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The Ex-Dividend Day Stock Price Behavior: The Case of Portugal

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Abstract This paper examines the ex-dividend day behavior of stock prices in the Lisbon Stock Market over the period 1990–1998, extending on international evidence and discussing the adequacy of competing theories, considering the Portuguese institutional environment. We find that on the ex-day stock prices fall by less than the dividend, which is in line with the findings of several studies based on US and non-US data. The main contributions of this paper are: (1) the rejection of a tax explanation for the stock price drop, because it is inconsistent with the Portuguese tax regime; (2) considering the very small stock price tick and the fact that dividends are always integer multiples of tick size, the discreteness hypothesis of Bali and Hite (Journal of Financial Economics 47(2):127–159, 1998) is also ruled out as a possible explanation for ex-day price movements. We find no evidence of tax related clientele effects. We propose that ex-day price behavior may be an anomaly, reflecting a less than efficient market with low liquidity levels, price stickiness, and insipid arbitrage trading.

Keywords Ex-dividend day · Tax clientele · Tick price · Stock price drop

JEL Classification G20 Financial Markets and Institutions

Introduction

Miller and Modigliani (1961) show that, in the context of perfect markets, with no taxation and no transaction costs, dividend policy is irrelevant. In this context, investors are indifferent between dividends or capital gains, and the price of the stock should go down by the full amount of the dividend on the ex-dividend day.

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For the past 30 or 40 years, a large body of work on the ex-dividend day price behavior of stocks has demonstrated that the price drop in most cases is only partial, decreasing by less than the full dividend amount. Authors have proposed several competing theories to explain this empirical preference for capital gains over dividends. These include the existence of tax-induced clienteles (Elton and Gruber 1970), short-term trading (Kalay 1982), dividend capturing by institutional investors (Naranjo et al. 2000), discreteness of stock prices due to minimum tick-sizes (Bali and Hite 1998) and non-tax-based preferences for capital gains (Frank and Jagannathan 1998), including behavioral bias (Shefrin and Statman 1984). Although the partial price drop is well established as an empirical regularity, the explanation of this behavior is still very much an unresolved issue, both for US stock markets and for non- US stock markets.

The contribution of this study is to extend international evidence as to ex-dividend stock price behavior by studying Portuguese stocks and to discuss the adequacy of some of the competing theories for explaining this behavior considering the Portuguese institutional background, tax regime, and empirical findings. We find no evidence of tax-induced clienteles, contrary to the findings of Elton and Gruber (1970), and we show that the partial price drop can not be explained purely by the fiscal regime. We also demonstrate that the hypothesis of discreteness of stock prices due to minimum tick-sizes, as proposed by Bali and Hite (1998) is not a valid explanation for the partial price drop on the ex-dividend day. These findings make a positive contribution, because the rejection of some of the possible explanations helps researchers identify which issues may still be relevant for future research. For practitioners, the evidence of a partial price drop on the ex-dividend may be an important piece in the implementation of successful arbitrage strategies or, at least, is relevant information for the adequate timing of planned transactions (before or after the dividend).

In the next section, we review the main theoretical explanations and supporting empirical studies. In the third section, we present the Portuguese institutional background, including information on the Lisbon Stock Exchange, firm dividend policy, and tax regimes. The fourth section presents the theoretical framework for the empirical tests, while the fifth section explains data and sample selection. In the sixth section, we present our empirical results and its implications for the competing theories. The final section concludes.

A Review of the Literature

Tax-Induced Clienteles

Although Miller and Modigliani (1961) accept the existence of dividend clienteles, they argue that if the distribution of payout ratios corresponds exactly to the distribution of investor preferences, then the case is no different to the case of perfect markets, where it is irrelevant whether investors receive dividends or capital gains. Each firm will tend to attract its own clientele, consisting of investors that prefer its payout ratio. Black and Scholes (1974) propose that firms, knowing that there are preferences for differing types of dividend yields, will adjust their dividend policies

as necessary to satisfy such demand. Farrar and Selwyn (1967) observe that the unfavorable fiscal treatment of dividends over capital gains implies that firms should not pay dividends because investors would prefer the higher after tax returns associated with capital gains. Brennan (1970) develops this line of work and reaches similar conclusions.

Given the wide variety of investors present in markets, there is no doubt that there will be differing preferences caused by any given fiscal framing. But the main question is whether, by observation of real data, this clientele effect can be empirically detected. Elton and Gruber (1970) establish a relationship between stock price behavior on the ex-day and the tax levied on the marginal stockholder. In a market with rational arbitrage, the price drop should reflect the relative after-tax value of dividends and capital gains for the marginal stockholder. This implies that the marginal investor's income tax rate can be inferred simply by observing the price drop on the ex-day. The equilibrium condition is:

$$P_B - t_c(P_B - P_C) = P_A - t_c(P_A - P_C) + D(1 - t_o) \tag{1}$$

where P_B is the stock price on the cum-dividend day, P_A is the stock price on the ex-dividend day, P_C is the stock price when bought, D is the dividend, t_o is the dividend tax and t_c is the capital gains tax. From Eq. 1 we obtain:

$$\frac{P_B - P_A}{D} = \frac{1 - t_o}{1 - t_c} \tag{2}$$

Elton and Gruber (1970) find that, on average, the stock price drop is less than the dividend amount, which is consistent with the tax on dividends being higher than the tax on capital gains, in the period covered by their study. They also find a statistically significant positive relationship between the right hand side of Eq. 2, both with dividend yield and payout ratio. Barclay (1987) confirms the results of Elton and Gruber (1970), while Blume et al. (1974) find only a modest inverse relation between investor tax brackets and dividend yields. Schlarbaum et al. (1978) find very little evidence of this type of relationship using individual investor data from a brokerage firm. After the 1986 tax reform act in the US that equalized taxes on dividends and capital gains, Michaely (1991) finds that the ex-day price drop remained below one contrary to the tax-induced clientele hypothesis.

Short Term Trading Around the Ex-Day

Several papers study the effect of dynamic trading strategies around the ex-dividend day. These strategies imply that investors trade around the ex-dividend day in order to avoid or to capture the dividend, depending on their preferences for dividends or capital gains. Kalay (1982) shows that the price drop is bounded by transaction costs:

$$1 - \frac{\alpha\overline{P}}{D} \leq \frac{\overline{P}_B - P_A}{D} \leq 1 + \frac{\alpha\overline{P}}{D} \tag{3}$$

where, $\overline{P} = \left(\overline{P}_A + P_B\right)/2$ and $\alpha\overline{P}$ is the expected cost of a round trip transaction. Only within the boundaries defined by transaction costs in Eq. 3, where there are no

arbitrage opportunities, would it be possible to infer the marginal investor's income tax. Beyond those limits, the price drop would reflect only the effects of arbitrage trading. Miller and Scholes (1982) present a similar argument.

Eades et al. (1984) study the behavior of prices around the ex-dividend day and show the existence of abnormal returns on days other than the ex-day, which is contrary to the tax-induced clientele hypothesis. The results of Kalay (1982) are consistent with the findings of Karpoff and Walking (1988), who detect a significant relationship between ex-day returns and transaction costs. Lakonishok and Vermaelen (1986) confirm the presence of short-term traders in the market around the ex-dividend day, detectable because of high or abnormal volumes. Michaely and Vila (1996) set out an inverse relation between transaction costs and abnormal volume. The evidence of abnormal volumes around the ex-day is contrary to the clientele models. Naranjo et al. (2000) re-examine and extend the work of Eades et al. (1984) and find that the high-yield stock ex-day returns were highly influenced by corporate dividend capture.

Market Microstructure Arguments

The discreteness argument presented by Bali and Hite (1998) focuses on the multiple ticks of price changes as compared with the continuity of dividends. Because the price changes are discrete in most cases they cannot equal the dividend amount. The authors argue that the market systematically rounds the price drop down to the nearest tick and this causes the price to drop by less than the dividend amount. Dubofsky (1992) argues that an ex-dividend premium below one may be explained by mechanical rules imposed by the NYSE and AMEX for the ex-day adjustment of open limit orders to buy stock.

The transition of ticks in US markets from 1/8 to 1/16 ticks and then to decimalization in 2001 provided an excellent opportunity to test the theory of Bali and Hite (1998). The reduction of ticks and the progressive elimination of discreteness should result in a price drop on the ex-day increasingly closer to one. Cloyd et al. (2006) refute the discrete pricing hypothesis and find new evidence consistent with long-term tax-induced clienteles. The price discreteness of Bali and Hite (1998) has been also refuted by Jakob and Ma (2004) and Graham et al. (2003).

Non-Tax Related Clienteles

There may be other reasons unrelated to taxation explaining why investors might hold a preference for dividends or capital gains. Miller and Modigliani (1961) argued that clienteles might be formed based on the age of investors, with young investors preferring stocks with relatively lower dividend yields. Frank and Jagannathan (1998) examine ex-price behavior on the Hong Kong stock market, where short-term trading can be ruled out and where there were no taxes on dividends or capital gains. They find that the price drop is less than the dividend amount and attribute this to the nuisance of handling dividends. Kadapakkam (2000) reinforces this argument by showing that, after the advent of electronic settlement in Hong Kong, the ex-day price drop moved closer to one, greatly reducing the nuisance of handling dividends. Michaely and Murgia (1995) inform that, under

Italian tax laws, shareholders have to register with the tax-authorities on the ex-dividend day. If they prefer to remain anonymous, they sell before the ex-day and/or buy after the dividend. Although related to tax issues, this type of trading is closer to the nuisance argument of Frank and Jagannathan (1998).

Several behavioral hypotheses try to explain age or income clienteles including Shefrin and Statman (1984), who argue that investors may keep dividend income and capital gains in two separate mental accounts and therefore do not regard them as perfect substitutes. Thaler and Shefrin (1981) propose that, for reasons of self-control, investors may prefer to consume out of cash dividends and not from income generated by the sale of part of their portfolio. To avoid regret, they consume from dividend and do not sell stocks.

Evidence from Non-US Stock Markets

It is often the case that a non-US market has specific characteristics that can be used to develop a test that may not be possible with US data. We have already referred to the findings of Frank and Jagannathan (1998) on the Hong Kong market where dividends and capital gains are not taxed. This market provides an excellent background to test the tax-induced clientele hypotheses simply because tax-induced clienteles cannot exist, and the ex-day price drop should equal one. Contrary to that theory, the authors find that the ex-day price drop was in fact less than one. Kato and Loewenstein (1995) find only weak dividend-related tax effects in Japan and that the stock price actually rises on the ex-day due to the fact that the ex-day coincides with the beginning of the new fiscal year and institutional investors trade for other reasons on the dividend period.

In Europe, Green and Rydqvist (1999) study the ex-day price behavior in the Swedish lottery bond market, where cash distributions are tax-advantaged relative to capital gains. They find that the price drop is more than one, consistent with the tax-induced hypothesis. Also, relative to Sweden, Daunfeldt (2002) finds that the tax-induced clientele hypothesis is not supported by the data. Almost all international studies detect an ex-day price drop of less than one but, as in the US, evidence is mixed as to the existence of a tax clientele effect. Bell and Jenkinson (2000) and Michaely and Murgia (1995) find evidence supportive of that hypothesis in the UK and Italy; Romon (2000), Milonas and Travlos (2001) reject the existence of tax effects in France and Greece. For Canada, Bauer et al. (2006) rule out both tax and tick-size effects on ex-day behavior, thereby agreeing with the previous findings of Lakonishok and Vermaelen (1983) and Booth and Johnston (1984), who find that the ex-day price drop was smaller than would be consistent with the tax regimes in effect. In Australia, Brown and Clarke (1993) find mixed evidence on the tax-clientele hypothesis and weak evidence of short-term trading; in New Zealand, Bartholdy and Brown (2004) find that no single type of investor emerges as the marginal trader dominating all stocks. Borges (2004) finds evidence of short-term trading around the ex-day in Portugal, although the evidence is not very strong.

In summary, while the ex-day price drop of less than one is well established in non-US markets, the different theories have not been very successful at explaining this regularity. At best, the evidence is still mixed as to the existence of tax-clienteles and, in most cases, is inconsistent with the discreteness hypothesis.

The Portuguese Institutional Environment

The Lisbon Stock Exchange and Dividends in 1990–1998

After financial deregulation in 1984, the Lisbon Stock Exchange grew exponentially with the volume of trades increasing to 42,983 billion euros[1] in 1998 (around 48 billion dollars, at the average exchange rate of that year) even while remaining a small and emerging stock market by international standards. In 1998, there were 135 firms listed, creating a total market value of 53,613 billion euros (around 60 billion dollars). The privatization of a few large non-financial firms in the second half of the decade was a major factor in the rapid market growth during the years 1996–1998. Short selling was not permitted. Stocks usually had a face value of 5 euros (5.55 dollars) and stock prices had a tick of 0.005 euros (0.0055 dollars). This is a very small tick as compared to the NYSE tick of 0.125 dollars prior to decimalization.

During the period of 1990–1998, there were three components to transaction costs: brokerage fees, stock exchange fees, and banking fees. The banking fees were freely negotiable throughout the entire period with brokerage fees experiencing liberalization in 1995. Before 1995, brokerage fees were freely negotiable only for transactions above 249,399 euros. They were set at 0.5% for transactions below 24,940 euros, at 0.4% between 24,940, and 99,760 euros and at 0.25% between 99,760 and 249,399 euros. Stock exchange fees were fixed, but reduced steadily from 0.05% in 1990, to 0.04% in 1992, 0.03% in 1997, and 0.02% in 1998. Globally, transaction costs tended to drop during the whole period under analysis, and especially after 1995 when brokerage fees became freely negotiable.

In Portugal, cash dividends are paid once a year, generally in the second quarter of the year, after the regular Annual Shareholders Meeting. Shareholders vote on the annual accounts and on the proposed dividend amount, which is normally accepted. For firms listed on the Lisbon Stock Exchange market throughout the period of 1990–1998, the mean payout ratio has been 35.8%. The percentage of listed firms that pay dividends annually has ranged from 54.9% in 1993 to 86.2% in 1990, as shown in Table 1. Nearly half of firms paid dividends representing between 20 and 60% of their net profit.

Table 2 shows descriptive statistics for dividends and dividend yield, after excluding all observations where no dividend was paid. For the firms that paid dividends, the mean dividend per share was 0.47 euros. The minimum dividend per share paid was 0.05 euros, and the mean dividend yield was 0.0352.

Tax Regime

In 1989, the Portuguese authorities introduced an important tax reform that has since remained broadly unchanged. Several partial taxes on income were replaced by global taxes, IRS for individuals and IRC for firms. The Tax Benefits Law of 1989 included several exemptions and tax reductions in stocks and other financial market

[1] The Portuguese currency at the time was the escudo. We use the irrevocable conversion rate of 1 euro= 200.482 escudos, adopted on 31 December 1998, to convert all amounts to euros.

Table 1 Percentage of firms by different brackets of payout ratios

	Year								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
Payout ratio[a]									
<0%[b]	0%	1.3%	1.2%	2.4%	1.2%	5.3%	3.0%	1.4%	1.3%
0%	13.8%	17.7%	34.5%	45.1%	36.6%	34.2%	31.9%	28.8%	21.3%
>0%–20%	13.8%	7.6%	1.2%	2.4%	4.9%	3.9%	1.4%	2.7%	6.7%
>20%–40%	36.9%	29.1%	20.2%	15.9%	13.4%	17.1%	21.7%	26.0%	25.3%
>40%–60%	21.6%	29.1%	27.4%	15.9%	26.8%	19.8%	26.1%	24.7%	30.7%
>60%–80%	7.7%	10.1%	6.0%	7.3%	4.9%	9.2%	4.3%	9.6%	6.7%
>80%	6.2%	5.1%	9.5%	11.0%	12.2.%	10.5%	11.6%	6.8%	8.0%
Percent of firms with profits >0	100%	93.7%	78.6%	72.0%	79.3%	80.3%	87.0%	93.2%	94.7%
Observations	65	71	80	82	82	76	69	73	75

[a] Payout ratio is the ratio between total amount of dividends paid and net profit of the firm
[b] Includes firms with negative profits that paid dividends

instruments, with the purpose of stimulating savings and financial market development.

During the period under analysis, dividends received by individuals were taxed at 25%. The dividend is paid net of the tax and individuals are free from any further fiscal obligation. However, individuals can choose to include dividends in their gross income in which case they are liable to the progressive general IRS tax brackets. Clearly, where the individual income tax bracket is less than 25%, it proves advantageous to declare dividends. This option is also attractive for investors in higher tax brackets as the law allows for a partial reduction in double dividend taxation through a tax credit deductible from IRS to be paid. The tax credit is a percentage of the IRC paid by the firm on distributed profits and it has risen steadily from 20% (1989 and 1990) to 35% (1991 and 1992), 50% (1993 and 1994) and reaching the final level of 60% (as from 1995). Considering such a tax credit, and where there are no other tax benefits, it is always worthwhile to declare dividends even for individuals in the highest income tax bracket.

Table 2 Descriptive statistics for dividends and dividend yields: 1990–1998

	Dividend Per Share (Euros)	Dividend Yield[a]
Mean	0.47	0.035
Standard error	3.39	0.001
Median	0.37	0.029
Standard deviation	0.37	0.022
Kurtosis	8.10	2.690
Skewness	2.32	1.485
Minimum	0.05	0.004
Maximum	2.84	0.132

[a] Dividend yield is the ratio between dividend per share and the stock price on the cum-dividend day

Dividend taxes are reduced for certain types of stocks. For example, the tax only applies on 80% of the dividend amount paid by firms listed on the stock market and on 60% of the dividend for listed privatized firms. In 1994, these percentages were changed to 50% for both these types of stocks. Since 1995, only 25% of the dividends paid by privatized firms were taxed. The effect of these tax benefits is that the option of declaring dividends becomes less attractive. It is possible that some investors may prefer to avoid the nuisance of declaring dividends even if that means paying more taxes. The rule for non-resident individuals is to pay a uniform dividend tax of 25%; however, this can be reduced where the stock gains tax benefits resulting from being listed or from being a privatized firm.

Firms receiving dividends have to declare them as part of their profits and pay the non-progressive IRC tax. The IRC law allows for a correction of double dividend taxation. If the dividend-receiving firm has held more than 25% of the shares of the dividend-paying firm for more than 2 years, it can deduct 95% of dividends received from its profit, which results in an almost no-tax regime. Where these conditions are not met, the dividend-receiving firm will still benefit from a partial tax credit resulting from the IRC supported by the dividend-paying firm. Some types of firms, like holding companies, risk capital companies, regional development companies and brokers can always deduct 95% of dividends received, without any restriction. In the case of economic groups, there is no taxation on received dividends from within-group companies.

Capital gains are taxed at 5%, except where stocks have been held for more than 1 year in which case capital gains are not taxed. In the years 1990 and 1991, investors would have had to hold the stock at least 2 year s to be exempt from capital gains tax. However, all stock market transactions are subject to inheritance and transfer tax at a rate of 5%.

Theoretical Framing

Considering no transaction costs, the equilibrium price drop is given by:

$$\frac{\left(P_B - P_A^e\right)}{D} = \frac{1 - t_d}{1 - t_{cg}} \tag{4}$$

where, P_B is the stock price on the cum-day, P_A^e is the expected stock price on the ex-day, D is the dividend value, t_d is the dividend tax and t_{cg} is the capital gains tax. In equilibrium, the price drop relative to the dividend is a function of the taxes on dividends (t_d) and on capital gains (t_{cg}). If dividends experience unfavorable tax treatment relative to capital gains, then the price drop should be less than the dividend amount. Furthermore, the tax clientele hypothesis states that, knowing t_{cg}, we can determine t_d for the marginal investor, by observing $\left(P_B - P_A^e\right)/D$. The expected return before taxes is:

$$R^e = \frac{\left(P_A^e - P_B + D\right)}{P_B} = \frac{\left(t_d - t_{cg}\right)}{\left(1 - t_{cg}\right)} \frac{D}{P_B} \tag{5}$$

This result is obtained from the equilibrium condition (4). If $t_d > t_{cg}$, the expected return before taxes is positive on the ex-day and a positive relationship between the expected return before taxes and the dividend yield is derived from Eq. 5. The existence of a clientele effect linked to taxes stems from the fact that higher dividend yield stocks will attract investors with lower marginal income taxes. The existence of this clientele effect implies: (a), from Eq. 4, that there is a negative relationship between the price drop and t_d. This relationship, together with the clientele effect, implies that there will be a positive relationship between the price drop and the dividend yield or, in other words, higher dividend yields imply higher price drops and lower t_d; (b), the stronger the clientele effect is, the weaker will be the relationship between the expected return before taxes and the dividend yield because in these circumstances, when D/P_B in Eq. 5 increases, the coefficient $(t_d\text{-}t_{cg})/(1\text{-}t_{cg})$ will decrease weakening the impact of the dividend yield on the expected return before taxes.

Data and Sample Selection

Data on all annual dividend payment events by listed firms from 1990 to 1998 was collected from the Lisbon Stock Exchange (BVL) DATHIS database and completed with additional information from official BVL publications. We define each annual dividend payment event as an observation, so we may have up to nine observations for the same firm. Some observations were a-priori excluded from the data with the purpose of reducing the risk of data bias, including: (1) 23 observations where the firm had recently issued new shares, because this implied two different dividends, one for the new shares and one for the old shares; (2) 12 non-ordinary dividend payments; (3) 17 observations from privatized firms that had listed two different types of shares. Next, we excluded some observations from the sample, due to the non-existence of market prices at the time of the dividend, including: (4) 47 observations from firms de-listed around the ex-dividend day; (5) 39 observations from firms with very low liquidity in the dividend period, evidenced in the fact that there were no transactions on most of the days around the dividend event. This trimming of the data set resulted in an unbalanced panel incorporating 446 observations from 121 firms for the years 1990 to 1998. We believe that this base sample is representative of the whole market.

Up to March 27, 1997, the trading of dividend-paying shares was suspended for a period of four trading days prior to dividend payment. Thus, the last cum-dividend day occurred 5 days prior to the settlement date, which was the ex-dividend day. From March 27, 1997 onwards, the trading was no longer suspended and the ex-dividend day occurs 4 days before the settlement day. These trading suspension rules, combined with weekends, results in several observations with a difference of seven or eight calendar days between the cum-day and the ex-day (see Fig. 1).

Figure 1 suggests that, in a significant number of dividend events, the number of days between the cum-day and the ex-day is even greater. To further control for the possibility of bias resulting from this time difference, we construct a restricted sample comprising of only 174 observations from 94 firms, where the difference between the cum-day and the ex-day is of 4 days or less.

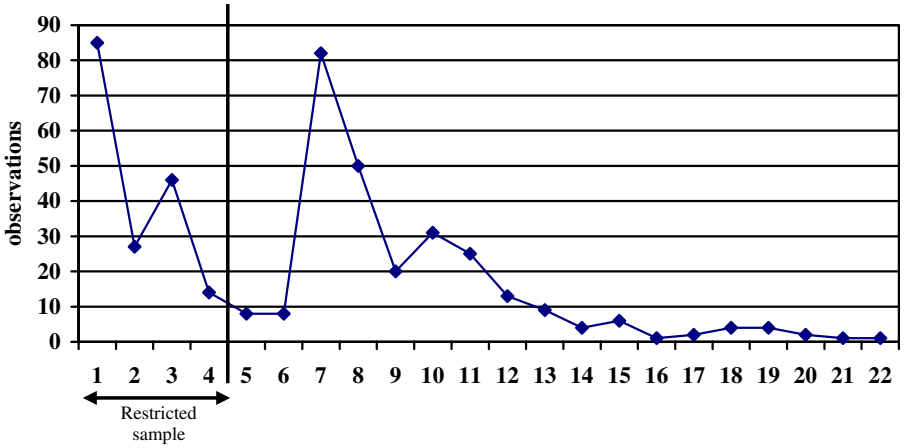

Fig. 1 Calendar days between cum-day and ex-day

Results

The Ex-Dividend Day Price Behavior

The first step was to compute the following statistic:

$$PC = \frac{P_B - P_A}{D} \tag{6}$$

where P_B is the stock price on the cum-day, P_A is the stock price on the ex-day and D is the dividend. The use of closing prices may introduce statistical bias because the price changes between the cum-day and the end of the ex-day may partly result from systematic changes in market prices or other specific factors with impact on the firm's value, and so the price drop is underestimated by the daily expected return. This bias could be strong considering that: (1) until March 24, 1997, stock transactions were suspended during the four sessions prior to the dividend settlement day, which means that between the cum-day and the ex-day there was always a difference of at least four calendar days; (2) some firms included in the base sample had very low liquidity levels, with no transactions around the ex-day.

To correct potential bias introduced by daily price movements, and following an approach similar to Michaely (1991), Graham et al. (2003) and Milonas and Travlos (2001), we compute a further statistic, adjusting the ex-day closing price by the rate of return of the stock market composite index:

$$PC' = \frac{P_B - (P_A/(1 + R_m))}{D} \tag{7}$$

where R_m is the return of the stock market index (BVL Geral) on the ex-day. The possibility that firms with low liquidity could distort the global results was controlled by another statistic (*PCR*) computed for the restricted sample of 174 observations including only firms where the number of days between the cum-day and the ex-day did not exceed four. We correct the effect of the daily expected return

Table 3 Results

	PC	PC′	PCR
Mean ($\bar{x}$)	0.612	0.658	0.426
Standard error of Mean ($s\sqrt{n}$)	0.101	0.101	0.140
Standard deviation of sample (s)	2.142	2.142	1.851
Minimum	−12.55	−12.445	−7.122
Maximum	23.65	21.576	13.524
Number of observations (n)	446	446	174

as in *PC′*. Table 3 presents some descriptive statistics of *PC*, *PC´* and *PCR*. The *PC* and *PC´* means are 0.6123 and 0.6583 respectively, which implies that the mean price drop is less than the dividend amount. The means of PC and PC´ are not statistically different from each other, but we will favor PC´ for theoretical reasons. For the restricted sample, the mean price drop relative to the dividend (*PCR*) is lower (0.4261), and this is statistically different, at the 1% level, from the means of PC and *PC'*. We will discuss in the conclusions why the price drop is smaller in the restricted sample, and not higher, as might be expected, given that this is a tighter test, which excludes from the sample the less liquid stocks.

We have shown in a previous section that the dividend taxation is diverse depending on several factors including the type of investor, the option as to whether or not to declare dividends or the existence of tax benefits on some stocks. Given this complexity, it is not clear if there is a tax advantage of capital gains over dividends, although this seems to be the most common case. However, we can still determine boundaries for the price drop, which would be compatible with a tax explanation. We do this by considering the less favorable dividend tax scenario (t_d= 25%) together with the most favorable capital gains tax scenario (t_{cg}=5%), which gives us the minimum value for the relative price drop compatible with the tax clientele hypothesis, that is, $PC' = \frac{P_B - (P_A/(1+R_m))}{D}$. From Eq. 4, the relative price drop would have to be 0.789 or above, to be consistent with a tax explanation.

Table 4 shows that the probability of the true mean of the observed relative price drop being above 0.789 is small, particularly in the restricted sample, which rules out a purely fiscal explanation for the price drop on the ex-day. We conclude that there must be other factors working in addition to, or instead of, a fiscal effect.

We can also rule out the discreteness of prices as a possible explanation for the partial price drop, as proposed by Bali and Hite (1998), for the simple reason that, in Portugal, the minimum dividend paid (0.05 euros) is an integer multiple of the tick (0.005 euros), and so there is no constraint imposed by tick-size on the stock price

Table 4 Test to statistics PC, PC′ and PCR

	PC	PC′	PCR
Mean ($\bar{x}$)	0.612	0.658	0.426
Standard error of mean ($s\sqrt{n}$)	0.101	0.101	0.140
z value for μ=0.789	−1.748	−1.294	−2.590
Probability of μ>=0.789	4.0%	9.8%	0.5%

adjusting to the new equilibrium. The partial price drop has to be explained by different reasons.

Ex-Day Price Behavior, Dividend Yields and Payout Ratio

We now proceed to analyze whether there is a relationship between the relative price drop and dividend yields or payout ratios. The existence of tax clienteles, favoring dividends or capital gains, should be demonstrated as a link between these variables.

This section begins with an approach based on the original Elton and Gruber (1970) study. The observations were ordered by dividend yields, and grouped by deciles. For each decile, the means of the dividend yields and of the *PC*, *PC′* and *PCR* statistics values are determined and we compute the Spearman correlation between the rankings. Table 5 summarizes the results.

For all three statistics, the point estimate of the correlation between the variables is negative, but it is only significant for *PC*. A negative correlation implies that, as the mean dividend yield increases, the mean price drop relative to the dividend becomes lower. However, the correlations for the statistics corrected by the daily market return (*PC′*) and for the restricted sample (*PCR*), are not significantly different from zero, and so we conclude that there is no correlation between these two variables. Note that these results do not corroborate those of Elton and Gruber (1970) who found evidence of a positive correlation.

We repeat the procedure for the payout ratio, and Table 6 presents the results. There is also no significant correlation between the relative price drop and payout ratio.

We also undertake a regression of *PC*, *PC′* and *PCR* on dividend yields (*DYIELD* variable), and we interact this with the number of calendar days between the cum-day and the ex-day (*DAYS* variable). Similar regressions for the payout ratio confirm

Table 5 Deciles ordered by dividend yield—Spearman rank correlation

Deciles	Mean	Mean	PC		PC′		PCR	
	Dividend Yield (Base Sample)	Dividend Yield (Restricted Sample)	Mean	Ranking	Mean	Ranking	Mean	Ranking
1	0.0092	0.0079	0.9290	9	0.8272	8	0.4213	5
2	0.0145	0.0127	0.6229	7	0.6762	7	0.6274	8
3	0.0185	0.0162	0.6145	6	0.6416	5	−0.1185	1
4	0.0224	0.0194	1.0371	10	1.0596	10	0.8641	10
5	0.0265	0.0234	0.4042	3	0.4783	3	0.4906	7
6	0.0315	0.0268	0.7970	8	0.9567	9	0.6797	9
7	0.0367	0.0309	0.3767	2	0.4179	2	0.4416	6
8	0.0412	0.0368	0.2014	1	0.2695	1	0.2922	3
9	0.0560	0.0436	0.5304	4	0.5811	4	0.2328	2
10	0.0806	0.0649	0.6992	5	0.6761	6	0.3482	4
Spearman correlation			−0.612		−0.467		−0.3091	
t test			2.189		1.492		0.9193	
Significancy level			3%		9%		19%	

Table 6 Deciles ordered by payout ratio—Spearman rank correlation

Deciles	Mean	Mean	PC		PC′		PCR	
	Payout Ratio (Base Sample)	Payout Ratio (Restricted Sample)	Mean	Ranking	Mean	Ranking	Mean	Ranking
1	0.1619	0.1696	1.6201	10	1.5817	10	0.6016	6
2	0.2476	0.2407	0.2581	2	0.1190	1	−0.3802	1
3	0.3158	0.3129	0.8788	9	0.9590	9	0.8055	10
4	0.3693	0.3631	0.4719	3	0.3105	3	0.0494	2
5	0.4268	0.4179	0.6879	6	0.8766	8	0.7296	7
6	0.4765	0.4626	0.7591	7	0.8459	6	0.7787	8
7	0.5188	0.4951	0.5569	4	0.6537	4	0.7815	9
8	0.5738	0.5577	0.5839	5	0.7226	5	0.3034	3
9	0.7197	0.6814	0.0741	1	0.1948	2	0.4446	4
10	1.7183	2.5585	0.7802	8	0.8486	7	0.5117	5
Spearman correlation			−0.2485		−0.2364		−0.0061	
t test			0.7256		0.6880		0.0171	
Significancy level			76%		75%		51%	

again that this variable has no explanatory power. Table 7 presents the results only for the OLS regressions with the dividend yield as an independent variable.

The results of the regressions in Table 7 confirm that the price drop is higher in the base sample, and that there is a smaller price drop in the restricted sample. The coefficients for *DYIELD* are not statistically significant in all three regressions confirming that there is no correlation between the variables. Remarkably, the *DAYS* variable emerges with significant explanatory power for the relative price drop. From the best specifications on Table 7, we find that the price drop is of around 40% of the amount of the dividend if the ex-day is the next calendar day after the cum-day

Table 7 Regressions of the relative price drop on dividend yields and on the number of days between the cum-day and the ex-day

Dependent Variable	Constant	DYIELD	DAYS	Adjusted R^2
PC	0.6122[c]			0.0000
	0.7599[c]	−4.4109		−0.0005
	0.2677[a]		0.0527[c]	0.0109
	0.4603[a]	−6.8306	0.0582[c]	0.0129
PC′	0.6584[c]			0.0000
	0.7681[c]	−3.2743		−0.0013
	0.3486[b]		0.0474[b]	0.0084
	0.5015[b]	−5.4263	0.05175[b]	−0.0101
PCR (restricted sample)	0.4264[c]			0.0000
	0.5285[a]	−3.5265		−0.0047
	0.3482		0.0409	−0.0053
	0.4501	−3.5414	0.0405	−0.0101

[a] Significant at the 10% level
[b] Significant at the 5% level
[c] Significant at the 1% level

(*DAYS*=1), and that it tends to drop more around 5% for each additional calendar day between the cum-day and the ex-day. One possible interpretation for this is that stock prices are sticky, and that it takes time to adjust to the new equilibrium. We will discuss this issue further in the conclusions. We also perform LSDV regressions allowing for firm fixed effects, but the results are very poor, as the adjusted R^2 drops notably in all cases. Both the Chow test and the likelihood ratio test reject the fixed effects specification against the alternative of no fixed effects. This result is not surprising, because the relative price drop after the dividend event is not a decision or characteristic of the firm, but rather, it is the consequence of the actions of investors who impact on all firms transversely, and so no firm-specific effect was expected.

The most important point to be made from these results is that the ex-day price behavior in Portugal is not explainable by the tax clientele theory, as we find no evidence of correlation between the price drop and dividend yield. This does not prove that tax clienteles do not exist but the evidence is certainly not supportive of this hypothesis.

Conclusions

Consistently, with US and non-US data, we find that in the Lisbon Stock Market the price drop on the ex-day is less than the dividend amount. For the base sample, the relative price drop is 0.658, and for the restricted sample, including the stocks where the number of calendar days between the cum-day and the ex-day is equal or less than four, the relative price drop is 0.426.

Besides adding to international evidence, the most important contribution of this paper stems from the institutional environment of the Portuguese market, which allows the rejection of two of the most influential theories advanced to explain the ex-dividend day price behavior. First, considering the very small tick of stock prices (0.005 euros) and the fact that dividends are always an integer multiple of the tick, there is no constraint imposed by discreteness on the stock price drop on the ex-day. Thus, the stock-relative price-drop of less than one, in an environment where stock prices change as if continuously, provides strong evidence against the discreteness hypothesis of Bali and Hite (1998). Second, our empirical results are not consistent with tax explanations for the ex-day price behavior, because the relative price drop falls below the minimum boundary that is consistent with the existing tax regime. There must be other factors also influencing stock prices, besides fiscal factors.

We find no evidence of a clientele preference of capital gains over dividends, as there is no significant correlation between the relative price drop and dividend yields or payout ratios. We believe that the explanation for an undetectable clientele effect stems from the Portuguese tax regime of dividends. Individuals who choose not to declare dividends are subject to a liberating tax, which is equal for all. On the other hand, the dividend tax is different for stocks of privatized firms, alongside other tax benefits and exemptions, and so the dividend tax rate depends more on stock specifics than on investor specifics. For institutional investors and firms, the dividends received have to be included in profits, and the IRC tax is equal for all

investors. In this context, there is no possibility of inferring the marginal investor's income tax rate, which is a central part of the tax clientele hypothesis.

Finally, it is important to comment on the non-existence of correlation between the relative price drop and dividend yield, and on the relationship between the price drop and the number of calendar days between the cum-day and the ex-day. We propose that this may be evidence of a market anomaly, in that there is an insufficient price drop on the ex-day and equilibrium is not restored immediately. For high dividend yielding stocks, the absolute price drop needed to restore arbitrage equilibrium is higher. In a low liquidity market, like the Lisbon Stock Market between 1990 and 1998, arbitrageurs may not have been able to restore equilibrium because, first, there might have been few of them and second, the risk involved in completing a round-trip transaction might have been excessive. Thus, the price drop would tend to be lower in high dividend yield stocks and this would show up as a negative correlation between the two variables. This is also consistent with the price stickiness implicit in the positive and significant coefficients of the *DAYS* variable, in Table 7. These results agree with the findings of Borges (2004), who tests the short-term trading hypothesis for the Lisbon Stock Market over the same period, studying volume behavior around the ex-dividend day. That study finds evidence of a positive abnormal trading volume, but not very strong, and its conclusion that there are unexplored profit opportunities in the dividend period is consistent both with the partial stock price drop on the ex-day and the sticky prices hypothesis.

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