STOCK SPLITS ON THE ATHENS STOCK EXCHANGE

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ABSTRACT

We investigate the valuation effects of stock splits undertaken by Greek firms traded on the Athens Stock Exchange. We find no evidence of price reaction on the announcement day, but strong evidence of positive price adjustments on the ex-day. Further evidence suggests that stock splits are used to adjust price to a "normal" trading range without producing a liquidity improvement. Both split factors and stock price reaction are not related to future earnings surprises, implying the absence of signaling effects. We attribute the price effects on the ex-day to an order imbalance in favor of demand caused by the absence of when-issued trading as smaller investors enter the market.

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Since Fama, Fisher, Jensen and Roll (1969) published their seminal paper on stock splits, a large body of research has investigated this particular corporate decision. The interest in stock splits is motivated by the fact that this event is not directly related to changes in the operating or financial structure of the firm and, therefore, should cause no change in stock price other than the adjustment warranted by the split factor. There is ample evidence, however, that stock splits in the U.S. and other markets are associated with significant positive excess returns around the announcement as well as the ex-day of the split [e.g., Grinblatt, Masulis and Titman (1984), Lamoureux and Poon (1987), Ikenberry, Rankine and Stice (1996)]. Several explanations have been advanced to explain the excess market reaction around the stock split days. For example, Lakonishok and Lev (1987) and McNichols and Dravid (1990), among others, suggest that firms split their stock in order to adjust the stock price back to an "optimal" trading range. Grinblatt, Masulis and Titman (1984), Brennan and Copeland (1988), and McNichols and Dravid (1990) show that stock splits are used to signal firm optimism about future prospects. Finally, the hypothesis of increased liquidity following stock splits has been met mostly with contrary evidence [see, for example, Copeland (1979), Lakonishik and Lev (1987), Conroy, Harris and Benet (1990) and Easly, O'Hara and Saar (2001)].

This study analyzes the price effects of stock splits undertaken by firms whose stock is traded on the Athens Stock Exchange (ASE). It also tests empirically some of the hypotheses that have been advanced, by prior literature, to explain the abnormal price reaction to stock splits. The institutional characteristics of the Greek stock market provide a useful experimental context

to study stock splits. For example, brokerage fees and other public trading costs, including listing fees, are cost-neutral to stock splits, implying limited signaling value. There are no specialists or market makers to affect the price formation as in the U.S., thus, ruling out any related microstructure-based explanations for the ex-day price reaction. The absence of capital gains taxes also eliminates the "tax option" explanation of Lamoureux and Poon (1987). The small size of round lots also makes it unlikely that stock splits are motivated by the goal of achieving an optimal balance between institutional and retail investor clienteles. Finally, listing and trading of new shares occurs with a delay without the benefit of a when-issued market. This restricts the available supply of shares and can affect prices around the ex-day.

In contrast to U.S. stock splits, we find no evidence of positive price reaction on the stock split announcement day. We find, however, positive significant price reaction on the ex-day, which corroborates similar findings for U.S. stock splits. Also, as a test of the price pressure hypothesis we report evidence regarding the stock price reaction at the time the new shares are listed and start trading on the ASE. In contrast to the price pressure hypothesis, but in line with the market efficiency hypothesis, we do not find significant stock price reaction on the listing day.

Further empirical tests produce several interesting findings. First, the split factor is positively related to the pre-split price of the stock, providing support to the trading range hypothesis. Second, marketability as measured by both the market-adjusted turnover ratio and the liquidity ratio declines in the post-split period. There is no evidence that split factors or market price reaction reflect the firms' private expectations about future earnings. However, splitting stocks experience earnings improvement in the years prior to the stock split.

This study contributes to the international literature because it examines the stock price reaction associated with the announcement of stock splits in a stock market where the signaling and the investor clientele motives are less important factors than in the markets covered by prior studies. The general conclusions are two: First, the liquidity-related findings, reported in earlier studies, constitute an international phenomenon. Second, both taxable (i.e., cash dividends) and non-taxable stock distributions (like stock splits and stock dividends) can produce stock price effects due to institutional market characteristics.

The rest of the paper is organized as follows. Section II reviews the literature on stock splits. Section III discusses the institutional mechanics that apply to stock splits on the ASE and draws empirical implications. Section IV describes the data and the sample. Section V presents and interprets the results and section VI summarizes the paper.

II. Literature Review

Studies of U.S. stock splits, including Grinblatt, Masulis and Titman (1984), Lamoureux and Poon (1987), McNichols and Dravid (1990), Maloney and Mulherin (1992) and Ikenberry, Rankine and Stice (1996) report evidence of significant positive abnormal returns around the split announcement day. The positive stock price reaction on the announcement day follows a significant positive price run-up in the months preceding the stock split decision (Grinblatt, Masulis and Titman (1984)). This price run-up is followed by a persistent upward price drift, that Ikenberry, Rankine and Stice (1996) attribute to investor underreaction at the announcement time. There is also evidence of significant positive abnormal price reaction around the ex-day (e.g., Eades, Hess and Kim (1984), Grinblatt, Masulis and Titman (1984), Lamoureux and Poon (1987) and Maloney and Mulherin (1992)). The significant reaction on the ex-day is puzzling because capital market efficiency rules out further revaluation around the ex-day given the high

certainty about the execution of the stock split. Lamoureux and Poon (1987) attribute the positive market reaction to price pressure induced by an expansion of the investor clientele of the splitting stocks which generates additional positive revaluation around the ex-day. Maloney and Mulherin (1992) provide evidence that the ex-day positive price reaction is due to a temporary order imbalance caused by a surge of buy orders as new investors are attracted to the splitting stock.

Significant positive abnormal returns around the announcement and ex-day have been also reported from markets outside the U.S. Some examples include: Kryzanowski and Hao (1991) for Canadian stocks; Biger and Page (1992) for stock splits on the Johannesburg Stock Exchange; Wu and Chan (1997) for Hong Kong stocks; and Niini (2000) for Finnish and Swedish stocks.

Researchers have attempted to explain the market's positive reaction to stock splits on the basis of valuation effects generated by changes in liquidity and trading costs, the adjustment of price to an optimal trading range, and signaling. The liquidity-improvement hypothesis is based on the proposition that lower-priced stocks draw more investors and generate greater trading volume, thus enhancing marketability and reducing the bid-ask spread. The overall evidence does not appear to support the liquidity improvement hypothesis. Copeland (1979) finds a widening of the bid-ask spread as percent of price following stock splits. Similar results regarding the bid ask spread in the post-split period are also reported by Conroy, Harris and Benet (1990), Schultz (2000) and Easley, O'Hara and Saar (2001). Consistent with these results, Lakonishok and Lev (1987), Lamoureux and Poon (1987) and Conroy, Harris and Benet (1990) find a decrease or no change in the trading volume of splitting stocks.

Conventionally, the trading range hypothesis suggests that adjusting the price back to its "optimal trading range" can induce a positive revaluation effect. The main argument behind this hypothesis is that small investors have a preference for low-price stocks in order to trade in round lots and, thus, minimize their trading costs. In contrast, large investors prefer high-price stocks since the trading cost per dollar falls as the price moves higher, thus, leaving the optimal trading range effect open to empirical validation. Also, in relation to the same hypothesis, firms may use a split to achieve an optimal balance of investor clienteles resulting in a better valuation of their stock. Several studies (e,g., Lakonishok and Lev (1987), Ikenberry, Rankine and Stice (1996) and Rozeff (1998)) find that stock prices increase faster for firms that later split their stock than their matches and the price gap disappears after the split (Lakonishok and Lev (1987)). Conroy, Harris and Benet (1990), McNichols and Dravid (1990) and Rozeff (1998) find that split factors are positively related to pre-split prices or price deviations from normal levels. Results based on the modeling of trades in Easley, O'Hara and Saar (2001) also provide mild support to the trading range hypothesis.

Stock splits can be also informative to the market in two ways. First, they can be used to signal the firm's private information about future prospects. Second, they can help attract the interest of more analysts and investors and thus lead to a positive revaluation of the stock. Stock splits can have signaling value because they have costly consequences, including execution costs, higher listing fees, and greater trading costs associated with price drops (Brennan and Copeland (1988)). Therefore, only firms with positive private information can afford to signal through a stock split. Firms can also split their stock to attract market attention (Grinblatt, Masulis and Titman (1984) and Brennan and Hughes (1991)). Only firms that believe to be undervalued or expect to perform well have the incentive to attract attention and cause a revaluation of their fundamentals. Both these information-based theories have received supportive evidence in the

U.S.. For example, Lakonishok and Lev (1987) find that, compared to their peers, splitting firms have strong pre-split earnings performance that is not reversed after the split. In addition, McNichols and Dravid (1990) report that unanticipated earnings per share (EPS) increase after the split; split factors are positively related to favorable post-split earnings surprises; and announcement excess returns increase with the split factor.[1]

III. Greek Stock Split Mechanics and Empirical Implications

In Greece, the process of conducting a stock split starts with a board of directors proposal and a call for a shareholders meeting that follows within about 25 days. Within a week or less, there is a board press release about the stock split proposal. Upon approval of the stock split, the ex-day is set to coincide with the record date. The listing of the new shares occurs (by law) within ten days of the ex-day or 30 days of the shareholders meeting day.

When-issued trading prior to the ex-day or the listing day of the split shares is not allowed on the ASE. Thus, between the ex-day and listing day, trading on the splitting stock – at the post-split price – is limited to the old shares.[2] Brokerage fees for trading on the ASE are freely negotiable and levied on the market value of traded shares. Hence, increasing the number of shares through a stock split does not impact transaction costs. The same is true for other charges related to public trading, like transfer fees and sales tax as well as listing fees - all of which depend on market value. The size of round lots is normally 10 shares, although some stocks trade in lots of 1 to 25 shares. During the period of this study the ASE operated as an electronic market without market makers, which were introduced later in 2003.

[1] For further evidence in favor of the signaling effect of stock splits, see Pillotte and Manuel (1996), Brennan and Hughes (1991), Schultz (2000), and Ye (1999). Despite the ample evidence in favor of the singnaling effect, some recent papers cast doubt on the effectiveness of stock splits to reduce information asymmetry between the firm and the market (Ikenberry and Ramnath (2002), and Easley, O'Hara and Saar (2001)).

The institutional characteristics of the ASE have serious implications for the empirical study of stock splits. The neutrality of transaction and other public trading charges reduces the effectiveness of stock splits in signaling positive inside information. If all firms can execute stock splits with little difference in cost consequences, investors can not distinguish reliably between good and bad firms. Nonetheless, stock splits can still draw attention to the firm's performance (as suggested by Grinblatt, Masulis and Titman (1984)), and thus cause a revaluation. The price adjustment can also reveal the insiders' favorable expectation that the recent price gains will not be reversed in the near future. It is unlikely that insiders will split the stock and reduce the price if they expect a negative price drift. Thus, although the signaling effects of stock splits by Greek firms are diminished due to institutional characteristics, there is still a residual informational effect that can cause price reaction. The small size of round lots and the strong reliance on large insider holdings makes it less likely that stock splits are used to restore the balance of stock ownership between large and retail investors. However, by generating a "buzz" about the firm, stock splits can attract the interest of retail investors. An expansion of the investor base could then affect prices favorably. The absence of when-issued trading has implication for price formation around the ex-day. The delayed availability of new shares limits trading to the old shares. As new – especially smaller investors – are attracted to the stock, an order imbalance in favor of buy orders can create price pressure and push prices up.

IV. The Sample and Data

The sample of stock splits is from the period 1990 to 2000. There were a total of 89 stock splits in the ASE over this period. Thirty-four cases are deleted from the original sample because their

[2] In the U.S., when-issued trading allows, especially small investors, to trade in split shares at the adjusted price in the period prior to the ex-day (Angel, Brooks, and Mathew (2004)).

ex-day coincided with the ex-day of another corporate event of the same stock, such as a stock dividend or a rights issue, thus, leaving a sample of 55 stock splits. Three stock splits are eliminated because the splits occurred shortly after the original listing day of the firm on the stock exchange. To avoid the computation of returns from a small number of transaction prices, sample firms with fewer than 30 trading days in the estimation period, that is, day -140 to day -41 relative to the event date, are deleted from the sample. These deletions resulted in a final sample of 49 stock splits for the price reaction tests around the announcement day and 46 stock splits for the price reaction tests around the ex-split day and listing day.

Announcement dates of the stock splits were collected from the Greek daily and periodical press. Daily stock returns, market returns, trading volume data, split factors and all other accounting information were extracted from electronic data files and various publications (Yearbooks and Annual Statistical Bulletins) of the Athens Stock Exchange.

Table 1 presents the annual number of stock splits and the distribution of stock splits by split factor in the period 1990-2000. Nearly half of the stock split factors are two-for-one. Only about 9% of the split factors are below 2. This implies that stock splits by Greek firms reduce their stock prices substantially.

Table 1 goes here

V. Tests and Results

V.1. Price reaction

The price reaction tests are performed in relation to four event days. Day A is the earliest day of the announcement of the stock split. This is the day the board decides to propose the stock split

and call a shareholders meeting. Day B is when the first public announcement of the stock split is made and it coincides with the day of the board's press release that includes its stock split proposal. Day C is the ex-day. Finally, day D is the listing day of the new shares and coincides with the day the new shares can be traded.

The price reaction (given by daily average abnormal returns and cumulative average abnormal returns) is estimated by applying, respectively, the mean adjusted returns-model, the market adjusted returns model, the market model, and the market model with the Scholes-Williams beta estimation method. Since most of the results concerning abnormal returns are qualitatively similar, we report only the findings derived from the market adjusted return model.[3] The composite index of the ASE is used as the proxy for the market portfolio. To apply the event type methodology, returns are computed over 151 days, from day -140 to day +10 relative to the event day, which is day 0. Following Brown and Warner (1980, 1985), in the case of missing returns, parameter estimation excludes both the day of the missing return and the return of the subsequent day.

V.1.1. Announcement price effects

We use two announcement days: day A and day B, as defined above. Table 2 reports the findings associated with event day A. In particular, it shows the event days -10 to +10 relative to announcement day A (event day 0), the number of observations used to derive the daily average abnormal returns (ARs), the daily average abnormal returns for each event day -10 to +10 relative to event day 0, the percentage of positive ARs, the t- statistics (t[AR]) for the corresponding ARs, the daily cumulative abnormal returns (CAR) for each event day in the period -10 to +10, and the cumulative abnormal returns and associated t-statistics (t[CAR]) for the intervals (-1, 0) and (-1,

+1) around event day 0.

Table 2 goes here

As shown in Table 2, the average abnormal return on event day -1 is 1.15%, statistically insignificant at any conventional level (t[AR]=1.63). The average abnormal return on event day 0 is 0.32%, also statistically insignificant at any conventional (t[AR]=0.46). The cumulative abnormal returns for event periods (-1, 0) and (-1, +1) are 1.47% and 1.27%, respectively, statistically insignificant at any conventional level of significance (t[CAR] is 1.47 and 1.04, respectively).

Table 3 reports the findings associated with event day B (first public announcement of the stock split in the press). The structure of Table 3 is similar to the structure of Table 2. As shown, in Table 3, the average abnormal returns for event days -1 and 0 are -0.06% and 0.53%, respectively, statistically insignificant at any conventional level (t[AR] is -0.09 and 0.72, respectively). Similarly to Table 2, the cumulative abnormal returns for event periods (-1, 0) and (-1, +1), are also statistically insignificant at any conventional level of significance (t[CAR] is -0.45 and 1.31, respectively).

Table 3 goes here

The results related to the announcement period show that there is no stock price reaction associated with the announcement of stock splits. This evidence is opposite to the corresponding one regarding the U.S. stock splits. The lack of positive price reaction is consistent with the limited signaling value of Greek stock splits due to the institutional characteristics of the ASE.

[3] The findings from the other models are available upon request.

V.1.2. Ex-day price effects

Table 4 reports the stock price reaction for each day in the period covering 10 days prior to 10 days after the ex-day (day C). As shown in Table 4, the average abnormal return on event day -1 is 1.71% which is statistically significant at the 0.05 level (t[AR]= 2.47). On event day 0 the average abnormal return is 5.78% which is statistically significant at the 0.01 level (t[AR]= 8.34). Consistent with the large positive stock price reaction on event day 0, the percentage of positive ARs on this day is 86.67%. The cumulative abnormal return for event period (-1, 0) is 7.49%, statistically significant at the 0.01 level (t[CAR]= 7.64). Similarly, the cumulative abnormal return for the event period (-1, +1) is 8.89%, also statistically significant at the 0.01 level of significance (t[CAR]= 7.40). These findings suggest that stock splits on the ASE generate similar ex-day price reaction as that found in the case of stock splits in the U.S. and other stock markets. Although puzzling from an efficient capital markets perspective, the findings are consistent with the stock split mechanics of the ASE. We investigate this issue further in sub-section V.5, below.

Table 4 goes here

V.1.3. Listing day price effects

The analysis of the stock price reaction on the listing day provides a test for the price pressure hypothesis. This hypothesis states that, at any given instant, the demand curve for a firm's shares is downward-sloping and that an increased supply of shares decreases their price.[4]

Table 5 presents the results of the price reaction around the listing day (day D). This is the first day the new shares resulting from the split are available for trading. As shown in Table 5, the average abnormal return on event day -1 is -1.35%, statistically significant at the 0.10 level of significance (t[AR]= -1.81). On event day 0 the average abnormal return is 1.02%, statistically

insignificant at any conventional level (t[AR]= 1.37). Regarding the event periods (-1, 0) and (-1, +1) the corresponding cumulative abnormal returns are -0.33% and 0.31%, respectively, statistically insignificant at any conventional level (t[CAR] is -0.31 and 0.24, respectively). These findings do not provide support to the price pressure hypothesis. However, in line with the market efficiency hypothesis, these findings are consistent with the absence of new information related to the stock split at the listing time of the new shares.

Table 5 goes here

V.2. Liquidity tests

To test whether stock splits impact the marketability of the splitting stocks we employ two measures: the relative turnover ratio and the liquidity ratio. Given the delayed delivery and trading of the new shares following the split, we compare levels of liquidity both before the stock split announcement and after the listing day, as well as before and after the ex-day. The relative turnover ratio is computed as the ratio of each stock's turnover (i.e., value of traded shares to market value of equity) to the turnover of all ASE traded stocks (i.e., value of all shares traded to total market capitalization). The liquidity ratio on any day is calculated as the trading volume (in Euros) on this day over the absolute percentage change in share price on the corresponding day relative to the prior day.

The pre-split mean (median) relative turnover ratio is estimated from the daily relative turnover ratios in the period -140 to -41 event days relative to the announcement day (day A). The post-listing mean (median) relative turnover ratio is estimated from day +41 to +140 after the listing day (day D). The pre-ex-day mean (median) relative turnover ratio is estimated from the daily relative turnover ratios in the period -5 to -1 relative to the ex-day (day C), whereas the

[4] See Asquith and Mullins (1986), and Loderer and Zimmermann (1988).

post-ex-day mean (median) relative turnover ratio is calculated for the period 0 to +5 relative to the ex-day.

The pre-split mean (median) liquidity ratio is estimated from the daily liquidity ratios in the period -20 to -11 relative to the announcement day A. The post-listing mean (median) liquidity ratio is also derived using the daily liquidity ratios in the period +11 to +20 relative to the listing day. Similarly to the pre-ex-day and post-ex-day mean (median) relative turnover ratios, we obtain the pre-ex-day and post-ex-day mean (median) liquidity ratios, respectively.

Results are reported in Table 6. Contrary to the expectation of liquidity improvement, the mean (median) relative turnover ratio declines from 2.05 (1.89) before the split announcement to 1.35 (1.33) after the listing day. The change is statistically significant at the one percent level. On the other hand, the mean (median) liquidity ratio of the pre-announcement period is not significantly different, at any conventional level, from the mean (median) liquidity ratio of the post-listing period (t-statistic is 0.28; Wilcoxon z-statistic is -0.15). Turning to liquidity changes around the ex-day, the mean (median) relative turnover ratio is 1.64 (1.39) in the pre-ex-day period and 1.46 (1.44) in the post-ex-day period. The difference is insignificant at any conventional level (t-statistic is -0.62; Wilcoxon z-statistic is 0.13). However, the mean liquidity ratio posts a marginally significant (at the 0.10 level) decrease from the pre- to the post-ex-day period. By construction, this decrease implies a wider price movement per one Euro of trading volume and, hence, a decline in liquidity. This is consistent with the fact that on the ex-day and until new shares are listed, the restricted supply of shares reduces liquidity.

Overall, the above findings suggest that splitting stocks do not realize gains in liquidity in the long run, or around the ex-day. If anything, the liquidity ratio results provide weak evidence of a decline in marketability around the ex day. These findings are, in general, consistent with those reported for splitting stocks in the U.S.

Table 6 goes here

V.3. Trading range tests

To test the trading range hypothesis we apply cross-sectional regressions where the dependent variable is the split factor (SPFAC) and the independent variables are: the pre-split stock price and the ratio of the stock price to the average market price (P/M). The pre-split stock price (P) is the average price of the stock and is calculated from the stock prices on event days -270 and -21, relative to the announcement day (day A). The average market price (M) is also estimated as the average of the prices of all stocks in the ASE and is calculated from the stock prices on event days -270 and -21, relative to event day A. We follow Lakonishok and Lev (1987) and estimate a logarithmic version of the split factor model specified above. Results are reported in Table 7. In regressions where either P/M or P is the single independent variable, the split factor is positively related to the raw or relative price prior to the stock split, and the relations are statistically significant at the 0.10 level of significance or higher levels. When both independent variables are included, only the average pre-split price is statistically significant at the 0.10 level. This is evidence in favor of the trading range hypothesis. Greek firms split their stock after a period during which the stock price has advanced ahead of both the average price of the stock as well as the average price of the market.

Table 7 goes here

V.4. Signaling tests

Following McNichols and Dravid (1990), we test for signaling effects by applying a three-step

approach. First, we compare pre-split to post-split earnings per share (EPS); second, we regress the split factor on "unanticipated" EPS; and, third, we regress the abnormal returns on the split factor.

Table 8 reports mean and median EPS, along with the associated statistics from various years and periods prior and after the year of the split. The reported numbers in Panel A are based on raw earnings per share. The mean and median EPS reported in Panel B are adjusted for market-wide EPS, i.e., the average EPS of the firms traded on the ASE. The t-statistics are used to test for the difference in the mean EPS from one period to another. The Wilcoxon matched-pairs signed-ranks test is used to test for the difference of the median EPS from one period to another.

As shown in Panel A, the mean (median) EPS is 0.28 (0.12) one year prior to the year of the stock split and it increases to 0.47 (0.18) during the year of the stock split (year t). The increase is statistically significant at the one percent level for both the mean and the median EPS (t-statistic is 3.49; Wilcoxon z-statistic is 4.62). Similarly, the mean (median) EPS has increased, relative to year t-1, to 0.42 (0.13) in year t+1, that is the year just after the year of the stock split. The associated increase of the mean EPS is statistically significant at the five percent level (t-statistic is 2.09), while the increase of the median EPS is statistically significant at the one percent level (Wilcoxon z-statistic is 3.73). The mean (median) EPS in year t-3 is 0.11 (0.05) and it increases to 0.28 (0.12) in year t-1, the difference being statistically significant at the one percent level. Also, the mean (median) EPS in the period starting from year t-3 and ending in year t-1 is 0.19 (0.08) and it increases to 0.42 (0.13) in year t+1, the difference being also statistically significant at the one percent level.

As shown in Panel B of Table 8, the mean (median) market-adjusted EPS in year t-1 is 0.20 (0.08) and it increases to 0.25 (0.11) in year t, the difference being statistically significant at

the five percent level. Similarly, the mean (median) EPS in year t-3 is 0.11 (0.04) and increases to 0.20 (0.08) in year t-1, the difference being statistically significant at the one percent level. Interestingly enough, however, the increase of the mean (median) market-adjusted EPS from year t-1 to year t+1 is statistically insignificant at any conventional level.

These results suggest that ASE firms that split their shares experience superior improvement in earnings in the years leading to the stock split year. This accounts for the price run-up in the period preceding the stock split. Following the stock split, these firms sustain their gains in earnings. This evidence is consistent with the findings reported by Lakonishok and Lev (1987) and their proposition that splitting firms intend to convey their expectations that their earnings improvement is not transient.

Table 8 goes here

Stock split factors may reflect the managers' decision to achieve an optimal trading range for the stock's price as well as to signal private information about future performance. In order to disentangle the effects of these two motives on the split factor, we first regress the split factors on the pre-split price (P) and the market value of the stock's equity (MVE), as suggested in McNichols and Dravid (1990):

$$SPFAC = a_0 + a_1 P + a_2 MVE + RESPFAC \quad (1)$$

P is the average price, defined earlier. MVE is the stock's market capitalization on day -11 relative to event A. MVE controls for the tendency of high capitalization stocks to have higher share prices, which, in turn, can exert a downward impact on the split factor. The residual

term RESPFAC accounts for effects not related to the trading range motive.

Table 9 (model 1) shows that split factors are related positively to the pre-split period price and negatively to the market value of equity. Both regression coefficients are statistically significant at the one percent level. This finding is similar to that reported for U.S. stock splits in McNichols and Dravid (1990) and provides additional evidence in favor of the trading range hypothesis.

Next, we test whether the split factors reflect management's private information about the stock's future prospects. In addition to the trading range effects, we need also to account for the market's expectations about the stock's future earnings performance that is reflected in the price run-up prior to the stock split announcement. As a proxy of the management's private information we take the difference between the post- and pre-split market-adjusted earnings per share. Thus, we have the following regression model:

$$SPFAC = a_0 + a_1 P + a_2 MVE + a_3 RUNUP + a_4 \Delta EPS + URESPFAC \qquad (2)$$

P and MVE are defined as previously. RUNUP is the sum of abnormal returns from day -120 to -2, relative to event day A. ΔEPS is the difference between the market-adjusted EPS in year t+1 and year t-1 relative to the stock split year t. The residual term, URESPFAC, captures the portion of the split factor that is not related to the independent variables of the regression (2).

Model 2 in Table 9 shows that P and MVE continue to have, respectively, a positive and negative relation to the split factor, statistically significant at the one percent level. The regression coefficient of the price run-up is positive and statistically significant at the five percent level. Managers adjust the split factor higher to account for the momentum in price increases. Since the price run-up reflects market expectations about future profits, its positive effect on the

split factor implies that the latter incorporates market-shared expectations about future earning performance. On the contrary, the change in earnings has no statistically significant effect, at any conventional level, on the stock split factor. These findings confirm that the motivation of Greek stock splits is to reset the stock price within a normal trading range and not to signal private information about future earnings. There is no evidence that managers incorporate their private information about future earnings in setting the stock split factor. This managerial behavior, concerning split factors, is consistent with the limited efficacy of stock splits to serve as signals, due to the institutional characteristics of the Greek stock market. The absence of trading and listing costs related to the level of share prices prevents split factors to be credible signals of firm performance.

The final test of whether split factors reveal value-related information to investors focuses on market reaction at the split announcement. The residual term, RESPFAC, in regression (1) captures the portion of the split factor that is not related to public information or the trading range effect. Whether the market reacts to the residual portion of the split factor because it is perceived to contain value-revealing information is tested with the regression:

$$AR = b_0 + b_1 RESPFAC \quad (3)$$

AR is the cumulative abnormal return in the window day -1 to day +1, relative to day 0 for event A. The residual term, URESPFAC, in regression (2) captures the portion of the split factor that cannot be explained by public or management's private information. The following regression model tests whether the market reaction is due to unexpected changes in earnings or to any

residual information contained in the stock split factor:

$$AR = b_0 + b_1 \Delta EPS + b_2 \, URESPFAC \qquad (4)$$

The empirical findings, not reported here, show that the regression coefficients of the variables RESPFAC (Regression 3) and URESPFAC (Regression 4) are statistically insignificant at any conventional level.[5] The coefficient of ΔEPS in Regression 4 is also insignificant, at any conventional level, suggesting that the price reaction is not related to earnings surprises. These findings, along with the lack of a statistically significant relationship between split factors and earning changes (in Table 9), suggest that signaling of future earnings surprises through stock splits is not reflected in the stock market's price reaction. Therefore, the evidence is consistent with the reduced potential of stock splits to signal future performance in the case of ASE-traded stocks.

V.5. The ex-day price reaction

The ex-day positive price reaction merits further investigation. Previous research has dismissed several explanations of the ex-day abnormal returns. Grinblatt, Masulis and Titman (1984) find no evidence that these returns can be explained by resolution of uncertainty (i.e., the execution of stock splits is uncertain) or the presence of a when-issued market for split shares. Eades, Hess and Kim (1984) fail to find evidence on the following explanations: errors in identifying the ex-day; day-of-the-week effect; contemporaneous dividend announcements; and infrequent trading. Several researchers have used microstructure effects to explain the ex-day results. Grinblatt, Masulis and Titman (1984) conjecture that if trades are executed mostly at the bid price before

the ex-day and at the asked price on the ex-day, the reported ex-day returns will be positive. Lamoureux and Poon (1987) argue in favor of a price pressure effect since they find that the positive ex-day return is eliminated in the subsequent days. The price pressure effect is generated by the expansion of the investor base of splitting stocks. Maloney and Mulherin (1992) combine the arguments of these two studies and provide evidence that the ex-day returns are caused by a temporary imbalance between buy and sell orders. They find that the surge of buy orders (and the increase in number of trades at the asked price) is due to an increase in the number of shareholders.

The tax related effects and/or the market makers impact on bid and asked prices are not relevant explanations for the ASE stock splits. Therefore, we turn our attention to the possibility of price pressure, and the patterns of liquidity around the ex-day. Table 4 shows that the three-day (-1 to +1) cumulative abnormal return is 8.89 percent. Over the next nine days (+2 to +10), the negative daily abnormal returns (for some of the days) are too low to offset the gain in the preceding period. Table 6 shows that the liquidity ratio decreases significantly (weakly, though) from the pre-ex-day to the post-ex-day period. In addition, 67.4 percent of the stocks in our sample register gaps of one to fifteen days between the ex-day and the first trading day of the new shares. Unreported findings related to the relative turnover ratio and abnormal trading volume show a spike of trading activity in the few days before and after the ex-day.[6] If new small investors are attracted to the splitting stocks, the combination of a surge in buy orders with the restricted supply of shares would put pressure on stock prices and would explain the positive ex-day price reaction. This conjecture is consistent with the hypothesis of a temporary order imbalance in favor of buy orders on and after the ex-day proposed by Maloney and Mulherin

[5] These findings are available upon request.
[6] These findings are available upon request.

(1992). Kryzanowski and Zhang (1996) also report an increase in small orders that turn from sell to buy orders on the ex-day for Canadian stocks. Since, for Greek stocks, the listing day for the new shares comes, on average, within a week after the ex-day, the order imbalance dissipates quickly resulting in insignificant abnormal returns after day +1, relative to the ex-day.

Table 9 goes here

VI. Conclusions

This paper investigates the price reaction to stock splits executed by firms traded on the Athens Stock Exchange. Unlike the evidence of strong positive announcement price effects associated with stock splits in the U.S., there is no price reaction at the announcement of stock splits on the ASE. We interpret this finding to be consistent with the institutional characteristics regarding stock splits on the ASE. Specifically, the neutrality of transaction costs reduces the potential stock splits have as signals of future performance. There is no evidence that split factors incorporate management's private information about future earnings beyond what the market anticipates and is already reflected in the pre-split price run-up. We find that earnings improve in the years prior to the split but there is no evidence of future earnings improvement. As in past studies, we confirm that liquidity does not increase as the result of stock splits. We do find, however, evidence that stock splits are used to readjust price to a "normal" trading range.

Consistent with other international studies, we find evidence of strong positive reaction around the ex-day. Based on evidence from liquidity and trading activity changes around the ex-day, we conjecture that the positive price reaction is caused mostly by a temporary imbalance of orders in favor of demand as proposed in previous studies. This imbalance is caused by the delay in the listing and trading of the new shares following the ex-day. The absence of when-issued trading on the ASE forces old and new investors to trade only the old shares, creating an upward

movement in price. In contrast to the price pressure hypothesis, but in line with the market efficiency hypothesis, there is no stock price reaction on the listing day of the new shares.

The findings of this study expand the international evidence about the value consequences of stock splits. The announcement price effects are in line with what we would expect in a market where signaling and investor clientele motives matter less than in markets where they do. The liquidity related results suggest that they are a more general international phenomenon. The evidence about the ex-day price effects suggests that taxable (i.e., cash dividends) as well non-taxable stock distributions (like stock dividends and stock splits) can produce price effects due to market mechanics. In the case of the ASE, the ex-day price effects can be attributed to the inelastic supply when trading on the new shares is not possible following the stock split.

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Table 1

Annual distribution of stock splits of firms listed on the Athens Stock Exchange and distribution of stock splits by split factor.
Period 1990-2000.

Year	Number of Splits	Split Factor	Percent (%)
1990	1	> 5 for 1	6.5
1991	0	5 for 1	6.5
1992	0	4 for 1	4.4
1993	1	3 for 1	17.4
1994	1	5 for 2	8.7
1995	3	2 for 1	47.8
1996	0	< 2 for 1	8.7
1997	5		100.0
1998	4		
1999	21		
2000	13		
Total	49		

Table 2

Event days, number of observations (N), daily average abnormal returns (AR), percentage of positive ARs, t-statistics (t[AR]) for the daily ARs, daily cumulative abnormal returns (CAR), and cumulative abnormal returns along with the associated t-statistics (t[CAR]) for the intervals (-1, 0) and (-1, +1) relative to the announcement day, day 0, based on event day A. Day A is the day the board decides to propose the stock split and call a shareholders meeting. Abnormal returns are calculated using the market adjusted returns model. Sample firms are listed on the Athens Stock Exchange.
Period 1990 to 2000.

Event day	N	AR	Percentage of positive ARs	t[AR]	CAR
-10	49	0.0019	40.82	0.27	0.0019
-9	49	0.0014	44.90	0.20	0.0033
-8	49	0.0038	40.82	0.54	0.0071
-7	49	0.0025	40.82	0.36	0.0097
-6	49	0.0097	55.10	1.37	0.0194
-5	49	0.0077	55.10	1.09	0.0271
-4	47	0.0158	63.83	2.24**	0.0429
-3	47	0.0093	57.45	1.31	0.0522
-2	49	0.0101	61.22	1.43	0.0623
-1	49	0.0115	63.27	1.63	0.0738
0	48	0.0032	54.17	0.46	0.0771
1	48	-0.0020	50.00	-0.29	0.0750
2	49	0.0099	63.27	1.40	0.0850
3	48	0.0044	54.17	0.62	0.0894
4	48	0.0062	52.08	0.88	0.0956
5	49	0.0029	44.90	0.41	0.0985
6	49	0.0005	53.06	0.06	0.0990
7	49	-0.0007	48.98	-0.10	0.0983
8	49	0.0012	44.90	0.17	0.0995
9	49	0.0108	65.31	1.53	0.1103
10	48	0.0093	62.50	1.32	0.1196

Event periods	CAR	t[CAR]
(-1, 0)	0.0147	1.47
(-1, +1)	0.0127	1.04

** Significant at the 0.10 level

Table 3

Event days, number of observations (N), daily average abnormal returns (AR), percentage of positive ARs, t-statistics (t[AR]) for the daily ARs, daily cumulative abnormal returns (CAR), and cumulative abnormal returns along with the associated t-statistics (t[CAR]) for the intervals (-1, 0) and (-1, +1) relative to the announcement day, day 0, based on event day B. Day B is the day of the earliest press release about the stock split decision. Abnormal returns are calculated using the market adjusted returns model. Sample firms are listed on the Athens Stock Exchange. Period 1990 to 2000.

Event day	N	AR	Percentage of positive ARs	t[AR]	CAR
-10	49	-0.0041	36.73	-0.56	-0.0041
-9	49	0.0085	55.10	1.15	0.0044
-8	49	0.0065	53.06	0.89	0.0109
-7	49	0.0092	59.18	1.25	0.0201
-6	47	0.0099	53.19	1.35	0.0300
-5	47	0.0109	55.32	1.49	0.0409
-4	49	0.0100	57.14	1.36	0.0509
-3	49	0.0106	61.22	1.45	0.0615
-2	48	0.0082	58.33	1.11	0.0697
-1	48	-0.0006	56.25	-0.09	0.0691
0	49	0.0053	61.22	0.72	0.0744
1	48	0.0120	64.58	1.63	0.0863
2	48	0.0144	58.33	1.95*	0.1007
3	49	0.0001	48.98	0.02	0.1008
4	49	0.0020	53.06	0.28	0.1028
5	49	-0.0014	51.02	-0.19	0.1015
6	49	0.0000	51.02	0.01	0.1015
7	49	0.0126	63.27	1.72	0.1141
8	48	0.0046	47.92	0.62	0.1187
9	48	0.0000	45.83	-0.01	0.1187
10	48	0.0085	54.17	1.16	0.1272

Event periods	CAR	t[CAR]
(-1, 0)	0.0046	0.45
(-1, +1)	0.0166	1.31

* Significant at the 0.10 level

Table 4

Event days, number of observations (N), daily average abnormal returns (AR), percentage of positive ARs, t-statistics (t[AR]) for the daily ARs, daily cumulative abnormal returns (CAR), and cumulative abnormal returns along with the associated t-statistics (t[CAR]) for the intervals (-1, 0) and (-1, +1) relative to the announcement day, day 0, based on event day C. Day C is the ex-day for the stock split. Abnormal returns are calculated using the market adjusted returns model. Sample firms are listed on the Athens Stock Exchange.
Period 1990 to 2000.

Event day	N	AR	Percentage of positive ARs	t[AR]	CAR
-10	46	0.0091	45.65	1.32	0.0091
-9	46	-0.0011	43.48	-0.15	0.0081
-8	46	-0.0023	43.48	-0.33	0.0058
-7	46	0.0074	67.39	1.07	0.0132
-6	46	0.0019	45.65	0.27	0.0151
-5	46	0.0032	54.35	0.46	0.0183
-4	46	0.0048	50.00	0.69	0.0231
-3	46	0.0020	54.35	0.30	0.0251
-2	46	0.0039	52.17	0.56	0.0290
-1	46	0.0171	56.52	2.47**	0.0461
0	45	0.0578	86.67	8.34***	0.1039
1	45	0.0140	62.22	2.02	0.1179
2	46	0.0015	50.00	0.22	0.1194
3	46	-0.0028	41.30	-0.40	0.1166
4	46	-0.0049	36.96	-0.71	0.1117
5	46	-0.0088	41.30	-1.27	0.1029
6	45	-0.0037	42.22	-0.53	0.0992
7	45	-0.0066	44.44	-0.95	0.0926
8	45	-0.0014	44.44	-0.20	0.0912
9	45	0.0036	42.22	0.52	0.0949
10	45	0.0032	48.89	0.47	0.0981

Event periods	CAR	t[CAR]
(-1, 0)	0.0749	7.64***
(-1, +1)	0.0889	7.40***

** Significant at the 0.10 level
*** Significant at the 0.01 level

Table 5

Event days, number of observations (N), daily average abnormal returns (AR), percentage of positive ARs, t-statistics (t[AR]) for the daily ARs, daily cumulative abnormal returns (CAR), and cumulative abnormal returns along with the associated t-statistics (t[CAR]) for the intervals (-1, 0) and (-1, +1) relative to the announcement day, day 0, based on event day D. Day D is the first day that all the new shares resulting from the split are listed. Abnormal returns are calculated using the market adjusted returns model. Sample firms are listed on the Athens Stock Exchange. Period 1990 to 2000.

Event day	N	AR	Percentage of positive ARs	t[AR]	CAR
-10	46	0.0101	57.50	1.35	0.0101
-9	46	0.0113	55.00	1.52	0.0214
-8	46	0.0041	52.50	0.55	0.0255
-7	46	-0.0046	37.50	-0.61	0.0209
-6	46	-0.0024	40.00	-0.33	0.0185
-5	46	0.0131	50.00	1.76	0.0316
-4	46	0.0023	45.00	0.31	0.0339
-3	46	0.0085	62.50	1.14	0.0424
-2	46	0.0050	57.50	0.67	0.0474
-1	46	-0.0135	35.00	-1.81*	0.0339
0	45	0.0102	51.28	1.37	0.0441
1	45	0.0064	48.72	0.86	0.0505
2	46	0.0051	52.50	0.68	0.0556
3	46	0.0004	47.50	0.05	0.0560
4	46	-0.0049	40.00	-0.66	0.0510
5	46	-0.0061	40.00	-0.82	0.0449
6	45	-0.0014	58.97	-0.19	0.0435
7	45	-0.0082	38.46	-1.10	0.0353
8	44	-0.0109	39.47	-1.46	0.0244
9	44	-0.0069	36.84	-0.92	0.0176
10	44	-0.0005	44.74	-0.07	0.0170

Event periods	CAR	t[CAR]
(-1, 0)	-0.0033	-0.31
(-1, +1)	0.0031	0.24

* Significant at the 0.10 level.

Table 6

Pre-split mean and median relative turnover and liquidity ratios, post-listing mean and median relative turnover and liquidity ratios, statistics (t- statistic, or z-statistic) of the associated differences, pre-ex-day mean and median relative turnover and liquidity ratios, post-ex-day mean and median relative turnover and liquidity ratios, and statistics (t-statistic, or z-statistic) of the associated differences. Sample firms are listed on the Athens Stock Exchange. Period 1990-2000.

	Pre-Split	Post-Listing	Statistics of the Differences	Pre-Ex-day	Post-Ex-day	Statistics of the Differences
Relative Turnover Ratio						
Mean	2.05	1.35		1.64	1.46	
t-statistic			-10.33***			-0.62
Median	1.89	1.33		1.39	1.44	
z-statistic			-8.54***			0.13
Liquidity Ratio (Euro Thousands)						
Mean	1,693	1,786		1,968	910	
t-statistic			0.28			-1.90*
Median	1,697	1,581		1,310	834	
z-statistic			-0.15			-1.75*

- Relative turnover ratio is computed as the ratio of each stock's turnover (i.e., value of traded shares to market value of equity) to the turnover of all ASE traded stocks (i.e., value of all shares traded to total market capitalization).
- Liquidity ratio on any day is calculated as the trading volume (in Euros) on this day over the absolute percentage change in share price on the corresponding day relative to the prior day.
- Pre-split relative turnover ratio is calculated from day -140 to day -41 relative to announcement day A, and post-listing turnover ratio is calculated from day +41 to day +140 after the listing day.
- Pre-split liquidity ratio is calculated from day -20 to day -11 prior to announcement day A and post-listing liquidity ratio is calculated from day +11 to day +20 after listing.
- Turnover and liquidity ratios around the ex-day are calculated from day -5 to day -1 and from day 0 to day +5, respectively.
- The z-statistic refers to the Wilcoxon test.
- Day A is the day the board decides to propose the stock split and call a shareholders meeting.

* Significant at the 0.10 level
*** Significant at the 0.01 level

Table 7

This table reports regression coefficients from regressing the split factor (SPFAC) on the ratio of the stock's average price to the market-wide average price, (P/M), and on the stock's average price. The t-statistics are in parentheses. The values in brackets are the White heteroskedasticity-consistent t-statistics. Sample firms are listed on the Athens Stock Exchange.
Period 1990-2000.

(1) $\ln SPFAC_i = \alpha_0 + \alpha_1 \ln P/M_i + \varepsilon_i$
(2) $\ln SPFAC_i = \alpha_0 + \alpha_1 \ln P_i + \varepsilon_i$
(3) $\ln SPFAC_i = \alpha_0 + \alpha_1 \ln P/M_i + \alpha_2 \ln P_i + \varepsilon_i$

Regression	α_0	lnp/M	lnP	R^2
(1)	0.8558	0.1549		0.0979
	(10.33)***	(2.19)*		
	[14.66]***	[2.04]*		
(2)	0.3223		0.1935	0.1628
	(1.42)		(2.92)***	
	[1.46]		[2.52]**	
(3)	0.0455	-0.1260	0.3031	0.1753
	(0.11)	(-0.81)	(2.01)*	
	[0.11]	[-0.78]	[1.86]*	

- We define the split factor as the number of new shares after the split per original share. For example, a 3 for 1 stock split will have a split factor of 3.
- The stock's average price (P) is the average price of the stock based on the stock prices on event days -270 and -21 relative to event day A.
- The market-wide average price (M) is based on the average price (equally weighted) of all stocks listed on the ASE on event days -270 and -21 relative to event day A.
- Day A is the day the board decides to propose the stock split and call a shareholders meeting.

* Significant at the 0.10 level
** Significant at the 0.05 level
*** Significant at the 0.01 level

Table 8

Mean and median earnings per share (EPS), in Euros, for various years and periods around the year of stock split (year t) of sample firms listed on the Athens Stock Exchange (ASE). The differences in mean EPS over various years/periods are tested using t-statistics. The differences in median EPS over various years/periods are tested using the Wilcoxon z-statistics. Panel A shows results based on raw EPS. Panel B shows results based on market-adjusted EPS.
Period 1990-2000.

Year	Mean EPS (in Euros)	Median EPS (in Euros)	t-statistic	Wilcoxon z-statistic
Panel A: Raw earnings per share (EPS)				
t-1	0.28	0.12	3.49***	4.62***
t	0.47	0.18		
t-1	0.28	0.12	2.09**	3.73***
t+1	0.42	0.13		
t-3	0.11	0.05	3.84***	5.23***
t-1	0.28	0.12		
t-3 to t-1	0.19	0.08	4.32***	5.54***
t	0.47	0.18		
t-3 to t-1	0.19	0.08	2.85***	4.80***
t+1	0.42	0.13		
Panel B: Adjusted earnings per share (EPS)				
t-1	0.20	0.08	1.62*	1.99**
t	0.25	0.11		
t-1	0.20	0.08	1.12	1.33
t+1	0.24	0.09		
t-3	0.11	0.04	3.38***	3.67***
t-1	0.20	0.08		

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 9

Results of the regressions
(1) $SPFAC = a_0 + a_1 P + a_2 MVE + RESPFAC$ and
(2) $SPFAC = a_0 + a_1 P + a_2 MVE + a_3 RUNUP + a_4 \Delta EPS + URESPFAC$.
The t-statistics are in parentheses. The values in brackets are the White heteroscedasticity-consistent t-statistics. Sample firms are listed on the Athens Stock Exchange.
Period 1990-2000.

Regression	α_0	P	MVE	RUNUP	ΔEPS	R^2
(1)	1.7979	0.0526	-0.0008			0.5236
	(4.49)***	(6.19)***	(-2.63)**			
	[7.78]***	[4.91]***	[-3.70]***			
(2)	1.2810	0.0477	-0.0006	0.6662	0.0002	0.654
	(3.41)***	(7.43)***	(-2.68)**	(2.34)**	(0.06)	
	[5.32]***	[5.51]***	[-3.20]***	[2.26]**	[0.05]	

- SPFAC is the split factor
- P is the average stock price based on the stock prices on event days -270 and -21 relative to the announcement day, day 0, based on event day A.
- MVE is the market value of equity on day -11.
- RUNUP is the price run up estimated as the sum of the daily abnormal returns over the interval event day -120 to -2, relative to the announcement day, day 0, based on event day A.
- ΔEPS is the difference in market-adjusted EPS from year t-1 to year t+1 relative to the year of the stock split (year t).
- RESPFAC and URESPFAC are the residual terms of regressions (1) and (2), respectively.
- Abnormal returns are estimated using the market-adjusted model.
- Day A is the day the board decides to propose the stock split and call a shareholders meeting.

** Significant at the 0.10 level
*** Significant at the 0.01 level