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The case of the 2003 "Jobs and Growth Tax Relief Reconciliation Act"

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Zusammenfassung

Dieses Papier analysiert das ex-date Aktienkursverhalten vor und nach der Einführung des Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA), welcher die Dividenden- und Kapitalertragssteuern für die höchsten Steuerklassen auf 15% senkte. Dies sollte langfristig die primären Steuervorteile des Handels um den Ex-Div-Stichtag für langfristige Anleger aufheben.

Das Papier zeigt, dass die Änderung der Besteuerung keine Auswirkungen auf die damit verbundene Steuerprämie hat, die sich aus dem Handel vor und nach dem Dividendenzeitpunkt ergeben sollte. Die "Bush tax cust" schienen die Wirtschaft anzukurbeln, da die Kursverluste am Ex-Dividendentag nach dem JGTRRA deutlich geringer waren als zuvor, während die Dividenden leicht stiegen, was möglicherweise eine deutlich niedrigere Prämie nach dem Steuergesetz erklärt. Dies könnte bedeuten, dass das Handelsverhalten langfristiger Anleger keinen wesentlichen Einfluss auf den Kurs am Ex-Dividenden-Tag hat. Die Ergebnisse deuten darauf hin, dass kurzfristige Händler, Unternehmen und institutionelle Investoren sowie der Markt und die Wirtschaft selbst die Haupttreiber für das Kursverhalten der Aktien zum Zeitpunkt der Dividendenzahlung sind.

Abstract

This paper analyses the ex-date stock price behavior before and after the introduction of the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA), which reduced dividend taxes as well as capital gains taxes to 15% for the highest tax brackets. This, in term, should cancel the primary tax advantages of trading around the ex-div date for long-term investors.

The paper shows that the change in taxation has no effect on the associated Tax Premium that should result from trading before and after the dividend date. The "Bush tax cuts" seemed to boost the economy as price drops on the ex-dividend date were significantly lower after the JGTRRA than before, while dividends increased slightly, possibly explaining a significantly lower Premium after the Tax Act. This, in term, could state that the trading behavior of long-term investors has no significant effect on the ex-dividend day price. The results indicate that short-term traders, corporations, and institutional investors, as well as the market and the economy itself, are the primary drivers for ex-dividend date stock price behavior.

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1. Introduction

On May 23, 2003, the Jobs and Growth Tax Relief Act also known as the JGTRRA was passed by Congress and five days later signed by President George W. Bush and put into law on the 28th of May. This marked one of the most significant tax changes in modern American history and for only the second time, set individual capital gains taxes equal to individual taxes on dividends for the highest marginal tax bracket.

Thus, eliminating the preferential tax treatment capital gains had compared to dividends, which have historically been taxed as ordinary income most of the time. The act set the maximum tax brackets at 15%.

This paper tries to find evidence for the effect taxes have on ex-dividend day price behavior, hypothesizing that with equal tax rates and no benefits for long term investors trading around the ex-dividend date, the effect taxes have on the ex-dividend price should be mitigated. As Miller and Modigliani showed in 1961, dividend policies should have no effect on the value of a firm and say that in perfect capital markets the price of a stock should fall by the amount of its dividend. In fact, if capital gains are taxed more heavily than dividends, investors may require a higher pre-tax return rate.[1] Their study further suggests, that due to different tax treatments clientele groups are created, which prefer different types of dividend-yielding stocks, depending on their marginal tax bracket. Individuals in higher tax brackets will prefer low dividend-yielding stock and vice versa. Besides, taxing capital gains and dividends at different rates will affect the behavior and change of the ex-dividend stock prices. Past research also suggests that no specific group of traders controls the ex-dividend stock price changes.[2]

This paper also looks for explanations to why other economic factors might have a stronger impact on stock price behavior post dividend than taxes.

The effect of the tax act is analyzed, and the results and possible effects on stock price behavior are explained. According to the long-term trading hypothesis the Premium or the price drop divided by the dividend should be lower than one before the tax change took place and equal to 1, but if not definitely higher after the tax change than before. If this is not the case, one can conclude that not long-term investors but short term traders and

[1] (Miller, 1961)
[2] (Jarrow, 1988)

corporations, as well as the market trend itself, are responsible for the price change post the ex-dividend date.

1.1. Dividends

Stellar firms usually earn more than they spend. When a company has a positive free cash flow, it can choose to either pay out this money or retain it. Mature companies are more likely to pay out their money than growth companies because they have fewer growth opportunities to invest this money in. Another thing they could do is accumulating a cash balance for rough times or surprise economic shocks to keep operations running. Beyond a certain point though investors will start calling for the firm to distribute parts of the accumulated cash in the form of dividends. To capture this dividend, an investor must hold the stock prior to the ex-dividend date which is usually two days before the actual record date of the dividend and way before the actual payout date of the dividend. One thing that occurs before all of those events is the declaration date of the dividend, so shareholders will know in advance when the dividend will be distributed and by extent will know the last holding date which entitles them to receive the dividend.

1.2. History of Dividend Taxation

To better understand the concept and role of dividend taxation and its effect on stock prices and trading decisions: Dividend taxation varies across different types of investors so that we will take a look at the historic tax treatment of dividends for individuals, corporations and other institutional investors in the US.

Individuals

In the past individuals have had their dividends taxed as ordinary income, meaning they paid the same amount of taxes on their dividends as on their ordinary income like salary, etc.. In contrast, income received from investments has been taxed at the capital gains tax rate which throughout history has always been lower or equal to the tax rate on dividends and ordinary income, with the equal stint coming after the 1986 Tax Reform Act. So, except for a brief moment in history, where both types of income were taxed at 28%, there has been a tax disadvantage for dividends compared to capital gains. One must note that

when talking about tax rates here, it refers to the highest marginal tax rates, but since more wealthy individuals will have their money invested in the stock market the most significant tax exposure will be on them. Think of this like the 80/20 rule, maybe only 20% of the individuals will be in the highest tax bracket, but those 20% make up 80% of the individual invested capital in the stock market. Below you will find a figure with the highest marginal tax rates on dividends and capital gains from 1971 till today. In the past dividends have been taxed up to 70%, while taxes on capital gains have never exceeded 35%.

TABLE 17.2 **Long-Term Capital Gains Versus Dividend Tax Rates in the United States, 1971–2012**

Year	Capital Gains	Dividends
1971–1978	35%	70%
1979–1981	28%	70%
1982–1986	20%	50%
1987	28%	39%
1988–1990	28%	28%
1991–1992	28%	31%
1993–1996	28%	40%
1997–2000	20%	40%
2001–2002	20%	39%
2003–*	15%	15%

*The current tax rates are set to expire in 2013 unless they are extended by Congress. The tax rates shown are for financial assets held for more than one year. For assets held one year or less, capital gains are taxed at the ordinary income tax rate (currently 35% for the highest bracket); the same is true for dividends if the assets are held for less than 61 days. Because the capital gains tax is not paid until the asset is sold, for assets held for longer than one year the *effective* capital gains tax rate is equal to the present value of the rate shown, when discounted by the after-tax risk-free interest rate for the additional number of years the asset is held.

Figure 1: Berk & DeMarzo Historical Capital Gains and dividend taxation

Institutional Investors

Most equities traded are held by institutional investors rather than individuals themselves. Those investors can be mutual funds, pension funds, or corporations. Each of those institutional investors is taxed differently. Pension funds and nonprofit-funds are neither taxed on dividends nor on capital gains. They are entirely tax-exempt. So, by extent, they should be indifferent when it comes to their approach of trading around the ex-dividend day. There is no tax benefit for these types of investors for trading around the ex-dividend date. Mutual funds are not tax-exempt but pay the taxes owed on dividends for their investors and then distribute the post-tax dividend to their shareholders. In this case,

trading behavior would depend again on the tax bracket of the individual investors in the mutual fund. Again, we land at the 80/20 rule from before and can imply that after the tax change, there are no more tax benefits for individual investors.

Corporation

A corporation can exclude 70% of their dividend tax payments while having no such benefit from capital gains, making them one of the few entities with a benefit associated with receiving dividends.

For investors to favor dividends, they must have a negative effective dividend tax rate, which measures the extra amount of taxes paid on dividends compared to capital gains. Conversely to investors who prefer dividends, dividend averse investors will have a positive effective dividend tax rate, and for indifferent investors, this tax rate will be zero, their gain is the same whether they sell the stock or receive a dividend. Let us assume an investor buys a stock right before the ex-dividend date and sells it after the ex-dividend date. He or she will usually incur a loss from the price drop and a gain from the received dividend. If the after-tax gain of the dividend exceeds the after-tax loss from selling the stock, the investor favors dividend payments and vice versa (assuming to trading and transaction costs).

So, for an investor to have no arbitrage opportunities, the following equation must hold. If there were no arbitrage opportunities for trading around the ex-dividend date, the price drop would equal the dividend payment. If on the other hand the price drop does not equal the dividend, one can imply an average effective tax rate for investors who traded around the ex-dividend date, saying the price drop is equal to the dividend times one minus the effective tax paid on dividends.

$$(P_{cum} - P_{ex})(1 - \tau_g) = Div(1 - \tau_d)$$

$$P_{cum} - P_{ex} = Div \times \left(\frac{1 - \tau_d}{1 - \tau_g}\right) = Div \times \left(1 - \frac{\tau_d - \tau_g}{1 - \tau_g}\right) = Div \times (1 - \tau_d^*)$$

$$\tau_d^* = \left(\frac{\tau_d - \tau_g}{1 - \tau_g}\right)$$

Figure 2: Berk & DeMarzo effective ex-dividend date tax rate formula

To further illustrate this example, let us consider a pension fund, an individual long-term investor, and a corporation who all receive a $100 dividend payment and sell a stock for $100.

The tax-exempt pension fund will receive $200, $100 from each investment.

The individual investor will receive $170, $85 from each investment [100*(1-t)].

The corporation, assuming a 21% corporate tax rate will receive $172,7, $93,7 from the dividends and $79 from selling the stock thus making dividends a more attractive investment with regards to taxes and total payoff. Hence the effective dividend tax rate for the corporation is negative.

In summary, one can say that whether investors prefer dividends, or a share repurchase (a process mimicking a dividend payment by repurchasing shares with excess cash instead of distributing it through dividends) does depend on the investors' tax bracket and their regulatory environment concerning tax exemptions.

Out of these preferences, different groups arise which should hold different types of securities to maximize their tax benefits. To illustrate this further, Franklin Allen and Roni Michaely found that in 1996, individual investors held 54% of all stock while only receiving 35% of all dividend payments implying a dividend aversion for individual investors.[3]

When speaking about the investors' preference towards dividends, one commonly refers to this effect as the clientele effect.

[3] (Michaely F. A., 2003)

TABLE 17.3 Differing Dividend Policy Preferences Across Investor Groups

Investor Group	Dividend Policy Preference	Proportion of Investors
Individual investors	Tax disadvantage for dividends Generally prefer share repurchase (except for retirement accounts)	~52%
Institutions, pension funds	No tax preference Prefer dividend policy that matches income needs	~47%
Corporations	Tax advantage for dividends	~1%

Source: Proportions based on *Federal Reserve Flow of Funds Accounts.*

Figure 3: Berk & Demarzo Dividend policy across Investors

1.3. Clientele effect

The clientele effect commonly refers to the investors' preference toward dividend payments and a firm's optimized payout policy to reflect the preferences of its investor clientele. Furthermore, a dynamic clientele effect exists which infers investors are trading around the ex-dividend date to minimize their tax payments and maximize their returns. Meaning investors in high dividend tax brackets would trade their shares to investors, who are at best, tax-exempt for income on dividends.

The clientele effect was first implied after a study by Elton & Gruber and later re-examined by Kalay. G. Elton and Gruber claimed to show that the marginal shareholder tax bracket could be implied by the firms' payout policy, stating that stockholders in higher tax brackets prefer capital gains over dividend income. [4]

In their study, price drops over dividends $\frac{Pcum-Pex}{Div}$ increased with an increasing dividend yield of the stock. Through the equation from the paragraph before they implied that investors in higher tax brackets hold lower dividend-yielding stocks.

In 1982 Avner Kalay re-examined those findings and found that without additional information the marginal tax bracket could not be implied. Even though there was still a positive correlation between the dividend yield and the price drop, Kalay stated that not enough adjustments had been made in Elton's und Grubers study to fully account for the ex-dividend day price effects. In his study, the price drop in relation to the dividend remained significantly below one, suggesting that most traders are in fact taxed higher on dividends than on capital gains.

[4] (Gruber, 1970)

Generally, too many factors like economic trends, irrational behavior, unknown correlation of other factors that involve investment decisions and an affinity for dividends can dilute the results of those studies to clearly be able to infer a marginal tax bracket of trading investors or investors in general.

1.4. Dividend Payout Policy

This paragraph is supposed to illustrate that a firms payout policy is not entirely based on rational but involves behavioral issues of investors and people for that matter. John D. Rockefeller already said: “Do you know the only thing that gives me pleasure? It’s to see my dividends coming in.”
A firm can choose to issue dividends, but it is not required to do so. So why would firms issue a dividend when they could just repurchase their shares instead and create an artificial dividend that would arguably have a better impact on a firms valuation. Let us say you own one out of 10 outstanding stocks of a firm. This firm has $100 excess cash and chooses to retain $90 of it. With those $10 in extra cash it can now either repurchase one share or distribute a one-dollar dividend (We are assuming a share price of 10$). If it chooses to repurchase shares, there will be fewer shares and less money, you as an investor would still own value of $10 cash for your share → $90 retained cash, nine stocks left. Same as if you received a dividend. You would own $9 cash for your share and a $1 dividend. The value would be the same unless there is a tax advantage for either dividends or capital gains. As we know, most of the time there has been a tax advantage for capital gains, so why have firms in the past issued more dividends rather than do stock repurchases?
This should give you a clue that dividends are not solely chosen to optimize shareholder gains, but more factors, rational or not, play a role when choosing a firms payout policy. As is the problem with those studies, one assumption is the rational behavior of traders, investors, and people. That is something one should keep in mind when looking at financial data and findings trying to explain their results with an absolute.

2. The Bush Tax cuts

During the Bush administration, two major tax codes were passed as a series of temporary income tax relief for individuals and later on for investors and businesses. Most

noteworthy to this paper is the reduction of dividend taxes to equal capital gains taxes for the first time since 1987. Capital gains taxes were lowered from 20% to 15% while taxes on dividends for the highest income bracket were lowered from 35% to 15% as well. Tax rates for lower household incomes were gradually set even lower than the above mentioned 15%. Both tax acts were passed to counter the dotcom bubble bust and the following recession after 2001 and to incite an economic upswing. Lower-income taxes should encourage more spending by individuals and a more significant incentive for businesses to invest in the stock market. While the Economic Growth and Tax Reconciliation Relief Act (EGTRRA) was the tax act passed for individuals the later Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) was enacted to help businesses and to accelerate the effects of the EGTRRA. Looking at the equity market, the JGTRRA was surely of bigger impact to price changes in stocks than the EGTRRA. Nevertheless, the main points of both acts in the upcoming section will be mentioned to give you a good understanding of the US economy during that time span.

2.1. Breakdown of the JGTRRA

As mentioned before the "Jobs and Growth Tax Relief Reconciliation Act of 2003" (JGTRRA) was enacted to cut taxes for businesses and corporation to increases investments in the stock market and also to put more money in the pockets of businesses to hire employees and reduce unemployment rate, while at the same time encourage increased spending to stimulate the economy. The JGTRRA was needed after the US economy grew by only 1% in 2001 and 1,8% in 2002. The JGTRRA was supposed to accelerate economic growth. Seeing the US economy showing much higher growth in GDP after 2003 with 2,8% in 2003 and more than 3% in the following years could be an indicator for a positive effect of the JGTRRA.[5]

The JGTRRA :

- Reduced capital gains taxes from 20% to 15% and from 10% to 5%
- Changed the dividend tax rate to a maximum of 15% for the highest income bracket
- Increased the maximum amount of deductible income
- Decreased the marginal tax brackets
- Raised tax exemption for the AMT (Alternative Minimum Tax)

[5] (World Bank, 2019)

The JGTRRA incentivized investments in the stock market due to a higher valuation of firms and lower purchasing costs. It also encouraged the payout of more and higher dividends. Dividends in comparison to capital gains are direct money in the pockets of the investor and can be further used to spur economic growth. After 2003, dividend-paying stocks became more attractive to investors and more companies issued equity instead of bonds reducing their risk of default and by extent, stabilizing the economy. The JGTRRA also encouraged firms to pay a higher dividend, although this is not seen during the period from 2003 till 2004, which this study covers. Dividends from S&P500 companies only increased minorly from 0.204 to 0.216 after the tax code change in 2003 till the end of 2004. By 2007 though the dividends had more than quadrupled with a mean of 0.879.
As can be imagined, the JGTRRA helped higher dividend-yielding stocks more than lower-yielding stocks, Auerbach and Hassett found in their 2003 study that firms with higher dividend yields benefited more from the new tax cuts.[6]
The tax code was set to expire in 2008, and many argued that it should have expired much sooner after the economy was back on track. With an earlier expiration date, spending could have slowed to a reasonable level again. By increasing taxes and not running a massive deficit while at the same time controlling ill-adviced spending, the effects of the 2008 financial crises could have possibly been better controlled. Instead, the tax cuts were further extended and became part of two more presidential campaigns and are now a permanent part of the US's fiscal policy.

2.1.1. The EGTRRA

The Economic Growth and Tax Reconciliation Relief Act (EGTRRA) was enacted on June 7 of 2001, nearly two years prior to the JGTRRA. It cut taxes for individuals and was suppose to increase individual spending to boost the economy after the 2001 recession. Families would have extra money to spend on services and goods. While the EGTRRA saved taxed payers over $1 trillion, more of these savings could be credited to higher-earning individuals and families with an income over $250.000. Instead of spending the money, people with lower incomes chose to save up, and people with high incomes already had enough money to afford what they needed. Overall the EGTRRA did not do enough to

[6] (Alan J. Auerbach, 2005)

stimulate the economy and induce an economic upswing, so Congress passed the JGTRRA to speed up the process.

2.2. Conclusion

Overall if we look at the effects of the "Bush Tax Cuts" we can conclude that it had mixed effects on the US economy. While it did help the economy and boosted spending and investments in the stock market, it also increased the budget deficit dramatically from 2001 onward, when the US ran a budget surplus. Undoubtedly two wars in Iraq and Afghanistan between 2001 and 2008 played its role as well in elevating the deficit to new heights. Economic growth was possibly weaker than expected, and the cost of accelerating growth was later on not offset by its benefits, but instead elevated the deficit and debt even further leading to the 2008 depression and financial crisis. Not only did the tax cuts increase the economies deficit, but they also fueled income inequality as high earners profited more than low-income households. Most of the tax savings went to individuals with a considerably larger income. This is in part due to the fact that people in lower tax brackets usually have less invested in the stock market, so a reduction in capital gains taxes only helps them in a minor way, while high net worth individuals profit tremendously. In addition, high earners income naturally received greater tax savings as well. While the tax changes benefited rich people more, they still increased the take-home money for the middle class as well and offset the slow-growing wages at the time.
This section was supposed to give you an overview of the "Bush Tax Cuts" and how they affected the US economy and financial decision making of businesses and investors. While this paper is not a paper on economic or fiscal policies, we still thought it of interest; hence, possible results from this study might be explained by the fiscal policy during the time.

3. The Framework

In this section, we will cover the factors and components that drive the assumptions of the ex-dividend day stock price behavior. First, we will explain the model under the assumption of a perfect Modigliani Miller scenario and describe the effect of taxes in such a frictionless scenario. Furthermore, we will elaborate on the two hypotheses that arise from these assumptions.

In perfect capital markets, Modidliani and Miller argue that Dividend Policy is irrelevant and that whichever payout policy a firm selects, may it be share repurchases or excess cash payouts, it will lead to the same firm or share value. What this does not take into account is the tax disadvantage associated with dividends. In a risk-neutral world, the value of the cash dividend is reduced by the tax disadvantage it bears. So if we look again at the CumEx transaction, we find that the profit from selling at the end of the cum-day is equal to selling at the beginning of the ex-day.

$$P_{ex-1} - t_c * (P_{ex-1} - P_0) = P_{ex} - t_c * (P_{ex} - P_0) + D * (1 - t_o)$$

$P_0 = tax\ base\ or\ purchase\ price$

P_{ex-1} = stock price on the cum-day

P_{ex} = stock price on the ex-day

D = dividends

t_c = tax on capital gains

t_o = tax on ordinary income/dividend

If you sell before the ex-dividend date, you receive the price of the stock on that date minus the tax on capital gains, which is the difference between your purchase and your selling price. If the stock has gone down, you would technically receive a tax benefit. The right side of the equation represents the sale after the ex-dividend date, where we would again receive the price of the stock on that date minus the capital gains tax plus the captured dividend minus the tax on the dividend. This equation assumes that the owner of the stock has been in possession of the stock for more than a year; otherwise, everything would be taxed with the ordinary income tax rate. To be indifferent, between selling before or after the ex-dividend date, these two sides need to be equal. Otherwise, there is an arbitrage opportunity for the seller. Rearranging the equation, we find that in an equilibrium:

$$\frac{P_{ex-1} - P_{ex}}{D} = \frac{1 - t_o}{1 - t_c}$$

We call this term the “Premium” in this study. The Premium will be lower than one if the tax rate on ordinary income is higher than the tax rate on capital gains, equal to 1 if the tax rates are the same and higher than one if taxes on capital gains are higher than on ordinary income and by extent dividends. Which, if you remember is the case for corporations, while the other two scenarios apply to all other investors with pension funds having the

same tax rates and individual investors for the most time having a higher tax rate on ordinary income.

3.1. Types of Traders

So who should trade around the ex-dividend date and why could these traders possibly influence the price of the stock on the ex-dividend date.
If we again look at the formula from above, we can conclude that short-term traders have little to benefit from trading around the ex-dividend date since their tax rate on capital gains equals their tax rate on ordinary income. This means that if they buy the stock on the cum-dividend day and sell it on the ex-dividend day, they would have to pay ordinary taxes on the capital gains received from the stock. So for them, the left side of the equation would equal one, even before the change of the tax code. Short-term traders buying and selling around the ex-dividend date would not be very rational, and if indeed this were the case, it could only be explained by reasons regarding behavioral finance. This type of trading again though should not have a distorting impact on how the price of the stock changes on the ex-dividend date, unless they are driving by behavioral impulses.
When looking at corporations, they are one of the few entities benefitting from dividend payments. So if we would see a price drop that exceeds the amount of the dividend, we could imply that the traders around the ex-div date are corporations. For example, implying a 21% corporate tax rate with 70% of dividends being tax-exempt, we come up with a Premium for corporations of 1,186. Usually though, a corporations main business is not to make money through trading stocks. Also, the number of investors who fall into this category is around 1%, as seen in the picture from section 1.2. Still, if only corporations traded around the ex-dividend date, we would expect the Premium to be higher than one. Past empirical evidence shows that this is not the case. Studies by Elton and Gruber(1970) and Kalay (1982) both found a mean Premium below one, supporting the long-term trading hypothesis that a dividend aversion of long-term traders causes the ex-dividend day price change.
Other studies have looked at a change in tax codes to better support this hypothesis. Lakonishok and Vermaelen (1983) examined the tax code change of 1971 in Canada which made dividends more favorable to capital gains and found, that even though they expected a Premium closer to one the opposite was the case. On the other hand, Poterba and Summers (1984) found evidence which points toward a tax effect. So the results in the past

have been mixed, and one might have already argued back then, that other factors could play a more significant role in determining the ex-dividend day stock price, other than dividends and taxes.

3.2. Long-term trading hypothesis

In this paper, we will examine and hypothesize a long-term trading effect. The idea is that long-term traders determine the price behavior around the ex-dividend date. Also, the tax change should have an important impact regarding long-term traders than corporations, and it should not affect the behavior of short-term traders. It should be noted that reducing the tax rates to 15% will drastically change the benefits that could be exploited by trading around the ex-dividend date since the tax profits become smaller (because the tax costs are lower) and transaction costs have a larger negative impact on profits unless they are lowered in proportion to the tax rate.

3.2.1. Assumptions based on the new Tax Act and projecting the ex-day behavior

Since the JGTRRA set the capital gains tax rate equal to the tax rate on dividends, and we assume that long-term traders make up the large percentage of traders. We further assume that the Premium will move closer to one and be higher after the tax code change than before.

The corporations' incentive to trade in order to capture the dividend has been lowered as well since the marginal rate of substitution between the advantage of dividends and capital gains has been narrowed.

3.3. Hypothesis

There are two assumption or two possible outcomes of this study. One is that the long-term trading hypothesis holds, the other is that instead short-term traders, the market itself and corporate traders dictate the price movement of stocks around the ex-dividend date. The first assumption would assume a higher Premium for the period after the tax code change and a Premium close to one after May 28th when the tax change was enforced. One could still see a Premium slightly below one since taxpayers could defer their tax payments by holding on to their security. By the principles of the time value of money, money today is worth more than money tomorrow due to inflation, etc.

So a reduction in money today by paying taxes now hurts an individual investors more than deferring his tax payments into the future, so as long as capital gains are not taxed higher than dividends, a slight dividend aversion should remain present even after the tax code change.
If we find results that the Premium moves up and towards one, it would indicate that the long-term trading hypothesis holds some truth to it, we say some at this point because no model accounts for the irrational behavior of investors and results can merely be seen as an indication. On the other hand, if the Premium does not change or even becomes lower, this could be an indication for other factors and short-term traders as price makers around the ex-dividend date. For example, corporations are the only ones profiting from dividends, and if they remain the only active traders around the ex-dividend date, the Premium could actually move in the opposite direction of what the long-term trading hypothesis predicts. Either way, we can only make speculative assumptions after the results since there is no way to accurately know who traded on or around the cum and ex-dividend date.

4. Literature Review

As mentioned earlier, dividends and capital gains have only been taxed at the same rate once before, during a brief period in time from 1988 till 1990, after the tax reform act of 1986. In his paper "Ex-Dividend Day Stock Price Behaviour: The Case of the 1986 Tax Reform Act", Roni Michaely analyzes stock price behavior around the ex-dividend date, and more specifically the effects the tax reform had on the price change of common stock. In his paper, he finds that this tax change had no effect on the ex-dividend stock price behavior and concludes that his findings are inconsistent with the long-term trading hypothesis, as it is mentioned above with long-term traders and not short-term traders influencing the stock price post dividend. The belief remains that short-term traders and corporate traders determine the price changes seen in stocks after the ex-dividend date. Still, we know that those types of traders are of lower quantity and that we cannot say for sure who trades on and around those dates, we can only infer for whom it would rationally make sense to trade around dividend distribution dates. More to that point later on. Now we will look at the study from 1990 by Roni Michaely in more detail.

4.1. Overview

The TRA or Tax Reform Act changed the landscape of taxation like never seen before. This may sound a bit dramatic, but in fact, since 1921 when taxation on capital gains was introduced, capital gains have had a preferential tax treatment, which was now eliminated for the first time in history. Roni Michaely starts by mentioning past studies and the results of those studies, from the basic Miller and Modogliani one from 1961, which states that in perfect capital markets dividend policy is irrelevant for a firms value, to Elton and Gruber study from 1970 which states that due to a difference in taxation of individuals, various clienteles form with preferences regarding dividend-yielding stocks and that the marginal tax rate of the marginal investor could be implied. Later studies[7] show that no specific group of traders influences the ex-dividend day price. Various other studies [8] found no conclusive evidence either to the effect of differential taxes on the ex-dividend day price. His paper represents a golden opportunity to evaluate further the hypothesis surrounding taxes and ex-dividend day price behavior because a new scenario can be analyzed, a scenario which, simplifies the whole process a lot.

The paper itself analyses the effect of the new US tax law on the ex-dividend price behavior of common stocks. The TRA gradually narrowed the gap between taxes on dividends and taxes on capital gains from 1986 until they were eventually set equal in 1988. So Michaely expects, that the price change will be a larger portion of the dividend in 1987 than in 1986 and a larger portion in 1988 than in 1987. He further expects the relationship of the dividend to the price change of the stock to be closer or equal to one in 1988. To his surprise he finds that the dividend aversion of long-term individual traders did not affect the stock price behavior in any significant way, to use his word: " We find no evidence for a negative tax effect either before or after the enactment of the 1986 TRA. To the contrary, our evidence is consistent with the hypothesis that the ex-day price is influenced primarily by short-term traders and corporate traders who favor dividend income over capital gain income". [9]

The remainder of the paper is structured into three sections. First, the hypothesis, second the data and methodology, and third, the empirical results. We will recall those parts in the next section.

4.2. Framework

[7] from Heath and Jarrow (1988) and Michaely and Vila (1991)
[8] Poterba (1986) & Karpoff and Walking (1988) among others
[9] (Michaely R., 1990)

The framework builds on the fact that in a risk-neutral world without taxes the stock price should drop by the amount of the dividend, since the dividend represents a cash outflow and by extent a reduction in the value of the firm backing the stock. As we know, the stock price is simply the market capitalization of a firm divided by its number of outstanding shares, so in a perfect world whatever cash amount the firm decided to distribute as dividend, that cash amount is now no longer held within the company. The reduction in cash is simultaneously a reduction in value, and since the cash amount represents the dividend payments, the stock will be less valuable by the amount of all dividend payments. This can be written as the following equation $P_{cum} - D = P_{ex}$.
In a world where capital gains and dividends are taxed at different rates, this equation can be modified to represent the preferential tax treatment of capital gains (It could also represent a tax benefit for dividends). Ignoring overnight interest, the equation is the same as in the section above

$$P_{ex-1} - t_c * (P_{ex-1} - P_0) = P_{ex} - t_c * (P_{ex} - P_0) + D * (1 - t_o)$$

$P_0 = tax\ base\ or\ purchase\ price$

P_{ex-1} = stock price on the cum-day

D = dividend

P_{ex} = stock price on the ex-day

t_c = tax on capital gains

t_o = tax on ordinary income/dividend

In Michaelys paper, as well as in other papers prior to his, this is the formula used to analyze price behavior around the ex-dividend date. His framework continues in a similar fashion to the one mentioned in Section 3. So instead of repeating everything, we will state the most important takeaways: the formula can be rewritten as

$$\frac{P_{ex-1} - P_{ex}}{D} = \frac{1 - t_o}{1 - t_c}$$

moreover, for short-term traders as well as long-term traders after the tax reform the formula could be expressed as follows

$$\frac{P_{ex-1} - P_{ex}}{D} = 1$$

If we look closer, we can also see that when rearranged the formula again becomes the same as if we would assume no preferential tax treatments and perfect capital markets.

Since there is no real formula to account for irrational trade behavior and market imperfections, this is also the formula we are left with to analyze the stock price behavior. Further, it is mentioned that we should not forget about the role corporate traders play in tax-motivated trading. Since for them, dividends are usually tax preferential, they could somewhat reverse this trend of a Premium[10] approaching one.
From all of this, two primary hypotheses arise, one is the long-term trading hypothesis, which sees a Premium below one for as long as dividends are taxed higher than capital gains due to an aversion of dividends. The other hypothesis is that short-term and corporate traders, or after the tax reform, corporate traders are the market price-makers when it comes to trading around the ex-dividend date. Either way, the TRA could give some indication on who trades around the ex-dividend date or offer that the evidence of who trades around the ex-dividend date is still inconclusive.

4.3. Data & Methodology

Lets now take a look at the data and methodology implemented by Roni. Ronis dataset includes the stock prices of all dividend-paying firms of the NYSE from 1986 till 1989 with the exception for stocks which paid their dividends in foreign currencies. Since the sample size falls within the time of the very volatile recession of 1987 the sample was divided into three parts, a pre-crash sample including the months till October, a post-crash one for the months October till December and the last sample for the entire 1987 year. The authors note that the precision of the post-crash months' results can be interpreted as highly questionable due to the extreme volatility in the stock market. Therefore the 1987 sample just includes the month before the crash in October.
In his analysis, the ex-dividend price is underestimated by the daily expected return to account for any mispricing. The aforementioned closing price is adjusted by the expected daily return in the following way, where $P^*_{Ex,i}$ is the adjusted closing price and $E(R_i)$ is the expected daily return :

$$P^*_{Ex,i} = \frac{P_{ex,i}}{(1 + E(R_i))}$$

[10]. The Premium is defined as the formula mentioned above on this page, which is the price change between the cum-dividend date and the ex-dividend date divided by the dividend.

Furthermore, the author adjusts for the heteroskedasticity in the Premiums variance, which is done in two ways. First, for the variance in the security itself and second for the size of the dividend yield, higher-priced stock movements will impact the Premium in a greater way than stock with smaller price tags. This effect is magnified when these stocks only distribute small dividends. This will be clarified a bit more in the later part of the research of this paper. So what happens, when you weight the cases accordingly is that smaller dividends are attributed with a higher weight while larger stock (stock with high prices) are weighted less. This helps to make a better comparison of the whole sample and adjust it to a uniform standard.

4.4. Results

As mentioned before the paper focused on the long-term trading hypothesis which yields two primary indications, one is that Premiums after the tax code change should be higher, the second is that the Premium should approach one and eventually become equal to one after 1989. What Roni Michaely finds is that the Premium in 1986 is already above one and that it does not significantly move in the subsequent years. In fact, the Premium drops from 1.054 to 1.028 in 1987 and to 0.998 in 1988 before rising again to 1.009 in 1989. These results do not indicate or support the existence of the long-term trading hypothesis. Below we find a table from the Michaely study with the mean Premiums, their standard deviation, and their z-values in their respective years.

Table II

Comparison of the Ex-Dividends Premiums in the Two Tax Regimes. The Premiums Are Adjusted for Heteroskedasticity

	Mean[a]	S.D.	*Z*-value[b]
1986	1.054	1.318	2.320
1987	1.028	1.229	1.330
1988	0.998	0.821	0.168
1989	1.009	1.131	0.527

[a] Using the OLS market model.
[b] Test of the null hypothesis that the mean premium equals one.

Figure 4: Roni results mean Premiums

To further evaluate and explain these results, Michaely compares his findings to prior results from Elton and Grubers (1970) as well as Kalays (1982). While the external environment is consistent in the studies, the 1966 Premiums from Elton and Gruber's study differ significantly from the one in 1987 with an average Premium of 0.838 to 1.028 which coincides with the long-term trading hypothesis that Premiums would rise after a tax code change. If we look at the Premium from 1986 though, there is no significant difference at the 1% level. The Fisher sign test further indicates that the number of Premiums below and above one is not significantly different in the periods 1986-1987, which again contradicts the long-term trading hypothesis. In addition, we do not see a significant correlation between the dividend yield ad the price drop in that period. These results all imply that there are more factors than tax changes and dividends that contribute to a change in price drops over the long run on the ex-dividend date. A lot of changes can happen over the course of 20 years in the financial world that would lead to short-term traders trading more frequently around the ex-dividend date. These include, but are not limited to lower transaction costs, more and better-educated traders and innovations in financial instruments. This fact is also inherently important when we look at the results of this study later on. A lot has changed in the financial world between 1986 and 2002 that could impact the result of our study in different ways from the one in 1986.

Next, in the study from 1986, the results of different dividend yield groups are analyzed to determine a possible significance or relevance for different yield groups. What the study

shows is that the Premium is U-shaped, meaning that the highest and lowest dividend-yielding stocks experience the highest Premiums. There are ten equal groups with the lowest two groups having Premiums of 1.850 and 1.100 respectively, and the two highest dividend-yielding groups having Premiums of 1.224 and 1.069. All the other groups have mean Premiums far below one.

The 9th and 10th percentile Premiums are consistent with the preferential corporate tax treatment of dividends in respect to capital gains. Overall the results do not give conclusive evidence for why stocks in the higher or lower percentiles experience higher Premiums than the middle decile groups. Maybe one can imply that low yielding stocks are indeed held by people who enjoy a preferential tax treatment of capital gains and are dividend averse, but to us, this implication is very far fetched.

Below is the table with the results of the dividend groups again with their mean Premiums, standard deviation, and z-values.

Decile	yield[a] (%)	Mean	S.D.	Z-Value[b]	% above One	Z-Value
			Panel A (1986)			
1	0.17	1.850	8.87	1.71	54.4	1.56
2	0.33	1.100	5.67	0.33	49.7	−0.11
3	0.45	0.684	4.32	−1.30	48.4	−0.55
4	0.56	0.801	3.27	−1.10	45.9	−1.45
5	0.68	0.645	2.33	−2.77	44.7	−1.90
6	0.78	0.713	1.94	−2.65	43.1	−2.46
7	0.92	0.821	1.86	−1.72	42.2	−2.79
8	1.2	1.017	1.33	0.23	48.4	−0.55
9	1.65	1.224	0.87	4.61	64.1	5.03
10	2.45	1.069	0.62	1.97	59.1	3.24
			Panel B (1987)			
1	0.15	0.846	9.74	−0.28	49.2	−0.27
2	0.31	1.310	5.13	1.10	56.0	2.14
3	0.41	0.836	4.10	−0.73	49.2	−0.27
4	0.50	1.017	3.34	0.09	52.3	1.04
5	0.61	0.520	3.05	−2.86	43.5	−2.36
6	0.71	0.810	2.00	−1.73	47.4	−0.93
7	0.85	0.858	1.73	−1.49	45.9	−1.48
8	1.16	0.952	1.39	−0.63	46.8	−1.15
9	1.67	1.185	0.79	4.26	59.5	3.46
10	2.71	1.070	0.58	2.18	57.4	2.69

[a] The dividend yield is defined as the dividend amount over the cum-day price.
[b] Test of the null hypothesis that the mean premium equals one.

Figure 5: Roni results dividend groups

The study ends with the conclusion that the TRA should not have changed the incentive for short-term or corporate traders to buy or sell around the ex-dividend date and therefore according to the long-term trading hypothesis the stocks should have experienced higher

Premiums. Since this was not the case, the author concludes, that the change in the tax code does not affect long-term individual investors influencing the ex-dividend stock price behavior. The author also states that he believes the development of financial markets and instruments has had a more significant impact on stock price behavior than the tax code change.

5. Data and Methodology

5.1. Data

Now that we have looked at a previous example of a similar study, it is time to look at the data we have gathered and how that data was evaluated and analyzed. The dataset was collected through the Wharton database and is a merged document from the research platforms Compustat and CRSP. Our dataset is comprised of all the dividend-paying stocks from the S&P500 Index from January 2002 till December 2004, which covers around 400 stocks in total. For the sake of comparability, only stocks that were present in the S&P500 throughout the time from 2002 till 2004 were considered in the dataset. Meaning every company that dropped out of the index between 2002 and 2004 was not considered in the analysis. Companies who were missing vital information regarding dividends, stock prices, or expected daily returns were further excluded from the dataset. The final dataset covers 361 companies.

5.1.1. Description of Dataset

For those 361 companies, we looked at the closing prices before and after the ex-dividend date in relation to the amount of the dividend and calculated the aforementioned Premium for each stock. The sample contains 3850 events with 1703 events coming before the tax code change and 2147 events taking place after the JGTRRA. We also created a shorter subset for the three months prior and post the tax code change, which includes 282 events before and 334 events after the tax code change. This was done to single out the immediate impact of the tax change since more extended periods could allow for more disturbance and bigger dilution impacts from other factors influencing the stock price behavior.
The first dataset gives us a large enough sample to cover the full impact of the new circumstances also with a longer future outlook in mind, while the second much smaller set was used to specifically look at the changes in the immediate time following the tax code change. Together both sets should be sufficient to provide some conclusive evidence to

whether or not taxes on dividends play a significant role in determining the ex-dividend stock price.

5.2. Methodology

5.2.1. Explanation of the Model

To gain a better comprehensive understanding of the methodology used to analyze our dataset, we must recognize specific distraction factors that can arise when evaluating our data and which need to be adjusted for. First, the ex-dividend closing price is underestimated by the expected daily return, second is the problem of the uneven distribution of premia across different price sizes, or in other words the heteroscedasticity of the Premiums variance. As a third problem, one might consider the fact that two independent variables might not only have an effect on the dependent variable but on each other as well. Since financial variables usually interact with each other, the assumption of interacting independent variables, when it comes to the outcome results of this study can be presumed. To account and adjust for these difficulties, we made some modifications to better interpret the results of the data set and obtain a more realistic undiluted outcome.

5.2.2. Adjustments for daily return

The expected return is described as the profit an investor anticipates to make on an investment over a given time period. It is usually calculated by multiplying the probability of an outcome by the return of such an outcome. The returns are usually based on historical data and are no guarantee for future returns, they are merely a weighted average of historical returns. Still, we need to factor them into our model, hence they give some indication about what investors expect the stock to do or in which direction they expect it to move.

In our original dataset from the Wharton database, we obtained the closing prices of stocks after the ex-dividend date. These prices are underestimated by the expected daily return since investors would expect the price of a stock to move over the course of a day and the dividend payment is already factored in at the opening price of the stock on that date. To better illustrate this, let us imagine a stock with a price of €101 before the ex-dividend date, a dividend of €1 and an expected return of 1% daily (I know this number is very very unrealistically high, but it helps to better illustrate the example). We assume no taxes in this example. So if we consider the Modigliani Miller theorem, the opening stock price on

the ex-dividend day should be €100, which is the price minus the dividend. At the end of the day, at closing of the markets we expect the price to be back up at €101, the €100 opening day price plus the 1% return on the stock (€100*1%=€1). So you can see if we theorize that the stock price drops by the amount of the dividend and we look at the closing price we would find our theory to be wrong because we didn't account for what could happen within trading-day hours at the markets, yet if we look at the opening price, our theory would look way more convincing and true, but still would leave out investors "believes" of what the stock price might do on that day. Since we only obtain the closing prices for every individual stock, we need to factor out the daily return. This is done by applying the following formula to receive the adjusted closing price, which better represents the price drop truly caused by the dividend payment:

$$P^*_{ex,i} = \frac{P_{ex,i}}{(1 + E(R_i))}$$

E(R_i) represents the expected daily return of each stock i.
The expected return was also obtained from the Wharton database and adjusted for the expected daily return, which was done by scaling the return over a the given time period to account for the daily expected return, e.g. if the expected return of a stock is 3% over 100 trading days we divide the 3% by 100 to obtain the expected daily return, which we then used with the aforementioned formula to receive our adjusted closing price for every stock.

5.2.3. Weighted OLS and heteroscedasticity

The second problem that we encountered is the problem of an uneven variance across the Premiums or the problem of heteroscedasticity across stock sizes. Stocks with higher prices tend to deviate further away from the mean than smaller priced stocks.
Before we dive into this problem in more detail, we quickly want to explain what heteroscedasticity means. As you might have guessed, heteroscedasticity is the opposite of homoscedasticity. Both describe the distribution of a sample set and how it deviates from the mean. If in a sample set the deviation from the mean is the same across every value of the set it is homogeneous if, on the other hand, the standard deviation is not the same across every value we speak of a heterosceadious dataset.

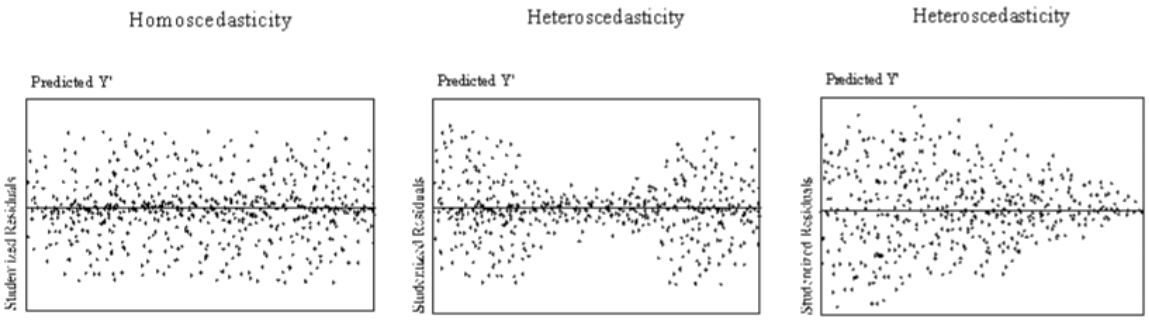

Figure 6: ResearchGate Hetero & Homoscedasticity plots

Now back to why this is a problem for us. As mentioned before, higher-priced stocks with smaller dividends deviate less from the mean than smaller sized stocks after the dividend has been paid out. That also means that the effects dividends play on higher priced stocks are lower. The same goes for the size of the dividends itself. Low priced stocks with relatively high dividends will experience the greatest effects. In the sample set, every stock was weighted by its exposure to the size of the dividend and the stock price itself. That means the Premiums are weighted inversely to their disturbance and in proportion to their dividend yield (relationship of stock price to dividend amount). First, we regressed Y onto our X variable, so our Premium is in correspondence to our price drop, to generate our unstandardized residuals. Next, we compute the absolute values of the residuals to create estimators of the standard deviation. Then we regress the absolute value of the residuals onto the fitted Y variables and save these fitted values. To compute the weights, we need to divide one by the fitted square values, so 1/(fitted values)^2. Last we need to rerun the regression using the weight variable corresponding to each case. Now every price drop variable will be weighted accordingly to its contribution to the overall outcome of the model.

5.2.4. Moderation & Mediation Analysis

So why moderation and mediation analysis? The strength or effect to which dependent variables influence outcomes may well depend on more than just the direct effect they have on the independent variable. To better illustrate this, let us look at an everyday example: We would say that sunshine directly affects how many people eat ice cream at the park that day, right? If the sun shines for more hours, more people are going to eat ice cream at the park. This seems like a fairly obvious, logical, and straightforward conclusion and intuitively there is not much to argue there, but what the analysis is lacking is the effect of

temperature. Sunshine might have a direct effect on the number of people eating ice cream, but if we think about it, that fact is influenced by the temperature on that day. More people will eat ice cream on a sunny 30-degree day than on a sunny day with the temperature in the low 10ths. Also, more people will eat ice cream on a sunny 30-degree day than on a cloudy 30-degree day. What one might take away from this example is that the temperature regulates the effect sunshine has on the number of people eating ice cream on a given day, hence having an indirect effect on the outcome variable. To analyze this, we introduce moderation and mediation analysis.

Simply put, moderation refers to the change in strength of the relationship between two variables due to a third variable called the moderator. A perfect example for this would be the effect designation has on salary. A more senior job title, more experience, etc. leads to a higher salary, but moderation variables, like gender, might have a significant moderating influence on that, since females often get paid less for the same job with same educational background. It goes without saying that there can be more than one influencing moderator to a problem, as has been shown for this exact issue.

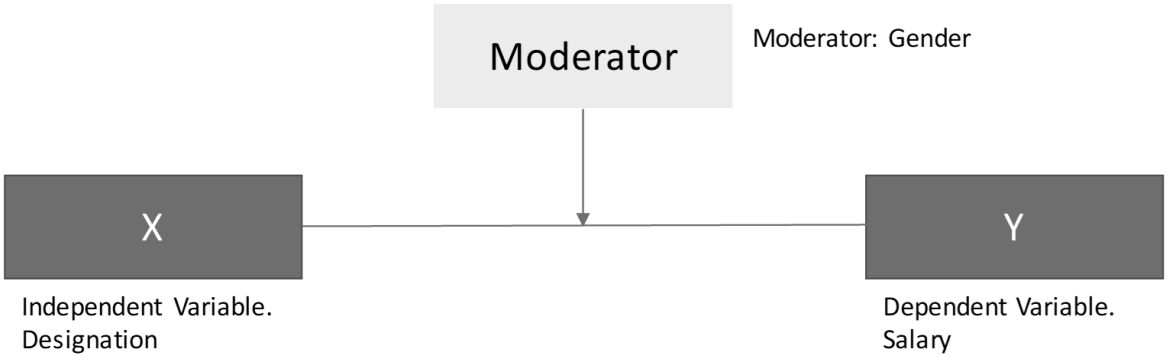

Figure 7: Moderation Model

To sum up, moderators are variables that influence the strength of an effect of one variable on another.

Now we will move on to the more complicated issue, which is mediation. Mediation analysis measures the indirect effect that variable X has on variable Y via mediator M. The "Sobel Test" then measures the significance of that effect; it serves as a t-test for mediation analysis.

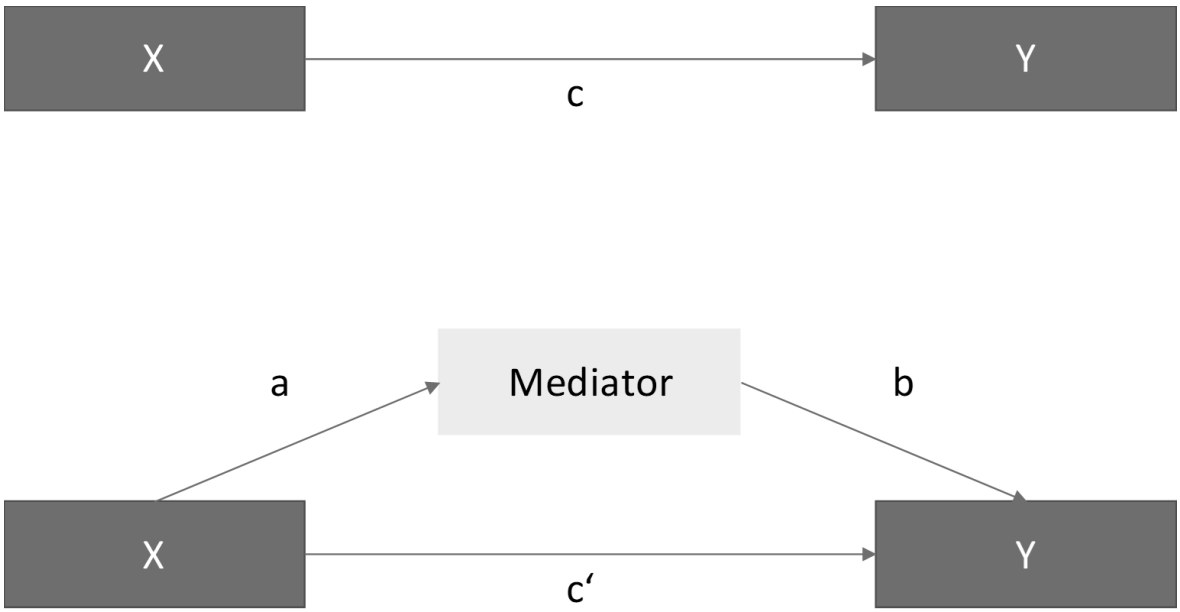

Figure 8: Mediation Model

c = Total effect
c'= Direct effect
a*b = indirect effect

The total effect is the effect from X on Y when M is not included, while the direct effect is the effect from X on Y when M is included. The indirect effect is the combined effect from X on M and M on Y, where a and b are unstandardized beta weights. Since the indirect effect is expressed as a times b, which is the unstandardized beta, we need to convert them to standard beta weights to gain a better grasp on the mediation effects. You can partially or fully standardize the indirect effect, the difference is that the partially standardized effect does not take the variation of the independent variable into account. To fully standardize the indirect effect, we need to multiply the partial standardized indirect effect with the standard deviation of the predictor/dependent variable (Hayes, 2008).

Partially standardized effect = a*b/ standard deviation of DV
Fully standardized indirect effect = (a*b/ standard deviation of DV)* Standard deviation of IV.
Running a mediation analysis, we also obtain different ratios of the indirect effect explaining its significance or strength on the outcome.

- ***a*b/total* effect** tells us the % of the indirect effect in the total effect

- **a*b/direct effect** tells us the % of the indirect effect of the directs effect
- **Proportion of variance explained by the indirect effect** R^2indirect = R^2 mediator – (R^2 mediator and predictor - R^2 predictor) or R^2 M = R^2 Y,M – (R^2 Y, MX - R^2 Y,X)

  Where,

  R^2 M = Proportion of variance explained by indirect effect

  R^2 Y,M = Proportion of variance explained by mediator

  R^2 Y, MX = Proportion of variance explained by mediator and predictor

  R^2 Y,X = Proportion of variance explained by predictor

Here an example from Preacher & Kappa Kelly[11]

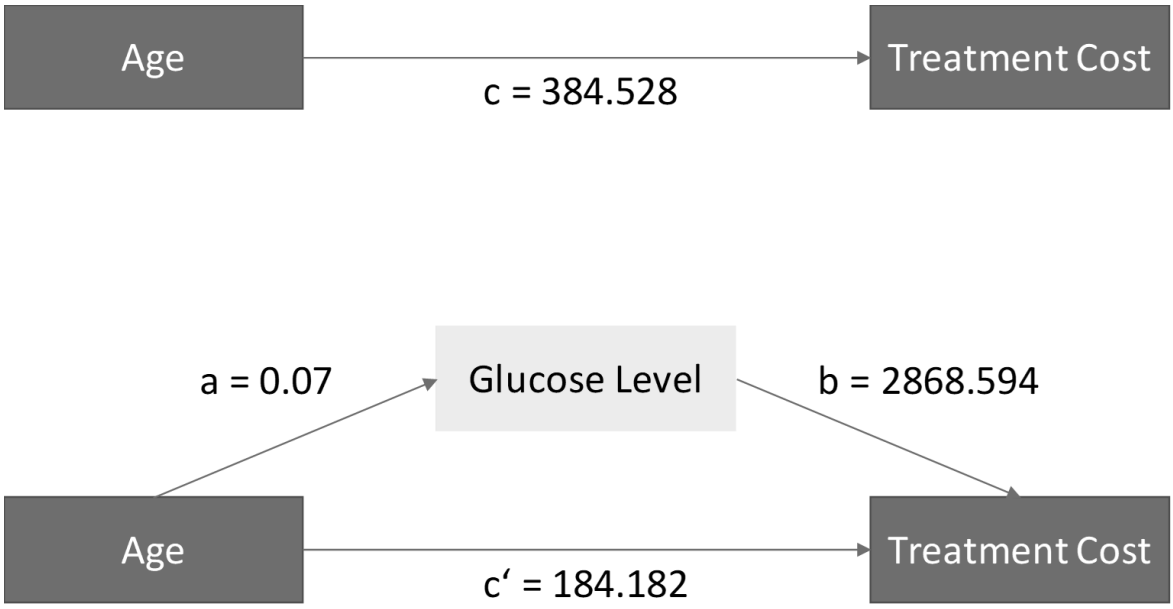

Figure 9: Mediation Example

As we can see in the example above, indirect effects can play a significant part in explaining the outcome of a regression analysis.

Now, there is no rule that says there cannot be more than one mediator or that you cannot combine mediator and moderator models.

[11] (Preacher, 2011)

While SPSS does not offer a direct option for mediation and moderation analysis, there is a plug-in that can and was for the evaluation of this data installed within SPSS that allows for various types of moderation and mediation models. The ones used will be explained in further detail in the section covering the result of the analysis since there were a couple of ideas on what and in which way dividends, ex-day price, dividend yield, expected daily return and price drop interact which each other to explain the eventual Premium.

6. Results

6.1. Statistical Results

We performed several statistical tests to analyze the data set and get a deep and full understanding of the data as a whole. First, we will present the descriptive statistics, where we will look at the mean Premium for both periods, before and after the tax code change. We will also look at different groups in terms of dividend yield, price and time (a before and after analysis, where we just look at the three precedent and subsequent months with regards to the change in the tax code). We then take a look at the results from the t-test to determine the statistical significance of our findings. Afterwards, we take a look at the correlation between the different variables and run a weighted regression analysis. Then we check out mediation and moderation models to look at the direct and indirect effect of our variables and finally we compare the descriptive results to data from 2007 right before the financial crises to get a feel for what possibly really drives the prices of securities.

6.1.1. Descriptive Statistics & Hypothesis testing (t-test)

If we first look at the descriptive statistics as a whole, that means we don't yet differentiate between the before and after-tax effect we see that our Premiums range from negative 22 to about positive 24, that in it of itself is giant gap and we know that a deviation this extreme from the mean is likely to be caused by more variables than taxes, affecting the

price drop of a stock. Overall, across all 3713 events, we see a mean Premium of 0.68, a 95% confidence interval ranging from 0.49 to 0.86, a 5% trimmed mean of 0.71 and a median value of 0.77. All of the above-mentioned values are far below a Premium value of 1, which at this point is not too surprising since we expected the Premium to be lower than one before the tax code change and higher afterwards with a gradual increase over time. However, if we assume the mean Premium to be about one after the change in the tax code, the Premium prior would need to be about 0.5, to explain the mean overall Premium (2002-2004) of around 0.7 to 0.75, which seems like a very low number. If we take a look at the variables on the other side of the equation, namely the dividend and the price drop, we see mean values of 0.22 for the dividend and 0.17 for the price drop with the 5% trimmed mean not far off and the median for both variables slightly lower at 0.19 and 0.15 respectively. If we plug those variables into our Premium function, we obtain results that match up quite nicely with our values for the Premiums.
Now let us evaluate the results for the sets in the before and after groups.

	Overall (Zscore)	Before (Zscore)	After (Zscore)
Premium			
Mean	0.68 (3.48)	0.97 (0.30)	0.45 (5.98)
Median	0.77	0.97	0.66
5% Trimmed Mean	0.71	1.00	0.48
Dividend			
Mean	0.22	0.21	0.22
Median	0.19	0.19	0.19
5% Trimmed Mean	0.20	0.20	0.20
Price drop			
Mean	0.17	0.20	0.15
Median	0.15	0.17	0.13
5% Trimmed Mean	0.17	0.20	0.14

Table 1: Mean and Median Premiums

ZScore = mean difference/standard difference

Mean difference = sample mean - population mean

Standard difference = Standard deviation/square root of n

Therefore if we compare the Zscore to the ones we find in the z-table (for an alpha of 0.05 and 0.01), we do not reject the null hypothesis for the overall and after period, while we do reject the null if we solely look at the before period.

The results from the table above show that the level of the Premiums is not affected by the change in taxes in the way we expected it to change.
While the Premiums before the tax code change were close and not significantly different to one, they dropped tremendously after the implementation of the new tax law from 0.97 to 0.45, so the exact opposite of what would support the long-term trading hypothesis. To see what drives the change in Premiums we do not have to look very far, while the dividends remain the same over the course of both periods, the price drop is significantly lower in the period after the JGTRRA. So while there was an upswing in the stock market evident by lower price drops, dividends remained constant for the immediate time after taxes on dividends and capital gains taxes were set to 15%. As we will later see, the JGTRRA eventually had its effects of raising dividends when we take a look at the 2007 sample data.
To test the significance of our findings, we conduct an independent sample t-test where we compare our mean value to the expected mean value of 1. That is we expected it to be lower before the tax code and closer or equal to 1 after. We obtain a t-value of -0.202 for the before period and a t-value of -4.715 for the after period. However, for the after period, we reject the null hypothesis, meaning that our value for the after period is significantly different from 1, not that that was not obvious before. For the before period, we do not reject the null hypothesis stating that our mean value is not significantly different to our "population" mean of 1. Below in Table 2, you will find the relevant statistical measurements of the t-test analysis.

Test Value = 1

T	Df	Sig. (2-tailed)	Mean Difference
-0.202	1621	.840	-0.03008
-4.715	2090	.000	-0.55280

Table 2: T-test Results

We also checked and ran an analysis for the significant difference in means between the two groups (the before and after group). Even though it is obvious that the result probably will not deviate from the result of the one-sample t-test since we compared the difference to a mean of 1 and one groups mean was not statistically different from one. In addition, we conducted an additional significance test for datasets, which are not normally distributed like ours. Our data though is large enough to conduct a t-test for normally distributed samples as well.

The results of the independent t-test show that our groups are not homogeneous so we need to compare the test results for “equal variances not assumed." We find that there is a significant difference between the two groups, with the before group reporting a higher Premium on average.

APA style:

An independent sample t-test reported a significant difference in Premium reported between a before and after group, t (3278.666) = 2.760, p<.005. The before group reports an average higher Premium of (M=.552 SD= .189) as compared to the after group.

The next test is the Mann-Whitney(U) test, which is used to evaluate differences between two independent groups that are non-normally distributed. When running the non-parametic test, we first need to check if our two groups have the same distribution shapes. This assumption is met in our case and we can look at the empirical results. The Mann-Whitney test rejects our null hypothesis so we can conclude that the median, which is used for non-parametic tests, of the two groups is significantly different at the .05 level. The median for the before group is .968 and the median for the after group is .659 as shown in Table 1 on the prior pages.

Above we stated that we believe the change to be a result of a change in price drop and not a change in dividend. To test this, we ran the same test for both variables, the price drop and the dividend with the results, that the median price drop in both groups is significantly different while the dividend is not. This furthers strengthens our assumption that the lower price drop caused the Premium to move down. In the conclusion section, we further elaborate on the point to why the average price drop might be lower after the tax code change. However, the general impression is that the JGTRRA indeed caused an economic upswing which led to an immediate rise in stock prices, but a change in dividends occurred with a bigger time lag evident by higher dividends in the mid-2000s.

Now that we have established that the average Premium became lower we need to look at different stock characteristics and determine the effects on each group, for example we

split the dataset into four equally distributed price, EPS and dividend yield groups and compared their results to see which group was most affected by the tax change and if we could imply a trend. In the table below, you will find the results for the price group, the EPS group, and the dividend yield group. For every case the group 1 contains the lowest quartile of values, group 2 contains the next 25% and so on(e.g.for price, the 25% of stock with the lowest price are in group 1, and the 25% stocks with the highest price are in group 4, same goes for EPS and dividend yield groups). We can see that the Premium drops significantly for the higher price groups before the change in taxes, from slightly higher than 1 to below 0.7 for stocks with the highest price. This would imply that stocks with lower prices are affected more by the dividends the stock pays out. Intuitively this seems very logical since investors tend to react more severely to bigger changes in stock prices. Imagine a €100 stock paying a 10 cents dividend and a €10 stock paying a 10 cents dividend, obviously the latter will experience a bigger effect and by extent investors might want to caption the benefits of trading such stock, while with the €100 stock, the arbitrage opportunity might be so negligible it can be ignored or if including transaction cost might not exist at all. After the tax change, the Premium jumps all over the place and does not really give a good indication of whether higher-priced stocks are less sensible to dividend payouts. The EPS groups do not display too much interesting information for the "before" time period and show an increasing trend in the “after” period, increasing from 0.42 for the first group to about 0.74 for the group with the highest earnings per share. The dividend groups do not give much indication about a trend in the "before" period, but in the “after” period” stocks with a higher dividend yield have a significantly higher Premium. This would mean that stocks with higher dividends experience proportionally higher price drops than lower dividend-yielding stocks. So investors would interpret paying out higher dividends, instead of keeping the money in the business, as a negative sign. This makes sense to some extent since at the beginning of a bull market there are a lot of investment opportunities and the money could be better spend on investment projects to further grow the business and increase the businesses value in that way instead of distributing a dividend to shareholders.

Period	**Price Groups**	**Median Premium**	**EPS Groups**	**Median Premium**	**DIV Yield Groups**	**Median Premium**
Before	1	1.0311	1	0.8596	1	1.3389

	2	1.0719	2	1.0776	2	0.8711
	3	0.8711	3	1.0926	3	0.7745
	4	0.6865	4	0.8750	4	1.0036
	Total	0.9688	Total	0.9741	Total	0.9688
After	1	0.6136	1	0.4179	1	-0.7526
	2	0.7497	2	0.6136	2	0.3333
	3	0.5740	3	0.7017	3	0.7453
	4	0.6781	4	0.7401	4	0.8095
	Total	0.6588	Total	0.6579	Total	0.6588

Table 3: Median Premium by groups for before and after time period

Another thing we did is look at the mean Premium from 2002 to 2004. After a somewhat steady period before Q2 in 2003, the Premium dropped massively in Q2 of 2013 and even became negative in Q3 of 2003. To explain the inverse effect of what we thought would happen to the Premium we looked for other drivers that kept prices rising after May 23rd, 2003 and found that there was an immense spike in earnings growth in 2003 that could have caused stock prices to rise even immediately after dividends have been paid out. This again would speak for the fact that total economic growth or stock price momentum ultimately trumps the effect dividends have on stock prices after 2000. Besides, lower taxes, and by extent, higher marginal transaction costs could also steer investors away from trying to catch the dividend Premium by trading around the ex-dividend since it might barely exist anymore.

Below you will find two charts, further illustrating the points made above.

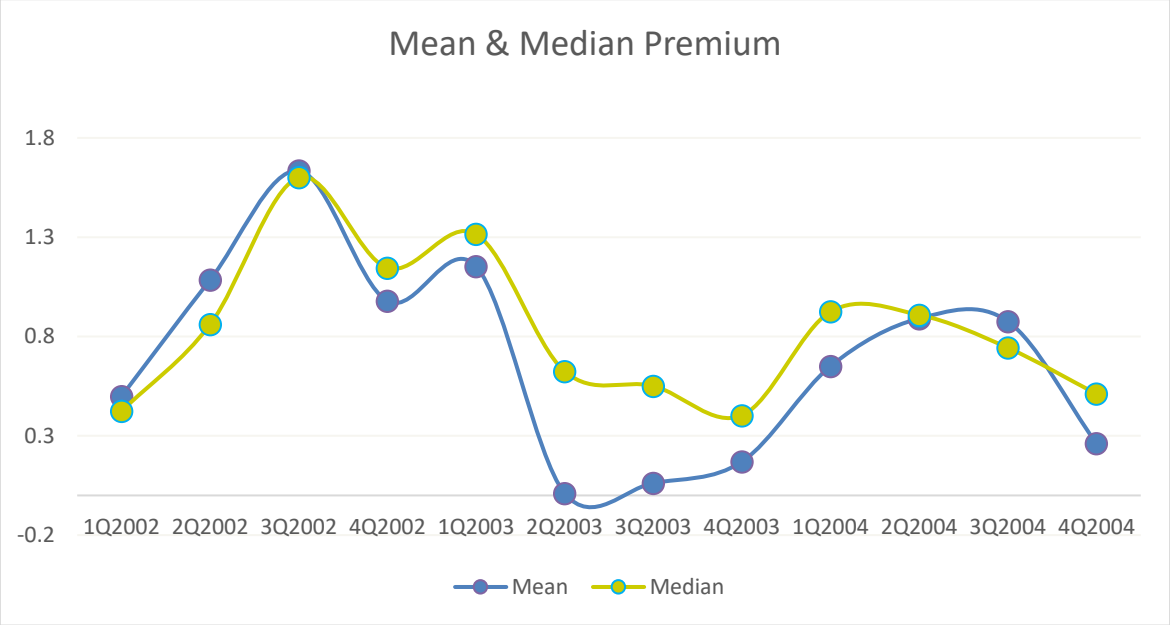

Figure 10: Mean & Median Premium 2002-2004

Figure 11: Earnings Growth per month 2000-2008

6.1.2. Correlation

For the results to be meaningful and relevant in explaining our outcomes, we need to check if a correlation exists between the main drivers of the analysis. In our case, the price drop of a stock and the dividends paid out by the underlying company significantly correlate at the 1% level, meaning the correlation effect is highly essential and present. Since our dataset is not normally distributed, we ran the non-parametric Correlation test to obtain Spearman's rho. Dividends and the drop in price are weakly positively correlated at 0.253 with an R squared of 0.057, meaning dividends only explain a tiny portion of the price drop of a stock, 5.7% to be exact. This is in line with our values and explanations from

before. We also observe that the correlation and R squared are higher after the tax code change. The R squared jumps from 0.034 to 0.081 and the correlation from .206 to .298. The increase is not tremendously significant and at these low levels could be deemed fairly irrelevant.
The correlation also does not change that much right around the time when the JGTRRA was implemented, staying around .300 for the months March till August 2003. From March till May 23rd the R Squared is 0.106 and for the time after, till the end of August 2003, the R squared is 0.069. All indicators for a weak connection between dividends and price drops in that time span. Also, this could mean that when stock market-relevant and economic changing news are announced, more behavioral aspects take control of the stock market and its movement, evident by an even lower explanation of correlation right around the dismissal of the new tax bill.

6.1.3. Weighted Regression Analysis

Since we observed heteroskedasticity between the price drop and the observed Premium we needed to perform a weighted least squared regression analysis to account for the weight each variable should have in determining the results of the overall model.
To do so, we assigned a weight to each variable, and later on, ran a regression where each variable is assigned to its corresponding weight variable. While running the original regression model gives us Premium $= c + \beta x1 + \beta x2 = 0.774 + 5.922x1 - 5.149x2$, the weighted regression results in Premium $= c + \beta x1 + \beta x2 = 1.01 + 5.910x1 - 6.178x2$. So if dividends indeed would be equal to price drops, we would nearly receive our constant value, which we expected to be one. Plugging in the means for x1 (Price drop) and x2 (dividend), we receive the mean Premiums for each period. As you can see in the table below, there is not a great deviation between the weighted analysis and the normal regression. Also, both regressions produce an R^2 of more than 50%.

mean Premium			mean Premium weighted	
before	**After**		**before**	**After**

0.878656	**0.5196334**		**0.878656**	**0.526434**

Table 4: Mean & Median Premium weighted and not weighted

6.1.4. Mediation and Moderation

As said above, independent variables might influence each other, and as such, there might be a direct effect on the dependent variable and an indirect effect. Hence there is hardly an effect from dividends on price drop, we chose not to include a mediation analysis here since the outcome will not change much. We ran and tested several ideas regarding mediation and moderation analysis but did not see the added value in them, helping us explain our results. (In fact, we ran a couple of mediation/moderation analysis with, e.g., the moderator "dividend yield" between the dividend and the price drop but did not obtain any meaningful and altering results or for that matter different result than from the standard OLS regression analysis)

6.1.5. Comparison to 2007 bull market results

All those results from above seemed a bit strange and out of the ordinary to us, so in order to further elaborate on the outcome, we ran another analysis for the year 2007, the time right before the financial crisis and at the height of the bull market. The two pictures on the next page show the scatter plot with the corresponding regression line and the R squared. While the two equations are almost identical and would on average state that the price drop is identical to the dividend, the variance is simply too large to honestly say that the dividend can be a predictor for the price drop of a stock these days. And that goes for both, the periods from 2002-2004 as well as for 2007.

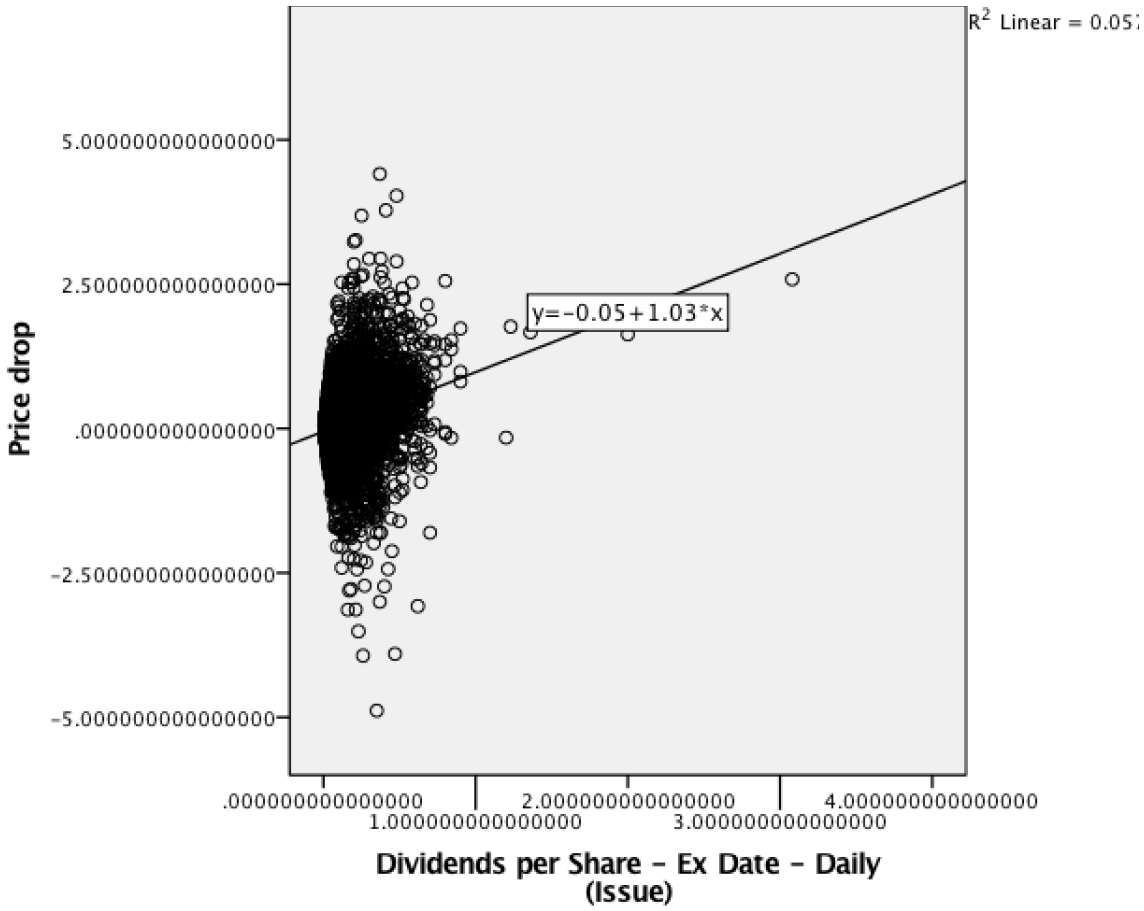

Table 5: Regression 2002-2004

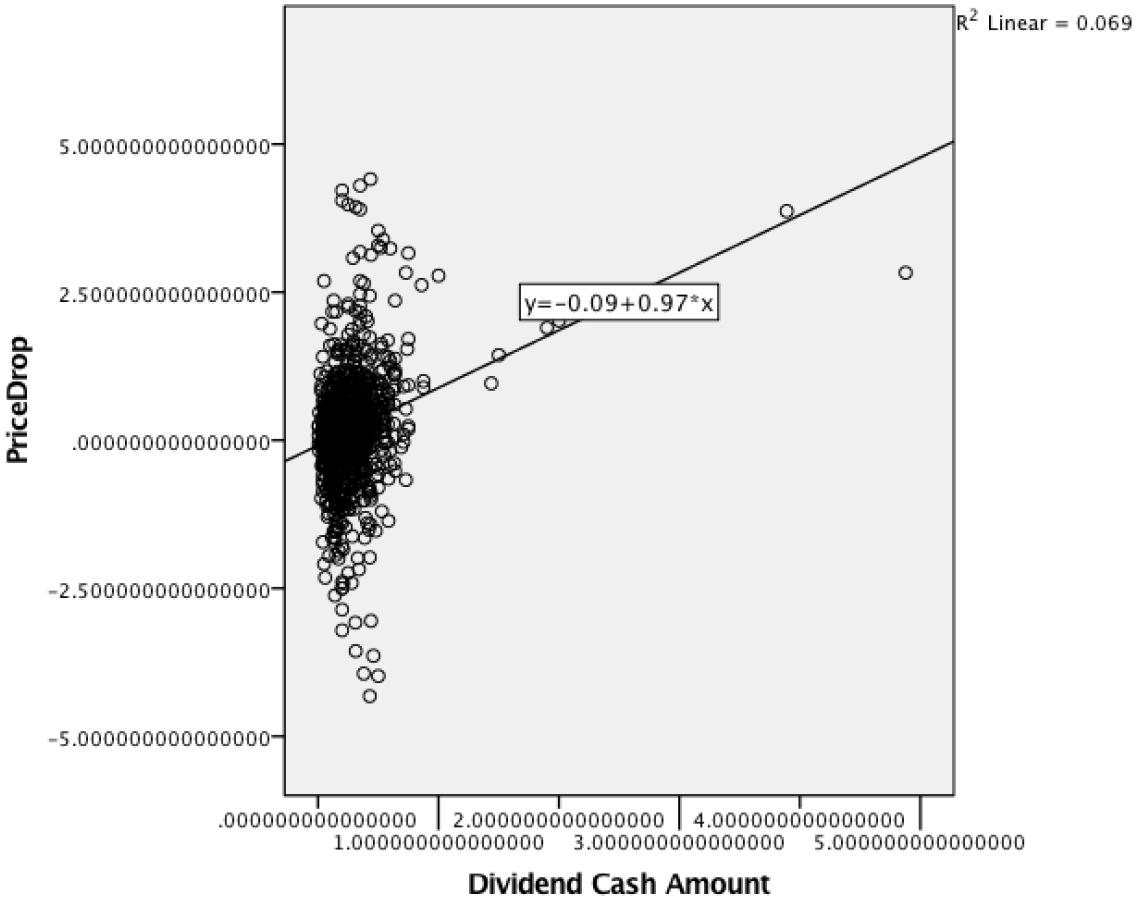

Table 6: Regression 2007

7. Conclusion and Implications

No matter from what angle or perspective we look at the data, two things become relatively clear. First, the Premium moves away from a mean of 1 after the tax code change, opposite of what we expected and second the dividends only influence the price drop of the corresponding stock in a minor fashion. So in conclusion, we can say that the results of the mean Premium would be a more significant indicator if dividends and price drop would pose a higher positive correlation between each other during the time span of our dataset from 2002-2004. Since this is not the case, we cannot draw a clear conclusion, that any type of investor is a price-maker around the ex-dividend date but moreover that other factors influence the price drop around the ex-dividend that are not the dividend itself.
If however, we could solely look at the mean Premium change we would conclude that short-term traders and corporations are the price-makers around the ex-dividend date, since everyone else might have stopped trading on this particular date since there is no more advantage in doing so. However, since there is no high correlation, we cannot say this with any certainty.
To analyse or figure out what drives the stock price in general and more so at the ex-dividend date is not part of this paper, yet we tried to intuitively reason and explain what might have caused the Premium, or the relationship of price drop to dividend to decrease after the tax code change, which more or less eliminated the preferential tax treatment of capital gains in relation to dividends. The first thing that comes to mind is what the JGTRRA initially intended to do, to spark an economic upswing and encourage more people to buy stocks and encourage companies to issue more dividends in the future to reward shareholders. What we can see in our data, that price drops after dividends issuance declined, while the cash amount of dividends stayed about the same after May 23rd, 2003. So we would imply that the stock market became bullish again after evidence surfaced that the government tried to stimulate the economy causing positive momentum in the stock market, which has been known to explain a good amount of investor returns.
While an upswing in stock prices was an immediate consequence of the new administration, a rise in dividends experienced a small time lag in comparison.
Eventually, they rose to a higher level, as intended by the JGTRRA, but the price drop remained the same on average, with a median of 0.17 compared to a median of around 0.25 for dividends.

The tax act itself might have caused a lot of economic changes, and the stock market is not a true representative of logical behavior in bullish times. Also, investors might have already started to focus long term, and frequently trading stock is not part of such a strategy.

Since taxes have been lowered overall, and presumably transaction costs stayed the same or proportionally increased with regards to taxes, another intuitive idea becomes that not everybody trades around those dates since transaction costs have a bigger impact now in comparison to possible tax savings. This is even more so the case if you intend to repurchase the stock afterwards since its price has been rising and you would like to keep owning that particular stock that has been rising in value. A round trip of trading would very likely cost you more in transaction costs than it saves you in taxes. Also, if most people do not benefit from trading around that date or are reluctant to do so and rather hold on to their stock or buy more, it becomes harder to find trade partners for the ones that still could benefit from trading around that date.

Another point is that people are not rational and we can only infer who might be the traders on the ex-dividend date. Since there is only a small percentage of traders who could profit from trading around the ex-dividend date and for some of them, namely corporations it is not their main line of business, we may not know their exact impact on the stock price. Let us assume that for example, a corporate trader buys a stock to receive the tax-exempt dividend, the seller of the stock does not necessarily need to be an investor, who is dividend averse but just someone who wants to sell his or her security anyways. Then again, if there is only one group left which profits from selling but there is none left that profits from buying, the demand and supply is shifted and for every buyer, there will not be a seller.

To round up, we believe that the change in mean Premium was caused by an upswing in the economy and positive momentum in the stock market paired with fewer incentives to trade around the ex-dividend date to capture possible tax benefits and that the real determinant of changes in stock price regardless of the date is momentum, the underlying values of a stock and the economic environment.

7.1. Drawbacks

There are some drawbacks to this work, which became evident during the analysis and writing of this paper. One surely is, since dividends do not seem to be a great indicator for stock price drops anymore, the variable: "Premium" might also not be a great indicator of which type of traders trade and profit from trades around the ex-dividend date anymore.

Another interesting fact that is missing is the volume traded around the ex-dividend date and how it changed after the adjustments to the new tax law. Moreover, one could have looked at the stock price a couple of days prior and after the ex-dividend in order to determine its overall market trend. All these are factors we would try to incorporate in any further analysis on this topic, although it seems somewhat pointless since obviously more variables and to a stronger extent influence, the stock price in general and those are the ones that should be included in any further studies related to this topic.

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The bibliography contains all sources the paper refers to. If several papers are cited by one author, they are sorted by publication year. Each item in the bibliography ends with a period.

Appendix

An Appendix should be included if applicable.

Formulas

CumEx Transaction equation

$$P_{ex-1} - t_c * (P_{ex-1} - P_0) = P_{ex} - t_c * (P_{ex} - P_0) + D * (1 - t_o)$$

$P_0 = \ tax\ base\ or\ purchase\ price$

P_{ex-1} = stock price on the cum-day

P_{ex} = stock price on the ex-day

D = dividends

t_c = tax on capital gains

t_o = tax on ordinary income/dividend

Rearranged CumEx Transaction equation

$$\frac{P_{ex-1} - P_{ex}}{D} = \frac{1 - t_o}{1 - t_c}$$

Adjusted closing price formula

$$= \frac{P_{ex,i}}{(1 + E(R_i))}$$

SPSS Output

Explore

Before and After Tax code change

Case Processing Summary

	Before and After Tax code change	Cases				
		Valid		Missing		Tot
		N	Percent	N	Percent	N
Dividends per Share - Ex Date - Daily (Issue)	Before	1622	100.0%	0	0.0%	1622
	After	2091	100.0%	0	0.0%	2091
Price drop	Before	1622	100.0%	0	0.0%	1622
	After	2091	100.0%	0	0.0%	2091
Premium	Before	1622	100.0%	0	0.0%	1622
	After	2091	100.0%	0	0.0%	2091

Descriptives

	Before and After Tax code change			Statistic	Std
Dividends per Share - Ex Date - Daily (Issue)	Before	Mean		.212848952000000	.0036
		95% Confidence Interval for Mean	Lower Bound	.205674930000000	
			Upper Bound	.220022974000000	
		5% Trimmed Mean		.201983285000000	
		Median		.190000000000000	
		Variance		.022	
		Std. Deviation		.147304380000000	
		Minimum		.010000000000000	
		Maximum		.900000000000000	
		Range		.890000000000000	
		Interquartile Range		.190000000000000	
		Skewness		1.045	
		Kurtosis		1.140	
	After	Mean		.221240603000000	.0038

		95% Confidence Interval for Mean	Lower Bound	.213618760000000	
			Upper Bound	.228862445000000	
		5% Trimmed Mean		.207077369000000	
		Median		.190000000000000	
		Variance		.032	
		Std. Deviation		.177720415000000	
		Minimum		.004500000000000	
		Maximum		3.080000000000000	
		Range		3.075500000000000	
		Interquartile Range		.200000000000000	
		Skewness		4.030	
		Kurtosis		45.801	
Price drop	Before	Mean		.202390886000000	.0189
		95% Confidence Interval for Mean	Lower Bound	.165214816000000	
			Upper Bound	.239566955000000	
		5% Trimmed Mean		.206359115000000	
		Median		.172201582000000	
		Variance		.583	
		Std. Deviation		.763337165000000	
		Minimum		-3.901329323000000	
		Maximum		4.031379254000000	
		Range		7.932708576000001	
		Interquartile Range		.793289241000000	

		Skewness		-.138	
		Kurtosis		2.307	
	After	Mean		.149282984000000	.0144
		95% Confidence Interval for Mean	Lower Bound	.120870972000000	
			Upper Bound	.177694996000000	
		5% Trimmed Mean		.143280563000000	
		Median		.132382266000000	
		Variance		.439	
		Std. Deviation		.662490017000000	
		Minimum		-4.884990283000001	
		Maximum		4.407645963000000	
		Range		9.292636247000000	
		Interquartile Range		.605966604000000	
		Skewness		.078	
		Kurtosis		6.489	
Premium	Before	Mean		.969917284000000	.1487
		95% Confidence Interval for Mean	Lower Bound	.678094632000000	
			Upper Bound	1.261739936000000	
		5% Trimmed Mean		1.002612479000000	
		Median		.968862351000000	
		Variance		35.904	
		Std. Deviation		5.992001847000000	
		Minimum		-22.723608500000000	

		Maximum		24.711703880000000	
		Range		47.435312380000000	
		Interquartile Range		4.491562028000001	
		Skewness		-.051	
		Kurtosis		3.466	
	After	Mean		.447198198000000	.1172
		95% Confidence Interval for Mean	Lower Bound	.217277431000000	
			Upper Bound	.677118965000000	
		5% Trimmed Mean		.486436968000000	
		Median		.658809088000000	
		Variance		28.742	
		Std. Deviation		5.361120211000000	
		Minimum		-22.708158570000002	
		Maximum		24.330711140000002	
		Range		47.038869710000000	
		Interquartile Range		3.354529011000000	
		Skewness		-.093	
		Kurtosis		4.903	

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Means

Notes

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Case Processing Summary

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Premium * Div_Groups	3713	100.0%	0	0.0%	3713	100

Premium * EPS_Groups	3704	99.8%	9	0.2%	3713	100

Premium * Price_groups

Premium

Price_groups	Mean	Std. Deviation	Median	Grouped Median
1.00	.817350818000000	6.251442904000000	.849373761000000	.849373761000000
2.00	.977150001000000	4.891524261000001	.905792607000000	.905792607000000
3.00	.500667580000000	5.552401783000001	.681745006000000	.681745006000000
4.00	.407186061000000	5.825391304000000	.682361942000000	.682361942000000
Total	.675544645000000	5.650566236000000	.766524197000000	.766524197000000

Premium * Div_Groups

Premium

Div_Groups	Mean	Std. Deviation	Median	Grouped Median
1.00	.248537702000000	9.987416970000000	.207628764000000	.207628764000000
2.00	.675919600000000	5.020426303000001	.588028777000000	.588028777000000
3.00	.816142677000000	2.940656743000000	.754979349000000	.754979349000000
4.00	.901277344000000	1.871553792000000	.883688201000000	.883688201000000
Total	.675544645000000	5.650566236000000	.766524197000000	.766524197000000

Premium * EPS_Groups

Premium

EPS_Groups	Mean	Std. Deviation	Median	Grouped Median
1.00	.599695204000000	6.614686764000000	.603604855000000	.603604855000000
2.00	.946813508000000	5.646040097000000	.769999108000000	.769999108000000
3.00	.548849117000000	5.092802297000000	.834962158000000	.834962158000000

4.00	.593748606000000	5.167776840000000	.797549281000000	.797549281000000
Total	.673624205000000	5.656135415000001	.767651906000000	.767651906000000

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SORT CASES  BY BeforeAfter.
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Means

Notes

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	N of Rows in Working Data File	3713
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	Cases Used	Cases used for each table have no missing values in any independent variable, and not all dependent variables have missing values.

Syntax		MEANS TABLES=Premium BY Price_Groups Div_Groups EPS_Groups /CELLS=MEAN STDDEV MEDIAN GMEDIAN.
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	Elapsed Time	00:00:00.00

Case Processing Summary

		Cases				
		Included		Excluded		Tota
Before and After Tax code change		N	Percent	N	Percent	N
Before	Premium * Price_groups	1622	100.0%	0	0.0%	1622
	Premium * Div_Groups	1622	100.0%	0	0.0%	1622
	Premium * EPS_Groups	1620	99.9%	2	0.1%	1622
After	Premium * Price_groups	2091	100.0%	0	0.0%	2091
	Premium * Div_Groups	2091	100.0%	0	0.0%	2091
	Premium * EPS_Groups	2084	99.7%	7	0.3%	2091

Premium * Price_groups

Premium

Before and After Tax code change	Price_groups	Mean	Std. Deviation	Median	Groupe
Before	1.00	.869371481000000	6.160644486000001	1.031146777000000	1.0311
	2.00	1.371928187000000	5.593486575000000	1.071943620000000	1.0719
	3.00	1.131782587000000	6.465690892000001	.871132048000000	.87113
	4.00	.391355682000000	5.642783636000001	.686580280000000	.68658
	Total	.969917284000000	5.992001847000000	.968862351000000	.96886
After	1.00	.765102494000000	6.347654871000001	.613609657000000	.61360
	2.00	.634378522000000	4.163291416000000	.749730474000000	.74973
	3.00	.037302473000000	4.724969599000001	.574008782000000	.57400

	4.00	.41604575200000	5.929804151000001	.67814360400000	.67814
	Total	.44719819800000	5.361120211000000	.65880908800000	.65880

Premium * Div_Groups

Premium

Before and After Tax code change	Div_Groups	Mean	Std. Deviation	Median	Groupe
Before	1.00	1.00427046200000	10.724302790000000	1.33893881500000	1.3389
	2.00	1.06266153600000	5.597436719000000	.87113204800000	.87113
	3.00	.84657864500000	3.289425174000000	.77453924900000	.77453
	4.00	.97691600800000	2.364553968000000	1.00365656500000	1.0036
	Total	.96991728400000	5.992001847000000	.96886235100000	.96886
After	1.00	-.27016278600000	9.424657981000001	-.75266543800000	.75266
	2.00	.40272289500000	4.554593587000000	.33352457600000	.33352
	3.00	.79248280600000	2.640842503000000	.74534175800000	.74534
	4.00	.83018609400000	1.239637233000000	.80950061800000	.80950
	Total	.44719819800000	5.361120211000000	.65880908800000	.65880

Premium * EPS_Groups

Premium

Before and After Tax code change	EPS_Groups	Mean	Std. Deviation	Median	Groupe
Before	1.00	.80057946000000	6.649009497000001	.85961868600000	.85961
	2.00	1.37219306900000	6.106322895000001	1.07759722600000	1.0775

	3.00	.819349944000000	5.810932711000000	1.092686375000000	1.0926
	4.00	.829844380000000	5.013195461000001	.875033256000000	.87503
	Total	.970414344000000	5.995672069000000	.974113408000000	.97411
After	1.00	.392039569000000	6.580043562000000	.417944763000000	.41794
	2.00	.553620131000000	5.159583731000001	.613609657000000	.61360
	3.00	.364438969000000	4.534963568000000	.701750479000000	.70175
	4.00	.462847934000000	5.251094977000000	.740034633000000	.74003
	Total	.442914020000000	5.367543378000001	.657945422000000	.65794

T-TEST
/TESTVAL=1
/MISSING=ANALYSIS
/VARIABLES=Premium
/CRITERIA=CI(.95).

T-Test

Notes

Output Created		03-AUG-2019 11:36:21
Comments		
Input	Data	/Users/maxhubner/Desktop/Masterarbeit dividend/Workdataset original zscore outliers (MAIN WORKSET!!!).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	Before and After Tax code change

	N of Rows in Working Data File	3713
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST /TESTVAL=1 /MISSING=ANALYSIS /VARIABLES=Premium /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.00

One-Sample Statistics

Before and After Tax code change		N	Mean	Std. Deviation	Std. Error
Before	Premium	1622	.969917284000000	5.992001847000000	.148780671
After	Premium	2091	.447198198000000	5.361120211000000	.117240734

One-Sample Test

		Test Value = 1					
						95% Confidence Inte	
					Mean	Difference	
Before and After Tax code change		t	df	Sig. (2-tailed)	Difference	Lower	
Before	Premium	-.202	1621	.840	-.030082715800000	-.321905368000000	.261
After	Premium	-4.715	2090	.000	-.552801802000000	-.782722569000000	.322

```
SORT CASES  BY Months.
SPLIT FILE LAYERED BY Months.
SPLIT FILE OFF.
MEANS TABLES=Premium BY Months Months_adj
  /CELLS=MEAN STDDEV MEDIAN GMEDIAN.
```

Means

Notes

Output Created		03-AUG-2019 11:38:53
Comments		
Input	Data	/Users/maxhubner/Desktop/Masterarbeit dividend/Workdataset original zscore outliers (MAIN WORKSET!!!).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	3713
Missing Value Handling	Definition of Missing	For each dependent variable in a table, user-defined missing values for the dependent and all grouping variables are treated as missing.
	Cases Used	Cases used for each table have no missing values in any independent variable, and not all dependent variables have missing values.
Syntax		MEANS TABLES=Premium BY Months Months_adj /CELLS=MEAN STDDEV MEDIAN GMEDIAN.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.00

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percen
Premium * Months	3713	100.0%	0	0.0%	3713	100.

Premium * Months_adj	3713	100.0%	0	0.0%	3713	100.

Premium * Months

Premium

Months	Mean	Std. Deviation	Median	Grouped Median
1.00	.499286264000000	5.975687447000000	.424282854000000	.424282854000000
2.00	1.085437229000000	5.815954117000000	.861005887000000	.861005887000000
3.00	1.634812473000000	6.507264345000000	1.601159675000000	1.601159675000000
4.00	.978709669000000	6.220144249000001	1.145460253000000	1.145460253000000
5.00	1.153612304000000	5.440467731000000	1.315799242000000	1.315799242000000
6.00	.010810985500000	5.722084130000001	.624579065000000	.624579065000000
7.00	.062414078200000	5.817952289000000	.550742501000000	.550742501000000
8.00	.169970413000000	5.165281825000000	.402578395000000	.402578395000000
9.00	.650696823000000	5.568666829000001	.925104644000000	.925104644000000
10.00	.890737203000000	5.329405551000001	.908875257000000	.908875257000000
11.00	.876208898000000	5.258491487000001	.743357157000000	.743357157000000
12.00	.261559554000000	4.842755698000000	.511307010000000	.511307010000000
Total	.675544645000000	5.650566236000000	.766524197000000	.766524197000000

Premium * Months_adj

Premium

Months_adj	Mean	Std. Deviation	Median	Grouped Median
1.00	.499286264000000	5.975687447000000	.424282854000000	.424282854000000
2.00	1.085437229000000	5.815954117000000	.861005887000000	.861005887000000

3.00	1.634812473000000	6.507264345000000	1.601159675000000	1.601159675000000
4.00	.978709669000000	6.220144249000001	1.145460253000000	1.145460253000000
5.00	1.153612304000000	5.440467731000000	1.315799242000000	1.315799242000000
6.00	.175263920000000	5.675471953000001	.837555132000000	.837555132000000
7.00	-.029247857300000	5.704527249000001	.549588432000000	.549588432000000
8.00	.096953205700000	5.478131272000001	.424251771000000	.424251771000000
9.00	.650696823000000	5.568666829000001	.925104644000000	.925104644000000
10.00	.890737203000000	5.329405551000001	.908875257000000	.908875257000000
11.00	.876208898000000	5.258491487000001	.743357157000000	.743357157000000
12.00	.261559554000000	4.842755698000000	.511307010000000	.511307010000000
Total	.675544645000000	5.650566236000000	.766524197000000	.766524197000000

```
REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Premium
  /METHOD=ENTER Pricedrop DividendsperShareExDateDailyIssue
  /RESIDUALS DURBIN.
```

Regression

Notes

Output Created	03-AUG-2019 11:41:32

Comments		
Input	Data	/Users/maxhubner/Desktop/Masterarbeit dividend/Workdataset original zscore outliers (MAIN WORKSET!!!).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	3713
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.
Syntax		REGRESSION /MISSING LISTWISE /STATISTICS COEFF OUTS R ANOVA CHANGE /CRITERIA=PIN(.05) POUT(.10) /NOORIGIN /DEPENDENT Premium /METHOD=ENTER Pricedrop DividendsperShareExDateDailyIssue /RESIDUALS DURBIN.
Resources	Processor Time	00:00:00.03
	Elapsed Time	00:00:00.00
	Memory Required	4592 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Dividends per Share - Ex Date - Daily (Issue), Price drop[b]	.	Enter

a. Dependent Variable: Premium

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
1	.722[a]	.521	.521	3.912540561000000	.521	2016.187	2

Model Summary[b]

Model	Change Statistics	Durbin-Watson
	Sig. F Change	
1	.000	

a. Predictors: (Constant), Dividends per Share - Ex Date - Daily (Issue), Price drop

b. Dependent Variable: Premium

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61727.490	2	30863.745	2016.187	.000[b]
	Residual	56792.582	3710	15.308		
	Total	118520.072	3712			

a. Dependent Variable: Premium

b. Predictors: (Constant), Dividends per Share - Ex Date - Daily (Issue), Price drop

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t
		B	Std. Error	Beta	
1	(Constant)	.774	.106		7.283
	Price drop	5.922	.093	.743	63.455
	Dividends per Share - Ex Date - Daily (Issue)	-5.149	.400	-.150	-12.857

a. Dependent Variable: Premium

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation
Predicted Value	-29.957160950000002	24.971807480000000	.675544645000000	4.077888298000000
Residual	-22.086204530000000	22.166975020000000	-.000000000000001	3.911486394000000
Std. Predicted Value	-7.512	5.958	.000	1.000
Std. Residual	-5.645	5.666	.000	1.000

a. Dependent Variable: Premium

```
REGRESSION
  /MISSING LISTWISE
  /REGWGT=weight
  /STATISTICS COEFF OUTS R ANOVA CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Premium
  /METHOD=ENTER Pricedrop DividendsperShareExDateDailyIssue
  /RESIDUALS DURBIN.
```

```
REGRESSION
  /MISSING LISTWISE
  /REGWGT=weightmr
  /STATISTICS COEFF OUTS R ANOVA CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Premium
  /METHOD=ENTER Pricedrop DividendsperShareExDateDailyIssue
  /RESIDUALS DURBIN.
```

Regression

Notes

Output Created		03-AUG-2019 11:42:40
Comments		
Input	Data	/Users/maxhubner/Desktop/Masterarbeit dividend/Workdataset original zscore outliers (MAIN WORKSET!!!).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	3713
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.
Syntax		REGRESSION /MISSING LISTWISE /REGWGT=weightmr /STATISTICS COEFF OUTS R ANOVA CHANGE /CRITERIA=PIN(.05) POUT(.10) /NOORIGIN /DEPENDENT Premium /METHOD=ENTER Pricedrop DividendsperShareExDateDailyIssue /RESIDUALS DURBIN.
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.00
	Memory Required	4592 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed[a,b]

Model	Variables Entered	Variables Removed	Method

1	Dividends per Share - Ex Date - Daily (Issue), Price drop[c]	.	Enter

a. Dependent Variable: Premium

b. Weighted Least Squares Regression - Weighted by weightmr

c. All requested variables entered.

Model Summary[b,c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
1	.722[a]	.521	.521	1.822750170000000	.521	2016.586	2

Model Summary[b,c]

Model	Change Statistics	
	Sig. F Change	Durbin-Watson
1	.000	

a. Predictors: (Constant), Dividends per Share - Ex Date - Daily (Issue), Price drop

b. Dependent Variable: Premium

c. Weighted Least Squares Regression - Weighted by weightmr

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13399.881	2	6699.941	2016.586	.000[c]
	Residual	12326.171	3710	3.322		
	Total	25726.053	3712			

a. Dependent Variable: Premium

b. Weighted Least Squares Regression - Weighted by weightmr

c. Predictors: (Constant), Dividends per Share - Ex Date - Daily (Issue), Price drop

Coefficients[a,b]

Model	Unstandardized Coefficients		Standardized Coefficients	t
	B	Std. Error	Beta	

1	(Constant)	1.001	.106		9.424
	Price drop	5.910	.093	.747	63.500
	Dividends per Share - Ex Date - Daily (Issue)	-6.178	.401	-.181	-15.396

a. Dependent Variable: Premium

b. Weighted Least Squares Regression - Weighted by weightmr

Residuals Statistics[a,b]

	Minimum	Maximum	Mean	Std. Deviation
Predicted Value	-30.030881880000000	24.763460160000000	.676077202000000	4.066556459000000
Residual	-22.305315020000002	21.953636170000000	-.000532557226000	3.915279397000000
Std. Predicted Value[c]	.	.	.	.
Std. Residual[c]	.	.	.	.

a. Dependent Variable: Premium

b. Weighted Least Squares Regression - Weighted by weightmr

c. Not computed for Weighted Least Squares regression.