Capital Gains Taxes and Stock Return Volatility: Evidence from the Taxpayer Relief Act of 1997

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Abstract

This paper presents evidence that a 1997 reduction in the capital gains tax rate increased stock return volatility. We attribute this increase to reduced risk sharing between investors and the government and increased exposure of stocks to consumption risk, leading to higher asset return risk and volatility. We predict cross-sectional variation in the extent to which capital gains taxes affect volatility. Specifically, the more stock returns are expected to be subject to capital gains taxation, the greater the increase in volatility following a capital gains tax rate reduction. Consistent with these predictions, we find a larger increase in the return volatility of non-dividend-paying stocks and stocks that had already experienced large price changes at passage of the legislation.

1. Introduction

This paper examines the effect of capital gains taxes on stock return volatility. Previous studies of the effects of capital gains taxes on asset prices have focused on the level of stock returns and on trading volume. This study extends that literature to consider how a 1997 reduction in the capital gains tax rate changed the volatility of stock returns.

Our analysis relies on the role of financial markets in facilitating risk sharing between investors and the government in the presence of capital gains taxes and the effect of capital gains taxes on consumption risk exposure of different stocks. Since the government shares in the realized gains and losses of assets held by taxable investors, a capital gains tax rate cut reduces risk sharing between investors and the government and increases the exposure of stocks to consumption risk. These will lead to higher stock return risk and volatility.

Designing a test that directly links a capital gains tax rate reduction to an increase in stock return volatility is problematic. The reason is that capital gains tax rate changes are infrequent and rarely occur in isolation from other major tax changes. In fact, to our knowledge, the only time that capital gains tax rates have changed and other taxes remained constant is the capital gains tax reduction in the Taxpayer Relief Act of 1997 (TRA 97). Therefore, TRA 97 enables us a unique opportunity to isolate a change of the capital gains tax rate cut and to study its effect on stock return volatility.

Using equity returns from 1994 to 2000, we pursue an indirect approach in our empirical tests. First, we control for an extensive set of factors known to affect the volatility of stock returns. Second, we focus on two cross-sectional differences in volatility change following the 1997 reduction in the capital gains tax rate from 28% to 20%. The first cross-sectional difference deals with dividend status. We predict that non-dividend paying stocks (whose returns face capital gains taxes only) experienced higher return volatility increases, after the 1997 rate reduction, than dividend-paying stocks did.

The second cross-sectional difference concerns the amount of the gain (or loss) when the stock is sold. The greater the appreciation (or depreciation) is at the time of sale, the more important the impact of the capital gains tax. Obviously, when the legislation was passed, the market could not know the exact magnitude of the eventual gains or losses that would be triggered when investors sold their shares in the future.

However, the market could have estimated the size of the unrealized (or imbedded) gains or losses based on the stock's recent appreciation or depreciation. All other things equal, shares with the largest unrealized gains (losses) when the legislation was passed should have the largest realized gains (losses) when they were sold. Thus, we predict that those firms with the largest price changes (whether appreciations or depreciations) at the time of the legislation experienced greater increases in return volatility than firms that had experienced smaller price changes and thus had smaller unrealized gains or losses when the law was passed.

We find that stock return volatility increased significantly after TRA 97. Our tests show that the magnitudes of the increases in return volatility vary in a predictable manner with firm characteristics exhibiting different sensitivities to a reduction in capital gains tax rate, such as dividend distribution and stock price changes (as a measure of unrealized gains or losses when TRA 97 was passed). Unable to advance any alternative explanation for these findings, we interpret them as evidence that the reduction in the capital gains tax rate contributed to higher stock return volatility.

To our knowledge, this is the first study of the relation between asset return volatility and capital gains taxes. It builds on an increasing literature about how capital gains taxes affect asset prices and trading volume. With regards to asset prices, existing theoretical studies suggest that the effect of capital gains taxes on stock prices is ambiguous because introducing capital gains taxes decreases both the demand and the supply of stocks. Consistent with this ambiguity, empirical investigations of the effect of capital gains taxes have produced conflicting results. Several studies (Lang and Shackelford (2000), Shackelford and Verrecchia (2002), Ayers, Lefanowicz, and Robinson (2003), Blouin, Raedy, and Shackelford (2003), among others) report that the presence of capital gains taxes reduces stock price and current stock return, while other studies document that imposing capital gains taxes increases stock price and current stock return (Feldstein, Slemrod, and Yitzhaki (1980), Landsman and Shackelford (1995), Erickson (1998), Reese (1998), Klein (2001), Jin (2005), among others).

With regards to capital gains taxes and trading volume, Dhaliwal and Li (2006) report that tax-motivated trading activity creates excess trading volume around ex-dividend days. Specifically, they find a concave relation between ex-dividend day trading volume and institutional ownership, their measure of investor tax heterogeneity. In other words, the more shareholders who face different tax rates, the more trading around ex-dividend dates, as differentially taxed investors swap securities to minimize their tax liabilities.

In a recent study, Dai, Maydew, Shackelford, and Zhang (2008) investigate the effect of capital gains taxes on stock prices and trading volume by jointly considering the impact on demand and supply of stocks. Using TRA 97 as the event (the same 1997 tax change that we study), they find that stock returns were higher in anticipation of a tax cut. They also find that non-dividend paying firms, firms with large unrealized capital gains, and firms owned by more tax sensitive shareholders experienced a lower return after the lower tax rate became effective. In addition, they document that the capital gains tax rate cut increased the trading volume the week before and immediately after the tax cut announcement.

None of the existing studies, however, has examined the impact of capital gains taxes on asset return volatility. Asset return volatility is one of the key determinants of investors' demand and supply of risky assets. If capital gains taxes affect asset return volatility, then they affect investors' demand and supply of risky assets and ultimately asset returns.

In this paper, we first discuss the relation between the capital gains taxes and stock return risk and volatility focusing on the risk sharing role of the capital gains taxes between investors and the government and the effect of capital gains taxation on the exposure of stocks to consumption risk. We demonstrate that changes in capital gains taxes adversely affect risk sharing and the exposure of different stocks to consumption risk. Based on our analysis, we develop hypotheses of the relation between a reduction in capital gains tax rate and changes in stock return volatility.[1] Then, we empirically test the predictions using the TRA 97 as our event.

[1] It is very difficult to set up a tractable theoretical model to derive the link between risk sharing and the capital gains taxes directly. How the capital gains taxes affect asset prices and return volatility depends on many specific assumptions about the economy. For example, do government expenditures enter the utility function of investors? Does the government have to balance the budget in each period? Are there other taxes, such as income or sales taxes? There are also important general equilibrium effects on labor supply and substitution across financial assets. Consequently, we formulate our hypotheses based on intuitive economic reasoning.

We hypothesize that after the reduction in the capital gains tax rate non-dividend-paying stocks experienced a higher return volatility increase than dividend-paying stocks and stocks with large price changes (appreciations or depreciations) experienced a larger increase in volatility than did stocks with small price changes.

Our predictions reflect the roles played by the financial markets and financial assets traded in those markets in the economy. From investors' perspective, financial markets and financial assets serve two important functions: risk sharing and consumption smoothing. Besides actively sharing risk with other market participants, investors also share the risk of holding risky stocks with the government (passively) through capital gains taxes. To demonstrate, if the investors' asset holdings have depreciated in value, then the investors' after-tax losses are less than the decrease in the market value of the asset because a fraction of the loss is borne by the government in the form of reduced capital gains taxes or even tax rebate from the government. Therefore, a cut in the capital gains tax rate reduces the risk sharing between investors and the government resulting in more volatile consumption for investors.

Capital gains taxation also affects the exposure of stocks to consumption risk. In asset pricing literature, consumption risk of stocks refers to the co-variability of asset payoffs and consumption innovations. Investors require higher returns on assets that have large payoffs when consumption is high (and low marginal utility of consumption) and small payoffs when consumption is low (and high marginal utility of consumption). This is because these assets offer less scope for consumption smoothing while investors desire to smooth consumption over time and value assets that help hedging consumption volatility. This concept, that taxes can aid in reducing an investor's exposure to consumption risk, was first proposed to explain the difference between the yields on taxable bonds and tax-exempt municipal bonds (see, for example, Piros, 1987, Chalmers, 2006, among others).

We extend this reasoning to the case of capital gains taxation. Suppose that the economy is good, investors in the economy receive high income (both non-financial and financial income). These investors will have high consumption levels and a low marginal utility of consumption. In the meantime, investors will likely realize more capital gains in good times and pay more capital gains taxes.

Now, suppose that the economy is bad, investors receive less income. They are likely to consume less and have a higher marginal utility of consumption. They will also likely realize smaller capital gains or even realize capital losses. Their capital gains taxes will be lower or even negative (i.e., reduce total taxes paid).

This suggests that the investors' capital gains tax costs co-vary negatively with the marginal utility of consumption. In other words, the presence of capital gains taxes reduces the co-variability between stock payoffs and consumption innovations and effectively lowers the exposure of stocks to consumption risk. Consequently, when the capital gains tax rate is reduced, the co-variability between stock payoffs and consumption innovation is higher and the exposure of stock returns to consumption risk increases.

According to the consumption capital asset pricing model, the risk of a portfolio of stocks is determined by its equilibrium risk to consumption (Rubinstein, 1976 and Breeden, 1979). While earlier empirical studies failed to provide supporting evidence using contemporaneous consumption growth,[2] more recent studies show a strong positive relation between stock return risk and the ultimate consumption risk, as measured by the consumption growth over current and future quarters (Parker and Julliard (2005) and Tedongap (2007)). This suggests that for a portfolio of stocks, reduced risk sharing and increased exposure to consumption risk associated with a reduction of capital gains tax rate will lead to higher stock return risk and volatility.

In principle, we could test for the impact of a capital gains tax rate change on risk sharing and the exposure of stocks to consumption risk, and thus its impact on stock return volatility, by evaluating the time series variation of the stock market returns. However, it would be difficult to rule out alternative explanations for changes in return volatility. Thus, we turn to specific variation in characteristics of particular groups of stocks to provide a more powerful test. If we find variation in the impact of the capital gains tax rate reduction on return volatility along predictable patterns, i.e., greater for stocks that are more affected by the rate reduction, then we will have greater assurance that the link between capital gains taxes and volatility is not spurious.

[2] See Mankiw and Shapiro (1986), Breeden, Gibbons, and Litzenberger (1989), Campbell (1996), Cochrane (1996), Lettau and Ludvigson (2001), among others.

The impact of a capital gains tax rate change on stock return volatility should vary depending on the characteristics of particular stocks. For example, if investors receive all returns as dividends, then changes in capital gains taxation should have no impact on risk sharing and exposure of these stocks to consumption risk, and consequently no effect on the return volatility of these stocks. Conversely, if all returns are expected to be taxed at the new capital gains tax rate, then we would expect a rate reduction to substantially reduce risk sharing and increase the exposure of these stocks to consumption risk, leading to higher return risk and volatility.

In our tests, we assume that firms will maintain their current dividend policy, and thus, predict that, *ceteris paribus*, non-dividend-paying stocks are subject to greater reduction in risk sharing and larger increase in exposure to consumption risk than other firms when capital gains tax rates are lower. Consequently, a capital gains tax rate reduction will result in larger increases in return volatility for non-dividend-paying stocks than for dividend-paying stocks. To the extent non-dividend-paying firms initiate dividends or dividend-paying firms cease issuing dividends after passage of the bill, our tests will be weakened.

Similarly, when investors sell, stocks with large price changes trigger larger capital gains or losses than stocks with little or no appreciation or depreciation. *Ceteris paribus*, shares with large unrealized appreciation (depreciation) at enactment of the legislation are more likely to have large gains (losses) when they are sold. Thus, a capital gains tax reduction causes stocks with large price changes at the time of the sale to become riskier because there is more reduction in risk sharing with the government and larger increase in exposure to consumption risk. Therefore, we predict that these stocks experience higher return volatility increases when capital gains tax rates are cut.

The argument above further implies that non-dividend paying stocks with large price changes are subject to the greatest reduction in risk sharing and largest increase in exposure to consumption risk than all other stocks when there is a capital gains tax rate cut. Therefore, we will likely see the largest return volatility increases for non-dividend paying stocks with large price changes compared with dividend-paying stocks with small price changes which are likely to be the least affected by the capital gains tax rate cut.

We test these predictions by examining return volatility changes of portfolios of stocks with different dividend distributions and stock price changes before and after the 1997 reduction in the individual capital gains tax rate from 28 percent to 20 percent. Using data from January 1994 to December 2000, we construct stock portfolios based on dividend distribution and stock price changes (depreciation or appreciation) in the most recent past 18 months, the requisite holding period to gain favorable capital gains tax treatment following enactment of TRA 97.

Consistent with our predictions, we find that the portfolios of non-dividend-paying stocks with large price changes at the time of TRA 97's passage experience the largest return volatility increases among all other portfolios. Specifically, after the capital gains tax rate cut, the monthly return volatility for non-dividend-paying stocks with price appreciations in the upper quartile (upper 25 percentile) rose 2.16 percentage points (significant at the 0.01 level) more than the return volatility for dividend-paying stocks with price appreciations in the lower quartile (lower 25 percentile), after controlling for an extensive set of documented determinants of stock return volatility. For stocks that had experienced price depreciations during the most recent past 18 months, the non-dividend-paying portfolio with stock price depreciations in the upper quartile increased 1.20 percentage points (significant at the 0.05 level) more than the return volatility for dividend-paying stocks with price depreciations in the lower quartile.

As predicted, the non-dividend-paying portfolios always experienced a larger increase in return volatility than the dividend-paying portfolios. When stocks had experienced small appreciation (in the lower quartile), the difference was 0.69 percentage points. When stocks had experienced large appreciation (in the upper quartile), the difference was 1.72 percentage points. When stocks had experienced small depreciation (in the lower quartile), the difference was 0.65 percentage points. When stock had experienced large depreciation, the difference was 0.90 percentage points. All differences are significant at the 0.05 level.

As expected, the portfolio of stocks with large price changes at the time of passage (the upper quartile) always experienced a larger increase in return volatility than the portfolios of stocks with small price changes. However, among the four comparisons, the difference is only significant at the 0.05 level once. Specifically, the incremental increase in return volatility is 1.48 percentage points more for the portfolio of non-dividend-paying stocks with large price appreciations than for the portfolio of non-dividend-paying stocks with small price appreciations, after controlling for an extensive set of determinants of stock return volatility.

It is worth noting that the stock return volatility increase associated with a capital gains tax rate cut does not necessarily imply that investors are worse off when the capital gains tax rate is lower. This is because a capital gains tax rate cut may increase the after-tax stock return. Consequently, investors may experience the same or an improved return-and-risk trade-off and thus face the same or better investment opportunities. However, the findings in this paper suggest that when capital gains taxes rates are cut, taxable individual investors incur costs, which, to our knowledge, have heretofore gone unnoticed by scholars and ignored by policymakers. Therefore, these findings should contribute to our understanding of the impact of capital gains taxes on the capital markets and inform policymakers of the full implications of changing the taxation of capital gains, an issue under current policy debate.

The paper is organized as follows. In section 2, we expand our discussion of the relation between capital gains taxes and stock return volatility and develop hypotheses about the effects of a capital gains tax rate cut on return volatility for the cross-section of portfolios of stocks with different capital gains tax liabilities. Section 3 presents empirical methodology to test the predictions of our analysis. Section 4 discusses the results of the empirical analysis. Section 5 provides closing remarks.

2. Capital Gains Taxes and Stock Return Volatility

Financial markets and the financial assets traded in those markets serve two important roles for investors: consumption smoothing and risk sharing. Some individuals earn more than they currently wish to spend; others spend more than they currently earn. Trading in financial assets allows these individuals to shift their purchasing power from high-earnings periods to low-earnings periods by buying financial assets in high-earning periods and selling these assets to fund their consumption needs in low-earning periods. Financial markets and the financial assets also allow investors to allocate risks among themselves so that the risk in their portfolio is commensurate with the return to the portfolio, i.e., investors with high risk tolerance hold riskier assets, such as stocks, and those with low risk tolerance hold assets with less risk, such as money market instruments. In an economy without government taxation, market participants achieve consumption smoothing and risk sharing through the trading of financial assets on financial markets.

However, through taxation and, in our case, capital gains taxation, the government influences the consumption smoothing and risk sharing of market participants and the exposure of stocks to consumption risk. In the United States, capital gains taxes are levied based on the appreciation or depreciation on the asset at the time of the sale. Specifically, in the case of common stocks, if a stock has appreciated in value, the investor pays capital gains taxes on the appreciation when the stock is sold. Conversely, if the stock has depreciated in value at the time of the sale, the investor can use the realized losses to offset realized gains on other assets. If the realized losses exceed the realized gains, the losses can be used to reduce the taxable ordinary income up to a limit with the remaining losses carried forward to offset future gains and ordinary income. (Because historically there are almost always enough capital gains available to offset capital losses, we assume throughout the paper that all realized capital losses can be fully and immediately utilized to offset other realized capital gains.[3]) Thus, the tax treatment of gains and losses on stocks offers a risk sharing mechanism between investors and the government that affects the consumption smoothing of stock market participants and the exposure of stocks to consumption risk --- the covariability of stock payoffs and investors' marginal utility of consumption.

The fundamental insight of the Consumption Capital Asset Pricing Model (CCAPM) is that the risk of an asset is determined by its equilibrium risk to consumption.

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[3] Individuals, the only investors affected by the reduction in the capital gains tax rate studied in this paper, face no limit on the amount of capital losses that they can use to offset capital gains. If capital losses remain after offsetting all capital gains, then individuals can apply up to $3,000 of capital losses against ordinary income in the current year and carryforward the remaining balance to offset income in future years. In practice, this constraint is rarely binding (Poterba, 1987 and Auerbach, Burman and Siegel, 2000). The Internal Revenue Service (1999a, 1999b) reports that in the year of the capital gains rate reduction (1997), individuals in the maximum tax bracket (39.6 percent), who accounted for 61 percent of all net capital gains, reported $169 billion of long-term capital gains and only $5 billion of long-term capital losses and $16 billion of short-term capital gains and only $8 billion of short-term capital losses. In short, individual investors had far more capital gains than they had capital losses to offset them. Thus, for our purposes, it is reasonable to assume that realized capital losses can be used to offset realized capital gains.

A higher consumption risk of an asset is associated with a higher risk of its return. For portfolios with a large number of stocks, the return risk is often measured by its volatility, implying a positive relation between the consumption risk and the stock return volatility. In the past, most empirical tests of the CCAPM found a weak relation between stock returns and consumption risk (measured by the contemporaneous consumption growth rate). Recent studies have found a strong positive relation between stock returns and consumption risk, when the consumption risk is measured over a longer horizon. For example, Parker and Julliard (2005) document that the ultimate risk to consumption, defined as the covariance of asset returns and consumption growth over a horizon of three years can explain between 44 and 73 percent of the variation in expected returns across portfolios of stocks. Because a reduction in the capital gains tax rate adversely affects the risk sharing between investors and the government and increases the exposure of stocks to consumption risk, it leads to higher stock return volatility.

Similar conclusion can also be derived in a single-period CAPM model with personal taxes developed in Brennan (1970). Under the usual assumptions of the basic CAPM model, Brennan (197) shows that the expected or required return on a stock can be expressed as:

$$\overline{R}_j - r = H\,COV(R_j, R_m) + T(\delta_j - r),$$

where $\overline{R}_j$ and δ_j are the required return and the expected dividend yield on stock *j*, respectively, *r* is the risk free rate, $COV(R_j, R_m)$ is the covariance of the return of stock *j* (R_j) with the market return (R_m), *H* and *T* are functions of weighted averages of investors' marginal tax rates on dividends and capital gains, where the weights depend upon investors' marginal rates of substitution between expected return and variance of return. If we further assume that investors in the economy have the same marginal tax rates, the above equation can be simplified as follows:

$$\overline{R}_j - r = \frac{1 - t_g}{w} COV(R_j, R_m) + \frac{t_d - t_g}{1 - t_g}(\delta_j - r),$$

where t_g and t_d are the marginal tax rate on capital gains and dividends, respectively, and *w* represents investors' marginal rates of substitution between expected return and variance of return. Given that the second term is small compared with the first term and the covariance risk will likely be higher for a lower capital gains tax rate, the expected return on stock *j* will increase when the marginal tax rate on capital gains decreases. For a large portfolio of stocks, a higher expected return will be accompanied by higher risk commensurate with the higher return in equilibrium. This suggests that, when a capital gains tax rate reduction leads to higher expected return, it will also lead to higher risk and volatility that is commensurate with higher expected return.

Capital gains taxation also affects the exposure of stocks to consumption risk. The idea is clearly illustrated in Chalmers (2006). In an attempt to explain the empirical puzzle about why long-term tax-exempt yields, compared with taxable yields, are significantly higher than predicted by theory, Chalmers (2006) argues that taxes may bestow a benefit in that the fraction of taxable bond's return paid in taxes lowers exposure to consumption risk when compared to otherwise identical tax-exempt bonds. The argument goes as follows. Suppose that the economy is good and most investors in the economy receive high income and pay higher taxes on taxable bonds. These investors will have high consumption level and realize a low marginal utility of consumption. Now suppose that the economy is bad and most investors receive less income and pay lower taxes on taxable bonds. They are also likely to consume less and have a higher marginal utility of consumption. Because tax costs out of taxable bonds co-vary negatively with the marginal utility of consumption, taxes can bestow an attractive risk characteristic onto taxable bonds in that they reduce exposure to consumption risk, decreasing after-tax yields when the economy is strong and increasing after-tax yields when the economy is weak.

We can extend the basic intuition above to the effect of capital gains taxes on the exposure of stocks to consumption risk. In the case of capital gains taxes, when the economy is good, most investors receive high income and are likely to have high consumption levels and a low marginal utility of consumption. They are likely to realize more gains and pay more taxes. When the economy is bad, most investors receive less income and are likely to consume less and, therefore, have a higher marginal utility of consumption. They are also likely to realize less gains or even losses. Therefore, the tax costs also co-vary negatively with the marginal utility of consumption. Capital gains taxation also can bestow an attractive risk characteristic onto stocks in that the capital gains taxation lowers the exposure of stocks to consumption risk.

That said, the impact of a capital gains tax rate change on the risk sharing between taxable investors and the government and on the exposure to consumption risk should vary across stocks, and, consequently, the change in return volatility should vary across stocks. The first cross-sectional difference concerns dividend policy. If taxable investors receive all returns from a firm as dividends, then no income received is subject to capital gains taxes. Consequently, the change in capital gains tax rate should have no direct effect on stock return volatility. On the other hand, if the taxable investors receive no dividends, then the entire return comes as capital gains. In that case, all income will be subject to capital gains taxes. As a result, a capital gains tax rate change for these all-capital-gains firms should have a large impact on the risk sharing between the taxable investors and the government and on the exposure of these firms to consumption risk. This should increase the stock return volatility. In general, the higher the percentage of profits taxed as capital gains, the more a cut in the capital gains tax rate reduces the amount that the government shares in the risk and the higher the exposure to consumption risk. The reduction in risk sharing and the increase in exposure to consumption risk imply higher stock return volatility.

The second cross-sectional difference concerns the amount of the gain (or loss) when the stock is sold. To review, if the sale proceeds of a taxable investor in a stock are equal to his tax basis (i.e., the cost of purchasing the stock), then the investor has no income subject to the capital gains tax at the time of the sale of the stock because he has neither gain nor loss. Consequently, since there is no income subject to capital gains taxes, the government bears no risk and there is no impact on the exposure of the stock to consumption risk. On the other hand, if the investor's sale proceeds are zero, then the loss is equal to the cost of purchasing the stock. Therefore, the full loss (which equals the tax basis) can be used to reduce the investor's taxes. Similarly, if the investor's sale proceeds are equal to the gains (because the cost of the stock was zero), then all proceeds are subject to capital gains taxation.

Capital gains taxation bestows a benefit when shares are sold in that it reduces the exposure of these stocks to consumption risk because the tax costs co-vary negatively with the marginal utility of consumption. Of course, when the legislation was passed, investors could not know the tax costs because they could not know the eventual gains and losses. However, they could estimate the amount of the built-in gain or loss at the time of the legislation based on recent stock price performance using the following logic: if stocks had experienced large appreciation (depreciation) before the legislation, then, ceteris paribus, their eventual gains (losses) should be large. Thus, the unrealized gains (losses) at enactment can serve to approximate the eventual gains (losses) and accompanying tax costs. This estimate is needed because the magnitude of the negative covariance depends upon the size of tax costs upon selling,

Our discussions above lead to the following hypothesis about the cross-sectional difference in the return volatility change upon a capital gains tax rate cut.

Hypothesis: *A reduction in the capital gains tax rate will increase the return volatility of non-dividend-paying stocks more than that of dividend-paying stocks and will increase the return volatility of firms with large price changes (appreciations or depreciations) more than that of firms with small price changes.*

We test this hypothesis by forming portfolios of stocks with different dividend policy and stock price changes. In the next section, we discuss the empirical methodology.

3. Empirical Methodology

We use the Taxpayer Relief Act of 1997 as our event to empirically test the cross-sectional difference in the change of stock return volatility upon the capital gains tax rate cut. TRA 97 lowered the maximum tax rate on capital gains for individual investors from 28 percent to 20 percent for assets held more than 18 months. TRA 97 is particularly attractive for an event study because the capital gains tax cut was large and relatively unexpected, and the bill included few other changes that might confound our analysis. Little information was released about TRA 97, until Wednesday, April 30, 1997, when the Congressional Budget Office (CBO) surprisingly announced that the estimate of the 1997 deficit had been reduced by $45 billion. Two days later, on May 2, President Bill Clinton and Congressional leaders announced an agreement to balance the budget by 2002 and, among other things, reduce the capital gains tax rate. These announcements greatly increased the probability of a capital gains tax cut. On Wednesday, May 7, 1997, Senate Finance Chairman William Roth and House Ways and Means Chairman William Archer jointly announced that the effective date on any reduction in the capital gains tax rate would be May 7, 1997. As promised, the lower tax rate on long-term capital gains (eventually set at 20 percent) became retroactively effective to May 7, 1997, when the President signed the legislation on August 5, 1997.

Using TRA 97 as our capital gains tax rate change event, we examine the changes in return volatilities for various stock portfolios constructed based on firms' dividend distributions and past 18 months price changes.[4] The constructed portfolios exploit cross-sectional differences in dividends and past price movements, enabling us to test our hypothesis.[5]

Specifically, we first use the firm's dividend distribution in the prior year to partition stocks into a dividend-paying group and a non-dividend-paying group. Within each group, we then dichotomize stocks into those whose share prices have appreciated over the last 18 months and those whose share prices have depreciated over the same period. Next, we divide the stocks whose share prices have risen into quartiles based on the amount of their price appreciation. We call these quartiles, gains portfolios. Similarly, we divide the stocks whose share prices have declined into quartiles based on the amount of their depreciation. These quartiles are termed loss portfolios.

Our procedure creates eight gain portfolios (four dividend-paying and four non-dividend paying gain portfolios) and eight loss portfolios (four dividend-paying and four non-dividend paying loss portfolios). To test our hypothesis that a capital gains tax rate cut leads to a larger increase in the return volatility of non-dividend paying stocks than that of dividend-paying stocks and stocks with large price changes than stocks with small price changes, we focus on the portfolios of dividend-paying and non-dividend-paying stocks with either very small (the lowest quartile) or very large (the highest quartile) price changes. In other words, our analysis uses only eight of the 16 portfolios. The eight portfolios that we study are the ones with the most extreme price movements. Four are

[4] We use 18-month price changes to form our portfolios because TRA 97 established 18 months as the minimum holding period for investors to apply the lower long-term capital gains tax rate.

[5] We test the hypothesis using return volatility of stock portfolios because a capital gains tax rate cut affects the systematic risk exposure of different stocks. For portfolios of large number of stocks, the systematic risk can be represented by the return volatility of the portfolio.

gain portfolios: dividend-paying small gain portfolio (*DSG*), dividend-paying large gains portfolio (*DLG*), non-dividend paying small gain portfolio (*NDSG*), and non-dividend paying large gain portfolio (*NDLG*). Four are loss portfolios: dividend-paying small loss portfolio (*DSL*), dividend-paying large loss portfolio (*DLL*), non-dividend paying small loss portfolio (*NDSL*), and non-dividend paying large loss portfolio (*NDLL*).

For all of our tests, we use daily returns to construct monthly return volatility measure. The sampling period used in our empirical analysis spans from January 1994 to December 2000.[6] To avoid the transient effect caused by the capital gains tax rate cut announcement, we exclude observations from April to September of 1997 from our analysis whenever we use *Post* dummy in the analyses.

Let r_{itj} be the return on stock portfolio *i* on day *j* in month *t* and σ_{it} be stock portfolio *i*'s return volatility in month *t*. Following Schwert (1987), we construct the monthly return volatility for each portfolio-month as follows

$$\sigma_{it} = \sqrt{\sum_{j=1}^{J_t} (r_{itj} - \bar{r}_{it})^2}, \tag{1}$$

where $\bar{r}_{it} = \frac{1}{J_t}\sum_{j=1}^{J_t} r_{itj}$ is the sample mean return for stock portfolio *i* in month *t*, J_t is the number of observations in month *t*.

3.1 Empirical Research Designs

To test our hypothesis on the cross-sectional effect of the capital gains tax rate cut on stock return volatility, we introduce two sets of dummy variables: time dummies and portfolio dummies. Time dummies consist of annual dummies for each year from 1994 to 2000 and a categorical variable $Post_t$ which takes a value of zero on and before 3/31/1997 and value of one on and after 10/1/1997. While the annual dummies allow us to examine the mean return volatility changes across different years, the *Post* dummy allows us to analyze the change of the volatility level for two different capital gains tax

[6] We stop our investigation period at year 2000 to avoid a series of events in 2001 that may have affected stock return volatility, namely, the beginning of the Bush Administration, including the passage of major tax reductions, an economic downturn, and the aftermath of the terrorists attack on September 11, 2001. For sensitivity tests, we repeat our analyses using a broader period (1993 to 2002) and all the results are consistent with what we report here.

rate regimes around the event. As mentioned above, we exclude the "announcement" months (April 1997 to September 1997) from our examination to remove possible transient effect when the *Post* dummy is used in our regression analysis.

The second set of dummy variables consist of categorical variables which identify portfolios of different characteristics directly related to the sensitivity of return volatility to capital gains tax rate change as specified in our hypothesis such as dividend versus non-dividend distribution and small versus large price changes. Specifically, we use $NDLk_i$, $k=G$ or L, to denote non-dividend-paying portfolios with large price appreciation (gains) or depreciation (losses), DLk_i, $k=G$ or L, to denote dividend-paying portfolios with large price appreciation (gains) or depreciation (losses), $NDSk_i$, $k=G$ or L, to denote non-dividend-paying portfolios with small price appreciation (gains) or depreciation (losses), and DSk_i, $k=G$ or L, to denote dividend-paying portfolios with small price appreciation (gains) or depreciation (losses). Each portfolio dummy takes a value of one if portfolio *i* belongs to that portfolio category and a value of zero otherwise. For instance, if portfolio *i* is a non-dividend-paying large gain portfolio, $NDLG_i$ takes a value of one and zero otherwise. Similarly, if portfolio *i* is a dividend-paying small loss portfolio, DSL_i takes a value of one and zero otherwise.

We begin with univariate analyses of the return volatility change for each constructed portfolio. In our first univariate analysis, we examine the average monthly return volatility for each year from 1994 to 2000. Once we identify 1997 as the year where volatility began to increase substantially, we define a dummy called *Post* for a similar analysis after dropping transient months.[7]

To further facilitate our cross-sectional analyses, we introduce another dummy variable HVP_i (high volatility portfolio), which takes a value of zero if portfolio *i* is a pre-selected benchmark portfolio and a value of one for an alternative portfolio believed to have a higher return volatility than the pre-selected benchmark portfolio. We then perform the following regression to test if the alternative portfolio experienced a higher return volatility increase than the benchmark portfolio:

[7] Note that some of the months in 1997 belong to pre-TRA 97 and some of the months belong to post-TRA1997. Even so, our results in Table2 show that 5 out 8 portfolios indicate that 1997 is the starting year for volatility increase (p-values are under 10%). We have also conducted the univariate analysis by grouping the first 4 months of 1997 into 1996 and last 4 months of year 1997 into 1998. The results show that the year 1998 would be the starting year for volatility increase across all portfolios.

$$\sigma_{it} = \alpha + \beta_1 Post_t + \beta_2 HVP_i + \beta_3 Post_t \times HVP_i + \varepsilon_{it}. \quad (2)$$

Under the hypothesis that the alternative portfolio experienced a higher return volatility increase than the benchmark portfolio, we should have a positive coefficient estimate for the interaction term $Post_t \times HVP_i$, i.e., $\beta_3 > 0$.

Our primary objective is to test the cross-sectional implications of a capital gains tax rate cut on stock return volatility stated in Section 2. To achieve this goal, we examine differences in monthly return volatility increases across portfolios with different sizes of price changes (as a measure of the unrealized gains and losses) with and without dividend distribution in a regression model that encompasses portfolios of stocks with different sensitivities to the capital gains tax rate cut. Similar to the univariate analysis, we first examine variation in return volatility across different years for a cross-section of portfolios consisting of dividend and non-dividend paying stocks with price changes in the lower and upper quartiles (either appreciations or depreciations). This allows us to cross-validate the selection of the event year when we jointly consider a cross-section of portfolios of stocks with different sensitivities to the capital gains tax rate cut. We then estimate the following panel regression model utilizing observations for four portfolios consisting of dividend and non-dividend paying stocks with price changes in the lower and upper quartiles (either appreciations or depreciations):

$$\begin{aligned}\sigma_{it} = {} & \alpha + \beta_1 Post_t + \beta_2 NDLk_i + \beta_3 NDSk_i + \beta_4 DLk_i + \beta_5 Post_t \times NDLk_i \\ & + \beta_6 Post_t \times NDSk_i + \beta_7 Post_t \times DLk_i + \sum_{j=1}^{m} \theta_j \Delta\sigma_{i(t-j)} + \sum_{j=1}^{n} \eta_j \bar{r}_{i(t-j)} \\ & + \gamma X_t + \varphi Z_{it} + \varepsilon_{it},\end{aligned} \quad (3)$$

where *k*= *G* or *K*, $\Delta\sigma_{i(t-j)}$ and $\bar{r}_{i(t-j)}$ are lagged mean adjusted portfolio return volatility and monthly average of daily portfolio return, respectively,[8] X_t refers to a vector of aggregate control variables, and Z_{it} represents a vector of characteristics specific to constructed portfolio *i* as of time *t*, and the baseline group is the dividend-paying stocks with small price changes, *DSk*, *k*= *G* or *K*.

Existing empirical asset pricing studies suggest that stock return volatility exhibits persistence and that large negative stock price changes tend to be followed by periods of

[8] The mean adjusted portfolio return volatility is obtained by removing the time series average of the portfolio return volatility from each observation for that return volatility series.

high stock return volatility. The former is referred to as the return volatility clustering and the latter is sometimes referred to as the leverage effect because a stock price decline increases a firm's debt-to-equity ratio which may make the firm riskier.[9] To control for these effects, we allow stock return volatility to depend upon lagged return volatility and stock returns.

This specification allows us to test the hypotheses on the effect of a capital gains tax rate cut on the return volatility by examining the coefficient estimates for the interaction terms, $Post \times NDLk$, $Post \times NDSk$, and $Post \times DLk$. Our hypothesis in Section 2 states that portfolios of non-dividend-paying stocks with large price changes (either appreciations or depreciations) will experience largest return volatility increases after the capital gains tax rate cut than portfolios of dividend-paying stocks with small price changes. We expect portfolios of non-dividend-paying stocks with small price changes and dividend-paying stocks with large price changes to have return volatility increases that lie between these two most extreme portfolios. This suggests that the interaction terms, $Post \times NDLk$, $Post \times NDSk$, and $Post \times DLk$ will have positive coefficients, i.e., $\beta_5 > 0$, $\beta_6 > 0$, and $\beta_7 > 0$. Furthermore, the coefficient for the portfolio of non-dividend-paying stocks with large price changes will be larger than that for the portfolio of non-dividend-paying stocks with small price changes and the portfolio of dividend-paying stocks with large price changes, i.e., $\beta_5 > \beta_6$ and $\beta_5 > \beta_7$. We have no prediction about the relative increases of β_6 and β_7.

This specification also allows us to test whether the benchmark portfolio of dividend-paying stocks with small price changes (either appreciations or depreciations) experienced a volatility increase after the capital gains tax rate cut and whether the alternative portfolios had a higher volatility than the benchmark portfolio before the capital gains tax rate cut. A positive coefficient estimate for β_1 indicates a higher return volatility for the benchmark portfolio after the capital gains tax rate cut. A positive coefficient estimate for β_2, β_3 or β_4 indicates that the alternative portfolio has a higher

[9] See Engle (1982) and Bollerslev (1986) for models on volatility clustering, and Black (1976) and Christie (1982) for the "leverage effect."

return volatility than the benchmark portfolio before the capital gains tax rate cut, respectively.

3.2 Selection of Control Variables

It is important to control for variables which may affect stock return volatility in order to test the hypothesis on the cross-sectional effect of a capital gains tax rate cut on return volatility. Existing studies on stock return volatility have identified an extensive set of variables which may affect return volatility. These factors can be broadly classified into two categories. The first category consists of macroeconomic variables such as interest rates, industrial production growth, and aggregate financial variables such as term premium and default premium. The second category consists of firm level variables such as stock turnover, transactions costs, growth options, cash flow risk, investor composition, among others. We follow existing studies on stock return volatility and control for both macroeconomic factors and return volatility determinants pertaining to different portfolios based on firm level variables.

Relying on the present value argument of stock valuation, Schwert (1989) used the industrial production growth (proxy for cash flows) and the short-term interest rate (proxy for discount rate) as possible macroeconomic factors for the time variation of market return volatility. He found only weak evidence of any predictive power from macroeconomic factors. While both the short-term interest rate and the industrial production growth had positive effect on stock return volatility, the effect is statistically insignificant in most sample periods. Schwert (1989) also found that there is no stable relation between dividend or earnings yields and stock return volatility and the spread between the yields on Baa- versus Aaa-rated corporate bonds had a positive effect on stock return volatility.

Based on the capital asset pricing theory, Lettau and Ludvigson (2001) propose using *CAY*, a proxy for the log consumption-aggregate wealth ratio, as a determinant for stock returns. They argue that for a wide class of optimal models of consumer behavior, the log consumption-aggregate wealth ratio summarizes expected returns on aggregate wealth, or the market portfolio. They show that the *CAY* variable is a better predictor than are the dividend yield, the term premium, the default premium, and other previously widely used predictors combined. Lettau and Ludvigson (2003) further document that *CAY* has a statistically significant predictive power for stock market volatility with a negative coefficient. We thus use a measure of short-term interest rate, the industrial production growth, and the *CAY* to control for macroeconomic activities.

Several studies also documented that there are stock market volatility spillovers in that increases in volatility in some markets lead to increases in volatility in other markets (King and Wadhwani, 1990, Hamao, Masulis and Ng, 1990, among others), and larger volatility spillovers are likely following large negative returns compared to large positive returns (Bae and Karolyi, 1994, Karolyi and Stulz, 1996, among others). To mitigate the effects caused by changes in domestic and global stock market performances and volatility, we include lagged monthly average of daily returns ($\bar{r}_{t-j}$) and lagged mean adjusted monthly return volatility ($\Delta\sigma_{t-j}$) for the domestic market portfolio and lagged mean adjusted monthly return volatility ($\Delta\sigma^{f}_{t-j}$) and monthly average of daily return for foreign stock markets ($\bar{r}^{f}_{t-j}$), respectively, as control variables. Taking into account existing empirical studies on the relation between stock market volatility and macroeconomic activities as well as possible market volatility spillovers, we choose to include the following aggregate control variables in our regression analysis:

RREL --- the stochastically detrended risk-free rate,

GIP --- the industrial production growth rate (*GIP*),

CAY --- the consumption-wealth ratio,

$\Delta\sigma_{t-j}$ --- the lagged mean adjusted monthly return volatility of the US stock market,

$\bar{r}_{t-j}$ --- the lagged monthly average of daily return for the US stock market,

$\Delta\sigma^{f}_{t-j}$ --- the lagged mean adjusted monthly return volatility of foreign stock markets,

$\bar{r}^{f}_{t-j}$ --- the lagged monthly average of daily return for foreign stock markets.

Existing empirical studies have also documented a number of firm level variables that may affect stock return volatility. For instance, Cohen, Ness, Okuda, Schwartz, and Whitcomb (1976) document that stock turnover (the number of shares traded divided by the stock's floating supply) has a positive effect on stock return volatility. They attribute the effect to the new information conveyed by stock turnover. Related to the information flow of share trading, transactions costs are also found to have an effect on stock return volatility. Jones and Seguin (1997) examine the effects on volatility of an across-the-board reduction in transactions costs by investigating the evidence from the commissions deregulation in May 1, 1975 which introduced lower, negotiated commissions on U.S. national stock exchanges. They found that a reduction in transaction costs is associated with a decline in stock return volatility. Using the currency market data for Florence (Italy) in the late 14th and early 15th centuries, Booth and Gurun (2008) also found that volatility is positively related to the bid-ask spread. These studies attribute the findings to improved information flow and market efficiency associated with lower transactions costs. Since both the New York Stock Exchange and the Nasdaq reduced the tick size for stock trading between June 1997 and August 1997, the same time that TRA 97 was being finalized, we need to control for the bid-ask spread of stock trading.

Campbell, Lettau, Malkiel, and Xu (2001) document more firm idiosyncratic volatility than market volatility from 1962 to 1997.[10] They suggest several factors as possible explanations. These factors include changing discount rates, a shift towards reliance on external as opposed to internal capital markets, firms' growth potentials, changes in executive compensation, firms' leverage position, and the increased share of institutional ownership.[11] Xu and Malkiel (2003) and Cao, Simins, and Zhao (2007) document that firms' growth options have a significant positive effect on idiosyncratic risk of equity. Cohen, Hall, and Viceira (2000) find the changes in executive compensation have a statistically significant effect on the risks of their firms' activities, but the effect is small in magnitude. Empirical studies also documented that the leverage effect tends to be stronger for firms with higher debt-to-equity ratio than firms with lower debt-to-equity ratio (Cheung and Ng, 1992 and Duffee, 1995), suggesting a possible positive association between return volatility and a firm's leverage position. Both

[10] Pastor and Veronesi (2006) document similar results for periods until 2002.

[11] Among the list of possible explanations proposed by Campbell, Lettau, Malkiel, and Xu (2001), we control for most of them except for the shift towards reliance on external as opposed to internal capital markets and changes in executive compensation. For the former, it is difficult to construct an explicit variable to measure the shift. For the latter, while changes in executive compensation have an effect on management risk taking behavior, the size of the effect is small as documented in Cohen, Hall, and Viceira (2000).

Gompers and Metrick (2001) and Xu and Malkiel (2003) document that the share of institutional ownership has a positive effect on stock return volatility. In addition, Xu and Malkiel (2003) also found that firm size has a negative effect on idiosyncratic volatility. In a recent paper, Irvine and Pontiff (2008) document that higher idiosyncratic return volatility reflects higher earnings or cash flow variability, suggesting a positive relation between idiosyncratic return volatility and cash flow variability.

To control for the possible effects on the return volatility of our constructed portfolios associated with the firm level variables discussed above, we include the value-weighted turnover in the most recent past month (*Turnover*), the average monthly bid-ask spread in the most recent past month (*BidAskSpread*), price-earnings ratio as a proxy for growth option (*P/E* ratio), firm's debt-to-asset ratio (*D/A*), the average individual investor ownership in the most recent past quarter (*IND*), the logarithm of market capitalization of the portfolio (*Size*), and the earnings volatility measured by the coefficient of variation in quarterly earnings (*CV earnings*). In summary, the list of control variables specific to each constructed portfolio is as follows:

Turnover --- the value weighted averages of individual stock turnover,

BidAskSpread --- the value weighted average of individual stocks' percentage bid-ask spread,

P/E ratio --- the value weighted average of individual stocks' price-earnings ratios,

D/A --- the value weighted averages of firms' debt-asset ratios,

IND --- the value weighted average of individual ownership of stocks in the portfolio,

Size --- the logarithm of the market value of the portfolio,

CV earnings --- the value weighted average of firm's quarterly earnings' coefficient of variation.

In our regression analysis of Equation (3), we also include monthly dummies to account for possible calendar effect.

4. Empirical Analysis

4.1. Sample and Summary Statistics

To empirically test the cross-sectional effect of TRA 97 on the return volatility, we use all stocks included in the CRSP database. As noted above, the investigation period is from January 1994 to December 2000, excluding April through September of 1997. This sample period enables us to have the same number of observations before and after the announcement, while avoiding any potentially confounding effects arising during the legislative deliberations.

For the aggregate control variables, we construct the stochastically detrended risk-free rate by removing the average risk-free rate in the prior twelve months from the risk-free rate in month t as in Campbell and Shiller (1988). The growth rate of the industrial production is calculated using monthly industrial production index obtained from the Federal Reserve Bank of St. Louis. We obtain the proxy for the consumption-wealth ratio (*CAY*) from Martin Lettau's website.[12] Since the consumption-wealth ratio is at quarterly frequency, we use linear interpolation to obtain monthly observations. We use the excess return on the value-weighted portfolio of stocks included in the CRSP database as the market return. The returns for the foreign equity markets are based on the Morgan Stanley Capital Markets International (MSCI) ACWIsm ex USA Index. This is a free float-adjusted market capitalization index designed to measure equity market performance in all global developed and emerging markets outside of the United States.

We obtain daily individual stock return data from the daily CRSP database. Dividend and stock price are extracted from the monthly CRSP database. We compute the appreciation and deprecations using a firm's most recent 18 month stock price change prior to month t.[13] Monthly individual stock turnover is constructed by dividing the

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[12] *CAY* variable is constructed as the transitory deviation of the logarithm of aggregate consumption from the common long-term trend shared by the logarithm of consumption, asset holdings, and labor income. Lettau and Ludvigson (2001) obtained the *CAY* variable by first estimating a cointegrated vector autoregressions (VAR) for the three variables and then subtracting the estimated common trend from the logarithm of consumption at each period.

[13] We also performed the analysis for the loss and gain portfolios using price changes in the past 12 months. The results are very similar to that for the 18-month price changes.

monthly trading volume by the shares outstanding at the end of the month.[14] The average monthly percentage bid-ask spread for individual stocks is constructed using the transaction level Trade And Quote (TAQ) database.[15] For the measure of firms' growth options, we use the ratio of the end-of-month price to the lagged earnings per share.[16] We compute a firm's debt-asset ratio using data from the COMPUSTAT database. Because the COMPUSTAT database is only available quarterly, we assume that a firm's debt-asset ratio remains the same within the quarter. To obtain measures of individual investor ownership, we use institutional investors' ownership information submitted by investment management companies to the Security Exchanges Commission on Form 13-F.[17] We compute the individual investor ownership on stock i at time t (IND_{it}) as follows:

IND_{it} = 1 – the percentage of shares owned by institutional investors at time t.

Firm size is measured by the end-of-month price multiplied by the total shares outstanding for each firm. To measure earnings volatility, we use the coefficient of variation calculated using 24 quarterly earnings in the previous six years. For each portfolio, we compute the monthly value-weighted averages of the above firm level variables.

Table 1 reports the summary statistics for stock returns and volatility separately for eight portfolios formed based on a firm's dividend distribution in the prior year and the stock price change in the past 18 months. These consist of the dividend and non-dividend paying portfolios of stocks with past 18 month price appreciation or depreciation in the lower and upper 25 percentile, respectively. They include four portfolios of dividend and non-dividend paying stocks which have appreciated in price in the past 18 months and four portfolios of dividend and non-dividend paying stocks which have depreciated in price in the same period. Specifically, the four gains portfolios include the portfolio of dividend-paying stocks with past 18 month price appreciation in the lower 25 percentile (dividend-paying small gain portfolio or DSG), the portfolio of

[14] Ideally, we would use the monthly trading volume for individual investors only. However, this information is unobservable. Thus, we assume that the differences, in any, between individuals' turnover and other investors' turnover do not affect the study's inferences.
[15] We thank Kam-Ming Wan for providing us the monthly bid-ask spread data on individual stocks.
[16] We also used alternative measures such as the market value to book value ratio and the forecasted operating income growth rate on individual firms obtained from the IBES database as a proxy. The results are qualitatively similar.
[17] We thank Rabih Mousssawei for providing us the institutional stock ownership data.

dividend-paying stocks with past 18 month price appreciation in the upper 25 percentile (dividend-paying large gain portfolio or DLG), the portfolio of non-dividend paying stocks with past 18 month price appreciation in the lower 25 percentile (non-dividend paying small gain portfolio or NDSG), and the portfolio of non-dividend paying stocks with past 18 month price appreciation in the upper 25 percentile (non-dividend paying large gain portfolio or NDLG). Similarly, the four loss portfolios include the portfolio of dividend-paying stocks with past 18 month price depreciation in the lower 25 percentile (dividend-paying small loss portfolio or DSL), the portfolio of dividend-paying stocks with past 18 month price depreciation in the upper 25 percentile (dividend-paying large loss portfolio or DLL), the portfolio of non-dividend paying stocks with past 18 month price depreciation in the lower 25 percentile (non-dividend paying small loss portfolio or NDSL), and the portfolio of non-dividend paying stocks with past 18 month price depreciation in the upper 25 percentile (non-dividend paying large loss portfolio or NDLL). Note that for loss portfolio, the lower or upper percentile is by absolute value.

Panel A presents the summary statistics for the portfolios of dividend and non-dividend paying stocks which have experienced price appreciation in the past 18 months. The dividend-paying small gain portfolio has an average daily return of 0.037 percent with a standard deviation of 0.16 percent. The dividend-paying large gain portfolio has a mean daily return of 0.057 percent with standard deviation of 0.21 percent. Consistent with the higher average daily return of the dividend-paying large gain portfolio than the dividend-paying small gain portfolio, the dividend-paying large gain portfolio also has a higher average monthly volatility of 4.7 percent compared with volatility of 3.2 percent for the dividend-paying small gain portfolio, reflecting a positive risk and return tradeoff. Similar results are also found for the non-dividend paying portfolios. The non-dividend paying small gain portfolio has an average daily return of 0.028 percent with a standard deviation of 0.30 percent while the average daily return for the non-dividend paying large gain portfolio is 0.117 percent with a standard deviation of 0.41 percent. The average monthly volatility is 5.3 percent for the small gain portfolio and 8.3 percent for the large gain portfolio. The non-dividend paying portfolios experience higher return volatility than their dividend-paying counterpart. The results are also consistent with a positive risk and return tradeoff. Intuitively, since the investment returns to holding non-dividend paying stocks are in the form of capital gains while the investment returns to holding dividend-paying stocks are partially in the form of dividend yield and there are more uncertainty on capital gains than dividends, non-dividend paying portfolios will likely have higher volatility than dividend-paying portfolios.

Panel B presents the summary statistics for the portfolios of dividend and non-dividend paying stocks which have experienced price depreciation in the past 18 months. The dividend-paying small loss portfolio has an average daily return of 0.035 percent with standard deviation of 0.19 percent. The dividend-paying large loss portfolio has an average daily return of 0.028 percent with a standard deviation of 0.28 percent. The average monthly return volatility is 3.4 percent for the small loss portfolio and 4.4 percent for the large loss portfolio. On the other hand, for the non-dividend paying stocks, the small loss portfolio has an average daily return of 0.019 percent with a standard deviation of 0.28 percent while the large loss portfolio has a higher average daily return at 0.054 percent with a standard deviation of 0.41 percent. The large loss portfolio also has a higher average monthly return volatility of 6.0 percent compared with that of the small loss portfolio of 5.1 percent. Similar to the pattern observed for the gain portfolio in Panel A, the non-dividend paying portfolios have higher return volatility than their dividend-paying counterpart.

Overall, the results on the constructed portfolios provide empirical evidence that non-dividend paying stocks have higher return volatility than dividend-paying stocks, stocks that had experienced large price changes (appreciation or depreciation) have higher return volatility than their respective counterpart with small price changes (appreciation or depreciation), and higher return is associated with higher risk.[18]

Table 2 provides a univariate analysis of the annual average monthly return volatility for all constructed portfolios across different years from 1994 to 2000. This analysis allows us to identify the possible change in return volatility and establish a possible relation between the change in monthly return volatility and the capital gains tax rate cut associated with the TRA 97. Panel A (B) presents the annual average of monthly return volatility for each gain (loss) portfolio compared with the baseline year of 1994

[18] The only exception to the higher return and higher risk relation is the dividend-paying large loss portfolio which has a lower average daily return than the dividend-paying small loss portfolio but a higher average monthly return volatility.

which is represented by the intercept. For all eight portfolios analyzed, we found that return volatility in 1995 and 1996 are not significantly different from their respective return volatility in baseline year 1994. In the meantime, the return volatility for 1997 is higher than the baseline year 1994 and difference is statistically significant in four out of eight portfolios at the 5 percent level with an additional portfolio having a higher return volatility than the baseline year 1994 at the 10 percent level. The one-sided test for strictly higher return volatility for 1997 than for the baseline year 1994 cannot be rejected for all except one portfolio (the dividend-paying small loss portfolio or DSL) at the 10 percent level. Considering that the TRA 97 occurred in the middle of the year, the return volatility for 1997 includes both the lower volatility in months before the tax cut and the higher volatility in the months after the cut. Thus, the full impact on the return volatility first shows up in 1998. Indeed, as expected, the annual average of monthly return volatility for 1998 is higher than that in the baseline 1994 and highly statistically significant at one percent for all portfolios.

We also test whether the additional average return volatility for year 1997 and 1998 above the base year 1994 is significantly different from the previous years (1995 or 1996) for all constructed portfolios. Consistent with our findings discussed above, in seven out of eight portfolios, the additional average return volatility for year 1997 are significantly different from 1995 at the 5 percent level. The number is reduced to two portfolios when we compare 1997 and 1996. In the meantime, there are seven out of eight portfolios for which the additional average return volatility for year 1998 is significantly different from both 1995 and 1996. The number is reduced to four out of eight when we compare year 1998 and 1997. Overall, our evidence suggests that the return volatility experienced a significant increase during 1997, leading to a significantly higher return volatility after 1998 compared with years before 1997. Combining the empirical evidence uncovered here with chronicle of events surrounding TRA 97, we think that our selection of the event window and the removal of April to September of year 1997 to reduce the transient effects are sensible. For our subsequent univariate tests, we will focus on the average return volatility changes in the period prior to the TRA 97 and the period post the TRA 97.

We then examine the average return volatility difference for each portfolio before and after TRA 97 using the breakpoint identified in the return volatility analysis across different years. Table 3 provides the univariate test results of the change in the average monthly return volatility for all portfolios before and after the capital gains tax rate cut of TRA 97. Our results indicate that all portfolios experienced significant return volatility increases. Further, the return volatility increase is larger for non-dividend paying stock portfolios than for dividend-paying stock portfolios. For instance, the increase in monthly return volatility is 1.60 percent for the dividend paying portfolio and 2.11 percent for non-dividend paying portfolio for stocks that had experienced small price appreciation (lower 25 percentile) in the past 18 months and 2.84 percent for the dividend-paying portfolio and 3.47 percent for the non-dividend-paying portfolio for stocks that had experienced large price appreciation (upper 25 percentile) in the past 18 months. Similar pattern also is observed for stocks that had experienced price depreciation. Specifically, the monthly return volatility is 1.56 percent for dividend-paying portfolio and 1.71 percent for non-dividend paying portfolio for stocks that had experienced small price depreciation, and it is 2.15 percent for dividend-paying portfolio and 2.43 percent for non-dividend paying portfolio for stocks that had experienced large price depreciation.

Our results also show that portfolios of stocks with large price changes in the past 18 months (appreciation or depreciation) experience higher return volatility increases than portfolios of stocks with small price changes. For instance, for dividend-paying stocks, the increase in the average monthly return volatility is 1.60 percent (1.56 percent) for the portfolio of stocks with small price appreciation (depreciation) and 2.11 percent (1.71 percent) for the portfolio of stocks with large price appreciation (depreciation). For non-dividend paying stocks, the increase in the average monthly return volatility is 2.84 percent (2.15 percent) for the portfolio of stocks with small price appreciation (depreciation) and 3.47 percent (2.43 percent) for the portfolio of stocks with large price appreciation (depreciation).

Table 4 presents the test results on the relative return volatility increases of non-dividend paying portfolios versus dividend-paying portfolios and portfolios of stocks with small price changes (appreciations or depreciations) versus portfolios of stocks with large price changes. Panel A shows the test results on the difference in return volatility increases of non-dividend paying portfolios versus dividend-paying portfolios. The coefficient for the interaction term $Post_t \times HVP_i$ is positive for all four regressions. The estimates range from 0.6 percent for the portfolios of stocks with small price depreciations to 1.4 percent for the portfolios of stocks with large price appreciations. All estimates are statistically significant at the 10 percent level under one-sided test. The return volatility increase is larger for stocks that have experienced price appreciation than for stocks that have experienced price depreciation.

Panel B shows the test results on the difference in return volatility increases of portfolios of stocks with different magnitude of price changes. Consistent with the findings on the relative return volatility increases of non-dividend paying stocks versus dividend-paying stocks, the coefficient for the interaction term $Post_t \times HVP_i$ is positive for all four regressions. The estimates in general are lower than the estimates for non-dividend versus dividend paying portfolios and range from 0.15 percent for the dividend-paying stocks with price depreciations to 0.63 percent for non-dividend paying stocks with price appreciations. The statistical significance is also weaker with only one out of four estimates being significant at 10 percent (dividend-paying stocks with large price appreciations and non-dividend paying stocks with large price depreciations). We offer more extensive and detailed investigations on the relative return volatility increases of non-dividend paying stocks versus dividend-paying stocks and stocks that had experienced large price changes versus stocks that had experienced small price changes in our cross-sectional regression analysis below.

Table 5 presents the summary statistics for the aggregate variables used to control for the macroeconomic activities and the overall domestic and global equity market performances. For the sample period from January 1994 to December 2000, the stochastically detrended risk-free rate has a monthly average of 0.021 percent with a standard deviation of 0.053 percent. Over the same period, the industrial production grew at 0.38 percent per month on average with a standard deviation of 0.51 percent. The proxy for the consumption-wealth ratio, *CAY*, has an average of -0.18 percent and a standard deviation of 2.39 percent. The average daily excess return for the value-weighted domestic market portfolio is 0.035 percent with a standard deviation of 0.21 percent. The monthly volatility of the market excess return has a mean of 4.1 percent with a standard deviation of 2.2 percent. For the same time period, the average daily return for foreign equity markets is 0.019 percent with a standard deviation of 0.19 percent. The average monthly volatility for foreign stock markets is lower than the U.S. stock market at 3.5 percent with a standard deviation of 1.5 percent.

Further, the industrial production growth rate and the proxy for the consumption-wealth ratio are lower post TRA 97 than before TRA 97. Consistent with the finding on the changes in the return volatility reported for the constructed portfolios, the volatility for overall domestic equity market and the foreign stock markets are also higher with the increase in the return volatility for domestic equity market much higher than the increase in the return volatility for foreign stock markets. This implies that it is necessary to control for the changes in overall domestic stock and foreign equity market performances.

Table 6 presents the summary statistics for the portfolio specific control variables including the value-weighted averages of firms' stock turnover (*Turnover*), percentage bid-ask spread (*BidAskSpread*), price-earnings ratio (*P/E*), debt-to-asset ratio (*D/A*), individual investor ownership (*IND*), the logarithm of market value of the portfolio (*Size*), and the coefficient of variation for quarterly earnings (*CV earnings*). Panel A reports the summary statistics for the dividend and non-dividend paying portfolios of stocks which have experienced price appreciations in the past 18 months (Gains Portfolios) while Panel B shows the summary statistics for portfolios of stocks which have experienced price depreciations in the past 18 months (Loss Portfolios).

For stocks that had experienced price appreciations in the past 18 months, the average stock turnover ranges from 6 percent for the portfolio of dividend-paying stocks with small price appreciation (lower quartile) to 25 percent for the portfolio of non-dividend paying stocks with large price appreciation (upper quartile). For stocks that had experienced price depreciations, the average stock turnover has a narrower range from 6 percent for the dividend-paying stocks with small price depreciations (lower quartile) to 17 percent for the non-dividend paying stocks with large price depreciations (upper quartile). For all portfolios, stocks with small price changes (appreciations or depreciations) have lower turnover than stocks with large price changes (appreciations or depreciations). Dividend-paying stocks have lower turnover than non-dividend paying stocks. For stocks that had experienced price appreciations in the past 18 months, the average turnover for portfolios of stocks with small price appreciation increases after TRA 97 versus before TRA 97. It decreases for portfolios of stocks with large price appreciation. On the other hand, for stocks that had experienced price depreciations in the past 18 months, the average turnover increases after TRA 97 versus before TRA 97 for all four portfolios but the increase is only significant for dividend-paying stocks with small price depreciations and non-dividend paying stocks with large price depreciations. The change in the average turnover is in general small in magnitude.

For stocks that had experienced price appreciations, the average bid-ask spread ranges from 0.28 for the portfolio of dividend-paying stocks with large price appreciation to 0.80 percent for the portfolio of non-dividend paying stocks with small price appreciations. In the meantime, the average bid-ask spread is much higher for stocks that had experienced price depreciations. It ranges from 0.37 percent for dividend-paying stocks with small price depreciations to 1.53 percent for non-dividend stocks with large price depreciations. Dividend-paying stocks have lower average bid-ask spread than non-dividend paying stocks. Consistent with the reduction is tick size, the average bid-ask spread is lower after the TRA 97 than before the TRA 97. The decreases range from 0.13 percentage point for the portfolio of dividend-paying stocks with small price appreciation to 0.39 percentage point for the portfolio of non-dividend paying stocks with large price appreciations. The decrease in the bid-ask spread is bigger ranging from 0.18 percentage point for dividend-paying stocks with small price depreciations to 0.98 percentage point for non-dividend paying stocks with large price depreciations.

The average price-earnings ratio ranges from 25.8 for the portfolio of dividend-paying stocks with small price appreciations to 40.8 for the portfolio of non-dividend paying stocks with large price appreciations. The range for the average price-earnings ratio is wider from 6.4 for non-dividend paying stocks with large price depreciations to 44.2 for dividend-paying stocks with small price depreciations. The average P/E ratio experienced a statistically significant increase for the portfolios of stocks with large price appreciation (both dividend and non-dividend paying) before TRA 97 and after TRA 97. On the other hand, the increase in the average *P/E* ratio is statistically significant for non-dividend paying stocks with both small and large price depreciations.

For stocks that had experienced price appreciations, the average debt-to-asset ratio (*D/A*) is the highest at 64.5 percent for the dividend-paying stocks with small price appreciations and the lowest at 37.6 percent for the non-dividend paying stocks with large price appreciations. The average debt-to-asset ratio has a narrower range for stocks with price depreciations. It ranges from 49.6 percent for non-dividend paying stocks with large price depreciations to 64.0 percent for dividend-paying stocks with small price depreciations. The average debt-to-asset ratio is higher for dividend-paying stocks than for non-dividend paying stocks and for stocks with small price appreciations than for stocks with large price appreciations. The change in the debt-to-asset ratio before and after TRA 97 is small in magnitude (less than 5 percent for stocks with price appreciations and less or equal to 8 percent for stocks with price depreciations). Further, the change is statistically insignificant for the portfolios of stocks with small price appreciations and the portfolio of non-dividend paying stocks with small price depreciations.

The average share of stocks owned by individual investors remains in a narrow range between 43 to 47 percent for all four portfolios of stocks that had experienced price appreciations. The individual investor ownership is also lower after TRA 97 than before TRA 97 for the portfolios of stocks with small price appreciations and higher for the portfolios of stocks with large price appreciations. For stocks that had experienced price depreciations, the average share of stocks owned by individual investors is around 47 percent except for non-dividend paying stocks with large price depreciations which has a higher individual investor ownership of 61 percent. All four portfolios experienced a decrease in individual investor ownership. Among them, three are statistically significant.

For stocks that had experienced price appreciations, the average logarithm of firms' market value ranges from 14.9 for the portfolio of non-dividend paying stocks with small price appreciations to 17.2 for the portfolio of dividend-paying stocks with large price appreciations. For stocks that had experienced price depreciations, the average logarithm of firms' market value is lower and ranges from 12.8 for non-dividend paying stocks with large price depreciations to 16.1 for dividend-paying stocks with small price depreciations. In general, the average size is larger for dividend-paying firms than for non-dividend paying firms. The average size is also larger after TRA 97 than before TRA 97 for all portfolios reflecting increased market value of firms on average.

Finally, there is a wide range for the earnings variability measured by the coefficient of variation. For stocks that had experienced price appreciations, the *CV earnings* ranges from -9.49 for non-dividend paying stocks with small price appreciations to 1.32 for non-dividend paying stocks with large price appreciations. For stocks that had experienced price depreciations, the *CV earnings* ranges from -9.78 for non-dividend paying stocks with large price depreciations to 6.21 for non-dividend paying stocks with small price depreciations. The earnings variability is however much lower and remains in a narrower ranges for dividend-paying stocks (from 0.71 for stocks with small price appreciations to 0.97 for stocks with large price appreciations and from -2.04 for stocks with large price depreciations to 0.72 for stocks with small price depreciations). The earnings variability is also higher after TRA 97 than before TRA 97 for dividend-paying stocks while the change in the earnings variability is insignificant for non-dividend paying stocks.

4.2. Test the effect of a capital gains tax cut on stock return volatility

We begin our hypothesis test on the cross-sectional implications of the capital gains tax rate cut on stock return volatility by examining the mean return volatility across different years from 1994 to 2000 for a cross-section of four portfolios consisting of dividend-paying and non-dividend paying stocks with price changes in the lower quartile and the upper quartile (either appreciations or depreciations). This is achieved by performing the following panel regression treating the portfolio of dividend-paying stocks with small price changes (either appreciations or depreciations) as the benchmark group:

$$\sigma_{it} = \alpha + \beta_1 DLk_i + \beta_2 NDSk_i + \beta_3 NDLk_i + \lambda' D_t + \varepsilon_{it}, \quad (4)$$

where $D = [YR1995\ \ YR1996\ \ YR1997\ \ YR1998\ \ YR1999\ \ YR2000]'$ is the vector of annual dummy variables with year 1994 as the baseline.[19]

[19] We use the PROC MIXED Procedure in SAS to estimate our panel regression model. Our estimation method utilizes the clustered estimate for the standard errors.

Table 7 presents the results of the regression analysis of Equation (4) for portfolios of dividend and non-dividend paying stocks with price appreciations (two columns on the left) and price depreciations (two columns on the right), respectively. The regressions results for both stocks with price appreciations and stocks with price depreciations suggest that portfolios of stocks with large price changes and/or non-dividend paying stocks have higher return volatility. For both regressions, the coefficient estimate for YR1997 is positive at 1.09 percent for the stocks with price appreciations and 0.88 percent for the stocks with price depreciations. The estimates are highly statistically significant. In the meantime, the return volatility in year 1995 and year 1996 is not significantly higher than the baseline of year 1994. Additional tests on the difference in the average monthly return volatility of year 1997 versus 1995 and 1996 suggest that the return volatility in 1997 is higher than the return volatility in 1995 and 1996.

Considering that year 1997 is the capital gains tax cut announcement was made in mid-1997, the full effect on return volatility is likely to appear in year 1998. Indeed, the coefficient estimate for YR1998 also is highly statistically significantly positive and larger than the coefficient estimate for YR1997. When testing the differences in return volatility of year 1998 versus previous years, we find that the higher return volatility for year 1998 is highly statistically significant when compared to year 1995 and 1996 for both portfolios of stocks with price appreciations and depreciations and year 1997 for stocks with price depreciations. Our findings suggest that there has been an increase in the return volatility during year 1997. In our subsequent tests on the implications of the capital gains tax rate cut on return volatility, we focus on the return volatility surrounding the event window.

To test the cross-sectional effect of the capital gains tax rate cut on the return volatility of portfolios of stocks with different sensitivities to the tax rate change, we estimate the panel regression model specified in Equation (3) for the portfolios of dividend and non-dividend paying stocks which have experienced price appreciation (columns on the left) and the portfolios of dividend and non-dividend paying stocks which have experienced price depreciation (columns on the right), respectively. Table 8 presents the estimation results for both regressions. We use the portfolio of dividend-paying stocks with small price appreciation or depreciation, respectively, as the benchmark portfolio in our regression analysis.

The coefficient for *Post* is positive in both regressions suggesting that the benchmark portfolio, dividend-paying stocks with small price changes, experienced an increase in return volatility following the capital gains tax rate cut of TRA 97. The coefficient estimate shows that the dividend-paying stocks with price appreciations in the lower 25 percentile experienced 0.44 percentage point higher average monthly return volatility while the dividend-paying stocks with price depreciations shown 1.32 percentage point higher average monthly return volatility after the capital gains tax rate cut than before the capital gains tax rate cut. However, the estimate is only statistically significant for the dividend-paying stocks with price depreciations. The three dummy variables that identify alternative portfolios, *NDLk*, *NDSk*, and *DLk*, are all positive indicating that the alternative portfolios have higher average monthly return volatility before the capital gains tax rate cut. The portfolio of non-dividend paying stocks with large price changes (either appreciations or depreciations) has the highest incremental return volatility among all three alternative portfolios. Specifically, the portfolio of non-dividend paying stocks with large price appreciations (*NDLG*) has 1.80 percentage point higher average monthly return volatility while the portfolio of non-dividend paying stocks with large price depreciations (*NDLL*) has 1.65 percentage point higher average monthly return volatility than their respective benchmark portfolio. All coefficient estimates for the alternative portfolio dummy variables are statistically significant at the 5 percent level based on a one-sided test.

As predicted, all three interaction terms, $Post \times NDLk$, $Post \times NDSk$, and $Post \times DLk$, are positive for both portfolios of stocks with price appreciations and depreciations. This indicates that non-dividend paying stocks with large price changes, non-dividend paying stocks with small price changes, and dividend-paying stocks with large price changes all experience higher average monthly return volatility increase than dividend-paying stocks with small price changes following the capital gains tax rate cut of TRA 97. The estimates are statistically significant at the 10 percent level for stocks with price appreciations using a one-sided test and are significant for two out of three coefficients (*NDLk* and *NDSk*) at the 5 percent level using one-sided test for stocks with price appreciations and depreciations, respectively.

Non-dividend paying stocks with large price changes (*NDLk*) experienced the largest increase in return volatility, followed by non-dividend paying stocks with small price changes (*NDSk*) and dividend-paying stocks with large price changes (*DLk*). This is consistent with our predictions on the cross-sectional effects of a capital gains tax rate cut on stock return volatility. Specifically, non-dividend paying stocks with large price appreciations has 2.16 percentage points higher average monthly return volatility than the benchmark portfolio of dividend-paying stocks with small price appreciations. For stocks with price depreciations, the portfolio of non-dividend paying stocks with large price depreciations also has 1.20 percentage points higher average monthly return volatility than the benchmark portfolio of dividend-paying stocks with small price depreciations.

Consistent with the hypothesis that a capital gains tax rate cut has a larger effect on the return volatility of stocks from which taxable investors receive no dividends and the entire income comes as capital gains, non-dividend paying stocks experience larger increases in the average monthly return volatility than dividend-paying stocks. Non-dividend paying stocks with small price appreciations experience 0.69 percentage points higher average monthly return volatility while non-dividend paying stocks with small price depreciations show a similar 0.65 percentage point higher monthly return volatility compared with the respective benchmark portfolio. For portfolios of stocks that had experienced large price changes, our additional tests reported at the bottom of Table 8 show that the effect is even stronger. For stocks with large price appreciations (*NDLG*), the non-dividend paying stocks experience 1.72 percentage points incremental average monthly return volatility increase than the dividend-paying stocks (*DLG*). In the meantime, for stocks with large price depreciations, non-dividend paying stocks (*NDLL*) have 0.90 percentage point larger return volatility increase than dividend-paying counterpart (*DLL*).

Our empirical evidence also is consistent with the hypothesis that stocks with large price changes will experience higher return volatility increases. For instance, dividend-paying stocks with large price appreciation have 0.45 percentage point higher average monthly return volatility increase than the benchmark portfolio of dividend-paying stocks with small price appreciations. For dividend-paying stocks with large price depreciations, the incremental return volatility is only 0.29 percentage point more than the benchmark portfolio of dividend-paying stocks with small price depreciations and insignificant. Additional tests on non-dividend paying stocks with different sizes of price changes are provided at the bottom of Table 8. Specifically, non-dividend paying stocks with large price appreciations experience 1.48 percentage points higher average monthly return volatility than non-dividend paying stocks with small price appreciations. In the meantime, non-dividend paying stocks with large price depreciations show 0.54 percentage point higher average monthly return volatility than their counterpart with small price depreciations. However, the coefficient estimate is lower than for non-dividend paying stocks with price appreciations and insignificant.

We now examine the effects of control variable on return volatility. The sum of the coefficients for the two lagged mean adjusted portfolio return volatility is positively and statistically significant for the regression analysis for both stocks with price appreciations and depreciations in the past 18 months, indicating the existence of return volatility clustering that is widely documented in existing literature (see Pagan, 1996). The sum of the coefficients for the two lagged monthly average of daily portfolio returns is negative but only statistically significant for the portfolios of stocks that had experienced price depreciations. This also is consistent with the leverage effect documented in empirical asset pricing studies. The fact that the result is stronger for portfolios of stocks with price depreciations suggests that the leverage effect will likely vary across stocks with different return performances.

We find no significant effect on return volatility from interest rate. The sum of the coefficients for the two lagged industrial production growth is positive for stocks with price appreciations and negative for stocks with price depreciations. However, the effect is insignificant for the stocks with price depreciations and only marginally significant for the stocks with price appreciations. These findings are in-line with the finding of Schwert (1989) which reported weak and insignificant effect on return volatility of macroeconomic variables. The sum of the coefficients for lagged consumption-wealth ratio proxies is negative for stocks with price appreciations and positive for stocks with price depreciations. Lettau and Ludvigson (2003) reported a negative predictive relation between quarterly market return volatility and the proxy for the consumption-wealth ratio. Our results thus suggest that the predictive relation between stock return volatility and the proxy for the consumption-wealth ratio varies across different stocks with respect to their past performances. We find no significant effect on the monthly return volatility from the performances of domestic stock market and global equity markets as reflected by the insignificant coefficient estimates for the variables representing the returns and volatility of domestic and global equity markets.

For portfolio level control variables, we find that stock turnover has a positive and significant effect on return volatility for both stocks with price appreciations and depreciations. The finding is consistent with the existing studies which attribute the effect to information flow associated with higher stock turnover (Cohen, Ness, Okuda, Schwartz, and Whitcomb, 1976, among others). The coefficient estimate suggests that for every one percent increase in the turnover, the monthly return volatility is 0.11 percent higher for stocks that had experienced price appreciations and 0.06 percent higher for stocks that had experienced price depreciations. Consistent with findings reported in existing studies that lower transactions costs reduce return volatility due to improved information flows and market efficiency, the coefficient estimates for the bid-ask spread is positively related to the monthly return volatility suggesting that a lower bid-ask spread (lower transactions costs) will help reduce return volatility. The effect is however only statistically significant for stocks that had experienced price depreciations in the past 18 months. The price-earnings ratio (*P/E*) also has a positive effect on monthly return volatility as indicated by the positive coefficient estimate. However, it is only statistically significant for stocks with price depreciations. The economic significance also is small. An increase in the *P/E* by 10 only increases the monthly return volatility by 0.012 percentage point for the stocks with price depreciations.

The debt-to-asset ratio also has a positive effect on return volatility. This is consistent with the argument that a higher debt-to-asset ratio is associated with a higher risk of a firm. Lending support to this argument, our result shows that the positive effect of a higher debt-to-asset ratio is only marginally statistically significant for stocks that had experienced price depreciations but not for stocks that had experienced price appreciations. Individual investor ownership has no significant effect on stock return volatility. This suggests that the existing finding on a positive relation between the return volatility and the institutional ownership may be driven by hidden variables omitted from the existing studies. Firm size measured by the logarithm of firms' market value has a weak positive effect on the return volatility of stocks with price depreciations but has no significant effect on the return volatility of stocks with price appreciations. This may be attributed to possible different effects of firms' size on total return volatility and idiosyncratic volatility. Finally, we find that earnings variability measured by the coefficient of variation (*CV earnings*) has no significant effect on the total return volatility. This again can be attributed to the possible different effects of earnings variability on total return volatility versus idiosyncratic volatility.

Overall, the results of our cross-sectional regression analysis provide empirical evidence that is consistent with the cross-sectional implications of a capital gains tax rate cut on return volatility of stocks with different sensitivities to capital gains taxes. Non-dividend paying stocks with large price changes (price appreciations or depreciations) experience higher return volatility increases than dividend-paying stocks with small price changes. Non-dividend paying stocks also experience larger return volatility increases than dividend-paying stocks for both small and large price changes. Non-dividend paying stocks with large price appreciations also experience higher return volatility increase than non-dividend paying stocks with small price appreciations. Finally, dividend-paying stocks with large price appreciations experience higher return volatility increases than dividend-paying stocks with small price appreciations.

5. Conclusion

This paper examines the impact of capital gains tax rate on the volatility of stock returns. Our analysis shows that a capital gains tax rate cut reduces the risk sharing between investors and the government and increases the exposure of stocks to consumption risk. This leads us to predict that reducing capital gains taxes increases stock return volatility. To test this prediction, we study a unique change in the tax law that allows us to isolate the impact of a capital gain tax rate reduction on return volatility. In particular, we focus on the cross-sectional differences of a capital gains tax rate cut on portfolios of stocks with different sensitivities to capital gains taxes including dividend distribution and past stock price changes.

We find widespread increase of stock return volatility following enactment of the Taxpayer Relief Act of 1997. Our univariate analysis shows that the return volatility increases are highly significant for stock portfolios constructed based on dividend distribution and past stock price changes. To provide convincing evidence that the 1997 tax cut affected volatility (and mitigate concerns about omitted correlated variables), we conduct cross-sectional tests which are designed to detect the differential responses in return volatility of stocks with different characteristics. We hypothesize that the effect of a capital gains tax change on stock return volatility should vary depending upon dividend policy and the size of past stock price changes. Consistent with expectations, we find that non-dividend paying stocks that had experienced a larger increase in return volatility than dividend-paying stocks. We also find that stocks with large price changes (appreciations or depreciations) in the past had a larger increase in return volatility after a capital gains tax rate cut than stocks with small price changes. Consistent with our intuition, the latter effect is stronger for non-dividend paying stocks than for dividend-paying stocks.

Because capital gains tax rate changes are infrequent and rarely occur in isolation from other major tax changes, it is difficult, if not impossible, to construct a test that provides strong direct evidence that a reduction in the capital gains tax rate caused stock return volatility to increase. Our approach has been to control for an extensive set of determinants of stock return volatility and see if firms most affected by the capital gains tax rate reduction showed the greatest change in return volatility. Specifically, non-dividend paying firms with large price changes experience the largest increases in return volatility than dividend-paying firms with small price changes. Non-dividend paying firms had a greater increase in return volatility than dividend-paying firms. Non-dividend paying firms with large price changes (appreciations or depreciations) also experienced a greater increase in return volatility than non-dividend paying firms with small price changes. Since we are unable to provide direct evidence that the tax cut increased stock return volatility, we are cautious in our conclusions. However, we are left without an alternative explanation for the surge in volatility following the rate reduction in 1997, and, in particular, why portfolios of stocks with different sensitivities to capital gains taxes experienced predictably different increases in return volatility. Thus, we infer from these findings that the 1997 reduction in the capital gains tax rate contributed to an increase in stock return volatility in subsequent years.

In closing, while a reduction in the capital gains tax rate may increase stock return volatility, investors are not necessarily worse off. The expected investment opportunities or the risk and return trade-off are the key consideration for long-term investment decisions. A capital gains tax rate cut may increase investors' after-tax stock return leading to a better risk and return trade-off. In this case, investors may benefit from a capital gains tax rate cut. It is interesting to see the effect of a capital gains tax rate reduction on the risk and return trade-off on stock investment. We leave that analysis for future research.

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Table 1 Summary Statistics for Portfolio Returns and Volatility

Panel A reports the monthly average of daily returns and monthly return volatility for four gain portfolios while panel B report the monthly average of daily returns and monthly return volatility for four loss portfolios. We form portfolios based on each firm's prior year dividend distribution and past 18-month price change. We first partition all firms in the CRSP dataset into dividend paying versus non-dividend paying stocks. Within each group we then dichotomize firms into the subgroups of stocks which have experienced price appreciation (gains) and depreciation (losses) in the most recent past 18 months, respectively. For each of the four subgroups, we form four quartile portfolios based on the size of price changes and define the bottom 25 percentile as the small gain or loss portfolio and the upper 25 percentile as the large gain or loss portfolio, respectively. We use "*DSk*" and "*DLk*", *k=G* or *L*, to denote dividend-paying portfolios with small or large price changes (gain or loss), and use "*NDSk*" and "*NDLk*", *k=G* or *L*, to represent non-dividend paying portfolios with small or large price changes (gain or loss). $\bar{r}$ is the monthly average of daily return for month *t*. σ is the monthly volatility at month *t* using Schwert (1989) measure. The sample period covers January 1994 to December 2000.

Panel A: Portfolios of Stocks with Price Appreciation

	Variable	Mean	Median	Std Dev	Minimum	Maximum
Div. & small gain	$\bar{r}$	0.03650	0.05251	0.16238	-0.45701	0.41057
(*DSG*)	σ	3.21248	2.95851	1.18844	1.25555	6.86714
Div. & large gain	$\bar{r}$	0.05660	0.07416	0.20865	-0.54194	0.41955
(*DLG*)	σ	4.72555	4.62108	1.54902	1.95748	8.65420
NDiv. & small gain	$\bar{r}$	0.02815	0.03931	0.29521	-0.98523	0.91874
(*NDSG*)	σ	5.28273	4.57969	2.08380	2.37184	11.01901
NDiv. & large gain	$\bar{r}$	0.11728	0.15702	0.40618	-1.09639	1.04318
(*NDLG*)	σ	8.30689	7.52126	3.18502	3.52583	17.62147

Panel B: Portfolios of Stocks with Price Depreciation

	Variable	Mean	Median	Std Dev	Minimum	Maximum
Div. & small loss	$\bar{r}$	0.03508	0.05013	0.18541	-0.46783	0.46103
(*DSL*)	σ	3.37884	3.12864	1.22964	1.56737	7.08552
Div. & large loss	$\bar{r}$	0.02802	0.06299	0.28292	-1.00616	0.72127
(*DLL*)	σ	4.36893	4.65502	1.45629	1.77401	8.51524
NDiv. & small loss	$\bar{r}$	0.01908	0.07096	0.27779	-1.05744	0.53168
(*NDSL*)	σ	5.14604	4.74428	1.79692	2.48266	9.24919
NDiv. & large loss	$\bar{r}$	0.05359	0.06909	0.41064	-1.07431	0.89322
(*NDLL*)	σ	6.02083	5.45314	2.36115	2.85232	14.75200

Table 2 Univariate Analysis for the Return Volatility across Different Years

This table presents univariate analysis results for constructed portfolios. For each portfolio, we regress the monthly return volatility on a vector of annual dummies $D = [YR1995\ YR1996\ YR1997\ YR1998\ YR1999\ YR2000]'$, while year 1994 serves as the base year. Panel A reports the results for portfolios of stocks that had experienced price appreciations in the most recent past 18 months (gains portfolios) while Panel B reports the results for portfolios of stocks that had experienced price depreciations (loss portfolios). For each regression, we also present the test results of the difference in the mean return volatility of year 1997 or year 1998 versus previous years. The test results of equal volatility between year 1997 or year 1998 and previous years are reported at the bottom of each panel. We form portfolios based on each firm's prior year dividend distribution and past 18-month price change. We use "*DSk*" and "*DLk*", *k*=*G* or *L*, to represent dividend-paying portfolios with small (lower 25 percentile) or large (upper 25 percentile) price changes (gain or loss), and use "*NDSk*" and "*NDLk*", *k*=*G* or *L*, to represent non-dividend paying portfolios with small or large price changes (gain or loss). The sample period is from January 1994 to December 2000.

Panel A: Portfolios of stocks that had experienced price appreciation (gains portfolios)

	DSG		*DLG*		*NDSG*		*NDLG*	
Variable	beta	p-value	beta	p-value	beta	p-value	beta	p-value
Intercept	2.4391	<.0001	3.9021	<.0001	4.3899	<.0001	5.9792	<.0001
YR1995	-0.3569	0.3460	-0.9848	0.0295	-0.8214	0.2034	1.1958	0.2081
YR1996	0.2503	0.5080	-0.1796	0.6870	-0.7195	0.2646	0.8197	0.3869
YR1997	**0.8262**	**0.0312**	**1.5140**	**0.0010**	**0.8311**	**0.1982**	**1.3359**	**0.1602**
YR1998	1.3056	0.0009	1.4211	0.0020	2.0346	0.0021	2.4578	0.0109
YR1999	1.3904	0.0004	1.5152	0.0010	1.5461	0.0181	3.1163	0.0014
YR2000	1.9979	<.0001	2.4782	<.0001	3.3792	<.0001	7.3684	<.0001
Tests of the difference in return volatility between 1997 or 1998 versus previous years								
1997 vs 1995	1.1831	0.0024	2.4988	0.0001	1.6525	0.0118	0.1401	0.8822
1997 vs 1996	0.5759	0.1301	1.6936	0.0003	1.5505	0.0178	0.5162	0.5853
1998 vs 1995	1.6624	0.0001	2.4059	0.0001	2.8560	0.0001	1.2620	0.1843
1998 vs 1996	1.0553	0.0064	1.6007	0.0006	2.7541	0.0001	1.6381	0.0860
1998 vs 1997	0.4794	0.2066	-0.0929	0.8349	1.2035	0.0639	1.1219	0.2373
N	84		84		84		84	
Adj. R^2	0.3982		0.5069		0.4336		0.4752	

Panel B: Portfolios of stocks that had experienced price depreciation (loss portfolios)

	DSL		*DLL*		*NDSL*		*NDLL*	
Variable	beta	p-value	beta	p-value	beta	p-value	beta	p-value
Intercept	2.8185	<.0001	3.5805	<.0001	4.1281	<.0001	4.6898	<.0001
YR1995	-0.6672	0.1071	-0.8748	0.0610	-0.8129	0.1609	-0.7162	0.3782
YR1996	0.1156	0.7784	0.5068	0.2740	0.4721	0.4135	1.1606	0.1549
YR1997	**0.4482**	**0.2769**	**1.0095**	**0.0312**	**1.1871**	**0.0420**	**1.4232**	**0.0821**
YR1998	1.2815	0.0025	2.0490	<.0001	2.7068	<.0001	3.6981	<.0001
YR1999	1.1069	0.0084	0.8517	0.0679	1.1175	0.0552	1.0921	0.1805
YR2000	1.6376	0.0001	1.9769	<.0001	2.4550	<.0001	2.6591	0.0015
Tests of the difference in return volatility between 1997 or 1998 versus previous years								
1997 vs 1995	1.1154	0.0079	1.8842	0.0001	2.0000	0.0008	2.1394	0.0098
1997 vs 1996	0.3326	0.4189	0.5027	0.2779	0.7150	0.2168	0.2626	0.7461
1998 vs 1995	1.9487	0.0001	2.9237	0.0001	3.5197	0.0001	4.4143	0.0001
1998 vs 1996	1.1660	0.0056	1.5422	0.0012	2.2347	0.0002	2.5375	0.0024
1998 vs 1997	0.8334	0.0451	1.0395	0.0267	1.5197	0.0098	2.2749	0.0062
N	84		84		84		84	
Adj. R^2	0.3354		0.4013		0.3875		0.2973	

Table 3 Univariate Tests on the Mean Return Volatility Change

This table reports the univariate test results on the mean volatility change before and after TRA 97 for constructed portfolios. We form portfolios based on each firm's prior year dividend distribution and past 18-month price change. We use "*DSk*" and "*DLk*", *k=G* or *L*, to represent dividend-paying portfolios with small (lower 25 percentile) or large (upper 25 percentile) price changes (gain or loss), and use "*NDSk*" and "*NDLk*", *k=G* or *L*, to represent non-dividend paying portfolios with small or large price changes (gain or loss). We exclude observations from April 1997 to September 1997 (the event months) to remove the transient effect. Pre-TRA 97 covers the period from 1/1/1994 to 3/31/1997 and Post-TRA 97 spans the period from 10/1/1997 to 12/31/2000.

	Portfolios of Stocks with Price Appreciation (gains portfolios)			
	DSG	*DLG*	*NDSG*	*NDLG*
Pre-TRA 97	2.3987	3.6291	3.8927	6.6907
Post-TRA 97	4.0035	5.7373	6.7291	10.1612
Difference	**1.6048**	**2.1082**	**2.8364**	**3.4705**
p-value	**<.0001**	**<.0001**	**<.0001**	**<.0001**

	Portfolios of Stocks with Price Depreciation (loss portfolios)			
	DSL	*DLL*	*NDSL*	*NDLL*
Pre-TRA 97	2.6050	3.5151	4.0938	4.8398
Post-TRA 97	4.1682	5.2286	6.2480	7.2661
Difference	**1.5632**	**1.7135**	**2.1542**	**2.4263**
p-value	**<.0001**	**<.0001**	**<.0001**	**<.0001**

Table 4 Relative Return Volatility Change

This table presents the results for relative return volatility change after TRA1997 by estimating Equation (2):

$$\sigma_{it} = \alpha + \beta_1 Post_t + \beta_2 HVP_i + \beta_3 Post_t \times HVP_i + \varepsilon_{it},$$

where *Post* is a dummy variable which takes value of 1 if the observation is after 10/1/1997 and 0 before 3/31/1997 and *HVP* is a dummy variable which takes value of 0 if the observation is from a benchmark portfolio and value of 1 if it is from an alternative portfolio predicted to have a higher return volatility. Panel A shows the results of comparing non-dividend paying versus dividend-paying portfolios and panel B reports the results of comparing portfolios of stocks with large price changes versus small price changes. We form portfolios based on each firm's prior year dividend distribution and past 18-month price change. We use "*DSk*" and "*DLk*", *k=G* or *L*, to represent dividend-paying portfolios with small (lower 25 percentile) or large (upper 25 percentile) price changes (gain or loss), and use "*NDSk*" and "*NDLk*", *k=G* or *L*, to represent non-dividend paying portfolios with small or large price changes (gain or loss). We exclude observations from April 1997 to September 1997 (the event months) to remove the transient effect. The sample period is from January 1994 to December 2000. The p-value corresponds to the probability of a one-sided test on a positive coefficient.

Panel A: Non-dividend paying versus dividend-paying portfolios

	DSG vs. NDSG		*DLG vs. NDLG*		*DSL vs. NDSL*		*DLL vs. NDLL*	
	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	2.3987	0.0001	3.6291	0.0001	2.6050	0.0001	3.5151	0.0001
Post	1.6048	0.0001	2.1082	0.0001	1.5632	0.0001	1.7136	0.0001
HVP	1.4940	0.0001	3.0615	0.0001	1.4889	0.0001	1.3248	0.0009
*Post***HVP*	**1.2316**	**0.0020**	**1.3623**	**0.0238**	**0.5910**	**0.0736**	**0.7127**	**0.1000**
N	156		156		156		156	
-2 log likelihood	507.90		627.60		462.90		672.60	

Panel B: Portfolios of stocks with large price changes versus small price changes

	DSG vs. DLG		*NDSG vs. NDLG*		*DSL vs. DLL*		*NDSL vs. NDLL*	
	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	2.3987	0.0001	3.8927	0.0001	2.6050	0.0001	4.0939	0.0001
Post	1.6048	0.0001	2.8365	0.0001	1.5632	0.0001	2.1542	0.0001
HVP	1.2305	0.0001	2.7980	0.0001	0.9101	0.0004	0.7460	0.0746
*Post***HVP*	**0.5033**	**0.0725**	**0.6340**	**0.1913**	**0.1504**	**0.3361**	**0.2721**	**0.3220**
N	156		156		156		156	
-2 log likelihood	505.90		589.40		474.20		621.10	

Table 5 Summary Statistics for Aggregate Control Variables

This table provides summary statistics for the aggregate control variables and the analysis of the differences in these variables before and after TRA1997. *RREL* is the stochastically detrended risk-free rate; *GIP* is the growth rate of industrial production; *CAY* is the demeaned consumption-wealth ratio; $\bar{r}_{market}$ is the monthly average daily excess return of value-weighted CRSP stock index; σ_{market} is the monthly volatility of the excess return of the value-weighted CRSP stock index; $\bar{r}_{foreign}$ is the monthly average daily excess return of value-weighted Morgan Stanley Capital International (MSCI) world stock index excluding the United States; and $\sigma_{foreign}$ is the monthly volatility of the excess return of the value-weighted MSCI world stock index excluding the United States. The sample period is from January 1994 to December 2000. Pre-TRA 97 covers the period from 1/1/1994 to 3/31/1997 and Post-TRA 97 spans the period from 10/1/1997 to 12/31/2000.

Variable	Mean	Median	Std Dev	Minimum	Maximum	Pre-TRA 97	Post-TRA 97	Difference	p-value
RREL	0.0211	0.0183	0.0527	-0.1088	0.1478	0.0312	0.0109	-0.0203	0.0882
GIP	0.0038	0.0038	0.0051	-0.0084	0.0216	0.0045	0.0032	-0.0013	0.0267
CAY	-0.0018	0.0026	0.0239	-0.0462	0.0331	0.0203	-0.0237	-0.0440	<.0001
$\bar{r}_{market}$	0.0347	0.0706	0.2053	-0.8176	0.3547	0.0442	0.0252	-0.0190	0.6853
σ_{market}	4.1068	3.5721	2.1922	1.1409	10.6724	2.7915	5.4222	2.6307	<.0001
$\bar{r}_{foreign}$	0.0186	0.0269	0.1874	-0.7184	0.4616	0.0231	0.0142	-0.0089	0.8356
$\sigma_{foreign}$	3.4583	3.1647	1.4817	1.3769	8.0809	2.4685	4.4481	1.9796	<.0001

Table 6 Summary Statistics for Portfolio Control Variables

This table reports the value-weighted monthly averages and the analysis of the differences before and after TRA 97 for the turnover (*Turnover*), percentage bid-ask spread (*BidAskSpread*), price-earnings ratio (*P/E ratio*), debt/asset ratio (*D/A*), individual investor ownership (*IND*), logarithm of market value (*Size*), and the coefficient of variation for quarterly earnings (*CV earnings*) for each constructed portfolio. Panel A is for portfolios of stocks with price appreciations and Panel B is for portfolios of stocks with price depreciations. We form portfolios based on each firm's prior year dividend distribution and past 18-month price change. We use "*DSk*" and "*DLk*", *k=G* or *L*, to represent dividend-paying portfolios with small (lower 25 percentile) or large (upper 25 percentile) price changes (gain or loss), and use "*NDSk*" and "*NDLk*", *k=G* or *L*, to represent non-dividend paying portfolios with small or large price changes (gain or loss). We exclude observations from April 1997 to September 1997 (the event months) to remove the transient effect. Pre-TRA 97 covers the period from 1/1/1994 to 3/31/1997 and Post-TRA 97 spans the period from 10/1/1997 to 12/31/2000.

Panel A: Portfolios of Stocks with Price Appreciation (gains portfolios)

Variable	Mean	Std Dev	Pre-TRA 97	Post-TRA 97	Difference	p-value
			Dividend-paying stocks with small gains (DSG)			
Turnover	0.0593	0.0155	0.0503	0.0682	0.0179	<.0001
BidAskSpread	0.3036	0.0806	0.3700	0.2373	-0.1327	<.0001
P/E ratio	30.7318	37.5731	36.4725	24.9910	-11.4815	0.1789
D/A	0.6459	0.0376	0.6414	0.6503	0.0089	0.2998
IND	47.2839	4.5825	50.5314	44.0364	-6.4950	<.0001
Size	16.5585	0.6604	16.1034	17.0134	0.9100	<.0001
CV earnings	0.7084	0.4204	0.5892	0.8276	0.2384	0.0113
			Dividend-paying stocks with large gains (DLG)			
Turnover	0.0815	0.0195	0.0829	0.0801	-0.0028	0.5273
BidAskSpread	0.2764	0.1102	0.3590	0.1938	-0.1652	<.0001
P/E ratio	25.8393	11.1656	20.3692	31.3094	10.9402	<.0001
D/A	0.6253	0.0499	0.6115	0.6392	0.0277	0.0133
IND	43.1957	3.6070	42.5014	43.8899	1.3885	0.0892
Size	17.2369	0.9877	16.4931	17.9808	1.4877	<.0001
CV earnings	0.9653	3.3070	0.0569	1.8735	1.8166	0.0143
			Non-dividend paying stocks with small gains (NDSG)			
Turnover	0.1618	0.0463	0.1418	0.1817	0.0399	<.0001
BidAskSpread	0.7972	0.7934	0.9246	0.6697	-0.2549	0.1574
P/E ratio	28.4376	19.0283	24.5724	32.3027	7.7303	0.0726
D/A	0.4939	0.0767	0.4845	0.5032	0.0187	0.2835
IND	42.7312	7.4893	45.1694	40.2930	-4.8764	0.0034
Size	14.9145	0.9085	14.5002	15.3287	0.8285	<.0001
CV earnings	-9.4877	70.6895	-20.2001	1.2246	21.4247	0.1825
			Non-dividend paying stocks with large gains (NDLG)			
Turnover	0.2487	0.0679	0.2802	0.2173	-0.0629	<.0001
BidAskSpread	0.4927	0.3382	0.6884	0.2971	-0.3913	<.0001
P/E ratio	40.7530	15.9144	32.5330	48.9729	16.4399	<.0001
D/A	0.3758	0.0546	0.3960	0.3556	-0.0404	0.0008
IND	44.3044	6.7487	40.5840	48.0248	7.4408	<.0001
Size	16.4637	1.6999	14.8928	18.0345	3.1417	<.0001
CV earnings	1.3212	4.9977	2.0925	0.5498	-1.5427	0.1745

Panel B: Portfolios of Stocks with Price Depreciation (loss portfolios)

Variable	Mean	Std Dev	Pre-TRA 97	Post-TRA 97	Difference	p-value
Dividend-paying stocks with small losses (DSL)						
Turnover	0.0601	0.0161	0.0528	0.0672	0.0144	<.0001
BidAskSpread	0.3695	0.1266	0.4586	0.2803	-0.1783	<.0001
P/E ratio	44.2222	174.6433	17.3834	71.0609	53.6775	0.1763
D/A	0.6398	0.0541	0.6121	0.6674	0.0553	<.0001
IND	47.1095	5.3267	50.5859	43.6330	-6.9529	<.0001
Size	16.0768	0.8454	15.6641	16.4895	0.8254	<.0001
CV earnings	0.7193	1.3513	0.6611	0.7775	0.1164	0.7063
Dividend-paying stocks with large losses (DLL)						
Turnover	0.1041	0.0378	0.1025	0.1057	0.0032	0.7113
BidAskSpread	0.6267	0.2726	0.7513	0.5020	-0.2493	<.0001
P/E ratio	16.8427	25.9716	16.5809	17.1046	0.5237	0.9297
D/A	0.6205	0.0785	0.5804	0.6606	0.0802	<.0001
IND	47.0121	7.2863	52.9262	41.0979	-11.8283	<.0001
Size	14.9938	0.9368	14.8139	15.1736	0.3597	0.0900
CV earnings	-2.0379	13.6929	-4.7647	0.6890	5.4537	0.0785
Non-dividend paying stocks with small losses (NDSL)						
Turnover	0.1506	0.0523	0.1406	0.1607	0.0201	0.0899
BidAskSpread	0.7322	0.2682	0.9343	0.5301	-0.4042	<.0001
P/E ratio	26.0525	21.3583	20.3388	31.7661	11.4273	0.0171
D/A	0.5022	0.0826	0.4895	0.5149	0.0254	0.1757
IND	47.2569	7.7219	48.2355	46.2782	-1.9573	0.2657
Size	14.7895	1.1088	14.2026	15.3764	1.1738	<.0001
CV earnings	6.2066	21.9128	10.7478	1.6655	-9.0823	0.0669
Non-dividend paying stocks with large losses (NDLL)						
Turnover	0.1726	0.0572	0.1599	0.1852	0.0253	0.0496
BidAskSpread	1.5307	0.6030	2.0193	1.0420	-0.9773	<.0001
P/E ratio	6.3968	37.3614	-6.8575	19.6511	26.5086	0.0013
D/A	0.4958	0.0744	0.4726	0.5191	0.0465	0.0051
IND	61.3182	9.2497	67.3406	55.2956	-12.0450	<.0001
Size	12.8049	1.0081	12.0853	13.5244	1.4391	<.0001
CV earnings	-9.7796	82.3376	0.3260	-19.8853	-20.2113	0.2813

Table 7 Change in a Cross-Section of Return Volatility across Years

This table reports the regression results on the changes in a cross-section of return volatility of four portfolios of stocks with price appreciation or price depreciation across different years. Specifically, we estimate the regression model given by Equation (4):

$$\sigma_{it} = \alpha + \beta_1 DLk_i + \beta_2 NDSk_i + \beta_3 NDLk_i + \lambda' D_t + \varepsilon_{it},$$

where DLk_i, $NDSk_i$, and $NDLk_i$, *k=G* or *L*, represent the dummy variable for the portfolio of dividend-paying stocks with large price changes (appreciation or depreciation), non-dividend paying stocks with small price changes (appreciation or depreciation), and non-dividend paying stocks with large price changes, respectively, $D_t = [YR1995\ \ YR1996\ YR1997\ \ YR1998\ \ YR1999\ \ YR2000]'$ is the vector of annual dummy variables. For each regression, we also provide test results on the difference of the return volatility of year 1997 or year 1998 versus previous years at the bottom of the table. We form portfolios based on each firm's prior year dividend distribution and past 18-month price change. We use "*DSk*" and "*DLk*", *k=G* or *L*, to represent dividend-paying portfolios with small (lower 25 percentile) or large (upper 25 percentile) price changes (gain or loss), and use "*NDSk*" and "*NDLk*", *k=G* or *L*, to represent non-dividend paying portfolios with small or large price changes (gain or loss). The sample period covers January 1994 to December 2000.

	Gain Portfolios		Loss Portfolios	
Variable	estimate	p-value	estimate	p-value
Intercept	2.3148	<.0001	2.5748	<.0001
DLG	1.5131	<.0001	0.9901	<.0001
NDSG	2.0702	<.0001	1.7672	<.0001
NDLG	5.0944	<.0001	2.6420	<.0001
YR1995	-0.5566	0.0324	-0.7689	0.0029
YR1996	-0.0190	0.9416	0.4185	0.1028
YR1997	**1.0894**	**<.0001**	**0.8772**	**0.0007**
YR1998	1.5271	<.0001	2.0606	<.0001
YR1999	1.5556	<.0001	1.0252	<.0001
YR2000	2.6871	<.0001	2.0156	<.0001
Test of the difference in return volatility between 1997 or 1998 versus previous years				
YR1997 vs YR1995	1.6459	<.0001	1.6461	<.0001
YR1997 vs YR1996	1.1084	<.0001	0.4587	0.0738
YR1998 vs YR1995	2.0837	<.0001	2.8294	<.0001
YR1998 vs YR1996	1.5461	<.0001	1.6421	<.0001
YR1998 vs YR1997	0.4377	0.0920	1.1833	<.0001
N	336		336	
-2 log likelihood	1206.40		1150.10	

Table 8 Tests of the Cross-Sectional Effect of a Capital Gains Tax Rate Change on Return Volatility

This table reports the test results on the cross-sectional effect of TRA 97 on the monthly return volatility of the excess return of the constructed portfolios based on dividend distribution in the prior year and price changes in the most recent past 18 months (appreciation or depreciation). We form portfolios based on each firm's prior year dividend distribution and past 18-month price change. We use "*DSk*" and "*DLk*", *k=G* or *L*, to represent dividend-paying portfolios with small (lower 25 percentile) or large (upper 25 percentile) price changes (gain or loss), and use "*NDSk*" and "*NDLk*", *k=G* or *L*, to represent non-dividend paying portfolios with small or large price changes (gain or loss). We perform the regression analysis using the specification given in Equation (3):

$$\sigma_{it} = \alpha + \beta_1 Post_t + \beta_2 NDLk_i + \beta_3 NDSk_i + \beta_4 DLk_i + \beta_5 Post_t \times NDLk_i$$
$$+ \beta_6 Post_t \times NDSk_i + \beta_7 Post_t \times DLk_i + \sum_{j=1}^{m} \theta_j \Delta\sigma_{i(t-j)} + \sum_{j=1}^{n} \eta_j \bar{r}_{i(t-j)}$$
$$+ \gamma X_t + \varphi Z_{it} + \varepsilon_{it},$$

where DLk_i, $NDSk_i$, and $NDLk_i$, *k=G* or *L*, represent the dummy variable for the portfolio of dividend-paying stocks with large price changes (appreciation or depreciation), non-dividend paying stocks with small price changes (appreciation or depreciation), and non-dividend paying stocks with large price changes, respectively, *Post* is a dummy variable which takes value of 1 if the observation is after 10/1/1997 and 0 before 3/31/1997, X_t represents the vector of macroeconomic control variables, and Z_{it} stands for the vector of portfolio level control variables. The portfolio of dividend-paying stocks with small price appreciation or depreciation serves as the benchmark portfolio, respectively. For each regression, we also report the test result of relative return volatility increases between the portfolio of non-dividend paying stocks with large price changes (*NDLk*) and the portfolio of dividend-paying stocks with large price changes (*DLk*), and between the portfolio of non-dividend-paying stocks with large price changes (*NDLk*) and small price changes (*NDSk*), for *k=G* or *L*. We exclude observations from April 1997 to September 1997 (the event months) to remove the transient effect. The sample period covers January 1994 to December 2000. Monthly dummies are included in the regressions to control for calendar effect. The probability for the categorical variables and their interactions are based on one-sided test and are reported in boldface.

		Gain Portfolios		Loss Portfolios	
Variable	Predicted Sign	estimate	P-value	estimate	p-value
Intercept	?	-0.5650	0.8380	-3.6199	0.1529
Post	+	**0.4425**	**0.2195**	**1.3233**	**0.0114**
NDLk	+	**1.7956**	**0.0144**	**1.6503**	**0.0094**
NDSk	+	**0.8048**	**0.0428**	**1.2483**	**0.0005**
DLk	+	**0.7763**	**0.0011**	**0.7084**	**0.0046**
Post*NDLk	+	**2.1640**	**0.0008**	**1.1960**	**0.0156**
Post*NDSk	+	**0.6882**	**0.0302**	**0.6533**	**0.0467**
Post*DLk	+	**0.4460**	**0.0831**	**0.2920**	**0.1671**
$\Delta\sigma_{i(t-1)}$	+	0.3120	0.0002	0.2237	0.0025
$\Delta\sigma_{i(t-2)}$		-0.0261	0.7207	0.0984	0.1442
$\bar{r}_{i(t-1)}$	-	-0.4374	0.2958	-1.2022	0.0003
$\bar{r}_{i(t-2)}$		-0.2123	0.6243	-0.6850	0.0470
$RREL_{(t-1)}$	?	1.2637	0.5438	-1.5478	0.4629
$RREL_{(t-2)}$		-1.1016	0.5761	-2.1599	0.2735
$GIP_{(t-1)}$	?	0.3592	0.0520	0.0381	0.8334
$GIP_{(t-2)}$		-0.1034	0.5659	-0.1564	0.3678
$CAY_{(t-1)}$	?	0.3403	0.0425	0.6014	0.0002
$CAY_{(t-2)}$		-0.3991	0.0169	-0.4249	0.0092
$\Delta\sigma_{(t-1)}$	?	-0.0082	0.9021	-0.0047	0.9444
$\Delta\sigma_{(t-2)}$		0.0147	0.8301	-0.0062	0.9248
$\bar{r}_{(t-1)}$	?	-1.4611	0.0379	0.2886	0.6797
$\bar{r}_{(t-2)}$		-0.3743	0.6179	0.4853	0.5008
$\Delta\sigma^{f}_{(t-1)}$	?	-0.0147	0.8873	0.0009	0.9927
$\Delta\sigma^{f}_{(t-2)}$		0.0702	0.5435	0.0839	0.4614
$\bar{r}^{f}_{(t-1)}$	?	0.8491	0.1676	0.1965	0.7415
$\bar{r}^{f}_{(t-2)}$		0.3929	0.5153	-0.7875	0.1860
Turnover	+	11.3474	0.0005	5.5764	0.0184
BidAskSpread	+	0.1406	0.4812	1.0646	0.0284
P/E ratio	+	0.0019	0.4620	0.0012	0.0459
D/A	+	0.2067	0.8865	2.1402	0.0917
IND	-	-0.0455	0.1940	0.0470	0.2370
Size	-	0.1554	0.2612	0.2618	0.0477
CV earnings	+	-0.0011	0.6230	0.0016	0.4725
*Post*NDLG vs Post*DLG*	+	**1.7180**	**0.0044**		
*Post*NDLL vs Post*DLL*	+			**0.9040**	**0.0446**
*Post*NDLG vs Post*NDSG*	+	**1.4758**	**0.0212**		
*Post*NDLL vs Post*NDSL*	+			**0.5427**	**0.1675**
N		312		312	
-2 log likelihood		1051.60		1006.30	