THE EX-DIVIDEND DAY STOCK PRICE ANOMALY: EVIDENCE FROM THE GREEK STOCK MARKET

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Abstract

This paper examines the ex-dividend stock price and trading volume behavior in the Greek stock market for the period 2000–2004. We use both standard event-study methodology and cross-sectional regression analysis in assessing the ex-dividend stock price anomaly. We find that stock prices drop less than the dividend amount. By examining abnormal returns as well as abnormal trading volume around the ex-dividend day, we find strong evidence of short-term trading, which is consistent with the presence of dividend-capturing activities around the ex-dividend day. The results from the cross-sectional regression analysis confirm that the short-term trading hypothesis explains the ex-dividend day stock price anomaly in Greece.

Keywords: Ex-dividend day, short-term trading hypothesis, Athens Stock Exchange, tax clienteles.

JEL classification Codes: G12; G3

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1. Introduction

One of the most controversial issues in corporate finance theory is the behavior of stock prices around ex-dividend days, a subject that has for 50 years fueled a substantial number of theoretical and empirical studies. According to Miller and Modigliani (1961), in a Walrasian perfect capital market with no frictions, such as transactions costs and taxes, and no uncertainty, stock prices on ex-dividend days should fall exactly by the dividend amount. However, the majority of studies conducted in the United States, the United Kingdom, Canada, and other developing markets report a significant deviation from this prediction. In particular, these studies generally find that stock prices decrease on ex-dividend days by an amount that is less than the dividend. The first known study is that of Campbell and Beranek (1955), who reported a 90% drop of the ex-dividend stock prices, on average, compared to the dividend amount, using data from a small sample of NYSE firms. Since then, many studies have tried to explain this ex-dividend stock price anomaly, but no clear conclusion has been reached.

The existing literature provides three main explanations for the ex-dividend stock price anomaly. The first explanation rests on preferential tax treatment of capital gains compared to dividends (the tax effect hypothesis). A second argument attributes the deviation from the one-for-one price vs. drop-to-dividend relationship to the presence of transactions costs that inhibit stock prices from dropping on ex-dividend days by the exact dividend amount (the short-term trading hypothesis). Recently, a third explanation has been offered, providing an entirely different approach. In this explanation, microstructure impediments, such as those of tick size and bid-ask spread, are considered responsible for the existence of the ex-dividend stock price anomaly.

In this paper, ex-dividend stock price behavior is examined in a unique institutional environment where frictions observed in other markets that prevent prices from dropping by an amount equal to the dividend do not exist. In particular, there are neither taxes on dividend income, nor on capital gains. Moreover, dividend policy in Greece is not within a company's absolute discretion. The Greek Corporate Law 2190/1920 sets a specific quantifiable floor for the amounts of dividends a firm can distribute to its shareholders. Finally, significant microstructure impediments, such as price discreteness and bid-ask bounce, do not seem to play important role in determining stock price on ex-dividend days in the Greek stock market. Free of the significant frictions observed in other developed markets, the Greek stock market is an interesting laboratory for examining the market reaction on ex-dividend days.

Consistent with earlier studies, we find a significant deviation from the one-for-one price vs. drop-to-dividend relationship. This deviation implies significant abnormal returns for those

investors that trade around ex-dividend days. Moreover, we find buying pressure one day before the ex-dividend day (the cum-dividend day) and selling pressure on the ex-dividend day. These forces induce the trading volume abnormally on these two days. Due to the lack of preferential tax treatment of dividends compared to capital gains and the neutralized effect of microstructure impediments in Greece, we can rule out *a priori* two of the three possible explanations offered for the ex-dividend stock price anomaly, that is, the tax effect hypothesis and the price discreteness hypothesis. The only hypothesis that seems plausible for explaining why stock prices drop less than the dividend amount on ex-dividend days is the short-term trading hypothesis.

This study contributes to the existing literature in several ways. First, there are no empirical studies using data from the Athens Stock Exchange (ASE) that have examined ex-dividend stock price behavior in such depth. This is the first attempt to gauge both the stock price and trading volume behavior around ex-dividend days. Second, we employ a methodology that takes into account the peculiarities of the Greek capital market. In particular, the investigation of both the ex-dividend day stock price and trading volume behavior on the Athens Stock Exchange (ASE) is interesting due to the unique dividend distribution procedure, the neutralized tax environment, the weak presence of significant market microstructure impediments (i.e., tick size, bid-ask spread, limit order adjustment mechanism) observed in other developed stock markets. Finally, as the short-term trading hypothesis suggests, we test the relationships between dividend yield and abnormal returns, dividend yield and abnormal volume, transaction costs and abnormal returns, and transaction costs and abnormal volume using both standard event-study methodology and cross-sectional regression analysis. We believe that our empirical findings enrich the existing literature by employing data from a peculiar but interesting stock market.

The remainder of the paper is organized as follows. Section 2 presents a brief literature review regarding the ex-dividend day phenomenon. Section 3 discusses the institutional environment of the Greek capital market. Section 4 outlines the methodology employed in this study. Section 5 describes the data. Section 6 presents the results from the stock price and trading volume around ex-dividend days. Section 7 contains the main conclusions and discusses their implications.

2. Prior research

The first known study of the ex-dividend stock price anomaly is that of Campbell and Beranek (1955), who reversed the general view that stock prices drop by the full dividend amount on ex-dividend days. Using data from NYSE stocks, they observed that the ex-dividend price drop was 90% of the dividend amount. Durand and May (1960) conducted another seminal work

examining ex-dividend day behavior of American Telephone and Telegraph stock (AT&T) for a time series of 43 consecutive dividends. They found that the average price change from the cum-dividend day to the ex-dividend day was $2.16, or about 4% less than the $2.25 dividend.

Elton and Gruber (1970) were the first researchers to attempt a logical explanation for the ex-dividend stock price anomaly. Using a one-year sample with 4,148 dividends, Elton and Gruber (1970) confirmed that ex-dividend day stock prices tend to fall systematically less than the dividend amount and they developed a model to explain this phenomenon. This model became known as "the long-term trading hypothesis" or "the tax-effect hypothesis." Elton and Gruber (1970) showed that when dividends are taxed at a higher rate than capital gains, the stock price must drop by less than the dividend for investors to be indifferent between (i) selling the stock cum-dividend and (ii) holding the stock, receiving the dividend, and selling ex-dividend. Hence, if an investor decides to sell on the cum-dividend day, he or she receives the cum-dividend price (P_c) and pays tax at the capital gains rate (t_g) on the excess of the cum-dividend price over the price at which the share was bought (P_o). On the other hand, if the investor decides to sell ex-dividend, he or she receives a dividend and the ex-dividend price (P_e), but pays tax on the dividend at the dividend tax rate (t_d) and pays tax on the excess of the ex-dividend price (P_e) over the price at which the share was bought at the capital gains tax rate (t_g). The above relationship is given by:

$$P_c - (P_c - P_o)*t_g = P_e - (P_e - P_o)*t_g + D*(1-t_d) \quad (1)$$

Rearranging Equation (1) we get:

$$\frac{P_c - P_e}{D} = \frac{1-t_d}{1-t_g} \quad (2)$$

Elton and Gruber (1970) argued that the statistic[2] ($\frac{P_c - P_e}{D}$) (or ΔP/D) must then reflect the marginal tax rates of the marginal stockholders and that one should be able to infer these tax rates by observing the above ratio.

Elton and Gruber (1970) sorted their sample into deciles by dividend yield and computed the mean ΔP/D for each group. They found that ΔP/D generally increases with dividend yield, suggesting that investors in lower tax brackets prefer stocks with higher dividend yields, while higher-bracket investors prefer lower-yield stocks. Thus, Elton and Gruber (1970) confirmed the existence of the "dividend clientele effect" as first proposed by Miller and Modigliani (1961).

Elton and Gruber's (1970) arguments motivated numerous studies on the ex-dividend day behavior of stock prices. These studies addressed various factors, such as the differential taxation

[2] This statistic is known as the ex-dividend price drop ratio, drop-off ratio, premium, price change to dividend drop ratio ΔP/D, and so forth.

between dividends and capital gains in the United States,[3] different tax codes in other countries,[4] transaction costs,[5] changes in the tax code,[6] and the elimination of fixed commissions[7] (see Table 1).

Most studies agree with Elton and Gruber's (1970) findings, but some disagree that the ex-dividend day price drop can be attributed to tax effects. Kalay (1982) was among the first to suggest that the price drop on the ex-dividend day was not related to tax effects. He presented an alternative argument, which is known as the "short-term trading hypothesis." According to this hypothesis, an investor[8] with the same tax rate on dividends and capital gains can buy cum-dividend and sell ex-dividend if the ex-dividend stock price drop is less than the dividend. In this case, if the dividend receivable and the tax savings from the capital loss exceed the total transaction costs, such a strategy will be profitable. This can be expressed as:

$$(1-t_o)*[D-(P_c-P_e)-a*P]>0 \quad (3)$$

where $P=\frac{(P_c+P_e)}{2}$, a = expected transactions costs of a roundtrip trading, and t_o = tax rate on ordinary income.

If the expected price drop is greater than the dividend, the investor could sell short cum-dividend and buy back ex-dividend. In this case, the investor gains the amount of the price drop since he or she buys back at a lower price to close the short position. This can be expressed as follows:

$$(1-t_o)*[(P_c-P_e-D)-a*P]>0 \quad (4)$$

Therefore, profit will be realized only if arbitrageurs do not operate to wipe it out. Kalay (1982) demonstrated the above proposition by setting the no-profit opportunities condition as follows:

$$1-\frac{aP}{D}\le\frac{P_c-P_e}{D}\le 1+\frac{aP}{D} \quad (5)$$

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[3] See Litzenberger and Ramaswamy (1979), Poterba and Summers (1984), Barclay (1987), Stickel (1991), Lamdin and Hiemstra (1993), Michaely and Vila (1996), Wu and Hsu (1996), Bhardwaj and Brooks (1999), and Dhaliwal and Zhen Li (2006).

[4] See Booth and Johnston (1984) for Canada, Hietala (1990) and Hietala and Keloharju (1995) for Finland, Michaely and Murgia (1995) for Italy, Lasfer (1995) and Bell and Jenkinson (2002) for the United Kingdom, Kato and Lowenstein (1995) for Japan, Espita and Ruiz (1997) for Spain, Frank and Jagannathan (1998) for Hong Kong, Liljeblom et al. (2001) for Sweden, McDonald (2001) for Germany, Lasfer and Zenonos (2003) for Italy, the United Kingdom, Germany, and France, Milonas et al. (2006) for China, Milonas and Travlos for Greece, Farinha and Soro (2006) for Portugal, and Daunfeldt et al. (2006) for Sweden.

[5] See Kalay (1982), Lakonishok and Vermaelen (1986), Hearth and Rimbley (1993), Boyd and Jagannathan (1994), Bowers and Fehrs (1995), Siddiqi (1997), Naranjo et al. (2000), and Castillo and Jakob (2006).

[6] See Grammatikos (1989), Michaely (1991), and Lamdin and Hiemstra (1993).

[7] See Graham (2003) for a recent review of the ex-dividend day phenomenon.

[8] Investors with the same tax rates on dividends and capital gains are security dealers, stockbrokers, arbitrageurs, and some corporations. These are all "short-term traders."

Equation (5) implies that the higher the dividend yield of the stock, the closer to the full amount of the dividend will be the drop in the stock price so as to prevent a profit opportunity for short-term traders. In addition, the ΔP/D ratio would be 1 in the absence of transaction costs (a = 0) and assuming risk neutrality, but if there were transaction costs (a >0), the ratio could be less or more than 1 without causing arbitrage opportunities for short-term traders, provided that the deviation remains within the no-profit opportunities bounds. If transaction costs are prohibitively high, short-term traders will be deterred from trading and the $\frac{P_c - P_e}{D}$ ratio will reflect the tax rate of the marginal long-term investor.

Lakonishok and Vermaelen (1986) confirmed Kalay's (1982) argument by investigating both the trading volume and stock price behavior around ex-dividend days. Their results showed that trading volume increased significantly before and after ex-dividend days. This increase was more pronounced for high-yield, actively traded stocks and during the period following the introduction of negotiable brokerage commissions. Moreover, stocks experienced abnormal price increases before ex-dividend days and abnormal price decreases afterward. The abnormal price increases were positively related to dividend yield and transaction costs. On the other hand, the abnormal trading volume was positively (negatively) related to dividend yield (transactions cost).

More recent literature suggests that even when short-term traders (arbitrageurs) are absent from the market, the ex-dividend price formation may be influenced by factors other than taxes. Specifically, Bali and Hite (1998), using a sample of both cash dividends and nontaxable distributions from NYSE and AMEX firms, offered an explanation for the ex-dividend day stock price anomaly that relied on arguments never before heard. Bali and Hite (1998) investigated the effects of the discreteness of stock price changes due to multiple ticks versus the continuity of dividends. They developed an ex-dividend day price drop model in which prices were restricted to multiples of a tick. Their model indicated that investors would never be willing to pay more for a dividend than its value, and they showed that the equilibrium ex-dividend day price drop would be the amount of the dividend rounded to next smaller tick. This argument, based on the aforementioned microstructure impediment, is known as the "price discreteness hypothesis."

Frank and Jagannathan (1998) examined ex-dividend day stock price behavior on the Hong Kong Stock Market (HKSE), where neither dividends nor capital gains are taxed and, unlike on the NYSE, there were no market makers until 1993. They found that stock prices dropped on the ex-dividend day by half the dividend amount.[9] Frank and Jagannathan (1998) argued that the unexpected price drop on the ex-dividend day was the result of transactions on the cum-dividend

day occurring at the bid price, while transactions on the ex-dividend day took place at the asking price. That is, since for the average investor it is a burden to receive the dividend and then go through the process of collecting it, most investors prefer not to receive it. Market makers, however, are in a better position to collect dividends, so they buy the stock on the cum-dividend day. As a consequence, on the cum-dividend day, most trades occur at the bid price, while on the ex-dividend day, most trades occurred at the asking price.

Jakob and Ma (2004) used NYSE data from the $1/8-th, $1/16-th and decimal tick regimes to conduct a direct empirical test of the impact of both price discreteness and NYSE Rule 118[10] on ex-dividend day price behavior. They reported that as discreteness was eliminated, the ex-dividend price drop anomaly actually increased. In addition, regardless of tick size, bid prices fell more than offer prices no matter whether one measures the drop from cum-dividend day open to ex-dividend day open or from cum-dividend day close to ex-dividend day open. These findings were consistent with Dubofsky (1992), but contrary to those of Bali and Hite (1998). In a subsequent study, Jakob and Ma (2006) examined the ex-dividend day price drop behavior of stocks listed on the Toronto Stock Exchange (TSE). In contrast to the NYSE, the TSE did not automatically adjust limit orders on the ex-dividend date.

Castillo and Jakob (2006) examined the behavior of Chilean stock markets on cum- and ex-dividend days for the period 1989–2004, during which capital gains were not taxed in Chile, but dividends were. In addition, microstructure considerations such as tick size and bid-ask spread were neutralized. The authors reported an average price drop ratio to dividend ratio ($\Delta P/D$) of 0.815. The authors also examined whether dividend clientele effects were prevalent in the Chilean capital market but found no empirical support for same. They attributed the ex-dividend stock price anomaly to the frictions that restricted ex-dividend day price adjustment.

Recently, Yahyaee et al. (2007) examined ex-dividend price day behavior in a unique data set from Oman where there are neither taxes on dividends nor on capital gains, stock prices were decimalized, and dividends were distributed annually. Like previous studies, they found that stock prices dropped by less than the dividend amount, resulting in a significant positive ex-dividend day return. The authors also examined the abnormal trading volume around the ex-dividend day and found no evidence of short-term trading. Similarly to Frank and Jagannathan (1998), Yahyaee et

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[9] Similar results are found by Yahyaee et al. (2007) for the Oman capital market where there are no taxes levied on dividends or capital gains.

[10] Dubofksy (1992) was the first to investigate the impact of NYSE Rule 118 and AMEX Rule 132 on the ex-dividend day price anomaly. NYSE 112 and AMEX 132 dictated that, on ex-cash dividend days, open limit orders to buy stocks are reduced by the cash dividend amount. With discrete prices, if the resulting price is not a tick multiple, it is further lowered to the next tick. Prices in limit sell orders are not adjusted. For example, if the tick size is $0.125 ($1/8) and a dividend is $0.15, then the price of limit buy orders will be adjusted down by $0.25 and limit sell orders will not be adjusted (Jakob and Ma, 2004).

al. (2007) found evidence that the bid-ask bounce is the primary factor behind ex-dividend day behavior.

[Insert Table 1 here]

The present study examines ex-dividend day stock price behavior in a market free of microstructure and tax effects. This is possible by examining the Greek stock market, where neither dividends nor capital gains are taxed, the tick size is relatively small, and market making occurred for only a few stocks during the period examined. It is worth mentioning that the study of Milonas and Travlos (2001) was the first attempt to gauge ex-dividend day stock price behavior on the Athens Stock Exchange for the period 1994–1999. The authors used the classical ΔP/D ratio to investigate whether ex-dividend day stock price drops by the full amount of the dividend paid. They employed both closing prices on the cum- and ex-dividend days, adjusting the latter to market movements. Their results show that in an environment without tax effects and without the microstructure considerations applicable in other capital markets, stock prices dropped by an amount that was less than the dividend paid. However, the authors did not analyze the ex-dividend day abnormal return resulting from the smaller than expected drop on ex-dividend days; nor did they calculate the abnormal trading volume around ex-dividend days.

3. The Greek institutional environment

3.1. General information

The Athens Stock Exchange (ASE) is small compared to other European stock exchanges in terms of market capitalization, number of firms listed, and turnover volume. By the end of 2004, 350 firms had listed their shares on the ASE. The market's total capitalization has increased rapidly since 1995 due to new seasoned issues of shares. The greatest increase occurred in 1999 when the total value of listed companies reached 184,000 million Euros, an increase of 195% over that of 1998 (Owusu-Ansah and Leventis, 2006). The ASE has witnessed tremendous growth since 1995 and reached historical levels in the middle of 1999. The influx of international funds during that period was remarkable, contributing to the Athens Stock Exchange Index (ASEI) rising to record levels.[11] However, there was a dramatic fall in prices for all stocks after that period that lasted until the end of March 2003. Within less than two years, the majority of stocks lost more than 70% of their market capitalization and thousands of small individual investors saw their savings vanish. Starting in April 2003, there was a gradual uptrend in the ASEI that lasted until the fall of 2007. During the last eight years, the Hellenic Capital Market Commission's board of directors has issued several rules and regulations in an attempt to enhance investor protection,

[11] From 1997 until September 1999, the ASE Index experienced a sixfold increase.

safeguard the normal operation and liquidity of the Greek capital market, enhance the efficiency of trading, and has also addressed institutional issues, including short selling, margin account, and market making (Tsipouri and Xanthakis, 2004).

3.2. Dividends and taxation

The Greek capital market is a promising laboratory in which to test the market reaction on ex-dividend days because of several unique features concerning the distribution and taxation of dividends. First, unlike the United States and the United Kingdom, where dividends are paid on a quarterly and semi-annually basis, respectively, dividends in Greece are paid on a yearly basis. Moreover, in Greece, it is a common corporate practice that the ex-dividend day is defined as the first working day after the annual general shareholders meeting (GSM).

A second unique aspect of the Greek stock market is that Greek corporate law (Law 2190/1920) mandates a minimum annual cash dividend equal to either 6% of the stock capital or to 35% of the net profits, minus the amount needed to maintain regular reserves,[12] whichever amount is larger. Dividends will not be distributed only when 80% of the shareholders vote to that effect at the annual GSM. The mandatory dividend distribution in Greece is similar to that in Chile (see Castillo and Jakob, 2006) but different from practice in the United States, the United Kingdom, and other developed markets.

Third, in Greece, there are no personal taxes on dividends. Corporate dividends are determined after deducting corporate taxes from net profits (Law 2065/1992). Therefore, shareholders are not subject to tax on received dividends, that is, dividends are not double-taxed as they are in the United States. Similarly, no taxes are imposed on capital gains[13]. The only tax is a flat tax of 0.15% imposed on the proceeds of every stock sale. Short-selling in the ASE was introduced in 2001. Trades are cleared two days after the day of transaction. Market making was introduced in 2001 and initially applied to few stocks.

Fourth, commission costs in the ASE were deregulated in 1996. Since then, brokerages are free to set fees, but the fees may not be more than the maximum of 1% set by the Association of Securities Firms. Tick size is very small and is scaled as follows:

Stock prices in Euros	0.01<stock price<3.00	3.01<stock price<60.00	stock price>60.01
Tick size in Euros	0.01	0.05	0.1

[12] At least 5% of the net profits are withheld to maintain regular reserves. This obligation ceases when the amount of the stock in formation reaches one third of the stock capital.

[13] Since January 1, 2009 a flat tax of 10% is imposed on both dividends and capital gains (Law 3697/2008).

Comparing these multiple ticks with those prevailing in the predecimal era in the U.S. market, we observe that tick size in Greece is nearly 7 to 8 times smaller than in the United States.

Finally, until April 1, 2001, opening stock prices of firms listed on the ASE were reduced artificially on their ex-dividend day by the dividend amount. Act 59 of the Hellenic Capital Market Commission, effective April 2, 2001, abolished this practice.

In sum, the Greek institutional environment contains many idiosyncrasies not found in other developed markets, making it a very interesting setting for investigating the ex-dividend day stock price anomaly. Specifically, due to the lack of tax differentiation between dividend income and capital gains, *a priori* the tax-effect hypothesis, as proposed by Elton and Gruber (1970), would apply in the ASE. In addition, the small tick size and the weak presence of market making in the ASE attenuates the impact of tick size and bid-ask spread on stock prices on ex-dividend days. However, the absence of tax on dividends and capital gains, along with the relatively high dividend yield of Greek stocks, make these stocks an attractive target for arbitrageurs. The present study examines whether the ASE experiences intense arbitrageur activity around ex-dividend days.

4. Research design

4.1. Ex-dividend stock price behavior

According to Elton and Gruber (1970), a stockholder selling his or her shares before the stock goes ex-dividend does not have the right to receive the dividend. On the other hand, if the stockholder chooses to sell the shares on the ex-dividend day, then he or she has the right to receive the dividend, but might expect to sell the stock at a lower price. In other words, for a shareholder who decides to sell his or her shares on the ex-dividend day, his or her total wealth on that day from holding the shares consists of the share price on the ex-dividend day plus the amount of the dividend received.

In a market without transaction costs and taxes, the price fall on the ex-dividend day (P_e) should be equal to the amount of dividend (D), that is, $P_e - P_c = D$, where P_c is the price on the cum-dividend day. Dividing both sides by D, we obtain the classical ex-dividend drop ratio, which is called raw price ratio (RPR):

$$RPR = \frac{P_c - P_e}{D} = \frac{D}{D} = 1 \quad (6)$$

The raw price ratio (RPR) measures the price change from the cum-dividend day to the ex-dividend day in terms of the dividend paid. RPR is calculated three ways.[14] First, we calculate RPR using closing prices both on cum- and ex-dividend days ($RPR_{c\text{-}c}$). The second calculation uses

[14] See Milonas and Travlos (2001) and Milonas et al. (2006).

closing prices on cum-dividend days and opening prices[15] on ex-dividend days (RPR_{c-o}) and the third uses closing prices on both cum- and ex-dividend days, but adjusts the latter for stock market movements. Kalay (1982), Michaely (1991), and Naranjo et al. (2000) recognized that the closing price on the ex-dividend day is affected by the stock's normal daily return and attempted to adjust for this drift. Following prior research, we address this problem by adjusting the ex-dividend day closing price for the daily market return (R_m), proxied by the Athens Stock Exchange General Index. This ratio is called the market-adjusted price ratio (MAPR) and is calculated as follows:

$$MAPR = \frac{P_c - [P_e/(1+R_m)]}{D} \quad (7)$$

The theoretical value of RPR and MAPR equals 1. In other words, we test the following null hypotheses:

H_{1a}: The mean of $RPR_{c-c} = 1$.

H_{1b}: The mean of $RPR_{c-o} = 1$.

H_{1c}: The mean of MARP = 1.

Several authors, such as Eades et al. (1984), Barclay (1987), Michaely (1991), Boyd and Jagannathan (1994), and Bell and Jenkinson (2002), assert that the traditional ratio ΔP/D (or RPR) suffers from heteroskedasticity and independence. Heteroskedasticity arises because the ΔP/D ratio is scaled by the dividend amount, which means that the weight given to changes in observations where dividends are low is excessive. For that reason, we also compute the price change from the cum-dividend day to the ex-dividend day as scaled by the cum-dividend day $\frac{P_c - P_e}{P_c}$ (or ΔP/P). Following Milonas et al. (2006), we define this ratio as the raw price drop ratio (RPDR):

$$RPDR = \frac{P_c - P_e}{P_c} \quad (8)$$

Similarly to RPR, RPDR is calculated three ways. First, we calculate RPDR using closing prices both on cum- and ex-dividend days ($RPDR_{c-c}$). The second calculation is done by using closing prices on cum-dividend days and opening prices on ex-dividend days ($RPDR_{c-o}$) and the third uses closing prices on both cum- and ex-dividend days, but however, adjusts the latter for stock market movements. We adjust the ex-dividend day closing price for the daily market return (R_m), proxied by the Athens Stock Exchange General Index. This ratio is called the market-adjusted price drop ratio (MAPDR) and is calculated as follows:

[15] We use opening prices on ex-dividend days in order to control for overnight market movements between the cum-dividend day and the ex-dividend day.

$$MAPDR = \frac{P_c - [P_e/(1+R_m)]}{P_c} \quad (9)$$

All raw price drop ratios have a theoretical value equal to the dividend yield (DY), which is computed as the dividend per share divided by the stock price on the last cum-dividend day.

$$DY = \frac{D}{P_c} \quad (10)$$

Finally, the abnormal raw return (ARR) on the ex-dividend day is calculated as follows:

$$ARR = \frac{P_e + D - P_c}{P_c} \quad (11)$$

In summary, we test the following null hypotheses:

H_{1d}: The mean of $RPDR_{c\text{-}c}$ = DY.

H_{1e}: The mean of $RPDR_{c\text{-}o}$ = DY.

H_{1f}: The mean of MAPDR = DY.

H_{1g}: The mean of abnormal raw returns (ARR) = 0.

To examine market reaction on and around ex-dividend days, we employ the standard event-study methodology described by Dodd and Warner (1983) and Brown and Warner (1985), among others. First, we estimate the stock price reaction for an event window of 40 days around the ex-dividend day (Day 0), that is, from Day –20 to Day +20. Following Brown and Warner (1985), we estimate market reaction by calculating the abnormal returns (AR) using the market model, the market-adjusted return model, and the raw returns model.[16] The market model parameters are estimated using 200 observations, commencing 220 days prior to the event day (that is, from Day –220) and ending on Day –21. The market return is proxied by the Athens Stock Exchange General Index.

We anticipate a mean abnormal return on ex-dividend days and a cumulative abnormal return[17] pre and post the ex-dividend period equal to 0. That is, the null hypotheses are:

H_{1h}: The mean of abnormal returns on ex-days (ARs) = 0.

H_{1i}: The cumulative abnormal returns pre and post the ex-dividend period (CARs) = 0.

4.2. Ex-dividend trading volume behavior

Lakonishok and Vermaelen (1986) asserted that investigating stock price reaction alone cannot distinguish which of the long-term and short-term trading hypotheses fully explains the

[16] The majority of U.S. and international studies on the ex-dividend day phenomenon use one of the following models to calculate abnormal returns: the market model, the market-adjusted return model, the mean-adjusted return model, or the raw returns model. However, the mean-adjusted return model suffers from heteroskedasticity and thus we decided not to use it.

abnormal stock price behavior on ex-dividend days. They suggested that investigating trading volume would add new evidence regarding the group of investors that influence stock price behavior on ex-days. According to Lakonishok and Vermaelen (1986), if short-term traders have a major impact on ex-dividend day stock prices, one should observe a net increase in trading volume around ex-dividend days. Following their methodology, we estimate abnormal trading volume (AV) with the mean-adjusted model[18] using 100 observations prior to the event day, that is, from Day –120 to Day –21 and 100 observations after the event day, that is, from Day +21 to Day +121. The abnormal trading volume is estimated as the Euro value of shares traded,[19] that is, the product of the shares traded and the stock price. Lakonishok and Vermaelen (1986), Kato and Loewenstein (1995), and Wu and Hsu (1996) followed a similar approach.

Similarly to abnormal returns, we anticipate a mean abnormal volume on ex-dividend days and a cumulative abnormal volume[20] in the pre and post ex-dividend period equal to 0. That is, the null hypotheses are:

H_{1j}: The mean of abnormal volume on ex-dividend days (AV) = 0.

H_{1k}: The cumulative abnormal volume of the pre and post ex-dividend period (CAV) = 0.

4.3. Regression analysis

Following Kato and Loewenstein (1995), Michaely and Vila (1996), Wu and Hsu (1996), Naranjo et al. (2000), Lasfer and Zenonos (2003), Dhaliwal and Zhen Li (2006), and Yahyaee et al. (2007), we regress abnormal returns on ex-dividend days (AR_0) against a number of independent variables, including systematic risk (BETA), dividend yield (DY), transaction costs (TC), size (SIZE), average (normal) volume (AVVOL), ex-dividend day abnormal volume (AV), and a dummy variable (DUMMY) that takes into account the period before and after the introduction of the Act 59 of 30th March 2001.

We employ the weighted least squares (WLS) method to analyze the impact of the various independent variables on the ex-dividend day abnormal returns. Our cross-sectional regression model is as follows:

$$AR_{0,i} = a_0 + a_1 * BETA_i + a_2 * DY_i + a_3 * TC_i + a_4 * SIZE_i + a_5 * AVVOL_i + a_6 * AV_i + a_7 * DUMMY_i + e_i \quad (12)$$

According to Michaely and Vila (1995, 1996), the ex-dividend day abnormal volume should be decreasing in risk. They argue that both systematic risk and idiosyncratic risk will

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[17] Cumulative abnormal returns (CARs) are the sum of the average abnormal returns for a specific event period.

[18] Kato and Loewenstein (1995), Wu and Hsu (1996), Athanassakos (1996), and Koski and Scruggs (1998) also estimate the abnormal trading volume employing the mean-adjusted model.

[19] Michaely and Vila (1996), Kadapakkam (2000), and Graham et al. (2003) compute the mean volume as the mean daily turnover (shares traded relative to shares outstanding). Then, they define the abnormal volume as the difference between the daily turnover and the mean daily turnover. However, the number of shares traded daily was not available.

[20] Cumulative abnormal volume (CAV) is the sum of the average abnormal volume for a specific event period.

dampen trading activities around ex-dividend days. In our study, we control for systematic risk and we expect it to have a negative effect on the ex-dividend day abnormal returns. The variable BETA is estimated 200 days before the event window (–220, –21), employing the market model.

According to Lakonishok and Vermaelen (1986), if the short-term trading hypothesis is valid, the ex-dividend day abnormal return will be positively related to transaction costs and dividend yield. As in Karpoff and Walkling (1988), Naranjo et al. (2000), Dhaliwal and Zhen Li (2006), and Yahyaee et al. (2007), we use the inverse of the stock price as a measure of transaction costs ($1/P_c$). The dividend yield variable (DY) is estimated as the ratio of the annual dividend over the price on the cum-dividend day (D/P_c).

According to Lasfer and Zenonos (2003), if the firm size effect is valid, that is, smaller firms experience larger abnormal returns than bigger ones, there should be an inverse relation between the variable SIZE and ex-dividend day abnormal returns. We estimate firm size as the natural logarithm of the market value of equity on the cum-dividend day.

If dividend capture occurs, abnormal returns should be positively related to liquidity (see Lakonishok and Vermaelen, 1986; Karpoff and Walkling, 1990). Similarly to Kato and Loewenstein (1995), we use the average volume (AVVOL) as a proxy for liquidity during our estimation period. Therefore, we expect a positive sign for the variable AVVOL. Average volume is measured by the mean-adjusted model during the estimation period (–120, –21 and +21, +121).

The reason for including the variable of the ex-dividend day abnormal volume (AV) is the presence of dividend capture by some groups of investors. If short-term trading occurs around ex-dividend days, then a positive relation between abnormal returns and abnormal volume is expected.

Finally, we include a dummy variable (DUMMY) to control for the effect on stock prices of the Act 59 of 30th March 2001. Hence, the dummy variable takes the value of 1 for the period before introduction of the Act 59 and 0 for the period after its introduction.

5. Data

Daily closing and opening prices, as well as trading volume, for Athens Stock Exchange (ASE) firms are used to study the stock price and trading volume behavior around ex-dividend days. These data were obtained from the Dissemination Information Department of the ASE. Our sample period is from January 1, 2000 to December 31, 2004.

To avoid contamination of our results by the occurrence of other corporate events, a concern first raised by Miller and Scholes (1982), firms are excluded if they experiences any other corporate events, such as earnings announcements, dividend announcements, stock splits, share

repurchases, stock dividends, and right issues, within a 20-day event period around the ex-dividend day (–10, +10). The corporate event dates were collected manually by searching more than 120,000 daily financial press releases and verifying these dates on corporate websites.

Furthermore, to be included in the final sample, companies had to satisfy the following criteria: (a) they could not be engaged in the financial and utility industries because such industries have different financial reporting standards; (b) price data are available for the period commencing 220 days prior and ending 20 days subsequent to the ex-dividend day; (c) trading volume data are available for a window of 120 days prior and 120 days subsequent to the ex-dividend day; and (d) to avoid the problem of thin trading[21] (stocks that trade infrequently), firms that had no transactions for more than 100 days in the estimation period were excluded. In Greece, it is a common corporate practice for ex-dividend day to occur the day after the annual GSM and thus there might be other issues affecting the stock price on this day. Specifically, during the annual GSM, shareholders approve last year's financial statements and accept or reject a firm's investment policy. In addition, firm management discloses future corporate plans. To control for significant information emanating from this meeting, we also exclude all cases where the annual GSM takes place within a 20-day window around ex-dividend dates (–10, +10). The above criteria result in a sample of 256 observations.

6. Empirical findings

6.1. Ex-dividend drop-off ratios

Table 2 sets out descriptive statistics for the entire sample of 256 dividend distributions. The mean (median) dividend is 0.064 Euros (0.050) and the corresponding price change from the cum-dividend day to the ex-dividend day is 0.051 (0.020), indicating that the price drop is smaller than the dividend amount. The mean (median) dividend yield is 1.7% (1.4%). Moreover, the mean RPR as well as that of MARP is smaller than their theoretical value of unity. Similarly, the mean RPDR and that of MAPDR is smaller than the dividend yield. Finally, the mean abnormal raw return on the ex-dividend yield is greater than zero (0.771%).

[Insert Table 2 here]

Table 3 presents both theoretical and observed mean and median values for $RPR_{c\text{-}c}$, $RPR_{c\text{-}o}$, MARP, $RPDR_{c\text{-}c}$, $RPDR_{c\text{-}o}$, MAPDR, and ARR. The differences of the means from their corresponding theoretical values are tested using the t-test, and the differences of the medians from

[21] It is a well-known problem that this nonsynchronous trading results in biased estimates of the market model parameters (Brown and Warner, 1985).

their theoretical values are tested with the Wilcoxon signed rank test.[22] The mean (median) RPR_{c-c} is 0.877 (0.500). The corresponding t-statistic is –0.49, suggesting that the mean of RPR_{c-c} is not statistically smaller than its theoretical value at any conventional level of significance. Regarding the median, it is statistically significant at the 1% level. Calculating the RPR using opening prices instead of closing prices on the ex-dividend day (RPR_{c-o}), we observe that its mean (median) is 0.146 (0.250), statistically different from its theoretical value of unity at the 1% level. Similarly, the mean (median) MARP is 0.580 (0.352), statistically different from unity at the 10% level (1% level).

Calculating the price change from the cum-dividend day to the ex-dividend day in terms of cum-dividend price ($\Delta P/P$), we find that RPDR and MAPDR ratios are less than their theoretical value, that is, the dividend yield. In particular, the mean (median) $RPDR_{c-c}$ is 0.009 (0.006), statistically significant at the 1% level (5% level). The mean (median) $RPDR_{c-o}$ is 0.008 (0.004), statistically significant at the 1% level. On the other hand, the mean MAPDR is marginally lower than the dividend yield (0.016 vs. 0.017), statistically insignificant at any conventional level of significance. However, its median value (0.006) is statistically different from its theoretical value (0.014) at the 1% level. Finally, we calculate the abnormal raw returns on the ex-dividend day (ARR) and we find that the smaller drop of stock prices on ex-dividend dates compared to the dividend paid results in a statistically significant mean (median) abnormal return equal to 0.8% (0.7%).

Overall, the above results reject the null hypothesis that stock prices drop by exactly the dividend amount on ex-dividend dates. This is an interesting result given that in Greece the factors observed in other markets that inhibit ex-dividend stock prices from dropping by the dividend paid do not exist. Finally, our results are in line with those reported by Milonas and Travlos (2001), even though they examined a different period of time. Moreover, similar conclusions are drawn by using opening prices on ex-dividend days instead of closing prices.

[Insert Table 3 here]

6.2. Ex-dividend stock price behavior

To achieve clearer insight into which factors determine ex-dividend stock price behavior, we further analyze stock prices for a 41-day window around ex-dividend dates. We calculate abnormal returns using three models: (i) the market model, (ii) the market-adjusted return model,

[22] The Wilcoxon signed rank test, also known as the Wilcoxon matched pairs test, is a nonparametric test used to test the median difference in paired data. This test is the nonparametric equivalent of the paired t-test. The Wilcoxon signed rank procedure assumes that the sample is randomly taken from a population, with a symmetric frequency distribution. The symmetric assumption does not assume normality, simply that there seems to be roughly the same number of values above and below the median (Wilcoxon, 1945).

and (iii) the raw returns model. For space reasons, we analyze only the results from the market model, a decision supported by Cable and Holland (1999), who argue that the market model compares favorably to other models proposed in the literature. Table 4 displays stock price behavior pre and post ex-dividend day. On the ex-dividend day (t = 0), the mean abnormal return is 0.968%, statistically significant at the 1% level. However, positive and significant abnormal price behavior is also observed two days prior to the ex-dividend date, that is, Day –2 (0.397%) and Day –1 (0.456%). These results corroborate the findings of Table 2 that on ex-dividend dates there are significant returns to be gained.

[Insert Table 4 here]

Due to the absence of differential tax treatment of dividends compared to capital gains and the weak presence of microstructure impediments in Greece, we can rule out *a priori* two of the three arguments made to explain the ex-dividend stock price anomaly, that is, the tax effect hypothesis of Elton and Gruber (1970) and the price-discreteness hypothesis of Bali and Hite (1998). Even the argument of Frank and Jagannathan (1998) that market making is responsible for the ex-dividend stock price anomaly did not find empirical support in our study due to the weak presence of the bid-ask spread for the majority of Greek stocks during the period examined. The only hypothesis that seems to offer a possible explanation is that of Kalay (1982). We assess the impact of short-term trading on ex-dividend day returns by analyzing the behavior of share prices around the ex-dividend dates. If short-term traders capture dividends, then ex-dividend day returns should not be confined solely to ex-dividend dates. Instead, they should be positive on the pre ex-dividend date and negative on the post-ex-dividend date to reflect the buying (selling) behavior in the pre- (post-) event period. Short-term traders are also expected to target high-yield and low-transaction cost stocks. The ex-dividend day return of these stocks will be low to reflect the level of transaction costs (Kalay, 1982).

Table 5 reports cumulative abnormal returns (CARs) across various event periods [–20 to +20]. In line with the predictions of the short-term trading hypothesis, we provide evidence of significant positive CARs in the pre-event periods [–20 to –1, –10 to –1, and –5 to –1]. In particular, in periods [–20, –1], [–10, –1], and [–5, –1], the CARs are 1.872% (t = 1.92), 1.333% (t = 1.93), and 1.432% (t = 2.94), respectively (see Panel A). On the other hand, the CARs in the post-event period for two of the three event windows [+1 to +20 and +1 to +5] are negative, but statistically insignificant at any conventional level of significance (see Panel B). Specifically, in periods [+1, +20] and [+1, +5], the CARs are –0.459% (t = –0.47) and –0.208% (t = –0.43), respectively. These results indicate that in Greece dividend capture is predominant and may

explain the ex-dividend day stock price anomaly. They suggest that investors buy shares in the pre-event period and sell their shares after the ex-dividend day in order to capture the dividend.

[Insert Table 5 here]

Table 6 reports the distribution of ex-dividend day returns sorted by dividend yield and transaction costs. Transaction cost data are not directly observable. Similarly to Wu and Hsu (1996), Naranjo et al. (2000), Dhaliwal and Zhen Li (2006), and Yahyaee et al. (2007), we calculate transaction costs as the reciprocal of the cum-dividend stock price ($1/P_c$). If short-term trading is occurring, we expect a positive relationship between ex-dividend day returns and dividend yield and a positive relationship between ex-dividend day returns and transaction costs. In other words, we expect the short-term traders to target companies with high-yield and low-transactions costs. For that reason, we sort the whole sample into five quintiles according to dividend yield in ascending order. Within each quintile, we form another five quintiles according to transaction costs, again in ascending order, creating a total of 25 quintiles. Table 6 reports that the abnormal returns of low-yield, low-transaction cost companies amount to –0.872% (t = –0.72). In contrast, the ex-dividend day abnormal returns of high-yield, high-transaction cost companies are 3.414% (t = 2.03). These results suggest that ex-dividend day prices in Greece are likely to be affected by short-term traders. At the same time, the high-yield, high-transaction cost companies display positive CARs in the pre-event period and negative ones in the post-event period. These results support the short-term trading hypothesis.

[Insert Table 6 here]

6.3. Ex-dividend trading volume behavior

Lakonishok and Vermaelen (1986) proposed that merely investigating ex-dividend stock price behavior around ex-dividend dates cannot discriminate the tax effect hypothesis from the short-term trading hypothesis. They suggested that the trading volume behavior around ex-dividend dates could provide clear evidence regarding which of the two hypotheses explains the ex-dividend stock price behavior. Table 7 reports the trading volume behavior for a 41-day window around the ex-dividend date. The abnormal trading volume (AV) is measured in currency value (Euros) and in comparison with the average (normal) volume (AVOL) calculated in the estimation period. We see that the abnormal volume is 7,242 Euros higher than the normal volume on the ex-dividend day (2.13%). Moreover, positive abnormal volume is observed, even on the cum-dividend day, as equal to 24,917 Euros (7.34%). These results, along with those from the stock price behavior, confirm that some investors trade around the ex-dividend day in order to capture the dividend. Thus, the abnormal trading volume, even though insignificant, is positive on the cum- and ex-dividend days, reflecting the buying (selling) pressure on the cum-dividend day

(ex-dividend day). These results are in line with those found by Lakonishok and Vermaelen (1986), who also documented that the abnormal trading volume is concentrated across these two days.

[Insert Table 7 here]

From Table 8 (Panels A and B), we see that the cumulative abnormal volume (CAV) is negative in the pre- and post-event periods, but positive on the cum- and ex-dividend days. In particular, the CAV for these two days is 32,160 Euros (0.46%) higher than the normal volume.

[Insert Table 8 here]

Similarly to Lakonishok and Vermaelen (1986), Kato and Loewenstein (1995), and Wu and Hsu (1996), we calculate the abnormal trading volume according to the dividend yield and transaction costs. Unlike abnormal returns, we approximate transaction costs[23] with the normal trading volume, which is negatively related to transaction costs, according to Lakonishok and Vermaelen (1986). To test the prediction that trading activity should be positively related to dividend yield and negatively related to transaction costs, we divide our sample into 25 quintiles. First, we sort stocks according to dividend yield, forming five quintiles. Then, five quintiles are created within each dividend yield quintile according to trading size, which is negatively related to transaction costs. The average abnormal trading volume is computed for each quintile using data from Days –3, –2, and –1.

Table 9 shows that, over the whole period, abnormal trading volume increases with dividend yield. For example, for the lower-yield, lower-transaction cost stocks, the abnormal trading volume is only 7,550.46 Euros, whereas for the higher-yield, higher-transaction cost stocks, the abnormal trading volume is 267,968 Euros, statistically higher than the normal daily trading volume (t = 5.71). These results are in line with those found by Lakonishok and Vermaelen (1986), Kato and Loewenstein (1995), and Wu and Hsu (1996), suggesting that short-term trading occurs in the Greek market.

[Insert Table 9 here]

6.4. Regression results

Table 10 reports the regression results of ex-dividend day returns against the systematic risk (BETA), dividend yield (DY), transaction costs (TC), firm size (SIZE), average (normal) volume (AVVOL), ex-dividend date abnormal volume (AV), and a dummy variable (DUMMY). If ex-dividend day share prices are affected by dividend capture, ex-dividend day returns should be related to dividend yield and transaction costs. Due to the problem of multicollinearity[24] between

[23] Lakonishok and Vermaelen (1986), Kato and Loewenstein (1995), and Wu and Hsu (1996) calculate transaction costs using the normal trading volume instead of the inverse of the price on the cum-dividend date.
[24] The correlation between size and transaction costs is over 80%.

size and transaction costs, we perform two regressions. The first regression includes all variables except for SIZE. In the second regression, we replace transaction costs with the size variable. The cross-sectional results from the first regression show that the coefficient of the systematic risk (BETA) is negative and statistically significant at the 5% level (t = –1.98). This result is consistent with the findings of Michaely and Vila (1996) and Dhaliwal and Zhen Li (2006), who asserted that systematic risk is lower after ex-dividend days. The coefficient of the dividend yield (DY) is positive and statistically significant at the 10% level (t = –1.93), a finding consistent with the predictions of the short-term trading hypothesis. Kato and Loewenstein (1995), Michaely and Vila (1996), Wu and Hsu (1996), Naranjo et al. (2000), and Lasfer and Zenonos (2003) also found a positive coefficient for the dividend yield variable. In addition, the sign of the coefficient of transaction costs (TC) is in line with the predictions of the short-term trading hypothesis. In particular, it is positive and statistically significant at the 10% level (t = 1.69). Wu and Hsu (1996) and Naranjo et al. (2000) found similar results regarding the transaction costs variable. The coefficients of the rest of the variables are not statistically significant. A noteworthy feature is the insignificance of the dummy variable, which implies that the Hellenic Capital Market Commission's decision to stop artificially reducing opening prices on the ex-dividend day by the dividend amount did not affect the ex-dividend day returns for the period examined.

Similar findings are observed in the second regression where size replaces transaction costs. The coefficient of the dividend yield is again positive and statistically significant at the 10% level (t = –1.92) and the coefficient of the systematic risk variable is negative and statistically significant at the 10% level (t = –1.94). The short-term trading hypothesis predicts that larger firms are less risky; therefore, they should be preferred by short-term traders. In this case, the relationship between ex-dividend day returns and firm size should be negative, implying that larger companies are subject to short-term trading and thus their ex-dividend day returns will be lower (Lasfer and Zenonos, 2003). Indeed, the coefficient of the size variable is negative, but statistically insignificant (t = –1.31). Kato and Loewenstein (1995) and Naranjo et al. (2000) found the same sign regarding the coefficient of size. The other variables display no significance at any conventional level of significance. These results from the cross-sectional regression analysis are consistent with the predictions of the short-term trading hypothesis. Both the dividend yield and transaction costs seem to affect ex-dividend day returns.

Overall, our results are consistent with earlier empirical evidence from the United States, the United Kingdom, and other developed countries. Furthermore, the results provide a plausible explanation for the existence of the ex-dividend stock price phenomenon.

[Insert Table 10 here]

7. Conclusion

In this paper we analyze ex-dividend stock price and trading volume behavior in a market without differential tax treatment of dividends and capital gains. Moreover, the tick size is relatively low and market making is limited to just a few stocks during the period examined. Another interesting feature of the Greek market is the mandatory distribution of a minimum dividend. Despite the neutralized institutional environment, our results show that the ex-dividend day price did not drop by the full amount of the dividend. Significant positive abnormal returns are observed on the ex-dividend day. *A priori*, the tax effect hypothesis and the hypothesis based on microstructure impediments did not find empirical support in our study using data from the Athens Stock Exchange. The only hypothesis that did receive empirical support is the short-term trading one. In line with the predictions of the short-term trading hypothesis, we find a positive stock price trend before the ex-dividend day and a negative one afterward. This result implies buying pressure on the part of short-term traders in the pre ex-dividend day period and selling pressure in the post ex-dividend day period. In addition, we find that short-term traders target high-yield and low-transaction cost stocks. On the other hand, the abnormal trading volume is concentrated across two days, the cum-dividend day and the ex-dividend day, a finding also consistent with the predictions of the short-term trading hypothesis. The ex-dividend day abnormal trading volume is found to be positively associated with dividend yield and negatively associated with transaction costs.

By sorting the ex-dividend day abnormal return and the ex-dividend day abnormal trading volume according to dividend yield and transaction costs, we find a positive relationship between the ex-dividend day return and transaction costs and a positive relationship between the ex-dividend day return and dividend yield. On the other hand, the relationship between the ex-dividend day abnormal trading volume and dividend yield is positive, whereas the relationship between the ex-dividend day abnormal trading volume and transaction costs is negative. These results are in complete agreement with the predictions of the short-term trading hypothesis as described by Lakonishok and Vermaelen (1986). Finally, the results from the cross-sectional regression analysis confirm that dividend yield and transaction costs play the most significant role in determining stock prices on ex-dividend days.

The ex-dividend stock price phenomenon does occur on the Greek market despite this market's several peculiarities, most notably the nontaxation of dividends and capital gains. The evidence suggests that investors buying shares from firms traded on the ASE benefit from the smaller price drop on ex-dividend days in addition to avoiding paying taxes on dividends and capital gains. In line with the results of Castillo and Jakob (2006), we observe that short-term

trading is more prevalent for high-yield stocks; however, arbitrageurs cannot eliminate ex-dividend day abnormal returns due to the presence of significant transaction costs that prevent stocks from dropping on ex-dividend days by the full amount of the dividend paid.

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Table 1. Empirical studies on ex-dividend days around the world

	Study	Examined Period	Examined Market	Finding
1	Campbell and Beranek (1955)	1949–1950	USA	ΔP/D<1
2	Durand and May (1960)	1948–1959	USA	ΔP/D<1
3	Elton and Gruber (1970)	1966–1967	USA	Tax effect
4	Litzenberger and Ramaswamy (1979)	1936–1977	USA	Tax effect
5	Kalay (1982)	1966–1967	USA	Short-term trading
6	Poterba and Summers (1984)	1955–1981	UK	Tax effect
7	Booth and Johnston (1984)	1970–1980	Canada	Tax effect
8	Lakonishok and Vermaelen (1986)	1970–1981	Canada	Short-term trading
9	Barclay (1987)	1900–1910 & 1962–1985	USA	Tax effect
10	Grammatikos (1989)	1975–1985	USA	Short-term trading
11	Hietala (1990)	1974–1985	Finland	Tax effect
12	Michaely (1991)	1986–1989	USA	Short-term trading
13	Stickel (1991)	1972–1980	USA	Tax effect
14	Lamdin and Hiemstra (1993)	1982–1991	USA	Tax effect
16	Hearth and Rimbley (1993)	1984–1988	USA	Short-term trading
17	Boyd and Jagannathan (1994)	1962–1987	USA	Short-term trading
18	Michaely and Murgia (1995)	1981–1990	Italy	Tax effect
19	Lasfer (1995)	1985–1994	UK	Tax effect
20	Kato and Lowenstein (1995)	1981–1991	Japan	Tax effect
21	Bowers and Fehrs (1995)	1976–1987	USA	Short-term trading
22	Wu and Hsu (1996)	1984–1990	USA	Tax effect
23	Michaely and Vila (1996)	1963–1991	USA	Tax effect
24	Siddiqi (1997)	1987–1988	USA	Short-term trading
25	Espita and Ruiz (1997)	1980–1992	Spain	Tax effect
26	Bali and Hite (1998)	1962–1994	USA	Tick size effect
27	Frank and Jagannathan (1998)	1980–1993	Hong Kong	Bid-ask spread effect
28	Bhardwaj and Brooks (1999)	1986–1989	USA	Tax effect
29	Naranjo, Nimaledran, and Ryngaert (2000)	1962–1994	USA	Short-term trading
30	Liljeblom, Loflund, and Hedvall (2001)	1994–1996	Sweden	Tax effect
31	McDonald (2001)	1989–1998	Germany	Tax effect
32	Milonas and Travlos (2001)	1994–1999	Greece	ΔP<1
33	Bell and Jenkinson (2002)	1995–1999	UK	Tax effect
34	Lasfer and Zenonos (2003)	1988–2002	UK, Italy, France, Germany	Tax effect
35	Graham, Michaely, and Roberts (2003)	1996–2001	USA	Tax effect
36	Jakob and Ma (2004)	1993–2001	USA	Limit order imbalance
37	Milonas, Travlos, Xiao, and Tan (2006)	1996–1998	China	Tax effect
38	Farinha and Soro (2006)	1993–2002	Portugal	Tax effect
39	Castillo and Jakob (2006)	1989–2004	Chile	Short-term trading
40	Jakob and Ma (2006)	1962–1994	USA	Limit order imbalance
41	Daunfeldt, Salender, and Wikstrom (2006)	1991–1995	Sweden	Tax effect
42	Yahyaee, Pham, and Walter (2007)	1997–2005	Oman	Bid-ask spread effect

Table 2. Descriptive statistics

N = 256	Dividend	Div. Yield	P_c - P_e	RPRc-c	RPRc-o	MARP	RPDRc-c	RPDRc-o	MAPDR	ARR
Mean	0.064	0.017	0.051	0.877	0.146	0.580	0.009	0.008	0.036	0.008
Median	0.050	0.014	0.020	0.500	0.250	0.352	0.006	0.004	0.006	0.007
St. Deviation	0.058	0.012	0.248	3.994	3.702	3.638	0.036	0.027	0.467	0.037
Minimum	0.002	0.001	-0.880	-17.333	-23.333	-12.025	-0.126	-0.104	-0.176	-0.160
Maximum	0.440	0.073	2.200	20.800	19.333	19.402	0.177	0.119	7.465	0.163
Range	0.438	0.072	3.080	38.133	42.667	31.427	0.302	0.224	7.640	0.323
1st quartile	0.030	0.008	-0.040	-1.061	-0.050	-0.756	-0.011	-0.001	-0.009	-0.012
3rd quartile	0.076	0.024	0.100	1.982	1.200	1.412	0.031	0.020	0.025	0.027

Div. Yield is the dividend yield measured as the ratio of dividend over the price on cum-dividend day. $P_c – P_e$ is the price change between cum-dividend and ex-dividend day. RPRc-c is the raw price ratio using closing prices both on cum- and ex-dividend days. RPRc-o is the raw price ratio using closing prices on cum-dividend days and opening prices on ex-dividend days. MARP is the market-adjusted price ratio using closing prices on both cum- and ex-dividend days, but adjusting the latter for market movements. RPDRc-c is the raw price drop ratio using closing prices on both cum- and ex-dividend days. RPDRc-o is the raw price drop ratio using closing prices on cum-dividend days and opening prices on ex-dividend days. MAPDR is the market-adjusted price drop ratio using closing prices on both cum- and ex-dividend days, but adjusting the latter for market movements. ARR is the abnormal raw return on ex-dividend days.

Table 3. Ex-dividend day stock price behaviour

N = 256	Theoretical Value	Mean	t-Statistic	P-Value	Theoretical Value	Median	Wilcoxon Signed Rank P-Value
RPR c-c	1.000	0.877	-0.49	0.622	1.000	0.500***	0.005
RPR c-o	1.000	0.146***	-3.69	0.000	1.000	0.250***	0.000
MARP	1.000	0.580*	-1.85	0.066	1.000	0.352***	0.000
RPDR c-c	0.017	0.009***	-3.44	0.001	0.014	0.006**	0.021
RPDR c-o	0.017	0.008***	-5.28	0.000	0.014	0.004***	0.000
MAPDR	0.017	0.016	0.66	0.512	0.014	0.006***	0.000
ARR	0.000	0.008***	3.38	0.001	0.000	0.007***	0.000
DY		0.017				0.014	

RPRc-c is the raw price ratio using closing prices both on cum- and ex-dividend days. RPRc-o is the raw price ratio using closing prices on cum-dividend days and opening prices on ex-dividend days. MARP is the market-adjusted price ratio using closing prices on both cum- and ex-dividend days, but adjusting the latter for market movements. RPDRc-c is the raw price drop ratio using closing prices on both cum- and ex-dividend days. RPDRc-o is the raw price drop ratio using closing prices on cum-dividend days and opening prices on ex-dividend days. MAPDR is the market-adjusted price drop ratio using closing prices on both cum- and ex-dividend days, but adjusting the latter for market movements. DY is the dividend yield measured as the ratio of dividend over the price on cum-dividend day. ARR is the abnormal raw return on ex-dividend days. The Wilcoxon signed rank statistic is computed by summing the ranked differences of the deviation of each variable from a hypothesized median above the hypothesized value * denotes statistically significant at the 0.1 level, ** denotes statistically significant at the 0.05 level, *** denotes statistically significant at the 0.01 level.

Table 4. Abnormal returns around ex-dividend days

N = 256	Market Model		Market-Adjusted Model		Raw Returns Model	
Days	ARs %	t-Statistic	ARs %	t-Statistic	ARs %	t-Statistic
-20	0.205	0.94	0.123	0.64	-0.077	-0.35
-19	0.248	1.14	0.172	0.89	0.102	0.46
-18	-0.340	-1.56	-0.490***	-3.13	-0.723***	-4.02
-17	-0.165	-0.76	-0.176	-0.96	-0.274	-1.35
-16	0.148	0.68	0.121	0.61	-0.035	-0.16
-15	0.094	0.43	-0.098	-0.50	-0.345	-1.56
-14	-0.174	-0.80	-0.313*	-1.68	-0.558**	-2.56
-13	0.148	0.68	0.019	0.10	-0.180	-0.83
-12	0.156	0.72	0.049	0.27	0.007	0.03
-11	0.217	1.00	0.114	0.61	0.034	0.16
-10	-0.110	-0.50	-0.178	-1.06	-0.357*	-1.79
-9	0.035	0.16	-0.090	-0.49	-0.217	-1.02
-8	0.267	1.22	0.211	1.19	0.033	0.17
-7	-0.138	-0.63	-0.188	-0.95	-0.322	-1.44
-6	-0.154	-0.71	-0.219	-1.16	-0.340	-1.52
-5	0.208	0.95	0.141	0.79	0.068	0.32
-4	0.189	0.87	0.109	0.58	0.024	0.11
-3	0.181	0.83	0.132	0.72	0.182	0.85
-2	0.397*	1.82	0.382**	2.18	0.288	1.41
-1	0.456**	2.09	0.343**	2.19	0.371**	2.01
0	0.968***	4.44	0.889***	4.48	0.738***	3.24
1	-0.118	-0.54	-0.199	-1.21	-0.131	-0.67
2	-0.155	-0.71	-0.278*	-1.76	-0.223	-1.20
3	0.111	0.51	-0.012	-0.07	-0.030	-0.15
4	0.147	0.67	0.112	0.62	0.140	0.66
5	-0.193	-0.89	-0.280	-1.61	-0.282	-1.40
6	-0.186	-0.85	-0.312*	-1.73	-0.221	-1.05
7	0.104	0.48	-0.066	-0.39	-0.121	-0.63
8	0.371*	1.70	0.359**	2.12	0.559***	2.77
9	0.188	0.86	0.050	0.28	-0.030	-0.14
10	0.164	0.75	0.110	0.58	0.009	0.04
11	-0.254	-1.16	-0.253	-1.43	-0.102	-0.50
12	0.159	0.73	0.024	0.13	0.000	0.00
13	-0.396*	-1.82	-0.400**	-2.32	-0.307	-1.56
14	-0.028	-0.13	-0.083	-0.52	-0.002	-0.01
15	0.010	0.05	-0.169	-1.10	-0.290	-1.51
16	0.070	0.32	-0.142	-0.69	-0.259	-1.07
17	-0.094	-0.43	-0.255	-1.44	-0.533**	-2.49
18	-0.192	-0.88	-0.330	-1.59	-0.257	-1.13
19	0.043	0.20	-0.158	-0.85	-0.526**	-2.50
20	-0.209	-0.96	-0.355*	-1.95	-0.522**	-2.38

This table shows the abnormal returns (ARs) for the sample firms for 41 days around the ex-dividend date (t = 0). * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level.

Table 5. Cumulative abnormal returns around ex-dividend days

Panel A: Cumulative abnormal returns (CARs) before the ex-dividend day

	Market Model		Market-Adjusted Model		Raw Returns Model	
PERIOD	**CAR %**	**t-Statistic**	**CAR %**	**t-Statistic**	**CAR %**	**t-Statistic**
CAR (-20 -1)	1.872*	1.92	0.166	0.14	-2.321*	-1.77
CAR (-10 -1)	1.333*	1.93	0.644	0.78	-0.270	-0.29
CAR (-5 -1)	1.432***	2.94	1.108*	1.90	0.932	1.42
CAR (-1 +1)	1.306***	3.46	1.034**	2.29	0.977*	1.93

Panel B: Cumulative abnormal returns (CARs) after the ex-dividend day

	Market Model		Market-Adjusted Model		Raw Returns Model	
PERIOD	**CAR %**	**t-Statistic**	**CAR %**	**t-Statistic**	**CAR %**	**t-Statistic**
CAR (+1 +20)	-0.459	-0.47	-2.633**	-2.26	-3.130**	-2.39
CAR (+1 +10)	0.433	0.63	-0.514	-0.62	-0.331	-0.36
CAR (+1 +5)	-0.208	-0.43	-0.656	-1.13	-0.527	-0.80

This table shows the cumulative abnormal returns (CARs) for the sample firms for various event periods around the ex-dividend date (t = 0). * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level.

Table 6. Abnormal returns on and around ex-dividend days arranged by dividend yield and transaction cost

Panel A: Abnormal returns on and before ex-dividend days arranged by dividend yield and transaction cost

DY	TC	AR_0 %	t-Statistic	CAR (-20 -1 %)	t-Statistic	CAR (-10 -1) %	t-Statistic	CAR (-5 -1) %	t-Statistic	CAR (-1 0) %	t-Statistic
LOW Q1	Q1 LOW	-0.872	-0.72	-2.685	-0.49	-4.284	-1.11	0.619	0.23	0.693	0.40
Q1	Q2	0.436	0.38	3.325	0.65	1.011	0.28	-0.519	-0.20	1.578	0.98
Q1	Q3	0.833	0.91	1.812	0.44	0.906	0.31	1.334	0.66	2.249*	1.75
Q1	Q4	1.293	1.27	-2.234	-0.49	-3.756	-1.17	-0.168	-0.07	-1.349	-0.94
Q1	Q5 HIGH	1.454*	1.72	1.059	0.29	1.021	0.38	2.819	1.50	-0.658	-0.55
Q2	Q1 LOW	-0.488	-0.38	-1.517	-0.27	-2.432	-0.60	2.329	0.82	0.016	0.01
Q2	Q2	0.487	0.39	1.202	0.21	-0.883	-0.22	0.541	0.19	0.129	0.07
Q2	Q3	-1.797	-1.74	4.553	0.99	6.314*	1.93	3.588	1.55	-0.931	-0.64
Q2	Q4	1.316	1.27	-0.552	-0.12	-0.670	-0.21	-1.601	-0.69	1.254	0.86
Q2	Q5 HIGH	1.408	1.37	1.888	0.41	-1.340	-0.41	-0.337	-0.15	1.614	1.11
Q3	Q1 LOW	2.407***	2.98	2.056	0.57	-2.224	-0.87	-1.040	-0.58	2.000*	1.75
Q3	Q2	-1.462	-1.61	1.751	0.43	3.604	1.26	2.651	1.31	-0.852	-0.66
Q3	Q3	1.985**	2.31	2.134	0.55	0.359	0.13	-0.359	-0.19	2.036*	1.67
Q3	Q4	1.164	1.15	10.236**	2.26	6.988**	2.18	4.341*	1.91	0.580	0.40
Q3	Q5 HIGH	1.450	1.48	1.516	0.34	3.868	1.24	2.721	1.24	1.484	1.07
Q4	Q1 LOW	1.985**	2.09	-4.188	-0.98	-1.495	-0.50	0.408	0.19	1.780	1.32
Q4	Q2	2.240***	2.64	4.713	1.24	5.228*	1.95	0.624	0.33	1.521	1.27
Q4	Q3	1.592*	1.68	6.785	1.60	3.048	1.02	2.042	0.96	1.896	1.41
Q4	Q4	2.070**	2.18	-3.197	-0.75	0.738	0.25	2.497	1.18	4.363***	3.25
Q4	Q5 HIGH	3.712***	3.85	0.800	0.19	3.041	1.00	2.746	1.28	4.398***	3.23
HIGH Q5	Q1 LOW	1.181	1.63	0.967	0.30	1.480	0.65	1.719	1.06	2.737***	2.67
Q5	Q2	1.815***	2.64	3.348	1.09	-0.212	-0.10	0.128	0.08	1.864*	1.92
Q5	Q3	1.945***	2.67	2.840	0.87	2.870	1.24	3.299**	2.02	2.144**	2.08
Q5	Q4	1.132	1.47	-2.361	-0.69	-0.349	-0.14	-0.187	-0.11	2.208**	2.03
Q5	Q5 HIGH	3.932***	4.24	2.818	0.84	3.901*	1.64	3.414**	2.03	2.833***	2.66

DY is the dividend yield calculated as the ratio of dividend per share over the cum-dividend day price. TC is the transaction cost calculated as the reciprocal of stock price on the cum-dividend day ($1/P_c$). AR_0 is the average abnormal return on the ex-dividend day. CAR is the cumulative abnormal return around various event periods. * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level.

Table 6. Abnormal returns on and around ex-dividend days arranged by dividend yield and transaction cost (continued).

Panel B: Abnormal returns after ex-dividend days arranged by dividend yield and transaction cost

DY	TC	CAR (+1 +20) %	t-Statistic	CAR (+1 +10) %	t-Statistic	CAR (+1 +5) %	t-Statistic	CAR (-1 +1) %	t-Statistic
LOW Q1	Q1 LOW	-8.683	-1.59	-2.149	-0.56	-0.546	-0.20	0.748	0.35
Q1	Q2	-1.756	-0.34	3.582	0.99	1.890	0.74	0.419	0.21
Q1	Q3	-2.276	-0.56	-0.468	-0.16	-1.062	-0.52	2.418	1.53
Q1	Q4	-9.906**	-2.18	-5.184	-1.62	-0.217	-0.10	-1.792	-1.02
Q1	Q5 HIGH	0.836	0.22	0.895	0.34	0.211	0.11	-1.008	-0.69
Q2	Q1 LOW	-2.099	-0.37	0.859	0.21	1.599	0.56	0.119	0.05
Q2	Q2	-7.411	-1.32	-7.174*	-1.81	-3.655	-1.30	0.599	0.28
Q2	Q3	-4.150	-0.90	3.799	1.16	1.340	0.58	-0.006	0.00
Q2	Q4	4.678	1.01	1.670	0.51	0.208	0.09	1.903	1.06
Q2	Q5 HIGH	0.109	0.02	0.792	0.24	-0.126	-0.05	1.493	0.84
Q3	Q1 LOW	-0.765	-0.21	0.198	0.08	-0.132	-0.07	2.100	1.50
Q3	Q2	2.126	0.52	0.852	0.30	-0.819	-0.40	-1.542	-0.98
Q3	Q3	3.035	0.79	0.877	0.32	0.508	0.26	1.205	0.81
Q3	Q4	6.204	1.37	7.272**	2.27	2.320	1.02	0.637	0.36
Q3	Q5 HIGH	2.870	0.65	5.544*	1.78	1.492	0.68	1.130	0.66
Q4	Q1 LOW	-1.307	-0.31	-2.178	-0.72	-2.694	-1.27	1.180	0.72
Q4	Q2	2.696	0.71	2.124	0.79	0.042	0.02	1.532	1.04
Q4	Q3	5.551	1.31	3.366	1.12	2.160	1.02	2.496	1.52
Q4	Q4	-1.707	-0.40	0.014	0.00	2.297	1.08	4.844***	2.94
Q4	Q5 HIGH	5.141	1.19	0.902	0.30	-0.518	-0.24	4.642***	2.78
HIGH Q5	Q1 LOW	-0.552	-0.17	-1.676	-0.73	-1.139	-0.70	1.710	1.36
Q5	Q2	-0.164	-0.05	0.170	0.08	-1.933	-1.26	1.096	0.92
Q5	Q3	1.874	0.57	-0.048	-0.02	1.669	1.02	2.672**	2.12
Q5	Q4	-4.481	-1.30	-0.678	-0.28	-2.026	-1.18	2.640*	1.98
Q5	Q5 HIGH	-2.812	-0.84	-2.885	-1.21	-5.744***	-3.41	1.723	1.32

DY is the dividend yield calculated as the ratio of dividend per share over the cum-dividend day price. TC is the transaction cost calculated as the reciprocal of stock price on the cum-dividend day ($1/P_c$). AR_0 is the average abnormal return on the ex-dividend day. CAR is the cumulative abnormal return around various event periods. * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level.

Table 7. Abnormal trading volume around ex-dividend days

Days	AVs in Euros	t-Statistic	% AV
-20	7,619.08	0.17	2.24
-19	-37,744.06	-0.90	-11.12
-18	75,865.07	0.48	22.34
-17	-35,121.99	-1.22	-10.34
-16	-55,448.91*	-1.83	-16.33
-15	-53,842.31	-1.48	-15.86
-14	-50,728.98	-1.06	-14.94
-13	43,009.40	0.32	12.67
-12	22,068.10	0.26	6.50
-11	24,018.25	0.33	7.07
-10	-57,647.38	-1.04	-16.98
-9	-20,442.25	-0.25	-6.02
-8	63,295.13	0.46	18.64
-7	-14,338.72	-0.23	-4.22
-6	-82,808.49***	-2.73	-24.39
-5	-102,387.85***	-4.12	-30.16
-4	-14,900.76	-0.30	-4.39
-3	-1,222.86	-0.03	-0.36
-2	-113,797.99***	-4.75	-33.52
-1	24,917.67	0.53	7.34
0	7,242.54	0.08	2.13
1	-40,921.65	-0.52	-12.05
2	-44,133.87	-1.14	-13.00
3	-106,657.82***	-4.06	-31.41
4	-123,786.47***	-4.62	-36.46
5	-36,699.13	-0.76	-10.81
6	-19,419.84	-0.27	-5.72
7	-89,835.17***	-3.36	-26.46
8	-40,303.85	-0.98	-11.87
9	-20,919.06	-0.50	-6.16
10	63,292.02	0.33	18.64
11	-75,441.44***	-2.79	-22.22
12	-63,634.68*	-1.65	-18.74
13	-37,284.93	-0.84	-10.98
14	-55,369.75	-1.30	-16.31
15	-53,589.75	-1.17	-15.78
16	-48,166.69	-1.13	-14.19
17	-23,956.53	-0.49	-7.06
18	-10,665.94	-0.17	-3.14
19	-85,047.19***	-3.07	-25.05
20	-119,870.49***	-5.13	-35.30

This table shows the abnormal trading volume (AVs) for the sample firms for 41 days around the ex-dividend date (t = 0). * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level.

Table 8. Cumulative abnormal trading volume around ex-dividend days

Panel A: Cumulative abnormal volume (CAV) before the ex-dividend day		
PERIOD	**CAV in Euros**	**t-Statistic**
CAV (-20 -1)	-379,639.84*	-1.71
CAV (-10 -1)	-319,333.50**	-2.03
CAV (-5 -1)	-207,391.79*	-1.87
CAV (-1 0)	32,160.21	0.46
Panel B: Cumulative abnormal volume (CAV) after the ex-dividend day		
PERIOD	**CAV in Euros**	**t-Statistic**
CAV (+1 +20)	-1,032,412.24***	-4.65
CAV (+1 +10)	-459,384.84***	-2.92
CAV (+1 +5)	-352,198.94***	-3.17
CAV (-1 +1)	-8,761.44	-0.10

This table shows the cumulative abnormal trading volume (CAV) for the sample firms for various event periods around the ex-dividend date (t = 0). * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level.

Table 9. Abnormal trading volume on and around ex-dividend days arranged by dividend yield and average volume

DY	TS	AVs in Euros	t-Statistic	AVS %	NV
LOW Q1	Q1 LOW	7,550.46	1.43	115.34	6,546,30
Q1	Q2	-6,001.09	-1.57	-27.49	21,829.08
Q1	Q3	-39,378.08***	-6.29	-55.20	71,330.71
Q1	Q4	45,589.54	0.66	15.10	301,824.33
Q1	Q5 HIGH	662,092.10*	1.65	47.01	1,408,532.31
Q2	Q1 LOW	3,039.79	1.47	25.18	12,069.93
Q2	Q2	-18,910.39***	-3.24	-40.82	46,325.72
Q2	Q3	-56,472.12***	-5.25	-46.02	122,714.22
Q2	Q4	72,890.97*	1.73	21.70	335,875.30
Q2	Q5 HIGH	234,249.63	1.00	16.28	1,438,727.58
Q3	Q1 LOW	-5,798.74*	-1.66	-25.08	23,124.48
Q3	Q2	82,345.07	1.42	100.40	82,016.75
Q3	Q3	40,041.36	0.73	21.51	186,165.03
Q3	Q4	3,066.87	0.03	0.83	369,140.34
Q3	Q5 HIGH	462,703.43***	4.49	46.46	995,962.09
Q4	Q1 LOW	19,613.54**	2.04	117.11	16,747.61
Q4	Q2	19,970.43	0.76	37.20	53,683.40
Q4	Q3	42,345.26	1.05	33.86	125,046.29
Q4	Q4	36,690.39	1.10	14.14	259,497.99
Q4	Q5 HIGH	373,659.01**	2.28	30.89	1,209,784.87
HIGH Q5	Q1 LOW	10,775.68	1.14	75.48	14,275.99
Q5	Q2	20,665.36	1.56	40.25	51,343.31
Q5	Q3	34,376.06*	1.64	-21.63	158,953,67
Q5	Q4	81,104.14	1.63	28.66	282,992.50
Q5	Q5 HIGH	267,968.26***	5.71	46.83	572,181.37

DY stands for the dividend yield calculated as the ratio of dividend per share over the cum-dividend day price. TS denotes the trading size. AVs is the average volume (in Euros) using data on Days –3, –2, and –1. NV is the average daily normal volume (in Euros), using data from Day –120 to Day –21 and from Day +21 to Day +121. * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level.

Table 10. Regression analysis on ex-dividend day returns on a number of explanatory variables

$$AR_{0,i} = a_0 + a_1 * BETA_i + a_2 * DY_i + a_3 * TC_i + a_4 * SIZE_i + a_5 * AVVOL_i + a_6 * AV_i + a_7 * DUMMY_i + e_i$$

	Model 1	**Model 2**
Intercept	0.07	0.018
	(0.078)	(1.32)
BETA	-0.011	-0.011
	(-1.98)**	(-1.94)*
DY	0.35	0.35
	(1.93)*	(1.92)*
TC	0.013	-
	(1.69)*	-
SIZE	-	0.004
	-	(-1.31)
AVVOL	-6.63E-10	-1.23E-10
	(-0.19)	(-0.04)
AV	-4.10E-10	-5.15E-10
	(-0.29)	(-0.36)
DUMMY	0.08	0.006
	(1.27)	(1.00)
N	256	256
Adj-R	0.061	0.059
DW	1.94	1.94
F-statistic	3.56	3.45

AR_0 is the abnormal return on the ex-dividend day. BETA is the systematic risk computed by the market model in the estimation period (–220, –21). DY stands for the dividend yield calculated as the ratio of dividend per share over the cum-dividend day price. TC is the transaction cost calculated as the reciprocal of stock price on the cum-dividend day ($1/P_c$). SIZE stands for the firm size as measured by the natural logarithm of the market value of equity on the cum-dividend day. AVVOL is the average daily normal volume (in Euros), using data from Day –120 to Day –21 and from Day +21 to Day +121. AV is the abnormal volume (in Euros) on the ex-dividend day. DUMMY is a variable that takes the value 0 for the period before the 59 Act and 1 for the period after the 59 Act. Numbers in parentheses are t-statistic values. * indicates a significant difference from zero at the 10% level, ** indicates a significant difference from zero at the 5% level, and *** indicates a significant difference from zero at the 1% level. We found no evidence of heteroskedasticity using the White test. We also tested for normality using the Jarque Bera test and found that the residuals in both regressions are normal.