

# Essays on Dividends

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# 1 Introduction

Dividend policy has drawn a lot of attention in financial literature. The dividend decision is one of the most extensively researched topics in the finance area and it has remained one of the toughest challenges for financial economists. Dividends are commonly defined as the distribution of earnings (past or present) among the shareholders of the firm in proportion to their ownership. The term dividend policy means the practice that the management, as well as the board of directors, follows in making dividend payout decisions or, in other words, the size and pattern of cash distributions over time to shareholders.

Corporate managers make two main decisions: the investment (or capital budgeting) and the financing decision. The capital budgeting decision illustrates the real assets that the firm should acquire, while the financing decision illustrates how these assets should be financed determining the capital structure of a corporation. However, the financing decision determines another type of decision as well: the dividend policy. The dividend policy determines, on the one hand, the amount of earnings that are available as a source of financing and, on the other hand, the amount of earnings paid as dividend.

A starting assumption in the majority of the academic finance literature is that managers should maximize the wealth of firm's shareholders, which translates into maximizing the value of the company as measured by the price of the company's common stock. Thus, they should set their dividend payments according to this objective. This goal can be achieved by giving the shareholders a "fair" payment on their investments.

The most important questions to be answered concerning dividend policy are: How much cash should firms give back to shareholders? What form should the payment take? Should corporations pay their shareholders through dividends or by repurchasing their shares? Which is the least costly form of payout from a tax perspective? Firms must take these important decisions period after period (some must be repeated and some need to be reevaluated each period), on a regular basis.

According to Allen and Michaely (2002), because these decisions are dynamic they are labeled as payout policy. The word policy implies some consistency over time, meaning that the payout, and dividends in particular, do not simply evolve in an arbitrary and random manner. Payout policy is important not only because of the amount of money involved and the repeated nature of the decision, but also because payout policy is closely related to, and interacts with, most of the financial and investment decisions that the firms make. Understanding payout policy may lead to a deeper understanding of other pieces in this puzzle. Theories of capital structure, mergers and acquisitions, asset pricing, and capital budgeting; all rely on a view of how and why firms pay out cash.

The three most popular ways by which companies can set their payout policies are: through cash dividends, stock dividends and repurchasing shares. This thesis will focus on the former of these ways, the cash dividends, since it examines both the effect of dividend announcement in firm's share price and the ex-dividend day anomaly at the Greek stock market, where neither stock dividends nor share repurchases are popular ways of payout.

Firms generally adopt dividend policies that suit the stage of life cycle they are in. For instance, already grown firms with larger cash flows and fewer projects tend to pay more of their earnings out as dividends. The dividend policies of firms may follow several interesting patterns adding further to the complexity of such decisions. First, dividends tend to lag earnings, meaning that increases in earnings are followed by increases in dividends and decreases in earnings sometimes by dividend reductions. Second, dividends are "sticky" because firms are typically reluctant to change dividends. In particular, firms avoid cutting dividends even when earnings drop. Third, dividends tend to follow a much smoother path than earnings. Finally, there are distinct differences in dividend policy over the life cycle of a firm resulting from changes in growth rates, cash flows, and project investments in hand.

Despite the different patterns of firms' dividend policy, the amount of distributed dividends is also affected by factors such as legal requirements, debt covenants and the availability of cash resources that impose some limitations on this amount. For these reasons the empirical literature has recorded sys-

tematic variations in dividend behaviour across firms, countries, time and type of dividend. Fama and French (2001) findings suggest that the US dividend paying firms tend to be large and profitable, while non-payers are typically small, less profitable but with high investment opportunities. La Porta, Lopez-de-Silanes, Shleifer and Vishny (2000), who study the dividend policies of over 4000 firms from 33 countries around the world, found significant variations across countries. In particular, it is found that dividend policies vary across legal regimes in a way that is consistent with the idea that dividend payment is the outcome of effective pressure by minority shareholders to restrict agency behaviour. Thus, firms in common law countries with good legal protection of investors tend to have lower payout ratios compared with firms in countries with weaker legal protection.

In light of the observed variations across firms, countries, time and type of dividends, the question of how dividend policy is determined has been the subject of many studies. A lot of researchers have used both theoretical and empirical models without completely understanding the factors that influence dividend decision and the manner in which these factors interact. Therefore, dividend policy is still one of the most complex aspects in finance. Four decades ago, Black (1976) in his study on dividend wrote: “The harder we look at the dividend picture the more it seems like a puzzle, with pieces that just don’t fit together”.

This thesis contributes to the literature by studying three special issues of dividends. More precisely this thesis is consisted of three stand alone papers examining the following three distinct questions. Firstly, one of the chapters tests the predictive power of dividend yield on future dividend growth using the Mixed Data Sampling (MiDaS) technique. Secondly, the next chapter examines the ex-dividend stock price behavior in Athens Stock exchange and it also explores whether or not an institutional change affects the ex-dividend stock price behaviour. Finally, the last chapter investigates the information content of dividend announcement in a unique institutional setting, the Greek stock market.

The major objective of the first standalone issue of this thesis is to examine the predictive power of dividend yield on future dividend growth. The

extensive relevant literature has not provided evidence which clearly support the hypothesis that dividend yield could predict future dividend growth. This chapter deals with two main reasons that raise the econometric complexity on testing the dividend growth predictability hypothesis, namely, the seasonality effects that appear when higher frequency data are used, and the effect of price volatility on the computation of the dividend yield. Specifically, an application of the Mixed Data Sampling (MiDaS) technique allows this study to use monthly dividend yield data in order to test the hypothesis that dividend yield can predict the future annual dividend growth. In order for the effect of price variation on dividend yield to be cancelled out, a smoothing technique is used to identify the component of the smoothed dividend yield that offers predictive power.

The empirical results, from a data set which includes the four largest equity markets, namely S&P500 (US), FTSE100 (UK), SPTSX60 (Canada) and NKY (Japan), strongly support the dividend growth predictability hypothesis. In more detail, for every country in the sample, dividend growth is predictable via the annual-to-annual monthly growth rate of dividend yield and the sign of the dividend growth - dividend yield relationship is negative for all countries, as theoretically expected. The existence of dividend growth predictability even for the US is worth noting and it is in contrast with what has been suggested in the recent literature.

Moreover, this study indicates that the predictability of dividend growth through MiDaS technique is not affected by the policy of firms to smooth dividends. The values of smoothing parameters as calculated by Lintner as well as the Marsh and Merton model are very similar with or without MiDaS calculation. Finally, it is found that both the liquidity of the market as well as the dividend volatility do not affect the predictability of the annual-to-annual monthly growth rate of dividend yield on the annual dividend growth.

The aim of the second stand alone paper is two-fold: a) to examine the determinants of the ex-dividend day behavior in the Athens Stock Exchange (ASE) during a ten year period 1996-2005 under a unique institutional setting and b) to examine how a major regulatory change in the method of the ex-dividend day price adjustment affects the extend of the stock price drop. The

examination of the ex-dividend stock price behaviour in the unique dataset of the Greek stock market is interesting since several factors such as taxes, price discreteness and transaction costs, among others that are used in the literature to clarify the ex-day behaviour are either absent or limited. Thus, the results of this chapter are very important since the Greek environment is very different from other countries, helping to understand the ex-dividend day price behaviour

Due to the fact that neither income from dividends nor from capital gains is taxed, the differential taxation between dividend and capital gains is absent and the marginal trader is not subject to taxes on dividends and capital gains. Moreover, the mandatory dividend distribution for profitable firms according to Law 2190/1920, as well as the fact that dividends are distributed once a year, whereas in many other countries (e.g., US, UK, Japan, Australia) dividends are paid quarterly or semi-annually, is one more significant characteristic of the Greek environment. These factors increase the size of the dividends relative to the minimum tick size for the stock compared to other countries, and this reduces the importance of the tick size as a driver of the ex-day behaviour. Also the annual dividend distribution reduce the importance of transaction costs since transaction costs become more important when dividends are relatively small, and act like a barrier against short-term trading. The fact that stock prices are decimalized in the Greek stock market implies that the confounding effects of stock price discreteness on the ex-day behaviour are much smaller compared to other markets where prices are not decimalized. Finally, the absence of market making, the open and close bid ask spreads are not an equivalent regulator of bid ask spread, as well as the fact that short selling in the ASE is limited to a few stocks, strengthened the advantage of the Greek environment as a testing ground. For all the above reasons, the ex-dividend day behaviour can be examined in a less noisy and a more powerful manner than the previous studies.

Given these special circumstances, the empirical results of this study demonstrate that stock prices, on average, decline by less than the dividend amount on the ex-dividend day during the examination period. The

relative price drop to dividend is far below one (which is the expected drop in the given environment). Moreover, the empirical results of this study indicate statistically significant abnormal returns, as well as abnormal volumes, around the ex-dividend day without any support of short-term trading. Furthermore, both of these variables are not affected by commonly used measures of transaction costs, such as the inverse of price on cum day and normal trading volume.

In addition, the cross sectional analysis of abnormal returns to dividend yield, after controlling for other variables, such as the idiosyncratic risk and transaction costs, reveals that none of them can affect abnormal returns. In addition, no evidence of a clientele preference of capital gains over dividends is observed, as there is no significant clear pattern between the relative price drop and dividend yields. 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.

Absent of taxes on dividends and capital gains and certain microstructure impediments, commonly used in the literature, illiquidity is the strongest candidate in explaining the magnitude of the ex-dividend day price adjustment. This is a logical conclusion since at the low illiquidity (high liquidity) quartile the price drop equals the dividend amount and the abnormal returns are close to zero.

In addition, the current research provides evidence that institutional changes may affect stock price behaviour on ex-day through the examination of the special institutional modification announced by the ASE Board of Directors (April 2001) according to which the opening ex dividend day price is equal to the closing price on cum day. The empirical results indicate that this institutional change alleviates, without eliminating completely the anomaly, in the sense that the raw price ratio tends to one and abnormal returns tend to zero after the institutional change. Thus, institutional interventions, that allow the free function of the market, may level out pricing inefficiencies. Finally, the rejection of some of the possible explanations that have already been proposed in the literature helps researchers to identify which explanations may be still valid for future studies.

The last paper empirically examines the information content of cash dividend increase announcements both "unexpected" and "historically related average-unexpected" ("hra-unexpected") in a special environment like that of the Athens Stock Exchange. Using standard event study analysis, abnormal returns are calculated for different time intervals around announcement day in order to identify whether or not such dividend announcements contain information relevant to price formation by firms listed in the Athens Stock Exchange for the period 2000-20004.

The Athens Stock Exchange exhibits idiosyncratic characteristics that make the examination of market reaction to cash dividend announcements really interesting and unique. The special tax treatment of dividends and capital gains is one of the main features of the Greek stock market since incomes from dividends and capital gains are not taxed. Another distinctive characteristic of the Greek environment is the minimum mandatory dividend distribution from profitable firms according to the law. All profitable firms are obligated to distribute cash dividends equal to at least one of the following: (a) 6% of their common equity or (b) 35% of the net income minus tactical reserves, whichever amount is higher.

An additional feature of the Greek stock market relates to firm ownership, which in many cases, is in the hands of a small number of major shareholders (low diffusion) that also hold managerial positions. This concentrated ownership structure should reduce the agency cost between managers and shareholders and may not create agency concerns to outside shareholders, reducing the information asymmetry. Most of the companies change their dividend every year and the announcement is made on an annual basis. All of the aforementioned arguments suggest that dividends should act as neither information-signals nor disciplinary mechanisms, and overall, these attributes suggest a diminished role for dividend announcements in the Greek stock market.

Contrary to that, the empirical results from such a specific environment show that market reacts strongly to announcements of dividend increase changes and that dividends act as information signals. Moreover, a significant negative relationship between cash dividend increase announcements, above

the minimum mandatory amount, and abnormal returns after the announcement is observed. The announcement of dividends higher than the mandatory dividend (both "unexpected" and "hara-unexpected" dividends) result in significant negative abnormal returns, whereas the announcement of mandatory dividends result in insignificant abnormal returns around the announcement day. Thus, dividend increase announcements above the mandatory amount have a negative stock price effect, a sign that the market considers these announcements forerunners of "bad" news that will follow.

The negative price reaction after the announcement of such dividends is also strengthened by the fact that the higher the "unexpected" dividend increases (compared to the minimum mandatory dividend) the greater the negative market reaction. In addition, the reduction on firms' average capital expenditures level that announce dividends higher than the mandatory amount, for the 2 years period after the announcement year with respect to the announcement year, is a significant indication in favor of the negative price reaction.

These findings, even though a dividend increase announcement is translated as "bad" signal for the investors, contrary to the literature, support the view that dividends convey unique and valuable information to investors and contradict with the tax-based signaling models, which propose that higher taxes on dividends relative to capital gains are a necessary condition for dividend announcements to be informative.

The rest of this thesis is organized as follows: Section 2, presents a brief review of the related literature on basic issues of dividend policy; Section 3, revisits dividend growth predictability via dividend yield; Section 4, examines the ex-dividend day behaviour in Athens Stock Exchange; Section 5 examines the dividend increase announcements in a different institutional setting: The case of Greece, and Section 5, summarizes this thesis.

## 2 Basic issues concerning dividend policy

Why shareholders like dividends and why they reward managers who pay regular increasing dividends is still unanswered. These questions are often referred to as the dividend puzzle, and the debate is generally believed to have been initiated by Miller and Modigliani's (1961) irrelevance proposition. Prior to their paper, most economists believed that the more dividends a firm paid, the more valuable firm would be. This point of view resulted from the company's discounted dividends valuation model. Their model values a company based on the assumption that a stock is worth the discounted sum of all its future dividend payments, discounted by an appropriate risk-adjusted rate. The model states that if the first dividend is paid at date  $t = 1$ , then at date  $t = 0$  the value of the company  $V_0$  is derived from the equation:

$$V_0 = \sum_{t=0}^{\infty} \frac{D_t}{(1 + r_t)} \quad (1)$$

where:

$V_0$ : the value of a firm at date  $t = 0$  (if first dividends are paid by the firm in the subsequent period at date  $t = 1$ ).

$D_t$ : dividends paid by the firm at the end of period  $t$ .

$r_t$ : the investors' opportunity cost of capital for period  $t$ .

This formula conditions the value of the company only on dividends paid. However, economists knew that it cannot be the only important factor in measuring the value of a firm. Gordon (1959) argued that investors' required rate of return would increase with the retention of earnings and increased investments. Even though increased investments would result in the increase of  $D_t$ , required rate of return would grow faster as investments are riskier than dividends.

Miller and Modigliani (1961) found this way of valuing company incomplete and hence decided to demonstrate how companies' value changes assuming different dividend payout decisions. The difference between their and Gordon's model was that they based their theories on investment policy in-

stead and they show that what really counts is the firm's investment policy. As long as investment policy does not change, altering the mix of retained earnings and payout will not affect firm's value. The dividend irrelevance proposition suggests that the real increase in firm value should result from an increase in firm's investments rather than sole increase in dividends. The payout literature, that followed the Miller and Modigliani (1961) irrelevance proposition, attempted to reconcile the unquestionable logic of dividend irrelevance theorem with the notion that both managers and investors care about payouts and dividends in particular.

When the assumptions underlying the irrelevancy theory are relaxed the question is whether it is still reasonable to conclude that dividends will have no effect on expected earnings, investment or on the firm's risk and hence the discount rate. For example, future earnings of a firm that pays dividends may be lower relative to a similar firm that does not pay dividends, if paying dividends involves incurring transaction costs or extra taxes. Indeed, much of the dividend literature has focused on the implications of relaxing the Miller & Modigliani (1961) irrelevancy theory assumptions and on introducing market imperfections.

The theoretical literature that deals with dividend policy in the presence of market imperfections may be categorized under two basic views: pros and cons. On the 'cons' camp are theories including the transaction cost theory of dividend and the tax hypothesis that suggest that dividend payments reduce shareholder wealth. For example if dividends are taxed more heavily than capital gains and investors cannot use dynamic trading strategies to avoid this higher taxation then minimizing dividends is optimal.

On the 'pros' camp are theories that suggest that dividend payments increase shareholder wealth, including the bird in the hand argument, the signalling theory and the agency theory of dividend. For example, if managers know more about the true value of their firm, dividends can be used to convey that information to the market, despite the costs associated with paying those dividends (However, note that with asymmetric information, dividends can also be viewed as bad news because firms that pay dividends are the ones that have no positive NPV projects to invest in). Moreover, if

contracts are incomplete or are not fully enforceable equityholders may, under some circumstances, use dividends to discipline managers or to expropriate wealth from debtholders. All these theories have been extensively discussed and tested but to date there is no consensus on how firms determine their dividend policies.

## 2.1 Miller and Modigliani dividend irrelevance theory

In 1961, two Nobel laureates, Merton Miller and Franco Modigliani (M&M) showed that in perfect and complete capital markets, a firm's dividend policy does not affect its value. The basic premise of their argument is that the firm's value is determined by choosing optimal investments. The net payout is the difference between earnings and investments, in other words a residual. Because the net payout comprises dividends and share repurchases, a firm can adjust its dividends to any level with an offsetting change in share outstanding. From the perspective of investors dividends policy is irrelevant because any desired stream of payments can be replicated by appropriate purchases and sales of equity. Thus, investors will not pay a premium for any particular dividend policy.

The proposition starts from presuming that the sources and the uses of firm's funds have to be balanced over any given period. Suppose that a firm has two sources of funds: retained earnings and the externally financed funds. During the same period, the firm distribute its funds on either investments or dividends. The balance can be expressed as equation (2) :

$$E_t + DS_t = D_t + I_t \quad (2)$$

where  $E_t$  denotes retained earnings at the start of period  $t$ ,  $DS_t$  denotes external funds financed during period  $t$  with ex-dividend price<sup>1</sup>,  $D_t$  and  $I_t$  denote dividend and investments respectively during time  $t$ .

On the other hand, given that the rate of return on each share of the firm equals  $r_t$ , the share price at period  $t$  (denoted as  $p_t$ ) in perfect capital

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<sup>1</sup>Note that negative  $DS_t$  indicates share repurchases.

markets can be expressed as equation (3) :

$$p_t = \frac{1}{1 + r_t}(d_t + p_{t+1}) \quad (3)$$

where  $d_t$  denotes dividend per share during period  $t$  and  $p_{t+1}$  denotes the ex-dividend share price. If the firm does not raise external funds during the period  $t$ , the total value of the firm at the beginning of period  $t$  (denoted as  $V_t$ ) can be expressed as equation (4) :

$$V_t = \frac{1}{1 + r_t}(D_t + V_{t+1}) \quad (4)$$

Nevertheless, if the firms raise external funds ( $DS_t$ ), equation (4) has to be changed to equation (5) :

$$V_t = \frac{1}{1 + r_t}(D_t + V_{t+1} - DS_t) \quad (5)$$

Recalling equation (2), the divergence between total dividends and the raised funds equals the residuals of retained earnings after investments. The equilibrium can be express as in equation (6) :

$$E_t - I_t = D_t - DS_t \quad (6)$$

Thus, equation (5) can be rearranged to equation (7) :

$$V_t = \frac{1}{1 + r_t}(E_t + V_{t+1} - I_t) \quad (7)$$

Equation (7) clearly indicates the first insight from Miller and Modigliani's analysis. Given the firm's retained earnings, the decision of investments is the only element which determines the value of the firm at period  $t$ . Since the firm value of the period  $t + 1$  is also predicted by the subsequent retained earnings and investments, it becomes that the firm value is determined by the sequential investment policy. Firm value is maximized by making an appropriate choice of investment policy.

The second insight concerns the firm's dividend policy, which involves setting the value of  $D$ , each period. After the decision of investments is made

to maximize firm's value, the divergence between total dividends and the externally raised funds should be equal to the residual of retained earnings. Consequently, for each level of dividend decided, the firm could correspondingly finance externally to balance the uses and the sources of the funds. Thus, it follows that dividend policy does not possess any influence on firm value in perfect capital markets.

The third and most important insight of Miller and Modigliani's analysis is that it identifies the situations in which dividend policy can affect the firm value. They specify what they mean by perfect capital market, rational behaviour and perfect certainty. In a perfect capital market all buyers and sellers have equal access to information, and none of them receives preferential treatment. Thus all traders are price-takers and none of them can affect the market price. Moreover, trading does not entail any transaction costs and there is no tax differentials associated with paying dividends either for firms or for individuals. Rational behaviour implies that more wealth is preferred to less, and investors are indifferent to whether wealth comes in the form of dividend or capital gains. Perfect certainty means that all investors are certain about the future investment and profits of all firms, thus there is no need to distinguish between debt and equity and an all-equity firm is assumed.

In the real world, however, it is hard for perfect capital markets to be found. Some of the major imperfect elements discussed in literature are: 1) information asymmetry, 2) agency problems and 3) the tax differentials between dividend and capital gains.

While information asymmetry exists between insiders (managers) and outsiders (investors), the information about stocks is no longer freely available for all traders. The underlying idea is that insiders know the real value of their firms in that they possess more information about investments and expected profits. By contrast, outsiders can only get information from financial reports or speculate about real firm value via firm's announcement, such as dividend or repurchases announcements. This fact leads to the possibility that these announcements are imposed by the managers in order to change the outsiders' evaluation on their firms. According to the signalling theory of

payout policies, the managers use dividend or repurchases to signal for their expected earnings and profits and it is assumed that investors respond positively to dividend increases or share repurchases and negatively to dividend decreases.

The second imperfect element is the agency issue and it is one of the oldest issues recognized in the corporate management. Its essence derives from the separation of ownership and management, where each agent would make decisions optimal rather for himself than for the good of the firm. Without complete contracts, managers may operate the firms in the light of their own interests. An implication of this is the possibility that expenses are lavished on unproductive projects or are consumed as perquisites by managers. However, dividend or share repurchases could serve as a tool to reduce free cash flow available for managers and therefore abbreviate the agency problem. For this reason, in companies where managers are also significant, shareholders have low agency costs because there is high probability that they will have the same goals as the owners. Even though asymmetries in information between owners and managers do not facilitate the monitoring of the latter, it can still be mitigated by monitoring managers and their decisions by the market. Easterbrook (1984) adopted that dividends reduce the cash available for the company to invest. As a result, it increases the frequency in which companies have to go to the equity market for extra capital. This pushes the firms to conform to the rules being in force in such markets, which is equal to high discipline and transparency of managers' decisions. Such efficient monitoring holds back non-optimal investment decisions as well as increased consumption.

The tax differentials are the third imperfection which makes the investors no longer indifferent between dividends and capital gains. A euro of dividend becomes less valuable than a euro of capital gains when the tax on dividend is higher, and vice versa. Similarly, with the same value of cash payout, the investors may also prefer share repurchases to dividend when capital gains are taxed on a lower rate. It follows that investors may be biased in their evaluation of the firm due to their discrimination between dividend and capital gains. Kalay (1984) noticed that investors with high income brackets prefer

to hold non-paying stocks, whereas those with low income tax brackets are more willing to invest in high dividend yield stocks. In addition, the dividend clientele hypothesis predicts that investors would invest in the stocks whose payout policy is consistent with their best interests. Therefore, managers would adjust their payout policy in an attempt to reduce the potential transaction costs for their clienteles.

The next subsection analyzes the signalling hypothesis of dividend announcements in an effort to examine whether or not dividends should influence changes in share prices around the announcements and ex-dividend days, that is one of the main questions of the current thesis.

## **2.2 Signalling hypothesis of dividend announcements**

Signaling hypothesis originates from the information asymmetry between managers and shareholders. This topic has been widely discussed in the literature and includes numerous studies concerning individual factors that might have signaling attributes as well as general studies about the dividend announcements. If insiders, managers, have better information about the firm's future cash flows, many researchers suggest that dividends could convey information about the firm's prospect. Outside investors is very unlikely to have the same information as insiders, who have better access to various data about current and future prospects of a corporation. It would be very costly for an individual investor to obtain all possible information about all companies he invested in. As a result, the insiders who want to indicate the better information can use dividends to convey credibly new information to the market or they can use dividends as a costly signal to change market perceptions concerning future earnings prospects.

The signaling theory is a widely used concept not only in the dividend puzzle, but also in other theoretical problems. The basic principle for all models is the same: insiders, who have private information about current and future prospects of a firm, want to convey this information to the market. It is crucial though that this signal is credible, which means that firms with bad projects do not want to or cannot imitate the action of better firms, because

the costs of this signal are prohibitively high. When the signal is credible, the market will reach a separating (or signaling) equilibrium. In this situation, the market can separate between a good firm and a bad firm and can value them properly. If the signal is not credible or if a good firm does not use any signal, the market is in a pooling equilibrium, where all companies are valued in the same way, because outside investors cannot distinguish which company is good or bad.

Although dividend effect has been detected earlier in the 1970, it is until 1979 that the first signalling model was developed from Bhattacharya (1979). Bhattacharya (1979), John & Williams (1985) and Miller & Rock (1985) are considered to be the thirist authors that introduced the signaling theory into the dividend puzzle. They provided main theoretical fundamentals that later allowed further development of the theory.

Bhattacharya (1979) developed a signalling model in which consists of two periods and firm's managers act in the original shareholders' interests. In the first period, managers decide the investment policy which they are going to carry out knowing its expected profitability and thus they committed dividends to their shareholders. In the second period, managers distribute dividends which they committed in the previous period by using the proceeds of the investment projects. A crucial assumption of the model is that if the proceeds are insufficient to cover the dividends, the firm must resort to outside financing and incur transaction costs in doing so.

At the first period, the managers can signal that the firm's project is good by committing to a large dividend at the second period. If a firm indeed has a good project, it will usually be able to pay the dividend without resorting to outside financing and therefore will not have to bear the associated transaction costs. In equilibrium, it is not worthwhile for a firm with a bad project to mimic the dividend decisions of a firm with a good project, because it will have to resort to outside financing more often and thus will have to bear higher transaction costs. If the dividends are high enough, these extra costs will more than offset the signaling advantage gained from the higher price received at the second period. Since the critical trade-off in the model is between the transaction costs incurred by committing to a large dividend

and the price paid at the second period, it follows that similar results hold when the dividends are taxed. Immediately after the dividends are paid, the firm is sold to a new group of shareholders, which receives the payoff generated by the project at the third period. The payoffs in the two periods are independent and identically distributed. The price that the new shareholders are prepared to pay at the second period depends on their beliefs concerning the profitability of the project.

Bhattacharya's model was really innovative since it is consistent with the observation that firms pay dividends even when these are taxed. Moreover it is able to explain the positive market reaction to dividend increases based on an intuitive notion that dividends reveal information about the firm's future prospects. The model is internally consistent and assumes that both investors and management behave in a rational manner.

However, Bhattacharya's model has been criticized because firms could signal better their prospects if they were using share repurchases instead of dividends. This way of signaling would result in the same trade-off between the transaction costs of resorting to outside financing and the amount received when the firm is sold, but it would result in lower personal taxes than when dividends are used. Furthermore, Bhattacharya's model fails to shed light on why dividends are made to signal when they are costly (Allen and Michaely, 2002). Since the real value of the firms will be disclosed when the firm realizes the proceeds of the previous period's investment projects in the second period, it is questionable whether it is worth to pay a lot of cash merely to signal for the next period. Furthermore, Bhattacharya (1979) assumes that the incentive of signalling dividend is the rise in liquidation value. Allen and Michaely (2002) questioned why the rise in liquidation value becomes the main concern for the managers in the first period and prompts them to distribute cash.

Miller & Rock (1985) developed a signaling model from the aspect of dividend, investment and financing policy. Their model consists of two periods in which firms invest in their projects and obtain earnings that are unobservable. These earnings are used to pay dividends and to invest into new projects. But the investments are again unobservable by the outsiders. They

also assumed that there are two groups of shareholders who behave differently after the dividends are announced. A group of shareholders sell their shares after dividend announcements but before dividend realizations while the rest hold the shares. The objective of the firms is to make a compatible dividend policy and maximize their wealth from these two groups. Additionally, as indicated by Miller and Rock (1985), the earnings are only used for investments and dividends. Based on these two assumptions, they derive the optimal dividend given a specific level of earnings.

To signal to the market the true value of a firm, managers pay higher than the optimal dividend to eliminate the information asymmetry and foregone funds from productive investments, thus the firm departs from Fisherian optimum criterion for investments saying that a firm should invest in its projects until the marginal internal rate of return equals the risk-adjusted rate of return on securities. Dividends have to be sufficiently high to prevent a firm with worse projects to cut its investments.

The model of Miller and Rock (1985), clearly explains that dividend is made to signal earnings and to eliminate the information asymmetry. Unlike the signalling costs in Bhattacharya's (1979) model, the transaction costs of external financing, the signalling costs in Miller and Rock's (1985) model are the cuts in funds from productive investment. In other words, it is the cost of underinvestment that makes the signal credible. The model could also be applied to share repurchases where the dividend, as discussed in Miller and Rock (1985), is the net dividend. However, this model does not explain why a firm should pay dividends rather than repurchase shares. A firm should be able to achieve similar signal by repurchasing its own shares. In addition the assumption that earnings are only used for investment and dividend is rarely valid in reality. When the retained earnings are allowed in the model, the managers have more flexible financial policies and signalling by dividend may not necessarily force managers to give up investment opportunities. As a result, Miller and Rock (1985) model represents a further step in the signaling theory, but does not represent a significant progress in solving the dividend puzzle.

John & Williams (1985) developed a more complex model inducing taxa-

tion costs as the parameter that makes dividend signaling credible. They also introduced liquidity demand of shareholders, which represents shareholders' need for cash income from the firm. This cash can be obtained either by receiving a dividend or by selling shares to new investors. The firm's managers act in the interest of the original shareholders and they know the true value of the firm, whereas outside investors do not.

When a firm is undervalued, its shareholders have to sell more shares to meet their liquidity demand and they suffer from a dilution of ownership. Thus even though a firm does not necessarily need to raise new cash by selling shares, it still signals to the market its true value by paying dividend which is taxed. Shareholders can then sell their shares for a higher price and more importantly, they can keep a bigger fraction of the firm. In the case of a good firm, this higher fraction through the rise of share price will compensate the shareholders for the taxes they had to pay on dividends. When a firm is overvalued its managers could mimic the dividend policy of the undervalued firm, but their shareholders will be taxed more due to the higher dividends. Since the shares held by these shareholders are not worthy enough, higher tax costs will offset their benefits from the rise of the share price.

John & Williams (1985) model implies that the optimal dividend increases with more favorable inside information and it decreases with taxes. It has also explained why a firm can pay dividends and sell new shares at the same time. Firms do not repurchase shares to avoid taxes because it is the cost of taxes that make the dividends desirable. They also admitted the existence of clientele effects caused by the differences in a liquidity demand.<sup>2</sup> One basic difference of John & Williams (1985) model with respect to those of Bhattacharya (1979) and Miller & Rock (1985) is that the firms do not repurchase shares to avoid taxes, because it is precisely the cost of the taxes that makes dividends desirable.

The basic critic to the John & Williams (1985) model is based on the assumption that shareholders' liquidity needs could only be achieved by selling their shares. Shareholders could satisfy their liquidity needs by borrowing

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<sup>2</sup>For example, senior citizens or widows have higher liquidity demand and thus they will incline to the firms with higher dividend.

from banks or by using credit cards, with the interest costs probably be lower than the costs from dividends taxation. Moreover firms could borrow and use the proceeds to repurchase their shares satisfying this way shareholders' liquidity needs. This approach would be worthwhile only if firms' shares were undervalued.

After these primary three models in dividend signaling a number of other theories with multiple signals were developed. For example, Ambarish, John and Williams (1987) developed a model in which firms can use as a signal dividends, share repurchases or investments. Their model proposes that it is more efficient for a valuable firm to use as signal both dividend and investment instead of solely dividend, since this way of signal the maximization of shareholders' wealth is more possible. In their model, managers are assumed to maximize their shareholders' wealth and avoid their rivals' mimicry on signalling. Managers' dividend policy is based on the asymmetric information between the insiders and outsiders.

The present value of investment, including assets in place and future investment opportunities, is only known by insiders (directors and managers) and it is unobserved by outsiders (investors). For this reason, highly valuable firms could decide to signal their true value either solely by dividend or by both dividend and investment. When signalling solely by dividend given an optimal investment level, the dividend has to be high enough to prevent less valuable firms to mimic valuable ones. However, such signalling is feasible but inefficient. When asymmetric information between firms and investors is mainly on assets in place, the model suggests that the more valuable firms reduce their investment level and pay fewer dividends, which is also capable of preventing mimicry and maximizing shareholders' wealth. Alternatively, when asymmetric information is mainly on investment opportunities, the firms could make the signalling efficient by increasing investment level and paying fewer dividends. In each of those two scenarios, the higher marginal cost of adjusting investments for less valuable firms prevent these firms from mimicking dividend policy and help more valuable firms to minimize signalling costs.

Williams (1988), extending the model of Ambarish, John, and Williams

(1987), presented a multi-period signalling model with the same elements. In his model, firms observe their cash and possess private information about the returns on investment projects. A feasible value of the returns, not necessarily the true value, is then reported to outsiders by the firms who possess private information. In order to make the report creditable, managers further signal by means of announcing dividends, investments and fractional new shares. If the signals are believed by investors, investors would buy the firm's stock accordingly and managers must optimize the policies on the three signals to meet the returns on investments they reported. In light of this model, it is assumed that the optimal investment is firstly financed by internal funds and secondly by issuing new shares. In equilibrium, firms exhaust all cash and sell sufficient shares to finance their investment projects which maximize the firm value. Dividends are thereby distributed to signal the firm's value and to support the stock sale, which in turn increases the external funds for investments.

Allen, Bernardo, and Welch (2000) proposed a different approach to dividend signaling. Similarly to the other signaling models, dividends are a signal of good news. However, in their model firms pay dividends because they are interested in attracting a better-informed clientele. Untaxed institutions, such as pension funds and mutual funds, are the primary holders of dividend-paying stocks. Institutions prefer dividends because of common institutional charter and prudent man rule restrictions that make it more difficult for many institutions to purchase investments with low dividend payout, and because of the comparative tax advantage that some institutions have over dividend relative to individual investors. Good firms want institutions to buy their stock and to monitor them since they are better informed and have a relative advantage in detecting high firm quality. Low-quality firms do not have the incentive to mimic them, since they do not wish their true worth to be revealed.

Thus, the basic implication of Allen, Bernardo and Welch (2000), is that higher dividends will lead to larger institutional holdings. If firms firstly determine their payout policy, and after choose between dividends and repurchases, then higher repurchases will lead to less institutional investors.

Allen, Bernardo and Welch (2000) argued that undervalued firms who want to signal their true value will pay taxable dividends because dividends attract institutions, which are better in revealing the true value. As in the John and Williams (1985) model, Allen, Bernardo, and Welch (2000) model involves a different role for dividends and repurchases. In fact, firms with more asymmetric information and firms with more severe agency problems will use dividends rather than repurchases.

Despite the variety of the signalling costs in the signaling models that described in this subsection, all of them try to prevent mimicry, helping “good” firms to be distinguished from “bad” firms. Moreover, the information signalled by dividends is a little different when these models are compared. In addition, despite the existence of some divergences among these models (for example, Bhattacharya’s (1979) model indicates that managers use dividends to signal future earnings, Miller and Rock’s (1985) model indicates that dividends signal current earnings, while John and Williams (1985) suggests that dividends signal the undervaluation of the current firm’s value) there are common implications, since under asymmetric information dividends are used as a communication mechanism between managers (insiders) and shareholders (outsiders). Firms that distribute dividends, and especially firms that increase their dividends, are those firms that are undervalued and they want to signal their true value. Moreover the main prediction of the above signaling models is that dividends convey good news about the future cash flows.

At this point it is important to be mentioned the research of Grullon, Michaely, and Swaminathan (2002) who presented an alternative explanation to dividend signaling models. Taking into account that dividend signaling models do not examine the relation between dividend changes and risk changes, they introduce the “maturity hypothesis”. As firms mature, their investment opportunity set is diminished, its growth and profitability have flattened, systematic risk has declined and firms generate more cash internally than they can profitably invest. Thus, a dividend increase indicates that a firm has matured.

According to the maturity hypothesis firms increase dividends when growth

opportunities decline, which leads to a decrease in the firm's systematic risk and profitability. As a consequence, the dividend increase clearly contains at least two pieces of news. The good news is that the risk has decreased, and the bad news is that profits are going to decline. The positive market reaction implies that news about risk dominates news about profitability.

## **2.3 Empirical evidence on dividend signaling**

### **2.3.1 Announcement effect**

Empirical evidence of the signaling theory is extensive. One of the implications from the dividend signalling theory predicts that markets respond positively to the good news conveyed by dividend increase and negatively to the bad news conveyed by dividend cuts. The market reactions to dividend announcements are usually measured by the abnormal returns around the announcements. The underlying hypothesis is that if positive (negative) abnormal returns are found around dividend increases (decreases), the theory can be confirmed.

Pettit (1972) in order to determine the relationship between dividend announcements and share prices, he tested the abnormal returns around the dividend announcements for 14 dividends and earnings intersectional portfolios sorted by dividend changes and earnings changes. Pettit (1972) used a market model to estimate abnormal returns and his sample was included from 625 firms (about 1,000 dividend announcements) listed on New York Stock Exchange, during the period 1964-1968. However, he used data at least 12 months before the announcement date to obtain coefficients that are not affected by some information that becomes public prior to the announcement of the dividend. As expected, market has the largest positive reaction to both dividend initiations and dividend increases that are larger than 25 percent. The evidence demonstrated that negative market reaction was found for dividend cuts and dividend omissions.

Aharony and Swary (1980) estimated the market reaction to dividend announcements by distinguishing the observations whose earnings are released

prior and after the dividend announcements and they reported that market reacts positively to dividend increases and negatively to dividend cuts regardless of dividend announced preceding or following earnings. Additionally, their findings also demonstrated that market reacted more strictly to dividend reductions than to dividend increases.

Asquith and Mullins (1983) also confirmed the results of Aharony and Swary (1980) by testing dividend initiation. Their result showed that, when earning announcements were made within ten days from dividend announcements, the market reaction to dividend initiation was substantially smaller. An implication of this finding is that the information provided by dividends and earnings announcements is partially substituted.

Michaely, Thaler, and Womack (1995) examined the impact of both initiations and omissions of cash dividends on share prices reaction. They observed 561 dividend initiation events and 887 dividend omission events over the period 1964-1988. Michaely et al. (1995) documented that during three days surrounding the announcements the average excess return was about -7.0% for omissions and +3.4% for dividend initiations. Therefore, they noted that the market reactions to dividend omissions are greater than for dividend initiations. This implies that the market reacts optimistically toward dividend initiations (or increases). However, the market is more pessimistic in response to the announcements of dividend omissions (or decreases). Michaely et al. (1995) also found significant long-run drifts in stock prices in response to dividend initiations and omissions. They reported +7.5% excess returns after one year of initiation announcements and +24.8% after three years. For dividend omissions they reported abnormal returns of -11.0% in the first year and -15.3% after three years. Thus, the price impact may explain, to some extent, why managers are so reluctant to cut dividends.

Amihud and Murgia (1997) employed regression analysis to test whether the dividend changes convey information about firms' values. Using a sample of 200 German firms listed on Frankfurt Stock Exchange, Amihud and Murgia (1997) examined the stock price reaction to dividend announcements. They used 255 events of dividend increases and 51 events of dividend decreases for the period 1988 to 1992, and they compared the results with findings of stud-

ies based on US data. Amihud and Murgia (1997) reported that the average excess return of stock prices is +0.97% for dividend increases and -1.73% for dividend decreases. In addition, they have observed that even though the earnings news preceded dividend change announcements, dividends still have significant information. However, the findings of this study are inconsistent with tax-based signalling models (i.e. John and William, 1985) because dividends in Germany are not tax-disadvantaged and thus share prices should not react to dividend changes.

Travlos, Trigeorgis and Vafeas (2001) provided evidence from an emerging market in favour of the dividend signalling hypothesis. They used a sample of 41 announcements of cash dividend increases and 39 announcements of stock dividends for firms listed on the Cyprus Stock Exchange for the period 1985 to 1995, and examined market reaction to the announcement of cash dividend increases and stock dividends. Travlos et al. (2001) found positive and significant abnormal returns for both cash dividend increases and stock dividend announcements and interpreted their results as consistent with the signalling hypothesis.

More recently, Bali (2003) presented evidence consistent with the preceding results, as he reported an average +1.17% abnormal return for dividend increases and -5.87% for decreases. In addition, Bali examined the long run drifts of stock prices reaction to dividend increases and decreases and reinforced Michaely et al. (1995) findings.

Yilmaz (2010), studied the market reaction to dividend change announcements at the Istanbul Stock Exchange using an event study analysis and testing a sample of 184 announcements made by 46 companies during the period 2005 to 2008. He constructed an event window consisted from three days, one day before and one day after the announcement day, in order to examine the market reaction to dividend announcements. His results were consistent with the information content of signaling hypothesis, since the market reacted positively to dividend increases (+0.54%), negatively to dividend decreases (-1.05%) and did not react at all to constant dividends.

Yahyaee et al. (2011) examine the information content of cash dividend announcements for the period between January 1997 and August 2005, in a

unique environment such as of Oman. In Oman neither dividends nor capital gains are taxed, there is high concentration of shares ownership, low corporate transparency and most companies change their dividends almost every year. Despite this special environment, Yahyaee et al. (2011) show that cash dividend announcements convey information to the market since they found positive abnormal returns around the dividend increases announcements “good signal” and negative ones around the dividend decreases announcements “bad signal”. The empirically supported existence of abnormal returns around the dividend announcements days is in contrast with tax-based signaling models which argue that higher taxes on dividends relative to capital gains are a necessary condition for dividends to be informative.

The results of the empirical works indicate that markets have an asymmetric response to dividend increases and decreases, which implies that reducing dividends carries more informational content than increasing dividends, due to the fact that reductions are more unusual or because reductions are of greater magnitude.

### **2.3.2 Dividend signalling and earnings performance**

Another prediction that emerges from the signalling theory is that dividend signals the information about expected earnings or profits. The underlying hypothesis is that if it is detected positive correlation between dividend changes and current and future earnings, then the theory is confirmed. If dividends are meant to convey private information to the market, predictions about future earnings of a firm based on dividend information should be superior to forecasts made without dividend information. Moreover, a dividend change should be followed by a subsequent earnings change in the same direction.

In a classic study, Lintner (1956) tried to understand the management’s decision-making process that determines dividend changes. Indeed, Lintner (1956) carried out a series of interviews with the managers of 28 US industrial firms about their firms’ dividend policies for a period of 7 years, from 1947 to 1953. From the survey it emerged that firms tend to establish dividend

policies with target payout ratios that are applied to current earnings. It is also found that firms have adjustment rates that determine the percentage of the target change by which the dividend levels are actually changed. Lintner (1956) also reports that although the target payout ratios and speed of adjustments vary across firms, in most cases they stay reasonably stable over time<sup>3</sup>.

Based on his findings, Lintner (1956) develops the partial adjustment model of the change in the dividend level from the previous to the current period. The model reflects management's belief that investors dislike erratic patterns in dividend levels and hence the emphasis is on the change from the previous actual level:

$$\Delta D_{i,t} = a_i + C_i(D_{i,t}^* - D_{i,(t-1)}) + e_{i,t} \quad (8)$$

$$\Delta D_{i,t} = (D_{i,t} - D_{i,(t-1)}) \quad (9)$$

$$D_{i,t}^* = R_i P_{i,t} \quad (10)$$

where  $\Delta D_{i,t}$  is the change in the dividend payment;  $D_{i,t}$  and  $D_{i,(t-1)}$  are the amounts of dividends paid in years  $t$  and  $t-1$  respectively;  $D_{i,t}^*$  is the target dividend amount;  $R_i$  is the target payout ratio;  $P_{i,t}$  is current profits after tax;  $C_i$  is the speed of adjustment;  $a_i$  is a constant which in general will be positive to reflect management's reluctance to reduce dividends; and  $e_{i,t}$  is an error term.

Equation (8) can alternatively be expressed as:

$$\Delta D_{i,t} = a_{i,t} + \beta P_{i,t} + \gamma D_{i,(t-1)} + e_{i,t} \quad (11)$$

where,

$$\beta = C_i R_i \quad (12)$$

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<sup>3</sup>The target payout ratios in the Lintner (1956) survey vary from 20% to 80%, with 50% being the most common. The speed with which the firms in the study move toward the target payout ratio ranges from 20% to around 50%.

and

$$\gamma = 1 - C_i \quad (13)$$

According to Lintner (1956), current net earnings,  $P_t$ , play the most important role in determining dividend changes. This is because current earnings are widely available and hence the managers' view is that investors expect dividends to reflect changes in this variable. Expanding equation (11) via noting that  $D_{i,(t-1)}$  can be expressed as a function of that period's profits and the previous period's dividends, the dividend level in each period is a weighted average of current and past profits. Hence, the dividend pattern is a smoothed pattern of earnings and is indicative of the time path of permanent earnings. The degree of smoothing depends on the speed of adjustment coefficient,  $C_i$ .

Upon fitting pre-war annual data from 1918 to 1941 to equation (8), Lintner discovered that his model explained 85.0% of the changes in dividend. Using the same data for predicting post-war dividends, Lintner's model produced a minimum mean square error of 6.4% compared to other naive prediction models where the error rate was 7.8%.

Lintner's (1956) assertion that this model could explain 85% of dividend decisions over the post-war period is later confirmed by Fama and Babiak (1968) who examine a larger sample (392 firms) over a 19-year period. A further suggestion by Fama and Babiak (1968) is that additionally including the lagged profits variables could possibly improve the predictive power of the model.

Brickley (1983) investigated the earnings changes on both the current and the subsequent year from the payment of special dividend and increase on regular dividends. He concludes that earnings increases are detected in both the year of special dividend paid and the year of regular dividend increases. Consistent with the signalling theory, Brickley's (1983) finding suggests that regular dividend increases is an indicator of current and future earnings.

DeAngelo, DeAngelo, and Skinner (1992) employed a binary logit model in order to investigate firms' dividend policy that experience at least one annual earnings loss or decline during 1980 to 1985. They reported that

dividend cuts are influenced by the earnings of the previous year, the current year and the subsequent year. They also found a negative relationship between earnings possession and possible reduction in dividends. Another important finding is that firms with initial loss, but not cutting dividends, perform better in subsequent earnings with respect to firms experience cut dividends and initial earnings loss. Their evidence on firms suffering initial earnings declines and loss supports the prediction of the dividend signalling theory.

In contrast to earlier findings, Benartzi, Michaely, and Thaler (1997), using a sample of 1025 firms listed on the NYSE and on the American Stock Exchange (AMEX) between 1979 and 1991, studied the relationship between firms' future earnings and dividend changes and they did not find evidence to support the notion that changes in dividends have the power to predict changes in future earnings. As demonstrated by their tests on the signalling power of dividend increases and dividend cuts for unexpected earnings of the years surrounding dividend changes, their evidence, by using both categorical analysis and regression analysis, indicate that the information signaled by dividends tends to be towards current earnings changes. Increase in dividends in time  $t = 0$  is preceded by significant increase in earnings in time  $t = -1$  and  $t = 0$ . However, increase in dividends is not followed by increase in earnings. Thus, if the dividends signal any information to the market, it is about information for the past, not about the future. Remarkably, the relations between dividend cuts and future changes in earnings appear to be negative. Therefore, Benartzi et al. (1997) results challenge the signalling hypothesis. In addition, DeAngelo, DeAngelo, and Skinner (1996) found no evidence that dividends provide valuable information about future earnings.

Moreover, there are several studies that partly confirm that future earnings could be related to dividends. For example, Healy & Palepu (1988) examined the most radical changes in dividend policy, dividend initiations and omissions and found that while dividend initiations are followed by an increase in earnings, that seems to be permanent, dividend omissions are a result of a decline in earnings in the previous year and these earnings quickly improve after the omission. A possible explanation for this unexpected find-

ing, according to Healy and Palepu (1988), is the potential survival bias of the dividend-omission sample.

In addition, Nissim and Ziv (2001), considering a particular model of earnings expectations, investigated the US firms for the period 1963 to 1998. They found that dividend changes and earnings changes are positively correlated, which supports the signalling hypothesis. Nissim and Ziv (2001) argued that previous studies failed to uncover the true connection between dividends and future earnings because researchers used the wrong model to control for the expected changes in earnings. Specifically, they reported that, when they used a regression analysis that controls for a particular (linear) form of mean reversion in earnings, dividend changes are positively correlated with future earnings changes. However, their results were not the same for dividend increases and decreases. However, Nissim and Ziv (2001) did not find an association between dividend decreases and future profitability after controlling for current and expected profitability and they assumed that this result is possibly due to the accounting conservatism.

Benartzi, Grullon, Michaely, and Thaler (2005) re-examine the relation between dividends and earnings changes using the Fama and French (2000) modified partial adjustment model to control for the predictable component of future earnings changes based on lagged earnings levels and changes. This model assumes that the rate of mean reversion and the coefficient of autocorrelation are highly nonlinear. Benartzi et al. (2005) used this approach because Fama and French (2000), in their empirical work, show that it explains the evolution of earnings much better than a model with a uniform rate of mean reversion. They showed that the relation between dividend changes and future earnings disappears, since they control for the nonlinear patterns in the behavior of earnings. The relation between dividend increases and earning increases in Year 1 was positive and significant in only 5 out of 35 cases. Their results indicate that earning increases do not follow dividend increases in any systematic way. They also found that dividend changes are negatively correlated with future changes in profitability (return on assets, return on cash-adjusted assets, and return on sales). Finally, they examined the relation between future earnings levels and changes in dividends and

found that dividends changes are very poor indicators of both earnings and profitability levels. Overall, they found no evidence supporting the idea that dividend increases signal better prospects for firm profitability. The contribution of their finding implies that the dividend puzzle is very likely induced by mean reversion and autocorrelation factors and dividend changes do not signal the changes in future profitability.

Grullon, Michaely and Swaminathan (2002) examined the relation between dividend changes and changes in the systematic risk of a firm. They also examined changes in profitability using different measures of profitability and relate these results to changes in risk. The main scope of their analysis was to relate changes in dividend policy to changes in a firm's life cycle, introducing the maturity hypothesis: that firms tend to increase their cash payouts as they become more mature (because of a diminishing investment opportunity set), and, therefore, dividend increases should be associated with subsequent declines in profitability and risk. Their sample comprised 7,642 dividend changes announced between 1967 and 1993. Using the Fama-French three-factor model or the CAPM, they found that firms that increased dividends experienced a significant decline in their systematic risk, but firms that decreased dividends experienced a significant increase in systematic risk. Firms that increased dividends also experienced a significant decline in their return on assets, which indicates a decline in systematic risk. Capital expenditures of firms that increased dividends stayed the same and the levels of cash and short term investments on their balance sheet declined.

Grullon, Michaely and Swaminathan (2002) found that the greater the subsequent decline in risk, the more positive is the market reaction to the announced dividend. Thus, changes in risk conditioned on changes in profitability begin to provide an explanation for the price reaction to dividend announcements. Indeed, their main findings were that dividend increases are associated with subsequent decreases in risk and profitability and that the initial market reaction to the dividend increase was strongly associated with the decline in risk. Finally, they suggested that increases in dividends convey information (although imprecise) about changes in a firm's life cycle, specifically, as a firm's transition from a higher growth phase to a lower growth

phase (mature phase).

Overall, the evidence of dividend signaling is far from conclusive. There is a mixed support about issues relating to the information content of dividends hypothesis, a common concept in the dividend literature. The empirical studies referenced above noted that firms use dividend policy to communicate information about their future prospects to the market, and this provides another possible explanation of why firms pay dividends. Moreover, signalling could play a pivotal role in determining firms' dividend policies and their values.

## **2.4 Ex-dividend date effects and clientele effects**

There are numerous other factors in literature which appear to affect the dividend policy of a firm. One of them is the share price behaviour around the ex-dividend date. Its theoretical analysis compares the expected price drop to the dividend per share on that day. In perfect capital markets, assuming certainty, the share price drop should equal the dividend per share. Any other share price behaviour provides arbitrage opportunities. A larger (smaller) price drop provides arbitrage profits for shelling short (buying) on the cum-dividend day and covering (selling) on the ex-dividend. A similar conclusion can be drawn under uncertainty if it is assumed that any excessive ex-dividend period risk is not reflected in the share price. This occurs if the risk is diversifiable and/or investors are indifferent to risk. Studying the ex-dividend period is important because a direct comparison can be made between the market valuations of a euro of dividend to the valuation of a dollar of capital gains.

In their classic article, Miller and Modigliani (1961) documented that dividends were irrelevant in a world without taxes, transaction costs and other imperfections. However, in the real world, taxes and transactions costs exist and hence affect the value of a firm (e.g. Litzenberger and Ramaswamy (1979), Litzenberger and Ramaswamy (1982), Poterba and Summer (1984), Lasfer (1995b), Bell and Jenkinson (2002)).

Miller and Modigliani (1961) pointed out that the portfolio choices of

individual investors might be influenced by these market imperfections, as investors choose securities that reduce these costs. They defined the tendency of investors to be attracted to a certain type of dividend-paying stocks as “dividend clientele effect”. Nonetheless, M&M (1961) maintained that even though the clientele effect might change a firm’s dividend policy to attract certain clienteles in a perfect market each clientele is “as good as another”. Hence the firm’s valuation is not affected and as a result, dividend policy remains irrelevant.

It is well documented in the literature that on average stock prices do not drop by the full amount. In particular, several studies have shown that stock prices drop by less than the amount of the dividend. Various types of explanations are advanced in the literature to explain the ex-dividend day behaviour. One possible explanation of the ex-dividend share price behaviour is the differential taxation of realized capital gains and dividend income, since investors are interested in after-tax returns. Another possible explanation is the presence of transaction costs and risk that inhibit share price to drop on ex-dividend day by the exact dividend amount. Also, market microstructure impediments such as tick size, bid-ask spread, nuisance of collecting and reinvesting dividends as well as liquidity, were considered responsible for the existence of a smaller price drop of the share than the dividend amount on ex-dividend date.

In practice, investors often face different tax treatments for dividend income and capital gains, and incur costs when they trade securities in the form of transaction costs and inconvenience (changing portfolios). For these reasons and based on different investors’ situations, taxes and transaction costs may create investor clienteles that will be attracted to firms that follow dividend policies that best suit their particular situations. Similarly, firms according to their dividend policy attract different clienteles. Firms that usually pay low (or no) dividends attract a clientele that prefers price appreciation (in the form of capital gains) to dividends. Usually these investors are in relatively high tax brackets. On the other hand, firms that pay a large amount of their earnings as dividends attract a clientele that prefers high dividends. Investors in low tax brackets, who rely on regular and steady in-

come, will tend to be attracted from these firms. In addition, some corporate or institutional investors tend to be attracted to high-dividend stocks firms.

Empirical studies that attempt to infer to the tax characteristics of firm's marginal investors examined the movements of stock prices around the ex-dividend days, and therefore provide an indirect test of the clientele effect hypothesis. Because, in most countries, dividends are usually taxed more heavily than capital gains, investors in high tax brackets will be better off receiving their income in the form of capital gains rather than dividends. The tax effect implies that the drop in stock price may be less than the dividend because investors value dividends less than capital gains.

In a seminal paper, Elton and Gruber (1970) presented empirical evidence about the tax-induced clientele hypothesis by observing the share price behaviour around the ex-dividend day.<sup>4</sup> Examining shares listed on the NYSE paying a dividend between April 1, 1966 and March 31, 1967, Elton and Gruber (1970) found that share prices fell by less than the amount of the dividend on ex-dividend days. They argued that when investors were about to sell a stock around its ex-dividend date, they would calculate whether they were better off by selling just before it goes ex-dividend, or just after. If they were selling before the stock went ex-dividend, they would have gotten a higher price. Their marginal tax liability on the capital gain is represented by the difference between the two prices. If they were selling just after, the price would have fallen because the dividend had been paid. In that case, they would receive the dividend plus this low price, and their marginal tax liability would be their personal tax rate times the dividend. In this setting, we can make a direct comparison between the market valuation of after-tax dividend dollars and after-tax capital gains dollars. In equilibrium, stocks must be priced so that individuals' marginal tax liabilities are the same for both strategies. Elton and Gruber (1970) also found a positive relationship between the dividend yield of a stock and its ex-dividend price drop. They

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<sup>4</sup>Several empirical studies analyse ex-dividend day behaviour of share prices for US firms. A partial listing includes Kalay (1982), Elton, Gruber and Rentzler (1984), Eades, Hess and Kim (1984), Barclay (1987), Karpoff and Walkling (1988, 1990), Grammatikos (1989), Bali and Hite (1998), Koski and Scruggs (1998), and Elton, Gruber and Blake (2005).

interpreted their results as evidence that differential taxes induced a preference for capital gains relative to cash dividends, supporting the tax clientele hypothesis.

Kalay (1982), criticizing Elton and Gruber (1970), argued that the marginal tax rates of the investors cannot be inferred from the ex-dividend day price drop to dividend ratio (price-drop ratio) and the observed positive relationship between price-drop ratio and dividend yield may not be due to tax induced clientele effects. Thus, Kalay (1982) presented another explanation, known as the “short-term traders” hypothesis. He argued that, assuming certainty, if the ex-dividend price ratio drop is less than one (less than the amount of dividends), short-term traders who face the same tax rate on dividends and capital gains could make arbitrage profits. That is, investors can buy a stock before it goes ex-dividend and sell it soon after (dividend capture hypothesis ( Karpoff and Walkling, 1990)). However, this arbitrage process could be hampered by transaction costs. Kalay (1982) suggest that transaction costs are insignificant for broker dealers who are the potential short-term traders, while Elton, Gruber and Rentzler (1984) argue that it matters even for broker dealers. Karpoff and Walkling (1988, 1990) show that excess ex-dividend-day returns are positively correlated with transaction costs (measured by bid-ask spread), and this relationship increases for stocks with high dividend yields. They also suggest that short-term trading around ex-dividend days is higher for high yield stocks (Michaely and Vila, 1996), implying that short term trading (or dividend capture) may influence the ex-dividend day stock price changes, and hence any clientele effects may not be the only explanation for these changes.

Bali and Hite (1998) and Frank and Jagannathan (1998) raised two additional obstacles in interpreting the ex-day price drop as evidence that differential taxes affect prices and trading behaviour. Bali and Hite (1998) suggest that tick sizes can explain ex-dividend price ratios which are not equal to one. They argue that the drop in price less than the dividend is due to discreteness in prices rather than taxes. According to them, because stock prices trade in discrete ticks but dividend amounts are continuous and, on average, fairly small in amount, the ex-day premium will be less than one even in

the absence of differential tax rates. Since investors are not willing to pay more than the dividend amount for the dividend received, the ex-day price drop will be rounded down to the nearest tick, so that the change in stock price on the ex-dividend day is always less than the amount of the dividend. Similarly, when a dividend received is between ticks, there will be positive abnormal returns.

Frank and Jagannathan (1998) offer another market microstructure interpretation where they argue that collection and reinvestment is bothersome for individual investors but not for market makers. Market makers have a comparative cost advantage to collecting and reinvesting dividends, so they buy shares before a stock goes ex-dividend and resell them after the stock goes ex-dividend. Most of the trades occur at the bid price before the stock goes ex-dividend and at the ask price on the ex-dividend day. The resulting shift from bid to ask causes positive ex-day returns. In their model, the resulting bid-ask bounce contributes, if not totally explains, the ex-dividend day behaviour.

Examination of the ex-dividend day share price behaviour has been occurred extensively to different stock markets from different studies, trying to investigate various factors that affect stock price, taking into account the fact that in some countries some of the proposed interpretation cannot be enforceable due to special circumstances in these countries. A more analytical discussion of the literature and analysis of the ex-dividend behaviour of share prices is presented in the stand-alone paper in section 4 that investigates the ex-dividend stock price behaviour on Athens Stock Exchange.

## **2.5 Significant dates relative to dividends**

This thesis considers and assesses the reaction of stock prices to dividends, both on announcement day and ex-dividend date. Hence, it is essential to understand when companies make dividend decisions and when possible investors' activity could be increased. The most important is the date when company announces its dividend, usually simultaneously with its earnings level. In the current analysis the market reaction is supposed to be the

strongest. There could be also a noticeable reaction in the day when shares are traded for the first time without the dividend attached. Therefore, every important date will be clearly defined below.

The announcement day (or declaration date) is the date when the board of directors sets the dividend and announces when the stockholders will get their payments. On the same day the liability is created in the company's books in an amount equal to the sum of all dividends that are going to be paid. In addition, at this point in time the ex-dividend date is announced to the public. Usually investors have in advance the information about the board of directors meeting in which the earnings and dividends are announced. Besides, companies tend to announce earnings and dividends in similar periods every year. Depending on how positive or negative results investors are expecting, it is possible that the activity before and after the declaration date is increased. For instance, speculators who expect that company will announce higher dividends than it is expected by the majority of market participants, would collect shares from the market to sell them at a higher price when the official dividend information is revealed.

Record date is the date when the list of shareholders, authorized to receive dividends, is set by the company. Investors are required to own the stocks of the company before this date in order to be entitled to the dividend. Hence, for a plain investor the ex-dividend date is very important. The record date is announced on the declaration day by the board of directors. It is unusual, but possible, that the record day falls on the declaration day. This move allows the directors to reward the dividend investors who already have shares of the company, and at the same time limits the speculative transactions around the record date. In such case the ex-dividend day falls before the declaration day.

Ex-dividend date (or reinvestment date) is the day after all shares that traded are no longer attached with the right to the announced dividend. If the stock is traded with a right to dividend it is said to be cum dividend. It is relatively common for stock's price to decrease on the ex-date by an amount equal to the dividend paid per share, which reflects the decrease in the company's assets. If an investor does not own the stock before the ex dividend

date, he/she would not be entitled to the dividend payout. Ex-dividend date usually falls from 2 to 4 days before the record date. It normally takes around 3 days to settle the regular stock sale or buy transactions, therefore this 2 - 4 day period allows for completion of all pending transactions before the record day.

Payment date (or distribution date) is the date when the company mails the checks. The payment date is just an ordinary day when the money is wired to the investors, without any influence on the existing outstanding shares. Therefore, no unusual investor reaction is expected.

## 3 Revisiting dividend growth predictability via dividend yield

### 3.1 Introduction

It is widely accepted in the literature that the dividend yield can better predict returns in stock markets than dividend growth (i.e. Cochrane, 2008). Chen (2009) shows that the predictive ability of dividend yield on dividend growth has been lost after the second world war. He claims that the driving force of this result is that during the past few decades firms (US firms in his case study) tend to smooth their dividends causing a disconnection in the relationship between dividend yields and expected dividend payments.

In addition, Chen *et al.* (2012) and Cochrane (2011), using post-war US data, find that asset prices are affected only from changes in expected returns but not from the variation of dividends. Also, Ang and Bekaert (2007) and Engsten and Pedersen (2010) using data for US and UK find that dividend growth cannot be predicted from dividend yield. However, Rangvid *et al.* (2013) show that this result does not extend internationally and that in small and medium-sized equity markets dividends are predictable via the dividend yield.<sup>5</sup>

This fact leads to an investigation of the factors that cause the implied inconsistency between the theoretically expected relationship and the empirical evidence. This chapter shows that this "inconsistency" vanishes when the appropriate econometric approach is used on a "properly treated" dividend yield.

The literature on dividend growth predictability is mainly based on annual dividends due to seasonality issues that emerge when higher frequency dividends are used. In this study it is argued that through the aggregation approach significant information will be washed out, especially for countries

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<sup>5</sup>In a different context, Vuolteenaho (2002), using US data at a firm level and not at the aggregate level as the previous works, finds that dividends are predictable for specific firms depending on their size. But at the aggregate level this predictability disappears because the idiosyncratic characteristics of each firm disappear.

where firms pay dividends more than once within the year. In theoretical and empirical corporate finance in an asymmetric information environment companies use dividend announcements in order to reveal information about their future prospects.<sup>6</sup> According to Acharya and Labrecht (2011) executives in companies adjust dividend payments to market expectations at the company level in order to keep their shareholders satisfied and therefore keep their positions. Although asymmetric information theories view the dividend process from a different angle they nevertheless suggest that it should be expected to observe predictability and a negative sign between the dividend yield and future dividend growth, if good firm prospects are embedded in the stock price while dividends are sticky or smoothed.

The Gordon-Campbell-Shiller model does not use information asymmetries in the relationship just expectation and discounting so things are more complicated. Moreover, the use of aggregated, annual, data washes out that information. Taking the above into consideration, this paper revisits the issue of dividend growth (un)predictability via the dividend yield. In particular, in the analysis that will follow information from dividends reported within the year is utilised. Predictability is enhanced by the introduction of higher frequency observations on the growth of dividend yield. By using monthly observations of the annual dividend growth one can extract new information for the future prospects of firms (dividend growth) from two sources: i) from dividend payments, as the firm shifts its policy as new information is revealed and ii) from the stock market where information is reflected in the stock price.

The empirical literature supports the fact that the inability of dividend yield to predict dividend growth stems from smoothing dividends. Specifically, Chen *et al.* (2012) find that dividends are much more smoothed in the post-war period comparing to the pre-war, offering a possible explanation to the extended literature that comes to the conclusion of the inability of dividend price ratio to predict dividend growth in the post-war period for the

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<sup>6</sup>Several theoretical models that examine the information embedded in dividend announcements (i.e. Bhattacharya, 1979, John and Williams, 1985 and Miller and Rock, 1985) predict that changes in dividend policy convey news about future cash flows. Especially, dividend increases (decreases) convey good (bad) news.

US market. Engsted and Pederson (2010), studying US and UK aggregate stock markets, observe the same “tale of two periods” regarding the dividend growth predictability through dividend yield.

Many researchers, based on the Campbell and Shiller (1988a,b) return decomposition, study the predictability of dividend yield for the aggregate US stock market. The decomposition of Campbell and Shiller (1988a, b) implies that dividend yield fluctuation should reflect changes on future expected returns or expected dividend growth, or both. The consensus of those works, using predictive regressions of returns and dividend growth on dividend yields, is that for the US stock market dividend growth is not predictable by the dividend price ratio while returns are, mainly for the post war period.

This finding has led to the stylized fact that almost all the variation in dividend yield is due to changing expectation of future returns (discount rates) with the expectation of future dividend growth having no role.<sup>7</sup> Rangvid *et al.* (2013) assess that argument in fifty stock markets and they conclude that dividends are highly predictable by dividend yield in small medium-sized equity markets in contrary to large equity markets, such as the US, UK, Japan and Canada.<sup>8</sup> In addition, they find that the driving force of the results is the difference in dividend smoothing from country to country, which is in line with Chen *et al.* (2012). In addition, Rangvid *et al.* (2013) investigate the correlation between firm size and dividend predictability and the relationship between volatility of dividends and dividend predictability.

Another stream of literature, using present value models, investigates the predictability of dividend price ratio for the aggregate US stock market. Cochrane (2008) challenges the results of predictive regressions, since

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<sup>7</sup>A partial list of papers using dividend yields to predict returns includes: Fama and French (1988), Campbell and Shiller (1988a,b), Cochrane (2011), Lettau and Ludvigson (2001), Lewellen (2004), Campbell and Yogo (2006), Ang and Bekaert (2007), Goyal and Welch (2008), Campbell and Thompson (2008), Lettau and van Nieuwerburgh (2008), Chen (2009), Chen and Zhao (2009) and van Binsbergen and Koijen (2010).

<sup>8</sup>They also show that by constructing two aggregate global stock portfolios, an equally-weighted and a value-weighted portfolio, dividend growth is more predictable in countries with medium-sized or small equity markets compared to countries with large market capitalization, such as the US.

the present value models reveal the hidden economic link between price-dividend ratios, expected returns and expected cash flow growth.<sup>9</sup> Lettau and Ludvigson (2005) using a consumption-based present-value relation argue that movement in expected dividend growth is positively correlated with movements in expected returns and this co-movement has offsetting effects on dividend price ratio that is unable to reveal the time-varying nature of expected dividend growth.

In this paper is shown that the use of intra-annual information from dividends, monthly in the current study, combined with their annual-to-annual transformation in monthly growth rates, can improve the link between dividend yield and dividend growth. The higher frequency information from dividends is utilized using the Mixed frequency Data Sampling (MiDaS)<sup>10</sup> approach, proposed by Ghysels *et al.* (2004), that can also avoid the seasonality issue of intra-annual data. Moreover, in order to cancel out the effects of price and dividend variance on dividend yield a smoothing technique is used, and the component of the smoothed dividend yield that offers predictive power is identified. Using monthly data, sampled at the end of month, a more robust model with respect to end of year price volatility is obtained, and which allows for separate treatment of information of different frequencies, annually and monthly.

The analysis of this chapter is based on four of the world's largest equity markets, namely, S&P500 (US), FTSE100 (UK), SPTSX60 (Canada) and NKY (Japan). This way the argument of Rangvid *et al.* (2013), that in large equity markets dividend growth is unpredictable through dividend yield

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<sup>9</sup>An example of related literature, among others, is: Menzly *et al.* (2004), Lettau and Ludvigson (2005), Ang and Bekaert (2007), Lettau and Van Nieuwerburgh (2008), Campbell and Thompson (2008), Pastor *et al.* (2008) and van Binsbergen and Koijen (2010).

<sup>10</sup>It has been shown that nonlinear approaches, like our approach, have higher explanatory power on the dynamics of dividends. For example, Jawadi (2009) applies a Smooth Transition Autoregressive (STAR) model that is nonlinear, for dividend forecasting, and they find that this model is better than the conventional linear models applied in the literature so far (other examples that use nonlinear approaches are Gallagher and Taylor (2001), Gutierrez and Vazquez (2004) and Van Norden and Schaller (2000)). The nonlinear feature of this approach allows for asymmetries in dividends adjustment to be present. But Jawadi (2009) doesn't report whether the STAR model can provide a statistically significant forecast of dividend growth through dividend yield but the results indicate that nonlinear models can capture important information of dividends.

can be assessed. It is also tested whether other factors, such as liquidity and dividend volatility, as it has been proposed in the literature, can affect the predictability of dividend yield when higher frequency information from dividends is utilised.

The findings suggest that for every country in our sample, the smoothed dividend-price ratio is significantly related with the future dividend growth. The results also identify the component of the smoothed dividend-price ratio, which, in all cases, offers predictive power. The existence of dividend growth predictability, especially for the US, is in contrast with what is suggested in the recent literature (e.g. Chen, 2009, and Rangvid et al., 2013). In addition, it is found that both the liquidity of the market as well as the dividend volatility do not affect the predictability of dividend growth through the annual-to-annual monthly growth rate of dividend yield.

This chapter is organized as follows. Section 2 provides a discussion of the related literature. Section 3 has a description of the main variables and the model of the analysis. Section 4 describes the model. Section 5 outlines the methodology of the empirical application. Section 6 presents the main results. Section 7 includes a forecasting exercise. Section 8 includes a discussion on dividend smoothing. Section 9 performs a robustness check and section 10 concludes the chapter.

## **3.2 Related literature**

The majority of the literature, based on the Campbell and Shiller (1988a,b) return decomposition, study the predictability of dividend yield for the aggregate US stock market. The decomposition of Campbell and Shiller (1988a, b) implies that dividend yield fluctuation should reflect changes on future expected returns or expected dividend growth, or both. The consensus of those works, using predictive regressions of returns and dividend growth on dividend yields, is that for the US stock market dividend growth is not predictable by the dividend price ratio while returns are, mainly for the post war period. This finding has led to the stylized fact that almost all the variation in dividend yield is due to changing expectation of future returns (discount

rates) with the expectation of future dividend growth having no role.<sup>11</sup>

Another stream of literature investigates the predictability of dividend price ratio for the aggregate US stock market. For example, Cochrane (2008), using present value model, challenges the results of predictive regressions, since the present value models reveal the hidden economic link between price-dividend ratios, expected returns and expected cash flow growth.<sup>12</sup> Moreover, the work of Lettau and Ludvigson (2005) is a consumption-based present-value relation that is a function of future dividend growth, with the use of data on aggregate consumption and dividend payments from aggregate wealth. They argue that movement in expected dividend growth is positively correlated with movements in expected returns and this co-movement has offsetting effects on dividend price ratio that is unable to reveal the time-varying nature of expected dividend growth. In addition, they find that dividend growth is important for predicting returns in the post-war US stock market notwithstanding the inability of the dividend-price ratio to predict returns. Kojien and van Binsbergen (2010), also using a present-value model, show that US market-wide dividends are predictable by the whole history of dividend yields.

On the other hand, the stylized fact for the US stock market that the returns are predictable by dividend yield, while dividend growth is not, cannot uniformly extend to other countries. Specifically, Rangvid *et al.* (2013) show that in global equity markets dividend growth predictability via dividend yield is the rule rather than the exception. Instead of looking solely at US data they examine fifty stock markets and they conclude that dividends are highly predictable by the dividend yield in small medium-sized equity markets in contrary to large equity markets, such as the US. They

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<sup>11</sup> A partial list of papers using dividend yields to predict returns includes: Fama and French (1988), Campbell and Shiller (1988a,b), Cochrane (2011), Lettau and Ludvigson (2001), Lewellen (2004), Campbell and Yogo (2006), Ang and Bekaert (2007), Goyal and Welch (2008), Campbell and Thompson (2008), Lettau and van Nieuwerburgh (2008), Chen (2009), Chen and Zhao (2009) and Kojien and van Binsbergen (2010).

<sup>12</sup> An example of related literature, among others, is: Menzly, Santos, and Veronesi (2004), Lettau and Ludvigson (2005), Ang and Bekaert (2007), Lettau and Van Nieuwerburgh (2008), Campbell and Thompson (2008), Pastor, Sinha, and Swaminathan (2008) and Binsbergen and Kojien (2010).

also construct two aggregate global stock portfolios, an equally-weighted and a value-weighted portfolio, and they test the predictive power of future dividend growth rates on current-period dividend yields. They follow that approach to verify that dividend growth is more predictable in countries with medium-sized or small equity markets compared to countries with large market capitalization, such as the US.

In addition, they find that the driving force of their results is the difference in dividend smoothing from country to country, which is in line with Chen *et al.* (2012). Their analysis of dividend smoothing is based on Lintner's (1956) partial adjustment model where they find that in small equity markets dividends are smoothed less, resulting to stronger predictability of dividend by the dividend yield. They also suggest a negative relationship between the firm size in a country and dividend predictability. By investigating whether differences in firm size could explain the differences in dividend predictability, they find that the smaller is the typical firm in a country the stronger is the dividend predictability. Finally, they test if there is any relationship between the dividend predictability and the volatility of firms' dividends and returns. Their findings indicate that the more volatile the dividends are the more predictable is the dividend growth by the dividend yield.

In a different study, Engsted and Pederson (2010) use annual data for US and three European countries (Sweden, Denmark and UK) to revisit the stylized fact of unpredictable dividend growth by the dividend-price ratio. The main difference in their approach comes from the fact that they calculate the dividend growth and returns using both real and nominal terms. Their findings indicate that the predictability patterns of returns and dividend growth for the US are very sensitive to whether these variables are measured in real or nominal terms.

However, in Sweden and Denmark dividend growth is strongly predictable by the dividend-price ratio in the "right" direction while returns are not, without qualitatively important differences between nominal and real predictability. For the UK market, the results are more similar to the US, since they observe a "tale of two periods", but with the important difference that the UK results are not significantly different for nominal and real variables.

The recent work of Chen *et al.* (2012) is based on US and they explore whether the inability of dividend yield to predict dividend growth stems from the fact that firms try to smooth the dividends that distribute to shareholders. They define dividend smoothing as the phenomenon that dividend payout is determined not only by current earnings (Lintner, 1956) or “permanent earnings” (Marsh and Merton, 1987), but also by past dividend payout. To that end, they construct a smoothness parameter and using simulation analysis for US, they find that the introduction of dividend smoothing can eliminate dividend growth predictability. More precisely, they find that dividends are much more smoothed in post-war period comparing to pre-war, offering a possible explanation to the extending literature that comes to the conclusion of the inability of dividend price ratio to predict dividend growth in the post-war period for the US market.<sup>13</sup>

Furthermore, Chen *et al.* (2012) show that the lack of dividend growth predictability in the post-war period does not necessarily mean that the aggregate stock price variations contain no cash flow news. Instead, the intuition of their results is that the dividend smoothing behaviour is so pronounced that dividends do not reflect any information about future cash flows. Thus, they explore two alternative measures that are less subject to smoothing: net payout and earnings. Their analysis shows that the major variation of the net payout (earnings) yield comes from net payout (earnings) growth, suggesting a role of cash flow news much larger than discount rate news, in both the pre- and post-war period.

### 3.3 Dividend Predictability

At this section the key variables that will be used throughout the chapter are outlined and the model of Campbell and Shiller (1988a,b), that is commonly used in the literature for the analysis of dividend growth predictability, is briefly presented.

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<sup>13</sup>Through the fact that dividend smoothing bury the predictability of dividend yield to dividend growth, and since dividend smoothing is much more pronounced in the post-war period, Chen *et al.* (2012) also support the result of Chen (2009) who find that dividend growth predictability disappears in the post-war period.

Let  $P_t$  and  $D_t$  denote the price of a stock (or the value of an index) at time  $t$  and the corresponding aggregate dividend that has been paid during the time interval  $(t-1, t]$ , respectively. Let also  $p_t := \ln P_t$  and  $d_t := \ln D_t$ . The returns are defined by:

$$r_t = \ln \left( \frac{P_t + D_t}{P_{t-1}} \right) .$$

The (log) dividend yield is given by  $dy_t = d_t - p_t$ . The literature on dividend predictability has been motivated from the work of Campbell and Shiller (1988a,b). They showed that a good approximation of the logarithmic dividend yield is given by:

$$dy_t \simeq c + E_t \sum_{j=1}^{\infty} \rho^{j-1} r_{t+j} - E_t \sum_{j=1}^{\infty} \rho^{j-1} \Delta d_{t+j} , \quad (14)$$

where  $E_t$  is the conditional expectation operator at time  $t$ . The intuition of the above equation is that the dividend yield should predict revisions on future returns and/or dividend growth. Specifically, equation (14) implies a positive relationship between dividend yield and expected future returns, and a negative relationship between dividend yield and expected dividend growth.

Following the above equation many researchers assess the main driving force of equity markets by running two separate regressions. Specifically, they test separately the effect of dividend yield on future returns and on dividend growth. The main reason for this approach is that stock returns are more volatile than dividend growth and a combination of the two into a single regression would minimize, if not completely eliminate, the effect of dividend growth.

The corresponding two equations are the following:

$$\Delta d_{t+1} = c_{0,d} + c_{1,d} dy_t + \omega_{t+1,d} \quad (15)$$

$$r_{t+1} = c_{0,r} + c_{1,r} dy_t + \omega_{t+1,r} , \quad (16)$$

where a common approach is to use annual data for every variable in order to avoid seasonality issues. Throughout the paper we will focus on the dividend growth predictability equation, (15).<sup>14</sup>

### 3.4 The Mixed Frequency Data Sampling Approach (MiDaS)

The literature on dividend growth predictability uses annual observations in order to avoid potential seasonality issues that appear in higher frequency dividend data (see, e.g. Rangvid *et al.*, 2013, among others). But this approach ignores potentially important information from higher frequency observations, which vanishes when aggregated over the periods that correspond to the lower frequency. In this chapter, a solution to this problem using mixed frequency data is proposed. A useful tool for the empirical analysis, when the regressor and the regressant are sampled at different frequencies, is the Mixed Data Sampling approach (MiDaS), introduced by Ghysels *et al.* (2004).

MiDaS has been extensively applied in financial data for assessing volatility predictions and stock returns (i.e. Forsberg and Ghysels, 2006 and Ghysels *et al.*, 2006), as well as in forecasting macroeconomic variables using intra-annual data (i.e. Bai *et al.*, 2009, Kuzin *et al.*, 2011 and Clements and Galvao 2008, 2009) and more recently in forecasting annual fiscal data using quarterly announcements (Asimakopoulous *et al.*, 2013).

The current chapter is the first attempt that MiDaS is applied on a dividend growth predictability model. Therefore, the current work, besides its theoretical contribution, introduces an additional methodological approach for the study of the predictability of dividend growth with the use of mixed frequency data.

Assuming that the higher frequency data (monthly in this case study) and the low frequency data (annual data) are denoted by  $X_t^M$  and  $Y_t^A$ , re-

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<sup>14</sup>However, we have also followed the same approach for assessing the predictability of returns through dividend yield and the results are not different from what the literature suggests. For that reason are not presented in this paper but are available upon request.

spectively. Then the standard MiDaS regression is:

$$Y_{t+1}^A = \beta_0 + \beta_1 B(L^{1/m}; \boldsymbol{\theta}) X_t^M + \varepsilon_{t+1} \quad (17)$$

where  $L^{1/m}$  is the higher frequency (monthly) lag operator (here  $m = 12$ ), and  $B(L^{1/m}; \boldsymbol{\theta}) = \sum_{j=0}^{K-1} \omega_j(\boldsymbol{\theta}) L^{j/m}$  is a polynomial of  $L^{1/m}$  that also depends on a vector of parameters,  $\boldsymbol{\theta}$ , which determine the curvature of the weighting scheme.

The above expression determines the effect of the higher frequency explanatory variable on the lower frequency dependent variable. Ghysels *et al.* (2007) provide several weighting schemes. They show that the exponential Almon lag polynomial has the most flexible shape and therefore is assumed to be the most general weighting scheme and this is the main reason that it is also incorporated in this analysis.

The exponential Almon lag polynomial is fully determined by two parameters  $\theta_1$  and  $\theta_2$ , hence  $\boldsymbol{\theta} = (\theta_1, \theta_2)'$ . The corresponding weights,  $\omega_j(\boldsymbol{\theta})$ , are given by

$$\omega_j(\boldsymbol{\theta}) = \frac{\exp\{\theta_1 j + \theta_2 j^2\}}{\sum_{j=1}^m \exp\{\theta_1 j + \theta_2 j^2\}}$$

The advantage of MiDaS when compared to alternative approaches, such as State Space and mixed frequency VAR models that use Kalman filter, is that it is parsimonious and less sensitive to specification errors due to the use of non-linear lag polynomials. In addition, MiDaS does not suffer from the parameter proliferation issue. This is important in the current analysis because the time span of the data is not large enough for most of the countries in the sample. Concerning the small sample size issue, Ghysels *et al.* (2006) show that MiDaS performs better than State Space models, that make use of Kalman filter, as the time span of data decreases.

Another significant advantage of MiDaS is that the weighting scheme is purely data driven and no prior assumption is necessary. Note that it is common in the literature to simply take the average of the higher frequency variables to transform them into low frequency, but the equal weighting assumption is usually not accurate and it might lead to incorrect estimators.

By definition, MiDaS avoids this issue. On the other hand, when compared to a purely high frequency model, MiDaS avoids the seasonality issues that appear in higher frequencies due to the lower frequency sampling of the regressant and the flexibility of the weighting scheme.

### 3.5 MiDaS Predictive Regression for Dividend Growth

This chapter considered that the lower frequency observations are annual and that the time variable,  $t$ , takes integer values and corresponds to the last day of the corresponding year. Specifically,  $p_t$  is the value of an equity index the last day of year  $t$ , and  $d_t$  is the aggregate dividend paid by all companies in this index during year  $t$ . By  $t - j/12$ ,  $j \in \{0, 1, \dots, 11\}$  is denoted the months within year  $t$ . For example,  $p_{t-1/12}$  is the value of the index the last day of November of year  $t$ , while  $d_{t-1/12}^m$  is the aggregate dividend paid by all companies in the index during November of year  $t$ . The corresponding monthly dividend-price ratio is denoted by  $dy_{t-1/12}^m := d_{t-1/12}^m - p_{t-1/12}$ .

As mentioned earlier, the selection of annual frequency for the dividend growth stems from the following facts: First, not all companies pay dividends every month, (especially in non US markets). Second, seasonality effects appear to be strong during a one year period. As implied by the relevant literature, it is of interest to test the following relationship:

$$\Delta d_{t+1} = c_0 + c_1 dy_t + u_{t+1}, \quad (18)$$

where  $E_t(u_{t+1}) = 0$ . Starting from (18), the first step of this chapter is to introduce higher frequency information, and at the same time, avoid any exposure to seasonality effects. To this end, since monthly dividends are available, this study can use intermediate prices (sampled at the end of every month) for the right-hand side of equation (18). Specifically, let

$$\overline{dy_t^m} := \sum_{j=0}^{11} (d_{t-j/12}^m - p_{t-j/12}^m). \quad (19)$$

Note that  $\overline{dy_t^m}/12$  is the average monthly dividend-price ratio during year  $t$ . In other words,  $\overline{dy_t^m}$  is the annualized average monthly dividend-price ratio for year  $t$ . When compared to  $dy_t$ ,  $\overline{dy_t^m}$  combines more synchronous information, because while the annual dividend in  $dy_t$  aggregates throughout a whole year, only the end-of-year price is involved. As a starting point of the analysis, this study will replace  $dy_t$  by  $\overline{dy_t^m}$  in (18) obtaining the following equation:

$$\Delta d_{t+1} = c_0 + c_1 \overline{dy_t^m} + u_{t+1} . \quad (20)$$

When compared to (18), the right-hand side of equation (20) is much less sensitive to end-of-year price volatility, while  $\overline{dy_t^m}$  may be seen as a smoothed version of the dividend-price ratio.<sup>15</sup>

### 3.5.1 The Role of Time and MiDaS

According to equation (20), if  $c_1$  is different than zero, then the future annual dividend growth is linearly related with the average monthly dividend yield. However, an initial inspection of the statistical properties of  $\overline{dy_t^m}$  for the data involved in the analysis, reveals that it is highly persistent. Specifically, for each country in the sample, the values of the ordinary least squares estimator,  $\hat{\rho}$ , of the coefficient of an AR(1) specification for  $\overline{dy_t^m}$ ,  $\overline{dy_t^m} = \rho \overline{dy_{t-1}^m} + \varepsilon_t$ , are: 1.002 for the US, 0.994 for the UK, 0.997 for Canada and 0.99 for Japan. Of course, this observation alone does not have a direct implication to the specification (20), although it provides an indication that  $\overline{dy_t^m}$  may have a unit root. However, this study can relax equation (20) by first decomposing  $\overline{dy_t^m}$  as  $\overline{dy_t^m} = \overline{dy_{t-1}^m} + \Delta \overline{dy_t^m}$ . This type of decomposition seems natural, given the persistent nature of  $\overline{dy_t^m}$ . Then, this study allows that the sensitivity of  $\Delta d_{t+1}$  to recent information on dividend yield ( $\Delta \overline{dy_t^m}$ ) differs from the sensitivity of  $\Delta d_{t+1}$  to  $\overline{dy_{t-1}^m}$ . This leads to the following equation:

$$\Delta d_{t+1} = c_0 + c_1 \Delta \overline{dy_t^m} + c_2 \overline{dy_{t-1}^m} + u_{t+1} . \quad (21)$$

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<sup>15</sup>In fact,  $\overline{dy_t^m}/12$  is a smoothed version of the monthly dividend-price ratio. However, the use of  $\overline{dy_t^m}$  instead of  $\overline{dy_t^m}/12$  in (20) and its subsequent variations does not affect the signs and p-values in the results of the corresponding regressions.

Equation (21) nests (20) as the special case where  $c_1 = c_2$ . On the other hand, under the joint hypothesis that  $\Delta d_{t+1}$  does not have a unit root while  $\overline{dy_{t-1}^m}$  has a unit root, it is estimated (21) under the restriction  $c_2 = 0$  in order to avoid the case of an unbalanced regression.

Next, let us focus on the component of (21) that corresponds to recent information,  $\Delta \overline{dy_t^m}$ . It is observable that

$$\Delta \overline{dy_t^m} = \sum_{j=0}^{11} [(d_{t-j/12}^m - p_{t-j/12}^m) - (d_{t-1-j/12}^m - p_{t-1-j/12}^m)] \quad (22)$$

where each summand of the right hand side of (22) corresponds to the annual growth of a monthly log dividend-price ratio,  $gdy_{t,j}^m := (d_{t-j/12}^m - p_{t-j/12}^m) - (d_{t-1-j/12}^m - p_{t-1-j/12}^m)$ ,  $0 \leq j \leq 11$ . According to (21), the sensitivity of  $\Delta d_{t+1}$  to each  $gdy_{t,j}^m$ ,  $0 \leq j \leq 11$ , is the same. The incorporation of MiDaS corresponds to the assignment of different weights to each summand of the right hand side of (22). Specifically, it is defined as follows:

$$\Delta wdy_t^m = \sum_{j=0}^{11} w_j [(d_{t-j/12}^m - p_{t-j/12}^m) - (d_{t-1-j/12}^m - p_{t-1-j/12}^m)] \quad (23)$$

The use of  $\Delta wdy_t^m$  instead of  $\Delta \overline{dy_t^m}$  in (21) yields the final equation which will be estimated through MiDaS:

$$\Delta d_{t+1} = c_0 + c_1 \Delta wdy_t^m + c_2 \overline{dy_{t-1}^m} + u_{t+1} \quad (24)$$

Equation (24) can be considered as a version of (18), which is robustified with respect to end-of-year price volatility, and which allows for separate treatment of information of different lags, annual and monthly. It must be noted that in MiDaS regressions as (24), the components of the weighted sum (of  $\Delta wdy_t^m$  in our case) are not treated as separate regressors. Hence the regressors in (24) are not strongly correlated. As in the case of (21), equation (24) also is estimated under the restriction  $c_2 = 0$ . Moreover MiDaS estimation in equation (24) does not include overlapping observations because the dividend growth at time  $t+1$ ,  $\Delta d_{t+1}$ , is regressed on the weighted average

of the annual growth of monthly dividend-price ratios,  $\Delta w \overline{dy}_t^m$ , from time  $t - 1$  to  $t$  (this is the high frequency variable) and on the annualized average monthly dividend-price ratio,  $\overline{dy}_{t-1}^m$ , at time  $t - 1$ .

### 3.6 Empirical Results on Dividend Growth Predictability

This section presents the results concerning the predictability of dividend growth using index data from US, UK, Canada and Japan. Specifically, the following indices are considered: S&P500 (US), FTSE100 (UK), SPTSX60 (Canada) and NKY (Japan). The aggregate monthly dividend paid by all companies in the index is reported by Bloomberg. The available information on monthly dividend starts at 1988 for US, and 1994 for UK, Canada and Japan. The end point of the analysis for every country is the end of 2012. The sample size for each country depends on the availability of the corresponding monthly dividends.<sup>16</sup>

The Table 1 below presents the descriptive statistics of the main variables used throughout the chapter. In more detail, the means, medians, maximum-minimum and number of observations of the annual and monthly dividend growth and dividend yield are presented. The number of observations in the US is larger than that of the other countries due to the larger sample available on Bloomberg.

A general conclusion that can be drawn from these results is that dividend growth in the US has the lowest volatility. This is observed through the difference between the maximum and the minimum values of dividend growth that is the smallest compared with the other countries in both annual

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<sup>16</sup>Japan is the only country in our dataset, for which the problem of zero monthly dividend occurred. Specifically, during the nineteen years of monthly dividend data for Japan, April dividends were always zero, while October dividends were issued only twice. In view of this fact, our analysis actually omits these two months for Japan. On the other hand, concerning the same country, we had to deal with an additional number of thirteen zero monthly dividends. This number is relatively small when compared with a dataset of 190 observations (after the exclusion of April and October zero dividends). In order to avoid the issue of applying the logarithmic function to zero, we treat the zero dividends as not available data when MiDaS is used.

Table 1: Descriptive statistics

	Annual Dividend Growth					Annual Dividend Yield				
	Mean	Median	Max	Min	# obs.	Mean	Median	Max	Min	# obs.
US	0.050	0.044	0.283	-0.239	24	-3.872	-3.906	-3.329	-4.450	25
UK	0.059	0.058	0.527	-0.237	18	-3.337	-3.296	-2.827	-3.717	19
Canada	0.073	0.060	0.333	-0.112	18	-3.905	-3.960	-3.197	-4.414	19
Japan	0.072	0.077	0.767	-0.300	18	-4.573	-4.624	-3.687	-5.850	19
	Monthly Dividend Growth					Monthly Dividend Yield				
	Mean	Median	Max	Min	# obs.	Mean	Median	Max	Min	# obs.
US	0.051	0.056	1.172	-0.530	288	-6.373	-6.438	-5.233	-7.315	300
UK	0.064	0.070	1.526	-1.483	216	-6.071	-6.056	-4.581	-8.317	228
Canada	0.077	0.073	1.059	-1.070	216	-6.450	-6.315	-5.515	-7.891	228
Japan	0.035	0.000	3.770	-1.296	216	-6.456	-7.700	-4.657	-11.130	228

The above Table presents descriptive statistics (means, medians, maximum-minimum, number of observations) of the annual and monthly dividend growth and dividend yield for each country.

and monthly frequencies. The country with the highest volatility, largest difference between the maximum and the minimum value, on dividend growth is Japan.

Regarding the dividend yield, the values and volatilities are similar among the countries apart from Japan that appears to have the highest variability (the difference between the maximum value and the minimum value is the highest compared to the other countries).

The results of this empirical study concerning dividend growth predictability are presented in Tables 2 to 5.

### 3.6.1 One-year-ahead predictability of dividend growth

Table 2 presents the results on one-year-ahead dividend growth predictability. The first block of columns of Table 2 corresponds to equation (18). The second block of columns corresponds to an application of MiDaS without the decomposition of the dividend-price ratio. In other words, although mixed frequency data are used in the second regression, the high frequency data correspond to monthly dividend-price ratios,  $dy_{t-j/12}^m$ ,  $0 \leq j \leq 11$ . The corresponding equations are given by:

$$\Delta d_{t+1} = c'_0 + c'_1 w dy_t^m + u_{t+1} , \quad (25)$$

where

$$wdy_t^m = \sum_{j=0}^{11} w'_j dy_{t-j/12}^m .$$

The third block of columns corresponds to equation (24).

The results of the first (annual frequency) regression of Table 2 can be compared with the corresponding results in Rangvid *et al.* (2013). Only for Canada the dividend-price ratio seems to be a significant component of dividend growth variability, with a  $p$ -value equal to 9%. On the other hand, the dividend-price ratio does not significantly affect the future dividend growth for both US and UK. This result is comparable and towards the same direction with previous studies, which are mostly based on US data (see, for example, Chen, 2009).

When monthly dividend-price ratios, as described in equation (25), are used instead of annual dividend-price ratios, the results are not uniform (second block of columns in Table 3). Specifically, only for the cases of Canada and Japan, someone can observe statistically significant dividend-price ratios with a  $p$ -value of 4% and 8% respectively. The results indicate that a simple approach that directly applies MiDaS to higher frequency dividend-price ratios, does not consistently reveal signs of dividend growth predictability.

When equation (24) is estimated, the situation changes radically. The decomposition of the dividend-price ratio and the application of MiDaS to its growth component yields significant results for all countries. Specifically,  $\Delta \overline{wdy}_t^m$  is always significant and the sign of  $c_1$  is always negative, in agreement with the theoretically expected sign. Table 2 also reports the results of a test on the hypothesis that  $c_1 = c_2$  for all countries. The only country for which this hypothesis cannot be rejected is Canada. Finally, Table 2 presents the results of the estimation of equation (24) under the restriction  $c_2 = 0$ . Again, for all countries, the coefficient of the growth of the smoothed dividend-price ratio is statistically significant.

Summarizing the results of Table 2, this study concludes that the decomposition of the (smoothed) dividend-price ratio revealed a component ( $\Delta \overline{wdy}_t^m$ ) that always contains predictive information. On the other hand,

Table 2: Regressions for the predictability of dividend growth

Panel A (dep. var. $\Delta d_{t+1}$ )	Annual $dy$ Equation (15)		MiDaS Monthly $dy$ Equation (25)		MiDaS - Smoothed $dy$ (equation (24))			
	$c_{1,d}$	p-value	$c'_1$	p-value	$c_1$	p-value	$c_2$	p-value
					F-test $H_0: c_1 = c_2$		With restriction $c_2 = 0$	
US	-0.04	0.55	-0.05	0.18	-0.16	0.02	-0.05	0.44
UK	-0.24	0.23	0.07	0.35	-0.15	0.01	-0.36	0.56
Canada	-0.13	0.09	-0.14	0.04	-0.16	0.09	-0.09	0.22
Japan	-0.07	0.15	-0.11	0.08	-0.18	0.03	-0.07	0.46
						0.04		0.04
						0.02		0.00
						0.19		0.04
						0.07		0.05

The above Table presents the results on one-year-ahead dividend growth predictability. The first block of columns of the Table corresponds to equation (18). The second block of columns corresponds to an application of MiDaS without the decomposition of the dividend-price ratio and the third block of columns corresponds to equation (24). The  $p$ -values correspond to Newey-West  $t$ -statistics. MiDaS with monthly  $dy$  corresponds to equation  $\Delta d_{t+1} = c'_0 + c'_1 wdy_t^m + u_{t+1}$ , where  $wdy_t^m = \sum_{j=0}^{11} w'_j dy_{t-j}^m$ . F-test tests the hypothesis  $c_1 = c_2$ .

the remaining component ( $\overline{dy_{t-1}^m}$ ) of the dividend-price ratio is not always significant. For each country, the sign of the relationship between future dividend growth and the corresponding significant component of the dividend-price ratio is always negative, being in agreement with the theoretically predicted sign. Concerning the US, in particular, it is worth noting that the results of this study are in contrast with what has been suggested in the literature so far (see Chen, 2009, and Rangvid *et al.*, 2013).

### 3.6.2 The importance of high frequency data

Table 2 provided evidence that the involvement of dividends at a higher than annual frequency, changes the picture concerning the predictability hypothesis of dividend growth. Consequently, it is reasonable to ask whether the selection of monthly frequency is necessary. Table 3 presents the results of a MiDaS estimation of equation (24) with the only difference that quarterly data are used (in other words, only four subperiods each year). It is directly observed that only for the US a significant relationship between  $\Delta d_{t+1}$  and  $\Delta w \overline{dy_t^m}$  is still identified (with a  $p$ -value of 6%), while for Japan, the only significant relationship is between  $\Delta d_{t+1}$  and  $\overline{dy_{t-1}^m}$ . Under the restriction  $c_2 = 0$ ,  $c_1$  is not statistically significant for all countries. The results of Table 3 reveal the importance of the choice of the highest possible (monthly) frequency in order to obtain globally uniform results. They also reveal how quickly time aggregation destroys useful information concerning the relationship between future dividend growth and  $\Delta w \overline{dy_t^m}$ .

### 3.6.3 Predictability of dividend growth at longer horizons

Let us now examine the relationship between the dividend-price ratio and the future dividend growth at longer horizons. Table 4 presents the results of the estimation of equation  $\Delta d_{t+i} = c_0 + c_1 \Delta w \overline{dy_t^m} + c_2 \overline{dy_{t-1}^m} + u_{t+i}$ , with  $i = 2, 3$  and 4. It can be seen that the relationship between  $\Delta d_{t+i}$  and  $\Delta w \overline{dy_t^m}$  has always negative sign and is not significant only for Japan when  $i = 4$ . Under the restriction  $c_2 = 0$ , the  $p$ -value of  $c_1$  is higher than 10% only for the UK, for  $i = 3$ , and for Japan, for  $i = 4$ .

Table 3: MiDaS with quarterly dividends

	With restriction					
	$c_2 = 0$					
	$c_1$	p-value	$c_2$	p-value	$c_1$	p-value
US	-0.07	0.06	0.01	0.90	-0.12	0.24
UK	0.12	0.23	-0.18	0.29	-0.13	0.16
Canada	-0.07	0.22	-0.17	0.17	-0.07	0.80
Japan	0.25	0.25	-0.21	0.03	-0.57	0.66

The above Table presents the results of a MiDaS estimation of equation (24) with the use of quarterly data (four subperiods each year).

$p$ -values correspond to Newey-West t-statistics.

Table 4: MiDas Regressions for the predictability of dividend growth - Longer horizons

Years ahead	With restriction $c_2 = 0$					
	2		3		4	
	$c_1$	$c_2$	$c_1$	$c_2$	$c_1$	$c_2$
US	-0.18 (0.01)	-0.07 (0.37)	-0.19 (0.01)	-0.09 (0.36)	-0.24 (0.02)	0.01 (0.88)
UK	-0.08 (0.03)	-0.09 (0.01)	-0.07 (0.05)	-0.11 (0.27)	-0.64 (0.01)	0.23 (0.01)
Canada	-0.18 (0.07)	-0.08 (0.30)	-0.23 (0.01)	-0.10 (0.17)	-0.29 (0.02)	0.17 (0.13)
Japan	-0.33 (0.05)	-0.05 (0.65)	-0.36 (0.04)	-0.07 (0.62)	-0.36 (0.26)	-0.22 (0.05)

The above Table presents the results of the estimation of equation:

$$\Delta d_{t+i} = c_0 + c_1 \Delta \overline{wdy}_t^m + c_2 \overline{dy}_{t-1}^m + u_{t+i}, \text{ with } i = 2, 3 \text{ and } 4.$$

$p$ -values in parentheses correspond to Newey-West t-statistics.

### 3.6.4 The added value of MiDaS

The results of this analysis are based on the decomposition of the smoothed dividend-price ratio,  $\overline{dy}_t^m$  and the application of MiDaS on its growth component,  $\Delta \overline{wdy}_t^m$ . This study has also shown that the application of MiDaS alone does not suffice to reveal the link between the information contained in monthly dividend-price ratios and future dividend growth (Table 2 ). In order to provide further support to its approach, it shows that the decom-

position of  $\overline{dy_t^m}$  alone is also unable to reveal this link. Table 5 presents the results of the estimation of equations  $\Delta d_{t+1} = c_0 + c_1 \Delta dy_t + c_2 dy_{t-1} + u_{t+1}$  and  $\Delta d_{t+1} = c_0 + c_1 \overline{\Delta dy_t^m} + c_2 \overline{dy_{t-1}^m} + u_{t+1}$ . It can be easily observed that in most of cases the  $p$ -values of the estimated coefficients are significantly larger than 10%, while only for Canada, and only for  $c_2$  the corresponding  $p$ -values are smaller than 10% in both regressions.

The conclusions of the empirical analysis can be summarized as follows: The application of MiDaS weights to the annual growth of the smoothed dividend-price ratio, revealed a negative and significant relationship between this component of the dividend-price ratio and the future dividend growth, when monthly dividend data are involved. This relationship remains negative and significant at longer horizons for all countries in our sample. When a slightly lower frequency (quarterly) on dividend data is used, the relationship in general vanishes. It is worth noting that only a combined decomposition of the smoothed dividend-price ratio with MiDaS, is able to reveal a significant relationship for all markets under consideration.

### 3.7 Testing the accuracy of MiDaS forecast

In this section an out of sample forecast is performed using equation (15) with annual data and with the use of high frequency dividend yield as a regressor (MiDaS approach). The forecast exercise is useful for determining how important is the difference in the coefficients that were obtained in the previous section.

For that reason an annual forecast over two, three and four years is performed. All these forecasts are performed using rolling estimation for one year ahead. Then the Root Mean Squared Forecast Errors (RMSFEs) from the regular approach and the MiDaS approach for each one of the forecasts are obtained. The ratio of the RMSFEs is presented in Table 6. Specifically, the ratio is determined as:  $\frac{RMSFEs(MiDaS)}{RMSFEs(reg)}$ . Therefore, a value lower than one indicates that MiDaS approach has a more accurate forecast. In order to test whether the difference is statistically significant we use the Diebold-Mariano test.

Table 5: Regressions for the predictability of dividend growth

	Estimated equation: $\Delta d_{t+1} = c_0 + c_1 \Delta dy_t + c_2 dy_{t-1} + u_{t+1}$						Estimated equation: $\Delta d_{t+1} = c_0 + c_1 \overline{\Delta dy_t} + c_2 \overline{dy_{t-1}^m} + u_{t+1}$					
	F-test			With restriction			F-test			With restriction		
	$H_0: c_1 = c_2$			$c_2 = 0$			$H_0: c_1 = c_2$			$c_2 = 0$		
	$c_1$	p-value	$c_2$	p-value	p-value		$c_1$	p-value	$c_2$	p-value	$c_1$	p-value
US	-0.24	0.10	-0.04	0.49	0.09	-0.22	-0.01	0.73	0.01	0.78	-0.01	0.70
UK	-0.12	0.51	-0.12	0.45	0.50	-0.06	-0.01	0.65	-0.08	0.46	-0.00	0.75
Canada	-0.09	0.49	-0.13	0.09	0.39	-0.03	-0.01	0.37	-0.11	0.07	-0.01	0.38
Japan	-0.12	0.51	-0.08	0.45	0.41	-0.06	-0.01	0.67	-0.04	0.59	-0.01	0.73

The above Table presents the results of the estimation of equations  $\Delta d_{t+1} = c_0 + c_1 \Delta dy_t + c_2 dy_{t-1} + u_{t+1}$  and  $\Delta d_{t+1} = c_0 + c_1 \overline{\Delta dy_t} + c_2 \overline{dy_{t-1}^m} + u_{t+1}$ .  $p$ -values in parentheses correspond to Newey-West t-statistics. F-test tests the hypothesis  $c_1 = c_2$ .

Diebold-Mariano (1995) introduced a test statistic with the null hypothesis being the equality of the forecasting accuracy of two different models. In more detail, the RMSFE is the loss function for testing the statistical difference of the forecast accuracy between the two models. In the current study, when the resulted t-statistic is negative it indicates that MiDaS has lower RMSFE on average than the alternative approach.

Table 6 reports three different forecasts. The 4 year forecast means that an annual forecast over four years is performed and then four different forecast errors are obtained. Whereas, in the 3 year forecast only three different annual forecasts are performed, giving three different errors for each country (similarly for the two years forecast).

Focusing on the 2 years forecast it can be seen that dividend growth are predicted more accurately for three out of the four countries using the MiDaS method, since the ratio of RMSFEs is lower than one. However, the improvement in the dividend growth forecast is statistically significant for the UK and Japan. Moreover, as the forecasting horizon increases the performance of MiDaS seems to decrease leading to similar forecasts with the same frequency approach.

### 3.8 Dividend smoothing determination

This section provides initially an analysis of the data that have been used, and how dividend smoothing behaves for large equity markets, such as the US, and if the results are in line with the results presented by Rangvid *et al.* (2012). To that end the descriptive statistics are initially examined. Then an estimation is presented of the two benchmark models of dividend behaviour, as they have been introduced by Lintner (1956) and Marsh and Merton (1987), using both annual data (linear approach) and monthly data for MiDaS approach.

Table 6: The RMSFEs ratios (MiDaS over the linear approach) of annual forecasts for 4 and 2 consecutive years

	Dividend growth					
	4 yrs forecast		3 yrs forecast		2 yrs forecast	
	Ratio of RMSFEs	D-B test	Ratio of RMSFEs	D-B test	Ratio of RMSFEs	D-B test
US	1.06	1.57	1.07	1.45	0.99	-1.17
UK	1.14	1.56	1.41	1.18	<b>0.89</b>	-2.85
Canada	1.05	0.09	3.50	1.21	1.53	0.52
Japan	1.02	0.07	<b>0.43</b>	-2.00	<b>0.60</b>	-8.67

The table presents the results from the forecast exercise. Specifically, the ratio of the RMSFEs of MiDaS over the "same frequency model": ( $RSMFE_{MiDaS}/RSMFE_{regular}$ ) is presented together with the Diebold-Mariano test (D-B test). When the ratio is above one it means that MiDaS reports a more accurate forecast than the "same-frequency" (regular) approach. Also, when the Diebold-Mariano test is negative it means that MiDaS approach reports a lower RMSFE than the "same frequency" approach. Finally, the ratio reported in the table will be in bold when the forecasts are statistically significant different at 10% level of significance.

### 3.8.1 Descriptive statistics

A first indicator regarding dividend smoothing can come through the descriptive statistics. When the volatility of dividend growth is low it indicates high dividend smoothing. But it is important to examine the reduction of the dividend growth volatility in connection with the overall economy. Therefore, following Chen *et al.* (2012), the following parameter is defined:

$$S = \frac{\sigma(\Delta d)}{\sigma(\Delta e)} \quad (26)$$

In equation (26) the numerator defines the dividend growth volatility and the denominator the earnings growth volatility. Therefore, the closer is the value of  $S$  to zero the higher is the dividend smoothing process for that specific country.

Table 8 shows that Japan has the lowest  $S$  and, therefore, the strongest dividend smoothing behaviour followed by UK and US. Note that the value

Table 7: Descriptive statistics

	Starting Year	Returns		Div. Yield	
		mean	st. dev	mean	st. dev
US	1971	9.39	17.43	3.01	1.28
UK	1994	6.77	16.6	3.14	0.78
Canada	1994	7.99	17.5	1.98	0.82
Japan	1994	-2.47	23.5	1.06	0.64

The table presents the descriptive statistics (mean and standard deviation) of the main annual variables under consideration.

Table 8: Descriptive statistics (cont.)

	$\Delta d$		$\Delta e$		$S = \sigma(\Delta d)/\sigma(\Delta e)$
	mean	st. dev	mean	st. dev	
US	5.71	6.57	0.72	18.12	0.36
UK	6.30	14.79	4.87	45.8	0.32
Canada	9.66	13.02	4.78	26.41	0.49
Japan	5.09	13.22	3.63	67.41	0.19

The table presents the descriptive statistics (mean and standard deviation) of the growth rate of dividend ( $\Delta d$ ) and earnings ( $\Delta e$ ). The last column of the table presents an indicator of the dividend behaviour for each country. The closer is  $S$  to zero the more smoothed are the dividends in that country.

of  $S$  can vary according to the time span of the data. In any case, the above table is a first indicator regarding the dividend smoothing across the four biggest countries.

### 3.8.2 Lintner model

Lintner (1956) was the first to introduce a model for estimating the dividend behaviour. In particular, he assumed that firms tend to pay as a dividend a percentage out of earnings. Therefore, an increase of earnings should lead to higher dividend. But firms usually pay as a dividend only a proportion out of that increase in earnings.

The intuition is that managers do not want to face a huge cut in dividends after a decrease in earnings. Lintner (1956) assess that fact through the speed

of adjustment parameter that can be estimated using the following equation:

$$\Delta d_t = \alpha_0 + \alpha_1 e_t + \alpha_2 d_{t-1} + \varepsilon_t \quad (27)$$

where the speed of adjustment is determined from  $-\alpha_2$  and  $e_t$  is the log of earnings. The higher is the speed of adjustment the lower is the dividend smoothing.

The above equation is also estimated using the MiDaS approach. This way it is examined whether the use of high frequency data for dividend payments as a regressor can lead to the same conclusions regarding the speed of adjustment. The Lintner regression using the MiDaS approach becomes:

$$\Delta d_{t+1} = \alpha_{0,mid} + \alpha_{1,mid} e_{t+1} + \alpha_{2,mid} \sum_{j=0}^{q_X^M-1} W(L^{N_M}; \theta) d_{t-j}^M + \varepsilon_{t+1,mid} \quad (28)$$

where in this case the speed of adjustment will be given by  $-\alpha_{2,mid}$ .

The results regarding the speed of adjustment from both approaches mentioned above are presented in Table 9 and Table 10. The results for every country are very similar between the two methods showing a very low speed of adjustment and not statistically significant different from zero.

Since it has been shown in the literature that Marsh and Merton (1987) model can lead to more accurate conclusions, that approach will also be followed in the next subsection in a similar way with Lintner's model, and a comparison of the results will be performed.

### 3.8.3 Marsh and Merton model

Marsh and Merton (1987) model is able to represent a more accurate behaviour of dividend smoothing because it explains if the smoothing behaviour is sustainable:

$$\ln \left[ \frac{D_{t+1}}{D_t} \right] + \frac{D_t}{P_{t-1}} = \gamma_0 + \gamma_1 \ln \left[ \frac{P_t + D_t}{P_{t-1}} \right] + \gamma_2 \ln \left[ \frac{D_t}{P_{t-1}} \right] + v_{t+1} \quad (29)$$

In the above specification the coefficient  $\gamma_1$  determines the reaction of div-

dividends to a change in permanent earnings. Thus, it is assumed that a change in the level of the price index is able to capture a change in permanent earnings. As a result, a higher value of  $\gamma_1$  indicates a low dividend smoothing pattern. On the other hand, the  $\gamma_2$  coefficient determines the speed of adjustment to the long-run value and it should be negative in theory. In this case, a dividend smoothing is lower the higher is the  $\gamma_2$ .

Using MiDaS the same regression is estimated but taking into account the monthly ratio of the natural logarithm of dividend over the lagged price instead of annual. The Marsh and Merton model using the MiDaS approach becomes:

$$\ln \left[ \frac{D_{t+1}}{D_t} \right] + \frac{D_t}{P_{t-1}} = \gamma_{0,mid} + \gamma_{1,mid} \ln \left[ \frac{P_t + D_t}{P_{t-1}} \right] + \gamma_{2,mid} \sum_{j=0}^{q_X^M - 1} W(L^{N_M}; \theta) X_{t-j}^M + v_{t+1,mid} \quad (30)$$

where  $X_t^M = \Delta(d_t) - \Delta(p_{t-1})$  is the monthly ratio used as the high frequency regressor in MiDaS equation.

In the MiDaS version of Marsh and Merton specification the coefficient  $\gamma_{1,mid}$  represents again the reaction of dividends to a change in permanent earnings. While the  $\gamma_{2,mid}$  coefficient determines the speed of adjustment. Therefore, the closer these values are to zero the higher the dividend smoothing for that country.

Table 9 and Table 10 present the results from the two approaches. The first column in Table 9 and Table 10 under the Marsh and Merton approach shows the result for the  $\gamma_1$  coefficient, whereas the second for the  $\gamma_2$  coefficient. Since the MiDaS approach has been used to transform the second regressor into high frequency an additional attention should be paid in the similarity between the  $\gamma_2$  and  $\gamma_{2,mid}$  coefficients (the second columns of the Marsh and Merton results).

The results for most of the countries are again similar between the two approaches. In most of the countries the coefficients are very similar showing that even with the use of MiDaS the results regarding the dividend smooth-

Table 9: Measuring the dividend smoothing parameter using same frequency data

	Lintner	$R^2$	Marsh and Merton		$R^2$
	$-\alpha_2$		$\gamma_1$	$\gamma_2$	
US	0.096 (0.84)	[0.14]	0.131 (1.49)	<b>0.043</b> (2.14)	[0.25]
UK	0.164 (0.93)	[0.10]	0.329 (1.61)	0.099 (0.69)	[0.18]
Canada	0.179 (1.18)	[0.26]	<b>0.339</b> (3.14)	0.063 (0.81)	[0.24]
Japan	0.017 (0.10)	[0.06]	0.459 (1.12)	0.016 (0.47)	[0.64]

The above table presents the results of the dividend smoothing behaviour for the model where only annual data are being used. In more detail, the table reports the key coefficients for defining the dividend behaviour from the Lintner and Marsh and Merton models. When the number is in bold it means that it is statistically significant different from zero at 90% level of significance. The numbers in the parenthesis denote the t-statistics that are estimated using Newey and West (1987) standard errors. The numbers in the squared brackets are the  $R^2$  for each regression.

ing remain consistent. Therefore, the use of monthly information does not lead to different conclusions regarding the speed of adjustment and dividend smoothing.

This is a significant result for the analysis of the current chapter because it is shown that the MiDaS approach is not a way to construct a more volatile high frequency dividend regressor. But, as it will be shown later on, it is a way to incorporate monthly information into the model and improve the predictability of dividend growth.

Another interesting result is that the adjusted  $R^2$  improves in all the MiDaS regressions in comparison to the regular Lintner model and Marsh and Merton model. This is another indicator that the monthly dividend information has significant explanatory power.

Table 10: Measuring the dividend smoothing parameter under MiDaS

	Lintner	$R^2$	Marsh and Merton		$R^2$
	$-\alpha_{2,mid}$		$\gamma_{1,mid}$	$\gamma_{2,mid}$	
US	0.114 (1.08)	[0.13]	0.221 (1.71)	<b>0.050</b> (2.46)	[0.36]
UK	<b>0.304</b> (2.63)	[0.45]	0.216 (1.45)	0.061 (1.15)	[0.35]
Canada	<b>0.226</b> (4.34)	[0.54]	<b>0.255</b> (2.85)	0.144 (1.01)	[0.42]
Japan	0.296 (1.10)	[0.33]	<b>0.550</b> (2.82)	<b>0.086</b> (2.78)	[0.75]

The above table presents the results of the dividend smoothing behaviour using mixed frequency data (MiDaS). Specifically, the table reports the key coefficients for defining the dividend behaviour from the Lintner and Marsh and Merton models. When the number is in bold it means that it is statistically significant different from zero at 90% level of significance. The numbers in the parenthesis denote the t-statistics that are estimated using Newey and West (1987) standard errors. The numbers in the squared brackets are the  $R^2$  for each regression.

### 3.9 Do other factors matter?

So far it has been shown that the existence of dividend growth predictability is statistically significant if monthly information is taken into account. In particular, the current work suggests that the use of intra-annual information from dividends, combined with the smoothing technique proposed in this chapter, can improve the link between dividend growth and dividend yield.

At this section it is tested whether these results are sensitive in other factors and particularly if the statistical significance and magnitude of the coefficient of the annual-to-annual monthly growth rate of dividend price ratio is affected from the introduction of other factors. In more detail, the effect of the liquidity of each country's market and the effect of the volatility of dividends on the predictability of dividend growth via dividend yield will be examined. To that end, equation (24) is augmented with an additional regressor that captures the effects from those factors. The augmented variable is an interaction term of the introduced factor and the annual dividend

yield, as in Rangvid *et al.* (2013).<sup>17</sup>

Therefore, as a first step it is added an additional regressor to the MiDaS equation (24) that will reflect the liquidity of the stock market index of each country in the sample. Then, in a different experiment, equation (24) is augmented with the volatility of dividends, again as an interaction term with the annual dividend yield. Also, note that the analysis that is followed is country specific and not cross sectional, like Rangvid *et al.* (2013). In this way the current work is able to assess the effects on the annual-to-annual monthly growth rate of dividend yield and through that on dividend growth predictability from the addition of these variables on each country separately.

The MiDaS regression with the addition of the factor variable becomes:

$$\Delta d_{t+1} = c_0 + c_1 \Delta w \overline{dy}_t^m + c_2 \overline{dy}_{t-1}^m + c_3 (dy_t \times F_t) + \varepsilon_{t+1} \quad (31)$$

where the factor variable ( $F_t$ ) for the first case study is a proxy for the liquidity of the market (case 1) and for the second case study is the volatility of monthly dividend growth (case 2).<sup>18</sup>

Table 11 presents the results with the use of same frequency data and Table 12 presents the results using mixed frequency data. The results indicate that for the case with same frequency data the liquidity of the market (first block in Table 11) has a significant and positive effect on dividend growth predictability only for Canada.<sup>19</sup> Regarding the dividend volatility and for the case with same frequency data (second block in Table 11) the effect is significant and positive only in Japan. But it should be noted that for the case with same frequency data, the dividend growth predictability appears

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<sup>17</sup>Note that the regression is also augmented by simply adding each factor into the regression without any interaction with the annual dividend yield and the results remain unchanged.

<sup>18</sup>The monthly dividend growth volatility has been calculated as the volatility of the change in the monthly logged-dividend. The proxy for the liquidity has been downloaded from the World Bank database and it denotes the share price of the index times the number of shares outstanding.

<sup>19</sup>Even though the sign is negative, the effect of the liquidity on dividend growth is positive because it enters the regression as an interaction term. Therefore, since the dividend yield is expected to have a negative effect on dividend growth, by definition, and the resulted sign for Canada is negative, it hints that the effect of liquidity on the dividend growth is positive.

to be sensitive to the factors that are introduced.

Under the mixed frequency data approach it can be seen that the factors introduced here do not affect significantly the coefficient of the annual-to-annual monthly growth rate of dividend-price ratio and through that the predictability of dividend growth. Specifically, it can be seen that the coefficient of the MiDaS variable ( $c_1$ ) remains statistically significant for every country across the experiments, as it was the case without the inclusion of the factors that was presented earlier.

The aforementioned results indicate that the findings using the MiDaS approach are neither sensitive to the liquidity of the market nor to the volatility of dividend growth in each country. This is an important result and it strengthens the argument made in this chapter with respect to the importance of the additional partial disaggregated information that leads to a predictable dividend growth through the annual-to-annual monthly growth rate of dividend yield.

Table 11: Robustness checks using same frequency data

	Case 1			Case 2		
	$c_1$	$c_2$	$R^2$	$c_1$	$c_2$	$R^2$
US	-0.06 (-0.45)	0.01 (0.23)	[0.02]	-0.02 (-0.47)	1.75 (0.75)	[0.03]
UK	-0.27 (-1.34)	0.01 (0.78)	[0.16]	-0.36 (-1.75)	1.93 (1.70)	[0.18]
Canada	<b>-0.19</b> (-3.26)	<b>-0.02</b> (-2.93)	[0.35]	-0.10 (-1.51)	-1.40 (-1.33)	[0.27]
Japan	-0.20 (-1.78)	-0.02 (-1.82)	[0.41]	<b>-0.26</b> (-2.28)	<b>-3.58</b> (-4.44)	[0.49]

The table presents the results from the augmented Campbell and Shiller (1988) model using initially the liquidity of the market as a factor, case 1 (first block of columns), and then the volatility of dividend payments as a factor, case 2 (second block of columns). Both factors have been added as an interaction term with the annual dividend yield, following Rangvid *et al.* (2013). The coefficient of dividend yield is reported in the table as  $c_1$  and the coefficient of the interaction term is  $c_2$ . The coefficients are in bold when they are statistically significant different from zero at 95% level of significance. The numbers in parenthesis denote the t-statistics that are estimated using Newey and West (1987) standard errors. The numbers in the squared brackets are the  $R^2$  for each regression.

Table 12: Robustness checks using MiDaS

	Case 1 (MiDaS)				Case 2 (MiDaS)			
	$c_1$	$c_2$	$c_3$	$R^2$	$c_1$	$c_2$	$c_3$	$R^2$
US	<b>-0.12</b> (-2.03)	-0.24 (-0.34)	0.01 (1.33)	[0.36]	<b>-0.08</b> (-1.97)	-0.01 (-0.12)	1.63 (1.13)	[0.10]
UK	<b>-0.25</b> (-1.99)	-0.17 (-1.33)	0.01 (1.48)	[0.34]	<b>-0.41</b> (-2.60)	<b>-0.36</b> (-2.65)	<b>2.40</b> (4.93)	[0.53]
Canada	<b>-0.38</b> (-4.67)	<b>-0.30</b> (-3.07)	-0.01 (-1.45)	[0.37]	<b>-0.32</b> (-5.48)	-0.17 (-0.91)	-1.29 (-0.95)	[0.40]
Japan	<b>-0.49</b> (-2.14)	0.09 (0.92)	0.01 (1.45)	[0.35]	<b>-0.38</b> (-2.01)	0.05 (0.94)	0.22 (0.13)	[0.22]

The above table presents the results of equation (31) using initially the liquidity of the market as a factor, case 1 (first block of columns), and then the volatility of dividend payments as a factor, case 2 (second block of columns). Both factors have been added as an interaction term with the annual dividend yield, following Rangvid *et al.* (2013). The coefficient of high frequency dividend yield is reported in the table as  $c_1$ , the coefficient of the lagged dividend yield is  $c_2$  and the coefficient of the interaction term is  $c_3$ . The coefficients are in bold when they are statistically significant different from zero at 95% level of significance. The numbers in parenthesis denote the t-statistics that are estimated using Newey and West (1987) standard errors. The numbers in the squared brackets are the  $R^2$  for each regression.

### 3.10 Conclusions

In this chapter it has been revisited the issue of whether a significant relationship exists between the dividend-price ratio and the future dividend growth in large equity markets. In order to uncover this relationship this study used higher frequency (monthly) data. The analysis focused on the main equity indices of US, UK, Canada and Japan, taking into consideration the argument of Rangvid *et al.* (2013) that in large equity markets the dividend-price ratio is not significantly related with the future dividend growth.

Using a mixed data sampling approach (MiDaS) in order to avoid high frequency seasonality issues, and smoothing out the effects of price volatility on the dividend-price ratio, this study found that for every country in our sample the dividend-price ratio contains significant information on the growth of future dividends. It also identified a component of the smoothed

dividend-price ratio that always contains significant predictive information. The sign of the dividend growth - dividend-price ratio relationship is negative for all countries, as theoretically expected. It also examined whether the dividend-price ratio is significantly related to the dividend growth that occurs up to four years ahead. The results showed that the relationship persists almost always, with the only exception being that of Japan with the four-years ahead dividend growth.

In addition, this study applied exactly the same approach using data of a relatively lower (quarterly) frequency, in order to examine the predictability of the one-year ahead dividend growth. The results showed no significant relationship between the dividend-price ratio and the dividend growth, as far as UK, Canada and Japan are concerned, while only concerning US a significant relationship is still present. Finally, it has been shown that these results remain valid even if the liquidity of the market or the volatility of dividend payments is considered.

An additional interpretation from the results of this study could possibly be that the use of time-aggregated dividends reduces the ability of Campbell-Schiller type models to identify a significant relationship between the dividend-price ratio and the future dividend growth. The effect of time aggregation is relatively strong, since even the use of quarterly data is not able to recover this relationship.

## 4 Ex-dividend day behaviour in Athens Stock Exchange

### 4.1 Introduction

It is suggested in the literature that in perfect capital markets with no taxation and no transaction costs, a share's price drop on the ex-dividend day, adjusted for any market related influence, should be equal to the dividend. In these markets, Miller and Modigliani (1961) show that, dividend announcement should be irrelevant to share pricing. However, the literature pertaining to imperfect markets argues that dividends signal information on firm prospects, thus share market price should react to dividend announcement. Therefore, on ex-dividend day there is no further information to be revealed. As a consequence, an investor is indifferent between buying the share cum dividend or ex dividend. Instead, researches that assess the ex-dividend price behaviour of stocks for more than 50 years have shown that, on average, stock prices drop by less than the dividend amount.

The ex dividend day literature, in an effort to justify the price drop anomaly, proposes different potential explanations. These explanations can be categorized in three groups: The first one is based on the existence of differential taxation between dividend and capital gains which can also, indirectly, reveal the identity and the tax status of the marginal investor. The second investigates whether frictions, such as transaction costs and risk, impede short term traders<sup>20</sup> to trade around ex-dividend day in order to capture arbitrage profit. The third stride is based, among others, on market microstructure explanations, such as price discreteness, bid-ask spread and dividend handling nuisance.

Empirical research has been harvesting results from countries differing in tax structures and time periods, in order to exploit differing tax regimes systems and market microstructure explanations. The main conclusion is that the ratio of price drop to dividend, known also as ex-day premium, has been

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<sup>20</sup>Who are not subject to differential taxation on dividends and capital gains.

consistently different from one. However, due to difficult settings in isolating the driving forces which create the distortion, researchers cannot give an established explanation concerning the ex-dividend stock price behaviour. As a consequence one of the main puzzles in finance still remains unresolved.

The added value of this study is to extend the international evidence by studying the ex-dividend stock price behaviour in a unique environment where alternative explanations are investigated. This study examines the ex-dividend day behavior of stocks listed on Athens Stock Exchange (ASE), the only stock exchange in Greece, during a ten year period from 1996 to 2005. The Greek case study for studying both cum- and ex- dividend behavior is interesting for several reasons: The differential taxation between dividend and capital gains is absent, since neither dividends nor capital gains are taxed. Hence the data set of Athens Stock Exchange, allows us to avoid the complexities of the U.S. tax system where the population of US investors includes many different types of traders subject to a variety of tax structures. Moreover, in the Greek market the marginal trader is not subject to taxes on dividends and capital gains, which make this economy a promising laboratory to test the ex-dividend day behaviour.

Dividends are distributed once a year, whereas in many other countries (e.g., US, UK, Japan, Australia) dividends are paid quarterly or semi-annually, and the distribution of them is mandatory for profitable firms according to Law 2190/1920. Short selling in ASE is limited to a few stocks only. The tick size is very small compared to the dividend as well as the transaction cost. Also, transaction costs become more important when dividends are relatively small, and act like a barrier against short-term trading. However, since dividends are usually distributed annually rather than quarterly, this would suggest that transaction cost models may not be important in Athens Stock Exchange. There is no market making, so the open and close bid ask spreads are not equivalent regulator of bid ask spread. Lastly, there was a significant change in the mechanism concerning the ex dividend close adjustment in 2001, as well as a significant increase in the participation of the foreign investors, institutional and other, starting gradually from 2001. These special circumstances that are standing on Athens Stock Exchange

make this study valuable as it can isolate some of the explanations given from previous academic researches, such as the tax-explanation as proposed from Elton and Gruber (1970) and the price discreteness due to minimum tick size as firstly proposed from Bali and Hite (1998) and focus on other.

The empirical results of this study demonstrate that stock prices on average decline by less than the dividend amount on the ex-dividend day during the examination period. More specifically, the average price drop to dividend ratio is 0.4947 and the median value is 0.6679 respectively, far below from one. These results are similar with studies where the differential taxation is in favor of capital gains or where a large tick size, compared to dividend, is present. This study also examines the abnormal returns, as well as abnormal volumes, around ex-dividend day and it does not find evidence of short-term trading. Moreover, both of these results are not affected by commonly used measures of transaction costs, such as the inverse of price on cum day and normal trading volume.

The unique institutional modification announced by the ASE Board of Directors (April 2001) is also examined, according to which the opening ex dividend day price is equal to the closing price on cum day. It is further investigated whether this modification has any effect on observed ex dividend day behaviour and concluded that this announcement alleviates, but not wipes it out, the anomaly.

Finally, this study argues that illiquidity<sup>21</sup> affects stock price behaviour on ex-dividend day. In more detail, in low illiquidity (high liquidity) quartile the price drop equals the dividend amount and the abnormal returns are close to zero. These findings make a positive contribution to the related literature since a potential explanation for the ex-dividend stock price anomaly, the illiquidity of the market, is provided. In addition, the current research provides evidences that institutional changes may affect stock price behaviour on ex-day. Institutional interventions, that allow the free function of the market, may level out pricing inefficiencies. Furthermore, the rejection of some of the possible explanations that have already been proposed in the literature helps researchers identify which explanations may be still valid for

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<sup>21</sup> Measured by the illiquidity ratio proposed by Amihud (2002).

future studies.

In the next section the main empirical studies are revised in accordance with their theoretical explanations. The third section of this chapter describes the Greek institutional environment as well as the Greek institutional change that took place in 2001. In the fourth section there is a description of the data, while the fifth section presents the methodology, the empirical tests as well as the empirical findings and their implications. Finally, the last section presents the contribution of this study and concludes the chapter.

## 4.2 Literature review

The first pioneer empirical study on ex-dividend stock price behaviour was from Elton and Gruber (1970) who introduced the tax-effect hypothesis in order to justify their empirical evidence that stock prices on ex-dividend day drop less than the dividend distributed. Earlier studies from Campell and Beraneck (1955)<sup>22</sup>, Barker (1959)<sup>23</sup> and Durand and May (1960)<sup>24</sup> report indications that on average the ex-day stock prices drop by less than the amount of dividend paid without to provide justified economic reasons.

Instead of the aforementioned works, Elton and Gruber (1970) using a US data set argue that the price drop to dividend is smaller due to the fact that high personal taxes on dividend relative to capital gains reduce the net dividend. Since stock holders wish to maximize their after tax-wealth, the unfavorable treatment of dividend with respect to capital gains leads to a stock price drop less than the dividend in order to make marginal investors indifferent between trading on cum or on ex-dividend day. So, they developed a model, known as “the long-term trading hypothesis” or “the tax-effect

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<sup>22</sup>Using data from the NYSE stocks, they observed that the ex-dividend price drop was 90% of the dividend amount.

<sup>23</sup>Examining the ex-dividend day behaviour of 224 stock dividend issued by NYSE listed companies during the year 1951 through 1954, he found that the ex-day price drop was smaller than the dividend ammount.

<sup>24</sup>Examining the ex-dividend day behaviour of American Telephone and Telegraph stock (AT&T) they found that the average price drop between cum and ex- dividend day was 4% less than the distributed dividend.

hypothesis", that could infer marginal stockholder tax brackets by observing the ex-dividend behaviour of stock prices.

Assuming that the required rate of return for the ex-dividend period is no different from that of any other day and taking into account that investors are interested in after-tax returns, differential taxation of realized capital gains and dividend income should affect the analysis. Elton and Gruber (1970) specified the condition for "no profit" opportunities around the ex-dividend day in the presence of tax differential. According to their model, if an investor decides to sell his stock on the cum-day, he receives the cum dividend price ( $P_{cum}$ ) and he pays tax at the capital gain tax rate ( $t_g$ ) on excess of the cum dividend price over the initial purchase price of the stock ( $P_0$ ). If he decides to sell on the ex-dividend day, he receives the ex-dividend price ( $P_{ex}$ ) and pays tax on the excess of the ex-dividend price over the initial purchase price of the stock ( $P_0$ ) at the capital gains tax rate. Furthermore, on the ex-dividend day he will receive the dividend ( $D$ ) and pays tax at the tax rate of dividend income ( $t_d$ ). In order for the investor to be indifferent between selling the stocks on or before the ex-dividend date Elton and Gruber (1970) show that:

$$P_{cum} - t_g(P_{cum} - P_0) = P_{ex} - t_g(P_{ex} - P_0) + D(1 - t_d) \quad (32)$$

and after rearranging equation (32) the following is obtained:

$$\frac{P_{cum} - P_{ex}}{D} = \frac{1 - t_d}{1 - t_g} \quad (33)$$

The left-hand-side of equation (33) is called the ex-day premium or the dividend drop off ratio, whereas the right-hand-side part of the equation captures the different tax treatment of dividends versus capital gains and is called the ex-day tax preference ratio. Elton and Gruber (1970) argue that equation (33) can be used to infer to clientele effects<sup>25</sup>. A larger tax on dividend income ( $t_d \succ t_g$ ) results in an ex-dividend price drop smaller than the dividend per share. In such an economy, if the relative price drop on the

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<sup>25</sup>Originally proposed by Miller and Modigliani (1961).

ex-dividend day is noticed, the investors' marginal tax rates can be inferred. If investors with high marginal tax brackets hold low dividend yield stocks, then these stocks should have relatively small premiums, reflecting the tax bracket of the median shareholders. Equation (33) predicts that the higher the dividend yield, the higher the premium. This is the intuition underlying the tax clientele hypothesis. The study of Elton and Gruber (1970) was very important since they did not only confirm the existence of dividend clientele effect but they also provided evidence suggesting that a change in dividend could cause a costly change in shareholder wealth. Moreover, they find a statistically positive relation between the stock price drop on ex-day and the dividend yield<sup>26</sup> and finally they illustrate one form of market rationality where investors in higher tax brackets show a preference for capital gains over dividend income relative to those in lower tax brackets.

For the case of the Greek market, since there are not any taxes on dividends ( $t_d = 0$ ) nor on capital gains ( $t_g = 0$ ) equation (32) simplifies to:

$$P_{cum} = P_{ex} + D \quad (34)$$

Rearranging equation (34) :

$$\frac{P_{cum} - P_{ex}}{D} = 1 \quad (35)$$

According to equation (35) in ASE the price drop between the cum and the ex-day must be equal to the dividend amount. In other words the dividend drop off ratio equals to 1.

**Hypothesis 1:** *in this study is expected that the dividend drop off ratio is equal to 1*

Furthermore if equation (32) is rewritten as to express the effect of differential taxation on ex-day pricing in terms of ex-day returns:

$$\text{Return} = \frac{P_{cum} - P_{ex} + D}{P_{cum}} = \frac{1 - td}{1 - t_g} \frac{D}{P_{cum}} \quad (36)$$

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<sup>26</sup>They sort their sample into deciles in ascending order according to dividend yield and they estimate the dividend drop off ratio for each decile.

For the case of Greece, since there are not any taxes on dividends ( $t_d = 0$ ) nor on capital gains ( $t_g = 0$ ) equation (36) simplifies to:

$$\text{Return} = \frac{P_{cum} - P_{ex} + D}{P_{cum}} = \frac{0}{P_{cum}} = 0 \quad (37)$$

According to equation (37) in ASE the return is expected to be zero on ex-dividend day.

**Hypothesis 2:** *in this study is expected that the returns are zero on the ex-dividend day*

A lot of studies were motivated by the work of Elton and Gruber (1970) and in view of the differential taxation of dividend relative to tax gains in the US, the tax environment in other countries and changes in tax laws; they try to test the tax clientele theory. For US, Poterba (1984), Barclay (1987), Stickel (1991), Lamdin and Hiemstra (1993), Elton, Gruber and Blake (2005), Callaghan and Barry (2003), Graham, Michaely and Roberts (2003) and Dhalival and Li (2006) concluded that the differential taxation of dividend and capital gains influences the ex-day price behaviour. Similar results have been drawn for other countries as well: in Australia: Clarke (1992) and Bellamy (1994); in Canada: Booth and Johnston (1984); in China: Milonas et al. (2002); in Denmark: Florentsen and Rydqvist (2001); in Finland: Hietala (1990); in Germany: McDonald (2001); in Italy: Michaely and Murgia (1995); in New Zealand: Bartholdy and Brown (1999); in Sweden: Green and Rydqvist (1999); in UK: Poterba and Summers (1984), Bell and Jenkinson (2002).

On the other hand, many papers put the tax clientele hypothesis into question. These papers investigate how transaction costs and risk may affect ex-day prices and volume behaviour. Campbell and Beranek (1955) argued that any deviation of the expected ex-dividend price change from the amount of the dividend would create arbitrage opportunities for risk neutral investors to time their trades around the ex-dividend day.

Kalay (1982) formulated the short-term hypothesis and he showed that the marginal tax rates of stockholders, in general, cannot be inferred from the

relative price drop and he pointed out that the documented ex-dividend day behaviour of stock prices is not essentially evidence of tax-effect or clientele effect. Kalay (1982) shows that, in a world of certainty, investors that are not subject to differential taxation of dividends and capital gains, referred to as short-term traders, can buy the share on the cum-dividend day and sell it on the ex-dividend day, if the ex-dividend stock price drop is less than the dividend. In this case, if the amount of dividend plus the tax savings, from the capital loss, exceed the transaction costs of buying and selling the share, then there are profitable opportunities. In other words, short-term traders will capture dividends and eliminate any excess returns on the ex-dividend day<sup>27</sup> until the return of that trade is equal to their round trip cost. In this case, ex-day returns, if any, will reflect transaction costs of short-term traders. Kalay (1982) argues that ex-dividend day premium is bounded by transaction costs as:

$$1 - \frac{2\alpha}{\left(\frac{D}{P_{cum}}\right)} \leq \frac{P_{cum} - P_{ex}}{D} \leq 1 + \frac{2\alpha}{\left(\frac{D}{P_{cum}}\right)} \quad (38)$$

where  $2\alpha$  represents transaction costs of a round trip.

Equation (38) gives the range of values, in the presence of transaction costs, in which the ex-day premium can be situated without profitable arbitrage opportunities arising for any investor. Kalay (1982) has shown that only if transaction costs are high enough to discourage arbitrageurs to trade, then the relative taxations of dividends and capital gains should be reflected in prices. In contrast, if transaction costs are small, arbitrageurs will trade around the ex-day, as a result any excess return during ex-day will be eliminated. If this happens, the price drop ratio to dividend will reflect the transaction cost that the arbitrageurs face instead of their tax-preferences, according to Elton and Gruber (1970). If transaction costs were zero ( $\alpha = 0$ ) on the ex-dividend day, the price drop ratio (or ex-dividend premium) should

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<sup>27</sup>Elton, Gruber, and Rentzler (1984) argue that when Kalay estimated the transaction costs of trading securities, he omitted several important components, including transfer taxes, registration fees, clearance costs, and bid-ask spreads. They claim that when all costs are considered, transaction costs prevent even the lowest costs traders from affecting the ex-dividend day price through short-term trading.

be equal to one since arbitrageurs have the same tax rate on their short-term capital gains as on dividends. Moreover, equation (38) indicates that the premium is inversely proportional to the dividend yield, with the range of variation being narrower when the dividend yield is greater. This means that the presence of transaction costs might result in the ex-dividend premium deviating from one without the possibility of arbitrage. Miller and Scholes (1982) found similar result with Kalay (1982) and they argued that the presence of transaction costs eliminates arbitrage and dividend captured trading and therefore, in equilibrium the price drop is less than the dividend paid.

As arbitrage trading increased, the trading volume is respectively affected, because as transaction costs decrease the ex-day premium tends to one and the trading volume increases. This evidence is in accordance with dividend capture activity and it had been justified by the study of Lakonishok and Vermaelen (1986), who find that trading volume increases significantly around the ex-dividend day. They have also documented a statistically significant positive relation between abnormal volume and high dividend yield stocks. They also support the dividend capture activity as they found that the trading volume increases after the reduction in transaction costs as measured by commissions. In addition, they found an abnormal increase in stock prices that was positively related to dividend yield and transactions cost before the ex-dividend day and an abnormal decrease after the ex-dividend day. Grammatikos (1989) confirms the importance of short-term trading by reporting that the average market-adjusted ex-dividend day return after the introduction of the U.S.1984 Tax Reform Act is significantly lower than before the Act. The increased premium is consistent with the inability of short-term traders to remove all of the risk of engaging in a dividend trading strategy.

Further support for the short-term trading hypothesis is provided by Kaproff and Walking (1988, 1990) who, using different proxies (i.e. bid-ask spread, the inverse of stock's price, the market value of firm's common stocks, the number of outstanding shares and the standard deviation of stock's returns), argue that excess ex-day returns are positively related to transaction costs and to high dividend yield stocks. Eades et al. (1994) and Naranjo et

al. (2000) also reported that dividend capturing is affecting ex-day returns, with a price drop equal to dividend on ex-dividend day in the most liquid and highest yielding stocks, which are the stocks preferred from dividend capture investors and arbitrageurs.

Another factor that may restrain arbitrage is the uncertainty about the ex-dividend day price and the presence of risk. The difference between the expected ex-day price drop and the dividend per share can provide profits but not arbitrage opportunities. If the risk involved in the ex-day trading is accounted for, the effect of transaction costs on trading is not straightforward. Both risk and transaction costs inhibit trading, but their magnitude varies according to the type of each investor.

Michaely and Vila (1995) using a dynamic equilibrium framework show that investors with differential tax-induced valuation of dividends and capital gains trade with each other around the ex-dividend day. As a consequence ex-dividend day price and volume is a function of aggregate risk tolerance, risk of the individual stock around the ex-day, and the relative importance of trading groups that differ in terms of the tax treatment of their capital gains and dividend income. According to them the stock price drop to dividend ratio reflects the relative tax rates of all market participants, not just the marginal trader's. As a result, unless a perfect tax clientele exists<sup>28</sup>, it is not possible to infer tax rates from price alone. However, the cross-sectional distribution of tax rates can be inferred by using both price and volume data. Michaely and Vila (1995) also show that trading volume around the ex-dividend day is positively related to the tax heterogeneity and negatively related to transaction costs and risks associated with the deviation from an otherwise optimal portfolio. Empirical support for the dynamic tax-motivated trading hypothesis is provided by Michaely and Murgia (1995), Michaely and Vila (1996), Wu and Hsu (1996), and Dhaliwal and Li (2006).

As an alternative feasible explanation to the ex-day stock price behaviour, many papers propose market microstructure explanations and they argue that the ex-dividend day price drop is strongly affected by them. Moreover,

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<sup>28</sup>A perfect tax clientele means that each tax group holds different securities, and all trading is intra-group trading.

Bali and Hite (1998) established the price discreteness hypothesis. Using firms from NYSE and AMEX, in order to test whether tick size affects stock price behaviour on ex-dividend day, Bali and Hite (1998) provided evidences that in a world with stock prices constrained to be tick multiples and dividends that are continuous, the price drop to dividend ratio, computed on the ex-dividend date, does not need to be equal to one even without considering any tax effect. They claim that the market always will round down the value of the dividend to the tick just below the dividend, as investors are reluctant to pay more than the amount of dividend they receive, and they also find a positive relationship of tick size and ex-day premium.

Examining the impact of NYSE rule 118, Dubofsky (1992) argues that the policy of decreasing open limit buy orders but leaving unchanged open limit sell orders could result in the observed ex-dividend day behavior with positive abnormal returns. Dubofsky shows that price discreteness can underline the effect of the rule 118. He provides evidence that ex-dividend day excess returns arise from the mechanics of NYSE Rule 118, AMEX Rule 132, and the fact that prices constrained to discrete tick multiples.

Contrary to Bali and Hite (1998) and Dubofsky (1992), Graham et al. (2003) and Jakob and Ma (2004a) tested if discreteness is the reason why the price drop to dividend ratio is smaller than one and they did not find any support. They expect that a reduction of the tick sizes would result in an increase in the ratio after the NYSE changed its price quotations from 1/8th and 1/16th to decimals by the end of January 2001. Contrary to that, their empirical results illustrated that the price drop to dividends ratio actually decreased after the change, casting doubts on whether price discreteness is the dominant reason of a price drop to dividend ratio smaller than one. Kadapakkam and Martinez (2008) also suggest that the tick size effect is not applicable in countries where stock prices are decimalized.

Cloyd et al. (2004), using a data set with stocks trading in NYSE for bigger time interval than Graham et al. (2003) and Jakob and Ma (2004a), find that price discreteness is at least partially responsible for the positive ex-day abnormal returns, since they report a decline in relationship between dividend yield and ex-day abnormal returns. Moreover, the equalization

effect of the Federal statutory tax rates on dividend income and long-term capital gains in May 2003 supports the tax differential hypothesis, as Cloyd et al. (2004) report a reduced relationship between dividend yield and ex-day abnormal returns.

Another market microstructure explanation is the bid-ask bounce proposed by Frank and Jagannathan (1998). In their study, they investigate the ex-day stock price behaviour at the Hong Kong Stock Exchange market. The reason why they preferred this market is that neither dividends nor capital gains are taxes, similar to the Greek market, and that short-term trading can be ruled out. As a consequence a basic imperfection, the differential tax hypothesis, is absent in this setup. Despite this market features, stock prices were found to drop on the ex-dividend day by half the amount of dividend. According to them the reason for this behaviour of the stock prices was that buyers and sellers found dividends to be a nuisance because of their collection and reinvestment and therefore of less value than they were to market makers. Market makers, for whom collection costs are lower, will buy shares cum-dividend at the bid price and resell them on the ex-dividend date at the ask price. As a result, on last cum day most trades occur at the bid price, while on the ex-day at the asked price. In other words, the bid-ask price movement can lead to premiums less than one and to positive ex-dividend day returns that are also positively associated with the magnitude of the bid-ask spread<sup>29</sup>.

Despite the fact that the evidences outlined in most of the researches indicated that the decline in share price is less than the amount of dividend; the different tax-systems, the presence of transaction cost and risk as well as other sources that generate the ex-dividend day anomaly have clouded the issue. As a consequence, many researchers try to examine the ex-dividend stock price behaviour in environments where many of the above parameters are isolated. Thus, the scope of the current chapter is to investigate the ex-dividend day anomaly in ASE, an environment where many potential

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<sup>29</sup>Graham et al. (2003) and Cloyd, Li, and Weaver (2004) argued that Frank and Jagannathan model implies that, if prices are measured at the midpoint of the bid-ask spread, the premium should be one or close to one compared to when it is measured with closing prices.

explanations are absent and an important institutional change took place during the examination period.

One of the recent studies that try to isolate most of the frictions that have been proposed in the literature, is that of Borges (2008). Borges (2008) examines the ex-dividend day behaviour of stock prices in Lisbon Stock Market and she found that the drop price to dividend ratio is still less than the dividend paid<sup>30</sup>. The contribution of her study is that she rejected the tax-explanation hypothesis since it is inconsistent with the Portuguese tax-regime. Due to the fact that dividends are always an integer multiple of tick in accordance with the very small tick size (0,005 euro), Borges (2008) also rejected the price discreteness hypothesis<sup>31</sup>. In addition, according to her empirical results, there is not any clientele preference of capital gains with respect to dividend, as she did not find any significant correlation between the relative price drop and the dividend yield or payout ratio. Borges (2008) concluded that the ex-dividend stock price behaviour remains an anomaly, reflecting an inefficient market.

Yahyaee et al. (2008) conclusions are similar to Borges (2008), and they examined ex-dividend day behavior in a special environment in Oman, which is characterized by less frictional trading since there are no taxes on dividend and capital gains, dividends paid annually, and prices are decimalized. Again their results show that stock prices drop by less than the amount of dividends with positive abnormal returns on the ex-day<sup>32</sup>. Due to the distinctiveness of Oman market, these results cannot be explained by taxes and price discreteness. Also, the hypothesis that dividend-capture traders affect the ex-dividend day returns is inconsistent in Oman, as neither transaction costs nor risk inhibit arbitrage trading around ex-days. Moreover, the

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<sup>30</sup>For the base sample, the relative price drop was 0.658, and for the restricted sample, including the stocks where the number of calendar days between the cum-day and the ex-day was equal or less than four, the relative price drop was 0.426.

<sup>31</sup>In Portugal, during her examination period the minimum dividend paid was 0.05 euros that was an integer multiple of the tick 0.005 euros, and so there was no constraint imposed by tick-size on the stock price.

<sup>32</sup>The average decline in stock price on the ex-dividend day ranges from 0.65 to 0.69 depending on the calculation of the premium using close cum-day prices and open ex-day prices. The average abnormal return on the ex-day was 4.45%, whereas the median abnormal return was 3.43%.

short-term hypothesis is not valid in Oman, unlike the U.S., since through the examination of abnormal trading volume around the ex-dividend day, they found a significant reduction in trading volume. Yahyaee et al. (2008), contrary to Borges (2008), found that the market microstructure influences the ex-dividend day premium and ex-day return, since the use of midpoint prices of bid-ask bounce indicates that stocks prices drop by the full amount of dividends on the ex-day and ex-day abnormal returns are insignificantly different from zero.

Regarding the Greek stock market, there are two empirical studies, despite its special environment, that examine the stock price behaviour in Athens Stock Exchange. Firstly, Milonas and Travlos (2001) analyze the effects of ex-dividend day in share prices in the period 1994-1999. Their findings were similar with the empirical literature in U.S. and non U.S. countries since they show that on the ex-dividend day stock prices fall by less than the dividend paid<sup>33</sup>. In view of the fact that in the Greek stock market there are no tax effects, their conclusions were consistent with these of Hong-Kong and Oman, where dividend income and capital gains are tax free. In addition, due to the absent of market makers and the presence of computerized trading, the findings of Milonas and Travlos (2001) cannot be rendered to the nuisance of dividend capturing as well as to bid-ask spread bounce since this microstructure consideration is absent. The main contribution of their paper was that they add one more study on existing literature that it is against the differential taxation and the market microstructure explanations identified by prior studies.

Dasilas (2009) has also examined the ex-dividend price and trading volume behaviour in the Greek stock market for a different time period, 2000-2004, and he found similar results with Milonas and Travlos (2001), as stock prices drop less by than the dividend amount<sup>34</sup>. Contrary to Milonas and

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<sup>33</sup>The mean (median) Raw Price Ratio for the entire sample was 0.548 (0.728) with t-statistic (p-value) 4.03 (0.00) respectively, suggesting that the difference of the mean (median) from the corresponding theoretical value of 1.00 (1.00) was statistically significant at the 0.01 level of significance. The mean (median) Market-Adjusted Raw Price Ratio was 0.681 (0.821) with corresponding t-statistic (p-value) of -3.61 (0.00), statistically significant at the 0.01 level of significance.

<sup>34</sup>The mean (median) Raw Price Ratio using closing prices on cum-days and opening

Travlos (2001), Dasilas (2009) after the examination of abnormal returns, using event study and regression analysis as well as abnormal trading volume around the ex-dividend day, found strong evidences of short-term trading which is consistent with the presence of dividend-capturing activities around the ex-dividend day. He also presented evidences of a positive relationship between the ex-day return and transaction costs, and a positive relationship between the ex-day return and the dividend yield. Concerning the ex-day abnormal trading volume, he found a positive relationship between the ex-day abnormal trading volume and the dividend yield, while the relationship between the ex-day abnormal trading volume and transaction costs was negative. These results are in absolute line with the predictions of the short-term trading hypothesis as it has been described by Lakonishok and Vermaelen (1986). Therefore, according to Dasilas (2009) the main reason for the stock price anomaly on ex-dividend day in the Greek stock market is the short-term trading explanation.

In the Greek stock market, despite the fact that there are only two studies that examined the ex-dividend stock price behavior with both of them having identified the ex-dividend day price anomaly, each of them propose different contradicting potential explanations. Thus, the goal of this study is to enhance the understanding of stock price behaviour on ex-dividend day in Greece, by examining again all the potential explanations proposed from literature for the ex-dividend stock price behaviour, in a bigger time span 1996-2005, that includes the time interval of the previous studies. It also takes into account any institutional change as well as any liquidity problem that may be apparent in this time period and may affect stock prices on ex-dividend day.

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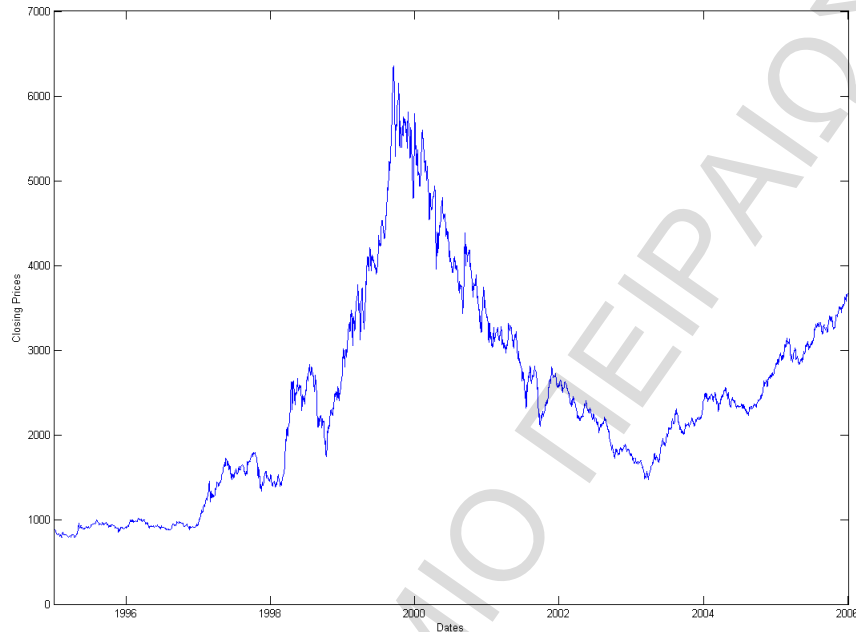
prices on ex-days was 0.146 (0.250) with t-statistic (pvalue) -3.69 (0.00), suggesting that the difference of the mean (median) from the corresponding theoretical value of 1.00 (1.00) was statistically significant at the 0.01 level of significance. The abnormal raw return on ex-days was 0.008 statistically significant at the 0.01 level.

### 4.3 The Greek environment

The ASE was established on September 1876 when the government granted the permission for its founding as autonomous public institution. Its main objective was, and it remains until today, to guarantee the smooth operation of capital market, adapted in each needs and requirements. Until the begging of 1990 the ASE was almost entirely a domestic market with few investors as well as few financial institutions and companies. However, from the middle of 1990, a line of institutional developments in Athens Stock Exchange, in accordance with the development process of Greek economy, the improvement of its economic figures and its unswerving course to the stability and the integration of country in the European Community, led to the alteration of Greek Stock Exchange through the important increase of its size and the innovation of its institutional framework and its operation.

As a result, the time period extended from 1993 until 1996 is characterized by a continuous increased number of companies that use ASE to draw capital causing great volatility in prices and indices. During the period 1997-2000, the Greek economy was characterized by its attempt to readjust its macro-economic condition so as to fulfill the criteria to become the 12th member of the Euro Zone. At the same time the convergence of inflation and interest rates to the EU levels, as well as the many public infrastructure projects that were announced for the 2004 Olympic Games, led to a long-lasting rally in equity prices in the ASE, creating an unexpected increase in the General Stock Index of ASE. The closing price of General Index jumped from 954 in 1997 to 5794 in 2000 reaching its maximum level. The above developmental course led to the nomination of Greek Stock Exchange market as developed from the international institutional investors. The maturation of market was proved beneficial, since it has increased considerably the attendance of foreign investors. But despite the important increase of foreign investors in Greece, from the middle of 2000 until the end of 2002 there were a remarkable decrease in investment activities in ASE with the General Index decreasing to 1748 at the end of 2002. After 2003 until 2005, there is a change in expectations with an almost steadily upward trend that drift the General Index to

Figure 1: Closing prices of General Index of Athens Stock Exchange from January 1995 to December 2005



reach 3663 at the end of 2005. The above description of the process of the Athens Stock Exchange can be easily demonstrated through figure (1) which illustrates the course of General Index from the beginning 01.01.1995 until the end of 2005.

The institutional set up and the taxation system of the Greek environment has significant idiosyncratic characteristics that make very important the examination of the stock price behaviour in the Athens Stock Exchange. These characteristics, as they have briefly been described in the introduction, isolate some of the most important explanations about the ex-day anomaly making the examinations of the remaining explanations very important.

The main distinctiveness of the Greek environment is that in Greece as in Chile and contrary to US market the distribution of dividend from firms is mandatory if the firm is profitable. The dividend is determined by the managerial board of director of the company, depending on the dividend policy

that follows, and it is subject to the final approval at the shareholders Annual General Meeting. The last one usually is closely related with financing and investment decisions. The dividends are distributed to the shareholders once a year, instead of US and no US markets that distribute dividend quarterly or semi-annually, by the net profits that are presented in the annual financial statements.

According to the article no 45(§2, b) of the law 2190/1920, firms are obligated to distribute as cash dividends 6% of their common equity (Mandatory dividend 1). Later according to article no 3 of the law 148/1967 which was then modified according to article no1 of the law 876/1979 firms are obliged to distribute the above dividend only if it is greater than 35% times net income minus tactical reserves (Mandatory dividend 2). Firms then, have to distribute the higher of the two mandatory dividends. When however, mandatory dividend 2 is greater than mandatory dividend 1 then the general assembly of shareholders requires a 65% majority to distribute the mandatory dividend 1 with the requirement that the difference between the two amounts will be capitalized in the balance sheet and will be distributed later as stock dividends to entitled shareholders.

The unusual regularity environment in Greece limits the ability of firms to adjust dividend yields to their clienteles' desired level. Since investors in high tax brackets that prefer profitable firms with low dividend yields cannot easily create a portfolio that includes domestic firms to satisfy their preferences, the dividend yield clienteles may not be as prevalent in Greece.

Another significant characteristic of the Greek environment is with respect to the tax system that does not impose any personal taxes neither on dividend nor on capital gains. According to Law 2065/1992, corporate dividends are determined after corporate taxes have been deducted from profits before taxes. More specifically, when firms distribute profits in form of dividend, interim dividend, wage in the members of administrative council etc., they do not proceed in retaining the tax amount, because these incomes are taxed in the name of company. Similarly no taxes are paid on capital gains. The only tax that paid by investors is a flat rate 0.015% on every stock sale

proceeds according to law 3296/2004<sup>35</sup>.

In addition, the specific trading characteristics of ASE make our study very interesting. The ASE is an electronic order driven market with trading hours to vary during the examination period from three hours until five hours at the end of 2005. During the trading session, the electronic system is based on the matching of orders according to price and time priorities. Only ASE Members can execute purchase and sale orders for shares through the Integrated Automatic Electronic Trading System (OASIS) of the market. Due to lack of the necessary depth, the Athens Stock Exchange set price limits in stock price movements in order to avoid sharp price increases caused by ‘buy manias’ and sharp declines caused by ‘sell panics’. The bid and offer orders, given by members during a trading day can, be reversed or changed at any time. The trading mechanism is continuous and strict price and time priority rules are followed. For example, for any two or more buy (sell) orders on the trading board, the order with the higher (lower) price has priority in execution. Similarly, if two orders of the same type have similar prices, the one noted on the board first has the priority in execution. The tick sizes are very small and equal 1 cent of a euro for securities with a price up to 2.99 €, 2 cents for securities up to 59.99€ and 5 cents for the rest.

Commission costs in the ASE have been deregulated in 1996. Since then, fees imposed by brokerage are set freely, but not above a maximum of 1% set by the Association of Securities Firms. Commission fees are negotiable depending on portfolio size, type of service offered and client categorization (institutional investor, individual, mutual fund etc.). Short-selling in ASE is not permitted and trades are cleared in two days after the day of transaction, as long as all reports have been submitted at the end of each trading session to the ASE by its members and they have been forwarded to the Central Securities Depository (CSD) for their settlement.

To conclude, a very important characteristic of the Greek environment that can affect the ex-dividend stock price behaviour in the Athens Stock Exchange is how the price is adjusted on ex-day concerning the dividend paid. Until 2001 the adjusted stock price ( $P_{ex}$ ) on ex dividend day equals

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<sup>35</sup>Until 2001 this rate was 0.03% and it has decreased from 0.06% in 1999.

the cum-price ( $P_{cum}$ ) minus the dividend paid ( $D$ ): . At 03/04/2001 the ASE Board of Directors approved the non-adjustment of the share price, in cases of dividend distribution, i.e. the dividend is not deduced from the closing price on the day prior to the ex-dividend one:  $P_{ex} = P_{cum}$  . In this way, it is left to the market forces to decide for the direction of price.

This Decision was published in OFFICIAL JOURNAL OF THE HELLENIC REPUBLIC 355, Copy B 30/3/2001 and it become applied in the 2/4/2001. According to the ASE Board of Directors: *"this decision will enable investors to remain shareholders in each company for a longer time period with a long-term prospect, as long as in the past, the dividend policy of the listed companies did not play an important role, in combination with the amount of the alternative returns. The argument is that a considerable dividend (which forms long-term investors, stable shareholders of the Company) reflects the boosting increasing course of a company and is a sign that this developing course will continue. Finally, this decision of the ASE enables the Greek Stock Market to get tuned in the developments of the mature Stock Markets, such as the London Stock Exchange, the Deutsche Boerse and the Australian Stock Exchange among others"*.

This study is the first one that considers this announcement and try to examine whether this announcement improve the stock price behaviour on ex-dividend day comparing a time period of five years before and five years after the announcement. Taking into account all the conditions mentioned above, which are present in the Greek environment, the study of the ex-dividend stock price behaviour in such a framework is a challenge and it can enhance the already existing literature that try to find a justified explanation for the ex-day puzzle.

#### 4.4 Data selection

The sample of this study includes all the firms listed in the Athens Stock Exchange (ASE) for the period January 1996 to December 2005 and that satisfy the following criteria: 1) Firms must have distributed cash dividends every year during the period under examination. 2) Firms that do not distribute

dividends continuously or they distribute interim dividend are not included in the sample. 3) Firm's stock must be continuously traded (they are not under supervision) during the examined period 1996-2005. 4) No stock splits, stock dividends, or stock offerings have occurred during the same time window. 5) The ex-dividend date must be publicly available. 6) Traded prices as well as trading volume is available in the  $[-20, +20]$  window around the ex-dividend day.

The sources of all the data included in the analysis are obtained from Dissemination Information Department of the ASE as well as from Datas-tream. Out of 350 firms listed in the ASE until the end of 2005 only 50 firms fulfilled the above requirements. Therefore, we examine 500 cash dividend distributions.

Table 13 provides descriptive statistics for the total sample of 500 cash dividend distributions. The average (median) distributed dividend per share is 0.200 (0.100) euros, much higher compared to Dasilas (2009) with values 0.064 (0.050), and the average stock price on cum-day is 7.686 (4.180) euros. The average (median) price drop between the cum-day and the ex-dividend day is 0.151 (0.060), which is again higher than Dasilas (2009). The average (median) dividend yield is 3.540% (2.660%), similar to Milonas and Travlos (2001), but much higher compared to that of Dasilas (2009) who found 1.700% (1.400%). The minimum dividend distributed is 0.008 euros and the maximum is 2.600 euros.

Table 13: Descriptive Statistics of the Sample

Statistic	Mean	Median	St. Dev.	Min.	Max.
Dividend ( $D$ )	0.2014	0.1000	0.3293	0.0080	2.6000
Price on Cum Day ( $P_{cum}$ )	7.6862	4.1800	11.0130	0.0260	95.5200
Dividend Yield ( $\frac{D}{P_{cum}}$ )	0.0354	0.0266	0.0345	0.0014	0.3514
Price Drop ( $P_{cum} - P_{ex}$ )	0.1516	0.0600	0.5059	-1.4100	5.9900

The sample consists of 500 pure cash dividend ex-days for the Athens Stock Exchange (ASE) stocks during the period from January 1996 to December 2005.  $D$  denotes the dividend per share. The stock price ( $P_{cum}$ ) denotes the stock price on the cum-day. Dividend yield ( $\frac{D}{P_{cum}}$ ) is the ratio between dividend per share and the stock price on the cum-dividend day. The stock price ( $P_{ex}$ ) denotes the stock price on the ex-dividend day.

## 4.5 Methodology and empirical results

### 4.5.1 The Price Behaviour on Ex-Dividend Day

In an environment where there is no taxation on dividends and on capital gains, as in Greece, the no arbitrage condition (assuming constant any other market or unsystematic influences) requires the following equality to hold:

$$P_{cum} = P_{ex} + D \quad (39)$$

where,  $P_{cum}$  is the stock price on cum day,  $P_{ex}$  is the stock price on ex-day and  $D$  is the dividend distributed.

By subtracting  $P_{ex}$  from both sides of the equation (39) and dividing by  $D$ , the Raw Price Ratio ( $RPR$ ) is obtained :

$$RPR = \frac{P_{cum} - P_{ex}}{D} = 1 \quad (40)$$

The  $RPR$  expresses the price change between the cum-day and the ex-day in terms of the dividend, and ceteris paribus, must be equal to 1. So, its theoretical value is 1 and in order to be tested the following null hypothesis is tested:

**Hypothesis 1<sup>36</sup>:** *The mean of  $RPR = 1$*

To correct potential bias introduced by daily price movements, and following an approach similar to Michaely (1991), Naranjo et al. (2000), Graham et al. (2003) and Milonas and Travlos (2001), an additional ratio is computed, the Market Adjusted Price Ratio, adjusting the ex-day closing price by the rate of return of the stock market composite index:

$$MAPR = \frac{P_{cum} - [P_{ex}/(1 + R_m)]}{D} \quad (41)$$

$MAPR$  adjusts the ex-dividend day closing price for the daily market return ( $R_m$ ). In this study the daily market return is proxied by the Athens

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<sup>36</sup>The same with hypothesis 1 in the literature subsection.

Stock Exchange (ASE) composite stock index. Similar to  $RPR$ , the theoretical value of  $MAPR$  is 1 and the following null hypothesis is tested:

**Hypothesis 2:** *The mean of  $MAPR = 1$*

The price difference depicted in equation (40) can also be expressed in terms of the price on the last cum day. By dividing with  $P_{cum}$  both sides of the equation (39) and after the necessary rearrangements, the Raw Price Drop ratio ( $RPD$ ) can be obtained:

$$RPD = \frac{P_{cum} - P_{ex}}{P_{cum}} = \frac{D}{P_{cum}} \quad (42)$$

This way, the criticism<sup>37</sup> that the  $RPR$  suffers from heteroskedasticity due to the fact that the price difference in  $RPR$  is scaled by the dividend amount. If the distributed dividend is too small then the influence in price change is excessive. The theoretical value of  $RPD$  is equal to dividend yield ( $DY$ ).

Similar to  $MAPR$ , the ex-dividend day closing stock price is adjusted for the daily market return ( $R_m$ ), as it is proxied by the Athens Stock Exchange (ASE) composite stock index. So, the Market-Adjusted Price Drop ratio ( $MAPD$ ) is computed as:

$$MAPD = \frac{P_{cum} - [P_{ex}/(1 + R_m)]}{P_{cum}} \quad (43)$$

The theoretical value of  $MAPD$  equals the dividend yield ( $DY$ ). So, the following null hypotheses are tested for the  $RPD$  and  $MAPD$ :

**Hypothesis 3:** *The mean of  $RPD = dividend\ yield$*

and respectively,

**Hypothesis 4:** *The mean of  $MAPD = dividend\ yield$*

Finally, according to Milonas and Travlos (2001) the raw ex-dividend day Return, ( $R_0$ ) is computed as:

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<sup>37</sup>See Michaely (1991), Boyd and Jagganathan (1994) and Bell and Jenkinson (2002), among others.

$$R_0 = \frac{P_{ex} - P_{cum} + D}{P_{cum}} \quad (44)$$

and the Market-Adjusted ex-dividend day Excess Return,  $MAER$  is:

$$MAER = R_0 - R_m \quad (45)$$

The theoretical value of  $MAER$  is 0. In other words, an investor who buys the stock on cum day and sells it on ex-day receiving also the dividend, makes no profits. To test the theoretical value of  $MAER$  the following null hypothesis is used:

**Hypothesis 5:**<sup>38</sup> *The mean of  $MAER = 0$*

In this study, all the aforementioned ratios are calculated in two ways: a) closing prices of stocks both on cum-dividend day and on ex-dividend day are used, b) closing prices on cum-dividend day and opening prices on ex-dividend day, are used. Measuring the ratios using the opening prices on ex-dividend day, noises associated with daily price movements can be eliminated.<sup>39</sup> The current work presents only the first way since the results are similar with the second approach.<sup>40</sup>

Table 14 shows both the theoretical and the observed values of all the ratios, that have been described above, for the total sample and for the whole examination period 1996-2005. A t-test is used to examine whether the differences of mean observed values with the theoretical ones are statistically significant, whereas the median values are tested using the Wilcoxon signed rank test. The mean  $RPR$  is 0.4947 with a t-statistic value -4.0318 implying statistical significance at the 1% level of significance. The corresponding median value is 0.6679, also with statistical significance at the 1% level of significance. After adjusting for the daily market return, the mean (median) value of  $MAPR$  is 0.5386 (0.6684) and it is statistically significant at the 1% level of significance.

<sup>38</sup>The same with hypothesis 2 in literature subsection.

<sup>39</sup>Elton and Gruber (1970) argue that opening prices reflect specialists' adjusted closing prices of previous day.

<sup>40</sup>The results of the second approach are available upon request.

Furthermore, Table 14 shows that both the *PDR* and *MAPD* are less than their theoretical value of dividend yield. More specifically, the mean (median) value of *PDR* is 0.0186 (0.0200) and the mean (median) value of *MAPD* is 0.0182 (0.0178). Both the mean and median observed values of *PDR* and *MAPD* are statistically significant at the 1% level of significance. These results indicate that the ex-dividend stock price anomaly is valid in the Greek environment. Moreover, the results of this study are consistent with previous studies by Frank and Jagannathan (1998) on Hong Kong which has similar tax treatment for dividends and capital gains as in Greece, and by Milonas and Travlos (2001) and Dasilas (2009) on the Athens Stock Exchange where taxes on dividends and capital gain are also absent.

Table 15 splits the sample above (panel A) and below (Panel B) the median dividend yield (2.66%) of the total sample, in order for the difference across groups of stocks of the above ratios, on the basis of dividend yield, to be tested. As indicated from Panel A of Table 15 the mean (median) value of *RPR* and *MAPR* is 0.4083 (0.7005) and 0.5082 (0.6111) respectively, with all of them being statistically significant at the 1% level. Also, similar results are obtained for the ratios *PDR* and *MAPD*.

Observing Panel B in Table 15 the mean (median) *RPR* is 0.5810 (0.6667) while the mean (median) *MAPR* is 0.5689 (0.6743). As indicated by the associated t-statistics (p-values), both of them are statistically different at the 0.01 level, from their theoretical values. A similar conclusion can be reached also by considering the *PDR* and the *MAPD*.

Similarly to the results from the sample of firms with dividend yields below the median value, the associated mean (median) values of both ratios and their corresponding t-statistics (p-values) indicate that the drop of the stock price on the ex-dividend day is smaller than its theoretical value, which equals the dividend yield. These findings imply that for firms with dividend yields above the median value, stock prices on the ex-dividend day drop by an amount that is smaller than the dividend paid.

Finally, in order for the stock price behaviour on the ex-day for the pe-

Table 14: Ex-dividend day behavior for the entire sample (N=500) for the whole period 1996-2005

	Theoretical Values		Observed Values	
	Mean	Median	Mean	Median (p-value)
Raw Price Ratio ( <i>RPR</i> )	1.0000	1.0000	0.4947***	-4.0318 0.6679 0.0000
Market-Adjusted Price Ratio ( <i>MAPR</i> )	1.0000	1.0000	0.5386***	-3.7263 0.6684 0.0000
Raw Price drop Ratio ( <i>RPD</i> )	0.0354	0.0266	0.0186***	-7.4693 0.0200 0.0000
Market-Adjusted Price Drop Ratio ( <i>MAPD</i> )	0.0354	0.0266	0.0182***	-8.0152 0.0178 0.0000
Dividend Yield ( <i>DY</i> )			0.0354***	22.9439 0.0266 0.0000

The table shows theoretical and observed values (mean and median) for four ratios: Raw price ratio (*RPR*), Market-adjusted price ratio (*MAPR*), Raw price drop ratio (*RPD*) and Market-adjusted price drop ratio (*MAPD*), along with their associated tests (t-statistic and p-value). Also, the mean and median values of the dividend yield (*DY*) are reported. The samples investigated are dividend distributions for the total period 1996-2005.

If  $P_{cum}$  denotes the stock price (in euro) on the last cum day,  $P_0$  the price of the stock on the ex-dividend day,  $D$  the dividend per share (in euro) and  $R_m$  the one day stock market return approximated by the ASE composite stock index then: (we follow an approach similar to Michaely (1991), Milonas and Travlos (2001) and Graham et al. (2003)).

*RPR*: is the raw price ratio which is calculated as  $RPR = \frac{P_{cum} - P_{ex}}{D}$

*MAPR*: is the market-adjusted price ratio which is calculated as  $MAPR = \frac{P_{cum} - [P_{ex}/(1+R_m)]}{D}$

*RPD*: is the raw price drop ratio, calculated as  $RPD = \frac{P_{cum} - P_{ex}}{P_{cum}}$

*MAPD*: is the market-adjusted price drop ratio, calculated as  $MAPD = \frac{P_{cum} - [P_{ex}/(1+R_m)]}{P_{cum}}$

*DY*: is the dividend yield measured as the ratio  $\frac{D}{P_{cum}}$

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

Table 15: Ex-dividend day stock behavior for the sample of dividend distributions below and under the median DY

Panel A: Ex day behavior for companies below the median DY (N=250)					
Theoretical Values			Observed Values		
	Mean	Median	Mean	(t)	Median (p-value)
Raw Price Ratio ( <i>RPR</i> )	1.0000	1.0000	0.4083	-2.3983**	0.7005 0.0046
Market-Adjusted Price Ratio ( <i>MAPR</i> )	1.0000	1.0000	0.5082	-2.0126**	0.6112 0.0006
Raw Price drop Ratio ( <i>RPD</i> )	0.0149	0.0142	0.0071	-3.6467***	0.0106 0.0078
Market-Adjusted Price Drop Ratio ( <i>MAPD</i> )	0.0149	0.0142	0.0065	-4.3653***	0.0092 0.0003
Dividend Yield ( <i>DY</i> )			0.0149	36.0687***	0.0142 0.0000

Panel B: Ex day behavior for companies above the median DY (N=250)					
Theoretical Values			Observed Values		
	Mean	Median	Mean	(t)	Median (p-value)
Raw Price Ratio ( <i>RPR</i> )	1.0000	1.0000	0.5810	-9.2586***	0.6667 0.0000
Market-Adjusted Price Ratio ( <i>MAPR</i> )	1.0000	1.0000	0.5689	-10.3253***	0.6743 0.0000
Raw Price drop Ratio ( <i>RPD</i> )	0.0559	0.0439	0.0301	-7.7486***	0.0300 0.0000
Market-Adjusted Price Drop Ratio ( <i>MAPD</i> )	0.0559	0.0439	0.0299	-8.1817***	0.0294 0.0000
Dividend Yield ( <i>DY</i> )			0.0559	22.8451***	0.0439 0.0000

The table shows theoretical and observed values (mean and median) for four ratios: Raw price ratio (*RPR*), Market-adjusted price ratio (*MAPR*), Raw price drop ratio (*RPD*) and Market-adjusted price drop ratio (*MAPD*) along with the associated tests (t-statistic and p-value). Also, the mean and median values of the dividend yield (*DY*) are reported. The samples investigated are dividend distributions for the total period 1996-2005.

If  $P_{cum}$  denotes the stock price (in euro) on the last cum day,  $P_0$  the price of the stock on the ex-dividend day,  $D$  the dividend per share (in euro) and  $R_m$  the one day stock market return approximated by the ASE composite stock index then: (we follow an approach similar to Michaely (1991), Milonas and Travlos (2001) and Graham et al. (2003)).

*RPR*: is the raw price ratio which is calculated as  $RPR = \frac{P_{cum} - P_{ex}}{D}$

*MAPR*: is the market-adjusted price ratio which is calculated as  $MAPR = \frac{P_{cum} - [P_{ex}/(1+R_m)]}{D}$

*RPD*: is the raw price drop ratio, calculated as  $RPD = \frac{P_{cum} - P_{ex}}{P_{cum}}$

*MAPD*: is the market-adjusted price drop ratio, calculated as  $MAPD = \frac{P_{cum} - [P_{ex}/(1+R_m)]}{P_{cum}}$

*DY*: is the dividend yield measured as the ratio  $\frac{D}{P_{cum}}$

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

riods “before” and “after” the change of the ex-dividend day share price adjustment method to be examined, Table 16 is separated in two panels. Then both the theoretical and observed values (mean and median) for the four ratios along with their statistical tests are calculated.

Panel A refers to the sample of dividend distributions “before” the change of the ex-dividend day price adjustment method, i.e. the period from 1996 to 2000, and Panel B refers to the sample of dividend distributions “after”, i.e. the period from 2001 to 2005, during which the ex-dividend day price was adjusted with the new method. In this way, the effect of the institutional change can be analyzed. The launch of the new adjustment method in the ASE is expected to reduce if not eliminate the difference between the dividend paid and the price drop.

As shown in Panel A of Table 16, for the period “before” the change of the ex-dividend day price adjustment method (from 1996 to 2000), the mean (median) RPR for the sample of dividend distributions is 0.3660 (0.5815). The corresponding t-statistic (p-value) is -2.7556 (0.0000), suggesting that the difference of the mean (median) from the corresponding theoretical value of 1.0000 (1.0000) is statistically significant at the 1% level of significance. The mean (median) MARP is 0.5051 (0.5928) with corresponding t-statistic (p-value) of -2.2110 (0.0000), that is also statistically significant at the 1% level of significance.

The stock price behaviour on the ex-dividend day can also be analyzed by comparing the RPD and the MAPD with their corresponding theoretical values. The mean (median) RPD is 0.0163 (0.0164) with a corresponding t-statistic (p-value) of -5.8737 (0.0026), which is statistically significant at the 1% level of significance. The mean (median) MAPD is 0.0165 (0.0159) with a corresponding t-statistic (p-value) of -6.0914 (0.0020), that is statistically significant at the 1% level of significance. Finally, the mean (median) DY is 0.0391 (0.0237) with a corresponding t-statistic (p-value) of 13.7017 (0.0000), is also statistically significant at the 1% level of significance.

In Panel B of Table 16, for the sample of dividend distributions “after” the change of the ex-dividend day price adjustment method, period 2001-2005,

Table 16: Ex-dividend day stock price behavior for the sample of dividend distributions "before" and "after" the change of the ex-dividend day price adjustment method in the Athens Stock Exchange (ASE)  
Panel A: Sample of dividend distributions "before" the change of the ex-dividend day price adjustment method  
Period 1996-2000 (N = 250)

	Theoretical Values			Observed Values		
	Mean	Median	Mean	(t)	Median	(p-value)
Raw Price Ratio ( <i>RPR</i> )	1.0000	1.0000	0.3660	-2.7556***	0.5815	0.0000
Market-Adjusted Price Ratio ( <i>MAPR</i> )	1.0000	1.0000	0.5051	-2.2110**	0.5928	0.0000
Raw Price drop Ratio ( <i>RPD</i> )	0.0391	0.0237	0.0163	-5.8737***	0.0164	0.0026
Market-Adjusted Price Drop Ratio ( <i>MAPD</i> )	0.0391	0.0237	0.0165	-6.0914***	0.0159	0.0020
Dividend Yield ( <i>DY</i> )			0.0391	13.7017***	0.0237	0.0000

Panel B: Sample of dividend distributions "after" the change of the ex-dividend day price adjustment method  
Period 2001-2005 (N = 250)

	Theoretical Values			Observed Values		
	Mean	Median	Mean	(t)	Median	(p-value)
Raw Price Ratio ( <i>RPR</i> )	1.0000	1.0000	0.6233	-3.7868***	0.7290	0.0000
Market-Adjusted Price Ratio ( <i>MAPR</i> )	1.0000	1.0000	0.5721	-4.0181***	0.7037	0.0000
Raw Price drop Ratio ( <i>RPD</i> )	0.0316	0.0280	0.0209	-4.8135***	0.0230	0.0000
Market-Adjusted Price Drop Ratio ( <i>MAPD</i> )	0.0316	0.0280	0.0199	-5.5263***	0.0195	0.0000
Dividend Yield ( <i>DY</i> )			0.0316	28.0761***	0.0280	0.0000

The table shows theoretical and observed values (mean and median) for four ratios: Raw price ratio (*RPR*), Market-adjusted price ratio (*MAPR*), Raw price drop ratio (*RPD*) and Market-adjusted price drop ratio (*MAPD*) along with the associated tests (t-statistic and p-value). Also, the mean and median values of the dividend yield (*DY*) are reported. The samples investigated are dividend distributions "before" the change of the ex-dividend day price adjustment method, the period from 1996 to 2000 (Panel A) and "after" the change of the ex-dividend day price adjustment method, the period from 2001 to 2005 (Panel B).

If  $P_{cum}$  denotes the stock price (in euro) on the last cum day,  $P_0$  the price of the stock on the ex-dividend day,  $D$  the dividend per share (in euro) and  $R_m$  the one day stock market return approximated by the ASE composite stock index then: (we follow an approach similar to Michaely (1991), Milonas and Travlos (2001) and Graham et al. (2003)).

*RPR*: is the raw price ratio which is calculated as  $RPR = \frac{P_{cum} - P_{ex}}{D}$

*MAPR*: is the market-adjusted price ratio which is calculated as  $MAPR = \frac{P_{cum} - [P_{ex}/(1+R_m)]}{D}$

*RPD*: is the raw price drop ratio, calculated as  $RPD = \frac{P_{cum} - P_{ex}}{P_{cum}}$

*MAPD*: is the market-adjusted price drop ratio, calculated as  $MAPD = \frac{P_{cum} - [P_{ex}/(1+R_m)]}{P_{cum}}$

*DY*: is the dividend yield measured as the ratio  $\frac{D}{P_{cum}}$

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

the mean (median) RPR is 0.6233 (0.7290). The corresponding t-statistic (p-value) is -3.7868 (0.00), suggesting that the difference of the mean (median) from the corresponding theoretical value of 1.00 (1.0000) is statistically significant at the 1% level of significance. The mean (median) MAPR is 0.5721 (0.7037) with a corresponding t-statistic (p-value) of -4.0181 (0.0000), and it is statistically significant at the 1% level of significance. The mean (median) RPD declined to 0.0209 (0.0230) with a corresponding t-statistic (p-value) of -4.8135 (0.0009), that is statistically significant at the 1% level of significance. The mean (median) MAPD is 0.0199 (0.0195) with a corresponding t-statistic (p-value) of -5.5263 (0.0000), which is statistically significant at the 1% level of significance. Finally, the mean (median) DY is 0.0316 (0.0280) with a corresponding t-statistic (p-value) of 28.0761 (0.0000), statistically significant at the 1% level of significance.

Again, the results show that on the ex-dividend day the stock price declines by an amount that is less than the dividend paid. However, it is observed that after the change of the ex-dividend day price adjustment method (“after” period) the raw price ratio, and the other ratios, are larger than those of Panel A indicating pricing improvement.

The overall conclusion from Tables 14,15 and 16 is that on the ex-dividend day stock prices drop by an amount that is smaller than the dividend distributed regardless the special framework of the Greek stock market. The findings of this study confirm previous results from other markets where neither dividends nor capital gains are taxable (i.e. Frank and Jagannathan (1998) and Kadapakkam (2000) for Hong Kong and Milonas and Travlos (2001) and Dasilas (2009) for Greece). Also, the results are consistent with evidence from countries where dividends are taxed heavier than capital gains. In addition, the findings are in line with the corresponding results reported by Grammatikos (1989) for the period after the 1984 tax reform. Also, this value compares well, in general, with the corresponding mean values reported by Michaely (1991) for the period April 1986-March 1987. This period is long before the implementation of the 1986 Tax Reform Act that equalized the tax treatment of dividend income and capital gains. Similarly, the findings are also consistent with the results of Bali and Hite (1998). To the con-

trary, the evidence of this study is inconsistent with the findings provided by Green and Rydqvist (1999), on the ex-dividend day, where the stock price was higher than the cum-price. They report a mean price ratio above 1 and statistically different from 1, for a sample of Swedish lottery bonds which operate in an environment with barriers to short-term arbitrage and with cash distributions from such bonds enjoying a tax advantage relative to capital gains. Finally, the ex-dividend stock price behaviour seems to be improved after the change of the ex-dividend day price adjustment method but it does not disappear, making this study very interesting since the main explanations proposed from other markets for the ex-day anomaly are not valid in the Greek environment. As it is noticeable, a change of a microstructure feature increased the price drop on the ex-dividend day and decreased the abnormal return on that day. While, there is no other plausible explanation for the behaviour of the ex-dividend day returns in ASE, it is evident that the market efficiency has improved.

#### 4.5.2 Abnormal returns around ex-dividend day

An event type methodology is used (as described by Brown and Warner 1980, 1985) to evaluate the presence of abnormal returns using an event window of 21 days around the ex-dividend day<sup>41</sup>. Abnormal returns were computed according to the “market model” and the “market-adjusted model” in order for the sensitivity of the results from market model to beta estimations to be assessed. Specifically, for each stock  $j$  and day  $t$ , an abnormal return,  $AR_{jt}$ , is calculated as:

$$AR_{jt} = R_{jt} - ER_{mt} \text{ with } ER_{mt} = \hat{a} + \hat{b}R_{mt} \text{ in case of market model} \quad (46)$$

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<sup>41</sup>For the implementation of the event type methodology, returns are computed over 170 days, from day -150 to day +20 relative to the ex-dividend day, which is day 0. The period that starts at day  $t_{-51}$  and ends at day  $t_{-150}$  is declared as the "estimation period" whereas, the period that starts at day  $t_{-20}$  and ends at day  $t_{+20}$ , including also the day "0", is declared as the 'event period'. Under the market adjusted model it is assumed that firm's  $i$  beta is 1.

$$AR_{jt} = R_{jt} - R_{mt} \text{ in case of market adjusted model} \quad (47)$$

where  $R_{jt}$  is the return of stock  $j$  on day  $t$  and  $R_{mt}$  is the return of the proxy for the market portfolio on day  $t$ . According to the "market-adjusted" model, the return of the market portfolio captures the normal theoretical return of each stock. The index of the ASE is used as the proxy for the market portfolio. Cumulative abnormal returns are also computed for different time periods during the event window. The null hypothesis for the examination of the presence of abnormal returns on ex-dividend day is:

**Hypothesis 6:** *The mean abnormal returns on ex-dividend day = 0.*

Table 17 reports daily average abnormal returns along with their t-statistics for the event period, which starts 5 days before and ends 5 days after the ex-dividend day ( $t = 0$ ). Also, Table 17 displays the cumulative abnormal returns (CARs) and associated t-statistics for the event windows  $(-5, -1)$ ,  $(-2, -1)$ ,  $(+1, +2)$ , and  $(+1, +5)$  around the announcement day (ex-dividend day,  $t = 0$ ). Table 17 shows that the average abnormal return on ex-dividend day computed by market model is 1.7002% and it is statistically significant at the 1% level of significance. Similarly, when the market adjusted model is used, the average abnormal return is 1.7181%, which is also statistically significant at the 1% level of significance.

Moreover, on cum-day, comparing both models, the abnormal return is positive and statistically significant at the 5% level of significance with values 0.3317% and 0.3648% respectively. In all other days around the ex-dividend and cum day there is not any significant abnormal return. Similar is the conclusion by observing the cumulative abnormal returns prior to the ex-dividend period. The values of event periods  $(-5, -1)$  and  $(-2, -1)$  with respect to market model are 0.9347% and 0.4430% with t-statistics 3.2200 and 2.4127 respectively, implying statistical significance at the 1% level of significance. But the values of event periods  $(-5, -1)$  and  $(-2, -1)$  with respect to the market adjusted model are 0.9992% and 0.5408% with t-statistics 3.2166 and 2.7528, implying also statistical significance at the 1% level of significance. For the

event periods (+1,+2) and (+1,+5) there are no statistically significant cumulative abnormal returns.

The above results are in accordance with the results presented in Tables 14,15 and 16, in the sense that a price drop smaller than the dividend distributed on ex-dividend day leads to potentially significant returns for exploitation. A possible explanation for the positive abnormal return may be the differential taxation hypothesis of Elton and Gruber (1970), but because of the fact that neither dividend nor capital gains are taxes in Greece, this explanation is not valid. In addition the tick size effect proposed by Bali and Hite (1998) is not applicable in ASE, since stock prices are decimalized. Moreover, since market-makers are absent from the Greek stock market, the argument of Frank and Jagannathan (1998) is not relevant.

The main explanation that could be attributed to the positive abnormal returns is the short-term trading hypothesis proposed by Kalay (1982). Since short-term traders are interested in capturing the dividend, positive abnormal returns should be found in days before the ex-dividend day and negative after ex-day, reflecting the short term trading. The empirical results of Table 17 indicate positive and statistical significant abnormal returns in the event periods (-5,-1) and (-1,-2) before the ex-dividend day, but statistical insignificant negative abnormal returns in the event periods (+1,+2) and (+1,+5) after the ex-day, not supporting the presence of short term trading hypothesis.

Taking into account that institutional changes may shape investor trading decisions “before” and “after” their introduction, and thus, affect stock returns on the ex-day that may inhibit the ex-dividend day price reduction, Table 18 reports ex-dividend day abnormal returns (ARs) and cumulative abnormal returns (CARs) for the period “before” (1996-2000) and “after” (2001-2005) the change of the ex-dividend day price adjustment method<sup>42</sup>. Following the same approach as before, the ASE General Index is used to calculate the market returns. The upper part of Table 18 reports event days,

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<sup>42</sup>Table 18 reports abnormal returns and cumulative abnormal returns estimated by market-adjusted model. Similar are the results using market model and they are available upon request.

Table 17: Abnormal returns (AR) around the ex-dividend day ( $t=0$ ) for the total period (1996 to 2005) and cumulative abnormal returns (CARs) for selected event periods using "market model" and the "market-adjusted model"

Event Day	Mean Abnormal Returns %		Mean Abnormal Returns %	
	Market Model	t-statistic	Market Adjusted Model	t-statistic
-5	0.1846	1.4222	0.1204	0.8666
-4	0.1946	1.4987	0.2027	1.4592
-3	0.1126	0.8671	0.1353	0.9737
-2	0.1113	0.8571	0.1760	1.2671
-1	0.3317	2.5550*	0.3648	2.6260*
0	1.7002	13.0975*	1.7181	12.3676*
+1	-0.0685	-0.5275	-0.1072	-0.7717
+2	-0.0159	-0.1222	0.0242	0.1741
+3	-0.0793	-0.6110	-0.0871	-0.6267
+4	0.0578	0.4450	0.0648	0.4664
+5	-0.0271	-0.2087	-0.0393	-0.2826
CARs				
Event Periods	Market Model	t-statistic	Market Adjusted Model	t-statistic
(-5,-1)	0.9347	3.2200*	0.9992	3.2166*
(-2,-1)	0.4429	2.4127*	0.5408	2.7528*
(+1,+2)	-0.0843	-0.4594	-0.0830	-0.4225
(+1,+5)	-0.1330	-0.4581	-0.1445	-0.4653

The table presents event days, average abnormal returns (ARs) around the ex-dividend day ( $t = 0$ ) over the total period (1996 to 2005) using "market model" and "market adjusted model" and respective tests of significance. Also the tables shows the cumulative abnormal returns (CARs) along with the associated t-statistics for the intervals (-5, -1), (-2, -1), (+1, +2) and (+1, +5) relative to the event day (ex-dividend day  $t=0$ ).

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

the daily average market-adjusted abnormal returns (ARs) and the associated t-statistics for event days -5 to +5, relative to the announcement day (ex-dividend day,  $t = 0$ ). The lower panel of Table 18 displays the cumulative abnormal returns (CARs) and the associated t-statistics for the event windows (-5, -1), (-2, -1), (+1, +2), and (+1, +5) around the announcement day (ex-dividend day,  $t=0$ ). The last two columns of Table 18 present the statistical significance difference of average abnormal returns between the period "after" and "before" the change of the ex-dividend day price adjustment method, as well as the statistical significance of that differences using a t-test.

During the period "before" the change of the ex-dividend day price adjustment method, the average abnormal return on the ex-dividend day is 2.2572%, which is highly significant at the 1% level of significance (t-statistic = 10.9671). Also, the abnormal returns on day  $t = -1$  are statistically significant at the 5% level of significance. The positive returns prior to the ex-day may be due to increased buying by investors that are interested in dividends. For the period "after" the change of the ex-dividend day price adjustment method the average abnormal return on the ex-dividend day drops to 1.1790%, which is statistically significant at the 1% significance (t-statistic = 5.7881).

Moreover, CARS during the period "before" are statistically significant for the event periods (-5, -1 and -2, -1). For the period "after" the change of the ex-dividend day price adjustment method, CARS are statistically insignificant for all the selected event periods. Furthermore, the difference of abnormal returns on ex-dividend day between the period "after" and the period "before" is -1.0782% and it is statistically significant at the 1% level of significance. Thus, it is observed that after the institutional change the abnormal returns decrease and CARS are statistically insignificant. This may be due to improved pricing by the market, possibly an indication of enhanced efficiency.

Table 18: Abnormal returns (AR) around the ex-dividend day ( $t=0$ ) for the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method and differences between ARs ("after" and "before") and cumulative abnormal returns (CARs) for selected event periods

Event Day	"Before" Period 1996-2000 (N=250)				Differences ("After" - ("Before"))			
	$AR_B(\%)$	t-statistic	$AR_A(\%)$	t-statistic	$AR_A - AR_B(\%)$	t-statistic	t-statistic	t-statistic
-5	0.2568	1.2476	-0.0222	-0.1088	-0.2789	-1.2196	-1.2196	-1.2196
-4	0.3294	1.6007	0.0687	0.3373	-0.2607	-1.1282	-1.1282	-1.1282
-3	0.2041	0.9916	0.0757	0.3717	-0.1284	-0.5910	-0.5910	-0.5910
-2	0.2104	1.0221	0.1603	0.7870	-0.0501	-0.2316	-0.2316	-0.2316
-1	0.4837	2.3500**	0.2665	1.3082	-0.2172	-1.0125	-1.0125	-1.0125
0	2.2572	10.9671***	1.1790	5.7881***	-1.0782	-3.1867***	-3.1867***	-3.1867***
+1	0.0424	0.2061	-0.2568	-1.2608	-0.2992	-1.1034	-1.1034	-1.1034
+2	0.1004	0.4878	-0.0520	-0.2553	-0.1524	-0.6459	-0.6459	-0.6459
+3	-0.1058	-0.5143	-0.0683	-0.3352	0.0376	0.1637	0.1637	0.1637
+4	0.0887	0.4311	0.0409	0.2006	-0.0479	-0.2335	-0.2335	-0.2335
+5	-0.0390	-0.1895	-0.0395	-0.1940	-0.0005	-0.0021	-0.0021	-0.0021
Event Periods	"After" Period 2001-2005 (N=250)				Differences ("After" - ("Before"))			
	$CAR_B(\%)$	t-statistic	$CAR_A(\%)$	t-statistic	$CAR_A - CAR_B(\%)$	t-statistic	t-statistic	t-statistic
(-5,-1)	1.4843	3.2253***	0.5490	1.2247	-0.9353	-3.1530***	-3.1530***	-3.1530***
(-2,-1)	0.6940	2.3844**	0.4268	1.5052	-0.2673	-0.8200	-0.8200	-0.8200
(+1,+2)	0.1428	0.4906	-0.3088	-1.0893	-0.4516	-1.1923	-1.1923	-1.1923
(+1,+5)	0.0867	0.1884	-0.3758	-0.8382	-0.4625	-0.8382	-0.8382	-0.8382

The table presents event days, average abnormal returns (ARs) around the ex-dividend day ( $t=0$ ) over the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method, the difference between ARs ("after" and "before") and respective tests of significance. Also shown are, cumulative abnormal returns (CARs), along with the associated test statistics for the intervals (-5, -1), (-2, -1), (+1, +2) and (+1, +5) relative to the event day (ex-dividend day  $t=0$ ). \*\*\*, and \*\* indicate significance at the 1% and 5% levels, respectively.

### 4.5.3 Behaviour of Trading Volume around Ex-days

To further investigate the presence of short term trading around the ex-dividend day, the data of trading volume are analyzed. Lakonishok and Vermaelen (1986) argue that the influence of short-term traders around the ex-day can best be investigated by examining abnormal volume around the ex-day, because the investigation of stock price behaviour around the ex-dividend day cannot discriminate the differential taxation explanation with the short term trading one. According to them, the presence of positive abnormal volume around the ex-day supports the existence of short term traders, meaning that there are not any market frictions that impede arbitrage activity.

In this section the abnormal trading volume ( $AV$ ) behaviour is examined over the 11-day period around the ex-dividend day ( $t = 0$ ). Following Lakonishok and Vermaelen (1986) and Koski and Scruggs (1998) approach, the abnormal trading volume is computed as:

$$AV_{it} = V_{it} - NV_i \quad (48)$$

where  $V_{it}$  is the trading volume on day  $t$  of stock  $i$ , and  $NV_i$  is the normal average volume of company  $i$  estimated over the period  $t + 11$  to  $t + 111$  (100 days) relative to the ex-dividend day ( $t = 0$ ). For the distributional comparability across firms to be attained, the standardized cross-sectional residuals procedure is used to derive the significance test:

$$SAV_{it} = \frac{AV_{it}}{\sigma(AV_{it})} \quad (49)$$

where  $\sigma(AV_{it})$  is the estimated standard deviation computed in the period  $t + 11$  through  $t + 100$ .

If there is short term trading around the ex-dividend day the abnormal trading volume must be statistically significant. The current work tests the following null hypothesis:

**Hypothesis 7:** *Abnormal trading volume on ex-dividend day equals to zero.*

Table 19 reports abnormal volumes ( $AV_S$ ) around the ex-dividend day ( $t = 0$ ) and the cumulative abnormal volumes ( $CAV_S$ ) for the intervals  $(-1, 0)$ ,  $(-5, 0)$  and  $(+1, +5)$  and their relative t-statistics for the total period under examination, 1996-2005. Table 19 indicates statistically significant positive abnormal volumes for all the 5 days before the ex-dividend day as well as on the ex-dividend day. The highest abnormal volume is observed on the ex-dividend day, with a value of 0.5979% and with a t-statistic=2.1972, and modified t-statistic=2.2067<sup>43</sup>, that is statistically significant at the 5% level of significance. In cum day, the abnormal volume is 0.3955% with t-statistic 5.0764 and modified t-statistic 6.9727, statistically significant at the 1% level of significance. All the subsequent 5 days after the ex-dividend day there is not any observed statistically significant abnormal volume.

Similarly, the examination of cumulative abnormal volumes in Table 19 indicates that only the CAVs of the intervals  $(-5,0)$  and  $(-1,0)$  are positive and statistical significance at the 1% level of significance, with values 0.9592% and 2.2815% respectively . The cumulative abnormal volume of the interval  $(+1,+5)$  is also positive with a value of 0.4349% but statistically insignificant at any conventional level of significance. As a consequence, the results of Table 19, for the examination of the total sample period 1996-2005, do not support the presence of short term trading hypothesis, contrary to the result of Dasilas (2009).

In order to be tested whether the change of the ex-dividend day price adjustment method is a source of friction, that affects trading activity and thus inhibits a proper adjustment to dividends, the total sample is separated into two periods: “before” (1996-2000) and “after“ (2001-2005) the institutional change, where the volume of trade for that periods is analyzed. Table 20, reports abnormal volume ( $AV$ ) around the ex-dividend day ( $t = 0$ ) and the cumulative abnormal volumes for the intervals  $(-1, 0)$ ,  $(-5, 0)$  and  $(+1, +5)$  and their relative t-statistics for the periods “before” (1996-2000) and “after“

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<sup>43</sup>A modified t-statistic is calculate following Johnson (1978), by adjusting the t-tests for asymmetric population. The modified t-test is :  $\hat{t} = t + \left( \frac{S}{6\sqrt{N}} \right) (1 + 2t^2)$  where  $S$  is skewness and  $t$  is the regular t statistic.

Table 19: Abnormal volumes (AV) around the ex-dividend day ( $t=0$ ) for the total period (1996 to 2005) and cumulative abnormal volumes (CAVs) for selected event periods

Event Day	Abnormal Volume	t-statistic	modified t-statistic
-5	0.1526	2.2222**	2.7644***
-4	0.3614	1.8661*	3.1617***
-3	0.5097	2.9638***	4.9788***
-2	0.3375	3.0955***	4.6385***
-1	0.3955	5.0764***	6.9727***
0	0.5979	2.1972**	2.2067**
+1	0.0786	1.2262	1.2364
+2	0.0604	0.9220	1.0543
+3	0.0369	0.6552	0.7208
+4	0.0359	0.5459	0.6066
+5	0.2397	0.7434	1.0454
Cumulative			
Event Periods	Abnormal Volume	t-statistic	modified t-statistic
(-1,0)	0.9592	3.3329***	5.8273***
(-5,0)	2.2815	4.9754***	7.4767***
(+1,+5)	0.4349	1.1985	1.6437

The table presents event days, average abnormal volumes ( $AV_S$ ) around the ex-dividend day ( $t = 0$ ) over the total period (1996 to 2005) and respective tests of significance. Also shown are, cumulative abnormal volumes ( $CAV_S$ ), along with the associated test statistics for the intervals (-1, 0), (-5, 0) and (+1, +5) relative to the event day (ex-dividend day  $t = 0$ ). \*\*\*, \*\* and \* indicate significance at the 1%, 5% and 10% levels, respectively.

(2001-2005) the change of the ex-dividend day price adjustment method.

For the “before” period, positive abnormal volumes are observed, statistically significant at the 10% level of significance ( $t=1.9179$ ) on the ex-day and most of the days preceding the ex-day. For the period “after”, on the ex-day the abnormal volume is smaller and statistically significant at the 10% level of significance. For both periods (“before” and “after”), the abnormal volume becomes insignificant after the ex-day.

The abnormal volume prior to the ex-dividend day suggests that some shareholders believe that the difference between the price cum-dividend and price ex-dividend is greater than the amount of the dividend (Koski and Scruggs (1998)). The results show that the introduction of the adjustment method affects the volume of trade without, however, eliminating the ex-dividend day behaviour. The above results do not satisfy the hypothesis for the presence of short term-trading and contradict with the results of Dasilas (2009) who finds evidence that support the short term-trading hypothesis.

Taking into account that trading volume is likely to be affected by transaction costs and the fact that there is a positive relation between trading volume and dividend yield, since short-term investors prefer high yield stock in order to be compensated for the transaction costs, as proposed by Lakonishok and Vermaelen (1986), Kaproff and Walking (1990) and Michaely and Vila (1996), the following two hypotheses are tested:

**Hypothesis 8:** *Abnormal trading volume is negatively related to the level of transaction cost.*

**Hypothesis 9:** *Abnormal trading volume is more pronounce for high dividend yield stocks.*

The implication of the above hypotheses is the following: as the cost of trading increases, fewer investors are going to find profitable trading activities around the ex-dividend day, and those who maybe do, they will trade for less amount. As a consequence, stocks with lower transaction costs will exhibit higher abnormal trading volume, around the ex-dividend day. Adding

Table 20: Abnormal returns (AR) around the ex-dividend day ( $t=0$ ) for the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method and differences between AVs ("after" and "before") and cumulative abnormal volumes (CAVs) for selected event periods

Event Day	"Before" Period 1996-2000 (N=250)				"After" Period 2001-2005 (N=250)				Differences	
	modified		modified		modified		modified		("After" - "Before")	
	$AV_B(\%)$	t-statistic	t-statistic	$AV_A(\%)$	t-statistic	t-statistic	t-statistic	$AV_A - AV_B(\%)$	t-statistic	t-statistic
-5	0.2077	2.0740**	2.5879***	0.1001	1.0617	1.3261	1.3261	-0.1077	-0.7827	-0.7827
-4	0.5460	1.4202	2.2838**	0.1837	2.1208**	2.5901***	2.5901***	-0.3623	-0.9386	-0.9386
-3	0.4187	2.6193***	4.2721***	0.6000	1.9740**	3.2102***	3.2102***	0.1813	0.5222	0.5222
-2	0.3862	2.7616***	4.1983***	0.2892	1.7282*	2.5539**	2.5539**	-0.0970	-0.4446	-0.4446
-1	0.4410	3.6830***	5.4303***	0.3516	3.4950***	4.4060***	4.4060***	-0.0894	-0.5733	-0.5733
0	1.0488	1.9179*	1.9305*	0.1655	1.8275*	1.8325*	1.8325*	-0.8832	-1.6263	-1.6263
+1	0.1587	1.7852*	1.7904*	-0.0002	-0.0027	-0.0030	-0.0030	-0.1589	-1.2408	-1.2408
+2	0.0228	0.3156	0.3401	0.0970	0.8931	1.0727	1.0727	0.0742	0.5654	0.5654
+3	-0.0032	-0.0379	-0.0408	0.0760	1.0252	1.1285	1.1285	0.0792	0.7033	0.7033
+4	-0.0119	-0.1252	-0.1340	0.0821	0.9057	1.0469	1.0469	0.0940	0.7152	0.7152
+5	0.5902	0.9071	1.3287	-0.1021	-1.8748*	-1.7402*	-1.7402*	-0.6924	-1.0736	-1.0736
Event Periods	modified				modified					
	modified		modified		modified		modified			
	$CAV_B(\%)$	t-statistic	t-statistic	$CAV_A(\%)$	t-statistic	t-statistic	t-statistic	$CAV_A - CAV_B(\%)$	t-statistic	t-statistic
(-1,0)	1.4898	2.5509***	4.2506***	0.5171	3.1717***	3.9483***	3.9483***	-0.9726	-1.5596	-1.5596
(-5,0)	3.0484	3.6778***	5.5904***	1.6900	3.5658***	4.8653***	4.8653***	-1.3584	-1.3558	-1.3558
(+1,+5)	0.7566	1.0754	1.5383	0.1527	0.5338	0.5726	0.5726	-0.6038	-0.7864	-0.7864

The table presents event days, average abnormal volumes ( $AV_S$ ) around the ex-dividend day ( $t = 0$ ) over the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method, the difference between  $AV_S$  ("after" and "before") and respective tests of significance. Also shown are, cumulative abnormal volumes ( $CAV_S$ ), along with the associated test statistics for the intervals (-1, 0), (-5, 0) and (+1, +5) relative to the event day (ex-dividend day  $t = 0$ ).  
\*\*\*, \*\* and \* indicate significance at the 1%, 5% and 10% levels, respectively.

together the transactions costs in high yield stocks is less constraining and dividend capture trading activities will be more pronounced for these stocks.

In order for the two hypotheses to be tested, the full sample is firstly divided in two periods "before" and "after" the change of the ex-dividend day price adjustment method, but after each subsample is ranked according to the dividend yield. Therefore, three dividend yield groups are created, from low to high dividend yield group. Then, three groups are created within each dividend yield group according to the transaction cost: low, medium and high. Note that the transaction cost is approximated, according to Lakonishok and Vermaelen (1986) and Dasilas (2009), with respect to trading size (normal trading volume) which is negatively related to the transaction cost.

Table 21 and Table 22 report the average abnormal volumes ( $AV_S$ ) for the intervals  $[-1, 0]$  and  $[-3, -1]$  respectively around the ex-dividend day ( $t = 0$ ) as well as their relative t-statistics, in parenthesis, for the period "before" (1996-2000) and "after" (2001-2005) the change of the ex-dividend day price adjustment method, according to the categorization of each subsample as described above<sup>44</sup>.

As reported in Tables 21 and 22, there is not any positive relation between dividend yield and trading volume. More specifically, for the period "before" (1996-2000), in Table 21, the average trading volume in high-dividend yield-high trading size (lower transaction cost) group for the time interval  $[-1, 0]$  is 0.9284, that is statistically significant at the 5% level of significance. But it is substantially smaller with respect to the cumulative trading volume of low-dividend yield-high trading size (lower transaction cost) group that is 1.0877, also statistically significant at the 5% level of significance. This difference is much bigger when the same group is compared for the time interval  $[-3, -1]$  (Table 22) with average trading volumes 0.7442 and 1.1902 respectively, where both of them are statistically significant.

A similar conclusion can be reached by considering the average trading

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<sup>44</sup>In Tables 21 and 22 as proxy for transaction cost is used the trading size which is negatively related to the transaction cost. Similar are the results when the inverse of stock's  $i$  closing price on the last cum dividend day is used as a proxy for the transaction cost. Those results are also available upon request.

volumes for the period "after" (2001-2005) for both time intervals  $[-1,0]$  (Table 21) and  $[-3,-1]$  (Table 22). Again, there is not any relationship between dividend yield and trading volume. More specific, the average trading volume of cum day and ex-day in high-dividend yield-high trading size group is statistically insignificant ( $t=1.4499$ ) and smaller with respect to the high-dividend yield-low trading size group. The same conclusion can be drawn considering the average trading volume of high-dividend yield-high trading size group for the three days before the ex-dividend day (average trading volume is statistically insignificant,  $t=0.8345$ , and smaller with respect to the high-dividend yield-low trading size group ).

The overall conclusion from the examination of Tables 21 and 22 is that the trading volume is not affected by the transaction costs and there is not any positive relationship between dividend yield and trading volume. As a result, none of the hypotheses, Hypothesis 7 and Hypothesis 8 concerning trading volume, is valid. Moreover, the examination of Table 21 and Table 22 reveals that the change of price adjustment mechanism eliminates the ex-dividend day price anomaly but it does not disappear, since most values of the average trading volumes for each group in period "after" are smaller with respect to the same group in period "before", leading to a more efficient market. Furthermore, these results disagree with the empirical results of Dasilas (2009), who concludes that the short-term trading activity is present in Athens Stock Exchange.

#### **4.5.4 Relationship between Abnormal Returns to Dividend Yield and other Variables**

Many studies about the United States and other countries (Grammatikos, 1989; Michaely, 1991 and Frank and Jagannathan, 1998), have argued that there is a positive relationship between dividend yield ( $DY$ ) and raw price ratio ( $RPR$ ) and a negative relationship between dividend yield and abnormal returns( $AR_S$ )<sup>45</sup>. The higher the dividend yield of stocks the higher the raw

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<sup>45</sup>As the price drop ratio increases the abnormal returns decrease.

Table 21: Average abnormal returns for the time interval  $[-1,0]$  around the ex-dividend day ( $t=0$ ) for the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method and ranking of each subsample firstly according to DY and after according to Trading sizes

Firms distributed dividend 1996-2000 (N=250)					
		Trading size group			
DY group	Low	Low	Median	High	Total
		0.1326 (0.7000)	0.3872 (1.1057)	1.0877 (2.0126**)	0.5319 (2.4152**)
	Median	1.0243 (0.9523)	0.2576 (0.8571)	2.6556 (1.2858)	0.4951 (2.5200**)
		High	-0.0701 (-0.5190)	-0.0764 (-0.5944)	0.9284 (2.1218**)
	Firms distributed dividend 2001-2005 (N=250)				
			Trading size group		
DY group	Low	Low	Median	High	Total
		-0.1985 (-1.6751)	0.1348 (0.6287)	0.1405 (0.6656)	0.1030 (1.0063)
	Median	0.2831 (0.8852)	-0.0083 (-0.0523)	0.3223 (2.0105**)	0.6947 (2.0903**)
		High	0.6641 (2.0266**)	0.7919 (1.7624*)	0.2560 (1.4499)

The table presents average abnormal volumes ( $AV_S$ ) with respective tests of significance in parentheses, for the time interval  $[-1,0]$  around the ex-dividend day ( $t = 0$ ) over the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method, since the sample is ranked according to Dividend Yield and to Transaction Cost as be proxied by Trading Size (normal trading volume).

DY: is the dividend yield measured as the ratio  $\frac{D}{P_{cum}}$

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

Table 22: Average abnormal returns for the time interval [-3,-1] around the ex-dividend day ( $t=0$ ) for the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method and ranking of each subsample firstly according to DY and after according to Trading sizes

Firms distributed dividend 1996-2000 (N=250)

		Trading size group			
DY group	Low	Low	Median	High	Total
		0.2305 (1.1563)	0.1996 (0.8128)	1.1902 (2.0254**)	0.5319 (2.4152**)
	Median	0.5849 (1.1549)	0.2438 (1.0890)	0.6565 (2.9640***)	0.4951 (2.5200**)
		High	-0.0340 (-0.2561)	-0.1669 (-1.6709*)	0.7442 (2.7354***)
	High				0.1727 1.5473

Firms distributed dividend 2001-2005 (N=250)

		Trading size group			
DY group	Low	Low	Median	High	Total
		-0.0484 (-0.3123)	-0.0288 (-0.1979)	0.3960 (1.7467*)	0.1030 (1.0063)
	Median	0.9367 (1.8401*)	0.7756 (0.8784)	0.3720 (2.1854**)	0.6947 (2.0903**)
		High	0.5141 (2.2272**)	0.5853 (1.7450*)	0.1204 (0.8345)
	High				0.4109 (2.9052***)

The table presents average abnormal volumes ( $AV_S$ ) with respective tests of significance in parentheses, for the time interval [-3,-1] around the ex-dividend day ( $t = 0$ ) over the periods "before" (1996 to 2000) and "after" (2001 to 2005) the change of the ex-dividend day price adjustment method, since the sample is ranked according to Dividend Yield and to Transaction Cost as be proxied by Trading Size (normal trading volume).

DY: is the dividend yield measured as the ratio  $\frac{D}{P_{cum}}$

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

price price ratios and the lower the abnormal returns. These findings support the presence of a clientele effect, firstly proposed by Miller and Modigliani (1961), where investors in low tax brackets hold high dividend yield stocks. Another reason for the smaller ex-day price drop for low dividend yield stocks is that these stocks may be ignored by traders due to relatively high transaction costs.

In order to be examined the relationship between the raw price ratios, abnormal returns and dividend yields in the Athens Stock Exchange (ASE) the total sample (500 ex-dividend days) is sorted into five Groups of equal size based on the dividend yield. For each Group the average and median values of, dividend yield, ex-day abnormal returns and raw price ratios is reported. Table 23 reports the relative values. Although a clear pattern cannot be found, there is no evidence that the abnormal returns decline or the raw price ratio increases for higher yield stocks.

Regarding the first three Groups, the median raw price ratio increases as the dividend yield increases but in the fourth and fifth it declines again. The highest value of median raw price ratio is reported in Group 3 with a value of 70.7610%, instead of Group 5 where the median value is 66.7939%. The median abnormal returns increase monotonically as the dividend yield increases, which is in sharp contrast to evidence from other markets. Group 5 has the highest median dividend yield of 6.7917% and should attract a lot of attention from the ex-day traders. However, the median ex-day abnormal return for this Group is a sizeable 2.3987%, which is statistically significant at the 1% level of significance. The median ex-day return for the other four yield Groups does not exceed 1.2325%.

The same conclusions can be drawn when the mean values are examined. The mean RPR decreases in the second Group and it increases in the other three Groups. The mean abnormal returns exhibit the same pattern as the median. Despite the fact that the fifth Group has the highest mean dividend yield of 8.4948% and should attract a lot of investors, the mean RPR is 61.7629% and the mean abnormal return is 4.0081% (extremely high with respect to the other four Groups and statistically significant at the 1% level of significance).

Table 23: Raw price ratios (RPR) and abnormal returns (AR) sorted by dividend yield into five groups for the total periods (1996-2005)

	N	Mean	Median
Group 1	100		
Dividend Yield %		0.8401	0.8999
RPR%		42.7544	56.7330
AR %		0.3523	0.4372
(t-statistic) / [pvalue]		(1.1509)	[0.4161]
Group 2	100		
Dividend Yield %		1.6697	1.6325
RPR%		25.1083	68.3334
AR %		1.1830	0.5123
(t-statistic) / [pvalue]		(3.8249***)	[0.0005]
Group 3	100		
Dividend Yield %		2.6780	2.6562
RPR%		56.8117	70.7610
AR %		1.4288	1.1197
(t-statistic) / [pvalue]		(5.3585***)	[0.0000]
Group 4	100		
Dividend Yield %		4.0051	3.9607
RPR%		60.8890	67.4631
AR %		1.6182	1.2325
(t-statistic) / [pvalue]		(5.8902***)	[0.0000]
Group 5	100		
Dividend Yield %		8.4948	6.7927
RPR%		61.7629	66.7939
AR %		4.0081	2.3987
(t-statistic) / [pvalue]		(7.0539***)	[0.0000]

This table presents the total sample divided from five groups (of equal size N=100) based on the dividend yield (DY) for the total period (1996-2005). The mean and median values of raw price ratio and of abnormal returns are reported for each group as well as the respective tests of significance for the abnormal returns. If  $P_{-1}$  denotes the stock price (in euro) on the last cum day,  $P_0$  the price of the stock on the ex-dividend day, and  $D$  the dividend per share (in euro):

$DY$ : is the dividend yield measured as the ratio  $\frac{D}{P_{-1}}$

$RPR$ : is the raw price ratio, which is calculated as  $\frac{P_0 - P_{-1}}{D}$

$AR$ : is the abnormal returns, which are calculated using the market adjusted model

The t-statistics for mean abnormal returns are in parentheses and p-values for median abnormal returns are in brackets.

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

The relationship between the raw price ratios, abnormal returns and dividend yields in the ASE, from the effect of the introduction of the ex-dividend day price adjustment method, is also investigated in this subsection. For this reason, the sample is further sorted into five Groups of equal size based on the dividend yield, “before” and “after” the change of the ex-dividend price day adjustment method, and the associated values of ex-day abnormal returns and raw price ratios are reported. Table 24 presents mean and median abnormal returns and raw price ratios by dividend yield for the two periods.

For the period “before” the change of the adjustment method, in Table 24, similar to previous studies (Kadapakkam and Martinez (2008)), the results do not report a clear pattern since there is no evidence that the raw price ratio increases or that the abnormal returns decline as the dividend yield increases. Group 5, has the highest mean dividend yield of 10.9545% and should attract attention from ex-day traders, but the ex-day abnormal return for this Group is a sizeable 6.6847%, while the mean ex-day abnormal returns of the other four dividend yield groups is lower than 2%. In the first three Groups, the raw price ratio increases with the dividend yield and as dividend yields become higher (Group 4 and 5) the raw price ratio decreases. The median abnormal returns and raw price ratios, also, fluctuate as the dividend yield increases. Thus, for the period “before” the introduction of the ex-day adjustment method, there is no clear clientele effect, raw price ratios and abnormal returns are not affected by the dividend yields. An additional indication that the results of this study are in contrast to those of the US studies that support the clientele effect is due to different taxation between dividends and capital gains.

For the period “after”, in Table 24, under the change of the ex-dividend day price adjustment method, it is observed that as the dividend yield increases the mean abnormal returns fluctuate, while the mean raw price ratios increase as dividend yields increase after Group 3. The median abnormal returns increase as the dividend yield increases and drops sharply in the Group with the highest dividend yield (Group 5). The median raw price ratios have no clear pattern as dividend yields increase. Again, the Group with the highest dividend yield (Group 5) should attract the most attention, but the ex-day

abnormal return for this Group is 1.2679% and the abnormal returns of the other four dividend yield groups are between 0.7413% and 1.4758%. Thus, for the period “after”, under the change of the ex-dividend day price adjustment method it is observable that the two highest dividend yield groups have lower abnormal returns and higher mean raw price ratios compared to the period “before”. This cannot be attributed to a clientele effect and confirms the previous results. Thus, the change of the adjustment method affects the ex-dividend day returns in the ASE and confirms the hypothesis that the new adjustment method improves market efficiency.

#### 4.5.5 Cross sectional test

Since there is not any clear relationship between dividend yield and abnormal returns, the cross sectional relationship of abnormal returns after controlling for other variables is also analyzed in this section. More specific, it is examined the effect of transaction cost and risk on ex-dividend day stock price behaviour. Kalay (1982) argues that if the price drop does not equal the dividend then short term-traders, who face no differential taxes on dividends versus capital gains, could make abnormal returns by receiving a risk free dividend. Taking into account this effect, this study follows previous research (e.g. Karpoff and Walking, 1988; Kadapakkam, 2000; Yahyaee et al., 2008 and Dasilas, 2009) and includes as a proxy for the transaction costs the inverse of stock price on the last cum-day ( $\frac{1}{P_{cum}}$ ). If transaction costs were inhibiting the arbitrage of positive ex-day returns, a significant positive coefficient is expected to be found for this variable.

Another factor that might impede dividend capture activities on ex-day is risk. Because the ex-dividend stock price is not known, the price drop might be bigger or smaller than the dividend amount, as a consequence the short-term traders cannot receive a riskless dividend. So, ex-dividend day returns must include a risk premium in order to compensate traders for the risk sharing (Michaely and Vila, 1996). In order to take into account this effect, a risk measure similar to that used in previous studies (e.g. Michaely and Vila, 1996; Kadapakkam, 2000; Yahyaee et al., 2008) is also used in this study.

Table 24: Raw price ratios (RPR) and abnormal returns (AR) sorted by dividend yield into five groups for the periods "before" (1996-2000) and "after" (2001-2005) the change of the ex-dividend day price adjustment method

		“Before”		“After”	
	N	Period 1996-2000 N=250	Period 2001-2005 N=250	Mean	Median
		Mean	Median		
Group 1	50				
Dividend Yield %		0.6915	0.7367	1.0533	1.1735
RPR%		6.4150	95.3184	59.5780	23.8095
AR %		0.2230	0.1272	0.7413	0.6259
(t-statistic) / [pvalue]		(0.4930)	[0.8469]	(2.1316**)	[0.0258]
Group 2	50				
Dividend Yield %		1.3885	1.3833	2.0167	2.0414
RPR%		12.0824	40.4760	40.4578	75.0449
AR %		1.0215	0.4272	1.2445	0.7153
(t-statistic) / [pvalue]		(2.0464**)	[0.1616]	(3.0988***)	[0.0031]
Group 3	50				
Dividend Yield %		2.4057	2.3725	2.8272	2.7962
RPR%		69.0556	80.2112	66.1874	59.2892
AR %		1.4332	1.3183	1.1655	1.1197
(t-statistic) / [pvalue]		(3.2176***)	[0.0022]	(3.8957***)	[0.0002]
Group 4	50				
Dividend Yield %		4.1128	3.9619	3.9332	3.9127
RPR%		48.4795	55.1861	68.3685	72.9021
AR %		1.9236	1.2983	1.4758	1.2103
(t-statistic) / [pvalue]		(4.4014***)	[0.0000]	(3.8933***)	[0.0001]
Group 5	50				
Dividend Yield %		10.9545	9.1573	5.9919	5.8512
RPR%		46.9459	49.7617	77.0830	85.4466
AR %		6.6847	5.4664	1.2679	0.5374
(t-statistic) / [pvalue]		(6.9136***)	[0.0000]	(4.5614***)	[0.0002]

This table presents the total sample divided from five groups (of equal size N=50) based on the dividend yield (DY) for the periods “before” (1996-2000) and “after” (2001-2005) the change of the ex-dividend day price adjustment method.. The mean and median values of raw price ratios and of abnormal returns are reported for each group as well as the respective tests of significance for the abnormal returns. If  $P_{-1}$  denotes the stock price (in euro) on the last cum day,  $P_0$  the price of the stock on the ex-dividend day, and  $D$  the dividend per share (in euro):

$DY$ : is the dividend yield measured as the ratio  $\frac{D}{P_{-1}}$

$RPR$ : is the raw price ratio, which is calculated as  $\frac{P_0 - P_{-1}}{D}$

$AR$ : is the abnormal returns, which are calculated using the market adjusted model

The t-statistics for mean abnormal returns are in parentheses and p-values for median abnormal returns are in brackets.

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

More specific, this study uses the measure of  $\frac{\sigma_{ei}}{\sigma_{mi}}$  as the standard deviation of the residuals from a market model regression of daily returns for the dividend paying stocks on daily market returns divided by the standard deviation of daily market returns. Since a short-term trader has to be compensated for taking extra risk, it is expected that a positive relationship between the ex-day abnormal returns and our risk proxy may exist.

Finally, this section examines whether abnormal returns are affected by the institutional change of the share adjustment process. For that issue to be addressed, a dummy variable is created based on the day of the enforcement (30/03/2001). A negative value of this variable would suggest that the abnormal return is lower after the enforcement, meaning that the Decision improves the ex-day anomaly.

Thus, abnormal returns  $AR$  are regressed on the following independent variables: the dividend yield of stock  $i$  ( $DY_i$ ). The transaction cost  $\left(\frac{1}{P_{cumi}}\right)$ , which is calculated as the inverse of stock's  $i$  closing price  $P_{cumi}$ , where the last cum dividend day is used as a proxy for transaction costs. Risk  $\left(\frac{\sigma_{ei}}{\sigma_{mi}}\right)$  is the standard deviation of the residuals from estimating the market model, normalized by market risk (a proxy for idiosyncratic risk). The variable adjustment method ( $AM$ ) is a dummy variable for the ex-dividend day price adjustment method which takes the value of zero (0) for the period "before" the new adjustment method (1996-2000) and one (1) for the period "after" (2001-2005).

The regression model is as follows:

$$AR_i = a_0 + a_1(DY_i) + a_2\left(\frac{1}{P_{cumi}}\right) + a_3\left(\frac{\sigma_{ei}}{\sigma_{mi}}\right) + a_4AM + e_i \quad (50)$$

The results that are reported in Table 25 show that the coefficient of dividend yield is positive and statistically significant at the 1% level of significance. That result supports the presence of tax-effect or short-term trading and it is consistent with the predictions of other studies. (e.g. Dasilas, 2009; Kadapakkam, 2000 and Frank and Jagannathan, 1998). On the other

Table 25: Cross-sectional regression analysis of abnormal returns on the ex-dividend day for the total periods (1996-2005)

$$AR_i = a_0 + a_1(DY_i) + a_2\left(\frac{1}{P_{cum_i}}\right) + a_3\left(\frac{\sigma_{ei}}{\sigma_{mi}}\right) + a_4AM + e_i$$

$a_0$	$DY_i$	$\frac{1}{P_{cum_i}}$	$\frac{\sigma_{ei}}{\sigma_{mi}}$	$AM$	Adjusted $R^2$
-0.0033 (-0.8407)	0.6176 (13.0690***)	0.0029 (0.7987)	0.0003 (0.1275)	-0.0060 (-2.0824**)	0.3490

The table shows regression results explaining the ex-dividend day abnormal return ( $AR$ ).

The independent variables are:

$AR_i$ : is the abnormal return as estimated previously.

$DY_i$ : is the dividend yield for stock  $i$ .

$\frac{1}{P_{cum_i}}$ : is the inverse of stock's  $i$  closing price on the last cum dividend day as a proxy for transaction costs.

$\frac{\sigma_{ei}}{\sigma_{mi}}$ : is the standard deviation of the residuals from estimating the market model, normalized by market risk (a proxy for idiosyncratic risk).

$AM$ : is a dummy variable for the ex-dividend day price adjustment method, which takes on a value of zero (0) for the period "before" the new adjustment method (1996-2000) and one (1) for the period "after" (2001-2005).

The  $t$ -statistics are in parentheses.

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

hand neither the coefficient of transaction cost nor of the risk is statistically significant at any conventional level of significance with  $t$ -statistics (0.7987) and (0.1275) respectively.

These results indicate that, from one hand the transaction costs do not prevent arbitrage activity and risk considerations do not impede arbitrage activity from the other. That is inconsistent with the empirical results of Dasilas (2009) for the Greek stock market and indicate that neither the transaction costs nor the trading risk affect abnormal returns on the ex-dividend day, since they do not provide profitable opportunities for arbitrageurs. The fact that the coefficient of the dummy variable is negative with a value of -0.0060 and statistically significant at the 1% level of significance, supports the previous results that abnormal returns are reduced during the period "after" the introduction of the new ex-dividend day price adjustment method

in the ASE, confirming the improvement of the market pricing.

#### 4.5.6 Illiquidity test

Finally, this study analyzes whether liquidity affects mean and median raw price ratios as well as mean and median abnormal returns. Taking into consideration the fact that data for bid ask spread<sup>46</sup>, transaction-by-transaction market impact<sup>47</sup>, probability of information-based trading<sup>48</sup> and other intra-day and microstructure data are not available in the Greek stock market and for the sample period under question so as to be calculated a measure of liquidity, the current study uses the illiquidity measure proposed by Amihud (2002) instead. In order for this measure to be calculated, it is necessary for daily data on returns and volume to be obtained.

Stock illiquidity is defined as the average ratio of the daily absolute return to the trading volume in euros, (value of trade (euros)) on that day and it is given from the formula:

$$illiqt = \frac{|R_{it}|}{VOL_{it}} \quad (51)$$

where:  $R_{it}$  is the return on stock  $i$  on day  $t$  and  $VOL_{it}$  is the respective daily volume in euros.

The illiquidity measure calculates the absolute (percentage) price change per euro or daily trading volume or the order flow necessary to induce prices to rise or fall by one euro. In case of the ex-dividend stock price drop, the illiquidity ratio can be a significant impediment affecting the ex-dividend stock price behaviour. The illiquidity ratio can also be interpreted as a measure of consensus belief among investors about new information, and in the current study about the ex-dividend stock price drop. If investors agree about the ex-dividend price drop, the stock price changes without trading, while disagreement among investors induces increase in trading volume.

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<sup>46</sup>See, Amihud and Mendelson (1986), Eleswarapu (1997).

<sup>47</sup>See, Kyle (1985), Brennan and Subrahmanyam (1996).

<sup>48</sup>See, Easley et al. (1999).

In order to be examined whether illiquidity affects ex-dividend day stock price behaviour in the Athens Stock Exchange (ASE), the relationship between the raw price ratios, abnormal returns and illiquidity is examined by sorting the total sample (500 ex-dividend days) into five Groups of equal size in a descending order, from high to low, based on the illiquidity ratio. Reported for each Group is the average and median values of the ex-day abnormal returns and the raw price ratios. Table 26 presents the results and it can be seen that as illiquidity declines the median raw price ratio increases monotonically. Indeed, in high illiquidity Group (low liquidity), Group 1, the median RPR is 25.0549%, whereas in Group 3 the median RPR is 70.7143%, and in the lowest illiquidity Group (high liquidity), Group 5, the respective median value is 100,0000%. This result means that illiquidity (liquidity) affects the stock price behaviour in Athens Stock Exchange. More precisely, in the lowest illiquidity Group, the price drop is equal to the dividend amount. As a consequence in that Group, the ex-dividend price anomaly is cancelled out. The same increase of mean values of RPR as illiquidity declines, except the Group 4, is noticeable from the results of Table 26.

A similar interested conclusion can be drawn if the relationship of abnormal return and illiquidity ratio is examined in Table 26. As illiquidity declines from Group 1 to Group 5, the median abnormal returns also decline. As a result, a positive relationship between abnormal returns and illiquidity is presented. Indeed, the median average abnormal returns decline from 2.8132% in Group 1 to 1.4377% in Group 2, to 0.8710% in Group 3, to 0.6211% in Group 4 and to 0.3548% in Group 5. Similar is the direction of the mean abnormal returns, from 3.3377% in Group 1, the abnormal returns decline to 0.4484% in Group 5.

Moreover, the relationship between the raw price ratios, abnormal returns and illiquidity in the ASE, before and after the introduction of the ex-dividend day price adjustment method, is examined. In this case, the sample is sorted into five Groups of equal size based on the illiquidity ratio and the associated values of ex-day abnormal returns and raw price ratios are reported. Table 27 presents the mean and median abnormal returns as well

Table 26: Raw price ratios (RPR) and abnormal returns (AR) for five groups of shares based on the share's illiquidity ratio (illiq) for the total periods (1996-2005)

	N	Mean	Median
Group 1	100		
Highest illiquidity			
RPR%		32.1944	25.0549
AR %		3.3377	2.8132
(t-statistic) / [pvalue]		(6.4800***)	[0.0000]
Group 2	100		
RPR%		39.6149	57.9832
AR %		1.8287	1.4377
(t-statistic) / [pvalue]		(5.4859***)	[0.0000]
Group 3	100		
RPR%		68.9317	70.7143
AR %		1.3683	0.8710
(t-statistic) / [pvalue]		(3.7613***)	[0.0004]
Group 4	100		
RPR%		28.2451	85.7668
AR %		1.0896	0.6211
(t-statistic) / [pvalue]		(3.1378***)	[0.0017]
Group 5	100		
Lowest illiquidity			
RPR%		82.5925	100.0000
AR %		0.4484	0.3548
(t-statistic) / [pvalue]		(2.1046**)	[0.0367]

The table presents the total sample divided into five groups of shares (of equal size) based on the share's illiquidity ratio (illiq). For each illiquidity group mean and median raw price ratios ( $RPR$ ) and abnormal returns ( $AR$ ) with their respective test of significance are calculated. Results reported concern the total period (1996-2005). Following Amihud (2002) Illiquidity (Illiq) of each share is computed as:  $illiq_t = \frac{|R_{it}|}{VOL_{it}}$  where:  $R_{it}$  is the return on stock  $i$  on day  $t$  and  $VOL_{it}$  is the respective daily volume in euro.  $RPR$  is the raw price ratio, which is calculated as  $\frac{P_0 - P_{-1}}{D}$  and  $AR$  is the abnormal returns, which are calculated using the market adjusted model

The t-statistics for mean abnormal returns are in parentheses and p-values for median abnormal returns are in brackets.

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

as the raw price ratios according to illiquidity ratio for the periods “before” and “after” the change of the ex-dividend price day adjustment method.

For the period “before”, in Table 27, the change of the adjustment method, a clear positive pattern between mean and median abnormal returns and illiquidity ratio is found, similar to the analysis of the total sample presented in Table 26. As illiquidity declines abnormal returns also decline close to zero. More specific, in the Group with the highest illiquidity, Group 1, the mean and median abnormal return is 5.5241% and 4.5599% respectively, both being statistically significant. But, in the Group with the lowest illiquidity, Group 5, which also attracts the attention of the ex-day traders, the ex-day mean (median) abnormal return is close to zero with a value of 0.7664% (0.6650%).

The relationship of RPR is negative with respect to illiquidity ratio and the median values of raw price ratio follow a monotonically negative relationship based to illiquidity. From 13.6633% in Group 1, the median value of raw price ratio becomes 84.8783% in Group 5. On the other hand there is not a clear pattern between mean values of raw price ratio and illiquidity ratio. The highest mean value, 80.2220%, is reported in Group 3, whereas in Group 5 the mean raw price ratio is 60.0272%. Thus, “before” the introduction of the ex-day adjustment method, it is obvious that illiquidity affects stock price behaviour on the ex-dividend day.

Similar is the movement of abnormal returns and raw price ratios for the period “after”, in Table 27, the change of the ex-dividend day price adjustment method. As illiquidity decreases the abnormal returns gets close to zero, while the raw price ratios gets close to 1. Very important is the behaviour of stock prices on Group 5, the Group with the lowest illiquidity. In this Group, the median abnormal return is 0.3184% but not statistically significant different from zero and the median value of raw price ratio is 100.0000%. This means that the price drop, in this Group, equals the dividend amount absorbing any profitable short term trading on the ex-dividend day.

Similar is the movement of mean abnormal returns and mean raw price ratios. In Group 5, the mean abnormal return is 0.3435% and the mean raw price ratio is 84.9911%, whereas the values in Group 1 are 1.3644% and 60.1814% respectively. Thus, the period “after” the change of the ex-dividend

day price adjustment method it is observable that almost all the Groups have lower abnormal returns and higher mean raw price ratios compared to the period “before”. Thus, the change of the adjustment method affects the ex-dividend day returns in the ASE and confirms the hypothesis of this study that the new adjustment method improves market efficiency.

In summary, the above results indicate that liquidity explanations are the dominant cause of ex-day premium deviating from one and the ex-day abnormal returns deviating from zero. In case where the liquidity effects are taken into account, at the margin, the price drop on the ex-dividend day equals the dividend amount.

## 4.6 Conclusion

This study analyzes the ex-dividend stock price behaviour in the Athens Stock exchange. The Greek market is chosen due to peculiarities of its institutional framework. The absence of differential taxation between dividend and capital gains, since neither dividend nor capital gains are taxed, is one of the basic characteristics of the Greek environment. An additional distinctiveness is the mandatory distribution of dividend from profitable firms according to law 2190/1920 along with the fact that dividends are distributed annually. The very small tick size of stocks as well as that dividends are always integer multiples of tick size adds another important factor in the examination of stock price behavior in the Athens Stock Exchange.

Despite the facts that in a market like the Greek one would expect that the stock prices on the ex-dividend day should drop by an amount equal to the dividend, the empirical evidence of this study shows that the price drop is smaller than the dividend. More specific, the average raw price ratio (RPR) is 0.4947 and the market adjusted price ratio is 0.5386. Both ratios are statistically significant different from their theoretical values of 1.00 at any conventional level of significance. Similarly, there is a positive abnormal return on the ex-dividend day 1.7181 %, which is statistically significant at 1% level.

Table 27: Raw price ratios (RPR) and abnormal returns (AR) for five groups of shares based on the share's illiquidity ratio (illiq) for the periods "before" (1996-2000) and "after" (2001-2005) the change of the ex-dividend day price adjustment method

	N	“Before”		“After”	
		Period 1996-2000 N=250	Period 2001-2005 N=250	Mean	Median
Group 1	50				
Highest illiquidity					
RPR%		3.3635	13.6333	60.1814	39.0000
AR %		5.5241	4.5599	1.3644	2.0714
(t-statistic) / [pvalue]		(6.2484***)	[0.0000]	(2.9860***)	[0.0025]
Group 2	50				
RPR%		13.3940	46.7290	64.2654	66.6667
AR %		2.1903	1.4451	1.5103	1.3049
(t-statistic) / [pvalue]		(3.7490***)	[0.0006]	(3.8996***)	[0.0001]
Group 3	50				
RPR%		80.2220	76.6284	42.6611	60.0000
AR %		1.7500	0.9639	1.2577	0.9761
(t-statistic) / [pvalue]		(2.5365**)	[0.0484]	(4.4522***)	[0.0003]
Group 4	50				
RPR%		11.5522	77.4648	65.9364	88.8889
AR %		0.8921	0.3162	1.1481	0.8461
(t-statistic) / [pvalue]		(1.3475)	[0.3712]	(3.4058***)	[0.0008]
Group 5	50				
Lowest illiquidity					
RPR%		60.0272	84.8783	84.9911	100.0000
AR %		0.7654	0.6650	0.3435	0.3184
(t-statistic) / [pvalue]		(2.1241*)	[0.0956]	(1.8132*)	[0.0536]

The table presents the total sample divided into five groups of shares (of equal size) based on the share's illiquidity ratio (illiq). For each illiquidity group mean and median raw price ratios (*RPR*) and abnormal returns (*AR*) with their respective test of significance are calculated. Results reported concern the periods “before” (1996-2000) and “after” (2001-2005) the change of the ex-dividend day price adjustment method. Following Amihud (2002) Illiquidity (Illiq) of each share is computed as:  $illiq_t = \frac{|R_{it}|}{VOL_{it}}$  where:  $R_{it}$  is the return on stock i on day t and  $VOL_{it}$  is the respective daily volume in euro. *RPR* is the raw price ratio, which is calculated as  $\frac{P_0 - P_{-1}}{D}$  and *AR* is the abnormal returns, which are calculated using the market adjusted model

The t-statistics for mean abnormal returns are in parentheses and p-values for median abnormal returns are in brackets.

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

Moreover, the examination of the abnormal returns as well as the abnormal volumes around the ex-dividend day, do not reveal evidence of short-term trading, contrary to the results of Dasilas (2009). Both variables are not affected by commonly used measures of transaction costs, such as the inverse of price on cum day and trading volume. Furthermore, the cross sectional analysis of abnormal returns to dividend yield, after controlling for other variables such as the idiosyncratic risk and transaction costs, reveals that none of them can affect abnormal returns.

These findings are consistent with the results of other studies, with no taxes on dividends or on capital gains, like the Greek case study. Yahyae et al. (2008) who use a unique data set from Oman and Frank and Frank and Jagannathan (1998) who examine the stock price behavior on Hong-Kong, find that the price drop is less than the dividend paid. Moreover, the results of this study is in line with previous studies for the Greek stock market by Travlos and Milonas (2001) and Dasilas (2009).

This study also analyzes the effect of the ASE switching to the new mechanism that adjust the ex-dividend day stock prices. Under the new method, market transactions determine the opening price on the ex-dividend day. A ten year period (1996-2005) is investigated, by dividing it into two sub-periods. The first sub-period "before" (1996-2000) the introduction of the new ex-dividend day price adjustment method and the second sub-period "after" (2001-2005) the enforcement of the new method. The results of both periods are compared and reveal that the average premium from 36.60% before the change, becomes 62.33% after the enforcement of the new adjustment mechanism. Proportional is also the reduction in average abnormal return, going from 2.2570% to 1.1790%. The abnormal volume remains statistically significant in both periods ("before" and "after"), however the volume is slightly smaller after the new adjustment method. The results also suggest that the less legislative intervention via the adjustment method the more improved the pricing by the market, which is an indication of improved efficiency.

It is also shown that the microstructure impediments, such as illiquidity, could be a dominant source of the ex-dividend price behaviour. When the

sample is ranked in a descending order in five equal Groups according to illiquidity ratio, as proposed by Amihud (2002), it is revealed that illiquidity might be the main reason of the ex-day premium deviating from one and the ex-day abnormal returns deviating from zero. Indeed, for the “after” period, the median raw price ratio for low illiquidity (high liquid stock) is 100% and the abnormal return is 0.0032%, statistically significant at the 1% level of significance. In this Group the price drop on the ex-dividend day equals the dividend amount and there is not any profitable opportunities for short term traders, since the abnormal return is close to zero.

In sum, the main contribution of this study is that the ex-dividend day stock price behaviour cannot be attributed to tax effects, despite the fact that the ex-dividend anomaly is present, since the differential taxation of dividend and capital gains is absent. Moreover, the empirical evidences of this study do not support the short term hypothesis, as proposed from Dasilas (2009) for the Greek market, since short-term trading is not present in the Greek environment. In this sense, this study contribute to the literature by suggesting that the institutional change has improved efficiency and that illiquidity proved to be a significant impediment on the ex-dividend price adjustment in the absent of taxes and other microstructure impediments such as bid-ask spread, limit order adjustment mechanism, market maker, tick size and price discreteness.

## 5 Dividend increase announcements in a different institutional setting: The case of Greece

### 5.1 Introduction

Following the influencing work of Lintner (1956) there was evidence that the dividend payment decision is important for management and possibly not as trivial for firm value, as suggested by Miller and Modigliani (1958, 1961). Recently, DeAngelo and DeAngelo (2006, 2007) and Ross (2005) argued that even in frictionless markets dividend policy is as important as investment policy. Even though this line of thought is influential, the approach of this study is towards the asymmetric information stride of modern corporate finance. For example, Brav et al. (2005) present empirical evidence, based on an extensive questionnaire, that managers believe that dividend payouts convey information about the mean and/or riskiness of future earnings but they do not consciously use dividends as a costly signal. This information could assist in identifying among the different strands of dividend signaling models and hypotheses, the ones that have the best potential in fitting the data and have any chance in predicting actual dividend behaviour.

In relevant literature, several hypotheses have been derived to explain these effects. The dividend signaling hypothesis, suggests that there is information asymmetry about the firm's prospects between management and outside investors (the former know more) and dividends may be used to reduce these asymmetries. For instance, Bhattacharya (1979) and John and Williams (1985) imply that the dividend decision encompasses a costly signal due to external financing and heavier dividend taxation correspondingly, while Miller and Rock (1985) in essence suggest that adverse selection dissipation is related to the distortion in the firm's investment decision. All three of these seminal papers on dividend signaling are consistent with the deliberate use of dividends as signals of future earnings prospects<sup>49</sup>.

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<sup>49</sup>The first two require however, either concurrent resorting to external financing or double taxing dividends. One or both of these conditions may fail to occur in a specific market. Only the last of these models could be also consistent with the absence of any

Thus, an unexpected dividend increase (decrease) signals positive (negative) firm prospects to investors, a positive relation between firm prospects and dividend changes<sup>50</sup>. Also, this hypothesis explains why management is reluctant to alter its dividend payments. If management increases its dividend, investors will expect the firm to maintain this higher level, while a dividend decrease signals that management is pessimistic of the firm's earnings prospects, (i.e. see Asquith and Mullins, 1986).

Easterbrook (1984) argues that an increase in dividends signifies value increasing discipline on the part of the management. Jensen (1986) suggests that when managers (agents) have excess cash flows and insufficient investment opportunities (bad news), they will distribute the excess cash flow to shareholders (owners) to reduce agency conflicts between the shareholders and managers, (free cash flow hypothesis)<sup>51</sup>. Extensions of these approaches are the monitoring effects described in Shleifer and Vishny (1986), Fluck (1999) and Allen, Bernardo and Welch (2000), where major stockholders or outside stockholders receive increased dividends in the process of enforcing value maximizing investment decisions. In an asymmetric information context these theories compete with signaling models for the prediction of the positive abnormal returns. Empirical evidence has provided an abundance of potentially conflicting results surrounding the dividend announcement.

In addition, LaPorta et al (2000), introduce investor protection and its variation between common law (high protection) and civil law (low protec-

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signaling motive. In a sources and uses of funds sense, higher than expected dividends signify either higher future earnings (good news) or insufficient good investments (bad news).

<sup>50</sup>For the signaling effect of dividend changes see: Aharony and Swary, 1980; Asquith and Mullins, 1983; Easterbrook, 1984; Kalay and Loewenstein, 1985; Healy and Palepu, 1988; Benartzi et al., 1997; Nissim and Ziv, 2001; Brav et al., 2005; Yilmaz and Selcuk, 2010; Al-Yahyaee et al., 2011; and Dasilas and Leventis, 2011.

<sup>51</sup>Free cash flow is cash flow in excess of that required to fund all projects that have positive net present values when discounted at the relevant cost of capital. Conflicts of interest between shareholders and managers over dividends may be serious when the firm generates substantial free cash flow. Once the decision to distribute free cash flow is made, the choice of payment method (repurchase or cash) depends on the firm's previous stock performance, excess cash flow, leverage, and insider ownership at the time of the repurchase. However note that, in the ASE firms are not allowed to repurchase shares in order to channel excess cash to their shareholders (in Greece share repurchases are carried out through the open market).

tion) countries to investigate how the agency theory of dividends best describes dividend payouts around the world. Because "a bird in the bush can fly away", outside investors force higher dividends in high protection countries especially from firms with low growth potential. As with costly signaling, higher dividends reducing agency costs should increase their value, *ceteris paribus*. In low protection countries however, the growth distinction should not produce the same result (flight is easier; outside investors try to get whatever they can). Alternatively, dividends could be viewed as a substitute for legal protection. In this context growth firms pay higher dividends to boost reputation and hence their investment funding prospects.

Alternatively, Grullon et al. (2002), propose the "maturity hypothesis" according to which firms that have grown to maturity may face less systematic risk ("good" news) but also less profitable investment opportunities ("bad" news). It then becomes an empirical issue as to which effect is dominant. If good news dominates, then one can conclude favorably for the intentional signaling hypothesis. In this context more possibilities are open for theoretical analysis and empirical investigation in specific markets. Actually, the second possibility prompts to further analysis of the kind of information involuntarily revealed from an unanticipated dividend change depending on the type of asymmetries a market exhibits. Grullon et al., (2002), find little or no evidence that dividend changes predict abnormal variations in earnings.

From the above it is clear that the information that might be revealed through dividend announcements, which may also depend on various asymmetries and characteristics that a market exhibits, is very diversified. Thus, this study investigates the type of information released via dividend increase announcements in the Greek capital market rendering this analysis potentially useful.

The institutional setting of the Greek capital market for the period investigated is different from that of most other countries. The special circumstances of Greek environment make this study a promising laboratory. A basic differentiation is taxation since dividends are taxed only at the company level while at the personal level incomes from dividends and capital gains are

not taxed<sup>52</sup>. However, other market characteristics may have a more significant effect on stock prices, when dividend increases are announced (specifically: minimum mandatory dividends, and corporate control concentration (low ownership diffusion of firms)).

Greece is a civil law country with a required minimum dividend payment. In Greece, it is mandatory for profitable firms to distribute at least a certain fixed percentage of their earnings in the form of cash dividends (minimum mandatory dividends (MMD)). During the investigation period, 2000-2004, Greek firms are obligated to distribute cash dividends equal to at least one of the following: (a) 6% of their common equity (minimum mandatory dividend type 1 (MMD1)), or (b) 35% of the net income minus tactical reserves (minimum mandatory dividend type 2 (MMD2)), whichever MMD is higher<sup>53</sup>.

In this study, dividend increase announcements equal to the MMD are denoted as “expected” and dividend increase announcements higher than the MMD are denoted as “unexpected”. Additionally in this study a more strict definition is implemented in order to distinguish anticipated versus unanticipated dividend increase announcements. Namely, an increase dividend announcement is categorized as “historically related average unexpected” (“hra-unexpected”), if the announced dividend in year  $t$  is both higher than the MMD and higher than the average dividend of the previous three years (from  $t - 1$  to  $t - 3$ ) plus one standard deviation of the average dividend of the three past years. Profitable firms that choose voluntarily to announce “unexpected” or “hra- unexpected” dividend increases, obviously, have capital needs smaller than their earnings and investors may assume that the firm will maintain this higher dividend level in the future and that earnings will

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<sup>52</sup>Other countries where dividend and capital gains are not taxed are: Hong Kong (Kadapakkam, 2000); and Oman (Al-Yahyaee et al., 2008).

<sup>53</sup>If MMD2 is greater than MMD1, the firm may decide to distribute the MMD1 only if the general assembly of shareholders has a 65% majority, and they also agree to capitalize the difference between the two MMDs (MMD2 minus MMD1) in the balance sheet, and at a later date distribute it in the form of a stock dividend to entitled shareholders (see Laws: 2190 of 1920 (article 45/2B), A.N.148 of 1967 (article 3), and 876 of 1979 (article 1)). Also, the firm may avoid dividends if the general assembly has a 80% majority, and the decision is followed by a stock dividend as before. Today firms are obligated to distribute the MMD2.

be repeated, which is considered as “good” news<sup>54</sup>. These cases usually are well promoted by the companies and are welcomed by investors, thus, a positive price reaction is observed in the ASE accordingly (Dasilas and Leventis (2011)) (“signaling hypothesis”).

However, both “unexpected” and “hra-unexpected” dividend increases may, also, be a consequence of: insufficient investment opportunities, firm maturity, shareholders withdrawing cash, or any combination of these. All alternative motives typically may be viewed as negative firm prospects (“bad” news) and usually are not revealed with the dividend increase announcements. The lack of concurrent firm details may create uncertainty and negative expectations to investors – there have been cases where negative information related to the firm’s prospects were disclosed (or rumors publicized) after the dividend increase announcement.

When considering the corporate control concentration (ownership diffusion characteristic), low ownership diffusion reduces information asymmetries and agency issues between management and outside shareholders. Many of the firms listed on the ASE, and most of them are used in this study, have a significant number of their shares owned either by the state or by a few major shareholders (usually members of the same family) that may also hold management positions. Presumably, management has more information concerning firm prospects than outside investors. In Greece the presence of MMD is one more advantage in favor of less conflicts, since the distribution of MMD minimize the available cash resources that managers control and they could allocate in activities that benefit them<sup>55</sup>, contrary to the shareholders’ interest. The less unmonitored available cash to the managers, the harder it is for them to invest in negative NPV projects. Thus, when management announces “unexpected” or “hra-unexpected” dividend increases, in accordance with the minimum required dividend, either they may be looking after their own interests (need to withdraw cash) or firms have insufficient

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<sup>54</sup>Management is reluctant to alter its dividend payments (signalling hypothesis) and, as mentioned earlier on, firms listed in the ASE are not permitted to allocate excess cash to their shareholders through share repurchases.

<sup>55</sup>These activities can range from lavish expenses on corporate jets to unjustifiable acquisitions and expansions.

investment opportunities. Both interpretations have a negative effect on the share price.

Therefore, the testable hypotheses of this study are three. First, firms announcing “expected” dividend should not experience statistically significant abnormal returns (no surprise for shareholders or investors). Moreover, since outside investors are protected by means of a minimum mandatory dividend, the argument of lowering agency costs may not apply in the Greek stock market. As a result the free cash flow hypothesis proposed by Jensen (1986) cannot be implemented in this study. Second, firms that announce both “unexpected” and “hara-unexpected” dividend increases above mandatory without concurrent information concerning firm prospects are likely to experience negative abnormal returns. As it is mentioned above, “unexpected” dividend increases are higher than the minimum required dividend, which is a significant 35% with respect to net income, may signal insufficient investment opportunities, firm maturity, or shareholders’ need to withdraw cash. Third, in case there are significant abnormal returns during the period closer to the announcement day then the dividend announcements convey new information to the marketplace and affect firm’s value. Any significant abnormal returns around the announcement day will indicate that the irrelevance theory introduced by Miller and Modigliani (1961) cannot be validated. In addition, the possible presence of significant abnormal returns would challenge the tax-based signaling model of John and Williams (1985) which argue that higher taxes on dividends relative to capital gains are a necessary condition for dividends to be informative, since in Greek environment dividends are not taxed. Therefore, only the theoretical model of Bhattacharya (1979) and Miller and Rock (1985) can justify any observable abnormal return around the announcement day. But taking into account the minimum required dividend in Greece, both of these models may not be able to justify a positive relationship between dividend changes and subsequent share price reaction.

The results indicate that announcements of “expected” dividend increases do not have statistically significant effect on share prices; they have no new information for investors (they are not perceived as signals). On the other

hand announcements of both “unexpected” and “hra-unexpected” dividend increases show statistically negative abnormal returns one day after the dividend announcement. Since these announcements are not linked to concurrent information (newspaper articles, press releases, etc.) concerning profitable investment opportunities and future earnings, they probably make investors skeptical and, thus, may be regarded as signals of “bad” news. Also, firms announcing “unexpected” and “hra-unexpected” dividend increases may be looking after their own interests by withdrawing cash or firms might have insufficient profitable investment opportunities and so they have decided to distribute the free cash flow. Both motives result in negative returns as it is confirmed from the empirical analysis. The presence of statistical negative abnormal returns after the announcement of a dividend increase found in ASE challenges both the irrelevance theory introduced by Miller and Modigliani (1961) as well as the necessary presence of differential taxation between dividends and capital gains in order the former work as a signaling mechanism.

This study contributes to the research on dividend announcements in three ways: First, it presents a plausible alternative rationalization why investors may earn negative returns when “unexpected” or “hra-unexpected” dividend increases are announced; Second, it provides information from a different institutional setting (minimum mandatory dividend, and ownership structure); outside investors lack full access to all the information that may help identify the price effect of “unexpected” or “hra-unexpected” payout increases; Finally, it enriches the available evidence on this particular segment of literature, and enhances our understanding, as well as that of investors and practitioners, on the price formation process when dividend increases are announced.

The rest of this study is organized as follows: Section 2, presents a brief review of the related literature; Section 3, describes the data and the methodology; Section 4, presents the empirical results and Section 5, summarizes this study.

## 5.2 Literature Review

The literature consists of a significant number of empirical studies showing that dividend change announcements are positively related with stock returns in the days surrounding the dividend change announcement. It is well established that the dividend announcements contain information, since markets react favorably to announcements of dividend increases “good news” and adversely to announcements of dividend decreases “bad news”. The implication is that dividend increases represent positive signal about the company’s prospects, whereas dividend decreases represent negative signal about the company’s future prospects.

Aharony and Swary (1980), using a sample of 149 industrial firms listed on the New York Stock Exchange, investigate the effects of quarterly dividend announcements that made on a separately date from earnings announcements. Similar to Pettit (1972)<sup>56</sup>, they verified that cash dividend announcements provide information beyond that already provided by the quarterly earnings data. Their findings indicated that abnormal returns were not significantly different from zero in cases where firms did not change their dividends. In the case of dividend increases, there were positive abnormal returns, and most of the statistically significant abnormal returns occurred during days  $t - 1$  and  $t = 0$  (announcement day). In case of dividend decreases, there were negative abnormal returns during the twenty days surrounding announcement dates, and similar to the case of dividend increases, most of the significant abnormal returns occurred during days  $t - 1$  and  $t = 0$ . Thus, their results supported the information content of dividend hypothesis.

Asquith and Mullins (1983) investigated the impact of dividend initiation announcements on shareholders’ wealth by analyzing 168 firms that paid no dividends either during their corporate histories or for at least the last ten years. They tested the average daily excess stock returns ten days before and ten days after the announcement of dividend initiation. For the two-day announcement period their results show that there is an excess return of

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<sup>56</sup>Petit (1972) showed that a significant price increase follows announcements of dividend increases and a significant price drop follows announcements of dividend decreases.

about 3.7%. Moreover, using cross-sectional regression Asquith and Mullins (1983) found a positive and significant relationship between the magnitude of initial dividends and the abnormal returns on the announcement day. Their results are much larger in magnitude than Aharony and Swary's (1980) results.

Michaeli, Thaler, and Womack (1995) examined the impact of both initiations and omissions of cash dividends on share prices reaction. They observed 561 dividend initiation events and 887 dividend omission events over the period of 1964 to 1988. By using "buy and hold" method they calculated the excess returns of the securities for a three-day event period, and for monthly periods before or after the event respectively. Michaeli et al. (1995) documented that, during three days surrounding the announcements, the average excess return was about -7.0% for omissions and 3.4% for dividend initiations. They noted that the market reactions to dividend omissions are greater than for dividend initiations. This implies that the market reacts optimistically toward dividend initiations (or increases). However, the market is more pessimistic in response to the announcements of dividend omissions (or decreases). Michaeli et al. (1995) also found significant long-run drifts in stock prices in response to dividend initiations and omissions. They reported 7.5% excess returns after one year of initiation announcements and 24.8% after three years. For dividend omissions they reported abnormal returns of -11.0% in the first year and -15.3% after three years. The price impact may explain, to some extent, why managers are so reluctant to cut dividends.

Amihud and Murgia (1997) employed regression analysis to test whether the dividend changes convey information about firms' values. Using a sample of 200 German firms listed on Frankfurt Stock Exchange, Amihud and Murgia (1997) examined the stock price reaction to dividend announcements. They used 255 events of dividend increase and 51 events of dividend decrease for the period 1988-1992, and they compared the results with findings of studies based on US data. Amihud and Murgia (1997) reported that the average excess return of stock prices is 0.97% for dividend increase and -1.73% for dividend decrease. In addition, they observed that even though the earnings

news preceded dividend change announcements, dividends still have significant information. However, the findings of this study are inconsistent with tax-based signalling models (John and William, 1985) because dividends in Germany are not tax-disadvantaged and thus share prices should not react to dividend changes.

Travlos, Trigeorgis and Vafeas (2001) provided evidence from an emerging market in favour of the dividend signalling hypothesis. They used a sample of 41 announcements of cash dividend increase and 39 announcements of stock dividends for firms listed on the Cyprus Stock Exchange for the period 1985-1995, and examined market reaction to the announcement of cash dividend increases and stock dividends. Travlos et al. (2001) found positive and significant abnormal returns for both cash dividend increases and stock dividend announcements and interpreted their results as consistent with the signalling hypothesis.

Bali (2003) presented evidence consistent with the preceding results, as he reported an average 1.17% abnormal return for dividend increases and -5.87% abnormal return for decreases studying dividend announcements for firms traded in NYSE-AMEX for a period extended from January 1965 to December 1992. In addition, Bali (2003) examined the long run drifts of stock prices reaction to dividend increases and decreases and reinforced Michaely et al. (1995) findings.

Yilmaz and Gunay (2006) examined the effects of cash dividend payments on stock returns and trading volumes in the Istanbul Stock Exchange from 1995 to 2003. They found that prices start to rise a few sessions before cash dividend payments and fall less than dividend payments on the ex-dividend day, and finally decreasing in the sessions following the payment. The results of trading volume analysis showed a considerable upward shift before the payment date and that the volume became stable after the ex-dividend date. The findings supported price-volume reaction discussions on the dividend payment date and the significant effect of cash dividends on the stock market.

More recently, Yilmaz (2010) studied the market reaction to dividend change announcements at the Istanbul Stock Exchange using an event study

analysis and testing a sample of 184 announcements made by 46 companies during the period 2005 to 2008. He constructed an event window consist of three days, one day before and one day after the announcement day, in order to examine the market reaction to dividend announcements. His results were consistent with the information content of signaling hypothesis, since the market reacted positively to dividend increases 0.54%, negatively to dividend decreases -1.05% and did not react to constant dividends.

Yahyaee et al. (2011) examine the information content of cash dividend announcements for the period between January 1997 and August 2005, in a unique environment such as of Oman. The data set of Oman is unique for a number of reasons: Firstly, there are no taxes on dividends and capital gains, like Greece, offering to researchers the possibility to test the tax-based signaling models (Bhattacharya (1979) and John and Williams (1985)) argument that higher taxes on dividends relative to capital gains are a necessary condition for dividends to be informative. Secondly, most of Omani companies are owned by a small number of investors who have controlling interests, leading to a high concentration of shares ownership reducing information asymmetry between managers and shareholders (diminished role for dividends). Finally, there is low corporate transparency, which implies a positive effect for dividends, and most companies change their dividends almost every year.

Despite the special environment of Oman's stock market, Yahyaee et al. (2011) show that cash dividend announcements convey information to the market since they found positive abnormal returns around to dividend increases announcements "good signal" and negative ones around to dividend decreases announcements "bad signal". The existence of abnormal returns around the dividend announcements is in contrast with tax-based signaling models, since in Oman there are no taxes on dividends and on capital gains. The characteristics of Oman's market are very similar to the Greek market where there is no tax on dividends and capital gains and the concentration of shares' ownership is very high.

There are two studies that examine the market reaction to cash dividend announcement for the Greek market. More specific, Vazakidis and Athianos (2010) investigate the reaction of the stock prices to the announcements of

cash dividends by firms listed at the FTSE/ATHEX 20 and FTSE/ATHEX Mid 40 for a fixed period 2004-2008. Vazakidis and Athianos (2010) used the classical event study methodology, in order to measure the abnormal returns of companies' stock prices that occurred during an event period 20 days before and after the announcement day (event day). Since they find statistical significant abnormal activity in the stock market both before and after the dividend announcements they did not support the irrelevance theory introduced by Miller and Modigliani (1961). Due to the fact that they did not observe statistically significant abnormal returns to most of the announcement days, they argued that investors expected the positive impact of dividend announcements to stock prices, and they adapted their own portfolios according to their expectations. Finally, the statistically significant (at 10% level of significance) negative market reaction throughout the post-announcement period is interpreted by Vazakidis and Athianos (2010) as a bad signal for firm's prospects. They argued that investors interpret the news from the dividend announcements as ominous for the firms' future and thus they react with a negative manner.

More recently, Dasilas and Leventis (2011) investigate both the stock price and trading volume market reaction to cash dividend announcements for the period 2000-2004 using a data set of 231 dividend announcements (129 dividend increases, 58 dividend decreases and 44 no dividend changes) from firms listed on the Athens Stock Exchange (ASE) during that period and fulfill their criteria. Dasilas and Leventis (2011) employed a standard event study methodology with an event window 11 days around the dividend announcement date ( $t = 0$ ) in order to examine the stock price behaviour on dividend announcements.

When firms were announcing dividend increases the abnormal return was 0.48% on the announcement day, statistically significant at the 10% level of significance, and 0.60% on the previous day, also statistically significant at the 1% level of significance. Moreover the cumulative abnormal returns for the three days around to the announcement day, including that day, were 1.172%, statistically significant at the 1% level of significance. In case where firms were announcing dividend decreases there was a negative reaction to the

market, consistent with the notion that a dividend decrease conveys negative information to the public, resulting in stock price drop. Finally when firms were not changing their dividend payment, Dasilas and Leventis (2011) did not find significant market reactions on all days of the event window. Their empirical findings are in line with prior studies from US and abroad that support dividend signalling hypothesis, since they found that a dividend increase conveys positive information to the market, a dividend decrease conveys negative information to the market and no dividend change conveys insignificant information to the market. In addition Dasilas and Leventis (2011) suggested that stock prices absorb the release of corporate news quickly and efficiently, since in the remaining post and pre-announcement period, excluding the day  $t - 1$  and  $t + 1$  around the announcement day, the market reaction did not display any significance abnormal behaviour. Finally, they found evidences that the trading volume moves in the same direction as the dividend change signals, as it happened with stock prices.

## 5.3 Methodology and Data

### 5.3.1 Methodology

Previous studies have proposed various approaches to define dividend increases as “unexpected”. Several researchers simply compare the announced dividend ( $D_0$ ) to the dividend of the previous period ( $D_{-1}$ ), (Below et al., (1996), Canina (1999), Mikhail et al. (1999), Travlos et al. (2001) and Fuller and Thankor, (2002) among others), others stipulate that a dividend change is “unexpected” if the previous dividend was constant for a certain number of consecutive years. Thus, Balachandran and Theobald (2001) require at least three continuous constant dividend payments, while Fukuda (2000) proposes a two year period as sufficient. Still others identify a dividend change as “unexpected” in terms of a minimum percentage change of the announced dividend ( $D_0$ ) from that of the previous period ( $D_{-1}$ ). Indeed, Dhillon and Johnson (1994) require a shift of at least 30%, Amihud and Li (2002) require a change larger than 5%, while Grullon et al. (2002) examine a range be-

tween 12.5% and 500% and Hu (2003) proposes a range between 10% and 500%. Hence, it is obvious that there is no generally accepted method to define a dividend increase as “unexpected”.

In this study a dividend increase announcement is characterized as “expected” when the announced dividend ( $D_0$ ) in current year  $t = 0$  is equal to the expected minimum mandatory dividend (eMMD) corresponding to current earnings, according to legislation ( $D_0 = eMMD$ ). The increased announced dividend ( $D_0$ ) that is higher than the expected minimum mandatory dividend ( $eMMD$ ) is characterized as “unexpected” or “historically average unexpected (hra-unexpected)”.

A dividend increase announcements is characterized as “unexpected”, when the announced dividend ( $D_0$ ) on year  $t = 0$  is simply higher than the expected minimum mandatory dividend ( $eMMD$ ) corresponding to current earnings, according to legislation ( $D_0 > eMMD$ ). Whereas, a dividend increase announcements is characterized as “historically average unexpected” (hra-unexpected) when the announced dividend ( $D_0$ ) is: both higher than the expected minimum mandatory dividend ( $eMMD$ ) and higher than the average dividend of the previous three years ( $D_{-1}$  to  $D_{-3}$ ) plus one standard deviation of the average three years dividend.

Under the second definition more strictly requirements are necessary in order to be characterized a dividend increase announcement as unexpected. This way the current study can examine the information content of a "really" unanticipated announcement. The announced dividend on year  $t = 0$  must be not only higher than the previous years' dividend but also higher than the average three years historic dividend. Taking into account that managers are reluctant to change their dividend policy every year, they try to smooth them instead, such a dividend increase announcement (hra-unexpected) should signal news to the market.

The event type methodology<sup>57</sup>, as described by Brown and Warner (1980, 1985), is used to examine the market reaction during a dividend announcement. For the event type methodology to be applied, daily raw returns ( $R_{it}$ )

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<sup>57</sup>Event study methodology also is used from Travlos et al. (2001), Gurgul et al. (2003), McClusky et al. (2006), Dasilas & Leventis (2011), Yahyaee et al. (2011), among others.

were computed over 220 days, from day  $t - 200$  to day  $t + 20$  relative to the dividend announcement day, which is at day  $t = 0$ , as the following equation (52):

$$R_{it} = \ln(P_{it}) - \ln(P_{i,t-1}) \quad (52)$$

where,  $P_{i,t}$  denotes the daily closing price of the stock  $i$  on day  $t$  and  $P_{i,t-1}$  is the daily closing price of the same stock on the previous day ( $t - 1$ ).

The period starting at day  $t - 51$  and ending at day  $t - 150$  is declared as the "estimation period" whereas, the period starting at day  $t - 20$  and ending at day  $t + 20$ , including also the day  $t = 0$  is declared as the "event period". Following Brown and Warner (1980, 1985), in case of missing returns, the parameter estimation excludes both the day of the missing return and the return of the subsequent day. For the computation of returns from a small number of transaction prices to be avoided, stocks with fewer than 30 trading days in the estimation period, from day  $t - 150$  to  $t - 51$ , were deleted from the sample. The "event period" that is used in this study is lengthy enough in order to be investigated if there is a leakage of information before the announcement or if there is any delay in the reaction of investors, through the examination of the adjustment's speed to the information revealed.

For each day in the event period, the effect of dividend announcements on stock market is isolated, abnormal returns are computed using the "market model" as well as the "market-adjusted" model<sup>58</sup>.

According to market model for each stock  $i$  the expected stock return is equal to equation (53):

$$E(R_{it}) = a_i + \beta_i R_{mt} + e_{it} \quad (53)$$

where  $E(R_{it})$  is company's  $i$  expected return on day  $t$ ,  $R_{mt}$  is market's index return on day  $t$ ,  $a_i$  and  $\beta_i$  are firm's specific constant and  $e_{i,t}$  denotes error term which is assumed to be distributed as white noise.

The firm's specific coefficients,  $a_i$  and  $\beta_i$ , are estimated by an Ordinary Least Square estimation, through a regression on daily stock returns to mar-

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<sup>58</sup>In market adjusted model it is assumed that firm's  $i$  beta is 1.

ket return from the day  $t = -200$  to day  $t = -51$ , where  $t = 0$  is the announcement day. The General Index of the Athens Stock Exchange (ASE) is used to calculate market returns. Then, the abnormal return,  $AR_{it}$ , is the difference between the realized and the expected return.

$$AR_{it} = R_{it} - E(R_{it}) \quad (54)$$

where  $R_{it}$  is company's  $i$  real return on day  $t$  and  $E(R_{it})$  is company's  $i$  expected return on day  $t$ .

According to the "market-adjusted" model for each stock  $i$  and day  $t$ , abnormal returns or excess returns are computed as:

$$ER_{it} = R_{it} - E(R_{mt}) \quad (55)$$

where  $R_{it}$  is the return of stock  $i$  on day  $t$  and  $R_{mt}$  is the return of the proxy for the market portfolio on day  $t$ .

Again, the General Index of the Athens Stock Exchange (ASE) is used to calculate market returns. According to the "market-adjusted" model, the return of the market portfolio captures the normal theoretical return of each stock. The index of the ASE is used as the proxy for the market portfolio.

To neutralize firm-specific price variations caused by events other than the particular announcement being investigated (dividend announcement), this study calculates the cross-sectional average abnormal returns ( $\overline{AR}_t$ ) for each stock in the sample during each of the 21 days that constitute the event period.

$$\overline{AR}_t = \frac{\sum_{i=1}^N R_{it}}{N} \quad (56)$$

where  $\overline{AR}_t$  is the sample average abnormal returns during day  $t$  and  $N$  is the number of stocks in the sample.

Due to the fact that events did not occur at the same point in time for the  $N$  stocks in the sample, the cross-sectional average neutralizes firm-specific variations unrelated to the event of interest.

The final step in the analysis of stock price reaction to dividend announce-

ment is for the cumulative average abnormal returns (CAR's) to be calculated for different time intervals within the event period. The cumulative average abnormal return (CAR) for the N stocks in the sample beginning at time  $t_1$  through time  $t_2$  is computed as:

$$CAR_{(t_1, t_2)} = \sum_{t=t_1}^{t_2} \overline{AR}_t \quad (57)$$

Standard parametric tests are implemented in order to test for the statistical significance of the sample average abnormal daily rates of returns ( $\overline{AR}_t$ ) and cumulative average abnormal returns ( $CAR_{(t_1, t_2)}$ ) for the N stocks in the sample. If the information content of dividends hypothesis is valid, then average abnormal returns and/or the cumulative average abnormal returns should be significantly different from zero in case there is a dividend increase announcement.

Under the unique Greek environment, “expected” dividend increase announcements should reveal average abnormal returns and cumulative average abnormal returns not significantly different from zero, since the announcement of dividend is mandatory from the law. Without the minimum mandatory dividend distribution, firms may not announce dividend or they may choose an announce lower than the mandatory one.

On the other hand “unexpected” or “hara-unexpected” dividend increases announcements should reveal positive or negative average abnormal returns and cumulative average abnormal returns, according to how the market interprets these announcements.

### 5.3.2 Data

The sample includes all the dividend increase announcements by firms traded in the Athens Stock Exchange (ASE) during the period 2000-2004 that satisfy the following criteria: (a) The firms have distributed cash dividends every year of the period 1997-2004, thus our sample includes financially strong firms. (b) The announced dividend  $D_0$  is higher than the dividend of the previous year  $D_{-1}$  ( $D_0 > D_{-1}$ ) during the period 2000-2004. (c) The dividend

announcement date, as well as the balance sheet of each firm is publicly available. (d) Firm's stock are continuously traded (they are not under supervision) during the examined period 1997-2004. (e) There are no concurrent firm related information (press releases, newspaper articles speculating, etc.) relating dividend increases to respective firm prospects. The data sources include: Bloomberg, Data Stream and publications of the ASE and the Greek daily and periodical press.

Out of the 330 firms listed on ASE until the end of 2004 only 60 firms fulfill the above criteria and sum up to a total of 148 dividend increase announcements. Table 28 presents the sample of listed firms (N=60), that announced "unexpected" increase dividend per share (DPS) (N=148) during the period 2000-2004. The classification is done according to firm sector and the type of dividend increase ("unexpected" and "expected" ) (Panel A). Also, it presents a summary of the key statistical facts of announced DPS increases (average, median, max, min, standard deviation, skewness and kurtosis), for the total sample and the two sub-samples of dividend increases ("unexpected" and "expected") (Panel B).

Table 28 reveals that following the aforementioned approach a well-diversified sample is constructed, having selected firms from almost all sectors listed on the Athens Stock Exchange (13 from 17 sectors). According to Panel A of Table 28, out of the 148 dividend increase announcements in the sample, 38 of them represent "expected" dividend increases and are equal to the minimum mandatory dividend. The rest 110 dividend increase announcements are above the minimum mandatory amount and are denoted as "unexpected". From Panel B of Table 28, it is observable that the average DPS for the total sample is €0.32. However for the subsample of "expected" dividends the average is higher than €0.41. Also, the median DPS of the total sample is €0.14 and for firms that announce "unexpected" dividends is €0.15. Also the difference between the maximum and the minimum DPS for firms that announce "unexpected" dividends is quite large leading to a standard deviation of 0.40.

Table 29 presents the sample of listed firms (N=63), that announced a

Table 28: Sample of dividend increase announcements (N=148) by firms listed in the ASE grouped by sector and type of dividend ("expected" and "unexpected") (Panel A) and sample summary statistics of announced dividends per share (DPS) (Panel B). Period 2000-2004

Panel A: Sample of dividend increase announcements grouped by sector and type					
Sector	Firms	Sample	Dividend Increases		
			"expected"	"unexpected"	
			MMD	Above MMD	
Banks	4	13	4	9	
Basic Resources	9	21	7	14	
Chemicals	3	6	2	4	
Construction & Materials	9	25	5	20	
Financial Services	1	3	1	2	
Food & Beverage	7	18	5	13	
Health Care	1	3	2	1	
Industrial Goods & Services	7	17	2	15	
Media	1	2	0	2	
Personal & Household Goods	13	28	9	19	
Technology	2	4	0	4	
Travel & Leisure	2	4	1	3	
Utilities	1	4	0	4	
Total	60	148	38	110	
Panel B: Summary statistics of announced dividends per share (DPS), in euro (€) (N=148)					
Average DPS	0.3196	0.4061	0.2897		
Median DPS	0.1350	0.0850	0.1500		
Maximum DPS (Max)	2.6000	2.6000	2.3000		
Minimum DPS (Min)	0.0100	0.0100	0.0200		
Standard deviation of DPS (Stdev)	0.5080	0.7351	0.4014		
Skewness level of DPS (Skew)	2.9379	1.9583	3.4765		
Level of kurtosis (Kurt)	11.0549	5.1388	16.2439		

This table presents the sample of firms (N=60) listed in the Athens Stock Exchange that announced a dividend per share (DPS) increase (N=148) during the period 2000-2004 according to: firm sector and type of dividend increase ("unexpected" and "expected") (Panel A). Also, it presents a summary of the statistics for the announced DPS increases (average, median, max, min, standard deviation, skewness and kurtosis), for the total sample and two sub-samples of dividend increases ("expected" and "unexpected") (Panel B).

“historic related unexpected” dividend per share (DPS) increase (N=106)<sup>59</sup> during the period 2000-2004. Panel A of Table 29 classifies the dividend increase announcements according to: firm sector and type of dividend increase (“hra-unexpected” and “expected”). Panel B of Table 29 presents the descriptive statistics (average, median, max, min, standard deviation, skewness and kurtosis) for the total sample and the two sub-samples of “hra-unexpected” dividend increases: “hra-unexpected” and “expected”.

Similar to Table 28 a well- diversified sample is still constructed with the number of sectors of the listed companies to remain the same (13 from 17 sectors). According to Panel A of Table 29 there is a decrease in the number of “expected” dividend announcements (N=26) as well as in the number of announcements that are higher than the minimum mandatory dividend, “hra-unexpected” in this case (N=80). The picture that emerges from a careful study of Panel B of Table 29 reveals that the average DPS of the total sample is €0.40 higher compared with the average DPS of Table 28 (€0.32). Higher is also the average (median) DPS in case of “hra-unexpected” dividend increase with a value of €0.34 (€0.20). Moreover, the difference between maximum and minimum DPS for firms that announce “hra-unexpected” dividend increases remains high with standard deviation 0.45. Finally, the median DPS for the “expected” increase announcements is also higher with a value of €0.12. The values for the full sample and the two sub-samples, in case of “hra-unexpected” dividend increase announcements, are higher than the “unexpected” ones because the conditions to characterize an increase in dividend announcement are more demanding, leading to more extremes values.

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<sup>59</sup>The number of “hra-unexpected” dividend increases (N=106) is smaller than the number of “unexpected” dividend increases (N=148), since in order for a dividend increase announcement to be characterized as “hra-unexpected” should be higher than the average dividend of the previous three years plus one standard deviation. The remaining 42 dividend increase announcements (“unexpected” (N=148) minus “hra-unexpected” (N=106)) are characterized as “hra-constant unexpected” by the second method.

Table 29: Sample of "hra-unexpected" dividend increase announcements (N=106) by firms listed in the ASE grouped by sector and type of dividend ("expected" and "hra-unexpected") (Panel A) and sample summary statistics of announced dividends per share (DPS) (Panel B). Period 2000-2004

Panel A: Sample of "hra-unexpected" dividend increase announcements grouped by sector and type				
Sector	Firms	Sample	Dividend Increases	
			"expected"	"hra-unexpected"
			MMD	Above MMD
Banks	4	10	4	6
Basic Resources	9	12	4	8
Chemicals	3	4	1	3
Construction & Materials	11	17	3	14
Financial Services	1	3	1	2
Food & Beverage	7	10	2	8
Health Care	1	3	2	1
Industrial Goods & Services	7	12	1	11
Media	1	2	0	2
Personal & Household Goods	14	22	7	15
Technology	2	3	0	3
Travel & Leisure	2	4	1	3
Utilities	1	4	0	4
Total	63	106	26	80

Panel B: Summary statistics of announced dividends per share (DPS), in euro (€) (N=106)				
Average DPS	0.3993	0.5688	0.3443	
Median DPS	0.1900	0.1200	0.2000	
Maximum DPS (Max)	2.6000	2.6000	2.3000	
Minimum DPS (Min)	0.0300	0.0300	0.0300	
Standard deviation of DPS (Stddev)	0.5762	0.8435	0.4511	
Skewness level of DPS (Skew)	2.4654	1.4547	3.1007	
Level of kurtosis (Kurt)	5.1937	0.4100	10.2042	

This table presents the sample of firms (N=63) listed in the Athens Stock Exchange that announced a "hra-unexpected" dividend per share (DPS) increase (N=106) during the period 2000-2004 according to: firm sector and type of dividend increase ("hra-unexpected" and "expected") (Panel A). Also, it presents a summary of statistics for the announced DPS increases (average, median, max, min, standard deviation, skewness and kurtosis), for the total sample and two sub-samples of dividend increases ("expected" and "hra-unexpected") (Panel B).

## 5.4 Results

### 5.4.1 Total sample of dividend increases

The total sample considers all the “unexpected” dividend increase announcements for the period 2000-2004 (“expected” and “unexpected”) (N=148). Table 30 reports event days, daily average market-adjusted<sup>60</sup> abnormal returns ( $AR_t$ ), along with respective t-statistics for the period of 10 days before until 10 days after the dividend increase announcement day ( $t = 0$ ) by firms listed in the ASE during the period 2000-2004. Also, the lower part of the table displays the cumulative abnormal returns (CARs) and their respective tests of significance (t-statistics) for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10).

From Table 30 it is observable that the average abnormal return on the announcement day ( $t = 0$ ) is -0.21%, which is insignificant at all conventional levels. However, abnormal return on day  $t = +1$  is -1.08%, statistically significant at the 1% level of significance (t-statistic= -5.1750), this is due to the fact that dividends are announced after the market has closed. Also, CARs for event periods after the announcement (0, +2), (0, +5), and (0, +10) are -1.35%, -1.61% and -1.92% respectively, are all statistically significant at the 1% level of significance (t-statistics are -3.7304, -3.1448, and -2.7802 respectively). Whereas, CARs for event periods before the announcement (-10, 0), (-5, 0), and (-2, 0) are all of them statistically insignificant for any level of significance. The increasing impact on average abnormal returns for the post-announcement period may be a result of the gradual investor recognition of negative firm prospects due to a dividend increase announcement higher than the MMD. The results of this study show that, in general, dividend increases are a surprise to the market that affect negatively the shareholders’ wealth. These results are opposite to the results reported by Dasilas and Leventis (2011) who find a positive price reaction after the announcement of

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<sup>60</sup>Similar is the result with "market-model" that are available upon request. Thus, in the empirical analysis that follows all of the tables show  $AR_t$  calculated based on the "market-adjusted" model.

Table 30: Abnormal stock returns (AR) from the total sample of "unexpected" dividend increase announcements ("expected" and "unexpected") (N=148) Period 2000-2004

Event Day	$AR_t\%$		t-statistic
	Market	Adjusted Model	
-10		0.0008	0.3604
-9		0.0019	0.9034
-8		0.0015	0.7116
-7		-0.0023	-1.1243
-6		0.0020	0.9523
-5		0.0018	0.8670
-4		-0.0028	-1.3426
-3		0.0011	0.5208
-2		0.0031	1.4884
-1		0.0001	0.0299
0		-0.0021	-1.0282
+1		-0.0108	-5.1750***
+2		-0.0005	-0.2580
+3		-0.0018	-0.8818
+4		-0.0020	-0.9646
+5		0.0013	0.6045
+6		-0.0017	-0.8323
+7		-0.0006	-0.3042
+8		0.0017	0.8012
+9		-0.0024	-1.1298
+10		-0.0001	-0.0525
Event Periods	CARs		t-statistic
	Market	Adjusted Model	
(-10,0)		0.0049	0.7052
(-5,0)		0.0011	0.2185
(-2,0)		0.0010	0.2830
(0,+2)		-0.0135	-3.7304***
(0,+5)		-0.0161	-3.1448***
(0,+10)		-0.0192	-2.7802***

This table presents event days, number of observations (N), daily average market-adjusted abnormal returns ( $AR_t$ ), and respective tests of significance (t-statistics of  $AR_t$ ) of 148 cash "unexpected" dividend increase announcements (total sample of "expected" and "unexpected") by firms listed on the ASE for the period of 10 days before until 10 days after the announcement day ( $t = 0$ ) during the period 2000-2004. Also, it presents daily cumulative abnormal returns (CARs) along with the associated t-statistics, for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10). \*\*\* indicate significance at the 1% level.

dividend increases. However, the results of this study are partially similar with those reported by Vazakidis and Athianos (2010) who reported negative cumulative abnormal returns for the post-announcement event period. But the results of this study are opposite to the results of Vazakidis and Athianos (2010) for the pre-announcement event period who find positive cumulative abnormal returns.

Table 31 represents the entire sample (“expected” and “hra-unexpected”) of dividend increase announcements for the period 2000-2004 that characterized as “historically related average unexpected”(N=106). The main difference with Table 30 is that Table 31 incorporates only the firms that have announced higher dividend than the eMMD and higher than the average dividend of the previous three years (D-1 to D-3) plus one standard deviation of the previous three years average dividends. In addition, the “expected” dividend in this Table 31 is defined with the same manner as in Table 30 (it is equals to the minimum mandatory dividend). As Table 30, Table 31 reports daily average market-adjusted abnormal returns<sup>61</sup> ( $AR_t$ ), along with respective t-statistics for 21 days around the announcement day ( $t = 0$ ) by firms listed in the ASE during the period 2000-2004. Also, the lower part of the table displays CARs and their respective t-statistics for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10).

The pattern of market price reaction to “hra-unexpected” dividend increase announcement is very similar with that presented in Table 30. The average abnormal return on announcement day is negative -0.19% but statistically insignificant, whereas the average abnormal return on day  $t + 1$  is also negative but higher than the “unexpected” one, (-1.26%), which is statistically significant at the 1% level of significance. Similar to Table 30 the CARs for all the event periods after the announcement day are negative and statistically significant different from zero. The market reaction after the announcement day of an “hra-unexpected” increase dividend is in contrast

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<sup>61</sup>Similar is the result with "market-model" that are available upon request. Thus, in the empirical analysis that follows all of the tables show  $AR_t$  calculated based on the "market-adjusted" model.

Table 31: Abnormal stock returns (AR) from the total sample of "hra-unexpected" dividend increase announcements ("expected" and "hra-unexpected") (N=106) Period 2000-2004

$AR_t\%$			
Event Day	Market	Adjusted Model	t-statistic
-10		-0.0014	-0.6246
-9		0.0002	0.0746
-8		0.0017	0.7515
-7		-0.0025	-1.1088
-6		-0.0018	-0.8068
-5		0.0012	0.5521
-4		-0.0024	-1.0847
-3		0.0009	0.3882
-2		0.0021	0.9494
-1		-0.0003	-0.1473
0		-0.0019	-0.8669
+1		-0.0126	-5.6851***
+2		-0.0016	-0.7143
+3		-0.0018	-0.8331
+4		-0.0024	-1.0904
+5		0.0023	1.0239
+6		-0.0027	-1.2368
+7		0.0004	0.1807
+8		0.0024	1.0861
+9		-0.0027	-1.2428
+10		-0.0004	-0.1777
CARs			
Event Periods	Market	Adjusted Model	t-statistic
(-10,0)		-0.0042	-0.5799
(-5,0)		-0.0005	-0.0854
(-2,0)		-0.0001	-0.0374
(0,+2)		-0.0161	-4.1952***
(0,+5)		-0.0180	-3.3337***
(0,+10)		-0.0211	-2.8814***

This table presents event days, number of observations (N), daily average market-adjusted abnormal returns ( $AR_t$ ), and respective tests of significance (t-statistics of  $AR_t$ ) of 106 cash "hra-unexpected" dividend increase announcements (total sample of "expected" and "hra-unexpected") by firms listed on the ASE for the period of 10 days before until 10 days after the announcement day ( $t = 0$ ) during the period 2000-2004. Also, it presents daily cumulative abnormal returns (CARs) along with the associated t-statistics, for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10). \*\*\* indicate significance at the 1% level.

to the literature indicating that in Greece probably the announcement of a dividend increase higher than minimum mandatory is a negative signal for the investors. Moreover, similarly with the results reported in Table 30, the results of Table 31 are in contrast to the results reported by Dasilas and Leventis (2011) for the Greece for the same period and they are similar with the results of Vazakidis and Athianos (2010) concerning the post-announcement event period.

#### 5.4.2 Sample of “expected” dividend increases

Table 32 considers only the sample of “expected” dividend increase announcements - the distributed dividend is equal to the exact minimum mandatory dividend according to the relative legislation - with  $N=38$ , for the case of "unexpected" dividend increase announcements. In more detail, Table 32 reports event days, daily average market-adjusted abnormal returns ( $AR_t$ ), along with respective t-statistics for an event period of 21 days around the dividend increase announcement day ( $t = 0$ ) by firms listed in the ASE during the period 2000-2004. In the lower part of the table cumulative abnormal returns (CARs) are displayed along with their respective tests of significance (t-statistics) for the event periods  $(-10, 0)$ ,  $(-5, 0)$ ,  $(-2, 0)$ ,  $(0, +2)$ ,  $(0, +5)$ , and  $(0, +10)$ .

As shown in Table 32, the average abnormal return on the announcement day ( $t = 0$ ) is 0.12%, which is statistically insignificant at all conventional levels. However, abnormal returns on days  $t = -6$  and  $t = -4$  are 1.12% and -0.81%, both statistically significant at the 5% (t-statistic= 2.7237) and 10% (t-statistic= -1.9630) level of significance respectively. These returns prior to the announcement day may be due to a leakage of conflicting information that may affect investors trading behavior. Also, CARs for all event periods examined are statistically insignificant at all conventional levels. The results of Table 32 show that announcements of “expected” dividend increases, subsample of "unexepected" dividend increases, are no surprise for the market (no signaling implication to investors) and have no effect on the shareholders’

Table 32: Abnormal returns (AR) from "expected" dividend increase announcements (mandatory) (N=38), in case of "unexpected" dividend increases, Period 2000-2004

Event Day	$AR_t\%$		t-statistic
	Market	Adjusted Model	
-10		0.0016	0.4004
-9		0.0026	0.6360
-8		0.0014	0.3388
-7		-0.0067	1.6428
-6		0.0112	2.7237***
-5		0.0013	0.3273
-4		-0.0081	-1.9630*
-3		0.0029	0.6980
-2		-0.0015	-0.3617
-1		-0.0042	-1.0135
0		0.0012	0.3044
+1		-0.0012	-0.3002
+2		-0.0046	-1.1155
+3		0.0041	1.0012
+4		0.0000	-0.0105
+5		-0.0021	-0.5081
+6		0.0050	1.2108
+7		0.0010	0.2368
+8		0.0017	0.4262
+9		-0.0022	-0.5363
+10		-0.0045	-1.0965
Event Periods	CARs		t-statistic
	Market	Adjusted Model	
(-10,0)		0.0018	0.1350
(-5,0)		-0.0082	-0.8199
(-2,0)		-0.0044	-0.6182
(0,+2)		-0.0046	-0.6416
(0,+5)		-0.0026	-0.2566
(0,+10)		-0.0016	-0.1168

This table presents event days, number of observations (N), daily average market-adjusted abnormal returns ( $AR_t$ ), and respective tests of significance (t-statistics of  $AR_t$ ) of 38 "expected" cash dividend in case of "unexpected" dividend increase announcements by firms listed on the ASE for the period of 10 days before through 10 days after the announcement day (t=0) during the period 2000-2004. Also, it presents daily cumulative abnormal returns (CARs) along with the associated t-statistics, for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10). \*\*\*, and \* indicate significance at the 1%, and 10% levels, respectively.

wealth. These findings are in contrast to those reported by previous empirical studies for the ASE where there is a positive price reaction, attributed to the information hypothesis, (Dasilas and Leventis (2011)).

Contradicting with the results in Table 32, there is not any statistically significant abnormal activity during both the period pre and post the announcement day ( $t = 0$ ) in case of “expected” dividends ( $N=26$ ), for “hara-unexpected” dividend increases, as shown in Table 33. Specifically, on the event days  $t = -1$ ,  $t = 0$  and  $t = +1$  the abnormal returns are (-0.44%), (-0.27%) and (-0.61%) with t-statistics (0.93), (0.56) and (1.27) respectively. In addition, there is not any leakage of information prior to the event day since throughout the event windows that precede the announcement day,  $(-10, 0)$ ,  $(-5, 0)$  and  $(-2, 0)$  there are not any statistically significant cumulative abnormal returns.

The results of Table 32 and Table 33 indicate that announcements of minimum mandatory dividends (“expected”) do not have any signaling information for the outside investors. These types of announcements do not cause any shock to the market since they were expected from the investors, taking into account the legislation rules of Athens Stock Exchange according to which firms must announce at least the minimum mandatory dividend amount. This result is really innovative indicating that the information signaling hypothesis may not have any real implication in countries where the distribution of dividend is mandatory up to a specific amount, determined by each implemented legislation rule, and firms’ distributed dividend equals to the mandatory amount. Thus, any information signal is blurred in case of a mandatory dividend distribution.

#### **5.4.3 Sample of “unexpected” and “hara-unexpected” dividend increases**

This section considers only the sample of “unexpected” ( $N=110$ ) and “hara-unexpected” ( $N=80$ ) dividend increase announcements i.e. in both cases only dividends higher than the minimum mandatory amount (MMD), according

Table 33: Abnormal returns (AR) from "expected" dividend increase announcements (mandatory) (N=26), in case of "hra-unexpected" dividend increases, Period 2000-2004

Event Day	$AR_t\%$		t-statistic
	Market	Adjusted Model	
-10		-0.0036	-0.7447
-9		0.0023	0.4718
-8		0.0044	0.9164
-7		-0.0043	-0.8975
-6		0.0013	0.2767
-5		0.0001	0.0301
-4		-0.0058	-1.2092
-3		-0.0007	-0.1375
-2		0.0001	0.0249
-1		-0.0044	-0.9266
0		0.0027	0.5609
+1		-0.0061	-1.2684
+2		-0.0061	-1.2811
+3		0.0011	0.2226
+4		0.0006	0.1345
+5		0.0002	0.0355
+6		0.0043	0.8957
+7		0.0006	0.1159
+8		0.0023	0.4819
+9		-0.0052	-1.0778
+10		-0.0051	-1.0638
Event Periods	CARs		t-statistic
	Market	Adjusted Model	
(-10,0)		-0.0078	-0.4929
(-5,0)		-0.0079	-0.6766
(-2,0)		-0.0016	-0.1968
(0,+2)		-0.0095	-1.1481
(0,+5)		-0.0076	-0.6516
(0,+10)		-0.0108	-0.6766

This table presents event days, number of observations (N), daily average market-adjusted abnormal returns ( $AR_t$ ), and respective tests of significance (t-statistics of  $AR_t$ ) of 26 "expected" cash dividend in the case of "hra-unexpected" dividend increase announcements by firms listed on the ASE for the period of 10 days before until 10 days after the announcement day ( $t = 0$ ) during the period 2000-2004. Also, it presents daily cumulative abnormal returns (CARs) along with the associated t-statistics, for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10).

to the law, are taken into account. Table 34 reports event days, daily average market-adjusted abnormal returns ( $AR_t$ ), along with the respective t-statistics for the period of 10 days before until 10 days after the “unexpected” dividend increase announcement day ( $t = 0$ ) by firms listed in the ASE in the period 2000-2004 and have announced “unexpected” dividend increases.

Also in the lower part, the table displays cumulative abnormal returns (CARs) and their respective tests of significance (t-statistics) for the event periods  $(-10, 0)$ ,  $(-5, 0)$ ,  $(-2, 0)$ ,  $(0, +2)$ ,  $(0, +5)$ , and  $(0, +10)$ .

Table 34 indicates, similarly to the other tables, that the average abnormal return on the announcement day ( $t = 0$ ) is 0.33%, which is insignificant at any conventional level of significance<sup>62</sup>, while the abnormal return of the next day after the announcement,  $t = +1$ , is negative, -1.41% and statistically significant at the 1% level of significance (t-statistic= -6.1218). Generally, “unexpected” increases in dividends produce significant effects because investors understand the reluctance of managers to increase the dividend and, thus, interpret any increase in dividends as an information event. For all the other event days, except the day  $t = +1$ , in the post-announcement event period there is not any statistically significant abnormal return. In addition, regarding the pre-announcement event period the market does not seem to experience any significant abnormal activity. Namely, the 10 days before the dividend announcements, the stock prices presented abnormal activity which was however statistically insignificant, except for the second day before the announcement  $t = -2$ . In particular, on this day the abnormal stock return was +0.47% and statistically significant at the 10% level of significance (t-statistic= 2.0368), which may be due to a leakage of conflicting or other information that may affected investors trading behavior.

Furthermore, CARs for the three event periods after the announcement,  $(0, +2)$ ,  $(0, +5)$ , and  $(0, +10)$  are -1.65%, -2.07%, and -2.53% respectively, and all are statistically significant at the 1% level of significance (t-statistics are -4.1509, -3.6744, and -3.3162 respectively), indicating that “unexpected”

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<sup>62</sup>This is due to the fact that dividends are announced after the market has closed.

Table 34: Abnormal returns (AR) from "unexpected" dividend increase announcements (above mandatory) (N=110), Period 2000-2004

Event Day	$AR_t\%$		t-statistic
	Market	Adjusted Model	
-10		0.0004	0.1925
-9		0.0016	0.7092
-8		0.0015	0.6586
-7		-0.0008	-0.3581
-6		-0.0012	-0.5175
-5		0.0020	0.8549
-4		-0.0010	-0.4268
-3		0.0005	0.2046
-2		0.0047	2.0368**
-1		0.0015	0.6608
0		-0.0033	-1.4406
+1		-0.0141	-6.1218***
+2		0.0009	0.3728
+3		-0.0039	-1.6915
+4		-0.0027	-1.1691
+5		0.0024	1.0497
+6		-0.0040	-1.7603*
+7		-0.0012	-0.5166
+8		0.0016	0.7138
+9		-0.0024	-1.0465
+10		0.0014	0.6115
Event Periods	CARs		t-statistic
	Market	Adjusted Model	
(-10,0)		0.0059	0.7762
(-5,0)		0.0043	0.7715
(-2,0)		0.0029	0.7257
(0,+2)		-0.0165	-4.1509***
(0,+5)		-0.0207	-3.6744***
(0,+10)		-0.0253	-3.3162***

This table presents event days, number of observations (N), daily average market-adjusted abnormal returns ( $AR_t$ ), and respective tests of significance (t-statistics of  $AR_t$ ) of 110 "unexpected" cash dividend increase announcements by firms listed on the ASE for the period of 10 days before through 10 days after the announcement day ( $t = 0$ ) during the period 2000-2004. Also, it presents daily cumulative abnormal returns (CARs) along with the associated t-statistics, for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10). \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

dividend announcements convey important information causing the market to react until 10 days after the announcement. On the other hand, the event periods before the announcement  $(-10, 0)$ ,  $(-5, 0)$ , and  $(-2, 0)$  are all statistically insignificant implying that investors react after the revelation of “unexpected” dividend increase announcements.

The results of this table, Table 34, show that “unexpected” dividend increase announcements, above the MMD, have a significant negative effect that continues to be present for many days (as increasing CARs reveal) confirming the hypothesis of this study that “unexpected” dividend increase announcements, in a setting where dividends are mandatory, are perceived as “bad” news by shareholders and reduce their wealth. Finally, these findings are opposite to those reported in previous empirical studies for the ASE, such as Dasilas and Leventis (2011) who found positive abnormal returns on the first day after the announcement day as well as positive cumulated abnormal returns for the event window  $(+1, +5)$ . Moreover, the results of Table 34 are in contrast to most of the results in the literature which indicate positive market reaction in case of unexpected dividend increase announcement, both on the announcement days and the proceeding days.

In Table 35 the approach is similar to Table 33 and includes “hra-unexpected” ( $N=80$ ) dividend increases by firms listed in the ASE during the period 2000-2004. Table 35 reports that the market presents a quite similar tendency as in Table 34 in cases of “unexpected” dividend increases. On the announcement day the abnormal return is negative,  $-0.34\%$  but statistically insignificant at any level of significance. The only event days with statistically significant stock price abnormal activity in the post announcement day is only the next day after the announcement day,  $t + 1$  and the sixth day. In particular, on day  $t = +1$  the abnormal return is again negative  $-1.47\%$  (as in Table 34) and statistically significant at the  $1\%$  level of significance. On the event day  $t = +6$  the abnormal return is also negative  $-0.50\%$  and statistically significant at the  $5\%$  level of significance. Contradicting with Table 34, Table 35 indicates that there is not any leakage of information prior to the announcement day since there is not any statistically significant abnormal activity during the pre-announcement period.

As one can observe from Table 35 the pattern of CARs is exactly the same as that of Table 34. Namely, the CARs of the event periods before the announcement  $(-10, 0)$ ,  $(-5, 0)$ , and  $(-2, 0)$  are all statistically insignificant implying that there not any leakage of information. Contrary to the pre-announcement CARs, all the CARs for the event periods after the announcement  $(0, +2)$ ,  $(0, +5)$ , and  $(0, +10)$  are negative and statistically significant at the 1% level of significance. This market price reaction once more indicates that in stock markets, where the distribution of dividend is mandatory, the announcement of “hra-unexpected” dividend increase causes negative reaction and reduces the wealth of investors.

The main conclusion from the study of Table 34 and Table 35 is that “unexpected” as well as “hra-unexpected” dividend increases lead to a negative price reaction to the stock market, in contrast with other stock markets in the USA, in Europe as well as in Greece (Dasilas and Leventis (2011)). According to the results of this section, throughout the post-announcement event windows, after the announcement of any type of dividend increase, the sign of the CARs are negative and statistically significant<sup>63</sup>. Outside investors seem to interpret the signals coming from dividend increase announcements, either “unexpected” or “hra-unexpected”, as “bad” signals for the firms’ future, and thus they react with a negative manner. Insufficient investment opportunities, firm maturity and shareholders withdrawing cash, could be one of the reasons that lead to investors’ negative reaction following a dividend increase announcement. Nevertheless, the results could be different without the distribution of mandatory dividends from the profitable firms according to the legislation rules of the Greek stock market.

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<sup>63</sup>The behavior of CARs for the post-announcement event windows is in line with the behavior of CARs from the study of Vazakis and Athianos (2010) for the period 2004-2008. They also found negative CARs, but without having any separation according to the mandatory dividend distribution.

Table 35: Abnormal returns (AR) from "hra-unexpected" dividend increase announcements (above mandatory) (N=80), Period 2000-2004

Event Day	$AR_t\%$		t-statistic
	Market	Adjusted Model	
-10		-0.0007	-0.2833
-9		-0.0005	-0.2188
-8		0.0008	0.3274
-7		-0.0018	-0.7830
-6		-0.0028	-1.1832
-5		0.0016	0.6649
-4		-0.0013	-0.5475
-3		0.0014	0.5722
-2		0.0027	1.1611
-1		0.0010	0.4287
0		-0.0034	-1.4452
+1		-0.0147	-6.2140***
+2		-0.0001	-0.0407
+3		-0.0028	-1.1801
+4		-0.0034	-1.4411
+5		0.0029	1.2464
+6		-0.0050	-2.1249**
+7		0.0003	0.1477
+8		0.0024	1.0290
+9		-0.0020	-0.8302
+10		0.0011	0.4814
Event Periods	CARs		t-statistic
	Market	Adjusted Model	
(-10,0)		-0.0031	-0.3940
(-5,0)		0.0020	0.3405
(-2,0)		0.0003	0.0834
(0,+2)		-0.0182	-4.4455***
(0,+5)		-0.0214	-3.7047***
(0,+10)		-0.0245	-3.1272***

This table presents event days, number of observations (N), daily average market-adjusted abnormal returns ( $AR_t$ ), and respective tests of significance (t-statistics of  $AR_t$ ) of 80 "hra-unexpected" cash dividend increase announcements by firms listed on the ASE for the period of 10 days before until 10 days after the announcement day ( $t = 0$ ) during the period 2000-2004. Also, it presents daily cumulative abnormal returns (CARs) along with the associated t-statistics, for the event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10). \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

#### 5.4.4 Abnormal returns and the level of “unexpected” dividend increase

In order for the above relationship between abnormal returns and the level of “unexpected” dividend increases announcement, that emerged from the empirical analysis, to be examined, the sample of “unexpected”<sup>64</sup> dividend increase announcements (N=110) is sorted according to the difference between the announced dividend ( $D_0$ ) and the expected minimum mandatory dividend (eMMD) corresponding to current earnings according to law ( $D_0$ -eMMD). Afterwards, the sorted sample is divided into three groups (portfolios) of equal size (each portfolio contains 1/3 of the sample). The announcements included in the portfolio with the largest differences ( $D_0$ -eMMD large) are denoted as HIGH “unexpected” dividend increase announcements (N=37) and the announcements with the smallest differences ( $D_0$  - eMMD small) as LOW “unexpected” dividend increase announcements (N=37) (the 36 cases in between are not examined). Subsequently, abnormal returns are measured for the portfolios of HIGH and LOW “unexpected” dividend increase announcements. Also, the differences between the abnormal returns across these portfolios (HIGH and LOW), along with their significance tests (t-statistics), are calculated.

Table 36 presents daily average abnormal returns of the HIGH ( $AR_H$ ) and LOW ( $AR_L$ ) dividend portfolios and the differences between abnormal returns DARs of the HIGH and LOW dividend portfolios ( $DAR=AR_H-AR_L$ ) (N=37) along with their respective t-statistics for the period of -10 to +10 days relative to the announcement day ( $t = 0$ ) by firms listed on the ASE for the period 2000-2004. The lower part of the table displays cumulative abnormal returns of the HIGH ( $CAR_H$ ) and LOW ( $CAR_L$ ) portfolios and differences between cumulative abnormal returns DCARs ( $DCAR=CAR_H-CAR_L$ ) (N=37) along with their respective t-statistics for event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10).

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<sup>64</sup>The relationship between abnormal returns and the level of “hra-unexpected” dividend increases announcement is also examined but since the results were exactly the same with the “unexpected” dividend increase this study reports only the last set of results. The second set of results are available upon request.

Table 36: Abnormal stock returns (AR) and the level of "unexpected" dividend increase, Period 2000-2004

Event Day	AR of HIGH (AR <sub>H</sub> )		AR of Low (AR <sub>L</sub> )		Difference between AR of HIGH and LOW	
	"unexpected" dividends (N=37)		"unexpected" dividends (N=37)		"unexpected" dividends	
	AR <sub>H</sub>	t-statistic of AR <sub>H</sub>	AR <sub>L</sub>	t-statistic of AR <sub>L</sub>	DAR=AR <sub>H</sub> -AR <sub>L</sub>	t-statistic of DAR
-10	0.0008	0.1892	0.0001	0.0219	0.0007	0.0420
-9	0.0066	1.5693	-0.0032	-0.9287	0.0098	4.3006***
-8	0.0026	0.6190	0.0008	0.2333	0.0018	0.3017
-7	-0.0001	-0.0326	-0.0039	-1.1298	0.0038	0.9111
-6	0.0019	0.4437	-0.0028	-0.7948	0.0047	1.1157
-5	0.0011	0.2732	0.0013	0.3853	-0.0002	0.0030
-4	-0.0017	-0.4149	0.0001	0.0170	-0.0018	0.2082
-3	0.0012	0.2853	0.0015	0.4412	-0.0003	0.0080
-2	0.0076	1.8182*	-0.0029	-0.8436	0.0105	6.0281***
-1	-0.0011	-0.2554	0.0030	0.8684	-0.0041	1.0661
0	-0.0084	-2.0136*	0.0038	1.0939	-0.0122	10.4257***
+1	-0.0155	-3.6877***	-0.0174	-5.0200***	0.0019	0.0610
+2	-0.0027	-0.6414	0.0025	0.7349	-0.0052	1.1902
+3	-0.0038	-0.9166	-0.0029	-0.8445	-0.0009	0.0413
+4	-0.0045	-1.0630	-0.0022	-0.6368	-0.0023	0.3609
+5	0.0018	0.4375	0.0014	0.4141	0.0004	0.0079
+6	-0.0023	-0.5542	-0.0049	-1.4177	0.0026	0.5159
+7	-0.0025	-0.5973	0.0020	0.5754	-0.0045	0.9582
+8	0.0021	0.4922	0.0012	0.3326	0.0009	0.0482
+9	0.0007	0.1650	-0.0044	-1.2668	0.0051	1.3562
+10	-0.0010	-0.2421	0.0042	1.2032	-0.0052	1.7507
Event Periods	CAR <sub>H</sub>		CAR <sub>L</sub>		DCAR=CAR <sub>H</sub> -CAR <sub>L</sub>	
	t-statistic of CAR <sub>H</sub>		t-statistic of CAR <sub>L</sub>		t-statistic of DCAR	
	CAR <sub>H</sub>	t-statistic of CAR <sub>H</sub>	CAR <sub>L</sub>	t-statistic of CAR <sub>L</sub>	DCAR=CAR <sub>H</sub> -CAR <sub>L</sub>	t-statistic of DCAR
(-10,0)	0.0104	0.7482	-0.0022	-0.1917	0.0126	0.7922
(-5,0)	-0.0013	-0.1254	0.0068	0.8011	-0.0081	0.6315
(-2,0)	-0.0019	-0.2603	0.0039	0.6459	-0.0058	0.7029
(0,+2)	-0.0266	-3.6619***	-0.0110	-1.8424*	-0.0155	-4.1462***
(0,+5)	-0.0330	-3.2189***	-0.0147	-1.7385	-0.0183	-3.0358***
(0,+10)	-0.0361	-2.5993**	-0.0167	-1.4568	-0.0194	-2.5500**

This table examines the sample of "unexpected" dividend increase announcements (N=110) according to the difference between the announced dividend (D<sub>0</sub>) and the expected minimum mandatory dividend (eMMD) corresponding to current earnings. The sample is sorted and divided into three groups (portfolios) of equal size (each portfolio contains 1/3 of the sample). The announcements in portfolio with the largest differences (D<sub>0</sub>-eMMD) are denoted as HIGH "unexpected" dividend increase announcements (N=37) and the announcements with the smallest differences (D<sub>0</sub>-eMMD) as LOW "unexpected" dividend increase announcements (N=37). The table presents event days, daily average market-adjusted abnormal returns for the portfolio of 37 "unexpected" HIGH (AR<sub>H</sub>) and 37 "unexpected" LOW (AR<sub>L</sub>) dividend increase announcements and differences between abnormal returns of the respective portfolios (DAR=AR<sub>H</sub>-AR<sub>L</sub>) along with the respective tests of significance (t-statistics of AR<sub>t</sub> and DAR) by firms listed on the ASE for the period of 10 days before through 10 days after the announcement day (t = 0), during the period 2000-2004. Also, the table shows cumulative abnormal returns of the HIGH (CAR<sub>H</sub>) and LOW (CAR<sub>L</sub>) portfolios and differences between cumulative abnormal returns (DCAR=CAR<sub>H</sub>-CAR<sub>L</sub>) along with their respective tests of significance (t-statistics of DCAR) for event periods (-10, 0), (-5, 0), (-2, 0), (0, +2), (0, +5), and (0, +10). \*\* and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

As shown in Table 36, the portfolio of HIGH dividend increases ( $D_0$ -eMMD is large) has an average abnormal return on the announcement day ( $t = 0$ ) equal to -0.84% that is statistically significant at the 10% level of significance (t-statistic= -2.0136). Similarly, a negative abnormal return is observed on the event day  $t = +1$  of -1.55% which is also statistically significant but at the 1% level of significance (t-statistic= -3.6877). All other days have abnormal returns statistically insignificant at conventional levels of significance.

The two, five and ten days cumulative average abnormal returns after the announcement ( $CAR(0, +2)$ ,  $CAR(0, +5)$ ,  $CAR(0, +10)$ ) are equal to -2.66%, -3.30%, and -3.61% respectively, and they are statistically significant at the 1%, 1%, and 5% level of significance respectively (t-statistics are -3.6619, -3.2189, and -2.5993 respectively). The ten, five, and two days cumulative average abnormal returns before the announcement ( $CAR(-10, 0)$ ,  $CAR(-5, 0)$ , and  $CAR(-2, 0)$ ) are all statistically insignificant at conventional levels of significance.

For the portfolio of LOW dividend increases ( $D_0$ -eMMD is small) the abnormal return on the announcement day ( $t = 0$ ) is statistically insignificant at any conventional level of significance. A negative abnormal return is observed on the event day  $t = +1$  equal to -1.74%, which is also statistically significant at the 1% level of significance (t-statistic= -5.0200). Cumulative average abnormal returns are statistically significant at the 10% level (t-statistic= -1.8424) only for the two days period after the announcement day  $CAR(0, +2) = -1.10\%$ .

The daily differences between abnormal returns (DAR) of the HIGH ( $AR_H$ ) and LOW ( $AR_L$ ) “unexpected” dividend increase portfolios ( $AR_H - AR_L$ ) are presented in column 3 of Table 36. A negative DAR with value -1.22% is observed on the announcement day ( $t = 0$ ), which is statistically significant at the 1% level of significance (t-statistic= -10.4257). Also, on the event days  $t = -9$  and  $t = -2$  a positive DAR is observed of 0.98% and 1.05% respectively, that is statistically significant at the 1% level of significance (t-statistics are 4.3006 and 6.0281 respectively). This result may be due to a leakage of conflicting or other information that affect investors trading be-

haviour. The rest of the days before and after the announcement day have DARs statistically insignificant at any conventional levels of significance.

Moreover, differences between cumulative average abnormal return (DCAR) of the HIGH ( $CAR_H$ ) and LOW ( $CAR_L$ ) portfolios for the event periods (0, +2), (0, +5) and (0, +10) are -1.55%, -1.83%, and -1.94% respectively, and they are statistically significant at the 1%, 1%, and 5% level of significance respectively (with t-statistics: -4.1462, -3.0358, and -2.5500 respectively). For the event periods (-10, 0), (-5, 0), and (-2, 0) all CARs and DARs are statistically insignificant at any conventional levels of significance.

Statistically significant differences indicate that the higher the “unexpected” dividend increase, the greater the negative market reaction, establishing a negative relationship between “unexpected” dividends and shareholders wealth. Hence, investors consider higher “unexpected” dividend increase announcements as a stronger signal of “bad” news. Furthermore, the increasing negative cumulative average abnormal differences (DCARs) for event periods after the announcement day may reflect that investors gradually are becoming aware of facts concerning the firm’s negative prospects which are not embedded in the announcement of the “unexpected” dividend increases. Possible explanations may include, excess free cash flows combined with a lack of valuable investment opportunities or resolution of agency conflicts, thus, providing support to the free cash flow hypothesis (Jensen, 1986).

#### 5.4.5 Dividend Increases and Capital Expenditures

During the presentation of the empirical results it has been mentioned that insufficient investment opportunities (“bad” signal) may lead firms to announce dividends higher than the mandatory minimum amount leading to a negative market reaction. In order for the hypothesis that firms increase dividend payments due to inadequate investment opportunities to be tested, this subsection examines changes in capital expenditures during the 5 year period surrounding the fiscal year that a dividend “unexpected” or “hara-unexpected” increase announcement takes place. In particular, the change in capital expenditures of firms that made “unexpected” or “hara-unexpected”

dividend increases announcements is compared with similar firms that did not increase their dividend payments. If dividend-increasing firms did indeed distribute higher dividends due to lack of investment opportunities, then a slower capital expenditures growth across these firms compared to similar firms that did not increase dividend payments should be observed.

Table 37 presents the results of this analysis. Capital expenditures are calculated as a percentage of total assets and are estimated for two groups of firms, namely firms that made “unexpected”<sup>65</sup> dividend increases announcements (i) equal to the minimum mandatory amount and (ii) higher than the minimum mandatory amount. The year, in which each “unexpected” dividend increase takes place is the base year and is denoted by 0. Column 0 presents the annual change of capital expenditures in the base year (from year  $t$  to year  $t - 1$ ). The columns “-2 to -1” and “+1 to +2” present the (arithmetic) average annual level of capital expenditures for the two years before and after the base year respectively. “Ld-Lg” is the average level in the 2-year period after the base year minus the level in the 2-year period before the base year and “Ld-0” is the average level in the 2-year period after the base year minus the level in the base year.

In addition, an adjusted measure of capital expenditures is calculated, in order to eliminate any industry-related systematic effects in capital expenditures change and to capture the firm-specific change of dividend-increasing firms. Specifically, for each firm in the sample, the average capital expenditures level of all the firms that belong to the same industry and did not make an “unexpected” dividend increase announcement is estimated and subtracted from the capital expenditures level of the firm that make an “unexpected” dividend increase announcement.

The analysis of this study raises two important findings. Firstly, the results indicate that firms making “unexpected” dividend increase announcements, above the minimum mandatory level, experience a subsequent decline in capital expenditures, even after adjusting for market-related systematic

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<sup>65</sup>Similar is the result for “hra-unexpected” dividend increase announcements, available upon request

Table 37: Sample of capital expenditures as a percentage to total assets of "unexpected" dividend increase announcements for firms listed in the ASE, grouped by (i) above mandatory level and (ii) at mandatory level. Period 2000-2004

200-2004

Unadjusted "unexpected" dividend increases					Adjusted "unexpected" dividend increases						
Above mandatory					Above mandatory						
	-2 to -1	0	+1 to +2	Ld-Lg	Ld-0		-2 to -1	0	+1 to +2	Ld-Lg	Ld-0
Mean	0.1225	0.0819	0.0392	-0.0833**	-0.0418**	Mean	0.0164	0.0028	-0.0107	-0.0272**	-0.0124
Median	0.1053	0.0575	0.0206	-0.0648**	-0.0252**	Median	0.0239	-0.0054	-0.0154	-0.0260**	-0.0008
N	99	96	99	99	96	N	99	96	99	99	96

Unadjusted "unexpected" dividend increases					Adjusted "unexpected" dividend increases						
Mandatory					Mandatory						
	-2 to -1	0	+1 to +2	Ld-Lg	Ld-0		-2 to -1	0	+1 to +2	Ld-Lg	Ld-0
Mean	0.0722	0.0771	0.0288	-0.0434**	-0.0458*	Mean	-0.0123	0.0083	-0.0017	0.0106	-0.0071
Median	0.0650	0.0356	0.0257	-0.0487**	-0.0181**	Median	-0.0037	0.0096	0.0097	0.0119	-0.0013
N	33	32	33	33	32	N	33	32	33	33	32

This table reports capital expenditures as a percentage of total assets for two groups of firms, namely firms that made "unexpected" dividend increases (i) above mandatory level and (ii) at mandatory level. Banks and financial services sectors were excluded. The adjusted capital expenditure level equals the unadjusted level minus the average level of all firms that belong to the same industry group as the dividend-increasing firm and did not make an "unexpected" dividend increase. Year 0 is the year in which the dividend increase took place. The columns "-2 to -1" and "+1 to +2" present the (arithmetic) average level of capital expenditures for the two years before and after the base year respectively. "Ld-Lg" is the average level in the 2-year period after the base year minus the level in the 2-year period before the base year and "Ld-0" is the average level in the 2-year period after the base year minus the level in the base year. N is the number of dividend announcements. The data have been winsorized at the first and ninety-ninth percentiles. Values (only in columns "Ld-Lg" and "Ld-0") significantly different from zero at the 5% and 1% level are marked by \* and \*\* respectively. The significance levels of the means (medians) are based on a two-tailed t-test (two-tailed Wilcoxon rank test)

effects. The average annual capital expenditures level in the two years following the dividend increase shrinks by 8.33% (statistically significant at the 1% level of significance) compared to the average of the years -1 and -2 and by -4.18% (statistically significant at the 1% level of significance) compared to the base year. What is more important is that the difference remains negative and statistically significant even after adjusting for any industry-related effects. Firms increasing dividends “unexpectedly” and above the minimum mandatory level experience on average a 2.72% (statistically significant at the 1% level of significance) slower growth in capital expenditures from the 2-year period before until the 2-year period after the dividend increase, compared to the rest of the firms belonging to the same industry and not paying “unexpectedly” higher dividend.

The second important result concerns firms increasing dividends “unexpectedly” but paying the mandatory level. Bear in mind that the mandatory dividend is determined as a fraction of net income, thus the unexpected dividend increase in this group of firms is the result of higher earnings and not of an intentional decision by the firm to raise dividend payments. In other words, it is a mechanical effect. Therefore, the negative relation between dividend increases and subsequent industry-adjusted capital expenditures should not apply in this case. Indeed, it is found that firms increasing dividends unexpectedly but paying the minimum mandatory level do also experience a decline in subsequent capital expenditures, but this difference becomes insignificant once industry-related effects are controlled. Specifically, the average capital expenditures from the 2-year period after the announcement of mandatory dividend compared to the base year before the industry adjustment declines by 4.58% and it is statistically significant at the 5% level of significance, but the corresponding decline of 0.71% after the industry-adjusted capital expenditures is not statistically significant at any conventional level.

Thus, the results of Table 37 strengthen the argument of this study that in countries where firms must distribute at least a fraction of their earnings as dividend, minimum mandatory dividend, any amount higher than the minimum one reflects “bad” signal in market. Outside investors consider

the “unexpected” dividend increase announcement like as firms anticipate declining profitable investment opportunities in the future, as they do not need excess cash resulting from the declining rate of reinvestment (avoiding agency problem), and for that reason they distribute them to shareholders. Results are consistent with the idea that dividend-increasing firms have less investment needs and hence more free cash flows. Consequently, dividend-increasing firms pay out dividends to reduce their excess cash and to reduce overinvestment.

## 5.5 Summary and Conclusions

This study investigates whether dividend increase announcements may have effects on stock market returns in a different institutional setting. Greek stock market has unique characteristics that make the study of dividend information hypothesis really interesting. The tax treatment of dividends and capital gains is one of the main interesting features. In Greece dividends are taxed only at the company level, while at the personal level incomes from dividends and capital gains are not taxed. Thus, the presence of any information signal through the dividend announcement in Greece, challenges the tax-based signaling model argument that higher taxes on dividends relative to capital gains are a necessary condition for dividends to be informative. Since dividends are not taxed it is expected that dividend announcement is not a tax based signal for good firms.

Another key feature of the Greek market is the fact that profitable firms are obligated to distribute a specific percentage of their earnings to shareholders (“expected” or minimum mandatory dividends (MMD)) according to the law. However, frequently firms voluntarily choose to distribute dividends higher than the minimum mandatory amount required by law. An additional characteristic of the Greek stock market pertains to firm ownership, which in many cases, is in the hands of a small number of major shareholders (low diffusion) that also hold managerial positions and may not create agency concerns to outside shareholders, reducing the information asymmetry. Minority shareholders or small investors may not be able exercise any power through

General Assembly to avoid agency. Moreover, most of the companies change their dividend every year and the announcement of them is made on a yearly basis. All the previous characteristics make the information content of a dividend announcement crucially important, if there is any.

This study considers only dividend increase announcements. A dividend increase announcement higher than the MMD is defined as “unexpected”, whereas a dividend increase announcement both higher than the MMD and also higher than the average dividends of the previous three years plus one standard deviation of this average is defined as “historically related average unexpected”, (“hra-unexpected”).

Initially this study investigates the total sample of dividend increase announcements for both categories: “unexpected” and “hra-unexpected”, for the period 2000-2004. Subsequently, in order for a better understanding of each category to be obtained, the sample is split in to two sub-samples. The first sub-sample is consisted of firms paying “expected” dividends (minimum mandatory dividends) and the second one of firms paying “unexpected” or “hra-unexpected” dividends (both above the minimum mandatory dividend).

Results show that when profitable Greek firms announce dividend increases that equal the minimum mandatory amount (“expected” dividends) there is no surprise, meaning that there is no signal conveyed to the market and no effect on shareholders wealth. Therefore, neither on the announcement date ( $t = 0$ ) nor one day before ( $t = -1$ ) and one the day after ( $t = +1$ ) there is any statistically significant abnormal returns. On the other hand, announcements of dividend increases higher than the minimum mandatory amount (both “unexpected” and “hra-unexpected” dividends) have a negative stock price effect. This is a sign that the market considers announcements of “unexpected” or “hra-unexpected” dividend increases forerunners of “bad” news soon to follow. Specifically, the next day after the announcement of “unexpected” or “hra-unexpected” dividend increase announcements there is a negative abnormal return that is statistically significant at any level of significance. Moreover the negative market reaction throughout the post-announcement period is also apparent in the cumulative abnormal returns (CARs) of different time intervals. This suggests that announcements of

“unexpected” or “hra-unexpected” payout increases, provide investors with ambiguous information about more than a firm’s near-term earnings.

The rationale of this study acknowledges the institutional uniqueness of the Greek stock market: minimum mandatory dividends and low ownership diffusion. Thus, when a listed firm announces voluntarily a dividend higher than the law stipulates, it is reasonable to be assumed that it has a cash surplus. If the surplus is the residual cash after profitable investments it will be promoted accordingly to investors through concurrent announcements (“good” news). Alternatively, lack of publicly available concurrent information concerning the firm’s economic future may disclose other information. If only “unexpected” or “hra-unexpected” dividend increases are announced, investors may infer that the surplus is a result of insufficient investment opportunities or firm maturity in which case managers prefer to distribute the cash (rather than investing it at below the cost of capital or wasting it on organization inefficiencies). Also, managers with shareholdings may be interested in withdrawing cash from their firms or resolving agency issues (“bad” news).

Thus, announcements of “unexpected” or “hra-unexpected” dividend increases that are not followed by other information that justify the firm’s decision make investors skeptical of the firm’s motives for these incomprehensible increased payouts, interpreting them as signals of “bad” news which decrease the shareholders wealth. Also, the finding that the higher the “unexpected” dividend increases (compared to the minimum mandatory dividend), the grater the negative market reaction, further strengthening the above arguments.

One more positive indication in favor of the negative price reaction after the announcement of dividends that are higher than the minimum mandatory amount, is the empirical result of this study concerning the level of firms’ capital expenditures which make these announcements. More specifically, average capital expenditures level for the 2 years period after the announcement year, with respect to the announcement year of firms that make “unexpected” dividend increase announcements, decline statistically significant, even after adjusting for any industry-related effect. But the decline of av-

verage capital expenditures level of industry-adjustment firms that announce the minimum mandatory dividend for the years  $t + 1$  and  $t + 2$  with respect to the announcement year is not statistical significant for firms

Finally, the empirical confirmation of dividend signaling hypothesis from this study, even though a dividend increase announcement is translated as “bad” signal for the investors, contradict with the tax-based signaling models which propose that higher taxes on dividends relative to capital gains are a necessary condition for dividend announcements to be informative. Additional research with more detailed data may help to further clarify shareholders’ wealth effects in the ASE.

## 6 Summary

This dissertation consists of three stand alone specific issues on dividend policy. The dividend policy has drawn a lot of attention in financial literature and it has remained one of the toughest challenges for financial economists. The term dividend policy is the practice of management as well as the board of directors in making dividend payout decisions or, in other words, the size and pattern of cash distributions over time to shareholders. Numerous researchers, adopting either a behavioral or an empirical approach, have provided different justifications to deal with the issue of why companies pay dividends and whether the market response to the announcements can be predicted. However, a harmony on either issue have been failed to be achieved due to the existence of various market imperfections (taxes, transaction costs, information asymmetry, agency problems, etc.) which have provided the basis for the development of various theories on dividend policy.

In the first essay of the thesis the dividend growth predictability via dividend yield is assessed. In particular, it is examined whether the use of monthly, disaggregated, dividend payments instead of annual aggregated dividend payments can significantly improve the annual dividend growth predictability. A mixed data sampling approach is being used that avoids the high frequency seasonality issues and by smoothing out the events of price volatility on the dividend yield, it is found that for each one of the four countries the dividend yield contains significant information on the growth of future dividends. It is also identified a component of the smoothed dividend yield that always contains significant predictive information. In addition, the sign of the dividend growth - dividend yield relationship is negative for all countries, as theoretically expected. Furthermore, it has been shown that these results remain valid even if the liquidity of the market or the volatility of dividend payments is considered.

Therefore, the use of high frequency data, namely, the use of partially disaggregated information of dividend yield, along with the identification of its informative component, provided strong evidence that supports the hypothesis of dividend growth predictability via dividend yield.

The second essay of this dissertation extends the international evidence by studying the ex-dividend stock price behaviour of stocks listed on Athens Stock Exchange (ASE), during a ten year period 1996-2005. In the Greek stock market, the study of both cum- and ex- dividend behaviour is interesting for the following reasons: The differential taxation between dividend and capital gains is absent, since neither dividends nor capital gains are taxed. Dividends are distributed once a year, whereas in many other countries (e.g. US, UK, Japan, Australia) dividends are paid quarterly or semi-annually, and their distribution is mandatory for profitable firms, according to Law 2190/1920. Short selling in ASE is limited to a few stocks only. The tick size is very small compared to the dividend as well as the transaction cost. There is no market making, so the open and close bid ask spreads are not equivalent regulator of bid ask spread. Lastly, there was a significant change in the mechanism concerning the ex dividend close adjustment in 2001.

These idiosyncratic characteristics of the Athens Stock Exchange make this study valuable, as it can isolate some of the most awarded explanations from previous academic researches, such as the tax-explanation as proposed from Elton and Gruber (1970) and the price discreteness due to minimum tick size as firstly proposed from Bali and Hite (1998). Despite the fact that in a market like Greece one would expect that the stock prices on ex-dividend day will drop by an amount equal to the dividend, the empirical evidence of this study shows that on average the price drop is smaller than the dividend.

Moreover, the examination of the abnormal returns as well as the abnormal volumes around the ex-dividend day, do not reveal evidence of short-term trading. Both variables are not affected by commonly used measures of transaction costs, such as the inverse of price on cum day and trading volume. Furthermore, the cross sectional analysis of abnormal returns to dividend yield, after controlling for other variables, such as the idiosyncratic risk and transaction costs, reveals that none of them can affect significantly the abnormal returns.

It is also examined the unique institutional modification announced by the ASE Board of Directors (April 2001), according to which the opening ex dividend day price is equal to the closing price on cum day and it is investi-

gated whether this modification has any effect on the observed ex dividend day behaviour. The empirical results show that this announcement alleviates, but not eliminates, the anomaly. As a result, evidences are provided that institutional changes may affect stock price behaviour on the ex-day, since institutional interventions that allow the free function of the market, may level out pricing inefficiencies.

Finally, the second essay argues that microstructure impediments, such as illiquidity, could be a dominant source of the ex-dividend price behaviour. The empirical analysis indicates that illiquidity, as proposed by Amihud (2002), affects stock price behaviour on the ex-dividend day, causing the ex-day premium to deviate from unity and the ex-day abnormal returns to deviate from zero. More specific, in a low illiquidity (high liquidity) quartile the price drop equals the dividend amount and the abnormal returns are close to zero. These findings make a positive contribution to the literature as they propose a potential explanation for the ex-dividend stock price anomaly, the illiquidity of the market. Thus, the rejection of some of the possible explanations that have already been proposed in the literature helps researchers identify which explanations may be still valid for future studies.

The last essay of this study investigates whether dividend increase announcements both “unexpected” and “hara-unexpected” may have effects on stock market returns in a different institutional setting of the Athens Stock Exchange for the period 2000-20004. The special tax treatment of dividends and capital gains is one of the main features of the Greek stock market since dividends are taxed only at the company level while at the personal level incomes from dividends and capital gains are not taxed. Another idiosyncratic characteristic of the Greek environment is the fact that profitable firms are obligated to distribute a specific percentage of their earnings to shareholders (“expected” or minimum mandatory dividends (MMD)) according to the law.

An additional feature of the Greek stock market pertains to firm ownership, which in many cases, is in the hands of a small number of major shareholders (low diffusion) that also hold managerial positions and may not create agency concerns to outside shareholders, reducing the information

asymmetry. Moreover, most of the companies change their dividend every year and the announcement of them is made on a yearly basis.

The empirical results from such a specific environment show that market reacts strongly to announcements of changes in cash dividends. Investors do care about the information transmitted by dividend announcements. When profitable Greek firms announce dividend increases, that equal the minimum mandatory amount (“expected” dividends), there is no surprise as there is no signal conveyed to the market and there is no effect on the shareholders wealth. On the other hand, announcements of dividend increases higher than the minimum mandatory amount (both “unexpected” and “hra-unexpected” dividends) have a negative stock price effect, a sign that the market considers announcements of “unexpected” or “hra-unexpected” dividend increases forerunners of “bad” news that will follow. Thus, announcements of dividend increases that are not followed by other information that justify the firm’s decision, make investors skeptical of the firm’s motives for these incomprehensible increased payouts, interpreting them as signals of “bad” news which in turn decrease the shareholders wealth. These findings, even though a dividend increase announcement is translated as “bad” signal for the investors contrary to the literature, support the view that dividends convey unique and valuable information to investors and contradict with the tax-based signaling models, which propose that higher taxes on dividends relative to capital gains are a necessary condition for dividend announcements to be informative.

The negative price reaction after the announcement of dividends higher than the minimum mandatory ones is strengthened by the fact that the higher the “unexpected” dividend increases (compared to the minimum mandatory dividend) the grater the negative market reaction. Another significant indication in favor of the negative price reaction is confirmed from the reduction on firms’ average capital expenditures level, for the 2 years period after the announcement year, with respect to the announcement year.

The ideas and concepts presented in the third chapter can be further extended and contribute significantly in the literature of corporate finance. For example, it is left as future research to be examined whether dividend yield includes any predictability power at a more disaggregated level that will

be firm specific for an individual country. Moreover, the current analysis is silent in terms of managers' behaviour and how their perspectives of future economic climate and the anticipation of competitors decisions may affect their decisions for future dividend announcements.

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