

Dividend Tax Changes and Ex-dividend  
Behaviour: The Case of South Africa

By

Michelle Chinhema

Supervised by Phillip De Jager

Presented to the Faculty of Commerce at the University of Cape Town

In Partial Fulfilment of the Requirements for the Degree of

MCom Financial Management

By Coursework and Dissertation

2014

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

## Acknowledgements

*I am heartily thankful to my supervisor Phillip De Jager, whose supervision, support and encouragement from the preliminary to the concluding level enabled me to develop an understanding of the subject. A special thanks to my family and friends who helped and inspired me during my work.*

## Plagiarism Declaration

I know that plagiarism is wrong. Each significant contribution to this thesis from the work of other people has been acknowledged through citation and reference. This thesis is my own work. I have not used the material in this thesis in any of my other essays/reports/ projects. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Signature:

Date: 20/10/2014

## Abstract

In April 2012 South Africa changed its tax system on dividends. South Africa switched from using Secondary Tax on Companies (STC) to Dividend Withholding Tax (DWT) in an effort to align with the international standards and eliminate the perception of a higher tax rate. This paper attempts to establish the role of taxes in determining the ex-dividend day share price movements by comparing the pre-tax change and post-tax change in price drop ratio (PDR). In this study, I compare the mean and median PDR before and after the April 2012 Act using a t-test and Wilcoxon Mann Whitney test respectively. Furthermore, this study employs a fixed effects regression model to analyse the PDR change on the ex-dividend day before and after the April 2012 Act. The advantage of using a fixed effects model is that it controls for omitted time-invariant predictors so that the model is not biased because of omitted characteristics. I find a significant difference in the mean and median PDR before and after the tax change. Furthermore, I find that ex-dividend prices vary systematically with taxes as predicted by Elton & Gruber (1970:68) hence supporting the tax-based explanation for ex-dividend day prices. This research is particularly interesting because this is the first tax clientele study in South Africa and the 2012 Act provides a natural experiment where the tax effect can be isolated more effectively compared with other studies that have been done before. Furthermore, this research spans over a narrow time frame thereby reducing the effect of other factors that may also drive ex-dividend day prices.

Keywords: *Dividends; Taxes; Price Drop Ratio, Clientele Effect*

# Contents

List of Tables	v
List of Figures	v
<b>1 Introduction</b>	<b>1</b>
<b>2 Literature review</b>	<b>3</b>
2.1 Tax Effect . . . . .	7
2.2 Clientele Effect . . . . .	8
2.3 Tax Regime Change . . . . .	9
<b>3 Data and Methods</b>	<b>11</b>
3.1 Data . . . . .	11
3.2 Methods . . . . .	12
3.2.1 Mean and Median Differences in Ex-Dividend Day PDRs	13
3.2.2 Regression Analysis . . . . .	14
<b>4 Results</b>	<b>19</b>
4.1 Differences in Medians and Means between periods . . . . .	19
4.2 Regression Results . . . . .	21
<b>5 Robustness Checks</b>	<b>22</b>
<b>6 Conclusion and Recommendations</b>	<b>23</b>
<b>7 Appendix</b>	<b>25</b>
<b>8 References</b>	<b>33</b>

## List of Tables

1	STC/DWT and CGT rates . . . . .	5
2	Variables used in the study . . . . .	15
3	T-test and Wilcoxon Mann-Whitney test . . . . .	19
4	Fixed Effects Regression Model . . . . .	21
5	Summary Statistics . . . . .	25
6	Correlation Matrix . . . . .	26
7	Variance Inflation Factor Test for Multicollinearity . . . . .	27
8	Heteroscedasticity Test . . . . .	28
9	Hausman Test . . . . .	29

## List of Figures

1	<i>Kernel Density Function for PDR with winsorisation at 2.5% and 97.5%</i>	13
2	<i>Plot of Residuals per Company over Time</i> . . . . .	30
3	<i>Plot of Residuals against Fitted Values</i> . . . . .	31
4	<i>Fixed Effects Heterogeneity across time</i> . . . . .	32

# 1 Introduction

In April 2012, South Africa changed its tax system on dividends (hereafter 2012 Act). Since the implementation of the 2012 Act shareholders have been taxed at a rate of 15% on receipt of dividends. This tax on shareholders is referred to as dividend withholding tax (DWT). It's a withholding tax in that the 15% is withheld from the dividend payment by a withholding agent or the company paying the dividend. Individuals and most foreign investors in South Africa must pay DWT. Entities that are exempt from DWT are South African companies, public benefit organisations and retirement funds. Prior to the 2012 Act, South African companies instead of shareholders were subject to a dividend tax called Secondary Tax on Companies (STC)<sup>1</sup>. STC came into effect from 1993 and was levied at a rate of 10% just prior to the 2012 Act. The 2012 Act therefore provides a unique and significant event to study the implications of taxes on share prices and investor behaviour.

Miller & Modigliani (1961:411) showed that shareholders are indifferent between dividends and future earnings in an economy with perfect capital markets. This implies that the share price should decline on the ex-dividend day and that the decline should equal the size of the dividend per share. If this is not the case, investors are free to exploit the price differentials and make arbitrage profits. If dividends are taxed at a higher rate compared to capital gains, then investors may require a higher pre-tax rate of return on shares which pay out dividends. According to Miller & Modigliani (1961:411), this uneven treatment of dividend tax and capital gains tax could lead to the formation of various 'clienteles' such that investors in high tax brackets hold low dividend yield shares and vice versa. Elton & Gruber (1970:68) showed that the share prices decrease by less than the dividend amount on the ex-dividend day because of tax. Furthermore they showed that higher tax rates on dividends to capital gains taxes affect share prices on the ex-dividend day and suggested that the marginal tax rates for investors in different clientele groups could be estimated from the ex-dividend price drop. Alternative explanations that challenge the tax-based explanation include the market microstructure which suggests price discreteness (Bali & Hite, 1998:127), the bid-ask spread (Frank & Jagannathan, 1998:161) and the arbitrage theory which suggests that arbitrageurs join the market and exploit any differences in prices such that remaining differences equal transaction costs (Kalay, 1982:1059).

This paper attempts to determine the role of taxes in determining share price movements on the ex-dividend day. I analyse the ratio of the price drop to dividend on the ex-dividend day before and after the 2012 Act. I examine shares that pay regular taxable dividends between April 2010 and April 2014. This period gives me 2 years prior to the tax change and 2 years after the tax

---

<sup>1</sup>With STC South Africa was one of a handful of countries worldwide with a corporate level tax on dividends.



change to compare. Price data obtained from the BFA McGregor database is used.

First, I calculate the price drop ratio (PDR) as the ratio of the price change between the cum-dividend day and the ex-dividend day to the dividend paid out. I then apply a simple t-test and Wilcoxon Mann Whitney test to see if there are significant mean and median differences in the PDR. Thereafter, I apply a fixed effects (FE) regression model to the data by regressing the PDR against period (a dummy variable for the post-tax change period) while controlling for some main drivers of PDR which are size of the company, standard deviation of the share prices and percentage institutional holding of the company.

Analysing the tax relevance versus the tax irrelevance on the ex-dividend day, the results support the tax-based explanation for ex-dividend price movements. I find a statistically significant difference in the PDR between the pre-tax period and post-tax period at the 1% level for both the t-test and Wilcoxon Mann-Whitney test. The FE regression model shows a 7.87% increase in the price drop ratio as a result of the 2012 Act.

A few factors allow me to arrive at the conclusion that institutional investors play a key role in the ex-dividend price formation and trading activities. First, most shares in South Africa are held by institutional investors (40% stake) and second, after the Act, institutional investors were the only investors exempted from paying DWT while the dividend tax on individuals and foreign investors increased marginally. I therefore observe that the hypothetical effect of tax clienteles on share prices is positive when the ownership by tax-favoured or tax exempt institutions is high.

This study contributes to literature in the following ways. First, to the best of my knowledge, this is the first tax clientele study in South Africa. Second, I am among the first few to analyse the recent tax change and its associated effects on the ex-dividend day price formation in South Africa. Third, this is a natural experiment where the tax effect can be isolated more effectively compared with the studies that were done before. Previous USA & UK studies took place when the change in tax was relatively small compared to this very large and significant change in South Africa. Lastly, I have the advantage of using fixed effects in the regression model, which compensate for omitted time invariant variables. In light of the above, I investigate a few key issues in this paper. First, is the ex-dividend day share price drop significantly less than the dividend amount? Second, does it vary systematically with tax rates as predicted by Elton & Gruber (1970:68)?

The remainder of this paper is organised as follows. In Section 2, I discuss the literature that has been done on this topic. Section 3 contains the data and methods used. Empirical results are reported in Section 4 and conclusions in Section 5.

## 2 Literature review

Modigliani & Miller (1961:411) stated that under a certain market price process (the classical random walk) in an efficient market, when taxes, bankruptcy costs, agency costs, and asymmetric information are absent, the value of a company is unaffected by how that company is financed. The systematic analysis of these assumptions led to an expansion of the frontiers of economics and finance. When the financial market is not distorted by taxes, transaction or bankruptcy costs, imperfect information or any other friction which limits access to credit, investors can replicate a company's financial actions at no cost. This theory implies that a company's market value is independent of its dividend policy and that equity-holders are indifferent about the company's financial policy (Miller & Modigliani, 1961:411). However, some years later, Bhattacharya (1979:259), John & Williams (1985), Miller & Rock (1985) and Francis, Zai & Kou (2012: 147) developed signalling theory classic models showing that, in a world of asymmetric information, better informed insiders use the dividend policy as a costly signal to convey their company's future prospect. Therefore a dividend increase signals an improvement in a company's performance, while a decrease suggests a worsening of its future profitability. Consequently, a dividend increase (decrease) should be followed by an improvement (reduction) in a company's profitability, earnings and growth. Moreover, there should be a positive relationship between dividend changes and subsequent share price reactions. The relevant assumptions are important because they set conditions for effective arbitrage.

In an economy with perfect capital markets, Miller & Modigliani (1961:411) showed that shareholders are indifferent between dividends and future earnings. This implies that the share price should decline on the ex-dividend day and that the decline should equal the size of the dividend per share. If this is not the case then investors are free to exploit the price differentials and make arbitrage profits.

If the share is sold just before the dividend at price  $P_{cm}$ , the investor's profit is the capital gain on the share, less the capital gains tax ( $t_{cg}$ ), or

$$(P_{cm} - P_0)(1 - t_{cg}) \quad (1)$$

Alternatively, if the share is sold just after the dividend at price  $P_{ex}$ , the investor's profit is the after-tax value of the dividend, plus the after-tax value of the reduced capital gain, or

$$D(1 - t_d) + (P_{ex} - P_0)(1 - t_{cg}) \quad (2)$$

For the seller to be indifferent regarding the sale, the cum-dividend and ex-dividend profits from the two strategies must be equal. Equating the two expressions above and rearranging terms, gives:

$$\text{PDR} = \frac{\Delta P}{D} = \frac{(P_{\text{cm}} - P_{\text{ex}})}{D} = \frac{(1 - t_d)}{(1 - t_{\text{cg}})} \quad (3)$$

Where:

- PDR is the price drop ratio,
- $P_{\text{cm}}$  is the cum-dividend price,
- $P_{\text{ex}}$  is the ex-dividend price,
- $P_0$  is the purchasing price of the share,
- $D$  is the dividend amount,
- $t_d$  dividend tax rate,
- $t_{\text{cg}}$  capital gains tax rate.

From the equation above, I can predict that PDRs should be directly related to the quotient  $\frac{(1 - t_d)}{(1 - t_{\text{cg}})}$ , over time. In other words, in equilibrium, ignoring transaction costs and risk, the PDR reflects the ratio of differential tax rates between dividends and capital gains.

It follows that  $\Delta P/D < 1$  when  $t_{\text{cg}} < t_d$ . Elton & Gruber (1970:68) stated that ex-dividend day PDRs are, on average, less than one. However, they also found that PDRs generally increase with the dividend yield, suggesting that investors with lower ordinary tax rates prefer higher yield shares, while those in higher tax brackets prefer lower yield shares. If  $t_{\text{cg}} < t_d$  this implies that PDRs should be less than one on average and if  $t_{\text{cg}} > t_d$ , this implies that PDRs should be greater than one on average.

The table below shows the tax rates levied on the different shareholders before and after the 2012 Act in South Africa. The theoretical price drop ratios implied from the STC, DWT and CGT rates using equation (3) are reported. The percentage changes in implied PDRs between the pre-Act and post-Act period are also reported.

Table 1: STC/DWT and CGT rates levied by SARS before and after April 2012

Shareholders	Period	STC/DWT	CGT	Implied PDR	% PDR Change
Individuals	Before	STC = 10%	40%*25% = 10%	1	
	After	DWT = 15%	40%*33% = 13.33%	0.981	1.923%
Companies	Before	STC = -	25%*50% = 12.5%	1.143	
	After	DWT = -	20%*66% = 13.33%	1.154	0.962%
Institutional Investors	Before	STC = 10%	-	0.900	
	After	DWT = -	-	1.000	11.11%
Foreign Investors	Before	STC = 10%	-(Not on Shares)	0.900	
	After	DWT = 15%	-(Not on Shares)	0.850	-5.556%

**Notes:**

Variable definitions:

Shareholders variable shows the main categories of shareholders in the South African market. These are individuals, companies, institutional investors and foreign investors.

Period variable depicts the pre-tax change period (Before) and the post-tax change period (After). STC/ DWT shows the STC (Secondary Tax on Companies) and DWT (Dividend Withholding Tax) rates levied on respective investors. CGT shows the Capital Gains Tax (CGT) rates levied on respective investors.

The Implied PDR shows the price drop ratios calculated by the given STC, DWT and CGT rates for all shareholders. Implied PDR is calculated as  $PDR = (1-t_d)/(1-t_{cg})$ . PDR variables  $1-t_d$  and  $1-t_{cg}$  are calculated using maximum personal tax rates for individual investors.

% PDR Change shows the percentage change in the implied PDR between the pre-Act and post-Act period for all shareholders.

For individual investors, STC was levied at a rate of 10% and 15% before and after the 2012 Act respectively (Haupt, 2014:34). Because individual investors do not all face the same marginal tax rates, the usual approach is to consider only the highest tax bracket. Therefore the CGT for individual investors is calculated as the product of the highest marginal tax rate (40%) and the appropriate CGT inclusion rate (25% and 33% before and after the Act respectively (Haupt, 2014:34). This gives an effective CGT rate of 10% before the Act and 13.33% after the Act. The implied PDR from these rates are 1 and 0.981 for the pre-Act and post-Act period respectively. I can therefore expect a marginal change of 1.923% in the PDR after the 2012 Act.

Companies were not subject to STC or DWT before and after the 2012 Act (Haupt, 2014:34). This is because companies served (and still serve) merely as conduits between the dividend tax payer and the South African Revenue Service (SARS). The biggest change from STC to DWT is the party (firm or shareholder) who is legally liable for the tax. While STC reduced the net asset value of the firm and hence is ultimately borne by shareholders, there are various interpretations of how the change from STC to DWT could affect prices. One interpretation is that STC would probably be reflected in the share prices on the date that the firm declares a dividend (as it reduces the net asset value of a firm). For CGT, if the owner of the property is a company or close corporation 50% and 66% of the capital gain had to be included in the taxable income before and after the tax Act respectively (Haupt, 2014:34). The top tax rates of 20% and 25% according to Haupt, (2014:34), for companies and close corporations meant that the effective tax rate paid on the capital gains for these entities was 12.5% and 13.33% before and after the tax Act. In a similar manner as above, a marginal change of 0.962% in PDR for companies is expected.

Institutional investors are large organisations which include pension funds, mutual funds, hedge funds, nominees, endowment funds, insurance companies and other trusts. Institutional investors had an STC rate levied at 10% before the Act (Haupt, 2014:34). After the Act, they were not subject to DWT (Haupt, 2014:34). CGT before and after the 2012 Act was not levied on institutional investors because CGT occurred on disposal of an asset and this excluded shares. Taking all this into account, institutional investors give the largest percentage change in the implied PDR which is 11.11%.

The STC rate for foreign investors was levied at 10% before the Act (Haupt, 2014:34). After the Act, a maximum rate of 15% was levied (Haupt, 2014:34). This was usually less than 15% because of double tax treaties which allowed that tax payable in another country could be offset against tax payable in South Africa and vice versa, thus avoiding double taxation. Foreign investors holding shares in South Africa were not subject to CGT before and after the Act. A marginal change of -5.556% in PDR for foreign investors is therefore expected.

Research on the Top 100 companies done on the Johannesburg Stock Exchange (JSE) in 2012 revealed that 24% of the shareholders in the South African market were individual investors while 40% were institutional investors and 34% were foreign investors (Moneyweb, 2012). The remaining 2% of the shareholders were the government (Moneyweb, 2012). Michaely and Vila (1995) demonstrated that the observed PDR is a function of the weighted average of all traders' preferences. Using this principle, I can derive a weighted change in PDR across all shareholders using figures in the Table 1. This weighted implied change in PDR is the PDR that I can expect to observe from the data as a result of the 2012 change in tax. It can be calculated as follows.

$$(24\% * 1.923) + (40\% * 11.11) + (34\% * (-5.556)) = 3.017\%$$

## 2.1 Tax Effect

I now discuss the literature surrounding this ex-dividend day phenomenon. It has been well documented that when a company pays out dividends, there is a noticeable drop in the share prices on the ex-dividend day because of the inherent cash outflow (Ross, Westerfield & Jaffe, 2005:7). Consistent with much of the existing literature Alm & Arefjäll (1999) asserted that the effect of ex-dividend day was the cause of two price differentiations between cum-dividend day and ex-dividend day compared to the dividend amount.

Elton & Gruber (1970:68) were one of the first researchers to state that the behaviour of share prices on the ex-dividend day was due to the effect of taxation. In 1970, they did a study to measure the clientele effect and also identify the investor's marginal tax rate by examining the average price decline on the ex-dividend day. They based their research on the data of New York Stock Exchange and discovered that the average price decline as a percentage of dividend paid was 77.7%. The ratio of the price change to dividend was less than one when personal tax rate was less than corporate tax rate (Elton & Gruber, 1970:68). Based on the tax reform act of 1986, Lamdin & Hiemstra (1993:778) established that dividends and capital gains valuations were affected by the different taxes.

Barclay (1987:31) documented strong evidence in support of tax effect and stated in his study that before confirmation of income tax in USA market, the drop of share amount was same as the amount of dividend. Other researchers like Lakonishok (1986:287), Booth & Johnston (1984:457) for Canada and Jakob & Akhmedov (2006) for Denmark have documented empirical evidence in support of the tax effect as well.

Eades, Hess & Kim (1984: 3) and Grinblatt, Masulis & Titman (1984:461) were possibly the first writers who wrote about the ex-dividend day effect on the surrounding ex-dividend days. Claesson (1987) in addition to these researchers' work did a study on the efficiency of the Stockholm Stock Exchange from January 1978 to May 1985. In her analysis, she divided the dividend by the share price on the cum-dividend day and the resulting average dividend yield was 4.25%. The average price dropped by 4.18% on the ex-dividend day. It was seen that on the ex-dividend day the price of the share was almost exactly same as the dividend paid out (Alm & Arefjäll, 1999).

Milonas et al., (2006:155), conducted research on the behaviour of ex-dividend day on share prices in the Chinese market. In his study, he used the data of companies in the market between the time periods of January 1996 to December 1998 and showed that the fall in share prices on ex-dividend day was exactly same as the amount of dividend. For examining the non-taxable sample of observations, he used four hypotheses; the raw price ratio (RPR), market adjusted price ratio (MAPR), raw price drop ratio (RPD), and also the market

adjusted price drop (MAPD). The experimental and theoretical values of the mean, median and standard deviation for RPR, MAPR, RPD, MAPD were then presented. The differences in means were tested using the t-test. The conclusion was that in non-taxable observations, the share price fall on the ex-dividend day was exactly same as the amount of dividend. For the taxable shares, the share price dropped by less than the amount of dividend (Milonas et al., 2006:155).

Other studies have provided alternative explanations for the drop in the ex-dividend price. Frank & Jagannathan (1998:161) in their studies on the Hong Kong Market observed that drop in the share price was less than the dividend amount whether dividends or capital gains were subject to corporate/personal tax. The main reason of such share price movements, according to them was the bid and ask spread (Frank & Jagannathan, 1998:161). Bali & Hite (1998:127), in their model explained that the share prices were discrete and dividends were continuous and small. Their study documented that the fall in share prices on the ex-dividend day was a not tax effect but short-term trading effect (Bali & Hite, 1998:127). Milonas & Travlos (2001) did a study on Athens Stock Exchange where both capital gains and dividends were tax-free and documented that the price of shares dropped by less than the amount of the dividend as a result of the microstructure effect, not tax effect. Brown & Walter (1986: 139) have argued that the anomalous share price behaviour extends before and after the ex-dividend day, and has implications for time-related anomalies observed for the market as a whole.

A number of empirical studies have challenged Elton and Gruber's analysis. The reasons for this can be attributed to the following two biases. First, the documented positive correlations between ex-dividend prices and taxes can be the result of an incomplete adjustment for the daily price movement and the use of closing prices on the ex-dividend day (Kalay, 1982:1059). Second, the statistical significance of the measured correlations is questionable as some of the observations are likely to be dependent (Kalay, 1982:1059). I hope to address these two anomalies when I develop the model.

## 2.2 Clientele Effect

The theory of the clientele effect is related to the idea that a company's share price depends on factors such as investor preferences on different factors like tax policies, investor demands, dividends or other policy changes that affect the company. The clientele effect implies that investors are attracted to different company policies, and that an investor will adjust his/her shareholdings in correspondence with the change in company policies. Hence the share price will move due to this adjustment (Ross, Westerfield & Jaffe, 2005:7).

Miller and Modigliani (1961:411) suggested that the clientele effect was the cause of management's unwillingness to setting an exact pay-out ratio, which would

motivate shareholders to pay unwanted transaction cost. Elton and Gruber (1970:68) argued that a company's share price would vary in relation to the demand and goal of investors in reaction to tax policies and other policies. According to this theory, investors always concern about their interest i.e. they always think about the policies of different companies and they will adjust their holdings of shares quickly, if a company changes its policy (Elton & Gruber, 1970:68)

Blume, Crockett and Friend (1974:16) and Lewellen et al., (1978:1385) carried out a study on the clientele effect and came to the conclusion that the investors who faced a high marginal tax bracket tended to buy securities that had low dividend yields and investors in a low marginal tax bracket bought securities that had a high dividend yield. Because of the significant change on the tax system in 2012, I can test this tax clientele effect in South Africa.

### 2.3 Tax Regime Change

So far I have focused on research referring to tax on ex-dividend prices in general. Now I turn to focus on research that looked at the change in ex-dividend day prices as a result of a change or an amendment to the tax system. Lasfer (1995) studied the UK stock market behaviour before and after the changes in the taxation system. The significant differentiation in taxation especially on capital gains and dividends made a positive effect on the share return but resulted in negative share returns in the absence of the differentiation. Lasfer (1995) also found a positive share return on the ex-dividend date. Barclay (1987:31) documented that the price drop ratio ( $PDR = \Delta Price / Div$ ) was close to one and stable across dividend yield quintiles before the introduction of the income tax in 1913 in the U.S. Also consistent with the tax theory, a number of studies (Lamdin & Hiemstra (1993:778); Michaely & Vila (1996:471) and Koski (1996:303)) found that ex-dividend day returns fell after the 1986 Tax Reform Act (TRA), which lowered ordinary income tax rates but eliminated preferential tax treatment of capital gains.

In contrast to the research above, Michaely (1991:845) found no significant change in ex-dividend day pricing due to the 1986 TRA, but Bhardwaj & Brooks, 1999 showed that his results were likely to have been driven by outliers. Other researchers similarly found that ex-dividend day returns declined and tax-induced ex-dividend day trading volume diminished after a 2003 tax law change that equalised personal tax rates on dividends and capital gains. (Zhang, Farrell, & Brown, 2008:105). Several other papers have examined the ex-dividend day phenomenon over extensive periods of time. Some scholars considered multiple tax law changes over three decades but were unable to draw definitive conclusions about whether ex-dividend day pricing consistently changed as expected around each tax reform (Eades, Hess & Kim, 1984:3) and (Skinner, 1993:61).



In addition to finding that the PDR and ex-dividend day returns varied systematically with taxation over a broad sample period (1926-2005), Whitworth & Rao (2009:419) found that the commonly observed positive relationship between PDR and dividend yield was stronger when the gap widened between dividend and capital gains tax rates.

Given the research above I turn your attention to South Africa, a particularly interesting case in that over that past decade, companies were subject to Secondary Tax on Companies (STC). Since 1st April 2012, Dividend Withholding Tax (DWT) replaced STC. The main objectives behind the change from STC to DWT were to align South Africa with the international standards such that the recipient of the dividend and not the company was liable for the tax relating to the dividend and make South Africa a more attractive international investment destination by eliminating the perception of a higher corporate tax rate<sup>2</sup>. Very little research has been documented to show the effects of this switch from STC to DWT on the ex-dividend price change. Toerien & Marcus (2014:895) are among the first researchers to document the effect of this 2012 Act. They investigated the effect of the tax changes on investor expected returns using the Residual Income Valuation model (RIVM). However their research did not specifically focus on ex-dividend share prices. In addition share price data from 2002 - 2007 was used and inferences made about the 2012 dividend tax.

This research setting allows me to use data on both the pre-tax change and post-tax change and allows me to draw a much stronger causal link between dividend taxes and ex-dividend day prices than has been achieved in prior studies. This is because I examine a very narrow time frame which reduces the effect of other factors (e.g. economic cyclicalities, increased or decreased demand for dividends caused by fraudulent activities, etc.) that might also drive ex-dividend day prices.

To the best of my knowledge, a tax clientele study has not been done before in South Africa thus making this research the first clientele study in South Africa. De Villiers & Lenci (2002) in a South African study documented that transaction costs were the primary explanation for the ex-dividend price drop-off in their clientele study. The 2012 Act is a natural experiment where the tax effect can be isolated more effectively compared with the studies that have been done before. Other studies performed in the USA & UK took place when the change in tax was relatively small compared to this very large and significant change in South Africa (Whitworth & Rao, 2009), (Blume, Crockett & Friend, 1974).

I observe that the tax clientele effect on ex-dividend prices has not been investigated in South Africa and I hope to shed some light on the following research question in this paper: Is the ex-dividend day share price drop significantly less

---

<sup>2</sup>STC was an additional corporate tax coupled with lower accounting profits that had to be accounted for in the Income Statement.

than the dividend amount, and does it vary systematically with tax rates as predicted by Elton & Gruber (1970:68)?

In the next section, I discuss the data used in investigating the tax effect and methods used to analyse this data.

## 3 Data and Methods

### 3.1 Data

Time series data of Johannesburg Stock Exchange (JSE) listed and de-listed companies is used to explore whether the observed tax policy change influences ex-dividend price behaviour. Share price information, ex-dividend dates, dividend amount, shareholding and daily trading volume information is obtained from BFA McGregor, a major provider of financial data for South African listed and de-listed companies. Closing prices for the 120 days surrounding the ex-dividend day, [-65 to -6] and [+6 to +65], from April 2011 (2 years prior to the tax policy change) to April 2014 (2 years after the change in tax policy) are used.

The sample of companies selected for the analysis are based on a number of criteria. Only companies that pay out taxable ordinary dividends are included<sup>3</sup>. Companies with no change in shares outstanding between cum-dividend and ex-dividend days due to share splits or other events are excluded. A share split means a company decreases the price per share by dividing existing shares into the multiple shares. For example, if a share is at R100 and a company announces a two-for-one share split, the price per share should decrease by about R50. The ownership for the investor remains unchanged except for the increase in share certificates. Therefore the market price of the share should decline proportionately to maintain the same value. The decrease in price as a result of the share split will bias the results given that I am testing for share price movements. Hence companies with share splits between the cum-dividend day and ex-dividend day were excluded. Lastly, there must be at least 120 daily returns around the ex-dividend day.

To ensure that measures of ex-dividend day prices are meaningful, the shares have to have at least one trade on the ex-dividend day or the next five trading days and on the cum-dividend day or the next five days. This gives a sample containing 1262 observations or events, 637 in the pre-tax change period and 625 in the post-tax change period. All computations are performed using Stata.

---

<sup>3</sup>Non-taxable cash dividends, share dividends and share splits are excluded

## 3.2 Methods

Prior studies have generally used one of two inversely related measures to assess the behaviour of ex-dividend share prices; the price drop ratio (PDR) and the market model adjusted price drop (MMA). For the purpose of this analysis, I will only focus on the PDR method. The price drop ratio (PDR) is intuitively appealing because it explicitly compares the two quantities of interest: the change in price at the ex-dividend date and the dividend itself. To estimate the PDR, I adopt an approach similar to Michaely (1991:845). I adjust the exdividend day closing price by the expected daily return of the share since the price drop due to the dividend is underestimated by the daily-expected return<sup>4</sup>. This market movement adjustment takes care of the incomplete adjustment for the daily price movement bias mentioned by Kalay (1982:1059). I estimate the PDR over the window [-65 to -6] and [+6 to +65], where day zero is the ex-dividend day. This gives me 120 observations around each dividend on the ex-dividend date.

$$\text{PDR} = \Delta P_i^* / D \tag{4}$$

$$\text{Where: } \Delta P_i^* = P_{i,\text{cm}} - \frac{P_{i,\text{ex}}}{1 + \hat{\alpha}_i + \hat{\beta}_i * R_i^m}$$

$R_i^m$  is the proxy market return measured using the ALSI index on the share's ex-dividend day. The coefficients  $\hat{\alpha}_i$  and  $\hat{\beta}_i$  are estimated individually for each observation by regressing the share's returns on the market index returns over the interval.

Eades, Hess, & Kim (1984:3) state that the PDR however is not without its statistical problems. The most noteworthy issues being that a given price fluctuation has a greater impact on the ratio  $\Delta P_i^* / D$  for smaller dividends. To reduce this distortion caused by outliers, the data is winsorised at 2.5% and 97.5% thereby reducing the influence not only of extremely small dividends but also of extraordinarily large price fluctuations due to major market disruptions (see Figure 1 below). Summary statistics for PDR and other variables (before and after winsorisation) to be used in my analysis are reported in Table 5 in the appendix.

---

<sup>4</sup>The natural ex-dividend price is the opening price. But the opening price is biased because all orders on the books are adjusted by the amount of the dividend. Therefore, I use closing prices and adjust for the daily return on the exdividend day (e.g., Elton et al., 2005; Lamdin and Hiemstra, 1993; and Wu and Hsu, 1996)

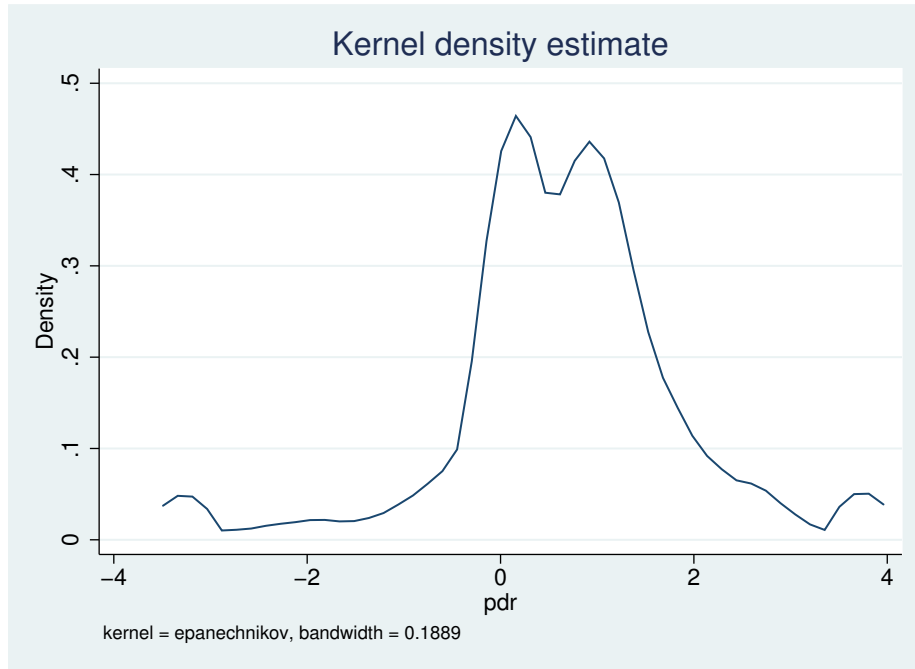


Figure 1: *Kernel Density Function for PDR with winsorisation at 2.5% and 97.5%*

The kernel density function above shows that the PDR for most companies is concentrated between 0 and 1.7. The double peak in the graph is just a reflection of fewer observations around the region with a dip.

### 3.2.1 Mean and Median Differences in Ex-Dividend Day PDRs

I test for the structural change in PDR by stratifying the sample into two categories. The two categories are the prices of shares before and after the tax regime change.

#### Mean differences in Ex-Dividend Day PDRs

In order to test for a difference in the ex-dividend day prices, I employ the t-test to compare responses from two groups. The following two assumptions are asserted. First, the share prices in each category are independent of those in the other group. Second, the distribution of PDR is normal.

The null hypothesis is that the two population means are equal i.e. the mean ex-dividend day PDR before April 2012 is equal to the mean ex-dividend day PDR after April 2012. To test the null hypothesis, I calculate the following values:  $\bar{x}_1$ ,  $\bar{x}_2$  (the means of the two samples),  $s_1^2$ ,  $s_2^2$  (the variances of the two samples),  $n_1$ ,  $n_2$  (the sample sizes of the two samples), and  $k$  (the degrees of

freedom). I then compare the calculated t-value, with k degrees of freedom, to the critical t value from the t-distribution table at the chosen confidence level and decide whether to accept or reject the null hypothesis.

I reject the null hypothesis when the calculated t-value >critical t-value thereby concluding that there is insufficient evidence to conclude that the means of the ex-dividend day prices are not equal. The reverse is true. If there is no difference between the mean ex-dividend day PDR over the two periods, this means that tax has no noticeable effect on mean ex-dividend day PDR. The reverse is also true.

### **Median differences in Ex-Dividend Day PDR**

In addition to the t-test, I use the median of the PDR. The Wilcoxon Mann-Whitney sign test tests the differences in the median PDR differences before April 2012 and after April 2012. This test is a non-parametric analogue to the independent samples t-test and can be used when one does not assume that the dependent variable is a normally distributed interval variable. Similarly, if there is no difference between the median ex-dividend day PDR over the two periods, this means that tax has no noticeable effect on median ex-dividend day PDR. The reverse is also true.

### **3.2.2 Regression Analysis**

This section develops a statistically robust method for determining the tax effect on ex-dividend day prices. This involves regressing my variable of interest, PDR, against some predictors. The tax effect is tested for using period, the post-tax period dummy variable. It is expected that if there is indeed a tax effect, then there should be a statistically significant coefficient on period. Although the tax effect is what I am trying to test, I control for other factors that may impact ex-dividend day share price changes in the regressions. The variables used in the regressions are presented in the table below.

Table 2: Variables used in the study

Category	Variable	Explanation
Dependent	PDR	Price drop ratio
Independent	period	Dummy variable for post-tax period
Control	lnmarketcap	The natural logarithm of market capitalisation
Control	sd_co	Standard deviation of share returns
Control	inst_holding	Percentage institutional shareholding in the company

**Notes:**

Variable definitions:

The table shows the dependent, independent and control variables used in the regression analysis. The dependent variable is PDR which is calculated as the ratio of the price differential between the cum-dividend day and the ex-dividend day to the dividend amount paid. The independent variable is period, a dummy variable for the post-tax period. The control variables are lnmarketcap, sd\_co and inst\_holding. lnmarketcap is the logarithm of the market capitalisation of the company on the ex-dividend day which is used as a proxy for liquidity. sd\_co is the standard deviation of the company around the ex-dividend day over the interval [-65 to -6] and [+6 to +65] and is used as a proxy for risk. inst\_holding is the percentage institutional holding of the company shares.

It has long been asserted that firm size has an influence on share returns (Cheung & Ng, 1992:1985). I control for size as a proxy for liquidity, which is calculated as the natural logarithm of market capitalisation of the company on the ex-dividend date. The natural logarithm is used in order to reduce the effect of outliers<sup>5</sup>. The assumption is that large-capitalisation shares are more liquid compared to low-capitalisation shares.

A share's relative volatility may also influence the degree to which both dividend capturers and ordinary investors are willing to trade it, thereby affecting price movements in the ex-dividend period. For each observation, I estimate sd\_co, the standard deviation of the share's returns around the window [-65 to -6] and [+6 to +65]. This is used as a proxy for risk. Other researchers use the variance of the security's return scaled by the variance of market returns or unsystematic risk (beta) Michaely & Vila (1995:471), Naranjo, Nimalendran, & Rynngaert (2000), and Dhaliwal & Li (2006).

<sup>5</sup>Natural logarithm has monotonic properties

I noted before that institutional investors hold most shares in South Africa. A variable for percentage holding by institutional investors is added to the model. Institutional holding consists of the total shareholding by funds, trusts, nominees and companies.

The efficiency and (in some cases) un-biasedness of the classical ordinary least-squares (OLS) regression model make it suitable to model the data when the assumption of data independence is met. However, instead of the OLS model, I use a fixed effects (FE) model because of its inherent ability to exploit within-group variation over time. De Jager (2008) argues for the use of fixed effects in the econometric analysis of accounting panel data when allowing for heterogeneity between companies. Baltagi (2008) supports this treatment of panel data with fixed effects. A FE model can explore the relationship between my outcome variables PDR and the predictor variable period while controlling for size, risk and institutional shareholding within each company. Each company has its own individual characteristics that may or may not influence the predictor variables. Various statistical and modelling issues that arise in an empirical implementation of this model are discussed below.

Two assumptions are used in the development of the FE model. First, when using the FE model, I assume that something within the company may impact or bias the predictor or outcome variables and I want to control for this. This is the rationale behind the assumption of the correlation between the entity error term and predictor variables. FE remove the effect of those time-invariant characteristics from the predictor variables so I can assess the predictors' net effect. The second important assumption of the FE model is that these time-invariant characteristics are unique to the company and should not be correlated with other company characteristics. Each company is different therefore the company's error term and the constant (which captures individual characteristics) should not be correlated with the others. The FE model therefore controls for all time-invariant differences between the companies, so the estimated coefficients of the FE models cannot be biased because of omitted time-invariant characteristics.

One limitation of FE models is that they cannot be used to investigate time-invariant causes influencing the PDR variable. Technically, time-invariant characteristics of the companies are perfectly collinear with the company dummies. Substantively, FE models are designed to study the causes of changes within a company and a time-invariant characteristic cannot cause such a change, because it is constant for each company (Kreuter & Kohler, 2012:2).

The fixed effects regression model is given by:

$$PDR_{it} = \beta_1 * period + \beta_2 * lnmarketcap_{it} + \beta_3 * sd.co_{it} + \beta_4 * inst\_holding_{it} + \hat{\alpha}_0 + u_{it}$$

Where:

$PDR_{it}$  is the PDR for company  $i$  and time  $t$

$period$  is a dummy variable indicating the post-tax period

$lnmarketcap_{it}$  is a proxy for liquidity for company  $i$  at time  $t$

$sd\_co_{it}$  is the standard deviation for company  $i$  at time  $t$

$inst\_holding_{it}$  is the percentage institutional shareholding of company  $i$  at time  $t$

$\beta_1 - \beta_4$  are the coefficients

$\hat{\alpha}_0$  is the constant term

$u_{it}$  is the stochastic error term

The key insight is that if the unobserved (time-invariant) variable does not change over time, then any changes in the dependent variable must be due to influences other than these fixed characteristics (Stock & Watson, 2007:2).

Multicollinearity (also referred to as collinearity) is tested for using the correlation matrix. The results (Table 6 in appendix) show low and statistically significant correlations between all the predictors with the highest correlation being -0.3920. In addition, the Variance Inflation Factor (VIF) test is also used (see Table 7 in Appendix). VIF values that are much less than 10 show that there is no collinearity between predictor variables. This takes care of the correlation bias mentioned by Kalay (1982:1059). Therefore collinearity between predictor variables is not considered a problem in our model.

The test for heteroscedasticity shows a p-value of 0 (Table 8 in sppendix). A p-value of less than 0.05 for this test indicates that I do not have homoscedastic (constant variance) error terms in the model<sup>6</sup>. I control for heteroscedasticity in the model by using the *robust* function in Stata. The *robust* function controls for all forms of heteroscedasticity; cross-sectional and panel heteroscedasticity. This means that the model contains robust standard errors. In the presence of heteroscedasticity, estimators of parameters for the fixed effects regression are still unbiased and consistent, but the standard errors are not efficient. If the standard errors are not adjusted for heteroscedasticity, I cannot use the usual t statistics or F statistics for testing my hypothesis. According to Michaely, (1991: 845), there are two source of heteroscedasticity; the security's variance and the dividend yield effect which implies that the variance of the error term is related to  $\frac{\hat{\sigma}_i^2}{(D/P)^2}$ , where  $\hat{\sigma}_i$  is the standard deviation.

I employ a Chow test to test if my data is poolable. FE models assume a difference in the intercept but similar slope across groups (in this case companies) or time. A poolability test asks if the slopes are the same across companies or time. The result gives a p-value of 0.03578, which is less than the 0.05 cut off meaning that that I reject the null hypothesis and conclude that the data is

---

<sup>6</sup>The presence of heteroscedasticity can invalidate statistical tests of significance that assume that the modelling errors are uncorrelated and normally distributed and that their variances do not vary with the effects being modelled.



not poolable. I then use the Hausman test to assess if a fixed effects model is appropriate for the data. The result of this test is shown in the appendix, Table 9. A p-value that is less than 0.05 shows that a FE model is appropriate for the data.

After fitting the fixed effects model, I plot the residuals per company over time and over fitted values. Both plots of residuals shown in the appendix (Figure 2 and Figure 3) show no particular pattern and gravitate around zero. Therefore I can be sure that the assumption of normally distributed error terms has not been violated. The plots show that the residuals over time and over fitted values are uncorrelated as they should be in a homoscedastic linear model with normally distributed errors. A plot of heterogeneity in PDR across time is also provided in the appendix (Figure 4).

Positive coefficient estimates ( $\beta_i$ ) are expected for one or more sets of implied PDRs, with their magnitudes being indicative of how much taxes impact the ex-dividend day price drop. In addition, I expect  $\alpha_1$  to be positive, depending on the importance of taxes in ex-dividend day pricing and the relative market influence of different types of investors.

## 4 Results

### 4.1 Differences in Medians and Means between periods

Results for the mean and median differences in PDR between the pre-tax change period and the post-tax change period are shown in the table below.

Table 3: T-test and Wilcoxon Mann-Whitney test results for the differences in PDR between the pre-tax change period and the post-tax change period

	Pre-Tax 1 Apr 2010 - 31 Mar 2012	Post-Tax 1 Apr 2012 - 31 Mar 2014
Mean	.5751906***	.7294936***
t-stat	-2.2083	-2.2083
Median	.6067014***	.7704403***
Wilcox p-value	0.0092	0.0092
Min	-3.302102	-3.302102
Max	3.77224	3.77223
Std. Dev	1.114784	1.353621
Sample size	637	625

**Notes:**

T-test results (for two sided p-values) are reported for testing the difference in the means equal to zero and Wilcoxon-Mann Whitney test results (for two sided p-values) are reported for testing the difference in the medians equal to zero. Data are winsorised at 2.5% and 97.5%.

Variable definitions:

PDR is defined as the cum-dividend day closing price minus the ex-dividend day closing price (adjusted by the expected daily return) divided by the dividend amount. The expected daily return is estimated using the market model with estimation over [-65, -6] and [+6, +65] days around the ex-dividend (where 0 is the ex-dividend day). The Mean is the average PDR value. The t-test is the test statistic. The Median is the median value of the market movement adjusted PDR. The Wilcox p-value is the test statistic for the Wilcoxon Mann Whitney test on the PDR. Min and Max show the minimum and maximum values respectively for the PDR in both the pre-tax change and post-tax change periods. Std. Dev is the sample standard deviation for the pre-tax and post-tax periods for the sample. Sample size shows the number of observations used for the pre-tax and post-tax periods.

\*, \*\* and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels respectively.

The results above show a statistically significant difference in the PDR between the pre-tax PDR and post-tax PDR at the 1% level for both the t-test and Wilcoxon Mann-Whitney test. The mean PDR is significantly lower than 1 before April 2012 (.5751906). Post April 2012, the mean PDR increases to .7294935. Analysing the medians generates similar results.

Given that I have a statistically significant difference in PDR, the regression results below now test to see if tax is the cause of this difference over the two periods.

## 4.2 Regression Results

The results of the regression analysis are shown in the tables below:

Table 4: Fixed Effects Regression Model

Variable	Coefficients
lnmarketcap	-0.154 [0.164]
period	0.257* [0.096]
sd_co	-0.081 [0.028]
inst_holding	-0.008 [0.015]
Constant	3.266+ [3.961]
Observations	1261
Number of Companies	231
R-Squared	0.008
Fixed Effects	Yes(Company FE)

### Notes:

This table reports company fixed effects regression results on 1261 dividends with ex-dividend dates from April 2010 to March 2012. PDR is regressed against period while controlling for lnmarketcap, sd.co and inst\_holding. Data are winsorised at 2.5% and 97.5%.

Variable definitions:

PDR is calculated as  $\Delta P_i^*/D$  where  $\Delta P_i^*$  is the market movement adjusted ex-dividend price drop. lnmarketcap is the natural logarithm of market capitalisation of the company on the cum-dividend date which is used as a proxy for liquidity. period is a dummy variable for the post-tax period. sd.co is the estimated standard deviation of the shares returns estimated over the interval [-65, -6] and [+6, +65] around the ex-date and is used as a proxy for risk. inst\_holding is the percentage institutional holding of the company shares.

Robust standard errors are reported in parentheses beneath the coefficient estimates.

\*\* p<0.01, \* p<0.05, + p<0.1 indicate statistical significance at the 1%, 5% and 10% levels respectively.

The regression above uses 1261 observations from 231 companies. The table shows that the period variable is the only significant variable in the model when controls for risk, shareholding and size have been included. Adding the

coefficient of the constant term and the coefficient of period, I observe that the price drop ratio increases by  $.257/3.266*100 = 7.87\%$  after the 2012 Act. This is a little higher than the theoretical expected PDR of 3.017% implied by the STC, DWT and CGT.

## 5 Robustness Checks

Two tests for sensitivity analysis are performed on the data. First, I repeat the tests above (t-test, Wilcoxon Mann Whitney and the fixed effects regression) when observations with a PDR of 0 have been removed <sup>7</sup>. By removing these observations, I want to determine the effect of ex-dividend prices that did not change on the ex-dividend day (PDR=0) on the overall outcome. Second, I repeat the above tests with no market movement adjustments made to the PDR. These two adjustments to the PDR give me a measure of robustness in my results. I expect to observe results consistent with the main model if removal of observations with PDR=0 and the removal of market movement adjustments have little or no effect on the PDR. If this is the case, then I can be confident in the robustness of my model. The results of the tests are reported below.

When observations with PDR equal to 0 (97 observations) are removed, I remain with 1165 observations out of 1262. Removing observations with a PDR of 0 gives higher mean and median values of 0.6308492 and 0.7069051 in the pre-Act period and 0.779119 and 0.8342547 values in the post-Act period respectively. I observe statistically significant mean and median PDR difference at the 1% level between the pre-tax and post-tax period.

The results of regressing PDR against period while controlling for size, risk and percentage institutional holding show a statistically significant coefficient for period of 0.265 at the 5% level. The coefficient for the constant term though not significant is 3.3319. This means that I expect a  $0.265/3.319*100 = 7.95\%$  increase in the PDR as a result of the 2012 Act. These results are consistent with the results from Table 4 where I observe an increase of 7.87% in the PDR. Removing observations with a PDR gives a higher increase in the PDR in the post-Act period. Because of the overall consistency in the model, the effect of PDR = 0 is very little and this assures me of the robustness of my results.

The t-test and the Wilcoxon-Mann-Whitney test when no market movement adjustments have been applied give mean and median values of 0.55768 and 0.5298246 in the pre-Act period and 0.75654 and 0.5298246 in the post-Act period respectively. Not adjusting the ex-dividend closing price by the expected daily return (no market movement adjustments), gives similar results to those shown in Table 4. The mean and median PDR are significant at the 1% level.

---

<sup>7</sup>PDRs rounded off to the nearest decimal point

Excluding the adjustment for market movement gives a significant coefficient for the period variable of 0.242 at the 1% level and a significant coefficient for the constant term of 6.720 in the fixed effects regression model. This means that I expect a  $.232/6.720*100 = 3.45\%$  increase in the PDR as a result of the 2012 Act. This value is close to the theoretical of value of 3.017%. It's worth noting that the control variables `lnmarketcap` and `sd_co` are also significant in this model. This is expected as PDRs for larger companies are more likely to be influenced by market movements.

This consistency in a positive and statistically significant coefficient on the PDR in the regressions and the significant mean and median values assures me of the robustness in my results.

## 6 Conclusion and Recommendations

This paper tests for the effect of the South African dividend tax on share price movements on the ex-dividend day. Consistent with the tax clientele theory, I find that for the overall sample period, ex-dividend price behaviour is systematically related to how capital gains and dividends are taxed. The results from the empirical study cannot reject the hypothesis that the ex-dividend price ratio is affected by the tax change in South Africa. This effect of tax on the ex-dividend price consequently affects investor behaviour.

I also find that the ex-dividend day PDR increases significantly in the post 2012 Act period. This suggests that investors recognise this tax differential between the periods and capitalise on it. Even for small liquid companies where I expect to observe a much smaller change in the PDR compared to larger companies, this effect of heterogeneous tax differentials on the PDR holds for the overall sample. In addition I have a PDR that is less than 1 which is consistent with the dynamic trading model, Michaely & Villa (1995: 471).

Before the 2012 Act, all shareholders had to pay STC. After the Act, institutional investors were the only investors exempted from paying DWT while the dividend tax on individuals and foreign investors increased marginally. The hypothetical effect of tax clienteles on share prices is positive when the ownership by tax-favoured or tax exempt institutions is high. Given the 7.87% increase in the PDR and that the most shares in South Africa are held by institutional investors, the results suggest that institutional investors play an important role in the ex-dividend price formation and trading activities. Because STC was levied on companies before the 2012 Act, no clientele effect would have been observed if STC was accounted for but not CGT.

Its important to note that some of the companies did not pay dividend tax over the part of the period of study because they still possessed STC credits. STC

credits arose from the fact that more dividends were received by or accrued to the company in the last dividend cycle than dividends declared during such a dividend cycle. Dividends to which STC credits were applied were not subject to the dividend tax. Even though this is the case for some companies, I still observe a significant tax effect on the PDR between aforementioned periods. Data regarding which companies possessed STC credits and to what extent they were used is not readily available.

Much remains to be investigated despite these contributions. My results provide strong evidence that ex-dividend day prices vary systematically with taxes. Further studies can provide insight into the effect of the tax deferral (DWT and CGT) on dividend clientele formation and on the sensitivity of the PDR to dividend yields. In addition other possible explanations are worth exploring in terms of explaining the PDR around the ex-dividend day. These include transactions costs, bid-ask spreads etc. I therefore leave this platform open to research for individuals wanting to investigate and understand more about the impact of taxes and other factors on ex-dividend day prices.

## 7 Appendix

Table 5: Summary Statistics

<b>Unadjusted for outliers</b>					
Variable	Mean	Median	Std. Dev	Min	Max
PDR	0.631258	0.6776148	2.165059	-26.67252	17.91919
lnmarketcap	22.35693	22.65054	2.272001	16.26867	27.79054
sd_co	1.970737	1.635535	1.431692	0	32.25514
inst_holding	97.36769	99.4133	5.307178	20.6229	100.2097
<b>Adjusted for outliers: Winsorised at 2.5% and 97.5%</b>					
Variable	Mean	Median	Std. Dev	Min	Max
PDR	0.6516085	0.67768148	1.240745	-3.302102	3.77224
lnmarketcap	22.35693	22.65054	2.272001	16.26867	27.79054
sd_co	1.970737	1.635535	1.431692	0	32.25514
inst_holding	97.36769	99.4133	5.307178	20.6229	100.2097

### Notes:

The table shows the summary statistics for the continuous variables used in my analysis. The table reports the mean, median, standard deviation, minimum and maximum values for each variable.

Variable definitions:

PDR is calculated as the ratio of the price differential between the cum-dividend day and the ex-dividend day to the dividend amount paid. lnmarketcap, sd\_co and inst\_holding. lnmarketcap is the logarithm of the market capitalisation of the company on the ex-dividend day which is used as a proxy for liquidity. sd\_co is the standard deviation of the company around the ex-dividend day and is used as a proxy for risk. inst\_holding is the percentage institutional holding of the company shares.



Table 6: Correlation Matrix between Predictors and the Dependent Variable

	PDR	lnmarketcap	sd_co	inst_holding	period
PDR	1.0000				
lnmarketcap	0.2068**	1.0000			
sd_co	-0.0748**	-0.3920**	1.0000		
inst_holding	-0.0279**	-0.2603**	0.0485	1.0000	
period	0.0622**	0.0736**	0.046	-0.2302**	1.0000

**Notes:**

The table shows the correlation between the predictors and the dependent variable.

Variable definitions:

PDR is calculated as the ratio of the price differential between the cum-dividend day and the ex-dividend day to the dividend amount paid. period is a dummy variable for the post-tax period. lnmarketcap is the logarithm of the market capitalisation of the company on the ex-dividend day which is used as a proxy for liquidity. sd\_co is the standard deviation of the company around the ex-dividend day and is used as a proxy for risk. inst\_holding is the percentage institutional holding of the company shares.

\*, \*\* and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels respectively.

Table 7: Variance Inflation Factor Test for Multicollinearity

Variable	VIF	1/VIF
lnmarketcap	1.27	0.788
period	1.06	0.946
sd_co	1.19	0.843
inst_holding	1.13	0.885

**Notes:**

The table shows the Variance Inflation Factor (VIF) results for testing for multicollinearity.

Variable definitions:

PDR is calculated as the ratio of the price differential between the cum-dividend day and the ex-dividend day to the dividend amount paid. period is a dummy variable for the post-tax period. lnmarketcap is the logarithm of the market capitalisation of the company on the ex-dividend day which is used as a proxy for liquidity. sd\_co is the standard deviation of the company around the ex-dividend day and is used as a proxy for risk. inst\_holding is the percentage institutional holding of the company shares.

Table 8: Heteroscedasticity Test

Variable	Coef.	Std. Err.	t	P>  t	95% CI	95% CI
lnmarketcap	-.1209	.1137	-1.06	0.2880	-.3440	.1021
period	.1875	.0764	2.45	0.0140	.0374	.3375
sd_co	-.0286	.0321	-0.89	0.3730	-.0916	.0343
inst_holding	-.0149	.0132	-1.13	0.2590	-.0409	.0110
const	4.6072	2.8697	1.61	0.1090	-1.0244	10.2388

chi2 (228) = 1.8e+08

Prob >chi2 = 0.0000

**Notes:**

The table shows the results of the test for heteroscedasticity in the model.

A p-value of 0 which is less the 0.05 cut of point shows that heteroscedasticity is present in the model.

Table 9: Hausman Test

Variable	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnmarketcap	-.1209	0.0876	-0.2086	0.1128
period	0.1875	0.1216	0.0658	0.0513
sd_co	-0.0286	-0.0246	-0.0039	0.0236
inst_holding	-0.0149	-0.0038	-0.0110	0.0118

$$\chi^2(4) = (b-B)[(V_b - V_B)^{-1}]^{\wedge}(b-B) = 6.65$$

$$\text{Prob } >\chi^2 = 0.01559$$

**Notes:**

The table shows the results of the Hausman test which tests for the suitability of a fixed effects model.

Variable Definitions:

(b) Fixed, shows the coefficients of the regression from fitting a fixed effects model for all predictor variables. (B) Random, shows the coefficients of the regression from fitting a random effects model for all predictor variables. (b-B) Difference, shows the difference in coefficients between the fixed effects model and the random effect model. S.E., shows the standard errors for the differences in coefficients.

A p-value of 0.0559 which is close to the 0.05 cut of point shows that a fixed effects model is suitable for my data.



Figure 2: *Plot of Residuals per Company over Time*

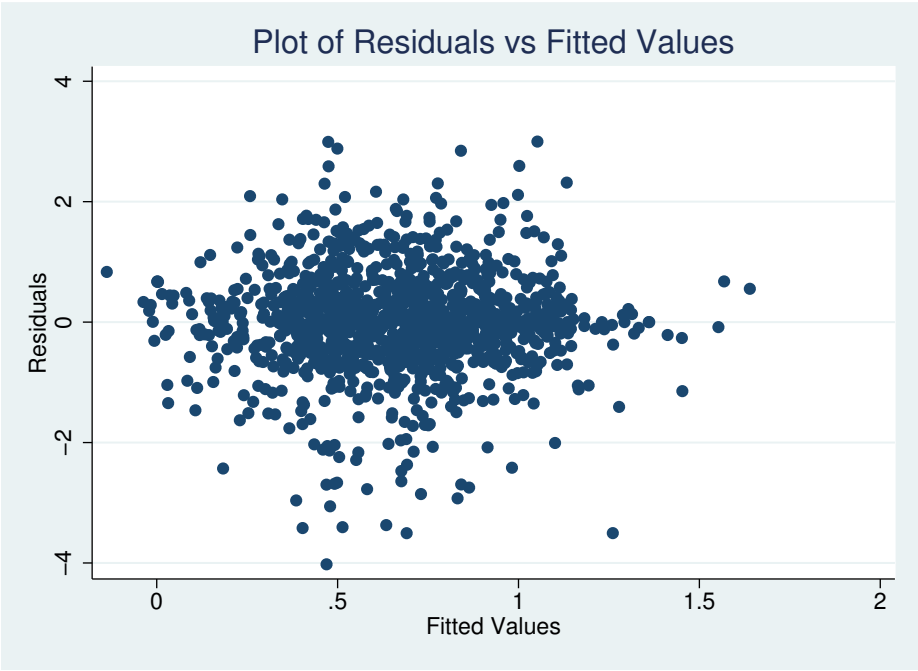


Figure 3: *Plot of Residuals against Fitted Values*

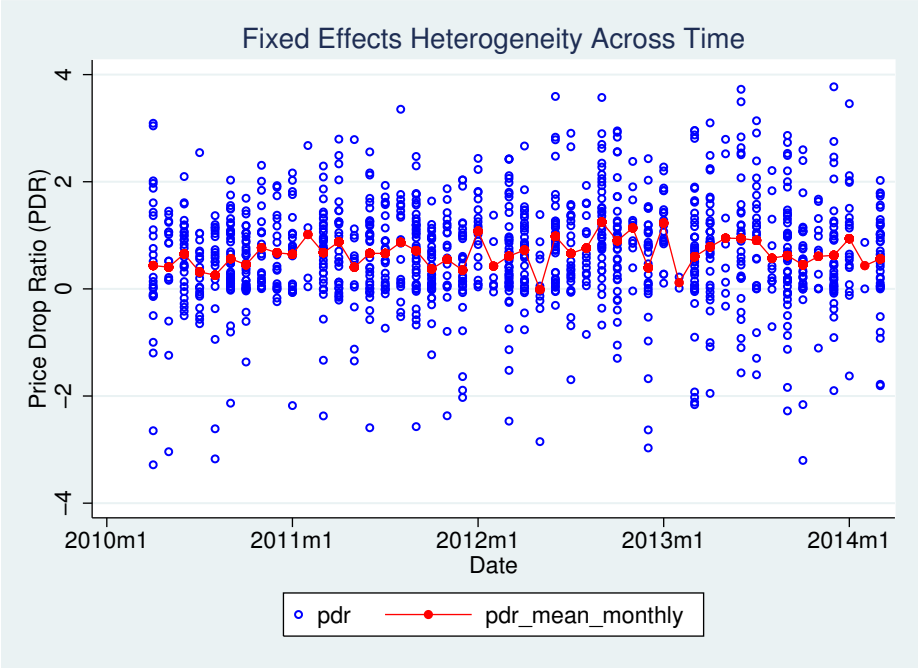


Figure 4: *Fixed Effects Heterogeneity across time*

## 8 References

- Alm K & Arefjäll M, 1999. Arbitrage possibilities on the ex-dividend day - A study on the ex-dividend day stock price behavior on the Swedish Stock market. MSc Thesis. Gothenburg University.
- Bali, R. & Hite, G. 1998. Ex-dividend day stock price behavior: discreteness or tax induced clientele? *Journal of Financial Economics*. 47(2): 127-159.
- Baltagi, B.H. 2008. *Econometric Analysis of Panel Data*. 4th ed. UK: West Sussex.
- Barclay, M. 1987. Dividends, Taxes and Common Stock Prices: the Ex-dividend Day Behavior of Common Stock Prices Before the Income Tax. *Journal of Financial Economics*. 19(1): 31-44.
- Bhattacharya, S. 1979. Imperfect Information, Dividend Policy, and the Bird in the Hand Fallacy. *Bell Journal of Economics*. 10(1): 259-270.
- Blume, M.E., Crockett, J. & Friend, I. 1974. Stockownership in the United States: Characteristics and Trends. *Survey of Current Business*. 54(11): 16-40.
- Booth, L.D. & Johnston, D.J. 1984. The Ex-Dividend Day Behavior of Canadian Stock Prices: Tax Changes and Clientele Effects. *The Journal of Finance*. 39(2): 457-476.
- Brown, P. & Walter, T. 1986. Ex-Dividend Day Behavior of Australian Share Prices. *The Journal of Finance*. 11: 139-152.
- Cheung, Y. & NG, L.K. 1992. Stock Price Dynamics and Firm Size: An Empirical Investigation. *The Journal of Finance*. 47(5): 1985-1997.
- De Villiers & Lenci, 2002. Transaction costs as the primary explanation for the ex-dividend price drop-off: The Case of South African Shares. *Journal of the Southern African Institute for Management Scientists*. 11(1): 13-20.
- De Jager, P. 2008. Panel Data Techniques and Accounting Research. *Meditari Accountancy Research*. 16(2). Available at SSRN: <http://ssrn.com/abstract=1624785>.
- Elton, E.J. & Gruber, M. J. 1970. Marginal Stockholder Tax rates and the Clientele Effect. *Review of Economics and Statistics*. 52(1): 68-74.
- Eades, K.M., Hess, P.J. & Kim, E.H. 1984. On Interpreting Security Returns during the Ex-Dividend Period. *Journal of Financial Economics*. 13(1): 3-34.
- Francis, J.C., Zai, T & Kuo, N. 2012. Effects of tax reform on drop-off ratios and on the ex-dividend and ex-right prices.. *Review of Quantitative Finance and Accounting*. 39(2): 147-164.



- Frank, M. & Jagannathan, R. 1998. Why do stock prices drop by less than the value of the dividend? Evidence from a country without taxes. *Journal of Financial Economics*. 47(2): 161-188.
- Grinblatt, M.S., Masulis, R.W. & Titman, S. 1984. The valuation effects of stock splits and stock dividends. *Journal of Financial Economics*. 13(4): 461-490.
- Haupt, P. 2014. *Notes on South African Income Tax*. South Africa.
- Jakob, K. & Akhmedov, U.M. 2005. The Ex-Dividend Day Stock Price Anomaly: Evidence from Denmark. Social Science Research Network. Available: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=896987](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=896987). [2014, February 28].
- Kalay, A. 1982. The Ex-dividend Day Behavior of Stock Prices: A Re-examination of the Clientele Effect. *Journal of Finance*. 37(4), 1059-1070.
- Koski, J.L. 1996. A microstructure analysis of ex-dividend stock price behaviour before and after the 1984 and 1986 Tax Reform Acts. *Journal of Business*. 69(3): 313-338.
- Kreuter, F. & Kohler, U. 2012. *Data Analysis Using Stata*. 2nd ed.
- Lakonishok, J. 1986. Tax-induced Trading around Ex-dividend Days. *Journal of Financial Economics*. 16(3): 287-319.
- Lamdin, D.J. & Hiemstra, C. 1993. Ex-dividend Day Share Price Behavior: Effects of the Tax Reform Act of 1986. *The Review of Economics and Statistics*. 75(4): 778-83.
- Lasfer, M. & Zenonos, M. 2003. The Tax Impact on the Ex-dividend dates: Evidence from European firms. Social Science Research Network. Available: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=423880](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=423880). [2014, March 2]
- Lewellen, W.G., Stanely, K.L., Lease R.C., & Schlarbaum, G.G. 1978. Some Direct Evidence on the Dividend Clientele Phenomenon. *Journal of Finance*. 33(5): 1385 - 1399.
- Michaely, R. 1991. Ex-dividend day stock price behaviour: The case of the 1986 Tax Reform Act. *Journal of Finance*. 46(3), 845-860.
- Michaely, R. & Vila, J. 1996. Trading volume with private valuation: Evidence from The ex-dividend day. *Review of Financial Studies*. 9(2), 471-509.
- Miller, M.H. & Modigliani, F. 1961. Dividend Policy, Growth and the Valuation of Shares. *Journal of Business*. 34(4): 411-433.
- Milonas, N.T., Travlos, N.G., Xiao, J.Z. & Tan, C. 2006. The Ex-Dividend Day Stock Price Behavior in the Chinese Stock Market. *Pacific-Basin Finance Journal*. 14 (2): 155-174.

Milonas, N.T. & Travlos, N.G. 2001. The Ex-dividend Day Stock Price Behavior in the Athens Stock Exchange. Available: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=274080](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=274080). [2014, March 2].

Moneyweb. 2012. *Black white investors reach parity*. Available: <http://www.moneyweb.co.za/moneyweb-economic-trends/black-white-investors-reach-jse-parity> [2014, October 16].

Ross, S.A., Westerfield, R.W., & Jaffe, J. 2005. *Corporate Finance*. 7th ed. USA.

Skinner, D.L. 1993. Twenty-five years of tax law changes and investor response. *Journal of Financial Research*. 16 (1): 61-70.

Stock, J.H. & Watson, M.W. 2007. *Introduction to Econometrics*. 2nd ed. Boston

Toerien, F. & Marcus, M. 2014. The Effect of South African dividend and capital gains taxes on share prices and investor expected returns. *Journal of Applied Business Research*. 30(3): 895-908.

Whitworth, J. & Rao, R.P. 2010. Do tax law changes influence ex-dividend stock price behavior? Evidence from 1926 to 2005. *Financial Management*. 39(1): 419-445.

Zhang, Y., Farrell, K.A. & Brown, T.A. 2008. Ex-dividend day price and volume. The case of 2003 dividend tax cut. *National Tax Journal*. 61(1): 105-127.