed effects as the primary specification. I present the Tobit results after the OLS results.[17]

D. Sample & Summary Statistics

The sample includes firms with non-missing values for the variables collected from Compustat, CRSP, and Thomson Reuters. Mean quarterly repurchases are $18 million, though the distribution is highly right-skewed, with the median firm repurchasing zero shares. A repurchase takes place in 34% of the firm-quarters in the sample (untabulated). The mean *Repurchases/MarketCap* equals 0.3784%. The average firm has total assets of $5.6 billion and a market capitalization equal to $3.9 billion. The mean *CapGains(TaxSensitive)* and mean *CapGains(TaxInsensitive)* equal 0.23% and 0.82%, respectively. The mean *Holdings(TaxSensitive)* is 5.1%, while the mean *Holdings(TaxInsensitive)* is 40.9%.

IV. Empirical Results

A. Capital Gains Lock-in & Repurchases

Panel A of Table II reports the results of estimating equation (1) with the OLS specification. Heteroskedasticity-robust standard errors clustered at the firm level and at the year-quarter level are reported in parentheses below the coefficient estimates. All columns include year-quarter fixed

in my setting. On the other hand, Woolridge (2002) and Green (2003) argue that the Tobit model is appropriate for censored as well as for corner solution regression models.

[17] As a substitute for firm fixed effects, I demean the dependent variable in the Tobit model by subtracting a firm's average value of *Repurchases/MarketCap* over the sample period.

effects, and columns (3)–(6) also include firm fixed effects. Columns (1) and (4) only include *CapGains(TaxSensitive)*, *CapGains(TaxInsenstive)*, *Holdings(TaxSensitive)*, and *Holdings(TaxInsensitive)*. In columns (2) and (5), I add the remainder of the explanatory variables with the exception of *ExecOptions/MarketCap*, which I add in columns (3) and (6). Since this variable is not available for some firms, its inclusion reduces the sample size from 215,598 to 114,356 observations.

At the bottom of the table I report the magnitude and statistical significance of the difference between the coefficients on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)*. This difference represents the estimated effect of capital gains lock-in on repurchases. Consistent with my expectation, the difference is negative and significant in all six columns (at the 1% level in all columns except column (2) where it is significant at the 5% level). I defer a discussion of the economic magnitude of the results to the presentation of the Tobit results.

In addition, the coefficient on *CapGains(TaxSensitive)* is negative and is significant at the 1% level in columns (4)-(6) and at the 5% level in column (3). In contrast, the coefficient on *CapGains(TaxInsensitive)* is positive and significant at the one percent level in all six columns. This positive and significant coefficient suggests that investors' eagerness to sell shares of a stock in which they have unrealized gains increases the supply of shares for the particular stock, thereby decreasing the price of the shares and making a repurchase relatively less expensive for the firm. The fact that the difference between the coefficients on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is negative and significant suggests that the lock-in of capital gains by tax-sensitive institutional investors offsets the presence of any disposition effect or portfolio rebalancing among tax-sensitive investors.[18] The negative and significant coefficient on

[18] If the unrealized capital gains of tax-insensitive investors in the sample proxy for price appreciation experienced by employees holding stock options, then another potential explanation for the positive relation between repurchases and

CapGains(TaxSensitive) further supports this conclusion. The coefficient on *Holdings(TaxSensitive)* is positive and significant in columns (1)–(4) but not significant once I include firm fixed effects and the full set of control variables in columns (5) and (6). The coefficient on *Holdings(TaxInsensitive)* is positive and significant at the 1% level in columns (1)–(3) but turns negative and significant at the 1% level in columns (5) and (6) once I include firm fixed effects and the full set of control variables. The negative and significant coefficient suggests that ownership by tax-insensitive institutional investors is negatively related to share repurchases. It is possible that these institutions prefer dividend-paying stocks for fiduciary reasons and do not care that dividends are taxed at a higher rate since these investors are tax-insensitive. The fact that the coefficient on *Holdings(TaxInsensitive)* flips signs once I include firm fixed effects illustrates the importance of including firm fixed effects to control for omitted correlated variables.

The coefficients on all but one of the lagged *Return* variables are negative and statistically significant. This result suggests that the aggregate level of share repurchases is negatively associated with a firm's recent stock market performance, and is consistent with the undervaluation hypothesis. The coefficient on *CashFlow/MarketCap* is positive and significant in columns (2), (5), and (6), suggesting that aggregate share repurchases are positively associated with the need to distribute excess capital. The coefficient on *Market/Book* is positive and significant when firm fixed effects are excluded and negative and significant when firm fixed effects are included, which again illustrates the importance of controlling for firm fixed effects. The negative and significant coefficient on *Market/Book* in columns (5) and (6) is consistent with firms with greater investment opportunities repurchasing fewer shares. The coefficient on *Ln(Assets)* is positive and significant,

unrealized capital gains of tax-insensitive investors is the tendency of employees to exercise stock options after they have experienced appreciation. Prior studies find that firms repurchase shares when employees exercise stock options in order to prevent dilution of the firm's stock price (Dunsby 1994; Jolls 1996; Fenn and Liang 1997; Dittmar 2000).

suggesting that larger firms repurchase more shares. Unlike the interpretation of the negative and significant coefficients on the lagged *Return* variables, the positive and significant coefficient on *Ln(Assets)* is inconsistent with the undervaluation hypothesis, which predicts that smaller firms with greater information asymmetry between managers and investors are more likely to repurchase shares than are larger firms. The coefficient on *Leverage-TargetLeverage* is negative and significant. This result supports the leverage hypothesis, which predicts that a firm repurchases shares when the firm's leverage ratio is less than the firm's target leverage ratio. The coefficient on *Volatility* is negative and significant, suggesting that firms with less volatile stock returns repurchase more shares. The coefficient on *EPS_Diff* is negative and significant in column (5), consistent with firms repurchasing more shares to increase EPS. The coefficient on *ExecOptions/MarketCap* is positive and significant in column (3), suggesting that firms that offer executives more stock options also repurchase more shares, likely to prevent dilution of their stock price. However, the coefficient is no longer significant once I include firm fixed effects.

In Panel B, I conduct two robustness tests. First, because *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* are highly correlated (untabulated Pearson correlation of 0.559), there is a potential concern that multicollinearity could affect the sign of the coefficients on these variables. Thus, I exclude *CapGains(TaxInsensitive)* and *Holdings(TaxInsensitive)* in column (1) and exclude *CapGains(TaxSensitive)* and *Holdings(TaxSensitive)* in column (2). I continue to find a negative and significant coefficient on *CapGains(TaxSensitive)* in column (1) and a positive and significant coefficient on *CapGains(TaxInsensitive)* in column (2). In column (3) instead of including each of the *CapGains* variables (as well as the *Holdings* variables) and testing the difference between the two, I include *CapGains(Difference)*, which equals *CapGains(TaxSensitive) – CapGains(TaxInsensitive)*, and *Holdings(Difference)*, which equals

Holdings(TaxSensitive) – Holdings(TaxInsensitive). Consistent with the results in Panel A, the coefficient on *CapGains(Difference)* is negative and significant at the 1% level.

B. Repurchases as an Earnings Management Tool

The explanation I offer for why capital gains lock-in reduces the number of shares that firms repurchase is that the supply constraint induced by capital gains lock-in results in firms having to purchase their shares at a higher price, and executives claim that price is the single most important factor in their repurchase decisions (Brav et al. 2005). To further support this conclusion, I identify a set of firms for whom price is a less important determinant in their repurchase decisions—firms that repurchase shares in order to meet or beat an earnings target. These firms are more concerned with the number of shares that they repurchase rather than the price they have to pay to repurchase them. I expect for capital gains lock-in to have a weaker or no effect on these firms' repurchase decisions.

To identify the firms that repurchase shares in order to meet an earnings target, I first calculate the difference between what EPS would have been had a firm not repurchased shares in the quarter and the mean of the first consensus EPS forecast following the announcement of the prior quarter's earnings where I require forecasts from at least two analysts. I keep all firms for which this difference is less than zero. Then among this set of firms, I only keep those whose actual EPS is equal to or greater than the mean of the first consensus EPS forecast following the announcement of the prior quarter's earnings where I require forecasts from at least two analysts. Columns (1) and (2) of Table 3 presents the results of estimating equation (1) for this set of firms. As expected, capital gains lock-in is unrelated to share repurchases in both columns (the difference between the coefficients on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is not significant). Columns (3) and (4) present the results for the remainder of firms. As expected, capital gains lock-

in is significantly negatively related to share repurchases for the remainder of firms (the difference between the coefficients on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is negative and significant at the 1% level). These results support the conclusion that capital gains lock-in has a negative effect on the number of shares that firms repurchase as a result of constraining supply and thus increasing the price required to repurchase shares.

C. Capital Gains Lock-in & Repurchases – Extensive and Intensive Margins

Next I examine whether firms anticipate the effect that capital gains lock-in will have on share repurchases.[19] If firms do not anticipate it, then there should be a larger difference between the percent of shares that a firm announces it intends to repurchase and the percent of shares that it actually repurchases for those firms with a larger difference between the unrealized gains of their tax-sensitive investors and those of their tax-insensitive investors. To test this, I collect the percent of shares sought in repurchases that are not tender offers as well as the share repurchase announcement date from SDC.[20] In addition I collect the number of shares repurchased in a quarter and the average price at which they were repurchased from Compustat. The Compustat data is only available beginning in 2004. Thus the sample period for this test is 2004-2015.

For each firm, I sum the number of shares repurchased between a share repurchase announcement date and the subsequent share repurchase announcement (or until the end of the sample period if there is not a subsequent repurchase announcement). To calculate the percent of shares repurchased, I divide this sum by the number of shares outstanding at the end of the quarter preceding the initial announcement. *Success1* equals the percent of shares repurchased divided by

[19] Firms could anticipate it either because they have learned from their experience with prior repurchases or because they track the tax-sensitivity and shareholder basis of their tax-sensitive investors either through their internal relations department or via stock surveillance services.
[20] SDC does not include all of the repurchases in my sample, which explains why the sample size for this test is small.

the percent of shares sought. *Success2* is analogous to *Success1* except that instead of summing the number of shares repurchased until the subsequent announcement or until the end of the sample period if there is no subsequent announcement, I stop summing in the first quarter in which a firm does not repurchase shares.

Table 3 presents the Pearson correlations between *CapGains(Difference)* and *Success1* and *Success2*. The first row presents the Pearson correlations. The second row reports the p-value for the significance of the correlations. The third row shows the number of observations. Consistent with a wider spread between the percent of shares sought and the percent actually repurchased for those firms with greater capital gains lock-in, both of the Pearson correlations are negative; however, neither is significant. The insignificant correlations suggest that firms anticipate capital gains lock-in. However, I caution against placing too much emphasis on this result since the SDC sample is incomplete.[21]

Next, I estimate a logit regression as a second test of whether firms anticipate the effect of capital gains lock-in on their ability to repurchase shares at a desired price. The dependent variable equals one if a firm repurchases shares in the quarter and zero otherwise. The independent variables are the same as those used in equation (1). Table 5 presents the results. Column (1) only includes the *CapGains* and *Holdings* variables, and column (2) includes all variables except *ExecOptions/MarketCap*. In both columns, we see that the difference between the unrealized capital gains of the two types of investors is significantly negatively related to the likelihood of repurchasing shares (at the 5% level in column (1) and the 10% level in column (2)). Thus, due to

[21] The results are nearly identical if instead of using the number of shares repurchased, I use the value of shares repurchased when calculating the percent of shares repurchased. I calculate the value repurchased as the number of shares repurchased multiplied by the average price at which they were repurchased, and then divide this product by the firm's market capitalization at the end of the quarter preceding the share repurchase announcement.

learning from prior experience or tracking the tax-sensitivity and unrealized gains of their investors, some firms choose not to repurchase shares altogether.[22]

The logit results suggest that capital gains lock-in affects the extensive margin (i.e., the decision of whether or not to repurchase shares). I next test whether capital gains lock-in also affects the intensive margin (i.e., given a firm repurchases shares, does it repurchase fewer shares as a result of capital gains lock-in?). My main analysis reported in Table 2 includes all firms (those that do and do not repurchase shares). In order to examine the intensive margin, I restrict the sample to only firms that repurchase shares in a quarter. Because the dependent variable is no longer highly skewed after I drop observations where repurchases equal zero, I do not need to log transform the dependent variable in this specification. The dependent variable equals *Repurchases/MarketCap* multiplied by 100. Table VI presents the results. Column (1) only includes the *CapGains* and *Holdings* variables and column (2) includes all variables except *ExecOptions/MarketCap*. Consistent with the results in Table 2, I continue to find that the difference between the unrealized gains of the two types of investors is significantly negatively related to the number of shares that firms repurchase (at the 5% level in column (1) and the 10% level in column (2)). Together, the results in Tables V and VI show that capital gains lock-in affects both the intensive and extensive margins of share repurchases.

D. Capital Gains Lock-in & Repurchases – Tax Rate Change

The results presented thus far are consistent with my hypothesis that capital gains lock-in has a negative effect on share repurchases. However, as discussed above, there are differences in the

[22] One caveat to this conclusion is that observing zero repurchases in Compustat does not necessarily mean that a firm did not intend to repurchase shares. A firm could announce its intention to repurchase shares and then never repurchase any shares because it later realizes that the price it would have to pay to repurchase shares due to capital gains lock-in is higher than it wants to pay.

portfolio characteristics of tax-sensitive and tax-insensitive institutional investors in the sample. It is possible that these differences are responsible for the results (i.e., that (β_1- β_2) is a biased estimate of the lock-in effect). I next take advantage of exogenous variation in the long-term capital gains tax rate to address this concern and to further link the results to capital gains lock-in.

Specifically, I examine whether the relation between unrealized capital gains of tax-sensitive investors and repurchases varies with the capital gains tax rate. For any given amount of unrealized capital gains, the extent of lock-in should increase with the tax rate since the cost of realizing taxable gains increases. I therefore expect the negative relation between tax-sensitive investors' unrealized gains and repurchases to be stronger when the capital gains tax rate is higher. I thus test whether the relation between repurchases and tax-sensitive investors' unrealized gains weakens immediately after the cut to the long-term capital gains tax rate from 28 percent to 20 percent enacted by the Taxpayer Relief Act of 1997 (TRA97). TRA97 is an ideal setting for a natural experiment to test the effect of capital gains tax rate cuts. Unlike other tax acts (e.g., the Jobs and Growth Tax Relief Reconciliation Act of 2003, which reduced the capital gains tax rate and the dividend tax rate), the 1997 act only changed the individual capital gains tax rate. Thus, it is free of confounding effects.[23]

I introduce an indicator variable, *Pre97Q2*, which equals one for the quarters 1995Q1–1997Q1 and zero for 1997Q2. I re-estimate equation (1) including *Pre97Q2* and its interaction with *CapGains(TaxSensitive)* and with *CapGains(TaxInsensitive)*. Blouin et al. (2017) find that the tax-sensitive institutional investors in my sample significantly reduced the weight placed on stocks in their portfolios with large unrealized gains in 1997Q2 relative to the preceding quarters and relative

[23] Papers that use the 1997 tax cut to study the effect of investor-level capital gains taxes on trading and asset prices include Lang and Shackelford (2000), Cook (2007), Ayers, Li and Robinson (2008), Dai et al. (2008), Blouin, Hail and Yetman (2009), Chyz and Li (2012), and Blouin et al. (2017).

to tax-insensitive institutional investors. Their finding is consistent with tax-sensitive investors "unlocking" their gains once the tax rate cut was announced, which I expect relaxed the supply constraint imposed by capital gains lock-in and weakened the negative effect of capital gains lock-in on repurchases. Thus, I expect the coefficient on the interaction of *Pre97Q2* and *CapGains(TaxSensitive)* to be negative, indicating that the lock-in effect is stronger before the tax rate cut.

Table VII reports the results. Firm fixed effects are included in both columns. In column (1) I include the main effect of *Pre97Q2* and exclude year-quarter fixed effects. In column (2), I include year-quarter fixed effects and drop *Pre97Q2* since it does not vary across observations within a year-quarter. Consistent with my expectation, in both columns the coefficient on the interaction *CapGains(TaxSensitive)* x *Pre97Q2* is negative and significant at the one percent level and the coefficient on the interaction *CapGains(TaxInsensitive)* x *Pre97Q2* is not significant.[24] These results provide evidence that the sensitivity of repurchases to tax-sensitive investors' unrealized gains that I document in Table 2 is not attributable to differences in the characteristics of the tax-sensitive and tax-insensitive institutional investors that are unrelated to taxes.

E. Capital Gains Lock-in & Repurchases – Availability of Cash

Although I control for a firm's level of cash in addition to its cash flow in equation (1), to rule out any concern that firms with greater unrealized capital gains among their tax-sensitive investors have less cash available to repurchase shares, I estimate equation (1) for a sub-sample of firms that receive a positive cash flow shock. AJCA provided a temporary tax holiday by reducing the U.S. tax rate on repatriated foreign earnings in 2004 or 2005 from 35% to 5.25%. The motivation for the tax holiday was to stimulate the economy, and share repurchases were not one of the approved

[24] Untabulated tests show that the difference between the two interactions is significant at the 1% level in both columns.

uses of cash. Despite this, Blouin and Krull (2009) find that repatriating firms increased share repurchases by $60 billion more than non-repatriating firms in 2005, a difference that cannot be explained by the variation in their earnings. The $60 billion equals 20% of the $291.6 billion that their sample firms repatriated under the Act.

I estimate equation (1) only for the four quarters in 2005 and only including firms that repatriated earnings under the provisions of AJCA. Column (1) of Table VIII includes the results only including the *CapGains* and *Holdings* variables, and column (2) includes all independent variables except *ExecOptions/MarketCap*. The coefficient on *CapGains(TaxSensitive)* as well as the difference between the two *CapGains* variables are negative and significant at the 10% level. This result eliminates any concern that the negative relation between capital gains lock-in and share repurchases is due to firms with greater unrealized gains among their tax-sensitive investors having less cash available for share repurchases.

F. Tobit Specification

As explained earlier, because the majority of the firms in the sample do not repurchase shares and thus *Repurchases/MarketCap* equals zero for these firms, I also estimate a variation of equation (1) using a Tobit model where the dependent variable equals (*Repurchases/MarketCap*). Because Tobit models do not accommodate firm fixed effects, I demean the dependent variable by subtracting a firm's mean value of (*Repurchases/MarketCap*) over the sample period.

Columns (1) and (2) of Table IX report the Tobit results only including the *CapGains* and *Holdings* variables and then with all independent variables except *ExecOptions/MarketCap*, respectively. Columns (3) and (4) present the results for the analysis surrounding TRA97. All columns include year-quarter fixed effects except column (3), which includes the *Pre97Q2*

indicator variable. Heteroskedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below the coefficient estimates.

At the bottom of the table in columns (1) and (2) I report the marginal effects of *CapGains(TaxSensitive)*, *CapGains(TaxInsensitive)*, and the difference between the two, measured at the means of the explanatory variables. Similar to the OLS results in Table II, the marginal effect of *CapGains(TaxSensitive)* is negative and significant at the 1% level in both columns and the marginal effect of *CapitalGains(TaxInsensitive)* is positive in both columns and significant at the 1% level in column (2). Moreover, consistent with my expectation, the marginal effect of the difference between the two is negative and significant at the 1% level in both columns.

In columns (3) and (4), the coefficient on the interaction *CapGains(TaxSensitive)* × *Pre97Q2* is negative and significant at the 1% level, consistent with the results in Table VII. The coefficient on the interaction *CapGains(TaxInsensitive)* × *Pre97Q2* is positive and significant at the 1% level, whereas it is insignificant in Table VII. Because the Tobit model is nonlinear, the marginal effects of these interaction terms could differ in sign from the coefficients. Using the estimates from the regression presented in column (3) and the means of the explanatory variables, I calculate the marginal effects of each of the interactions and report them at the bottom of the table. The marginal effect of *CapGains(TaxSensitive)* × *Pre97Q2* is negative and significant at the 1% level and the marginal effect of *CapGains(TaxInsensitive)* × *Pre97Q2* is positive and significant at the 1% level. Because the marginal effect of *CapGains(TaxInsensitive)* varies with the capital gains tax rate (although in the opposite direction of the marginal effect on *CapGains(TaxSensitive)*), the Tobit results do not provide as strong of support as the OLS results for the conclusion that differences in characteristics other than tax-sensitivity between the two groups of investors are not responsible for the negative relation between repurchases and capital gains lock-in.

Because the residuals are not observed for censored observations in a Tobit model, I use simulations to estimate the aggregate impact of capital gains lock-in on repurchases over the sample period. These simulations are based on the regression in column (2). I limit the sample to firms with positive *CapGains(TaxSensitive)*. I first fit the model using the coefficients from the regression and the actual explanatory variables to calculate the expected value of the latent dependent variable. I then generate a normally distributed random error term with mean zero and the standard deviation estimated in the regression (2.3) for each observation in the sample. I add the error term for each observation to the expected latent variable value for that observation. I then calculate the simulated *Repurchases/MarketCap* for each observation as the greater of the simulated latent repurchase level and zero. I multiply this by market capitalization to get the simulated repurchase level. Finally, I sum these simulated repurchase levels over all observations to calculate the simulated level of repurchases for all firms with positive *CapGains(TaxSensitive)*.

I then repeat this exercise, but without the capital gains lock-in effect. Since my approach assumes that the non-tax effects are the same for the unrealized capital gains of tax-sensitive and tax-insensitive investors in the sample, I set the coefficient on *CapGains(TaxSensitive)* equal to the coefficient on *CapGains(TaxInsensitive)*. The level of repurchases generated from this simulation represents what the level of repurchases would have been in the absence of a lock-in effect. My estimate of how much the sample firms would have spent on repurchases during the sample period in the absence of capital gains lock-in equals the difference between the simulated aggregate repurchases with and without the capital gains lock-in effect.

I repeat this exercise 1,000 times and calculate the mean additional repurchases in the absence of a lock-in effect, which is $72 billion. In summary, I estimate that had there been no capital gains lock-in effect on repurchases, the sample firms with positive *CapGains(TaxSensitive)* would have

repurchased $72 billion more of their shares over the 1995-2015 sample period than they actually did. This $72 billion equals 2.2 percent of the $3.2 trillion of repurchases for this sample of firms. This estimate is a lower bound of the total effect of capital gains lock-in on repurchases since I only observe the unrealized capital gains of the tax-sensitive institutional investors in the sample, which are only a fraction of the unrealized capital gains of all tax-sensitive investors.

V. Capital Gains Lock-In and Investment

A large literature finds that firms sometimes forgo investment opportunities that they cannot finance with internal resources (e.g., Fazzari, Hubbard and Petersen 1988; Blanchard, Lopez-de-Salines and Shleifer 1994; Lamont 1997; Rauh 2006). A firm facing such financing constraints is likely to consider repurchases and investments to be substitutes. In this case, a firm that repurchases fewer shares because capital gains lock-in makes a repurchase more expensive might use the available cash to undertake more real investment. I explore this possibility by examining whether capital gains lock-in is positively associated with firms' capital expenditures and R&D expenses.

I first regress quarterly capital expenditures multiplied by 100 and scaled by beginning-of-quarter total assets (*Capex/Assets*) on the two *CapGains* variables, the two *Holdings* variables, *Cash/MarketCap*, *CashFlow/MarketCap*, *Market/Book*, *Dividends/MarketCap*, *ln(Assets)*, *Leverage-TargetLeverage*, and *Volatility*, which are all defined above.[25] In addition, I control for the quarterly mean of *Capex/Assets* for a firm's 2-digit SIC industry (*Capex/Assets_IndMean*), quarterly R&D expenses scaled by beginning-of-quarter total assets (*R&D/Assets*), and the natural log of quarterly gross domestic product (*ln(GDP)*). Columns (1) and (2) of Table X present the

[25] I use Compustat item *capxy*, which is year-to-date capital expenditures. For the second through fourth quarters of the year, I subtract the value of *capxy* in the prior quarter from the value of *capxy* for the current quarter to compute quarterly capital expenditures.

results only including the *CapGains* and *Holdings* variables and then with all variables, respectively.[26] At the bottom of the table, I report the difference between the coefficients on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)*. Consistent with capital gains lock-in being positively associated with investment, the difference is positive and significant (at the 1% level in column (1) and the 10% level in column (2)). These results suggest that firms effected by capital gains lock-in allocate the cash that they might have otherwise used to repurchase shares instead to investment.

In columns (3) and (4) I interact *Pre97Q2* with each of the *CapGains* variables. Consistent with my expectation, the positive relation between unrealized gains of tax-sensitive investors and capital expenditures is stronger when the capital gains tax rate is higher, as evidenced by a positive and significant coefficient on *CapGains(TaxSensitive)* × *Pre97Q2*. However, the relation between *CapGains(TaxInsensitive)* and *Capex/Assets* also varies with the tax rate (in the opposite direction).

Next I test whether capital gains lock-in leads to firms substituting R&D for share repurchases. Similar to share repurchases, the distribution of R&D expenses is skewed as a result of the variable equaling zero for many firms. Thus, the dependent variable is the natural log of (0.001 + *R&D/Assets*), where *R&D/Assets* equals quarterly R&D expenses multiplied by 100 and scaled by beginning-of-quarter total assets. I regress this variable on the same independent variables that are in the Capex regression above with the exception that I replace *R&D/Assets* with *Capex/Assets* and *Capex/Assets_IndMean* with *R&D/Assets_IndMean*.[27]

[26] The number of observations in the capital expenditure and R&D regressions is greater than that for the repurchase regressions as a result of not including four lags of Return and not requiring IBES data (*EPS_Diff*).
[27] Note that I only multiply *Capex/Assets* and *R&D/Assets* by 100 when each is used as the dependent variable.

Table XI presents the results. In line with my prediction, the first two columns show that the difference between *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is positive; however the difference is not statistically significant. Columns (3) and (4) report that the coefficient on *CapGains(TaxSensitive)* × *Pre97Q2* is positive and significant at the 10% level in column (4) and positive but not quite significant by conventional standards in column (3) (p-value = 0.138). The coefficient on *CapGains(TaxInsensitive)* × *Pre97Q2* is negative and not close to being significant. These results suggest that when the capital gains tax rate was cut in the second quarter of 1997, firms freed up cash by cutting R&D in order to take advantage of the increased supply of shares available to repurchase.

Overall, the results in Tables X and XI provide evidence that capital gains lock-in has an indirect positive effect on real investment by making share repurchases relatively more expensive.

VI. Conclusion

Survey and empirical evidence suggest that price is an important determinant in firms' decisions to repurchase shares. I examine a factor that could impact price and in turn could impact a firm's decision of whether and how many shares to repurchase. Specifically, I test whether capital gains lock-in reduces firms' share repurchases. I estimate the effect of lock-in by examining how repurchases vary with shareholders' unrealized gains depending on whether these gains belong to tax-sensitive or to tax-insensitive investors. Consistent with my hypothesis, I find that capital gains lock-in reduces the number of shares that a firm repurchases. Furthermore, I show that a reduction in the capital gains tax rate decreased the effect of capital gains lock-in on repurchases, confirming that differences other than tax-sensitivity between the tax-sensitive and tax-insensitive institutional investors in my sample are not responsible for my results.

Firms seem to anticipate the capital gains lock-in effect as it is negatively associated with the likelihood of repurchasing (extensive margin) as well as the number of shares repurchased conditional on a repurchase occurring (intensive margin). Moreover, consistent with my conclusion that capital gains lock-in reduces share repurchases because it requires firms to repurchase shares at a price higher than they would like, the negative relation between capital gains lock-in and share repurchases is not significant for a sample of firms that are more concerned with the number of shares repurchased than the price paid (firms that repurchase shares in order to meet analysts' EPS forecasts). Furthermore, availability of cash to allocate to repurchases does not explain the negative and significant relation between capital gains lock-in and share repurchases as it holds for a sample of firms that received a positive cash flow shock after repatriating earnings at a reduced rate under AJCA. Finally, I find that capital gains lock-in is positively related to capital expenditures and R&D, consistent with firms that reduce share repurchases due to capital gains lock-in allocating the available cash to real investment.

References

Abarbanell, Jeffrey, Brian Bushee, and Jana Raedy, 2003, Institutional investor preferences and price pressure: The case of corporate spin-offs, *Journal of Business* 76, 233–261.

Ahern, Kenneth R., 2014, Do common stocks have perfect substitutes?: Product market competition and the elasticity of demand for stocks, *Review of Economics and Statistics* 96(4): 756–766.

Ai, Chunrong and Edward C. Norton, 2003, Interaction terms in logit and probit models. *Economic Letters* 80(1), 123–129.

Allen, Franklin, and Roni Michaely, 2003, Payout policy, in G.M. Constantinides, M. Harris, and R Stulz (eds.), *Handbook of the Economics of Finance*, Elsevier Science B.V., 335–427.

Anderson, Anne M., and Edward A. Dyl, 2004, Determinants of premiums on self-tender offers, *Financial Management* 33(1), 25–45.

Ayers, Benjamin, Craig Lefanowicz, and John Robinson, 2003, Shareholder Taxes in Acquisition Premiums: The Effect of Capital Gains Taxation, *Journal of Finance* 58, 2785–2803.

Ayers, Benjamin C., Oliver Zhen Li, and John R. Robinson, 2008, Tax-induced trading around the taxpayer relief act of 1997, *Journal of the American Taxation Association* 30(1), 77–100.

Bagwell, Laurie Simon, 1991, Share repurchase and takeover deterrence, *The RAND Journal of Economics* 22(1), 72–88.

Bagwell, Laurie Simon, and John B. Shoven, 1988, Share repurchases and acquisitions: An analysis of which firm participate. In Alan J. Auerbach (ed.), *Corporate Takeovers: Causes and Consequences*. Chicago: University of Chicago Press.

Banyi, Monica L., Edward A. Dyl, and Kathleen M. Kahle, 2008, Errors in estimating share repurchases, *Journal of Corporate Finance* 14(4): 460–474.

Bartov, Eli, 1991, Open-market stock repurchases as signals for earnings and risk changes, *Journal of Accounting and Economics*, 14(3), 275–294.

Bens, Daniel A, Venky Nagar, Douglas J. Skinner, and M.H. Franco Wong, 2003, Employee stock options, EPS dilution, and stock repurchases, *Journal of Accounting and Economics* 36: 51–90.

Blanchard, Oliver Jean, Florencio Lopez-de-Silanes, and Andrei Shleifer, 1994, What do firms do with cash windfalls?, *Journal of Financial Economics* 36: 337–360.

Blouin, Jennifer, Brian Bushee, and Stephanie Sikes, 2017, Measuring tax-sensitive institutional investor ownership. *The Accounting Review*, Forthcoming.

Blouin, Jennifer, Luzi Hail, and Michelle Yetman, 2009, Capital gains taxes, pricing spreads, and arbitrate: Evidence from crosss-listed firms in the U.S., *The Accounting Review* 84(5), 1321–1361.

Blouin, Jennifer, and Linda Krull, 2009, Bringing it home: A study of the incentives surrounding the repatriation of foreign earnings under the American Jobs Creation Act of 2004, *Journal of Accounting Research* 47(4): 1027–1059.

Blouin, Jennifer L., Jana Smith Raedy, and Douglas A. Shackelford, 2003, Capital gains taxes and equity trading: Empirical evidence, *Journal of Accounting Research* 41(4), 611–651.

Brav, Alon, John R. Graham, Campbell R. Harvey, and Roni Michaely, 2005, Payout policy in the 21st century, *Journal of Financial Economics* 77, 483–527.

Brown, David T, and Michael D. Ryngaert, 1992, The determinants of tendering rates in interfirm and self-tender offers, *Journal of Business* 65(4), 529–556.

Burks, Jeffrey J., David W. Randolph, and Jim A. Seida, 2015, Modeling and interpreting interactions in tradeoff research. Working paper, University of Notre Dame and Xavier University.

Chyz, James A., and Oliver Z. Li. 2012. Do tax sensitive investors liquidate appreciated shares after a capital gains tax rate reduction? *National Tax Journal* 65(3): 595–62.

Comment, Robert and Gregg Jarrell, 1991, The relative signaling power of Dutch-auction and fixed-price self-tender offers and open-market share repurchases, *Journal of Finance*, 46(4), 1243–1271.

Cook, Kirsten A., 2007, Stock price reaction to a reduction in the capital gains tax rate: Evidence from the Taxpayer Relief Act of 1997, Working paper, Texas Tech University.

Dai, Zhonglan, Edward Maydew, Douglas Shackelford, and Harold Zhang, 2008, Capital gains taxes and asset prices: Capitalization or lock-in?, *Journal of Finance* 63(2), 709–742.

Dann, Larry, 1981, The effects of common stock repurchase on security holders' returns, *Journal of Financial Economics*, 9(2), 101–138.

Datar, Vinay, Narayan Naik, and Robert Radcliffe, 1998, Liquidity and asset returns: an alternative test, *Journal of Financial Market*, 1(2), 203–219.

Desai, Mihir, and Li Jin, 2011, Institutional Tax Clienteles and Payout Policy, *Journal of Financial Economics*, 100(1), 68–84.

Dittmar, Amy K., 2000, Why do firms repurchase stock?, *Journal of Business* 73(3), 331–355.

Dunsby, Adam, 1994, Share repurchase, dividends, and corporate distribution policy, University of Pennsylvania - Electronic Dissertations. Paper AAI9532169.

Easterbrook, Frank H., 1984, Two agency-cost explanations of dividends, *American Economic Review* 74, 650–59.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen, 1988, Financing constraints and corporate investment, *Brookings Papers on Economic Activity*, 1988(1): 141–206.

Feldstein, Martin, Joel Slemrod, and Shlomo Yitzhaki, 1980, The effects of taxation on the selling of corporate stock and the realization of capital gains, *Quarterly Journal of Economics* 94, 777–791.

Fenn, George W., and Nellie Liang, 1997, Good news and bad news about share repurchases, Working paper, Washington, D.C.: Board of Governors of the Federal Reserve (FEDS Paper No. 98-4).

Frazzini, Andrea, 2006, The disposition effect and underreaction to news, *Journal of Finance* 61(4), 2017–2046.

Gow, Ian, Ormazabal, Gaizka, Taylor, D. 2010. Correcting for cross-sectional and time-series dependence in accounting research. *The Accounting Review* 85(3): 483–512.

Graham, John, and Alok Kumar, 2006, Do dividend clienteles exist? Evidence on dividend preferences of retail investors, *Journal of Finance* 61(3), 1305–1336.

Greene, William H., 2003, *Econometric Analysis*, Englewood Cliffs, NJ: Prentice-Hall.

Grinblatt, Mark and Matti Keloharju, 2001, What makes investors trade?, *The Journal of Finance* 56(2): 589–616.

Grinstein, Yaniv, and Roni Michaely, 2005, Institutional holdings and payout policy, *Journal of Finance* 60(3), 1389–1426.

Grullon, Gustavo, and David Ikenberry, 2000, What do we know about stock repurchases?, *Journal of Applied Corporate Finance* 13, 31–51.

Grullon, Gustavo, and Roni Michaely, 2002, Dividends, share repurchases and the substitution hypothesis, *Journal of Finance* 57(4), 1649–1684.

Holthausen, Richard, Richard Leftwich, and David Mayers, 1987, The effect of large block transactions on security prices: A cross-sectional analysis, *Journal of Financial Economics* 19(2), 237–267.

Hovakimian, Armen, Tim Opler, and Sheridan Titman, 1996, The debt-equity choice, *Journal of Financial and Quantitative Analysis* 36(1), 1–24.

Hribar, Paul, Nicole Thorne Jenkins, and W. Bruce Johnson, 2006, Stock repurchases as an earnings management device, *Journal of Accounting and Economics* 41: 3-27.

Huddart, Steven, and V.G. Narayanan, 2002, An empirical examination of tax factors and mutual funds' stock sale decisions, *Review of Accounting Studies* 7, 319–342.

Ikenberry, David, Josef Lakonishok, and Theo Vermaelen, 1995, Market underreaction to open market share repurchases, *Journal of Financial Economics*, 39(2-3), 181–208.

Ivkovic, Zoran, James Poterba, and Scott Weisbenner, 2005, Tax-motivated trading by individual investors, *American Economic Review* 95, 1605–1630.

Jagannathan, Murali, Clifford P. Stephens, and Michael S. Weisbach, 2000, Financial flexibility and the choice between dividends and stock repurchases, *Journal of Financial Economics* 57, 355–384.

Jensen, Michael C., 1986, Agency costs of free cash flow, *American Economic Review* 76, 323–329.

Jin, Li, 2006, Capital gains tax overhang and price pressure, *Journal of Finance* 61(3), 1399–1430.

Jin, Li, and S.P. Kothari, 2008, Effect of personal taxes on managers' decisions to sell their stock, *Journal of Accounting and Economics* 46, 23–46.

Jolls, Christine, 1996, The role of compensation in explaining the stock-repurchase puzzle, Working paper, Harvard Law School.

Kadapakkam, Palani-Rajan, and Sarabjeet Seth, 1997, Capital gains taxes and stockholders' response to Dutch auction tender offers, *Financial Review* 32(4), 779–800.

Kahle, Kathleen M., 2002, When a buyback isn't a buyback: Open market repurchases and employee option, *Journal of Financial Economics* 63(2), 235–261.

Kalay, Avner, Orly Sade, and Avi Wohl, 2004, Measuring stock illiquidity: An investigation of the demand and supply schedules at the TASE, *Journal of Financial Economics* 74(3), 461–486.

Kandel, Shmuel, Oded Sarig, and Avi Wohl, 1999, The demand for stocks: An analysis of IPO auctions, *Review of Financial Studies* 12(2), 227–247.

Kaul, Aditya, Vikas Mehrotra, and Randall Morck, 2000, Demand curves for stocks do slope down: New evidence from an index weight adjustment, *Journal of Finance* 55(2), 893–912.

Klein, Peter, 2001, The capital gain lock-in effect and long horizon return reversal, *Journal of Financial Economics* 59, 33–62.

Lamont, Owen, 1997, Cash flow and investment: evidence from internal capital markets, *Journal of Finance* 52(1): 83–109.

Landsman, Wayne, and Douglas Shackelford, 1995, The lock-in effect of capital gains taxes: Evidence from the RJR Nabisco leveraged buyout, *National Tax Journal* 48, 245–259.

Lang, Mark, and Douglas Shackelford, 2000, Capitalization of capital gains taxes: Evidence from stock price reactions to the 1997 rate reduction, *Journal of Public Economics* 76, 69–85.

Lie, Erik, and Heidi J. Lie, 1999, The Role of Personal Taxes in Corporate Decisions: An Empirical Analysis of Share Repurchases and Dividends, *Journal of Financial and Quantitative Analysis* 34(4), 533–552.

Loderer, Claudio, John W. Cooney, and Leonard D. Van Drunen, The price elasticity of demand for common stock, *Journal of Finance* 46(2), 621–651.

Maddala, Gangadharrao, S., 1991, A perspective on the use of limited-dependent variable models in accounting research, *The Accounting Review* 66(4): 788–807.

Moser, William J., 2007, The effect of shareholder taxes on corporate payout choice, *Journal of Financial and Quantitative Analysis* 42(4):991–1020.

Perez-Gonzalez, Francisco, 2002, Large shareholders and dividends: Evidence from U.S. tax reforms, Working paper, Stanford University.

Petersen, Mitchell 2009. Estimating standard errors in finance panel data sets: comparing approaches. *Review of Financial Studies* 22: 435–480.

Poterba, James, and Lawrence Summers, 1983, Dividend taxes, corporate investment and 'Q', *Journal of Financial Economics* 22 (1): 135–167.

Rauh, Joshua, 2006, Investment and financing constraints: Evidence from the funding of corporate pension funds, *Journal of Finance* 61(1): 33–71.

Reese, William, 1998, Capital gains taxation and stock market activity: Evidence from IPOs, *Journal of Finance* 53, 1799–1820.

Scholes, Myron, 1972, The market for securities: Substitution vs. price pressure and the effects of information on share prices, *Journal of Business* 45, 179–211.

Schultz, Paul, 2008, Downward-sloping demand curves, the supply of shares, and the collapse of Internet stock prices, *Journal of Finance* 63(1), 351–378.

Seasholes, Mark, and Lei Feng, 2005, Do investor sophistication and trading experience eliminate behavioral biases in financial markets?, Working paper, U.C. Berkeley.

Shackelford, Douglas, and Robert Verrecchia, 2002, Intertemporal Tax Discontinuities, *Journal of Accounting Research* 40(1), 205–222.

Shapira, Zur, and Itzhak Venezia, 2001, Patterns of behavior of professionally managed and independent investors, *Journal of Banking and Finance* 25: 1573–1587.

Shefrin, Hersh, and Meir Statman, 1985, The disposition to sell winners too early and ride losers too long: Theory and evidence, *Journal of Finance* 40(3), 777–790.

Shleifer, Andrei, 1986, Do demand curves for stocks slope down?, *Journal of Finance* 41(3), 579–590.

Sikes, Stephanie, 2014, The turn-of-the-year effect and tax-loss-selling by institutional investors, *Journal of Accounting and Economics* 57(1): 22–42.

Skinner, Douglas J., 2008, The evolving relation between earnings, dividends, and stock repurchases, *Journal of Financial Economics* 87: 582-609.

Stephens, Clifford, and Michael Weisbach, 1998, Actual share reacquisitions in open-market repurchase programs, *Journal of Finance*, 53(1), 313–334.

Strickland, Deon, 1996, Determinants of institutional ownership: Implications for dividend clienteles, Working paper, Arizona State University.

Stultz, Rene, 1988, Managerial control of voting rights: financing policies and the market or corporate control, *Journal of Financial Economics* 20(1–2), 25–54.

Vermaelen, Theo, 1981, Common stock repurchases and market signaling: An empirical study, *Journal of Financial Economics* 9, 139–83.

Wooldridge, Jeffrey W., 2002, *Econometric analysis of cross section and panel data*, Cambridge, MA: MIT Press.

Table I
Descriptive Statistics

This table presents summary statistics for the sample of firms used in this study. The sample consists of firm-quarter observations for the period 1995Q1-2015Q4. Repurchases are computed as total common and preferred repurchases for the current quarter, less any decrease in preferred stock outstanding (Compustat item *pstkq*) from the end of the prior quarter to the end of the current quarter. Total common and preferred repurchases are calculated from *prstkcy*. Since *prstkcy* is year-to-date repurchases, I subtract the previous quarter's value of *prstkcy* from the current quarter's value to calculate total repurchases for a quarter, with the exception of the first quarter of the year where I use the actual value of *prstkcy*. MarketCap is shares outstanding (*cshoq*) times stock price (*prccq*). *Repurchases/MarketCap* equals (Repurchases/MarketCap)*100. Total assets are *atq*. *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* are the unrealized capital gains of tax-sensitive and tax-insensitive institutional investors (see text for calculation), respectively, in a firm's shares scaled by *MarketCap*. *Holdings(TaxSensitive)* and *Holdings(TaxInsensitive)* are the percent of a firm's outstanding shares owned by tax-sensitive and tax-insensitive institutional investors, respectively. *Return* is the quarterly return on the firm's stock as reported in CRSP. *Cash* is cash and short-term investments (*cheq*). *CashFlow* is pretax income (*piq*) + depreciation and amortization (*dpq*). *Market/book* is the ratio of the market value of assets to the book value of assets. Market value of assets equals *MarketCap* + long-term debt (*dlttq*) + debt in current liabilities (*dlcq*). *Dividends* are total dividends (backed out from year-to-date dividends, *dvy*) less preferred dividends (backed out from year-to-date preferred dividends, *dvpy*). *Leverage* is defined as long-term (*dlttq*) + debt in current liabilities (*dlcq*) – cash and short-term investments (*cheq*). *TargetLeverage* is the median leverage for firms in the same 2-digit SIC code for the year. *Volatility* is the standard deviation of the daily stock return for the quarter. To calculate *EPS_Diff*, I first calculate the difference between what EPS would have been had a firm not repurchased shares in the quarter and the mean of the first consensus EPS forecast for the quarter following the announcement of the prior quarter's earnings where I require forecasts from at least two analysts. I then scale the difference by the product of 100 and the firm's average price over the quarter. *ExecOptions* is the estimated value of in-the-money unexercised exercisable options (*opt_unex_exer_est_val*) owned by the firm's top five executives and is measured annually. *Capex/Assets* is quarterly capital expenditures (backed out from Compustat item *capxy*, which is year-to-date capital expenditures) divided by total assets at the end of the previous quarter. I multiply this variable by 100 when it is the dependent variable (as reflected in table below). *R&D/Assets* is quarterly R&D expense (*xrdq*) divided by total assets at the end of the previous quarter. I multiply this variable by 100 when it is the dependent variable (as reflected in table below). *Ln(GDP)* is the natural log of quarterly GDP. *Capex/Assets_IndMean* and *R&D/Assets_IndMean* are the quarterly mean values of *Capex/Assets* and *R&D/Assets* for a firm's 2-digit SIC industry. All variables are winsorized at the 1st and 99th percentiles.

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Variable	N	Mean	Std. Dev.	5th Pctile	25th Pctile	Median	75th Pctile	95th Pctile
Repurchases, $millions	215,598	17.7269	60.8084	0.0000	0.0000	0.0000	1.0320	113.9000
Assets, $millions	215,598	5584.8001	15961.8868	55.0070	265.8350	924.0085	3347.4000	25884.1730
MarketCap, $millions	215,598	3954.4128	9472.5346	71.8440	272.2700	807.5348	2709.8899	19491.8000
Repurchases/MarketCap	215,598	0.3784	0.9946	0.0000	0.0000	0.0000	0.1221	2.3072
Ln(0.001+Repurchases/MarketCap)	215,598	-4.9439	3.0008	-6.9078	-6.9078	-6.9078	-2.0946	0.8365
CapGains(TaxSensitive)	215,598	0.0023	0.0344	-0.0376	-0.0018	0.0022	0.0117	0.0447
CapGains(TaxInsensitive)	215,598	0.0082	0.2351	-0.3694	-0.0400	0.0343	0.1253	0.2788
Holdings(TaxSensitive)	215,598	0.0514	0.0533	0.0014	0.0155	0.0352	0.0694	0.1559
Holdings(TaxInsensitive)	215,598	0.4087	0.2070	0.0679	0.2473	0.4173	0.5641	0.7335
Return	215,598	0.0097	0.2329	-0.3355	-0.1172	-0.0060	0.1110	0.4019
Cash/MarketCap	215,598	0.1879	0.3127	0.0046	0.0320	0.0956	0.2198	0.6291
CashFlow/MarketCap	215,598	0.0131	0.0617	-0.0492	0.0089	0.0191	0.0307	0.0653
Market/Book	215,598	1.7408	1.6384	0.2966	0.8258	1.2444	2.0526	4.8654
Dividends/MarketCap	215,598	0.0026	0.0060	0.0000	0.0000	0.0000	0.0033	0.0116
ln(Assets)	215,598	6.9030	1.8378	4.0075	5.5829	6.8287	8.1159	10.1614
Leverage-TargetLeverage	215,598	0.0033	0.2907	-0.5221	-0.1542	0.0100	0.1733	0.4814
Volatility	215,598	0.0292	0.0173	0.0108	0.0173	0.0249	0.0361	0.0628
EPS_Diff	215,598	-0.0333	2.5582	-0.0003	0.0000	0.0000	0.0000	0.0001
Exec_Options	114,356	0.0054	0.0091	0.0000	0.0003	0.0019	0.0063	0.0234
Capex/Assets	400,956	1.3050	2.0609	0.0000	0.1263	0.6250	1.5613	5.0377
R&D/Assets	400,956	1.2568	2.9737	0.0000	0.0000	0.0000	1.0667	6.8543
Ln(0.001+R&D/Assets)	400,956	-4.3756	3.6730	-6.9078	-6.9078	-6.9078	0.0655	1.9250
ln(GDP)	400,956	9.4970	0.1379	9.2381	9.3895	9.5256	9.6084	9.6920
Capex/Assets_IndMean	400,956	1.3743	1.3246	0.0262	0.7174	1.0752	1.6775	3.9648
R&D/Assets_IndMean	400,956	1.3784	2.0277	0.0000	0.0131	0.2540	2.4058	6.2820

Table II
Capital Gains Lock-In and Share Repurchases

Panel A: Primary Analyses

This table presents results from OLS regressions in which the dependent variable is ln (0.001 + *Repurchases/MarketCap*). The sample period is 1995Q1–2015Q4. The results in columns (1), (2), (4), and (5) are for all observations in the sample. Including *ExecOptions/MarketCap* as an additional control variable in columns (3) and (6) reduces the sample size. All explanatory variables except *EPS_Diff* are lagged one quarter. All specifications include year-quarter fixed effects and columns (3)–(6) also include firm fixed effects. The difference between the coefficient estimates on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is reported at the bottom of the columns. Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table 1 for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)	(3)	(4)	(5)	(6)
CapGains(TaxSensitive)	-0.282	-0.285	-2.151**	-1.925***	-1.399***	-2.152***
	(0.522)	(0.491)	(0.892)	(0.421)	(0.399)	(0.772)
CapGains(TaxInsensitive)	1.353***	0.993***	1.150***	0.365***	0.304***	0.491***
	(0.126)	(0.113)	(0.158)	(0.089)	(0.085)	(0.129)
Holdings(TaxSensitive)	1.164***	1.450***	1.978***	0.700**	0.382	0.684
	(0.359)	(0.330)	(0.521)	(0.309)	(0.299)	(0.488)
Holdings(TaxInsensitive)	2.031***	1.245***	0.613***	0.014	-0.420***	-0.684***
	(0.108)	(0.119)	(0.188)	(0.126)	(0.133)	(0.199)
Return_Lag1		-0.783***	-1.173***		-0.414***	-0.615***
		(0.075)	(0.112)		(0.054)	(0.080)
Return_Lag2		-0.601***	-0.842***		-0.271***	-0.357***
		(0.058)	(0.075)		(0.041)	(0.059)
Return_Lag3		-0.449***	-0.533***		-0.167***	-0.107*
		(0.059)	(0.075)		(0.043)	(0.062)
Return_Lag4		-0.343***	-0.391***		-0.094**	-0.026
		(0.047)	(0.066)		(0.040)	(0.063)
Cash/MarketCap		0.108	0.277**		-0.073	-0.099
		(0.085)	(0.131)		(0.073)	(0.111)
CashFlow/MarketCap		0.511**	0.388		0.659***	0.709**
		(0.245)	(0.327)		(0.215)	(0.321)
Market/Book		0.076***	0.213***		-0.075***	-0.094***
		(0.017)	(0.029)		(0.015)	(0.023)
Dividends/MarketCap		-8.818**	-0.049		2.316	-2.435
		(3.691)	(7.202)		(2.645)	(4.248)
ln(Assets)		0.259***	0.276***		0.332***	0.533***
		(0.023)	(0.029)		(0.036)	(0.055)
Leverage-TargetLeverage		-0.403***	-0.498***		-1.516***	-2.113***
		(0.078)	(0.127)		(0.092)	(0.157)
Volatility		-21.076***	-33.522***		-15.306***	-24.811***
		(1.569)	(2.732)		(1.559)	(2.794)
EPS_Diff		0.001	0.034		-0.005**	0.027
		(0.002)	(0.000)		(0.002)	(0.000)
ExecOptions/MarketCap			6.523**			3.978
			(2.738)			(2.691)
Constant	-6.241***	-7.272***	-7.225***	-6.007***	-7.349***	-8.084***
	(0.030)	(0.139)	(0.216)	(0.050)	(0.214)	(0.369)
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	-1.635***	-1.218**	-3.301***	-2.290***	-1.703***	-2.643***
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	No	No	No	Yes	Yes	Yes
Observations	215,598	215,598	114,356	215,598	215,598	114,356
Adjusted R-squared	0.0531	0.0967	0.0916	0.3497	0.3620	0.3461

Table II
Capital Gains Lock-In and Share Repurchases

Panel B: Robustness Analyses

This table presents results from OLS regressions in which the dependent variable is ln (0.001 + *Repurchases/MarketCap*). The sample period is 1995Q1–2015Q4. The three columns are modifications of the specification presented in column (5) of Panel A. In column (1), I exclude *CapGains(TaxInsensitive)* and *Holdings (TaxInsensitive)*. In column (2), I exclude *CapGains(TaxSensitive)* and *Holdings (TaxSensitive)*. In column (3), I replace *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* with *CapGains(Difference)*, which equals *CapGains(TaxSensitive)* minus *CapGains(TaxInsensitive)*, and replace *Holdings(TaxSensitive)* and *Holdings(TaxInsensitive)* with *Holdings(Difference)*, which equals *Holdings(TaxSensitive)* minus *Holdings(TaxInsensitive)*. All explanatory variables except *EPS_Diff* are lagged one quarter. All specifications include year-quarter fixed effects and firm fixed effects. Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table 1 for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)	(3)
CapGains(TaxSensitive)	-0.840**		
	(0.392)		
CapGains(TaxInsensitive)		0.223***	
		(0.082)	
Holdings(TaxSensitive)	0.476		
	(0.301)		
Holdings(TaxInsensitive)		-0.432***	
		(0.132)	
CapGains(Difference)			-0.270***
			(0.086)
Holdings(Difference)			0.417***
			(0.119)
Return_Lag1	-0.352***	-0.433***	-0.436***
	(0.052)	(0.054)	(0.054)
Return_Lag2	-0.233***	-0.284***	-0.285***
	(0.041)	(0.040)	(0.040)
Return_Lag3	-0.139***	-0.176***	-0.177***
	(0.044)	(0.043)	(0.043)
Return_Lag4	-0.075*	-0.100**	-0.101**
	(0.040)	(0.040)	(0.040)
Cash/MarketCap	-0.101	-0.065	-0.060
	(0.072)	(0.073)	(0.073)
CashFlow/MarketCap	0.764***	0.640***	0.629***
	(0.206)	(0.215)	(0.213)
Market/Book	-0.078***	-0.076***	-0.077***
	(0.015)	(0.015)	(0.015)
Dividends/MarketCap	2.233	2.453	2.488
	(2.659)	(2.649)	(2.657)
ln(Assets)	0.310***	0.332***	0.331***
	(0.035)	(0.036)	(0.036)
Leverage-TargetLeverage	-1.528***	-1.513***	-1.510***
	(0.092)	(0.092)	(0.092)
Volatility	-16.033***	-15.225***	-15.045***
	(1.523)	(1.570)	(1.565)
EPS_Diff	-0.005**	-0.005**	-0.005**
	(0.002)	(0.002)	(0.002)
Constant	-7.300***	-7.341***	-7.352***
	(0.213)	(0.214)	(0.214)
Year-Quarter Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Observations	215,598	215,598	215,598
Adjusted R-squared	0.3617	0.3619	0.3619

Table III
Repurchases as an Earnings Management Tool

This table presents results from OLS regressions in which the dependent variable is ln (0.001 + *Repurchases/MarketCap*). The sample period is 1995Q1–2015Q4. The sample of firms in columns (1) and (2) are those that repurchase shares in order to meet an earnings target. To identify these firms, I first calculate the difference between what EPS would have been had a firm not repurchased shares in the quarter and the mean of the first consensus EPS forecast for the quarter following the announcement of the prior quarter's earnings where I require forecasts from at least two analysts. I keep all firms for which this difference is less than zero. Then among this set of firms, I only keep those whose actual EPS is equal to or greater than the mean of the first consensus EPS forecast for the quarter following the announcement of the prior quarter's earnings where I require forecasts from at least two analysts. Columns (3) and (4) present the results for the remainder of firms in my primary sample. All explanatory variables except *EPS_Diff* are lagged one quarter. All specifications include year-quarter fixed effects and firm fixed effects. The difference between the coefficient estimates on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is reported at the bottom of the columns. Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table 1 for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)	(3)	(4)
CapGains(TaxSensitive)	-4.359	-2.324	-1.803***	-1.305***
	(2.810)	(2.877)	(0.405)	(0.385)
CapGains(TaxInsensitive)	-0.259	0.228	0.345***	0.298***
	(0.479)	(0.461)	(0.085)	(0.083)
Holdings(TaxSensitive)	1.541	1.464	0.600**	0.316
	(1.083)	(1.045)	(0.295)	(0.286)
Holdings(TaxInsensitive)	0.261	0.432	-0.023	-0.419***
	(0.494)	(0.439)	(0.122)	(0.129)
Return_Lag1		-0.740***		-0.375***
		(0.231)		(0.052)
Return_Lag2		-0.149		-0.248***
		(0.231)		(0.040)
Return_Lag3		-0.028		-0.148***
		(0.202)		(0.042)
Return_Lag4		-0.023		-0.085**
		(0.183)		(0.038)
Cash/MarketCap		-0.155		-0.040
		(0.316)		(0.070)
CashFlow/MarketCap		7.697***		0.567***
		(2.091)		(0.201)
Market/Book		-0.182***		-0.072***
		(0.050)		(0.014)
Dividends/MarketCap		-2.590		1.979
		(11.441)		(2.546)
ln(Assets)		0.253**		0.300***
		(0.126)		(0.034)
Leverage-TargetLeverage		-1.368***		-1.428***
		(0.307)		(0.089)
Volatility		-23.649***		-13.930***
		(6.473)		(1.444)
EPS_Diff		-8.302***		-0.000**
		(2.000)		(0.000)
Constant	-1.931***	-3.253***	-6.084***	-7.284***
	(0.545)	(1.051)	(0.048)	(0.202)
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	-4.10	-2.55	-2.15***	-1.60***
Year-Quarter Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Observations	9,068	9,068	206,530	206,530
Adjusted R-squared	0.6018	0.6404	0.3395	0.3508

Table IV
Difference Between Percent of Shares Sought and Percent of Shares Repurchased

This table presents correlations between *CapGains(Difference)*, defined in Panel B of Table 2, and two variables that capture the difference between the percent of shares that a firm announces it intends to repurchase and the percent of shares that it actually repurchases. I collect the share repurchase announcement date and the percent of shares sought for all repurchases that are not tender offers from SDC. I collect the number of shares repurchased (*cshopq*) each quarter from Compustat. The data in Compustat is only available beginning in 2004. Thus, the sample period for this test is 2004-2015. For each firm, I sum the number of shares repurchased between a share repurchase announcement date and the subsequent share repurchase announcement (or until the end of the sample period if there is not a subsequent repurchase announcement). To calculate the percent of shares repurchased, I divide this sum by the number of shares outstanding at the end of the quarter preceding the initial announcement. *Success1* equals the percent of shares repurchased divided by the percent of shares sought. Next, I calculate *Success2*, which is analogous to *Success1* except that instead of summing the number of shares repurchased until the subsequent announcement or until the end of the sample period if there is no subsequent announcement, I stop summing in the first quarter in which a firm does not repurchase shares. The first row presents the Pearson correlations. The second row presents the p-value for the significance of the correlations. The third row shows the number of observations.

		Success1	**Success2**
Negdiff		-0.0298	-0.0198
		0.1336	0.3183
		2532	2532

Table V
Capital Gains Lock-In and Repurchase Likelihood

This table presents results from Logit regressions in which the dependent variable equals 1 if *Repurchases/MarketCap* > 0, and equals zero otherwise. The sample period is 1995Q1–2015Q4. Column (1) only includes the *CapGains* and *Holdings* variables. Column (2) includes all explanatory variables except *ExecOptions/MarketCap*. All explanatory variables except *EPS_Diff* are lagged one quarter. All specifications include year-quarter fixed effects. The difference between the coefficient estimates on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is reported at the bottom of the columns. Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table 1 for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)
CapGains(TaxSensitive)	0.045	-0.112
	(0.427)	(0.444)
CapGains(TaxInsensitive)	1.116***	0.781***
	(0.102)	(0.101)
Holdings(TaxSensitive)	0.898***	1.206***
	(0.260)	(0.257)
Holdings(TaxInsensitive)	1.441***	0.986***
	(0.084)	(0.092)
CapGains(Difference)		
Holdings(Difference)		
Return_Lag1		-0.679***
		(0.063)
Return_Lag2		-0.511***
		(0.049)
Return_Lag3		-0.365***
		(0.053)
Return_Lag4		-0.271***
		(0.040)
Cash/MarketCap		0.004
		(0.063)
CashFlow/MarketCap		0.503*
		(0.257)
Market/Book		0.059***
		(0.014)
ln(Assets)		0.201***
		(0.016)
Leverage-TargetLeverage		-0.299***
		(0.065)
Volatility		-21.970***
		(1.733)
EPS_Diff		0.001
		(0.003)
Dividends/MarketCap		-4.448
		(2.937)
Constant	-1.638***	-2.426***
	(0.025)	(0.106)
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	-1.071**	-0.893*
Year-Quarter Fixed Effects	Yes	Yes
Firm Fixed Effects	No	No
Observations	215,598	215,598
Wald X2	10,355.31	17,062.46
Pseudo R-Squared	0.042	0.084

Table VI
Capital Gains Lock-In and Share Repurchases, Only Repurchasing Firms

This table presents results from OLS regressions in which the dependent variable is ln (0.001 + *Repurchases/MarketCap*). The sample period is 1995Q1–2015Q4. The sample is restricted to only firm-quarter observations where *Repurchases/MarketCap* > 0. Column (1) only includes the *CapGains* and *Holdings* variables. Column (2) includes all explanatory variables except *ExecOptions/MarketCap*. All explanatory variables except *EPS_Diff* are lagged one quarter. All specifications include year-quarter fixed effects as well as firm fixed effects. The difference between the coefficient estimates on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is reported at the bottom of the columns. Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table 1 for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)
CapGains(TaxSensitive)	-1.455***	-0.885**
	(0.438)	(0.415)
CapGains(TaxInsensitive)	-0.292***	-0.061
	(0.084)	(0.080)
Holdings(TaxSensitive)	-0.152	-0.052
	(0.216)	(0.213)
Holdings(TaxInsensitive)	-0.207**	-0.148
	(0.101)	(0.098)
CapGains(Difference)		
Holdings(Difference)		
Return_Lag1		-0.234***
		(0.045)
Return_Lag2		-0.043
		(0.036)
Return_Lag3		-0.015
		(0.034)
Return_Lag4		0.044
		(0.033)
Cash/MarketCap		0.448***
		(0.068)
CashFlow/MarketCap		0.730***
		(0.214)
Market/Book		-0.122***
		(0.012)
Dividends/MarketCap		-2.943*
		(1.766)
ln(Assets)		0.020
		(0.028)
Leverage-TargetLeverage		-0.691***
		(0.079)
Volatility		-2.855**
		(1.118)
EPS_Diff		0.003
		(0.003)
Constant	1.010***	1.005***
	(0.049)	(0.194)
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	-1.163**	-0.824*
Year-Quarter Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Observations	72,814	72,814
Adjusted R-squared	0.2773	0.2886

Table VII
Capital Gains Lock-In, Repurchases, and Capital Gains Tax Rate Change

This table presents results from OLS regressions in which the dependent variable is log (0.001 + *Repurchases/MarketCap*). The sample period is 1995Q1–1997Q2. *Pre97Q2* is an indicator variable equal to 1 for quarters 1995Q1–1997Q1 (when the capital gains tax rate was 28%) and equal to 0 for quarter 1997Q2 (when the capital gains tax rate declined to 20%). Column (1) includes *Pre97Q2* and its interactions with *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)*. In column (2), I include year-quarter fixed effects instead of including *Pre97Q2*. Both columns include firm fixed effects. All explanatory variables except *EPS_Diff* and *Pre97Q2* are lagged one quarter. Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table 1 for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)
CapGains(TaxSensitive)	2.455	2.764
	(1.673)	(1.702)
CapGains(TaxInsensitive)	-1.415***	-1.393***
	(0.349)	(0.309)
CapGains(TaxSensitive)*Pre97Q2	-2.859***	-3.215***
	(1.060)	(0.959)
CapGains(TaxInsensitive)*Pre97Q2	0.233	0.151
	(0.329)	(0.273)
Pre97Q2	-0.402***	
	(0.086)	
Holdings(TaxSensitive)	1.417	0.981
	(0.988)	(0.897)
Holdings(TaxInsensitive)	0.028	-0.477
	(0.393)	(0.303)
Return_Lag1	-0.184	-0.131
	(0.133)	(0.119)
Return_Lag2	-0.147*	-0.080
	(0.077)	(0.066)
Return_Lag3	-0.085	0.004
	(0.096)	(0.078)
Return_Lag4	-0.089	0.037
	(0.057)	(0.048)
Cash/MarketCap	-0.073	0.154
	(0.259)	(0.237)
CashFlow/MarketCap	0.773*	1.158***
	(0.400)	(0.361)
Market/Book	0.022	-0.019
	(0.029)	(0.028)
Dividends/MarketCap	-3.202	3.627
	(9.068)	(8.918)
ln(Assets)	0.216	-0.287**
	(0.183)	(0.142)
Leverage-TargetLeverage	-1.359***	-1.460***
	(0.219)	(0.220)
Volatility	-2.803	-4.788**
	(2.070)	(1.961)
EPS_Diff	-0.011***	-0.012***
	(0.002)	(0.002)
Constant	-6.486***	-3.770***
	(1.176)	(0.841)
Year-Quarter Fixed Effects	No	Yes
Firm Fixed Effects	Yes	Yes
Observations	22,399	22,399
Adjusted R-Squared	0.5359	0.5403

Table VIII
Capital Gains Lock-In and Repurchases Surrounding American Jobs Creation Act of 2004

This table presents results from OLS regressions in which the dependent variable is log (0.001 + *Repurchases/MarketCap*). The sample period is 2005Q1-2005Q4, and the sample only includes firms that repatriated foreign earnings under the provisions of the American Jobs Creation Act of 2004. Column (1) only includes the *CapGains* and *Holdings* variables. Column (2) includes all explanatory variables except *ExecOptions/MarketCap*. Both columns include year-quarter fixed effects as well as firm fixed effects. All explanatory variables except *EPS_Diff* are lagged one quarter. Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table 1 for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)
CapGains(TaxSensitive)	-36.404*	-34.782*
	(19.863)	(18.677)
CapGains(TaxInsensitive)	1.545	2.319
	(2.985)	(3.182)
Holdings(TaxSensitive)	-0.538	-0.945
	(7.134)	(6.167)
Holdings(TaxInsensitive)	-3.855	-4.294*
	(2.788)	(2.600)
Return_Lag1		0.188
		(0.492)
Return_Lag2		0.576
		(0.567)
Return_Lag3		0.156
		(0.615)
Return_Lag4		0.316
		(0.480)
Cash/MarketCap		-1.937
		(2.328)
CashFlow/MarketCap		-3.616
		(3.442)
Market/Book		-0.707***
		(0.181)
Dividends/MarketCap		6.568
		(20.562)
ln(Assets)		3.000*
		(1.628)
Leverage-TargetLeverage		-1.623
		(3.270)
Volatility		20.628
		(12.694)
EPS_Diff		-135.641
		(457.186)
Constant	-0.651	-24.016
	(1.164)	(14.615)
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	-37.949*	-37.101*
Year-Quarter Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Observations	1,125	1,125
Adjusted R-squared	0.7204	0.7278

Table IX
Capital Gains Lock-In and Repurchases: Tobit Specification

This table presents results from the Tobit regressions in which the dependent variable is *Repurchases/MarketCap* minus the firm's mean value of *Repurchases/MarketCap* over the sample period. The dependent variable is left-censored at zero. The sample period is 1995Q1–2015Q4 in columns (1) and (2) and 1995Q1–1997Q2 in columns (3) and (4). All explanatory variables except *EPS_Diff* and *Pre97Q2* are lagged one quarter. Year-quarter fixed effects are included in columns (1), (2), and (4) but are replaced by *Pre97Q2* in column (3). The marginal effects of *CapGains(TaxSensitive)*, *CapGains(TaxInsensitive)*, and their difference, evaluated at the mean value of all variables, are shown at the bottom of the table in columns (1) and (2). The marginal effects of *CapGains(TaxSensitive)*Pre97Q2* and *CapGains(TaxInsensitive)*Pre97Q2*, evaluated at the mean value of all variables, are shown at the bottom of the table in columns (3). Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table VI for the definition of *Pre97Q2* and Table 1 for the remainder of the variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)	(3)	(4)
CapGains(TaxSensitive)	-1.683***	-1.171**	-0.201	-0.266
	(0.514)	(0.507)	(0.271)	(0.285)
CapGains(TaxInsensitive)	0.783***	0.713***	-0.631***	-0.602***
	(0.113)	(0.103)	(0.085)	(0.087)
Holdings(TaxSensitive)	0.757***	0.877***	1.627***	1.572***
	(0.292)	(0.269)	(0.564)	(0.547)
Holdings(TaxInsensitive)	1.553***	1.198***	1.165***	1.094***
	(0.095)	(0.099)	(0.098)	(0.099)
CapGains(TaxSensitive)*Pre97Q2			-5.797***	-5.731***
			(1.300)	(1.325)
CapGains(TaxInsensitive)*Pre97Q2			0.702***	0.730***
			(0.228)	(0.211)
Pre97Q2			-0.405	
			(0.073)	
Return_Lag1		-1.031***	-0.562***	-0.547***
		(0.085)	(0.039)	(0.040)
Return_Lag2		-0.602***	-0.470***	-0.491***
		(0.064)	(0.151)	(0.022)
Return_Lag3		-0.376***	-0.302	-0.311
		(0.078)	(0.136)	(0.143)
Return_Lag4		-0.214***	-0.292***	-0.252**
		(0.057)	(0.010)	(0.103)
Cash/MarketCap		0.205***	-0.043	-0.032
		(0.059)	(0.139)	(0.060)
CashFlow/MarketCap		1.587***	2.216**	2.391**
		(0.399)	(1.046)	(1.027)
Market/Book		-0.030**	0.033**	0.027**
		(0.015)	(0.013)	(0.013)
Dividends/MarketCap		-9.432***	35.121***	35.953***
		(3.282)	(1.888)	(1.965)
ln(Assets)		0.127***	0.113***	0.107***
		(0.008)	(0.009)	(0.009)
Leverage-TargetLeverage		-0.556***	-0.518***	-0.532***
		(0.065)	(0.072)	(0.073)
Volatility		-20.833***	-13.655***	-14.700***
		(1.843)	(2.899)	(2.882)
EPS_Diff		0.000	-0.013	-0.013
		(0.004)	(0.000)	(0.000)
Constant	-3.603***	-3.825***	-2.928***	-3.367***
	(0.040)	(0.140)	(0.093)	(0.475)
Marginal Effects				
CapGains(TaxSensitive)	-0.289***	-0.194***		
CapGains(TaxInsensitive)	0.135	0.118***		
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	-0.424***	-0.311***		
CapGains(TaxSensitive)*Pre97Q2			-0.836***	
CapGains(TaxInsensitive)*Pre97Q2			0.112***	
Year-Quarter Fixed Effects	Yes	Yes	No	Yes
Observations	215,598	215,598	22,399	22,399

Table X
Capital Gains Lock-In and Capital Expenditures

This table presents results from OLS regressions in which the dependent variable is quarterly capital expenditures (backed out from Compustat item *capxy*, which is year-to-date capital expenditures) divided by beginning-of-quarter total assets. The sample period is 1995Q1–2015Q4 in columns (1) and (2) and 1995Q1–1997Q2 in columns (3) and (4). All explanatory variables except *Capex/Assets_IndMean* and *Pre97Q2* are lagged one quarter. Year-quarter fixed effects are included in columns (1), (2), and (4) but are replaced by *Pre97Q2* in column (3). All columns include firm fixed effects. The difference between the coefficient estimates on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is reported at the bottom of columns (1) and (2). Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table VII for the definition of *Pre97Q2* and Table 1 for the remainder of the variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)	(3)	(4)
CapGains(TaxSensitive)	1.172***	0.577***	-0.472	-0.460
	(0.175)	(0.149)	(0.587)	(0.585)
CapGains(TaxInsensitive)	0.661***	0.302***	1.147***	1.170***
	(0.054)	(0.037)	(0.175)	(0.175)
CapGains(TaxSensitive)*Pre97Q2			2.676***	2.682***
			(0.514)	(0.539)
CapGains(TaxInsensitive)*Pre97Q2			-0.592***	-0.613***
			(0.179)	(0.172)
Pre97Q2			-0.037	
			(0.083)	
Holdings(TaxSensitive)	0.443***	0.346***	0.736*	0.669
	(0.120)	(0.117)	(0.447)	(0.437)
Holdings(TaxInsensitive)	0.302***	0.277***	0.480***	0.403**
	(0.057)	(0.053)	(0.180)	(0.202)
Cash/MarketCap		-0.066***	-0.239***	-0.211***
		(0.022)	(0.070)	(0.071)
CashFlow/MarketCap		0.089	0.190	0.127
		(0.061)	(0.122)	(0.119)
Market/Book		0.150***	0.167***	0.164***
		(0.007)	(0.018)	(0.016)
Dividends/MarketCap		-0.704	-1.895	-1.620
		(0.919)	(1.820)	(1.744)
ln(Assets)		-0.124***	-0.450***	-0.440***
		(0.016)	(0.137)	(0.131)
Leverage-TargetLeverage		-0.451***	-1.088***	-1.079***
		(0.042)	(0.151)	(0.150)
Volatility		-3.150***	-3.761***	-3.927***
		(0.423)	(1.082)	(1.139)
R&D/Assets		-0.123	-0.381	-0.002
		(0.288)	(0.513)	(0.519)
ln(GDP)		-0.538***	0.208	1.045***
		(0.118)	(1.461)	(0.371)
Capex/Assets_IndMean		0.266***	0.042	0.061*
		(0.048)	(0.035)	(0.035)
Constant	1.693***	6.593***	1.753	-6.102**
	(0.024)	(1.127)	(13.325)	(3.032)
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	0.511***	0.275*		
Year-Quarter Fixed Effects	Yes	Yes	No	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Observations	400,956	400,956	54,860	54,860
Adjusted R-Squared	0.5050	0.5211	0.6580	0.6590

Table XI
Capital Gains Lock-In and Research & Development Expenditures

This table presents results from OLS regressions in which the dependent variable is ln (0.001 + *R&D/Assets*). The sample period is 1995Q1–2015Q4 in columns (1) and (2) and 1995Q1–1997Q2 in columns (3) and (4). All explanatory variables except *R&D/Assets_IndMean* and *Pre97Q2* are lagged one quarter. Year-quarter fixed effects are included in columns (1), (2), and (4) but are replaced by *Pre97Q2* in column (3). All columns include firm fixed effects. The difference between the coefficient estimates on *CapGains(TaxSensitive)* and *CapGains(TaxInsensitive)* is reported at the bottom of columns (1) and (2). Heteroscedasticity-robust standard errors clustered at the firm level and the year-quarter level are reported in parentheses below each coefficient estimate. See Table VII for the definition of *Pre97Q2* and Table 1 for the remainder of the variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

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	(1)	(2)	(3)	(4)
CapGains(TaxSensitive)	0.070	-0.031	-1.845***	-1.748***
	(0.136)	(0.135)	(0.471)	(0.439)
CapGains(TaxInsensitive)	0.016	-0.049*	-0.229	-0.163
	(0.026)	(0.029)	(0.252)	(0.210)
CapGains(TaxSensitive)*Pre97Q2			0.784	0.847*
			(0.528)	(0.481)
CapGains(TaxInsensitive)*Pre97Q2			-0.008	-0.032
			(0.200)	(0.189)
Pre97Q2			0.133	
			(0.161)	
Holdings(TaxSensitive)	0.104	0.149	0.614*	0.537
	(0.116)	(0.115)	(0.324)	(0.359)
Holdings(TaxInsensitive)	-0.056	0.041	0.150	0.018
	(0.048)	(0.045)	(0.214)	(0.123)
Cash/MarketCap		-0.058***	0.009	0.058
		(0.017)	(0.057)	(0.042)
CashFlow/MarketCap		-0.140***	0.157	0.091
		(0.047)	(0.102)	(0.083)
Market/Book		0.040***	0.021**	0.016
		(0.006)	(0.010)	(0.013)
Dividends/MarketCap		-2.956***	-3.042***	-2.204**
		(0.831)	(1.160)	(0.956)
ln(Assets)		-0.095***	-0.188***	-0.189***
		(0.016)	(0.064)	(0.050)
Leverage-TargetLeverage		-0.136***	-0.087	-0.074
		(0.038)	(0.101)	(0.096)
Volatility		0.517*	-0.997	-1.226**
		(0.307)	(0.669)	(0.586)
Capex/Assets		-0.054	-0.537	-0.405
		(0.194)	(0.387)	(0.310)
ln(GDP)		1.525***	2.430	1.862***
		(0.099)	(2.712)	(0.302)
R&D/Assets_IndMean		0.007	-0.153	0.014
		(0.007)	(0.107)	(0.055)
Constant	-4.577***	-18.264***	-26.274	-21.143***
	(0.019)	(0.873)	(24.955)	(2.633)
CapGains(TaxSensitive) - CapGains(TaxInsensitive)	0.054	0.018		
Year-Quarter Fixed Effects	Yes	Yes	No	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Observations	400,956	400,956	54,860	54,860
Adjusted R-Squared	0.8918	0.8922	0.8966	0.8988