Individual Ownership and Ex-Dividend Day Price Drop Ratio: Lessons from the US Tax Act 2003

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ABSTRACT

This study examines the reaction of share prices to firm ownership structure on the ex-dividend day for listed firms in the United States (US) from 2002 to 2010. This period includes the implementation of the US Tax Act 2003, which equalised individual investor tax rates on dividend and capital gains. Using a cross-sectional methodology and market-adjusted model, evidence shows that the average ex-day price drop ratio increases after the US Tax Act 2003. This study also finds evidence that ex-dividend day pricing forms a negative concave function of firms' individual ownership. This evidence strongly supports the tax-induced dynamic trading theory and is consistent with both tax clientele and short-selling hypotheses. This evidence also reveals that dividend capturing may occur around ex-day, where firms are partially owned by personal shareholders. These findings may be relevant to the Malaysian stocks under the single-tier tax system in Malaysia.

Keywords: Ex-Dividend Day Pricing, Individual Ownership, Price Drop Ratio, US Tax Act 2003
JEL Classification: G10, G35

1. Introduction

On ex-dividend day, the buyer of a stock does not enjoy dividend rights, which remain with the previous owner. Therefore, in the context of an

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efficient capital market, the stock price should approximately decrease by the full dividend amount on the ex-dividend day (Campbell & Beranek, 1955; Durand & May, 1960). Nevertheless, most studies have reported that the decline of share prices is considerably less than the value of dividends. Campbell and Beranek (1955) identified that on the New York Stock Exchange (NYSE), stock prices typically dropped by 90 per cent of the dividend amount on stock ex-dividend dates.

Four theories have been developed to explain the rationale behind ex-dividend day abnormal pricing, namely the tax clientele theory of Elton and Gruber (1970), the short-selling theory of Kalay (1982), the tax-induced dynamic trading theory of Michaely and Vila (1995), and the market microstructure theories of Bali and Hite (1998) and Frank and Jagannathan (1998). The tax clientele theory asserts that ex-dividend day pricing is a result of personal investors' tax heterogeneity, while the short-selling theory asserts that dividend capturing activities by corporate investors regulate the ex-day price decline. Consistently, the tax-induced dynamic trading theory argues that both individual and institutional investors are dominant ex-day price setters. On the other hand, the market microstructure theory focuses on the impact of price discreteness on ex-dividend day pricing.

More recently, literature has emerged that contradicts the theories above (Al-Yahyaee, 2013; Armstrong & Hoffmeister, 2012; Blau, Fuller, & Van Ness, 2011; Sundberg & Halvorsen, 2012; Thornock, 2010), as many scholars have attempted to empirically evaluate the said theories in the context of various capital markets with distinct tax regulations and microstructures. In the United States (US), individual investors were taxed more on dividend income (38.6 per cent) compared to capital gains (20 per cent) prior to the implementation of the US Tax Act 2003. This justified the tax clientele effect. However, after the implementation of the US Tax Act 2003, dividend tax rates (15 per cent) dropped to the same level of capital gains (15 per cent), which diminished the tax clientele justification of ex-day pricing. In contrast, corporate investors were confined to a higher tax rate on capital gains (35 per cent) compared to dividends (10.5 per cent) during this period. Thus, the implementation of the US Tax Act 2003 provided a unique opportunity to reinvestigate the accuracy of the tax based theories, as it has removed capital tax preferential treatment over dividends paid to individual investors.

Considering investors' tax heterogeneity, only a few studies have given attention to the impact of individual ownership on the ex-day phenomena and utilised differing assumptions and methodologies, such as Li (2003), Perez-Gonzalez (2003), Graham and Kumar (2006), Li (2010)

and Kim (2011). Since the individual ownership is an indirect proxy of dividend's tax-misgiving, an increase in the individual ownership should be accompanied by a decrease in the price drop ratio in line with the tax clientele theory. However, a non-linear negative relationship reveals short-selling interactions between individual and institutional investors. In other words, increasing the number of individual owners should cause the price drop ratio to decrease first and then start to increase due to the increased interaction between the individual and institutional owners. Institutional owners prefer dividend income and can participate in arbitrage activities (dividend capturing). The arbitrage force can push the price down by the full amount of dividend, where no more arbitrage opportunity exists. Therefore, the price drop ratio reverts by further increases in individual ownership and it forms a concave relationship. Nevertheless, the relationship between individual ownership and ex-dividend day price drop ratio has not been established. Understanding this relationship is crucial because it provides an indirect opportunity to benchmark the tax clientele versus short-selling theories. The incompatibility of current findings calls for a more robust investigation of this issue.

Accordingly, the first objective of this research is to investigate the relationship between individual ownership and the ex-dividend day price drop ratio, with the ultimate goal of determining whether the relationship is linear or concave. The linear-versus-concave nature of this relationship is theoretically important, since a linear relationship is in line with the tax clientele effect while a concave relationship is evidence of short-selling activities. The second objective is to re-examine the impact of the US Tax Act 2003 on the ex-dividend day price drop ratio. This confirmatory analysis will reveal the impact of the tax clientele effect, besides the ownership structure. Since the literature regarding ex-dividend day pricing theories is still inconclusive, this paper attempts to provide further insights on the applicability of the theories.

This study uses precise data on individual ownership of US listed firms obtained from Datastream for the period 2002 to 2010. The preciseness of this data avoids measurement assumptions and increases the accuracy of the findings of this study. This paper contributes to the literature by benchmarking ex-dividend day pricing theories through the impacts of the US Tax Act 2003 and ownership structure. This study strongly supports the concave relationship between ex-dividend day price drop ratio and individual ownership, in line with the short-selling theory. On the other hand, the tax clientele theory is also reinforced by the effects of the US Tax Act 2003, which increased the average price drop

ratio for the post-Act period. This study concludes that the tax-induced dynamic trading theory is the premier proposition of ex-dividend day pricing, a fair combination of both theories.

This research can also provide a benchmark for other countries that experience the same tax law changes. For example, the Malaysian stock market under the 2008 single-tier tax system is comparable to the US after the implementation of the US Tax Act 2003. As introduced in the Malaysian budget 2008, the imputation system was gradually faded out to be replaced with a single-tier tax system effective from 1 January 2008. However, the single-tier tax system was implemented with a transitional period to avoid shareholders' losses due to forfeiting unused credits. Thus, a six-year transitional period was granted by the Government (1 January 2008 to 31 December 2013) to allow corporations to pay frank dividends on unutilised balances over the transitional period. The single-tier tax system has a simple procedure and exempts shareholders from tax liability (IRBM, 2014). As a result, Malaysian shareholders are currently exempted from paying tax on both dividend and capital gains, since the single-tier tax system has been fully implemented in Malaysia starting January 2014. Due to this similarity, the research findings are applicable to Malaysian shareholders, and a similar study may be conducted in Malaysia to reveal the preference of the Malaysian shareholders.

The next section reviews the literature that leads to the research hypotheses. This is followed by discussions on the research methodology and data collection, as well as empirical results. The final section concludes this paper.

2. Literature Review

Campbell and Beranek (1955), Barker (1959) and Durand and May (1960) establish that in the NYSE, stock prices usually drop by less than the dividend amount on the stock ex-dividend day. Elton and Gruber (1970) discovered a link between stock price behaviour on the ex-dividend day and the individual investor's taxation. They showed that the decline in stock prices is lower than the value of dividends, as well as that individual investor tax rate on dividends is more than the capital gains.[1]

[1] According to Elton and Gruber (1970), the ratio of price drop to the dividend on ex-dividend date is related to the marginal rates of substitution between dividends and capital gains ($\frac{1-t_d}{1-t_g}$), where t_d is the maximum tax rate on dividend and t_g is the maximum tax rate on long-term capital gains for personal investors.

The tax clientele effect proposed by Elton and Gruber (1970) holds that in a market with arbitrage opportunity, the average decline in stock prices seems comparable to individual investors' dividend tax rates over capital gains, indicating that the incomplete decline in the ex-dividend day closing price could be logically inferred from the individual investors' dividend tax misgiving. Although this theory is more than 40 years old, several recent empirical findings support the tax clientele effect (Armstrong & Hoffmeister, 2012; Francis, Wu, & Kuo, 2011; Haesner & Schanz, 2011; Hardin, Huang, & Liano, 2010; Jeff & Yi, 2010; Kadapakkam, Meisami, & Shi, 2010; Li & Weber, 2009; Liu & Yang, 2009; Procianoy & Verdi, 2009; Sundberg & Halvorsen, 2012; Whitworth & Rao, 2010).

In contrast with the tax clientele effect, Kalay (1982) examined the impact of potential short-selling activities around the ex-date. He verified that corporate shareholders trading around the ex-date tend to obtain the dividend because of their tax preferences. In other words, since institutional investors pay a lower tax rate on dividends than capital gains, they may benefit by capturing dividends around the ex-day. Kalay's short-selling theory (1982) asserts that dividend capturing activities may adjust the ex-day price drop to the same level of the dividend amount, such that further short-selling activities become impractical for institutional investors.[2] The empirical evidence on short-selling theory includes Dai and Rydqvist (2009), Dasilas (2009), Akhmedov and Jakob (2010), Thornock (2010), Jia, Kalay, and Mayhew (2010) and Blau et al. (2011).

Alternatively, the tax-induced dynamic trading theory of Michaely and Vila (1995) merges the tax clientele and the short-selling theories and asserts that these theories are not mutually exclusive. Empirical support for the tax-induced dynamic trading proposition has been presented by Michaely and Murgia (1995), Wu and Hsu (1996), Michaely and Vila (1996), and Dhaliwal and Li (2006). They found a positive relationship between the tax heterogeneity and trading volume on the ex-dividend day.

In contrast, Bali and Hite (1998) establish a market microstructure theory which states than an abnormal price drop on the ex-dividend day may be caused by price discreteness. Before 2001, the price ticks

[2] Kalay (1982) demonstrated that between the boundaries shown by equation $(1-\frac{\alpha\bar{P}}{D} \le \frac{P_{cum} - P_{ex}}{D} \le 1+\frac{\alpha\bar{P}}{D})$ the arbitrage activities are not beneficial and the tax clientele effect is feasible. In this equation, $\bar{P} = (P_{cum} + P_{ex})/2$ and $\alpha\bar{P}$ is the estimated value for a round trip transaction.

on US stock markets were more than one cent (1/8s and 1/16s rather than decimals). They thus assert that due to the continuous size of the dividend and the discrete nature of prices, the price drop should be close to the full dividend amount, but rounded up to the closest price tick; this then led to an incomplete price drop on the ex-day. However, after price decimalisation in the US, this theory has been refuted and is no longer applicable to the US stock markets.

The aforementioned theories propagate taxation as the main cause of ex-dividend day price abnormality. Therefore, many studies have investigated the impact of tax law changes on ex-dividend day pricing, and the implementation of the US Tax Act 2003 has provided a unique opportunity to reinvestigate the accuracy of tax-induced propositions. Tax rate on the dividend is significantly lowered by the US Tax Act 2003, which removes capital gains preferential taxation over dividends for individual investors. Therefore, the effect of the implementation of the US Tax Act 2003 on the ex-date share pricing gives room for deeper evaluation of tax reliant theories. Prior to the US Tax Act 2003, individual investors were taxed more on dividends (38.6 per cent) than on capital gains (20 per cent). However, the tax rates on both dividend and capital gains dropped to the same level (15 per cent) for individual investors after the implementation of the US Tax Act 2003, while other investors' relative tax rates were not affected.

Due to the fact that the marginal rate of tax rates substitution was less than one (0.77) for individual investors prior to the implementation of the US Tax Act 2003, it was expected that the ex-day price drop would be below the dividend amount.[3] However, both dividend and capital gains tax rates gravitated towards 15 per cent for individual investors after the implementation of the US Tax Act 2003 and it has been hypothesised that the price drop ratio should increase in average after the implementation of the Act. Yi, Farrell, and Brown (2008) investigated the relationship between the US Tax Act 2003, ex-day pricing and trading volume. However, this study distinctly analyses the joint impact of the US Tax Act 2003 and individual ownership on the ex-dividend day price drop ratio given that the US Tax Act 2003 primarily affects individual investors' taxation.

Since the tax clientele theory is rooted in individual investors tax heterogeneity, Perez-Gonzalez (2003) divided the sample firms into two groups, based on their individual or institutional largest shareholders,

[3] According to the tax clientele theory of Elton and Gruber (1970):
Marginal Rate of Substitution = $\frac{1-t_d}{1-t_g} = \frac{1-0.386}{1-0.2} = 0.77$

and set forth to examine whether the ex-dividend day pricing changes across these two designated groups. However, Kim (211) criticised this method of classification which cannot accurately demonstrate the cross-sectional variations in ownership structure. He tried to re-examine the effect of ownership structure on the ex-dividend day price drop ratio. Nevertheless, his work suffers from the assumption of homogeneity within institutional investors as he calculated individual ownership as the proportion of institutional shareholders minus one. Moreover, his finding fails to indicate the nature of the relationship between the price drop ratio and individual ownership (linear versus concave), since there is a positive coefficient for individual ownership (in concave model) which is inconsistent with the tax centred theories. As mentioned earlier, the linear-versus-concave nature of the relationship is theoretically important since a linear relationship is in line with the tax clientele effect while a concave relationship is evidence of the short-selling theory.

Considering the above mentioned shortfall, this paper proposes that if individual investors possess the highest proportion of a particular firm's stocks before 2003, the ratio of ex-day price drop for that firm should possibly be lower than those firms owned primarily by institutional investors. As most individuals then experienced unfavourable tax treatment with regard to their respective dividends, a negative relationship between ex-dividend day price drop ratio and individual ownership is hypothesised, supporting the tax clientele theory.

On the other hand, if short-selling activities occurred around ex-dividend day, the concurrence of short-selling activities with tax clientele effect reinforces the tax-induced dynamic trading theory of Michaely and Vila (1995). Short-selling activities are maximised when the numbers of individual and institutional investors respectively are in balance. In other words, the higher interactions are expected to occur between ex-day traders where both individual and institutional shareholders have nearly the same ownership proportions. Therefore, it is hypothesised that the price drop ratio is a negative concave function of individual ownership, supporting the short-selling and tax-induced dynamic trading theory.

3. Data and Methodology

3.1. Data Description

The data on ex-day pricing were obtained from the Centre for Research and The Security Prices (CRSP), whereas the data on ownership were

gathered from Datastream for the period 2002 to 2010, since the data were available only from April 2002. Using April 2002 as the starting point for the study prevents the result from market microstructure effect, as New York Stock Exchange (NYSE) quotation prices were decimalised after January 2001. Moreover, using 2003 as the year of transformation was avoided, since there might be a lag in portfolio restructuring caused by the US Tax Act 2003.

The sample size was limited to share codes 10 and 11 with distribution codes 1222, 1232, 1242 and 1252, which pay taxable regular cash dividends to their ordinary shareholders.[4] Unit investment trusts, closed-end funds, ADRs, ETFs and REITs were excluded, due to their variable tax treatments and more complex distribution.

The following observations were excluded: Observations in which no trade occurred on the cum-day or ex-day, the price was less than five dollars, or the dividend was less than one cent or the dividend yield was less than 0.1 per cent. Outlier distortion was reduced as the sample was sorted by price drop ratio and then truncated at the lower and upper 2.5 per cent. There was no change in outstanding shares between ex-day and cum-day caused by stock split or other conditions. However, the observations were removed if such cases were found.

As the total portion of individual and institutional shareholders should be equal to 100 per cent for each firm, observations in which the total portion of ownership data was not equal to 100 per cent were also omitted. This type of data error might have been caused by some overlap between investor types. Therefore, these suspicious overlapped observations were removed. In the end, 26,012 observations remained for further analysis.

3.2. Methodology

To analyse the nature of relationships between individual ownership and ex-dividend day price drop ratio, regression Equations 1 and 2 were developed following Dhaliwal and Li (2006). Equation 1 investigated the linear relationship between individual ownership and ex-day price drop ratio in support of tax clientele theory, while Equation 2 examined the concave relationship caused by short-selling activities around ex-day.

[4] Stocks with distribution codes 1222, 1232, 1242 and 1252 pay regular cash dividends to their shareholders. Share codes 10, 11 and 12 pay dividend to their ordinary shareholders. However, only stocks with codes 10 and 11 were accessible for this research. This study follows Chetty, Rosenberg, and Saez (2005) and Yi et al. (2008) for sampling.

$$PDR_i = \alpha_0 + \alpha_1 TaxCut_i + \alpha_2 IND_i + \alpha_3 Yield_i + \alpha_4 Size_i + \alpha_5 Risk_i + U_i \quad (1)$$

$$PDR_i = \beta_0 + \beta_1 TaxCut_i + \beta_2 IND_i + \beta_3 Yield_i + \beta_4 Size_i + \beta_5 Risk_i + \beta_6 IND_i^2 + U_i \quad (2)$$

Where PDR_i is the ex-dividend day price drop ratio. $TaxCut_i$ is a dummy variable equal to one, if the observation falls in the years post-implementation of US Tax Act 2003 and zero if otherwise. IND_i is defined as the percentage of shares held by individual investors. $Yield_i$ is calculated as the ratio of dividend amount over cum-dividend day price for each observation. $Size_i$ is defined as the standardised value of total market capital on cum-dividend day for each observation. $Risk_i$ is measured by dividing the variance of share return over the market return for the estimation period of [-45, -6] and [+6, +45], by considering day 0 as the ex-dividend day. Following Whitworth and Rao (2010), the price drop ratio (PDR_i) is calculated for each ex-day observation by using the market adjusted model as follows:

$$PDR_i = \frac{P_i^{cum} - \frac{P_i^{ex}}{1 + \hat{\alpha}_i + \hat{\beta}_i R_m^{ex}}}{D_i} \quad (3)$$

Where P_i^{ex} and P_i^{cum} are the closing prices on the ex-date and the prior day respectively. D_i is the amount of dividend and R_m^{ex} is the return on the value-weighted market index on each share's ex-date. Coefficients $\hat{\alpha}_i$ and $\hat{\beta}_i$ have been estimated independently per ex-dividend day observation through regressing returns of each stock over the returns of the value-weighted market index during the period of [-45, -6] and [+6, +45], by assuming day zero as the ex-dividend day.[5]

$TaxCut_i$ is a dummy variable equal to one, if the observation falls in the year post-implementation of US Tax Act 2003 and zero if otherwise. Since individual investors' dividend tax-misgivings diminished after the US Tax Act 2003, a positive sign for $TaxCut_i$ is expected, supporting the tax clientele effect.

[5] Following Dhaliwal and Li (2006), the reaction period for each ex-dividend day is 11 days' period around ex-day (days -5 to +5 relative to ex-day which is zero). This period is excluded from risk measurement, which might be affected by ex-day. Therefore, the 80-days period including days -45 to -6 and +6 to +45 is considered the non-event period to compute the trading risk.

Individual ownership (IND_i) is measured as the percentage of stocks belonging to individual shareholders in a specific firm. Considering that individual investors are dividend tax-disfavoured, firms which are held more by individual investors are expected to have a lower price drop ratio (negative coefficient for IND_i) in support of the tax clientele theory. However, if the short-selling activities occurred around ex-day, the price prop ratio will decrease first by increasing in individual ownership and then start to increase where short-sellers can significantly interact with individuals and benefit through dividend capturing. This interaction will push the price down by the amount of dividend value shown by a positive coefficient for IND_i^2. If both tax clientele and short- selling theories are verified through Equations 1 and 2, the tax-induced dynamic trading theory of Michaely and Vila (1995) will be a better explanatory proposition.

$Yield_i$, $Size_i$ and $Risk_i$ are used as control variables. Dividend yield ($Yield_i$) is determined as the ratio of dividend over cum-day closing price for each observation. Elton and Gruber (1970) highlight the fact that among the low (high) tax group, potential investors gravitate towards high (low) dividend-paying stocks. Moreover, the standardised value of total market capital ($Size_i$) for each company is determined as a proxy for transaction costs. Transaction costs play a crucial role on ex-date pricing since more investors can participate in dividend capturing where transaction costs are low. As per Michaely and Vila (1996), $Risk_i$ is measured as securities' return variance over the period of [-45, -6] and [+6, +45], where day zero represents the ex-dividend day.

Table 1: Summary of Explanatory Variables Around Ex-Dividend Day

		Percentiles				
Variable	Mean	5th	25th	50th (Median)	75th	95th
IND_i	77.60	31	68	85	94	100
$Yield_i$	0.0067	0.0017	0.0035	0.0057	0.0085	0.0145
$Size_i$ (USD Million)	6,986	47	235	987	4,047	30,044
$Risk_i$	5.3595	0.8686	2.0281	3.6567	6.5279	15.0530

Notes: (a) Ownership data were acquired from Datastream. Other ex-date data were obtained from CRSP.
(b) Individual ownership (IND_i) stands for the percentage of all issued stocks possessed by individual investors. $Yield_i$ is the ratio of the dividend amount over cum-day closing price and $Size_i$ is defined as the total market capitalisation on cum-day (in Million US Dollar). $Risk_i$ is measured through dividing the variances of share return over the market return for the estimation period of [-45, -6] and [+6, +45] by considering day 0 as the ex-dividend day.
(c) In Datastream, individual ownership falls under the category of strategic ownership. Strategic ownership is divided into several types of investors (individual, corporate, pension, etc.) and includes the range of 2% to 100% for individual investors.

As descriptive statistics shown in Table 1, the mean of individual ownership (IND_i) is 77.60 per cent, ranges between 31 (5th Percentile) to 100 per cent (95th Percentile).[6] As the median of individual ownership (85 per cent) is slightly higher than its mean, the distribution of individual ownership is skewed to some extent. The mean and median of $Yield_i$ are 0.0067 and 0.0057, respectively. $Risk_i$ has the mean of 5.3595 and median of 3.6567, while the mean and median for market capitalisation ($Size_i$)[7] are 6,986 and 987, respectively. Looking to percentiles and comparing means and medians of these variables revealed that distributions of these variables are also skewed and non-normal. However, assumption of normality is not a matter of concern, since the sample size is very large. Moreover, the standardised values for regression analysis is used to adjust the magnitude of Size with other explanatory variables.[8]

4. Results

Table 2 demonstrates the structural change in PDR_i after the US Tax Act 2003. The t-statistic (for mean) and Wilcoxon signed rank[9] (for median) were utilised to test the equality of ex-dividend day price drop ratio with one, before and after the US Tax Act 2003. The results show that the average of stocks PDR_i on the ex-date, is significantly below one (0.5456) prior to the implementation of the US Tax Act 2003. Following the implementation of the US Tax Act 2003, the average of ex-date PDR_i increased to 0.7701 for year 2004[10] and 0.7833 for the period of 2004 to 2010. Similar results were generated by analysing the medians. The median of stocks' ex-date PDR_i in 2002 increased from 0.5556 to 0.7788 in 2004 and 0.8332 for the period of 2004 to 2010. In spite of the significant increase recorded in mean PDR_i for the years after the US Tax Act 2003,

[6] Individual ownership falls under the category of strategic ownership in Datastream. Strategic ownership is divided into several types of investors (individual, corporate, pension, etc.) and includes the range of 2 to 100 per cent for individual investors. If the proportion of stocks owned by non-individual investors is less than 5 per cent, they are not considered as strategic owners, which means the firm is owned strategically (100 per cent) by individual shareholders.

[7] Size is reported in USD million.

[8] Standardised values are computed by subtracting each value from its mean divided by standard deviation.

[9] According to EViews 7 documentation, Wilcoxon signed rank test can be carried out to test the null hypothesis that the median of a series X is equal to a specified value (m) against the two-sided alternative that it is not equal. See Sheskin (2000) and Conover (1980).

[10] Year 2004 as a sub-sample is used as a proxy for the post US Tax Act 2003 period. The year 2004 includes the sample size of 3,200 ex-day observations that is closed to the pre US Tax Act 2003 sample size (2,408 ex-day observations). This extra analysis is done for the reason of sample size adjustment between pre and post US Tax Act 2003 periods.

the average of PDR_i remained considerably lower than one (at the 0.01 significant level). This may be due to the ability of personal investors to postpone the capital gains tax payments to the future, when they sell their stocks. Considering the time value of money, this delay may cause the tax costs on capital gains to be lower in value than what personal investors should pay for dividend taxation.

Table 2: Ex-Dividend Day Price Drop Ratio Pre and Post US Tax Act 2003

Year	2002 (pre Act)	2004 (post Act)	2004 to 2010 (post Act)
Mean	0.5456***	0.7701***	0.7833***
(t-stat)	(-6.1354)	(-3.9401)	(-9.7045)
Median	0.5556***	0.7788***	0.8332***
(Wilcoxon)	(7.0488)	(5.1774)	(11.4359)
Sample Size	2,408	3,200	23,604

Notes: (a) Ex-dividend pricing data were obtained from CRSP.
(b) Price drop ratio (PDR_i) calculated for each observation by using the market adjusted model. This table examines whether the *mean (t-test)* and *median* (*Wilcoxon test*) of PDR_i are equal to one before and after the US Tax Act 2003.
(c) Year 2004 is considered separately as a sub-sample of post Act period for the reason of sample size adjustment.
(d) Values designated by ***, **, * represent the 1%, 5% and 10% significant levels, respectively.

As shown in Table 3, *t*-test was used to investigate the differences in average of PDR_i before and after the US Tax Act 2003. The findings show that except for year 2006, the average of PDR_i is significantly higher for the years after the US Tax Act 2003 came into effect (at the 0.05 significant level for years 2004, 2005, 2007 and 2008; at the 0.01 significant level for years 2009 and 2010). Structural change in the average of PDR_i is thus clear for the majority of the years after the US Tax Act 2003; these results support the tax clientele hypothesis. In other words, the average increase of price drop ratio after the implementation of the US Tax Act 2003 reinforces the proposition that a reduction in the individual investors' tax misgiving made the price drop closer to the amount of dividend, in line with the tax clientele effect.[11]

[11] For the majority of post US Tax Act 2003 years, the average of ex-dividend day price drop ratio is around 0.7 except years 2009 (0.9775) and 2010 (0.8687) which are closer to one. This variation may be caused by the financial crisis in 2007/2008 which resulted in the reduction of dividend payouts in subsequent years. However, there is no prior knowledge in this area, which calls for future investigation.

Table 3: Mean Difference of Price Drop Ratio Pre and Post US Tax Act 2003

Year	Mean	t-statistic	Sample Size
2002	0.5456	-	2,408
2004	0.7701**	(-2.4133)	3,200
2005	0.7350**	(-2.0656)	3,462
2006	0.6527	(-1.1942)	3,760
2007	0.7332**	(-2.0609)	3,774
2008	0.7997**	(-2.5049)	3,463
2009	0.9775***	(-4.4219)	2,989
2010	0.8687***	(-3.4939)	2,956

Notes: (a) Ex-dividend pricing data were obtained from CRSP.
(b) Price drop ratio (PDR_i) calculated for each observation by using the market adjusted model. This table examines whether the average of PDR_i in year 2002 is equal to the other post US Tax Act 2003 years by using *t-test*.
(c) Values designated by ***, **, * represent the 1%, 5% and 10% significant levels respectively.

To distinguish between PDR_i before and after the implementation of the US Tax Act 2003, Figure 1 demonstrates the average of ex-dividend PDR_i for the sample period. Supporting the tax clientele effect, it is apparent that the average of PDR_i increased after the US Tax Act 2003 was implemented and year 2002 established the minimum value corresponding to the higher individuals dividend tax misgiving. However, PDR_i fluctuated in the same range for years 2004, 2005 and 2006; but for years 2007, 2008 and 2009 there was an upward trend that peaked in year 2009. This increase in price drop ratio might be due to the financial crisis in 2007/2008 which forced many firms (especially financial institutions) to reduce or cut their dividends.[12] Reducing the dividend amount is comparable to a reduction in the dividend's tax cost, which lowers the tax clientele effect.

Table 4 illustrates the relationship between the US Tax Act 2003 and price drop ratio across three levels of individual ownership. This classification gives an overview of whether the impact of the US Tax Act 2003 is similar across three levels of individual ownership or varies in line with the tax clientele effect. According to the tax clientele theory, a greater impact of the US Tax Act 2003 should occur in firms

[12] Acharya, Gujral, Kulkarni, and Shin (2011) investigated the dividend payouts for financial institutions before and after the 2007/08 financial crisis. They found a significant drop in dividend from 0.26 per cent of assets to 0.17 per cent and 0.05 per cent in 2008 and 2009, respectively.

with high level of individual ownership. All regressions are estimated by the weighted least square method to avoid the heteroskedasticity problem. According to Michaely (1991), there are two sources of heteroskedasticity, namely the influences of the dividend yield and security variance. As can be seen, $TaxCut_i$ is not significantly related to PDR_i for firms with Low level of individual ownership, but it is positively associated with PDR_i for the Medium and High levels (at the 0.01 significant level). These results are expected, since the US Tax Act 2003 only reforms the individual investors' taxation. Accordingly, the impact of the US Tax Act 2003 on ex-day pricing should be insignificant

Table 4: The Impact of the US Tax Act 2003 on the Ex-Dividend Day Price Drop Ratio Across Three Levels of Individual Ownership

PDR	Individual Ownership (IND_i)		
	Low	Medium	High
Intercept	0.7288***	0.4102***	0.2458***
	(17.1126)	(4.4702)	(16.8898)
TaxCut	0.0470	0.3426***	0.4651***
	(1.1217)	(3.7343)	(37.2655)
Yield	5.7421***	1.1155***	2.1282***
	(23.1817)	(8.2054)	(5.1171)
Size	0.0608***	0.0497***	0.0566***
	(22.8418)	(5.8973)	(15.1106)
Risk	-0.0041	0.0081***	0.0060***
	(-1.1707)	(8.4989)	(7.9705)
Adj. R^2	0.1283	0.0176	0.1556
F-Statistic	(308.7998)***	(38.6678)***	(425.8127)***
Durbin-Watson	1.9733	1.9977	1.9561
No. of obs.	8,368	8,422	9,222

Notes: (a) Individual ownership data were acquired from Datastream. Ex-dividend pricing data were obtained from CRSP.
(b) Individual ownership (IND_i) is calculated as the the percentage of all issued stocks possessed by individual investors. Price drop ratio (PDR_i) is calculated for each ex-day observation by using the market adjusted model. $TaxCut_i$ is considered as a dummy variable equal to one, if the observation falls in years after the US Tax Act 2003. $Yield_i$ is the ratio of dividend amount over cum-day closing price and $Size_i$ is defined as the total market capitalisation on cum-day (standardised value). $Risk_i$ is measured through dividing the variance of share return over the market return for the estimation period of [-45, -6] and [+6, +45] by considering day 0 as the ex-dividend day.
(c) $Size_i$ is standardised by calculating the difference of each observation to mean divided by standardised deviation. Standardisation is done to adjust the magnitude of $Size_i$ with other explanatory variables.
(d) This table investigates the relationship between $TaxCut_i$ and PDR_i across three levels of individual ownership (IND_i). All regressions are based on weighted least square estimation to avoid the heteroskedasticity problem.
(e) The table demonstrates regression coefficients designated by ***, **, * to represent the 1%, 5% and 10% significant levels respectively, while *t-values* are shown in parentheses.

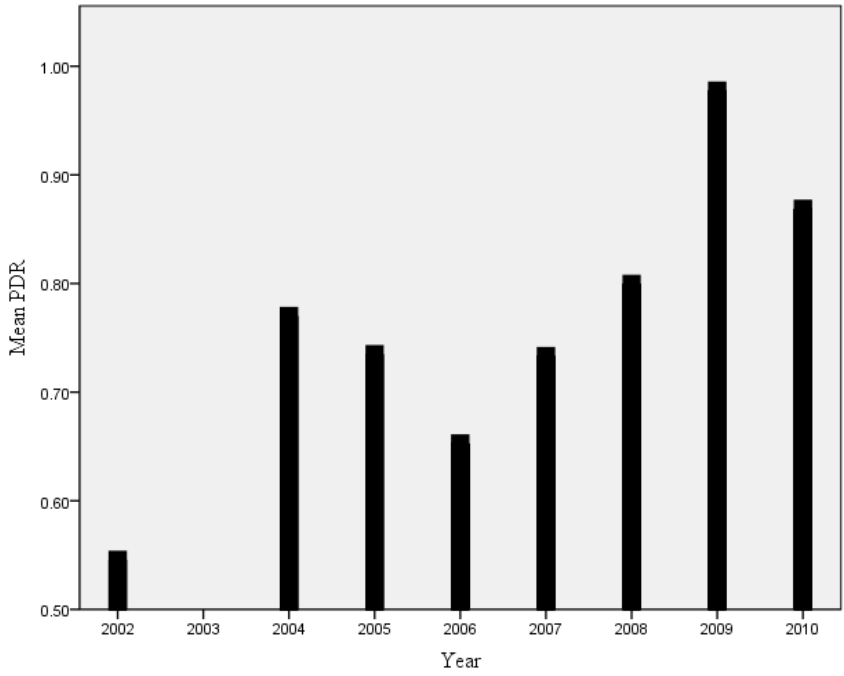

Figure 1: Average of Ex-Dividend Day Price Drop Ratio for Years 2002 to 2010

for firms with lower levels of individual ownership. The estimated coefficients of other explanatory variables are also expected. Based upon the tax based theories, Yield's coefficient remains positive and significant for all three estimations (at the 0.01 significant level). Since increasing Yield enables more dividend capturing for institutional owners, the positive relationship between the ex-day price drop ratio and Yield agrees with the short-term trading theory. Moreover, Size and Risk are positively related to the price drop ratio at the one per cent level in line with the tax-induced dynamic trading hypothesis. The only exception is the insignificant coefficient of Risk for the Low level that may be caused by the lower interaction among individual and institutional investors. This can lead to minimal short-selling activities and an insignificant coefficient for the trading risk. Size is a proxy for transaction costs. Increasing both size and trading risk means investors are less willing to trade around ex-day for any reason. Therefore, there is reduction in the ex-day price drop abnormality and the price drop is closer to the full amount of dividend.

The results of the estimated regressions for both linear and concave equations are shown in Table 5. Both regressions were estimated by the weighted least square method to avoid the heteroskedasticity problem. The results show a negative relationship (at the 0.01 significant level) between ex-dividend day price drop ratio and individual ownership (IND_i) in both linear and concave equations. These results support the tax-clientele theory since the price drop ratio is reduced by an increase in shareholders' dividend tax-misgivings as individual ownership increases. However, the concave equation reveals a more negative relationship (-0.0114) rather than linear equation (-0.0008) and the significant positive coefficient of IND_i^2 (0.0001) reinforces the concavity of the relationship between ownership structure and price drop ratio (at the 0.01 significant level). In addition, the adjusted R-square for concave estimation is 0.4409, which is considerably greater than the linear estimation (0.1202).

To increase the robustness of the results, Wald test was also done to investigate whether the coefficient of IND_i^2 is zero.[13] The estimated chi-square statistic (39.1046) in Table 5 shows that the coefficient of IND_i^2 is significantly different from zero at 0.01 significant level consistent with the results of concave equation. These findings support the concavity of relationship and reinforce the tax-induced dynamic trading theory. As mentioned earlier, the theoretical justification is that since the higher interactions and short-selling activities can occur where both individual and institutional shareholders have nearly the same ownership proportions, the shape of the relationship becomes concave. The coefficient of $TaxCut_i$ is significantly positive, revealing that the price drop ratio increases on average during post-Act years.[14] As in Table 4, the estimated coefficients of the other explanatory variables are positive at the 0.01 significant level in line with the expectations of this study.

To confirm the concavity of the relationship between ex-day price drop ratio and individual ownership, this study also used another proxy for short-selling activities known as the investors` tax heterogeneity. Following Dhaliwal and Li (2006), investors' tax heterogeneity ($Heter_i$) is defined as a product of individual and institutional investors. This product has the minimum of zero (100 per cent individuals multiplied

[13] Wald test investigates a model with full set of exogenous variables and examines whether restricting some of these variables to zero, significantly reduces the fitness of the model. Thus, this study utilised Wald test to reinvestigate whether the coefficient of IND^2 is significantly non-zero.

[14] Since TaxCut is a dummy variable equal to one for years after the US Tax Act 2003 was implemented, its positive coefficient shows that the post-Act ex-day observations have a greater price drop ratio (on average) in comparison with the pre-Act period.

by 0 per cent institutional = 0) and the maximum of 2500 per cent (50 per cent individuals multiplied by 50 per cent institutional = 2500). At the maximum level of investors' tax heterogeneity, the maximum interaction is possible for the dividend capturing activities. As the $Heter_i$ increases more arbitrage activities are possible around ex-dividend day which can push the price down by the full amount of dividend. As a result, this study expects to find a positive relationship between $Heter_i$ and PDR_i in support of the short-selling proposition.

Table 5: Effects of the US Tax Act 2003, Individual Ownership and Tax-Induced Investor Heterogeneity on the Ex-Dividend Day Price Drop Ratio

PDR	Linear Equation	Concave Equation
Intercept	0.6654***	1.2055***
	(25.4876)	(31.4037)
TaxCut	0.1482***	0.2257***
	(6.0669)	(82.7118)
IND	-0.0008***	-0.0114***
	(-7.0844)	(-11.3416)
IND^2		0.0001***
		(6.2534)
Yield	2.0613***	2.5536***
	(8.2860)	(8.7674)
Size	0.0540***	0.0566***
	(45.8308)	(34.8529)
Risk	0.0041***	0.0030***
	(3.9709)	(2.9228)
Adj. R^2	0.1202	0.4409
F-Statistic	(711.8063)***	(3,420.0830)***
Durbin-Watson	1.9824	1.9852
Wald Test (Chi-square)		(39.1046)***
No. of obs.	26,012	26,012

Notes: (a) Individual ownership data were acquired from Datastream. Ex-dividend pricing data were obtained from CRSP.
(b) Variable definitions are similar to Table 4.
(c) The first estimation is linear while the second one is concave and both investigate the relationship between IND_i and PDR_i. Both regressions are based on weighted least square estimation to avoid the heteroskedasticity problem.
(d) The table demonstrates regression *coefficients* designated by ***, **, * to represent the 1%, 5% and 10% significant levels respectively, while *t-values* are shown in parentheses.
(e) Wald test (chi-square) is utilised to reinvestigate whether the coefficient of IND_i is significantly non-zero.

Table 6 shows the estimated results for the relationship between investors` tax heterogeneity and ex-day price drop ratio. As can be seen, there is a positive relationship (0.0001) between $Heter_i$ and $PDR_i$ (at the 0.01 significant level). This result supports the short-selling theory since by increasing the investors` tax heterogeneity, the ex-dividend price drop ratio increases due to the arbitrage activities. This finding confirms the concavity of the relationship between individual ownership and ex-day price drop ratio. In other words, although increasing individual ownership decreases ex-day price drop ratio at first look, it also increases the short-selling interaction of individual and institutional shareholders ($Heter_i$) which can increase the PDR_i and makes the relationship concave. This study also finds a positive relationship between the $TaxCut_i$ and the PDR_i in support of the tax clientele effect. The estimated coefficients of other control variables are also in line with this study's expectations.

Table 6: The Relationship between Investors' Tax Heterogeneity and the Ex-Dividend Day Price Drop Ratio

PDR	Estimation
Intercept	0.4657***
	(82.2385)
TaxCut	0.2375***
	(77.5740)
Heter	0.0001***
	(13.6327)
Yield	2.7551***
	(9.5067)
Size	0.0559***
	(35.1765)
Risk	0.0023***
	(4.8629)
Adj. R^2	0.6558
F-Statistic	(9,913.3470)***
Durbin-Watson	1.9815
No. of obs.	26,012

Notes: (a) Individual ownership data were acquired from Datastream. Ex-dividend pricing data were obtained from CRSP.
(b) Investors' tax heterogeneity ($Heter_i$) is defined as the product of individual and institutional investors. Other variable definitions are similar to Table 4.
(c) This table re-examines the concave relationship between IND_i and PDR_i indirectly through the investors' tax heterogeneity ($Heter_i$). Estimation is based on weighted least square to avoid the heteroskedasticity problem.
(d) The table demonstrates regression *coefficients* designated by ***, **, * to represent the 1%, 5% and 10% significant levels respectively, while *t-values* are shown in parentheses.

The findings of this study support both tax clientele and short-selling propositions, since the concavity of the negative relationship between individual ownership and price drop ratio, and the positive relationship between the US Tax Act 2003 and PDR_i are properly verified. Therefore, this paper supports the tax-induced dynamic trading theory of Michaely and Vila (1995) representing a combination of both Elton and Gruber (1970)'s tax clientele effect, and Kalay (1982)'s short-selling theory. Dhaliwal and Li (2006) investigated the concavity of the relationship between institutional ownership and ex-dividend day trading volume. However, this paper investigates the individual ownership impacts on the ex-dividend day price behaviour and indirectly benchmarks the ex-day pricing theories through the ownership structure. The works of Perez-Gonzalez (2003) and Kim (2011) are also supported in this study to a greater extent using different methodology and proxies on ex-day pricing and ownership structure. This study differs from Perez-Gonzalez (2003), who examined the impact of large personal shareholders on firms' dividend policy. The findings of this study are also distinctive from Kim (2011), who found a positive relationship between price drop ratio and individual ownership by estimating a concave model. The positive coefficient of individual ownership is inconsistent with the tax centred theories which makes his results debatable. Contrary to Kim's inconsistent results, this study finds a negative relationship between individual ownership and ex-day price drop ratio in both linear and concave estimations, consistent with the tax-induced dynamic trading theory.

5. Conclusion

This study examines the impact of the US Tax Act 2003 and the individual ownership on the ex-dividend day price behaviour. This study proposes that increasing individual ownership causes the ex-date price drop ratio to reduce. By considering the tax-induced dynamic trading theory, this study also proposes the concavity of this negative relationship. In line with the tax clientele effect, the results illustrate that price drop ratio rises following the implementation of the US Tax Act 2003. Moreover, individual ownership is inversely proportional to the ex-date price drop ratio. This relationship has been shown to be concave in support of the short-selling theory.

This study has implications for both managers and shareholders. Since these research findings reinforce the tax-induced dynamic trading theory, it provides a clear guideline for US firm managers. Considering

the tax-induced dynamic trading theory, individual investors prefer capital gains for tax purposes and also desire a lower dividend income. In contrast, a higher dividend income increases institutional investors' wealth via both tax reasoning and short-selling activities. Therefore, for firms dominated by individual investors, managers should reduce the dividend income parallel to their dividend tax misgivings. On the other hand, tax-induced dynamic trading theory suggests that individual shareholders should sell their stocks on the cum-day and repurchase the stocks after the ex-day in order to maximise their wealth. Such action should be taken where the dividend yield is high. This is because for high dividend yield stocks, the individual investors' dividend tax misgivings will be higher than a round trip transaction cost. Therefore, it is prudent for individual investors to participate in the ex-dividend day trading in order to reduce their tax losses.

These theoretical and practical implications are also applicable to the Malaysian stock market, since the tax neutrality of Malaysian shareholders after the introduction of the 2008 single-tier tax system is comparable to the US after the implementation of the US Tax Act 2003. The US Tax Act 2003 reduces the individual investors' dividend tax rates, which makes individual investors tax neutral on dividend and capital gains. The same tax implementation is applied in Malaysia as the imputation system was gradually faded out to be replaced with the single-tier tax system effective from 1 January 2008. As mentioned earlier, the single-tier tax system was implemented with a transitional period to avoid shareholders' losses due to forfeiting unused credits. Thus, a six-year transitional period was granted by the government (1 January 2008 to 31 December 2013) to allow corporations to pay frank dividend on unutilised balances over the transitional period. By replacing the imputation system with the single-tier tax system, corporate income is only taxed at corporate level and shareholders are exempted from being taxed on both dividend and capital gains (IRBM, 2014). As a result, Malaysian shareholders are currently exempted from being taxed on both dividend and capital gains, since the single-tier tax system is fully implemented in Malaysia starting January 2014. Thus, this study can be replicated in Malaysia and the theoretical and practical implications of this study could be useful for the Malaysian corporate sector as well as shareholders.

A future comparative study can reveal the similarity and differences between Malaysia and the US regarding the ex-day price behaviour. In addition, it is suggested that future studies in this area use a longer

period of time, including more tax law changes in the US, to ensure a more in-depth analysis of tax clientele effect. However, finding other reliable sources of data on ownership structure might be an issue. The impact of the financial crisis that hit the US in 2007/8, as a recent economical event, is another interesting topic that can be considered in future studies. Moreover, other methods of analysis (e.g. Panel Data or Structural Equation Modelling) may help to examine and reinforce the research findings. Panel Data analysis can consider the individual differences across firms which are not controlled by research variables while Structural Equation Modelling will allow for confirmatory (causality) modelling (Ismail & Jenatabadi, 2014; Moghavvemi & Salleh, 2014; Samimi & Jenatabadi, 2014).

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