How the 2003 Tax Reform Act Affected the Distribution of Dividends and Share Repurchases

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I. Introduction

When the "Jobs and Growth Tax Relief Act of 2003" (TRA03) went into effect, the changes in tax provisions were numerous. Perhaps the most interesting of these modifications were the changes in the dividend and capital gains tax rates. By lowering the top dividend tax rate from 38.6% to 15%, and lowering the top capital gains tax rate from 20% to 15%, this tax reform is likely to have changed corporate payout policy by causing firms to rely more heavily on dividends than they did in the past. Since the primary argument in favor of share repurchases as opposed to dividends had been the differential tax rates, TRA03 provides economists with a natural experiment to determine if firms will substitute more towards dividends since the tax rate on dividends fell by more, or if other relative benefits of repurchases will allow them to remain the primary method of corporate payout. While TRA03 is not the first reform act to change the relative tax levels on dividends and capital gains, it is the most useful tax reform act for our experiment.

Many economists investigated the substitution between dividends and repurchases after TRA86, which lowered the top dividend tax rate from 50% to 28% while simultaneously raising the top capital gains tax from 20% to 28%. Findings varied, which is likely the result of the fact that TRA86 was a huge reform that changed several aspects of both personal and corporate tax policies. Furthermore, these changes were phased in over a period of two years. These differences make TRA 03 a much more suitable natural experiment than TRA 86.

Using the natural experiment created by TRA03, we hope to answer several questions. First, we will attempt to establish the determinants of the dividend distribution

by seeing what factors are likely to affect a firm's payout decisions. Next, we would like to see if firms in fact substitute towards dividends in response to the change. While it seems logical that they would, there are several arguments suggesting that repurchases could still remain the dominant method of corporate payment. These arguments will be covered in depth in the theory section of this paper.

By running regressions on the S&P 500 from 2006 as well as 2003, we will attempt to see if the determinants of a successful firm's payout decision changed in response to TRA 03. Additionally, we will run regressions on the firms that were both removed from the S&P 500 and added to the S&P 500 between 2003 and 2006. This will allow us to compare the behavior of firms who went from relatively successful to relatively unsuccessful to the behavior of firms that became relatively more successful during this period.

We hypothesize that firms will indeed substitute more towards dividends as they become relatively cheaper than they were before TRA03, but for repurchases to remain the more prominent method of corporate payout. We expect to see such substitution because the fall in the dividend tax rate was larger than the fall in the capital gains tax rate. Additionally, while we expect to see the ratio of dividends to repurchases increase, we also expect to see total corporate payouts to increase as a result of the lower tax rates. Furthermore, we believe that the make-up of a firm's shareholders will be relevant. For example, if a firm's investors are primarily institutional investment firms, we expect to see more dividends paid out because of the additional monitoring put on firm managers, as will be explained in more detail in the theory and model sections.

II. Literature Review

There has already been research on how changes in dividend and capital gains tax rates affect corporate payout. Unfortunately, their conclusions have been quite varied. For example, DeAngelo (2000) and Jagannathan (2000) find that aggregate repurchases rose and dividends fell in response to TRA86, which would imply that substitution does not exist. Jagganathan used several determinants such as operating income, non-operating cash flow, capital expenditure, debt ratio, institutional ownership, and firm sizes from 1985 to 1994 to find the dividend payout and share repurchases. He expects that firms with higher operating cash flow are more likely to increase dividends, while firms with higher non-operating cash flows are more likely to increase repurchases. Their empirical work suggests that much more than taxes are necessary to explain how dividends and repurchases are used in practice. The author thinks that dividends and repurchases are used at different places in the business cycle by different types of firms, so they shouldn't have the substitution effect between the dividends and repurchases.

On the other hand, Grullon and Michaely (2002) determined that substitution in response to TRA86 occurred at the firm level. Grullon and Michaely used the Linters' (1956) dividend model to generate future expected dividend payments. Linter's dividend model uses the actual change in dividends, earning, dividend level and market value of equity to forecast the dividend. They found that dividend forecasts are negatively correlated with share repurchase activity, which implies that the expected dividend payment tends to become more negative as the firms spend more money on share repurchases. He concluded that dividends and share repurchases should be substitutes.

Lie's (1999) findings are similar, stating that firms were less likely to repurchase shares after the change in the tax code.

While the mixed results from studies focusing on TRA 86 can be explained by the fact that it was a relatively complicated tax reform, TRA 03 was much simpler, yet results of studies on TRA 03 have varied just as wildly. Brav (2007) finds that after TRA03 repurchases rose more quickly than dividends, which defies our hypothesis of substitution. Chetty and Saez' (2005) findings seem more logical, arguing that there were increases in both dividends and share repurchases in response to TRA03, but their findings are not completely consistent with our hypothesis. They find that the number of firms paying out dividends had been falling for two decades before TRA 03, at which point the number went up. However, they find that changes in payout decisions are limited only to firms with low levels of forecasted growth, which is consistent with the idea that firms prefer to internally finance growth. Brown's (2007) conclusion is consistent with our hypothesis of substitution because there is a positive relationship between insider holding and an increase in dividends and decrease in repurchase after 2003 Act.

Our methodology will differ from previous studies in several ways. First, we will be the first study to look at companies for three years before and three years after TRA 03. Previous studies have looked at various horizons, but none has exceeded two years. This extra year of data will allow us to more accurately see a firm's tendencies, as well as give firms an extra year to adapt their payout strategy to the new tax structure.

Furthermore, we will run each of our regressions on several different data sets. These data sets will include: All firms listed on the S&P 500 in 2003, all firms listed on

the S&P500 in 2006, the firms that left the S&P 500 between 2003 and 2006, and finally the firms that were added to the S&P 500 between 2003 and 2006. By running separate regressions on the S&P 500 firms in 2003 and 2006, we hope to determine if the general behavior of successful firms changed in response to TRA 03. By comparing the firms that were added to the list to the firms that were removed to the list, we hope to determine if there are any particular differences in the payout decisions between firms that went from relatively successful to unsuccessful (the firms that were removed from the S&P 500) and firms that went from less successful to more successful (firms added to the S&P 500).

Finally, our models will take into account the fact that firms may not have reacted to TRA 03 at the time it was signed into effect. We will allow for the possibility that firms reacted to TRA 03 early, on time, and late. While TRA 03 was signed in to effect in the second quarter of 2003, it was retroactive and applied to all transactions that occurred since the beginning of calendar year 2003. Furthermore, it is possible that firms may have taken time to adjust to the tax reform.

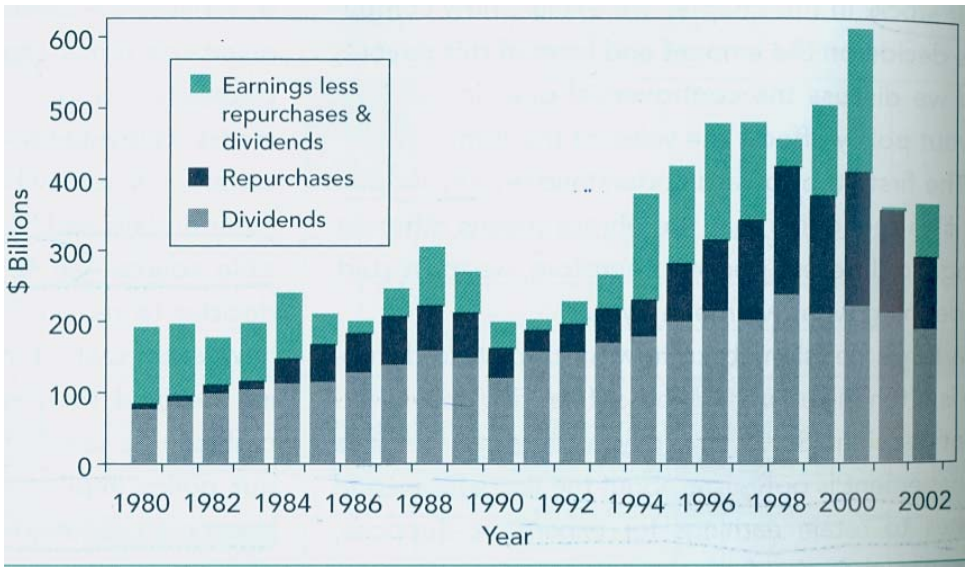
III. Theory:

Firms can distribute cash to shareholders by either paying dividends or repurchasing shares. Thus, a corporation's payout policy implies a trade-off between higher cash dividends and the repurchase of common stock.

Before 1983, stock repurchases were fairly rare but they have been increasing since then. In 2002, there was a huge increase of repurchases when seven U.S. corporations (including Johnson and Johnson [$6.5 billion], Altria Group [$6.4 billion] and Microsoft [$6.1 billion]) each bought back more than $4 billion of stock.

In most years, dividends have been the principal way that the U.S. corporations returned cash to its shareholders. However, Fama and French (2002) found that only about a fifth of public companies paid out dividends in 1999. Total dividend payments have increased fairly steadily, as can be seen in Figure 1. However, the proportion of companies paying dividends has declined sharply, and a large number of growing companies would rather repurchase stock than provide dividends. However, the dividend tax reduction in 2003 might change the corporations' strategy in choosing between paying dividends and repurchasing stocks.

Figure 1 (Dividends and stock repurchases in the USA, 1980-2002. Figures in $ billions)



How do firms decide to distribute dividends or repurchase stocks? Managers are usually reluctant to make dividend changes because many investors focus more on dividend changes than dividend levels. This means that firms are reluctant to increase dividends unless they are sure they will be able to maintain the level, because going back

and later lowering the dividend level would be a negative signal to investors. These dividend changes tend to follow a shift in long-run sustainable earnings of a firm, and managers are particularly worried about having to rescind a dividend increase. On the other hand, firms repurchase stocks when they have accumulated a large amount of excess cash, or wish to change their capital structure by replacing equity with debt. Therefore, share repurchase are frequently a one-time event and a company that announces a repurchase program is not making a long-term commitment to distribute more cash.

Before 2003, when the dividend tax was higher than income gain tax, there were many theories stating that firms should pay the lowest possible dividend, or no dividends at all. However, since corporations are not allowed to repurchase stocks with the intent of saving tax money for shareholders, they could not publicly announce that this was their intent, making it difficult to prove any payout theories.

In 2003, the top rate of taxes on both dividends and capital gains was reduced to 15%. Since the decrease in the dividend tax was higher than the fall in capital gain tax, we assume that there will be an increase in dividend payout and a reduction in stock repurchase. However, there are arguments suggesting that tax laws continue to favor capital gains. Taxes on dividends have to be paid immediately but taxes on capital gains can be deferred until shares are sold and the capital gains are realized. Therefore, stockholders can choose when to sell their share and thus, when to pay the capital gains tax. The longer they wait, the lower the present value of the capital gains tax liability. If corporations want to maximize the returns to shareholders, they may have higher incentive to repurchase stocks than to pay dividends.

However, there is another reason that U.S. corporations may pay dividends even when doing so results in higher tax bills. Even though companies that pay low dividends will be more attractive to highly taxed individuals, corporations that pay high dividends will have a greater proportion of institutional investors, including tax-exempt institutions, because higher dividend paying corporations usually prove to have more stable income. These financial institutions investors carefully monitor the corporations that they invest in and pressure managers to perform well. Successful corporations are happy to have institutional investors because they are eager to show their value and they can do so by having a higher proportion of demanding institutions among their shareholders. In order to attract higher proportions of demanding institutional investors as shareholders firms may pay a higher dividend rate. Many shareholders don't object to paying higher tax rate for dividends if shareholders know that institutional investors are prepared to put the time and effort into monitoring the management.

By examining our research, we will be able to find whether the reduction on dividend tax and capital gain tax, and the reduction of monitoring costs by institutional investors influenced corporate payout decisions, or if shareholders' flexibility on when to pay taxes prevent a change in the payout decision.

IV. Data:

While we will run several regressions, our primary model is as follows:

$$\frac{D}{D+R} = a_0 + \beta_1 D_0 + \beta_2 NIA + \beta_3 REVGROWTH + \beta_4 PB + \beta_5 INSTITUTIO\,N + \beta_6 LEVERAGE + \beta_7 SIZE + \beta_8 LNGDP + \varepsilon \quad \textbf{(1)}$$

Such That D is equal to dividends, D+R is equal to total firm payouts (dividends plus repurchases), NIA is equal to net income divided by total assets, REVGROWTH is

the average growth of revenue over three years, PB is the price to book ratio, INSTITUTION is the percentage of shares held by institutional investors, LEVERAGE is the firms leverage (defined by debt divided by equity), SIZE is the firm's total assets and LNGDP is the natural log of GDP.

To determine the number of shares repurchased, we found the change in the treasury stock. Bluin (2007) uses the repurchases as the change in treasury stock. If there is a net decrease in treasury stock, then we truncate our measure of repurchase to zero. While this is not the most accurate way to measure repurchases, it is the best way to estimate share repurchases with the available data.

The most important variable will be D_0, a dummy variable equal to one if the data is from after the second quarter of 2003, and zero otherwise. Furthermore, we will also experiment with alternate cut off dates for the dummy variable. This is to account for the possibilities that firms reacted to TRA03 at a time other than right when it went into effect. We will therefore run regressions where the dummy variable cut off date is one quarter before, and one quarter after TRA 03 went into effect. The dummy variable will tell us how firms reacted to TRA 03. A negative sign would suggest that firms opted away from the form of payout being measured in each equation. On the other hand, a positive sign would show an increase in the measured payout. A positive sign for D_0 in the primary model would allow us to conclude that firms substituted towards dividends after TRA 03. Figure 2 in the appendix shows that after TRA 03, many firms initiated dividend payments.

The dependent variable in this model will be the dividend ratio, such that the numerator is the total value of dividends, and the denominator is dividends plus

repurchases. We will use quarterly data from CompuStat on repurchases and dividends in order to derive this ratio. In order to find the number of shares repurchased, we looked at the quarter to quarter change in treasury stock. Furthermore, the data needed to calculate other key variables such as the net income over assets, revenue growth, price to book ratio, firm size, and leverage will all be obtained from CompuStat. Data on firms' institutional ownership is taken from the Thomson Financial dataset.

Since there are a vast number of firms, we will focus on the S&P 500. We will obtain data for all firms that are currently listed on the S&P 500, and firms that were listed in 2003 when the act went in to effect. We will run separate regressions on these two lists to determine if firm behavior changed in response to the tax reform. This is a good selection because these firms tend to be large so we expect that given their history of success, they will be more likely to use a payout strategy that is close to optimal than a less successful firm.

V. Model:

We will run three distinct regressions, each on 5 different data sets (2003 S&P 500, 2006 S&P 500, firms that were added to the list, firms that were removed from the list, and an aggregate data set which includes all firms listed on the S&P 500 in either 2003 or 2006) aimed at helping us better understand the effects of TRA 03 on dividend payouts. First we will see if dividends increased in response to TRA 03 by observing the sign of the dummy variable. Next we will run a regression comparing the total payouts (dividends + repurchases) before and after TRA 03 to see if total firm payouts went up after TRA 03 went into effect. Our third and final regression will give a more complex view of the ratio of dividends to total payouts by including several explanatory variables

to determine if changes in the dividend ratio were actually caused by TRA 03, or some outside factor.

Furthermore, to account for Chetty and Saez' finding that only firms with low levels of forecasted growth reacted to the tax cut, we will also divide the 2003 data set into three sections based on the firms three year average price to book ratio prior to 2003. Since price to book ratio is our control for future potential growth, we will be splitting the data into terciles based on projected levels of growth, allowing us to analyze the different behavior of firms with different expected levels of growth. Each model will now be examined more closely.

Our first model is aimed primarily at determining if dividend payouts increased or decreased after TRA 03. Our model is as follows:

$$D = a_0 + \beta_1 D_0 + \beta_2 NIA + \beta_3 REVGROWTH + \beta_4 PB + \beta_5 INSTITUTIO\,N + \beta_6 LEVERAGE + \beta_7 SIZE + \beta_8 LNGDP + \varepsilon \quad \textbf{(2)}$$

The dependent variable here will be the sum of total dividend payouts. The first, and most important independent variable is D_0, a dummy variable equal to one for data from after TRA 03 went into effect in the second quarter of 2003, and zero otherwise. There are two factors that are important to consider with this variable. First, while TRA 03 did not go into effect until May 2003, it was announced much earlier, and it was retroactive for all payouts dating back to January 1, 2003. Second, firms may not have been able to adjust their payout decision immediately. For these reasons, we will also be experimenting with different cut off dates for the dummy variable, as discussed earlier in the paper.

The next independent variable in our model, NIA, is the average net income over assets over the previous three years. We will calculate this measure by adding the net income divided by total assets for each of the previous three years, and then dividing by three. Net income divided by total assets shows how profitable a firm is. We chose to use the average of the previous three years because high earnings in only one quarter may not result in higher payouts because such a spike in earnings may not be sustainable. We expect to see a positive sign because more profitable firms should distribute more payouts to its shareholders. Da Silva (2004) supports this idea, stating that corporate payout and net income tend to be positively correlated.

Our third explanatory variable is REVGROWTH, which will equal the average revenue growth over the three years prior to the data observation. This will be calculated by adding the rates of revenue growth from the previous three years, and dividing by three. Again, we are using the three-year average to capture sustainable revenue growth rather than one time jumps in revenue. In accordance with the pecking order theory, which states that firms prefer to pay for growth first with internal money, and would rather use equity as a last resort, we hypothesize a negative coefficient for REVGROWTH. Initially the pecking order theory seems counterintuitive; however a closer examination sheds light on the underlying logic. To understand why growing firms may be less likely to payout dividends, it is important to understand that firms prefer to operate on the path of least resistance. By financing growth internally, firms can avoid the transaction costs associated with borrowing or raising equity[1].

[1] Fama, Eugene and Kenneth French, 2002, Testing Trade-Off and Pecking Order Predictions About Dividends and Debt, *The Society for Financial Studies*.

Our next variable, PB, is the price to book ratio, which is defined as price per share divided by shareholders equity per share. To calculate this, we will add the price to book ratios from the previous three years, and divide by three. This will act as a proxy for future growth, because if the price is valued much higher than the book value it is likely because investors anticipate the firm growing in the future. Again, in accordance with the pecking order theory, we anticipate a negative sign because the firm would rather distribute retained earnings internally rather than paying it out to investors.

INSTITUTION refers to the percentage of a firm's outstanding shares that are held by institutional investors. Since institutional investors closely monitor the performance of managers, we expect firms that have more institutional interest to perform better, and therefore distribute more dividends (because they will have more sustainable profits as a result of the additional monitoring). This means that we expect a positive sign for INSTITUTION.

Our final three variables do not have an expected sign, but are included to control for other factors that may influence a firm's payout decisions. First is LEVERAGE, which is equal to debt divided by the equity ratio, showing us the asset balance of a firm. SIZE is equal to the total assets held by a firm, and is included to control for the size of the firm. Finally, LNGDP is the natural log of the gross domestic product, aimed at controlling for the economic environment so as to separate increases in dividends that are caused by TRA 03 from dividend increases caused by other economic factors.

Our second model will regress total payouts with respect to the same explanatory variables as the first regression. The model will be as follows:

$$D + R = a_0 + \beta_1 D_0 + \beta_2 NIA + \beta_3 REVGROWTH + \beta_4 PB + \beta_5 INSTITUTION + \beta_6 LEVERAGE + \beta_7 SIZE + \beta_8 LNGDP + \varepsilon \quad \textbf{(3)}$$

In this equation, the dependent variable is $D+R$ which is equal to total firm payouts or dividends plus repurchases. We chose to run this regression to determine if total payouts went up after TRA 03. Since the tax rate on both dividends and repurchases went down, we expect to see total payouts rising in response to TRA 03, and therefore anticipate a positive sign for the coefficient of D_0

The third and final model we will run is the most important because it incorporates aspects of the previous two. However, it is important that we run all three regressions, because if we do not get the expected results from the main model, we will be able to better understand why. The third model is as follows:

$$\frac{D}{D+R} = a_0 + \beta_1 D_0 + \beta_2 NIA + \beta_3 REVGROWTH + \beta_4 PB + \beta_5 INSTITUTIO\ N + \beta_6 LEVERAGE + \beta_7 SIZE + LNGDP + \varepsilon \quad \textbf{(4)}$$

In this model D_0 is our variable of interest. Once again it is a dummy variable equal to one if the data comes from after TRA 03 went into effect, and we will experiment with cutoff dates before and after the act actually went into effect. We expect to see a positive sign for this variable's coefficient, which would allow us to conclude that substitution did in fact take place as a result of the tax reform.

The variables NIA and PB are the same as they were in the previous models, but this time we are not sure of the expected sign because growth in net income over total assets can affect the ratio of dividends to total repurchases by raising dividends only, raising repurchases only, or raising both forms of payout. If only repurchases increase, we would see a negative sign suggesting that firms substitute towards repurchases rather than dividends. However, it is also possible that firms would substitute towards

dividends, and we expect them to do so at a higher rate than the substitution to repurchases. This is a result of the fact that the dividend repurchase rate fell by more than the capital gains tax rate.

The variable *INSTITUTION* is the same as in the previous models, and we expect a positive sign for the same reasons as in the first two models. Furthermore, *LEVERAGE* and *SIZE* are once again included only as controls and have no expected sign.

VI. Results:

Tables 3 and 4 shows the results of our regressions run with the intention of determining an appropriate cut off time for the dummy variable. In each regression, *DummyA*, which is a dummy variable equal to one if the data came from one quarter after TRA 03 went into effect or later, yields the highest R-squared. This follows with logic because some firms likely did not immediately adjust their payout policies to the new tax code. For this reason, we will use *DummyA* as our standard dummy variable in each model.

There were two findings from our model in which the dividend to total payout ratio is the dependent variable that are contrary to our expectations. First, in every case our dummy variable is negative, and it is usually significant. This finding leads us to reject our hypothesis that firms would substitute more towards dividends in response to TRA 03. Instead, we must conclude that share repurchases remain the preferred method of payout. The most likely reason that firms did not tend to substitute towards dividends is that dividends are still a very volatile signal to send to investors. While an increase in dividends certainly looks good to the investor, it is also a huge commitment for the firm

because they must maintain the higher dividend level. Therefore, firms may still prefer repurchases because they are less of a long term commitment, as can be seen by the fact that dividends went up, but repurchases went up by more after TRA 03 went into effect (Figure 3) Since the price fell on both forms of payout, both forms increased; however, repurchases are likely to have gone up by more because they are still not as binding for the firm and are therefore looked upon with more favor.

The second finding from our primary model that is counterintuitive is the negative sign for the coefficient of *Institutional*, or the percentage of a firm's shareholders that are institutional investors. This negative sign is prevalent throughout our work and can be found in nearly every model. We had hypothesized a positive sign due to monitoring theory, but surprisingly, this does not appear to be the case.

In our regressions on both dividends and total repurchases we get a positive sign for *DummyA*, suggesting that both dividends and total payouts went up in response to TRA 03. This is not a surprising finding because the tax rates dropped, making both forms of payout relatively cheaper than they had been in the past.

Tables 5-7 compare the results of our regressions on firms listed in the 2006 S&P 500 to the results from firms listed on the 2003 S&P 500. We find no significant differences, suggesting that firms on both lists tended to behave relatively similar. This is likely the result of the fact that the two data sets are driven by data that is the same. Of the 500 firms listed in 2003, 389 were still on the S&P 500 in 2006. For a better view of how firms behaved differently, we can compare the results of our regressions on the firms that left the S&P 500 and the firms that were added to the S&P 500.

For our regression on the dividend to total payout ratio we see that firms leaving the S&P 500 have a negative but insignificant coefficient of *DummyA*, while firms being added to the S&P 500 have a positive and significant coefficient of *DummyA*. This finding seems to suggest that firms that became more successful in the years between 2003 and 2006 reacted to TRA 03 by substituting more towards dividends, while firms that lost their place amongst America's most successful firms did not react similarly.

When splitting the 2003 S&P 500 up into thirds based on price to book ratio, we find that the firms with the lowest price to book ratio yield a negative coefficient for *DummyA* when the dependent variable is the ratio of dividends to total payouts, which is contrary to our hypothesis. Since the price to book ratio acted as our proxy for projected future growth, we expected to see that firms with the lowest levels of projected growth would be more likely to pay out more dividends because they would not need to use their funds to finance growth. The results of these regressions can be seen in Table 8.

Many of our regressions have relatively a low R-squared compared to other economic regressions, but this is not surprising. Most regressions based on corporate payout policy thus far have also had relatively low R-squared values. This is due to the difficulty of describing a firm's payout policy. Alli and Khan (1993) use institutional holding, external financing cost, annual average growth rate in operating income and capital expenditure to examine the corporate dividend behavior to examine corporate payout policy. The adjusted R-Squared for their OLS regression was .54. Brown(2004) uses the insider holding ratio, market-to-book ratio, free cash flow/assets, debt/assets and monthly stock volatility to examine the dividend behavior before and after the 2003 dividend cut and their R-square for OLS regression results range from 0.20 to 0.21. A

recurring pattern for our results is that regressions focusing on the ratio of dividends to payouts yield relatively low R-squared values, while regressions on payouts have higher R-squared values. This is likely because the decision of how to efficiently balance dividends and repurchases is much more complicated than the decision to simply make a pay out.

By taking regressions on dividends and total payout, we might face two problems that we would like to adjust for in future research. First, there is a heteroskedasiticity problem. Heteroskedasiticity occurs when regression results produce error terms that are significantly varying in degree across the different observations.

One possible way to correct for this heteroskedasiticy problem is to take weighted least square regressions which give less weight to data points with greater variability and more weight to data that have smaller variability.

Also, we can use intervention analysis to simply determine the effect of tax law changes in 2003. We can form the equation:

$$y_t = a_0 + a_1 y_{t-1} + c_0 z_t + \varepsilon_t \qquad (5)$$

where: y_t = dividends or repurchases, z_t = the intervention(dummy) variable for the tax law change that takes on the value of zero prior to the 2003: Q1 and unity beginning in 2003:Q2.

To further explain the nature of the model, when t is before 2003:Q1, the value z_t is zero. From the beginning of 2003:Q2, the intercept term jumps to $a_0 + c_0$. Therefore, the impact effect of the tax law changes is given by the magnitude of c_0. If the coefficient of c_0 is relatively large, the value of y_t increases after the tax changes.

Serial autocorrelation is a common problem in regressions involving time series data. The most significant cause is that there is usually momentum built into time series regressions. For example, firms who pay dividends usually don't want to reduce their dividend amount, so there is positive serial autocorrelation effect in our regressions.

In order to correct for serial autocorrelation, we need to find the equation that provides best linear unbiased estimates regressions. First, we take two regressions such as:

$$Y_t = a_0 + \beta X_t + v_t \tag{6}$$

$$v_t = \rho v_{t-1} + \varepsilon_t \tag{7}$$

Now, we need to incorporate an estimation ρ into our equation (6). The objective of this process is to modify equation (6) to exhibit independently and identically distributed residuals.

Now, first we get the one-period lag of equation 1 which is:

$$Y_{t-1} = a_0 + \beta X_{t-1} + v_{t-1} \tag{8}$$

Then, we multiply ρ on both sides of equation (8). So, our equation is:

$$\rho Y_{t-1} = \rho a_0 + \beta \rho X_{t-1} + \rho v_{t-1} \tag{9}$$

We subtract from equation (6) to equation (9) in order to arrive at independently and identically distributed residual ε_t. Therefore,

$$Y_t - \rho Y_{t-1} = \alpha_0 (1-\rho) + \beta (X_t - \rho X_{t-1}) + \varepsilon_t \tag{10}$$

Which gives us the equation which is corrected for serial autocorrelation. Again, this is a process that we would like to consider in our future research.

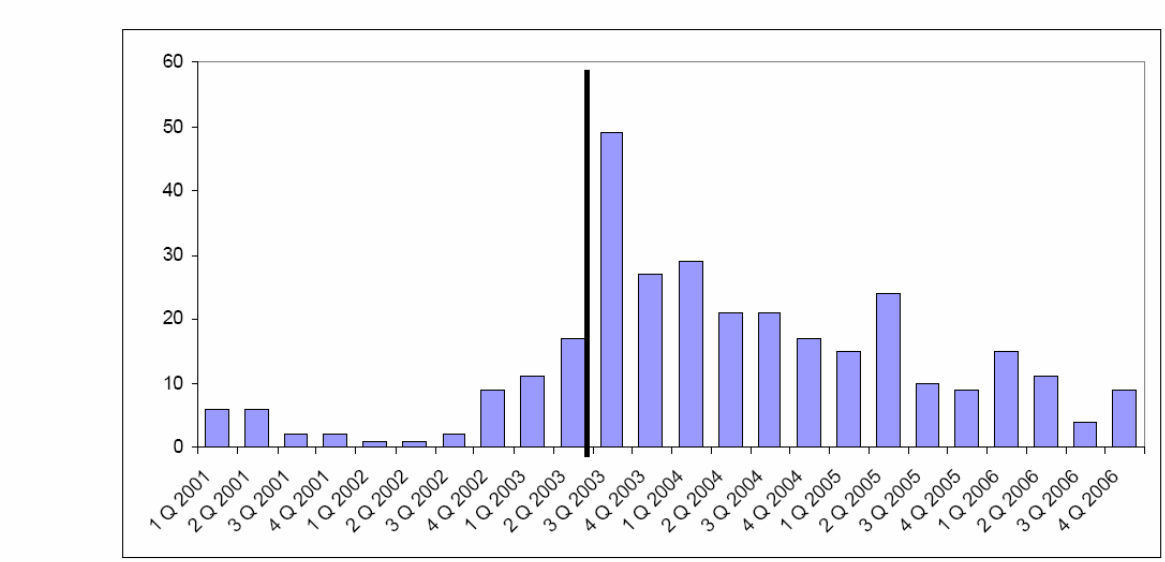
VII. Conclusion

With the intention of determining whether or not firms substituted more towards dividends in response to TRA 03, we ran a regression on the ratio of dividends to total payouts. We hypothesized that because the dividend tax rate fell by more than the capital gains tax rate, firms would substitute more towards dividends in response to the tax reform act. The results of previous studies were widely varied, with findings both supporting and negating our hypothesis. Using additional years of data, and making a few methodological changes, we decided to attempt to prove that firms substituted towards dividends in response to TRA 03.

Since the sign of the dummy variable is positive in all cases except for the regression on the dividend to total payout ratio, we conclude that dividend payments went up, but firms did not substitute away from repurchases. However, like the studies before ours, there are causes for concern. Most notably, we are worried about heteroskedasticity and serial autocorrelation, as mentioned in the results section. Since dividends tend to grow over time, it is likely that our dependent variables were correlated, a problem that we are eager to address in our future work.

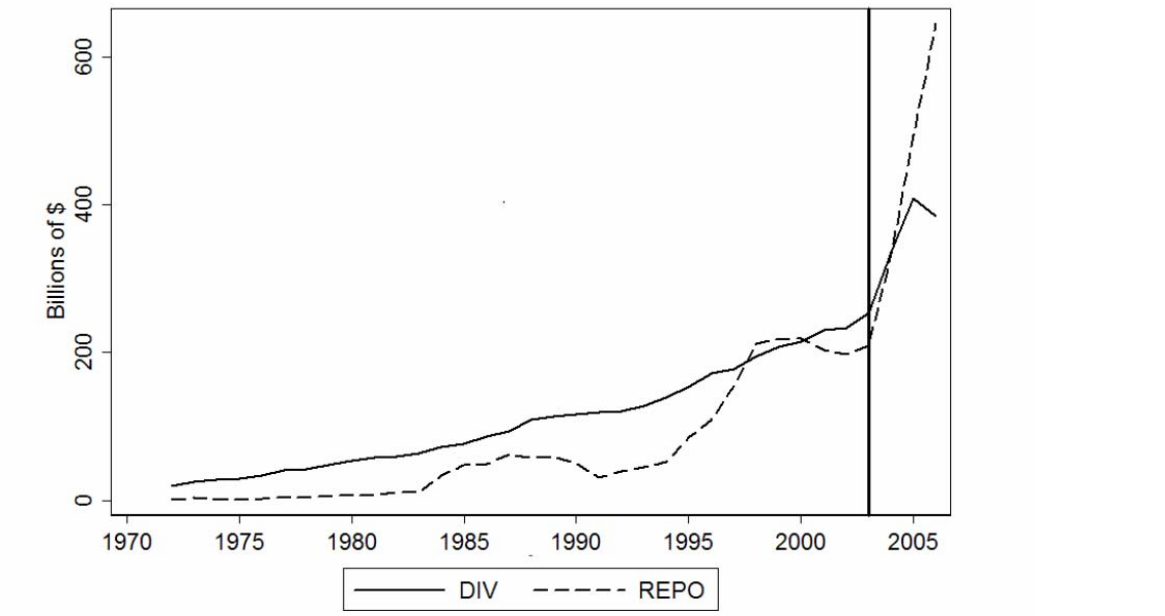
VII. Appendix:

Figure 2: Regular Dividend Initiation:



This figure shows the number of firms initiated regular dividends in each quarter from January 2001 to December 2006. The timing of the May 2003 dividend tax cut is shown by the vertical line.

Figure 3: Dividend and Repurchase DIV= Dividend REPO=Repurchase



This figure depicts aggregate dividends and share repurchase for a sample of U.S. firms.

Table 1: Average D-ratio (Dividend/ Total Payout) before and after the tax reform		
	D-ratio before 2003	D-ratio after 2003
AVE D-RATIO	0.759	0.687

Table 2: D-ratio from 2000 to 2006								
	D-ratio 2000	D-ratio 2001	D-ratio 2002	D-ratio 2003Q1	D-ratio 2003Q2-Q4	D-ratio 2004	D-ratio 2005	D-ratio 2006
AVE D-RATIO	0.759	0.755	0.760	0.766	0.771	0.728	0.676	0.649

Table 3:Total Payout (dividend+repurchase) using different dummy for S&P 500 in 2003			
	Normal Dummy*	Dummy Before*	Dummy After*
Dummy	6.736	6.308	7.243
	(6.421)	(5.958)	(6.929)
Income/Assets	4.100	4.130	4.060
	(4.739)	(4.769)	(4.693)
Revenue Growth	34.767	34.856	34.679
	(14.427)	(14.461)	(14.394)
Price/Book ratio	6.439	6.452	6.409
	(3.478)	(3.485)	(3.463)
Leverage	-9.933	-10.031	-9.891
	(-3.862)	(-3.899)	(-3.847)
Institutional Ratio	-2.750	-2.740	-2.760
	(-9.533)	(-9.482)	(-9.581)
Total Assets	1.433	1.434	1.432
	(31.855)	(31.872)	(31.847)
Ln(GDP)	18.161	18.053	18.258
	(8.123)	(8.061)	(8.178)
R-Squared	0.155	0.155	0.155
Notes: *Numbers in parenthesis are T-statistics			
* Normal Dummy: Input 1 from 2003:Q2 and 0 before 2003:Q2			
*Dummy Before: Input 1 from 2003 Q1 and 0 before 2003 Q1			
*Dummy After: Input 1 from 2003 Q3 and 0 before 2003 Q3			

Table 4:Total Payout (dividend+repurchase) using different dummy for S&P 500 in 2006			
	Normal Dummy*	Dummy Before*	Dummy After*
Dummy	6.948	6.538	7.453
	(6.814)	(6.348)	(7.341)
Income/Assets	4.390	4.430	4.340
	(4.873)	(4.916)	(4.823)
Revenue Growth	34.663	34.733	34.591
	(14.595)	(14.621)	(14.570)
Price/Book ratio	4.137	4.177	4.108
	(2.978)	(3.006)	(2.958)
Leverage	-8.594	-8.749	-8.546
	(-3.598)	(-3.662)	(-3.579)
Institutional Ratio	-2.680	-2.670	-2.690
	(-9.610)	(-9.562)	(-9.660)
Total Assets	1.439	1.441	1.438
	(32.232)	(32.256)	(32.221)
Ln(GDP)	17.702	17.594	17.802
	(8.120)	(8.059)	(8.177)
R-Squared	0.151	0.151	0.152
Notes: *Numbers in parenthesis are T-statistics			
* Normal Dummy: Input 1 from 2003:Q2 and 0 before 2003:Q2			
*Dummy Before: Input 1 from 2003 Q1 and 0 before 2003 Q1			
*Dummy After: Input 1 from 2003 Q3 and 0 before 2003 Q3			

Table 5:Dividend for S&P 500 listed in '03, '06, in '03 but not in '06, in 06' but not in '03				
	S&P 500 listed in 2003	S&P 500 listed in 2006	Firms listed in S&P 500 in '03 but not in '06	Firms listed in S&P 500 in '06 but not in '03
Dummy	2.772	2.635	1.039	0.442
	(3.954)	(3.954)	(0.361)	(0.213)
Income/Assets	2.030	2.130	4.463	0.580
	(3.506)	(3.617)	(2.741)	(0.612)
Revenue Growth	16.976	16.599	-14.428	10.911
	(10.543)	(10.697)	(-15.120)	(17.086)
Price/Book ratio	4.056	2.543	2.770	0.300
	(3.280)	(2.802)	(1.814)	(0.990)
Leverage	-6.499	-5.514	0.310	-2.432
	(-3.783)	(-3.533)	(0.697)	(-1.434)
Institutional Ratio	-1.860	-1.780	-0.029	-0.345
	(-9.626)	(-9.736)	(-0.346)	(-7.556)
Total Assets	0.962	0.963	4.279	1.407
	(32.002)	(33.017)	(19.635)	(17.938)
Ln(GDP)	13.131	12.616	0.649	2.558
	(8.792)	(8.857)	(1.053)	(7.199)
R-Squared	0.140	0.140	0.422	0.350
Notes: *Numbers in parenthesis are T-statistics				

Table 6:Total Payout for S&P 500 listed in '03, '06, in'03 but not in '06, in 06' but not in '03				
	S&P 500 listed in 2003	S&P 500 listed in 2006	Firms listed in S&P 500 in '03 but not on '06	Firms listed in S&P 500 in '06 but not on '03
Dummy	7.243	7.453	5.983	9.579
	(6.93)	(7.341)	(1.33)	(0.852)
Income/Assets	4.060	4.340	7.184	2.956
	(4.693)	(4.823)	(2.82)	(0.575)
Revenue Growth	34.679	34.591	-14.257	-7.966
	(14.394)	(14.57)	(-9.548)	(-2.3)
Price/Book ratio	6.409	4.108	6.791	5.622
	(3.463)	(2.958)	(2.847)	(3.414)
Leverage	-9.891	-8.546	-0.216	-36.071
	(-3.847)	(-3.579)	(-0.309)	(-3.922)
Institutional Ratio	-2.760	-2.690	-1.435	-2.920
	(-9.581)	(-9.660)	(-1.112)	(-1.179)
Total Assets	1.432	1.438	4.034	8.704
	(31.847)	(32.221)	(11.831)	(20.457)
Ln(GDP)	18.258	17.802	20.578	11.883
	(8.178)	(8.177)	(2.132)	(0.617)
R-Squared	0.155	0.152	0.220	0.186
Notes: *Numbers in parenthesis are T-statistics				

Table 7:D-ratio (Dividend/Total payout) for S&P 500 in '03, '06, in '03 but not in '06, in 06' but not in '03				
	S&P 500 listed in 2003	S&P 500 listed in 2006	Firms listed in S&P 500 in '03 but not on '06	Firms listed in S&P 500 in '06 but not on '03
Dummy	-0.023	-0.019	-0.012	0.039
	(-2.719)	(-2.221)	(-0.299)	(1.856)
Income/Assets	0.303	0.166	0.975	0.180
	(4.275)	(2.241)	(4.328)	(1.891)
Revenue Growth	3.370	3.100	-5.590	1.930
	(17.071)	(15.859)	(-4.235)	(3.007)
Price/Book ratio	-0.608	-0.500	1.734	-2.083
	(-4.011)	(-4.363)	(0.822)	(-6.846)
Leverage	0.847	0.769	0.417	11.867
	(4.021)	(3.907)	(0.676)	(6.979)
Institutional Ratio	-0.161	-0.183	-0.140	-0.341
	(-6.818)	(-7.941)	(-1.222)	(-7.452)
Total Assets	1.130	1.050	131.000	14.400
	(3.063)	(2.86)	(4.358)	(1.828)
Ln(GDP)	0.643	0.672	0.479	0.670
	(35.133)	(37.388)	(5.614)	(18.812)
R-Squared	0.140	0.140	0.069	0.063
Notes: *Numbers in parenthesis are T-statistics				

Table 8:D-ratio (Dividend/Total payout) for S&P 500 in 2003 ranked by P/B ratio

	Highest P/B ratio	Middle P/B ratio	Lowest P/B ratio
Dummy	0.000	-0.019	-0.054
	(0.024)	(-1.348)	(-3.515)
Income/Assets	0.044	0.459	0.456
	(0.197)	(3.893)	(4.622)
Revenue Growth	5.080	1.150	3.140
	(16.394)	(3.421)	(8.271)
Price/Book ratio	-1.541	-16.768	-0.347
	(-4.113)	(-7.995)	(-1.402)
Leverage	2.535	13.841	0.149
	(4.186)	(7.382)	(0.633)
Institutional Ratio	-0.108	-0.323	-0.074
	(-2.753)	(-7.814)	(-1.751)
Total Assets	2.250	-1.400	0.475
	(2.391)	(-2.490)	(0.646)
Ln(GDP)	0.514	0.844	0.638
	(16.907)	(24.637)	(19.486)
R-Squared	0.140	0.140	0.069

Notes: *Numbers in parenthesis are T-statistics

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