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Abstract

Stock splits are conceptually a very simple corporate event that consists in the division of each share into a higher number of shares of smaller par value. These operations have long been a part of financial markets. Portugal witnessed 26 of these operations from 1999 (the year the euro was introduced) to June 2003 essentially due to a legislative change that took place when the corporate law was adapted for the introduction of the euro.

In this paper stock splits are analyzed in terms of liquidity, risk, signaling and ideal price range explanations that could justify the sizeable cumulative abnormal returns (CAR) that we document around both announcement (5-day CAR of 3.8%) and ex-dates (5-day CAR of 7.5%). Our evidence shows no significant increase in trading volume (in EUR) although the number of trades does seem to increase, suggesting that trading by small investors is increased post-split. Our results also uncover an increase in the relative bid-ask spread but only for a sample subset of firms with the lowest pre- or post-split relative spreads. Our results also suggest, however, that liquidity reasons do not seem to be sufficient to explain the observed abnormal returns around the ex-date. A surprising feature is that the observed significant price increases were mainly concentrated around the ex-date, in contrast to most available evidence. The signaling hypotheses tested were not supported by the evidence presented in this study. These operations also cannot be explained by a placement of share prices levels closer to those of other Eurozone stock markets as Portuguese share prices levels are clearly much lower than the levels observable in those markets.

We also conducted a survey directed at splitting firm. This confirmed that liquidity increases were indeed one of the main objectives pretended by the managers of these firms. Most companies, however, considered that this had not been accomplished. Another stated objective deemed important by managers was share capital simplification. This is puzzling since it is difficult to explain the sizeable wealth effects documented with simple changes in the par value itself. Our survey did not support signaling as a justification on the part of managers for the decision to split.

1. Introduction

Stock splits have long been a puzzling phenomenon to market practitioners and researchers. As Lakonishok and Lev (1987) put it, "taken at face value, such distributions are just a finer slicing of a given cake – the total market value of the firm – and as such should have no effect on firms and investors". But, in fact, reality tells us a very different story. The effects of stock splits are well documented and have caught the attention of finance researchers. This simple "cosmetic" operation certainly plays an important role in explaining why the average share price in USD has remained within a small interval, which contrasts with the huge swings in stock market returns during the last decades (Angel, 1997).

Portugal has recently witnessed a "wave" of stock splits after the introduction of the Euro as the currency for 11 members of the European Union. On January 1st, 1999 the quotes of all stocks on the exchanges of all the Euro members were converted to euros. As a consequence of the euro introduction, all Portuguese firms (listed or not) had to convert their nominal capital to euros. Following this, several Portuguese companies decided to split their stock. Twenty six splits were thus recorded in the Portuguese stock market from January 1st 1999 to June 30, 2003.

A study by Alves and Alves (2001) has shed some light over the consequences of the 13 stock splits on the Portuguese market that were executed from September 1999 to October 2000. Their approach was to analyse potential liquidity effects of stock splits and the abnormal returns observed around the relevant dates. They assumed, however, liquidity to be the only rational reason for managers to justify their decision.

One of the main reasons the literature puts forward to explain stock splits is in effect liquidity. In simple terms, it is argued that the splitting of the stock allows more investors to buy the stock, therefore creating a more liquid environment and leading to an observable abnormal return around the announcement and ex-dates.

A more detailed analysis of this and other possible explanations is made in the following sections of this paper in order to set up a framework on which to base the hypotheses that will be tested subsequently. As in many fields of Economics, and Corporate Finance in particular, there is no clear cut explanation for the popularity of splits. In fact, some of the most common explanations have been challenged strongly.

Apart from liquidity, other issues related to stock splits which have received the attention of the literature include notably the measurement of abnormal returns (either in the short or long-term), risk changes, potential changes in ownership structure, previous price behaviour, managerial signalling and the issue of an optimal price range.

Our paper contributes to this literature by expanding the existing research concerning the Portuguese market in several directions. Apart from using a sample that is twice larger than that used by Alves and Alves (2001), and testing several alternative explanations for the wealth effects of stock splits that were not explored by these authors. We report evidence that in the Portuguese setting some of the conclusions that have been reached in prior research mainly focused on well developed markets do not necessary hold in market environments such as the Portuguese.

Our paper proceeds as follows. Section 2 provides a literature review of the major theoretical and empirical issues related to stock splits. In section 3 an historical perspective is made on the recent evolution of the Portuguese Exchange, followed in section 4 by the description of data sources and sampling procedures. Section 5 presents and discusses the empirical results. Section 6 summarizes and concludes the paper.

2. Literature review

2.1 The Abnormal Returns Associated with Stock Splits

Stock splits are associated with positive abnormal returns either in the short run (around the announcement dates and ex-dates) or in the long term (the evidence here is, however, somewhat more mixed).

For instance, Maloney and Mulherin (1992) present evidence of a wealth increase effect around the announcement and execution dates, for their sample of NASDAQ stock splits that occurred between the beginning of 1985 and the end of 1989. Around the announcement date, they find an important price run-up in the ten days leading to this date. These authors also find price increases around the execution date, though of smaller magnitude than those recorded for the announcement date. The price increase is also significant for the three days starting on the execution date. Maloney and Mulherin argue that this positive reaction on the ex-date cannot be connected to informational content, since the split date is known well in advance. They try to find support for this price reaction in microstructure components of the stock market.

Other authors studied the long-term implications of stock splits for abnormal stock returns. This is the case of Ikenberry et al. (1996), who looked at both short-term and long-term excess returns (one and three years). For the computation of announcement abnormal returns they considered a five-day market adjusted return (from day –2 to day 2). For the entire period they find an abnormal return of 3.38%. The results show an abnormal return of 7.93% for the first year following the announcement month. For the next two years the returns were not statistically significant, totalling –0.44% and 1.32% for year two and three, respectively. The authors believe that these results are consistent with the hypothesis that favourable information related to the split was completely embedded into prices within one year after the announcement. They argue that the evidence supported what they term as the "self-selection hypothesis" which will be detailed in section 2.4 of this paper.

Desai and Jain (1997) also focus their attention on long run performance for splitting firms. In their study they also analyse the long-term performance associated with reverse splits. They concluded that the stock splits abnormal return for the announcement month was 7.11%. For the sample of reverse splits the result obtained was –4.59%. Confirming the results by Ikenberry et al. (1996), the abnormal returns recorded by the authors for year one after the announcement month reached 7.05%, with insignificant abnormal returns of 1.02% and 0.72% in years two and three respectively. For the sample of reverse splits, they recorded an abnormal return of –10.75% for year one but insignificant returns for years two and three.

Boehme (2001) also presents results on the long long-term performance following the announcement of stock splits. Boehme collected information from a very long time frame, comprising 51 years, from 1950 to 2000. The main difference between this study and the two previous ones was essentially the employment of a different method for calculating long-term abnormal returns. The author used calendar time methodology based on a four-factor model. Boehme concluded that the previous explanations could not fully explain the returns for the period 1975-1987, when value weighting was applied. He proposed two explanations: 1) a market microstructure argument justifying that the average traders were not given the chance to earn the abnormal return; 2) the effect of chance, eventually post announcement unexpected changes in systematic risk. The author concluded that there was no persistent or unexplainable long run anomaly connected with stock splits. The author's evidence of abnormal positive performance following the announcement date until the execution date was not addressed in his study.

Some authors assume that stock splits and stock dividends are essentially the same thing (distribution of stock without actual exchange of cash), and add (large) stock dividends to their stock split samples[1]. Desai and Jain (1997) replicated their experiment, separating the sample into two sub-samples, one containing all the "pure" stock splits and the other containing the stock dividends. They observe that the results obtained are virtually unchanged. Two further studies, however, report different findings. Lakonishok and Lev (1987) in their search for the reasons why companies split their shares, studied separately stock splits and stock dividends. They collected data on stock distributions for the period 1963-1982. They documented that the earnings and dividend growth rates were higher for stock splitting than for stock dividend firms, when compared with control firms. Before the announcement, splitting firms also had a substantially higher price (almost 70%) than control firms[2]. They find the opposite for stock dividends firms. Rankine and Stice (1997) add more complexity to this issue. In their study, they meticulously separated stock splits from stock dividends operations. For two-for-one stock distributions, the CRSP classification for these operations was in accordance with their own only in 23% of the occasions. Another example of the confounding definitions of stock splits and stock dividends can be found in McNichols and Dravid (1990) who defined "*SD*'s with split factors of 10-20% as large stock dividends and *SD*'s with split factors greater than 20% as stock splits"[3]. Stock Distributions of less than 10% were considered small stock dividends.

A point where there is consensus regarding stock splits is that these operations are preceded by a period of abnormal returns before the announcement. Lakonishok and Lev (1987), Maloney and Mulherin (1992), Ikenberry et al. (1996) and Boehme (2001) all report a significant pre-split price run-up for splitting firms.

[1] See, for instance, McNichols and Dravid (1990), Pilotte and Manuel (1996), Desai and Jain (1997), Boehme (2001) or Tawatnuntachai and D'Mello (2002).
[2] This difference grows as the date of announcement approaches. The issue of the price run-up of splitting firms will be addressed later in this paper.
[3] *SD*'s means Stock Distributions and includes both Stock Splits and Stock Dividends.

2.2 Stock Splits and Liquidity Changes

Although a popular argument among practitioners for the rationale of stock splits, the available empirical evidence is not conclusive on the effects of stock splits on liquidity.

First, one must consider that liquidity can be measured in many different ways. For instance, Wulff (2002) uses the following measures:

a) Volume, calculated as the adjusted daily number of shares traded;
b) Volume turnover which is calculated as the volume divided by the shares outstanding;
c) Percentage of days with trades.

Another way of thinking about liquidity is by considering the cost of trading. In this issue most studies considered variations of the relative bid-ask spread. The literature shows that there is an increase in the relative bid-ask spread (Copeland, 1979, Conroy et al.,1990, Desai et al., 1998 , and Alves and Alves, 2001).

Muscarella and Vetsuypens (1996) uncovered significant evidence lending support to the argument that splits improve liquidity. They use a sample of ADR *solo-splits*, i.e., splits of ADRs (American Depositary Receipts) without a corresponding split in the home country. They find that the market reaction to simultaneous splits was a positive 1.13% mean return. For *solo splits* the results showed higher returns. For the total sample the mean return was 2.11% and 2.56% for the "clean" sub-sample (both statistically significant).

As in other studies, the liquidity premium[4], measured in dollar terms, seems to fall subsequently to the split. In contrast, the relative premium (liquidity premium divided by the transaction price) rises in a significant way. Maloney and Mulherin (1992) present in fact evidence of a decrease in the relative spread in the period prior to the execution of the split. They also report an increasing level in daily volume traded (in dollars) until the ex-date that decreases immediately after. They also document a reduction in the average daily value per trade. This is accompanied by an increase in the number of shareholders. This statistically significant result is also characterized by an increase in the number of institutional shareholders and the percentage of the capital

[4] Absolute value of the difference between the transaction price and the average of the bid-ask spread.

held by these investors. The authors argue that the split allowed current small shareholders to diversify their wealth by allowing them to sell the split shares in round lots.

Schultz (2000) also concludes that an increase in small trades occurs subsequent to the split. He reports a strong increase in trades that are smaller than the previous round lot trade. His conclusion is that a large number of small shareholders are added to the shareholder base after the split. This happens even though an increase in the effective spread[5] occurs for all trade sizes considered (all statistically significant). The author claims that these increased spreads are a powerful incentive for market makers to promote the stock.

In their study of Canadian stock splits, Kryzanowski and Zhang (1996) find evidence of an increase in trades conducted by small investors. Since the identity of the traders themselves cannot be determined, their proxy was trade size. They try to find evidence of an increase in small board-lot trading compared to odd-lot trading after the split. They classified each trade as a buy (sell) if the trade was at the ask (bid). For trades that occurred between the bid and ask, the algorithm proposed by Lee and Ready (1991) was used to classify them as buy or sell orders. For odd-lot trading, all the liquidity measures (e.g., trading volume, trading value, trading frequency and transaction size) reported a significant decrease. On the opposite side of small board-lot, these variables showed increases in mean values that are significant, with the exception of trading volume.

Lakonishok and Lev (1987) also addressed the issue of liquidity by analysing the monthly turnover for the splitting stocks and a control group. They report that the splitting stocks showed a rapid increase in trade volume from around sixty months prior to the split announcement up to the announcement date itself. After this the decrease is rapid and even more impressive than the increase.

Dennis and Strickland (2003) analysed the issue of liquidity by decomposing the shareholder ownership composition. Since some authors have found an increase in the relative bid-ask spread following the splits, one would expect that institutions would dislike splits, since the relative bid-ask spread is an important cost they incur.

[5] $Effective\ Spread_t = 2 * \left| P_t - \frac{B_t + A_t}{2} \right|$

Nonetheless the authors found evidence contradicting this assertion. They conclude that the proportion of institutional ownership following a split, conditional on the level of prior institutional ownership increased significantly. In terms of abnormal returns, the authors found that higher returns were associated with larger increases in institutional ownership.

Lamoureux and Poon (1987) report an increase in the number of shareholders, but the authors did not explore this increase in order to analyse who the new "entrants" were (small investors or institutions).

Wulff (2002) analyzed 276 stock splits in the Official Market of the Frankfurt Stock Exchange (FSE) from 1960 to 1996. One striking feature he documented was that the splits were highly clustered in the years 1967-1970 (1969 alone had 94 splits) and 1995-1996. The author reasoned that the main reason behind this clustering was connected with minimum par value rules that were applicable at the time to German companies. This restriction lead the author to claim that signalling could not be the main reason behind splits as companies did not seem to split when they found this operation to be appropriate, but only when the law changed. His analysis concerning liquidity is supportive of enhanced liquidity brought about by the split.

Alves and Alves (2001) conducted an analysis concerning the liquidity changes of stock splits in the Portuguese Exchange. The authors assume that the only real effect stock splits may have is liquidity-related. If liquidity is altered due to a split, then real effects on prices are to be expected. The period analysed by the authors comprised the four months prior and four months following the split. The evidence they reported concerning liquidity changes was mixed. In terms of turnover, they observed that eight shares experienced an increase in turnover while the other five suffered a decrease.

One area where greater consensus seems to exist is that of bid-ask spread changes induced by the split. The split itself reduces the price of the share while under normal circumstances the bid-ask spread in absolute terms also decreases. Desai et al. (1998) investigated changes in spreads after a split. The purpose of their study was to decompose the spread into its various components and to observe the influences that noise and informed traders had on it. The results in terms of relative spread showed an increase of 32% and 23% when using the mean and the median, respectively.

Conroy at al. (1990) also address the issue of bid-ask spreads. Their sample comprises splits from NYSE shares from the January 1981 to April 1983 period. An important feature of their study is that the comparisons made were between the two months prior to the announcement and the two months following the ex-date. They found that mean absolute spreads presented a decrease from 2.53 to 2.31[6]. However, in relative terms their sample witnessed a statistically significant increase from 0.951% to 1.229%. These changes in absolute and relative spreads were more intense in the case of large splits.

Guirao and Sala (2002) studied liquidity effects in Spanish stock splits that took place between 1997 and 1999. For their full sample they do not find evidence of liquidity improvements. Their conclusions changed somewhat when the orders were divided according to transaction size Small transactions and medium transactions especially on the "buy" side demonstrated a clear liquidity increase in terms of trade frequency and volume. The picture was different concerning large transactions. For the three sub-samples partitioned by size there was a common feature: the increase of the Effective Spread. Guirao and Sala concluded that, much in line with prior literature, small investors were drawn in by smaller prices, even though they were charged higher post-split transaction cost.

For the Portuguese market, Alves and Alves (2001) document a decrease, in absolute terms, for all of the thirteen stocks that split. Nonetheless their evidence showed an increase in the relative spread.

To summarize, there is a relative consensus among researchers concerning the decrease in absolute spreads that splits induce. Existing evidence points, however, in the opposite direction when the issue is relative spreads, which represent an important transaction cost to shareholders. Nonetheless, there is some evidence that this increase in the relative spread cost improves the efficiency of trading and induces a higher promotion of stocks by dealers. The number of shareholders is also believed to increase, including small shareholders, even though there is some evidence that institutional shareholders increase their holdings especially in companies where their holdings are smaller. There is also some results (e.g., Ikenberry et al, 1996) suggesting the existence of some optimal trading range and that companies tend to plan their split so that the

[6] Absolute spreads were measured in 1/8's.

price of their stock stays within its bounds. So, even if the relative spreads cost may increase and the volumes may not increase, there still may be better liquidity due to the placement of the share price on a more adequate level.

What also seems consensual is that liquidity per se lacks explanatory power for the abnormal returns associated with stock splits, especially those that have been found for the long run. Alternative explanations which have been addressed in the literature include risk changes and signalling, topics that we address in the following sections.

2.3 Risk Changes Induced by Stock Splits

Although most work surrounding stock splits focus on the effects on prices and its relation with liquidity changes, some work has also been developed concerning changes in risk.

Sheikh (1989) addressed this issue in the context of a study that tested the efficiency of the Chicago Board Options Exchange (CBOE), following previous authors that identified a significant increase in volatility subsequent to stock splits with a split factor larger than 25%. Even if the causes concerning this increase may not be clear, an increase in the price of calls should occur as a consequence of that increase in volatility. On the ex-date Sheikh observed a significant increase for the splitting group, with the control group showing an insignificant decrease. This resulted in a statistically significant difference between the two groups. The author concludes that the CBOE captured the ex-date variance increase as it occurred.

Dubofsky (1991) conducted a study that was basically an extension of a previous study by Ohlson and Penman (1985). In contrast to these authors, Dubofsky focused on both NYSE stocks and AMEX stocks and used a large time period from July 2, 1962 to December 31, 1987. The results obtained for the two exchanges lead the author to conclude there was a more pronounced increase in variance connected to NYSE stocks.

Desai et al. (1998) conducted a more in-depth study of volatility changes. These authors reported a significant increase in volatility following the split. Their conclusions were stronger than those of Dubofski (1991) since their calculations took into account the effects of price discreteness in the bid-ask bounce. They reported an increase in the relative bid-ask spread, which in turn lead to the need to estimate volatility with more complex procedures.

As Lamoureux and Poon (1987) state in their analysis of stock splits (and reverse splits) for the period between July 1962 and December 1985, "the market impact of splits is expected to be greatly diminished". They were referring to the introduction of a new tax bill in the U.S., which would eliminate distinctions between short-term and long-term capital gains. These authors argued that stock splits lead to an increase in variance and this variance was desirable, due to the way capital gains were then taxed in the U.S.. Since preferential treatment was given to long-term gains, then short-term losses could be used to offset short-term gains. To the authors, this justified the desirability of an increase in a stock volatility. Lamoureux and Poon in fact find evidence that the market reacted favourably to this increase in diversifiable risk. The authors computed the abnormal returns associated with the operation (around the relevant dates: execution date, announcement date and the date of the general shareholders meeting that approved the stock split), and confronted these results with those obtained for liquidity. In general terms, the abnormal returns were positive when liquidity improved and negative when it decreased. Lamoureux and Poon concluded that the market was efficient in translating to prices the effect of splits on liquidity.

2.4 Stock Splits and Managerial Signalling

If stock splits are perceived by market participants as valid signals of the firm's future performance then this could be a possible explanation for the abnormal returns associated with these operations. As Rankine and Stice (1997) and Wulff (2002) observe, it is easier to think about stock dividends as signals concerning the future since their cost is clearly discernible in terms of reduced financial flexibility[7]. In line with this argument, Rankine and Stice (1997) showed that abnormal returns associated with stock dividends were higher than those associated with splits.

To test if stock splitting companies perform better than the rest of the market, Lakonishok and Lev (1987) compared their earnings and dividend growth to those of a

[7] This is due to the reduced ability to pay dividends to shareholders, since most debt covenants and regulations link this ability to the level of retained earnings and capital surplus that are used when issuing a large stock dividend.

control group. They concluded that the splitting group experienced higher growth rates for both variables, but this difference was larger before the announcement than after.

The potential signalling nature of a split can, however, be affected by confounding events potentially related to such operations, namely dividend increases or initiations, as suggested by Desai and Jain (1997). Notwithstanding, their sub-sample with no dividend increases or initiations also revealed similar significant short-term and long-term abnormal returns.

Although reverse splits are a far less common phenomenon some authors have studied their effects in terms of abnormal returns. The consensual view is that this kind of operation is associated with short-term and long-term negative abnormal returns. Lamoureux and Poon (1987) used a NYSE and AMEX sample of reverse splits. They concluded that for both dates the abnormal returns were negative especially surrounding the ex-date. This is accompanied by an increase in liquidity when measured by the trading volume. The fact that returns were negative, even when liquidity increased, lead the authors to suggest that reverse splits were clearly seen as a negative signal by the market.

Similar conclusions are reached by Desai and Jain (1997). For their sample of NYSE, AMEX and NASDAQ reverse splits the authors document an announcement month abnormal return of –4.59%. For the first twelve months following the announcement the abnormal return reached –10.76%[8].

If splits are a credible signal how can its strength be measured? McNichols and Dravid (1990) find evidence supporting the hypothesis that the split factor itself conveys information. They presented and tested a model of management choice of split factors. The higher the pre-split price the higher should be the split factor due to the need to restore the price to some optimal trading range. Firm size is also controlled because the authors believed that bigger firms might desire a higher price. Their results confirmed that the split factor was indeed affected by firm size and pre-split price but the explanatory power of their proxy of management's private information was also very strong (although smaller than the one of the two other variables).

Pilotte and Manuel (1996) provide a study that tried to confirm whether the market learned from past experience. They analysed a sample of companies that split at

[8] For the thirty-six months following the announcement month the cumulative abnormal return was –33.9% (*p value* 0.041).

least twice during the 1970-1988 period. If the market perceives the split as a signal then it should use the past splits experience when it reacts to the current announcement. The reasoning is simple: if the company previously disappointed after a split, then the reaction to a current split announcement shouldn't be very positive. Except for the seventh and eighth splits conducted by sample companies, all were associated with significant increases in earnings. This was analysed for years –2 to +4 with 0 being the split year. This abnormal performance seemed to decrease in duration as the frequency of splits increased. The evidence reported by the authors confirmed that the standardized earnings changes for the announcement year and the following year were statistically significant in explaining the announcement date abnormal return[9]. For the authors this proved that the splits were informative.

Conroy and Harris (1999) also used the experience of past splits to explain the current ones. They claimed that managers designed the operations so that the post-split price achieved would be the same as the one after previous splits. In their regression analysis they included, besides the lagged split price, the current market-wide average price, the industry current average price and the current size-group average price as explanatory variables. The use of the lagged split price as explanatory variable greatly increased the explanatory power of their regressions. Conroy and Harris also tried to explain the origin of the abnormal returns associated with the split announcements. The split factor, the target split price and firm size were all found to be significant explanatory variables. The regression explanatory power was increased when the split factor surprise was considered. This last variable was calculated as the difference between the actual split factor and the one expected by the market. The market expectation was calculated by simulating what the split factor should be so that the price reached after the last split was again reached with the current split.

Ikenberry et al. (1996) present a combination of the trading range and the signalling hypotheses. They believe these two are not mutually exclusive. If managers perceive a benefit for their shares to trade within a specific trading range and they also believe it is costly to trade below the lower limit of the interval, then managers will only decide to split if the price stays within the interval after the ex-date and if they also believe that the performance of the company will be good, at least to avoid a price drop

[9] They name it stock return prediction error.

below the relevant threshold. They call this the "self-selection hypothesis". Their sample was comprised of 1,275 two-for-one splits from NYSE and ASE firms, for the period 1975-1990. The existence of short-term and long-term abnormal returns (they also found cumulative abnormal returns up to three years after the split), confirmed the authors' idea that the split signals good information to the market that is not discredited in the following years. This in turn confirmed the reasoning behind the self-selection hypothesis, since managers seemed only to decide a split if they expected the price level after the split not to decrease to a level lower than the minimum relevant threshold.

In brief, there is no absolute consensus concerning the informational role of splits, but the evidence presented in the literature points to investors believing that managers decide splits with informational intents. Splitting firms are normally associated with above average pre-split operational performance. The existence of significant short and long-term positive abnormal returns amply documented leads to the conclusion that the information managers convey may have some validity that could justify such price behaviour.

2.5 Conclusions

The former sections leave us with a few conclusions and some doubts. The main conclusion however, is that stock splits are an interesting phenomenon that is still far from completely understood.

There is almost an absolute consensus regarding short-term price effects induced by splits. The evidence presented by all the authors surveyed points to positive abnormal returns around splits announcements and/or ex-dates. The announcement date effect is usually more pronounced giving some credit to the hypotheses connected to the signalling argument. The long-term price effects were first found to be significant (in the first year following the announcement) but recent evidence has challenged this view. The following Figure summarizes much of the literature on documented abnormal returns associated with stock splits.

Figure 1

Positive Abnormal Returns associated with Stock Splits – Available Evidence

Short-term:	Long-term:
Lamoureux and Poon (1987) Maloney and Mulherin (1992) Ikenberry et al. (1996) Muscarella and Vetsuypens (1996) Desai and Jain (1997) Rankine and Stice (1997) Conroy and Harris (1999) Wulff (2002) Dennis and Strickland (2003)	Ikenberry et al. (1996) Desai and Jain (1997) (The previous works have been challenged by Boehme, 2001, and Byun and Rozeff, 2003)

In terms of liquidity there is still quite a disagreement especially regarding volume. Different time frames may result in conflicting results. Where there seems to be an almost absolute consensus concerns the effects on relative or effective (%) spreads. The increase in spreads is a common feature in all the works surveyed. This cost is effectively supported by investors. The argument of a relative tick size, may, however, justify this because market participants have greater incentive to place orders correctly and hence avoid trading errors. The following figure condenses this literature.

Figure 2

Liquidity Changes associated with Stock Splits – Available Evidence

Liquidity Increases:	Liquidity Decreases:	No Clear Evidence:
Lamoureux and Poon (1987) Kryzanowski and Zhang (1996) Muscarella and Vetsuypens (1996) Angel (1997) Schultz (2000) Dennis and Strickland (2003)	Copeland (1979) Conroy et al. (1990) Desai et al. (1998) Guirao and Sala (2002)	Lakonishok and Lev (1987) Maloney and Mulherin (1992) Alves and Alves (2001) Wulff (2002)

There also seems to be strong evidence supporting the idea of volatility increases. Both permanent and transient components have been found to increase. The options market seems to capture correctly this increase. A field worth exploring but which has received almost no attention in the literature is changes in systematic risk. This is one of the fields we will explore in our empirical analysis.

In many cases there seems to be evidence that signalling effects exist even if other elements, like dividend policy, may affect some of the results. In the case of splits history has been found to matter. Managers and markets play an interesting "game" in which each management board tries to convey the information it want to pass on, taking into consideration the previous experience of the company as well as intra-industry features and market wide prices.

The self-selection hypothesis of Ikenberry et al (1996) summarizes in an interesting way the contributions of the signalling and the liquidity literature. If there is an optimal trading range and there is a cost for trading below it, then managers will have a powerful incentive to split only if they truly believe in their company's future. This theory may constitute an important "rule of thumb" for managers to take into account when deciding whether or not to split.

3. Brief Historical Perspective

The Portuguese stock market experienced a considerable development during the late 1960's and the beginning of the 1970's. After being closed for a number of years, following the April 25th 1974 revolution, it reopened in 1977 gaining some additional visibility after Portugal's entry to the EEC in 1986.

A large part of the 1990's was a period of economic convergence towards the parameters of more developed countries, which in turn catalysed a significant increase in the Portuguese stock market index until 1999.

The bursting of the technology bubble, which was most notorious on NASDAQ and the economies' slip into recession made the period March 2000 – March 2003 one of the worse global bear markets ever recorded[10].

On January 1, 1999, the EURO (€) was introduced as the official currency of the 11 starting members[11]. The final exchange rates were fixed in December 31st, 1998. On

[10] For additional information regarding the features and an historical perspective of the Portuguese Stock Market, see Sousa (2002).
[11] Greece joined on January 1st 2001.

January 4th, 1999 all stock exchanges in the Euro-zone started trading in euros. The main minimum tick size for all the exchanges was set at one euro cent.

As a consequence of the euro introduction all companies (listed or not) had to convert their capital into euros during the transitional period (until December 31st 2001). In Portugal, almost all listed companies had their capital represented by shares worth a nominal (par) value of 1,000 PTE (Portuguese Escudos) each.

There were a series of regulations that commanded the transitional period. Among the most relevant, at the Union level, one can find Regulation (EC) No. 1103/97 dated June 17, 1997 and Regulation (EC) No. 974/98 dated May 3,1998. At the national level, Decreto-lei No. 343/98 dated November 6, 1998, is probably the most important piece of legislation. The changes it introduced to Portuguese Corporate Law indirectly allowed listed firms to split their shares. The main Code of Corporate Law[12] in Portugal had to be adapted due to the Euro introduction (the changes were introduced by the above mentioned Decreto-lei). Among the several changes, those introduced to the original Article No. 276 where the most crucial. The original article stated:

"Article No. 276

(Nominal value of capital and shares)

1. The societies' capital and shares must be expressed in a nominal value.
2. All shares must have the same nominal value (par value) that must not be lower than 1,000 Escudos (PTE).
3. The minimum nominal value of capital for individual firms is 5,000,000 Escudos.
4. A share is indivisible."

In practice it was almost impossible to conduct stock splits, because most Portuguese companies had their capital divided into 1,000 PTE par value shares. As the article stated, each share had a minimum nominal value of 1,000 PTE and was legally indivisible. Decreto-lei No. 343/98, however, changed numbers 2 and 3 of the above article, putting the minimum value at one euro cent.

A similar phenomenon was reported by Wulff (2002) for Germany. He provides evidence that almost all traded shares in that market had a par value equivalent to the minimum just before several reforms documented. After each reform a large number of splits occurred, changing the par value to the new authorized minimum.

[12] Código das Sociedades Comerciais.

4. Data Sources and Sample Selection

The present study covers all stock splits announced and executed in the Portuguese stock market from October 1999 to the end of June 2003. During this period 26 stock splits were announced and executed[13]. To identify the relevant operations and their announcement and ex-dates the main source was Dathis, a Euronext Lisbon database. The announcement dates were crosschecked with information collected from the financial press. For the execution dates (ex-dates) the information was compared with that from Bloomberg (the same for the split factors applied). Some additional information released by the companies was also collected from this source. The CMVM's[14] Internet site was used as an alternative source for information related to corporate actions involving splitting firms, during the relevant period. Dathis was also used as the source for the time series of splitting firms' closing, bid and ask prices, as well as volume (number of shares and euro amount) and number of daily deals.

The following table shows the stock splits considered in the sample and their respective ex-dates and split factors (defined as the new number of shares for each old share)[15].

[13] An additional stock split was announced by Sumolis. The General Shareholders Meeting that approved the operation took place on June 27th 2003, so the execution of the split took place after the end of our sample period.
[14] Comissão do Mercado de Valores Mobiliários – Portuguese financial markets' watchdog.
[15] Of the sample firms, only one had a par value per share different from 1,000 PTE, before all the changes that resulted in the stock split. Its par value was 1,200 PTE (EUR 5.99). The par value of each share after the split was EUR 1, so the split factor was 5.99.

Table 1 – Stock Splits, Ex-dates and Split Factors

	Ex-date	Split Factor	
BCP	15-11-1999	5	
BPA	22-09-1999	5	
BPI	06-10-1999	5	
Brisa	25-11-1999	5	
Brisa Priv	25-11-1999	5	
Celulose Caima	10-05-2002	5,99	
Cimpor	08-04-2003	5	
CIN	12-01-2000	5	
Cires	18-07-2000	5	
Cofina	20-11-2000	10	
Cort Amorim	08-11-2000	5	
Colep	15-02-2000	2,5	*
EDP	17-07-2000	5	
Finibanco	25-07-2001	5	
Ibersol	02-01-2001	10	
Modelo Continente	22-01-2001	5	
Mota Engil	23-01-2001	5	
Portucel	22-01-2001	5	
Portugal Telecom	25-11-1999	5	
SAG	23-05-2000	5	
Salvador Caetano	25-09-2001	5	
Semapa	14-09-2000	5	
Sonae SGPS	21-06-2000	5	
Teixeira Duarte	03-10-2000	12	
Telecel	16-11-1999	10	
V&A	29-05-2001	5	

* this operation was very complex, involving an extraordinary dividend, a capital decrease followed by an increase and each old share was substituted by 2,5 new shares.

It can be easily observed that the most commonly used split factor was five. With the euro introduction the share par value for most companies was 4.99 euros (1,000 PTE converted to euros). Prior to the split most companies conducted an increase in their nominal capital (converting equity reserves or retained earnings into share capital) and hence each share increased its par value to exactly 5 euros. The use of a split factor of 5 thus resulted in a new par value for each share of 1 euro.

One striking feature of our sample is the relatively long time span between the announcement of the stock split and its actual execution. For the whole sample the mean time recorded between the tow events was approximately 246 days (214 days for the median). Even removing the sample's clear outlier (Celulose do Caima) the mean and median values are still 214 and 205 days, respectively. This is in clear contrast with the time interval Conroy et al. (1990) report for their sample that is only an average of 51 calendar days. A plausible explanation for the long time it took companies to undertake their splits is the requirement that the General Shareholders Meeting approves the change in the shares' par value, since changes to the firms' charter rules have to be approved by shareholders.

5. Empirical Results

5.1 Liquidity Changes Around Stock Splits' Ex-dates

As referred in section 2.2., improved liquidity has been one of the main reasons put forward by several authors to explain the reason why companies split their shares. In this section we use some of the most commonly proposed proxies to measure possible liquidity effects.

One of the main arguments in favour of an increased liquidity hypothesis after stock splits is the allegation that small investors may have a preference for lower priced stocks. This type of investor typically faces considerable restrictions in terms of the amount available to invest in each share. If round-lots are a rule in the stock exchange, than the small investor has two alternatives: either to 1) buy odd-lots incurring in higher costs and probably obtaining worse prices; or 2) buy only round-lots, restricting the number of stocks in his portfolio. Any of these solutions will result, however, in a less interesting portfolio (in terms of the corresponding risk/return combination) compared to that which the investor would achieve without significant financial restrictions.

In the Portuguese case, where there were no round-lot restrictions at the time of our sample, can we claim that small investors were severely restricted from investing as a consequence of very high share prices? Prior to the split[16], the highest priced share in our sample was Telecel with a closing price of EUR 118.35. The minimum number of shares required for individual trades was one, implying that if a small investor wanted to invest in Telecel, the amount he had to put forward was just EUR 118.35 plus expenses, which does not seem to be a very restrictive amount.

Our null hypothesis on liquidity effects of stock splits is:

<u>H1: Stock splits have no liquidity effects around the respective ex-date.</u>

If there are any signalling effects associated with splits, then it is likely that possible short-term abnormal returns should be more significant at the announcement date. Existing research confirms this view. Regarding liquidity effects the argument is

[16] Day before the ex-date.

precisely the opposite. Accordingly, Wulff (2002) uses a period around the ex-day to analyse liquidity effects. With the same objective in mind, Conroy et al (1990) and Guirao and Sala (2002) provide a comparison between the pre-announcement and the post-ex-date periods.

Another reason why we chose to study liquidity changes around the ex-date is the relatively high time span between the announcement and the ex-date. The time frame considered in our analysis consists of a 45 trading days window before the stock split and 45 trading days after the split. To avoid contamination effects, the ex-date and ten trading days before and after the split were excluded from the sample. The window chosen is similar in length to that of Guirao and Sala (2002). Lamoureux and Poon (1987) use 60 trading days windows prior and after the announcement and ex-dates. Muscarella and Vetsuypens (1996) compare 120 trading days windows (around the ex-date), whereas Wulff (2002) uses 220 trading days windows.

Our analysis was conducted at two levels: individual stocks and the sample as a whole. The description of the variables used (pre and post-split) is as follows:

- Number of Days With Trades: the number of days the stock recorded trades, no matter the number of shares traded;
- No. of Trades: the total number of trades for the share, each trading day;
- No. of Shares Traded: the total number of shares traded during each trading day. The post-split number of shares is adjusted by the split-factor in order to be directly comparable with the pre-split period;
- Volume: the total euro volume of the trades recorded during each trading day. In this case there is no need to adjust the post-split period;
- Absolute Bid-Ask Spread: the closing bid-ask spread using euro prices for each trading day;
- Relative Bid-Ask Spread: the Absolute Bid-Ask spread divided by each trading day closing price. This is shown in percentage terms;
- Relative Volume: the Volume divided by the same trading day volume of the PSI 20 index. This is also presented as a percentage.

For the whole sample the results are first presented for the mean (the simple average of the 45 observations recorded for each period) of each variable. The resulting values were used to calculate the sample mean and median values. To test for differences between the pre and post-split periods, two tests were conducted. A parametric t test was used for differences in the mean and the non-parametric Wilcoxon test for differences in the median. The following table shows the results obtained[17].

[17] The results for the variable Relative Volume are shown in a different table (table 3).

Table 2 – Liquidity Changes around Stock Splits Ex-dates – Whole Sample

	Number of Days with Trades		Mean No. of Trades		Mean No. of Shares Traded		Mean Volume (EUR)		Mean Absolute Bid Ask Spread		Mean Relative Bid-Ask Spread	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
BCP	45	45	276,9	570,0	313.197	809.160	7.800.525	22.520.987	0,027	0,016	0,107%	0,282%
BPA	45	44	192,3	525,7	84.634	291.436	1.193.502	5.411.999	0,048	0,015	0,342%	0,415%
BPI	45	45	326,6	591,7	244.227	334.983	4.612.037	6.799.984	0,075	0,020	0,397%	0,493%
Brisa	45	45	449,5	1.443,6	116.688	318.057	4.286.072	12.429.301	0,143	0,033	0,391%	0,427%
Brisa Priv	32	45	3,2	14,6	590	848	21.821	34.751	0,605	0,138	1,671%	1,622%
Celulose Caima	27	18	1,6	1,4	170	68	4.301	1.851	1,465	0,323	5,717%	5,059%
Cimpor	45	45	73,1	108,2	28.813	42.141	462.894	694.731	0,038	0,020	0,237%	0,535%
CIN	43	45	13,7	442,9	8.245	47.523	201.928	1.678.107	0,426	0,050	1,762%	0,645%
Cires	26	24	2,2	1,8	403	124	4.526	1.541	0,598	0,116	5,368%	4,199%
Cofina	45	45	32,0	68,2	8.690	42.397	298.320	1.241.562	0,259	0,030	0,753%	1,180%
Cort Amorim	45	45	38,2	106,2	18.089	114.945	158.940	643.454	0,055	0,014	0,632%	1,262%
Colep	44	45	202,2	149,0	89.296	19.360	749.919	305.049	0,051	0,030	0,620%	1,045%
EDP	45	45	930,1	951,1	938.218	422.788	17.850.144	7.692.448	0,050	0,011	0,261%	0,314%
Finibanco	42	44	9,5	11,6	751	621	4.575	3.540	0,205	0,020	5,492%	1,699%
Ibersol	45	45	15,4	43,8	3.157	3.021	140.430	123.239	1,534	0,032	5,632%	0,797%
Modelo Continente	45	45	101,0	118,5	38.662	44.476	521.734	491.286	0,129	0,023	0,959%	1,076%
Mota Engil	32	45	4,1	9,4	5.208	4.270	46.405	28.514	0,530	0,031	6,210%	2,227%
Portucel	45	45	204,8	144,0	193.863	108.325	1.338.870	733.590	0,026	0,012	0,373%	0,802%
Portugal Telecom	45	45	1.203,4	2.342,3	863.852	977.947	34.789.900	59.924.053	0,154	0,063	0,383%	0,574%
SAG	45	45	150,4	161,6	63.399	56.253	857.276	728.461	0,066	0,020	0,518%	0,838%
Salvador Caetano	8	31	0,6	3,0	21	257	201	3.472	0,761	0,199	7,489%	8,706%
Semapa	45	45	82,8	89,1	49.448	26.220	990.664	506.350	0,154	0,036	0,817%	0,916%
Sonae SGPS	45	45	868,0	589,3	293.089	372.483	13.880.200	3.330.977	0,144	0,065	0,306%	0,782%
Teixeira Duarte	45	45	21,5	51,1	11.070	58.772	202.139	1.005.099	0,180	0,019	0,982%	1,394%
Telecel	45	45	329,8	1.385,0	63.103	118.484	7.709.627	20.406.138	0,442	0,078	0,360%	0,472%
V&A	39	43	6,1	9,2	879	954	5.261	3.745	0,243	0,030	3,795%	3,875%
Mean	40,7	42,5	213,0	382,0	132.222	162.151	3.774.316	5.644.009	0,323	0,056	1,984%	1,601%
Difference	1,8		169,0		29.929		1.869.693		-0,268		-0,382%	
t observed	1,506		2,408		0,962		1,361		-3,813		-1,302	
t critic (5%)	2,060		2,060		2,060		2,060		2,060		2,060	
p-value	0,1445		0,0238		0,3455		0,1857		0,0008		0,2049	
Median	45,0	45,0	78,0	113,4	33.737	46.000	492.314	711.596	0,154	0,030	0,692%	0,877%
Wilcoxon Test												
Normalized Z observed	1,423		3,035		1,714		1,181		-4,457		0,902	
p-value	0,155		0,002		0,086		0,238		< 0,0001		0,367	

The results reported are not completely conclusive concerning liquidity changes. Most companies continuously traded within each of the two 45 trading days period (61.5%). In aggregate terms the mean number of trades increased slightly, but both the parametric and the non-parametric tests classify that change as non-significant (p-values of 0.1445 and 0.155 respectively).

The variable Number of Trades showed a visible increase. At the aggregate level from the pre-split to the post-split period the mean number of trades increased from 213.0 to 382.0 trades per day per share, a 79.3% change. Even though more modest, the increase in the median is from 78.0 to 113.4 trades per day per share (a 45.4% increase). The p-values obtained from the t and the Wilcoxon tests (0.0028 and 0.002, respectively) show that there is a statistically significant increase in this variable.

Our sample of Portuguese stock splits also shows an increase in both the mean number of shares traded (post-split shares are adjusted by the split factor) and in the mean volume (measured in euros) but none of the tests recorded statistically significant changes (at conventional significance levels). In mean terms, the increase in the volume (euro) and number of shares traded was considerably lower than the increase in the number of trades[18].

We anticipated a decrease in the absolute bid-ask spread for two reasons: first, the work by Alves and Alves (2001) with a smaller sample documented such result; second, other markets where significant decreases have been documented, typically had smaller mean (and median) split factors[19]. As expected, all sample firms had a decrease in their mean absolute bid-ask spread. The results obtained for the Relative Bid-Ask Spread were somewhat surprising. As reported in section 2.2, most literature reports an increase in the relative bid-ask spread thus supporting the argument that investors are left worse off as the result of larger transaction costs. The results in Table 2 show, however, that in aggregate terms the mean relative bid-ask spread actually decreases (from 1.984% to 1.601%). On the other hand, the median increases from 0.692% to 0.877%. Parametric and non-parametric tests reveal, however, that these differences are not significant (p-values of 0.2049 and 0.367, respectively). We repeated our analysis

[18] In terms of the median the changes were not as dramatic, al though qualitatively similar.
[19] As described in section 1.3, the studies conducted concerning the U.S. market show the 2-for-1 splits as the most common. Some papers, for specific reasons, limit their sample to this type of splits, since it's the most common (for example see Byun and Rozeff , 2003).

but this time excluding those firms that had pre and/or post-split spreads above 3.5%. The results were quite different. We observed an increase in the mean relative bid-ask spread from 0.625% to 0.793%. This increase had a t statistic of 2.028, which is barely insignificant at the 5% level (p-value of 0.0577). As for the median, again an increase was recorded. The pre-split value was 0.397% and the post-split value was 0.782%. This increase was statistically significant (p-value of 0.0015). To further check these results a different approach was followed. The euro volume of each trading day for each firm was adjusted, dividing it by the trading volume for that day of the PSI 20 index. At least a part of the liquidity premium can be viewed in relative terms. If the stock liquidity (euro volume traded) increases and that increase is higher than that of the market, this might be a more significant symptom of a liquidity improvement. Table 3 shows the results.

Table 3 – Mean Volume Relative to PSI 20's Volume (%)

	Before	After
BCP	7,689%	9,403%
BPA	1,406%	3,836%
BPI	5,891%	3,764%
Brisa	3,888%	5,141%
Brisa Priv	0,019%	0,012%
Celulose Caima	0,004%	0,003%
Cimpor	0,835%	1,241%
CIN	0,095%	0,591%
Cires	0,003%	0,001%
Cofina	0,216%	0,366%
Cort Amorim	0,124%	0,347%
Colep	0,362%	0,146%
EDP	8,541%	5,576%
Finibanco	0,005%	0,004%
Ibersol	0,097%	0,073%
Modelo Continente	0,334%	0,413%
Mota Engil	0,011%	0,021%
Portucel	0,860%	0,594%
Portugal Telecom	31,978%	23,201%
SAG	0,355%	0,355%
Salvador Caetano	0,000%	0,003%
Semapa	0,639%	0,478%
Sonae SGPS	6,545%	2,136%
Teixeira Duarte	0,151%	0,645%
Telecel	7,975%	8,791%
V&A	0,005%	0,005%
Mean	3,001%	2,582%
Difference	-0,419%	
t observed	-0,986	
t critic (5%)	2,060	
p-value	0,3335	
Median	0,345%	0,446%
Wilcoxon Test		
Normalized Z observed	0,2413	
p-value	0,4047	

In terms of change signs, there is essentially a tie, as 13 go up and 13 go down. In aggregate terms there is a drop in the mean relative trading volume (in absolute terms there was an increase), but this drop is not significant (p-value of 0.3335). The median shows the contrary. The median relative volume traded goes from 0.345% to 0.446%, but this change also is not significant (p-value of 0.4047).

The results are in line with the mainstream literature in this issue. Our evidence is rather inconclusive regarding the influence of stock splits on liquidity. The only clear effect seems to be the increase in the number of trades, suggesting that, in line with Kryzanowsky and Zhang (1996) and Guirao and Sala (2002), small investors may have been attracted post-split. However, there is no significant impact on relative bid-ask spreads except for a sub-sample of firms, although the absolute spread was significantly reduced. At the same time, mean volume (in EUR) remained stable after the split.

5.2 Abnormal Returns around Stock Splits' Announcement and Ex-dates

This section analyses the price behavior around stock splits' announcement and ex-dates. The null hypothesis that is tested is:

> H2: There are no price effects (i.e. no abnormal returns) around stock splits' announcement and ex-dates.

Most studies find that abnormal returns are higher around the announcement date (for example: Lamoureux and Poon (1987); Maloney and Mulherin (1992)). The reason put forward to justify this is that stock splits provide a signal that is revealed at the announcement. However, the literature has also uncovered abnormal returns are also observable at the ex-date, albeit with a smaller magnitude than those recorded at the announcement date. The literature surveyed in section 2.2. typically attributes the ex-date price effect to beneficial liquidity effects that investors can only capture after the ex-date itself.

The PSI Geral Index was used as a proxy for the market return. This is a market-weighted index of the Mercado de Cotações Oficiais of Euronext Lisbon[20]. Daily returns for each stock (or index) were calculated according to formula

$$R_{i,t} = Ln\left({P_{i,t}}\middle/ {P_{i,t-1}} \right)$$

where Ln is the natural logarithm and $P_{i,t}$ the price of stock or index i at day t.

To estimate price effects two methods were used:

1) The return of each share around the relevant date was compared with that of the market.

$$NAR_{i,t} = R_{i,t} - R_{m,t} \qquad (2.1)$$

$NAR_{i,t}$: Non-adjusted Abnormal Return on Stock i at day t;

$R_{i,t}$: Return on Stock i at day t;

$R_{m,t}$: Return on the Market Index at day t.

2) The stock's return was compared with the return expected for that day according to the market model. The market model was estimated according to the following equation:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \qquad (2.2)$$

$R_{i,t}$: Return on Stock i at day t;

$R_{m,t}$: Return on the Market Index at day t;

$\varepsilon_{i,t}$: disturbance term with zero mean.

The abnormal return estimated through this model is:

$$AR_{i,t} = R_{i,t} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{m,t} \right) \qquad (2.3)$$

The market model was estimated using daily returns for each stock and the PSI Geral Index. The 12 trading days prior to the announcement date and the ex-date were

[20] PSI 20 was not used because several of the companies in the sample were never index constituents. Alves and Alves (2001) used PSI 30 in their work. This choice was impossible to replicate in our work because Euronext Lisbon ceased the publication of such index.

removed to avoid contamination effects[21]. For each variable we used 245 trading days (244 daily returns), which represents approximately one year.

As seen in the previous section, many of the sample firms were thinly traded. In these cases the estimation procedure followed may not be the ideal (there are many blanks in the shares' vector of daily returns). Escalda (1993) addresses this question specifically for the Portuguese stock market. Wulff (2002) also addressed this problem due to thin trading in many of his German sample firms. Dimson and Marsh (1983) proposed an alternative estimation procedure that produced robust results for their sample of U.K. firms. Their procedure uses the trade-to-trade return approach. This means that the returns used in their estimation are not daily returns, but returns between adjacent stock trades. The return for the same period for the market index is then calculated. The resulting returns (observations) are then weighted using the number of days between adjacent trades to render the Beta estimates efficient and unbiased. The estimated model is[22]:

$$\frac{R_{i,n_t}}{\sqrt{n_t}} = \frac{\alpha_i}{\sqrt{n_t}} + \beta_i \frac{R_{m,n_t}}{\sqrt{n_t}} + u_{i,n_t} \qquad (2.4)$$

n_t: number of days between adjacent trades;

$R_{i,nt}$: Return on Stock i between two adjacent trades;

$R_{m,nt}$: Return on the Market Index for the same period;

$u_{i,nt}$: disturbance term with zero mean.

The abnormal returns are estimated according to a similar form of equation (2.3), daily returns being substituted by the trade-to-trade returns, for both the stock and the market index.

To analyze the price effects we computed the Cumulative Abnormal Returns (CAR) for periods of 3 and 5 days centered in the announcement and ex-dates. The use of CAR is common in event-study methodology. CAR for firm i were obtained as follows[23]:

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[21] Abnormal returns for each event were analysed using 3 or 5 days around the relevant dates. The purpose was to eliminate 10 trading days prior to the first day used to estimate abnormal returns. As a result of this, we eliminated 12 trading days prior to each event.
[22] See Dimson and Marsh (1983) and Wulff (2002).
[23] a is equal to 1 if CAR for 3 days are being calculated and is equal to 2 if CAR for 5 days are being calculated.

$$CAR_i = \sum_{t=T-a}^{T+a} AR_{i,t} \qquad (2.5)$$

Table 5 reports the results obtained for the sample using the standard market model to estimate abnormal returns. The t statistic computed is the one proposed by Brown and Warner (1985) to take into account cross-sectional correlation (due to event clustering, which seems to be present in our sample)[24]. There are other proposals concerning the evaluation of the statistical significance of abnormal returns in event studies. For an overview of the main tests see Seiler (2000) and Serra (2002).

[24] See Appendix 1 for details regarding this test statistic.

Table 4 – Adjusted and Non-Adjusted Abnormal Returns around Stock Splits Announcement and Ex-dates

	Non-Adjusted CumulativeAbnormal Returns				Adjusted Cumulative Abnormal Returns			
	Announcement		Ex-date		Announcememt		Ex-date	
	3 days	**5 days**	**3 days**	**5 days**	**3 days**	**5 days**	**3 days**	**5 days**
BCP	-1,172%	-1,696%	-0,525%	-1,255%	-1,216%	-1,681%	0,715%	-0,017%
t observed	-0,517	-0,579	-0,136	-0,436	-0,538	-0,576	0,333	-0,006
BPA	-2,041%	-0,074%	10,296%	8,677%	-2,078%	-0,026%	10,264%	9,030%
t observed	-0,330	-0,009	2,335	2,640	-0,336	-0,003	4,157	2,833
BPI	1,314%	1,192%	-2,222%	0,547%	2,549%	2,230%	-2,874%	-0,734%
t observed	0,480	0,337	-0,443	0,146	0,964	0,653	-1,038	-0,205
Brisa	3,190%	4,160%	-3,095%	-6,512%	3,019%	3,315%	-2,037%	-5,646%
t observed	1,266	1,278	-0,764	-2,157	1,420	1,208	-0,916	-1,967
Brisa Priv	2,566%	3,772%	-1,607%	-2,514%	2,406%	2,770%	0,152%	-1,088%
t observed	0,628	0,715	-0,214	-0,448	0,651	0,581	0,037	-0,203
Celulose Caima	-0,325%	0,918%	-1,040%	5,150%	-0,230%	0,705%	-1,009%	3,840%
t observed	-0,077	0,168	-0,046	0,309	-0,056	0,133	-0,079	0,232
Cimpor	-0,311%	0,379%	0,033%	0,036%	-0,250%	1,258%	0,818%	1,044%
t observed	-0,117	0,110	0,007	0,011	-0,105	0,409	0,366	0,362
CIN	-5,110%	-5,274%	-1,770%	0,968%	-4,220%	-4,158%	-0,689%	3,623%
t observed	-1,232	-0,985	-0,253	0,186	-1,035	-0,790	-0,174	0,709
Cires	6,267%	9,695%	-	-2,723%	8,143%	10,692%	-	-1,191%
t observed	0,806	0,965	-	-0,279	1,053	1,071	-	-0,124
Cofina	6,881%	16,076%	1,596%	2,956%	8,530%	18,501%	1,448%	3,824%
t observed	1,231	2,228	0,133	0,331	1,565	2,629	0,214	0,437
Cort Amorim	4,123%	2,773%	4,642%	7,140%	3,896%	2,106%	3,898%	4,866%
t observed	1,473	0,767	0,943	1,946	1,703	0,713	1,669	1,613
Colep	0,734%	2,607%	3,421%	6,475%	0,895%	2,376%	3,826%	7,208%
t observed	0,218	0,599	0,536	1,362	0,269	0,553	1,098	1,602
EDP	2,265%	2,976%	-0,723%	-0,660%	2,312%	3,163%	-0,220%	-0,180%
t observed	0,951	0,968	-0,167	-0,205	0,987	1,046	-0,093	-0,059
Finibanco	2,482%	6,788%	1,934%	8,488%	-0,662%	5,032%	2,572%	9,671%
t observed	0,624	1,322	0,403	2,371	-0,175	1,032	1,116	3,250
Ibersol	-5,183%	2,205%	-1,236%	0,752%	-5,392%	0,841%	-1,381%	1,003%
t observed	-1,046	0,345	-0,174	0,142	-1,108	0,134	-0,343	0,193
Modelo Continente	0,027%	0,753%	2,415%	0,267%	-0,921%	-0,666%	2,314%	0,374%
t observed	0,010	0,218	0,446	0,066	-0,357	-0,200	0,743	0,093
Mota Engil	-9,068%	-3,428%	-1,251%	-1,835%	-11,890%	-4,782%	-1,250%	-1,844%
t observed	-2,404	-0,704	-0,153	-0,301	-3,659	-1,140	-0,279	-0,319
Portucel	6,268%	5,166%	2,436%	-0,509%	5,951%	5,491%	1,800%	-0,485%
t observed	1,960	1,251	0,493	-0,138	1,904	1,361	0,669	-0,139
Portugal Telecom	-8,756%	-10,518%	2,995%	1,037%	-9,190%	-9,818%	2,722%	0,804%
t observed	-2,977	-2,770	0,602	0,280	-3,257	-2,695	0,949	0,217
SAG	1,808%	0,204%	0,427%	1,198%	1,596%	-0,028%	-0,388%	-0,319%
t observed	0,525	0,046	0,071	0,268	0,465	-0,006	-0,118	-0,075
Salvador Caetano	10,757%	12,678%	-	-7,521%	10,598%	12,290%	-	-12,284%
t observed	1,240	1,132	-	-0,658	1,223	1,098	-	-1,084
Semapa	-4,176%	-5,514%	-1,359%	-3,522%	-2,223%	-2,998%	-1,522%	-4,382%
t observed	-1,577	-1,613	-0,253	-0,879	-0,913	-0,954	-0,547	-1,219
Sonae SGPS	-0,196%	0,016%	-2,717%	-3,786%	-1,211%	-0,516%	-1,651%	-1,898%
t observed	-0,074	0,005	-0,480	-0,897	-0,464	-0,153	-0,527	-0,469
Teixeira Duarte	2,722%	4,810%	0,100%	2,585%	-0,814%	-0,516%	-0,420%	0,941%
t observed	1,187	1,625	0,015	0,524	-0,586	-0,287	-0,131	0,227
Telecel	2,510%	2,365%	7,643%	7,694%	2,958%	2,999%	6,909%	6,502%
t observed	0,580	0,423	1,303	1,760	0,702	0,551	2,068	1,507
V&A	-0,924%	-1,911%	18,133%	22,922%	0,331%	-0,018%	18,423%	23,350%
t observed	-0,221	-0,354	2,123	3,600	0,086	-0,004	3,775	3,707
Average Ab. Return	2,764%	3,461%	6,753%	8,223%	3,076%	3,839%	9,967%	7,287%
t observed	1,95	1,89	4,53	4,28	2,23	2,16	7,08	4,01
p-value	0,0517	0,0592	0,0000	0,0000	0,0257	0,0311	0,0000	0,0001

Our results show that cumulative abnormal returns at both the announcement (5-day adjusted CAR of 3.8%) and ex-dates (5-day adjusted CAR of 7.3%) are statistically and economically very significant.

A rather surprising result is that abnormal returns are much higher around the execution day than at the announcement date (both for adjusted and non-adjusted returns). Previous literature (e.g., Maloney and Mulherin, 1992) pointed to precisely the opposite result.

The statistical significance of our findings is quite high for the ex-date for both non-adjusted and adjusted abnormal returns. The results are also robust to the exclusion of the most obvious outliers from the sample. As for the announcement day, the results are barely insignificant at the 5% level (p-values of 0.0517 and 0.0592) using unadjusted returns. When adjusted returns are considered both measures of cumulative abnormal returns are significant at the 5% level.

To test the relation between CAR and liquidity two further regressions were estimated (not reported in tables). First, a regression was run having as an independent variable the relative (%) change in mean volume (euro) for each of the share in the sample. The dependent variable used was 5 days CAR for the ex-date[25]. The results showed that the significance of the regression was low (p-value 0.09396) and the parameter associated with the independent variable had a negative sign (against expectations). In a second experiment, the dependent variable was the same as before, but the independent variable was set up as the change in the relative bid-ask spread. The estimated value for the parameter associated with the independent variable had a negative sign but the statistical significance of the regression was even lower than previous one (p-value 0.5860).

The following table replicates the above results using the alternative equation (2.4) to obtain the parameters used in the calculation of abnormal results. The non-adjusted CAR are obviously equal under the two methods. For the firms that did not trade daily in the observation period, the t statistics are slightly different. This is because the abnormal returns series is different from that of the market model. We used trade-to-trade returns for the market index and not the daily return as in the market

[25] We used this dependent variable for two reasons: first, since we are investigating changes in liquidity, it is more likely that these should occur around the ex-date; second, we used 5 days instead of 3, because two stocks did not have data concerning 3 days CAR.

model results. This was in order to make direct comparisons between adjusted and non-adjusted results under each method.

Table 5 – Adjusted and Non-Adjusted Abnormal Returns around Stock Splits Announcement and Ex-dates (using equation 2.4 alternative model)

	Non-Adjusted CumulativeAbnormal Returns				Adjusted Cumulative Abnormal Returns			
	Announcement		Ex-date		Announcememt		Ex-date	
	3 days	5 days	3 days	5 days	3 days	5 days	3 days	5 days
BCP	-1,172%	-1,696%	-0,525%	-1,255%	-1,193%	-1,641%	0,507%	-0,224%
t observed	-0,517	-0,579	-0,136	-0,436	-0,528	-0,562	0,236	-0,081
BPA	-2,041%	-0,074%	10,296%	8,677%	-2,153%	-0,069%	10,259%	9,080%
t observed	-0,330	-0,009	2,335	2,640	-0,348	-0,009	4,152	2,847
BPI	1,314%	1,192%	-2,222%	0,547%	2,572%	2,257%	-3,002%	-0,930%
t observed	0,480	0,337	-0,443	0,146	0,973	0,661	-1,084	-0,260
Brisa	3,190%	4,160%	-3,095%	-6,512%	3,047%	3,307%	-1,988%	-5,600%
t observed	1,266	1,278	-0,764	-2,157	1,432	1,204	-0,894	-1,951
Brisa Priv	2,566%	3,772%	-1,607%	-2,514%	2,387%	2,664%	0,067%	-1,169%
t observed	0,609	0,693	-0,205	-0,431	0,649	0,561	0,016	-0,216
Celulose Caima	-0,325%	0,918%	-1,040%	5,150%	-0,337%	0,623%	-1,290%	5,104%
t observed	-0,077	0,168	-0,044	0,295	-0,083	0,118	-0,096	0,294
Cimpor	-0,311%	0,379%	0,033%	0,036%	-0,215%	1,303%	0,834%	1,055%
t observed	-0,117	0,110	0,007	0,011	-0,090	0,423	0,374	0,366
CIN	-5,110%	-5,274%	-1,770%	0,968%	-4,186%	-4,124%	-0,649%	3,684%
t observed	-1,267	-1,013	-0,258	0,189	-1,056	-0,806	-0,167	0,733
Cires	6,267%	9,695%	-	-2,723%	8,582%	10,630%	-	-1,226%
t observed	0,750	0,899	-	-0,264	1,105	1,060	-	-0,127
Cofina	6,881%	16,076%	1,596%	2,956%	8,355%	18,278%	1,502%	3,970%
t observed	1,232	2,229	0,133	0,331	1,533	2,598	0,222	0,454
Cort Amorim	4,123%	2,773%	4,642%	7,140%	3,899%	2,084%	3,871%	4,757%
t observed	1,473	0,767	0,943	1,946	1,703	0,705	1,656	1,576
Colep	0,734%	2,607%	3,421%	6,475%	0,954%	2,472%	3,851%	7,231%
t observed	0,218	0,599	0,536	1,362	0,286	0,575	1,104	1,606
EDP	2,265%	2,976%	-0,723%	-0,660%	2,331%	3,197%	-0,198%	-0,159%
t observed	0,951	0,968	-0,167	-0,205	0,995	1,057	-0,083	-0,052
Finibanco	2,482%	6,788%	1,934%	8,488%	-0,820%	4,940%	2,560%	9,670%
t observed	0,633	1,341	0,397	2,341	-0,220	1,029	1,103	3,228
Ibersol	-5,183%	2,205%	-1,236%	0,752%	-5,227%	1,222%	-1,321%	1,018%
t observed	-1,043	0,344	-0,174	0,142	-1,073	0,194	-0,328	0,196
Modelo Continente	0,027%	0,753%	2,415%	0,267%	-0,880%	-0,609%	2,230%	0,342%
t observed	0,010	0,218	0,446	0,066	-0,341	-0,183	0,716	0,085
Mota Engil	-9,068%	-3,428%	-1,251%	-1,835%	-11,730%	-4,749%	-1,376%	-1,969%
t observed	-2,423	-0,710	-0,153	-0,301	-3,619	-1,135	-0,308	-0,342
Portucel	6,268%	5,166%	2,436%	-0,509%	5,865%	5,486%	1,860%	-0,416%
t observed	1,960	1,251	0,493	-0,138	1,876	1,359	0,691	-0,120
Portugal Telecom	-8,756%	-10,518%	2,995%	1,037%	-9,251%	-9,738%	2,628%	0,726%
t observed	-2,977	-2,770	0,602	0,280	-3,276	-2,671	0,916	0,196
SAG	1,808%	0,204%	0,427%	1,198%	1,601%	-0,014%	-0,472%	-0,443%
t observed	0,525	0,046	0,071	0,268	0,466	-0,003	-0,144	-0,105
Salvador Caetano	10,757%	12,678%	-	-7,521%	10,032%	11,277%	-	-9,831%
t observed	1,222	1,115	-	-0,677	1,149	1,000	-	-0,888
Semapa	-4,176%	-5,514%	-1,359%	-3,522%	-2,276%	-3,066%	-1,581%	-4,496%
t observed	-1,577	-1,613	-0,253	-0,879	-0,935	-0,976	-0,567	-1,250
Sonae SGPS	-0,196%	0,016%	-2,717%	-3,786%	-1,163%	-0,471%	-1,672%	-1,947%
t observed	-0,074	0,005	-0,480	-0,897	-0,445	-0,140	-0,534	-0,482
Teixeira Duarte	2,722%	4,810%	0,100%	2,585%	-1,403%	-1,395%	-0,445%	0,907%
t observed	1,172	1,605	0,015	0,522	-1,026	-0,790	-0,139	0,219
Telecel	2,510%	2,365%	7,643%	7,694%	2,920%	2,930%	6,968%	6,578%
t observed	0,580	0,423	1,303	1,760	0,692	0,538	2,085	1,525
V&A	-0,924%	-1,911%	18,133%	22,922%	0,541%	0,298%	19,068%	23,970%
t observed	-0,215	-0,344	2,094	3,552	0,139	0,059	3,881	3,779
Average Ab. Return	2,764%	3,461%	6,753%	8,223%	3,016%	3,736%	10,030%	7,488%
Std Deviation	0,008	0,011	0,009	0,011	0,008	0,010	0,008	0,011
t observed	1,95	1,89	4,47	4,21	2,19	2,10	7,09	4,10
p-value	0,0516	0,0591	0,0000	0,0000	0,0283	0,0353	0,0000	0,0000

From the table above one can observe that there are no major differences, at the aggregate level, between the results presented in this table and those of table 4. The CAR for the announcement date under the trade-to-trade approach are marginally smaller than those obtained under the market model (for both 3 and 5 days). The opposite occurs for the ex-date. In terms of statistical significance the magnitude of the p-value barely changes.

Lease et al. (1991), in the case of seasoned equity offerings, and Maloney and Mulherin (1992), in the case of stock splits, have found evidence that market microstructure features are a potential explanation for the observed abnormal price effects associated with those phenomenon. Around the relevant dates the closing price tends to approach the bid (in the first case) or the ask prices (in the second). In the context of stock splits, prices tend to be more clustered around the last ask price compared to a "normal" situation. In light of this they claim that probably the gain most authors calculate in terms of abnormal returns cannot in practice be captured by investors. To further test this hypothesis they analysed the existence of abnormal returns using bid instead of closing prices.

We replicated the above procedure in our work. Last bid prices were used (instead of closing ones) to estimate cumulative abnormal returns around stock splits' announcement and ex-dates. For consistency purposes, the market model and the trade-to-trade approach were again estimated using bid prices. The following table shows the results according to the market model[26].

[26] See Annex 1 for the table with the results obtained using the trade-to trade approach. Results are very similar to those of Table 6.

Table 6 – Adjusted and Non-Adjusted Abnormal Returns Around Stock Splits Announcement and Ex-dates (using Last Bid Prices)

	Non-Adjusted CumulativeAbnormal Returns				Adjusted Cumulative Abnormal Returns			
	Announcement		Ex-date		Announcememt		Ex-date	
	3 days	5 days	3 days	5 days	3 days	5 days	3 days	5 days
BCP	-1,249%	-1,403%	-1,338%	-2,178%	-1,293%	-1,404%	-0,097%	-0,938%
t observed	-0,550	-0,478	-0,345	-0,753	-0,570	-0,480	-0,045	-0,336
BPA	-1,692%	0,559%	9,726%	8,890%	-1,736%	0,648%	9,706%	9,208%
t observed	-0,281	0,072	2,405	2,949	-0,289	0,084	4,273	3,140
BPI	1,218%	2,162%	-2,422%	0,936%	2,336%	3,103%	-2,946%	-0,102%
t observed	0,434	0,596	-0,463	0,240	0,854	0,879	-1,001	-0,027
Brisa	3,456%	4,165%	-3,360%	-6,303%	3,294%	3,370%	-2,385%	-5,503%
t observed	1,438	1,342	-0,831	-2,092	1,615	1,280	-1,066	-1,905
Brisa Priv	0,425%	1,867%	-0,956%	-2,940%	0,210%	0,556%	0,805%	-1,515%
t observed	0,113	0,383	-0,162	-0,667	0,068	0,140	0,254	-0,371
Celulose Caima	1,187%	2,804%	-1,040%	-2,212%	1,298%	2,603%	-2,051%	-0,588%
t observed	0,278	0,509	-0,068	-0,193	0,316	0,490	-0,235	-0,052
Cimpor	-0,311%	0,379%	-0,821%	0,344%	-0,250%	1,258%	0,028%	1,432%
t observed	-0,117	0,110	-0,184	0,104	-0,105	0,409	0,013	0,508
CIN	-3,649%	-6,564%	-0,358%	0,968%	-2,597%	-5,230%	0,969%	4,341%
t observed	-0,880	-1,227	-0,054	0,196	-0,643	-1,003	0,264	0,915
Cires	17,507%	9,610%	-7,353%	-6,734%	19,124%	10,454%	-7,470%	-6,734%
t observed	3,198	1,360	-0,738	-0,906	3,536	1,497	-1,346	-0,940
Cofina	6,881%	15,847%	1,628%	1,843%	8,098%	17,648%	1,524%	2,881%
t observed	1,386	2,473	0,135	0,204	1,661	2,803	0,223	0,327
Cort Amorim	4,123%	4,298%	4,663%	5,949%	3,893%	3,626%	3,920%	3,670%
t observed	1,593	1,287	1,042	1,784	1,929	1,392	1,952	1,415
Colep	1,281%	0,595%	3,623%	6,475%	1,459%	0,570%	3,962%	7,098%
t observed	0,419	0,151	0,593	1,421	0,479	0,145	1,174	1,629
EDP	2,056%	3,306%	-1,001%	-0,938%	2,104%	3,499%	-0,497%	-0,457%
t observed	0,892	1,111	-0,240	-0,302	0,930	1,198	-0,218	-0,155
Finibanco	4,432%	4,258%	0,952%	4,735%	1,632%	2,698%	1,492%	5,743%
t observed	1,172	0,872	0,208	1,387	0,451	0,578	0,653	1,948
Ibersol	-6,473%	0,463%	-4,562%	-0,426%	-6,591%	-0,549%	-4,694%	-0,187%
t observed	-1,365	0,076	-0,647	-0,081	-1,407	-0,091	-1,173	-0,036
Modelo Continente	0,027%	-0,290%	2,056%	0,267%	-1,047%	-1,893%	1,781%	0,390%
t observed	0,010	-0,085	0,399	0,070	-0,413	-0,579	0,609	0,103
Mota Engil	-4,762%	-3,650%	-1,281%	-4,195%	-7,468%	-4,934%	-1,266%	-4,191%
t observed	-1,056	-0,627	-0,137	-0,604	-1,815	-0,929	-0,247	-0,633
Portucel	7,341%	4,787%	1,749%	-0,370%	7,015%	5,130%	1,094%	-0,345%
t observed	2,403	1,214	0,379	-0,108	2,360	1,337	0,441	-0,108
Portugal Telecom	-9,088%	-10,981%	2,995%	0,828%	-9,569%	-10,217%	2,631%	0,522%
t observed	-2,987	-2,795	0,610	0,227	-3,296	-2,726	0,931	0,143
SAG	1,352%	0,279%	-0,080%	0,862%	1,086%	-0,017%	-0,958%	-0,764%
t observed	0,446	0,071	-0,014	0,201	0,362	-0,004	-0,308	-0,191
Salvador Caetano	2,075%	4,073%	-15,096%	-12,000%	0,592%	1,128%	-11,182%	-6,983%
t observed	0,435	0,661	-1,854	-1,977	0,131	0,193	-2,444	-1,182
Semapa	-4,176%	-4,760%	-1,359%	-3,572%	-2,080%	-2,058%	-1,516%	-4,437%
t observed	-1,646	-1,453	-0,278	-0,979	-0,914	-0,701	-0,617	-1,398
Sonae SGPS	0,312%	-0,026%	-2,717%	-3,311%	-0,771%	-0,591%	-1,610%	-1,349%
t observed	0,116	-0,007	-0,474	-0,774	-0,293	-0,174	-0,509	-0,330
Teixeira Duarte	3,596%	-0,612%	0,095%	3,349%	-0,795%	-7,208%	-0,445%	1,637%
t observed	1,215	-0,160	0,013	0,623	-0,358	-2,515	-0,125	0,357
Telecel	2,516%	2,365%	7,248%	7,996%	2,736%	2,696%	6,692%	7,083%
t observed	0,581	0,423	1,257	1,861	0,638	0,487	2,028	1,662
V&A	-1,600%	-0,279%	7,986%	28,539%	-0,221%	1,803%	8,225%	29,037%
t observed	-0,413	-0,056	1,133	5,430	-0,064	0,403	2,132	5,829
Average Ab. Return	3,145%	2,800%	4,619%	7,885%	3,121%	2,792%	7,722%	7,599%
t observed	2,42	1,67	3,20	4,23	2,51	1,74	5,77	4,40
p-value	0,0153	0,0946	0,0014	0,0000	0,0122	0,0823	0,0000	0,0000

Table 6 reveals that the use of last bid, instead of closing, prices has some consequences. Concerning the announcement date there is an opposite behavior for 3 and 5 days CAR (for both unadjusted and adjusted) than the one documented earlier. The estimated CAR for 3 days increases and so does the test statistic while the opposite occurs for the 5 days CAR. It can now be observed that the 3 days CAR are significant at the 5% level for unadjusted and adjusted abnormal returns (p-values of 0.0153 and 0.0122) while for 5 days CAR the statistical significance has been diminished (0.0946 and 0.0823).

Regarding the ex-date, the 3 days CAR abnormal returns are clearly smaller using last bid prices. There is a strong impact in the test statistic, but the statistical significance is still quite high (p-values of 0.0000). In terms of the 5 days CAR, the conclusions are not so clear. There is an increase using adjusted cumulative abnormal returns and a decrease using the unadjusted version.

Even though not absolutely clear cut, it seems that around the ex-date closing prices tend to drift towards the ask price. The resulting consequence is that abnormal returns using closing prices may be somewhat overestimated. Thus, a relatively small part of the gains may not be earnable by investors. As to the announcement date the results are more conflicting.

To summarize, our evidence for the Portuguese market is consistent with stock splits leading to a significant positive price effects at either the announcement or execution dates. These price effects do not seem to be attributable to the microstructure market features mentioned by Maloney and Mulherin (1992). Finally, our evidence does not show the occurrence of relevant liquidity changes that could explain those abnormal returns.

5.3 Changes in Systematic Risk

If systematic risk changes, in other words, if the stock Beta (estimated according to a market model) changes, then the stock price should adjust to take into account this new risk. In a different setting (long-term abnormal returns), Boehme (2001) found that the positive abnormal returns associated to part of his sample of stock splits could be explained by ex-post reductions in systematic risk .

Since managers have greater insight over the company's prospects, this argument suggests that through stock splits they may be trying to signal that the company's systematic risk is falling.

To evaluate the post-split changes in systematic risk, we estimated the stock's beta. We only used the market model - equation (2.2) - using the closing price of each day. The time frame used was similar to the one presented earlier, that is, 12 trading days after the ex-date, 245 daily trading days for the market index (PSI Geral) and each stock[27].

Our null hypothesis on systematic risk changes is therefore:

H3: Stock splits are not associated with changes in the stock's systematic risk, measured by the stock's market model Beta.

To test this hypothesis we compared the pre-announcement and post-split betas. Table 7 shows the results.

[27] One observation (Cimpor) was excluded due to lack of sufficient data. For BPA the time frame used only 175 trading days, because this firm was delisted after a successful tender offer.

Table 7 – Beta Changes After Stock Splits

	Pre - Announcement	Post-split
BCP	1,067	0,155
BPA	1,057	0,262
BPI	1,246	0,259
Brisa	0,533	0,481
Brisa Priv	0,416	0,213
Celulose Caima	0,618	1,421
CIN	0,615	0,700
Cires	0,447	0,440
Cofina	0,287	1,181
Cort Amorim	0,225	0,456
Colep	0,808	0,318
EDP	0,775	0,527
Finibanco	0,311	0,341
Ibersol	0,481	0,723
Modelo Continente	0,651	1,017
Mota Engil	0,082	0,262
Portucel	0,618	0,605
Portugal Telecom	1,289	2,139
SAG	0,870	0,536
Salvador Caetano	0,881	1,100
Semapa	0,399	0,668
Sonae SGPS	1,303	1,667
Teixeira Duarte	0,100	0,224
Telecel	1,335	1,837
V&A	0,271	0,332
Mean	0,667	0,715
Difference	0,047	
t statistic observed	0,480	
p-value	0,6357	
Median	0,618	0,527
Normalized Z observ	-0,848	
p-value	0,3967	

The tests reported in the table above show no significant difference between pre- and post-split Betas. The p-values obtained for both tests were high, so the null hypothesis could not be rejected.

We continued our analysis by inquiring whether the evidence supported the rejection of the additional null hypothesis:

<u>H4: There is no relation between Beta changes and individual CAR.</u>

To test this hypothesis the following regression was estimated:

$$CAR_i = \alpha + \beta(\Delta MM\beta_i) + \varepsilon_i$$

CAR_i: 5 days Adjusted Cumulative Abnormal Returns for Stock i, around the announcement date[28];

$\Delta MM\beta_i$: Difference between post-split beta and pre-announcement beta, using the market model.

Our regression results do not provide evidence to reject H4. The p-value associated with the explanatory variable was 0.6934, while the sign associated with the explanatory variable was positive (contrary to what could be expected).

5.4 Changes in EPS Growth Rates

Lakonishok and Lev (1987) show that stock splitters exhibit a pre-announcement period characterized by higher earnings growth than a group of control firms. This agrees with the argument that splits may be seen as a sign from management that "good times" are to last. The self-selection hypothesis of Ikenberry et al. (1996) described in section 2.2. also considers this possibility.

If Portuguese managers believe that the earnings growth of their firms is to continue or improve, then they could use splits to communicate to the market their conviction[29].

To obtain the EPS (Earnings Per Share) data series, we used Bloomberg. With this data we calculated growth rates for the year prior to the announcement. The EPS growth rates were then computed for the year following the ex-date (if the ex-date was in the second semester; if this was in the first semester, the EPS growth rate was that of the year in which the execution occurred).

Our null hypothesis was the following:

<u>H5: Stock Splits do not signal any change in the growth rate of annual (split-adjusted) EPS.</u>

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[28] Even though the cumulative abnormal returns estimated were higher at the ex-date, it is nonetheless reasonable to expect that if there are signalling effects these should occur at the announcement date.

[29] As described in the following paragraph actual pre and post-split EPS growth rates were used. This may not be entirely correct. One should probably use the change in expected post-split results to analyse the information transmitted through splits. The procedure used, however, is similar to that followed by Lakonishok and Lev (1987) and Pilotte and Manuel (1996).

To test H5 a regression was run with the change between the annual EPS growth rates (calculated as described above) as the explanatory variable. The dependent variable was again the 5 days adjusted CAR for the announcement date. If the null hypothesis is rejected this would be consistent with stock splits being signaling vehicles regarding future EPS growth. If the relation is positive, then the market would correctly identify "good" firms as those with higher abnormal returns around the announcement date.

The regression model used here was:

$$CAR_i = \alpha + \beta(\Delta EPS_i) + \varepsilon_i$$

CAR_i: 5 days Adjusted Cumulative Abnormal Returns for Stock i, around the announcement date;

ΔEPS_i: Difference between post-split EPS Growth Rate and pre-announcement EPS Growth Rate, as described above.

Our results could not reject H5[30]. The estimated value for β was –0.0116. The sign for this estimate was thus the opposite of what could be expected. The statistical significance for the explanatory variable was quite low. The associated p-value was 0.3660 while the regression R-squared was only 0.0410. The results, therefore, show no support for stock splits signaling future changes in EPS growth rates of splitting firms.

5.5 Price Run-Up of Stock Splitting Firms

As mentioned in section 2, some evidence is consistent with splitting firms enjoying a period of rapid (relative and absolute) stock price appreciation in the pre-announcement period. For instance, Ikenberry et al. (1996) present evidence consistent with this assertion, although claiming that managers' decision is conditional on their expectations regarding the firms' future performance[31]. They also find an extremely

[30] Three splits were removed from the sample: the second class of Brisa's shares; Cimpor because the stock split only took place during 2003; and BPA due to the fact that its delisting occurred before the post-split EPS Growth Rate could be computed.

[31] As previously mentioned, the authors name this the "self-selection hypothesis".

favourable relative performance of splitting firms versus the S&P 500 index. Maloney and Mulherin (1992) also confirm an abnormal good performance for splitting firms.

If splitting firms in our sample have experienced a period of absolute (and relative) good performance, then this could influence the decision to split shares. If the Ikenberry et al's (1996) "self-selection hypothesis" is valid, then the split could be interpreted as a signal from the manager about the future performance of the firm.

The analysis of the firm's price performance was made in relative terms by comparing it with the performance of the PSI Geral Index. The comparison period was comprised of one year leading up to the announcement date. Table 8 shows the results:

Table 8 – Price Run-Up of Splitting Firms Vs PSI Geral

	Index	Stock	Difference
BCP	6,05%	15,67%	9,61%
BPA	10,32%	18,46%	8,14%
BPI	-14,72%	-19,19%	-4,47%
Brisa	0,68%	9,11%	8,43%
Brisa Priv	0,68%	1,76%	1,08%
Celulose Caima	10,82%	-2,33%	-13,15%
Cimpor	-21,40%	-18,53%	2,87%
CIN	-0,79%	-30,48%	-29,69%
Cires	28,36%	-16,41%	-44,78%
Cofina	29,91%	176,19%	146,29%
Cort Amorim	25,19%	-13,97%	-39,15%
Colep	-20,05%	-51,00%	-30,95%
EDP	27,39%	8,44%	-18,95%
Finibanco	24,87%	-1,92%	-26,79%
Ibersol	47,22%	-13,86%	-61,07%
Modelo Continente	18,72%	-6,17%	-24,90%
Mota Engil	17,10%	-0,31%	-17,41%
Portucel	36,42%	53,76%	17,34%
Portugal Telecom	-10,38%	-31,12%	-20,74%
SAG	14,20%	32,89%	18,68%
Salvador Caetano	-25,59%	-23,42%	2,17%
Semapa	30,24%	14,46%	-15,79%
Sonae SGPS	28,36%	66,16%	37,80%
Teixeira Duarte	27,86%	42,02%	14,17%
Telecel	-2,78%	32,06%	34,84%
V&A	-0,14%	-16,60%	-16,46%
Mean	11,10%	8,68%	
t statistic	-0,320		
p-value	0,7520		
Median	12,51%	-1,12%	
Wilcoxon test			
Normalized Z observ	-1,206		
p-value	0,2277		

In aggregate terms, the sample shows an increase in mean stock prices in the year leading up to the announcement[32]. However, this increase is lower than the one experienced by the market index. In median terms the picture is even more striking:

[32] Maloney and Mulherin (1992) also report an increase in absolute prices prior to the stock split.

splitting firms show a small price decrease while the index shows an even higher increase. Two-tailed parametric and non-parametric tests show that there is no statistically significant difference between the paired samples. Unreported market-adjusted returns also reveal no significant price run-up of splitting firms prior to the split announcement.

One can therefore conclude that, unlike prior research in other markets, our evidence does not support the existence of significant stock price appreciation before the split.

5.6 International Comparison of Market Prices and Bid-Ask Spreads

Angel (1997) collected information on the mean and median price levels of stocks around the world (in home currency and USD terms), observing that these vary considerably across markets. A question that could be raised is whether the euro introduction would lead to more homogenous mean prices in Eurozone countries. A possible reason for this could be the minimum tick size. In Euronext Lisbon the rule is for minimum tick sizes to vary according to share prices in the following way[33]:

From EUR 0 to EUR 50 – EUR 0.01;
From EUR 50 to EUR 100 – EUR 0.05;
From EUR 100 to EUR 500 – EUR 0.10;
Above EUR 500 – EUR 0.50.

These same rules are applied in the other three Euronext markets (Amsterdam, Brussels and Paris). For Spain, Guirao and Sala (2002) observe that this is also the rule for stocks priced at less than EUR 50 and 5 euro cents for stocks priced above this threshold. In Germany, the exchange rules state a single minimum tick size of EUR 0.01. In Italy there are five possible minimum tick sizes. For stocks priced between EUR 3.00 and EUR 30, the minimum tick is EUR 0.01. For stocks trading above EUR 30.00, the minimum tick is EUR 0.05. For all the exchanges mentioned the minimum

[33] For example and additional information see Circular No. 5-C/2003, from Euronext Lisbon.

round lot is 1. The great similarity of minimum tick sizes reported here is in clear contrast to that reported by Angel (1997)[34].

With the similar (or equal) rules for the exchanges mentioned shouldn't prices converge towards the same value? If Portuguese firm's managers believe that the share price of their firms should be aligned with those of firms listed in other markets (namely in the Eurozone), stock splits could serve that purpose.

To investigate this hypothesis further we collected from Bloomberg data on the price of stocks pertaining to each of the exchanges mentioned. The date chosen was Monday, June 30, 2003. For each exchange the companies selected were the constituents of the most relevant local stock index. The relevant indexes chosen were: for Spain (Madrid) IBEX 35, for France (Paris) CAC 40, for Germany (Frankfurt) DAX 30, for the Netherlands (Amsterdam) AEX 25, for Belgium (Brussels) BEL 20, for Italy (Milan) MIB 30 and for Portugal (Lisbon) PSI 20.

The following table summarizes the findings regarding mean prices, standard deviation and median prices.

Table 9 – Mean and Median Price Levels for Indexes Constituents

	PSI 20	CAC 40	AEX	BEL 20	IBEX 35	MIBTEL 30	DAX 30	EURONEXT Ex-Portugal	All Ex-Portugal
Mean Price	3,9255	40,3077	19,5310	51,0740	16,1706	7,2563	36,3237	36,8500	27,7585
Standard Deviation	3,9848	30,4033	20,0488	49,3436	10,8041	5,7934	24,6454	34,9718	29,0797
Median Price	2,355	34,270	14,200	35,230	14,120	5,880	32,870	26,815	17,900

The Portuguese stock market clearly exhibits the lowest price level for the exchanges considered. These differences were computed against Euronext Ex-Portugal and All Ex-Portugal. The two-tailed parametric t test and the non-parametric tests[35] conducted all lead to the rejection of the null hypothesis of mean/median equality. The p-values associated with the various tests were always less than 0.0001.

This finding therefore doesn't confirm the view that Portuguese managers conducted their stock splits in order to approximate the price level of the internationally

[34] His data reports to 1994.
[35] The non-parametric tests conducted were Kolmogorov-Smirnov and Mann-Whitney's U.

prevalent price since splits apparently increased the price distance to international benchmarks[36].

In an additional analysis, for the same index constituents as above, data was collected regarding closing, last bid and ask prices, as of June, 2003. The resulting daily market wide relative bid-ask spreads for the PSI 20 were then compared to those of Euronext Ex-Portugal and All Ex-Portugal. The following table shows the daily mean and median relative bid-ask spreads for each of the groups:

Table 10 – Mean and Median Daily Relative Bid-Ask Spreads (June 2003)

	PSI 20		EURONEXT EX-PSI 20		ALL EX-PSI 20	
	Mean	Median	Mean	Median	Mean	Median
02-06-2003	0,93%	0,61%	0,26%	0,19%	0,26%	0,20%
03-06-2003	1,11%	0,72%	0,27%	0,18%	0,30%	0,21%
04-06-2003	1,03%	0,59%	0,20%	0,09%	0,21%	0,14%
05-06-2003	1,14%	0,75%	0,25%	0,15%	0,26%	0,19%
06-06-2003	1,29%	0,63%	0,31%	0,19%	0,31%	0,19%
09-06-2003	1,01%	0,76%	0,33%	0,22%	0,31%	0,20%
10-06-2003	1,11%	0,79%	0,29%	0,18%	0,27%	0,18%
11-06-2003	0,96%	0,70%	0,33%	0,19%	0,29%	0,19%
12-06-2003	1,01%	0,50%	0,28%	0,17%	0,27%	0,17%
13-06-2003	0,98%	0,77%	0,27%	0,18%	0,30%	0,25%
16-06-2003	1,10%	0,73%	0,26%	0,19%	0,27%	0,21%
17-06-2003	1,14%	0,88%	0,25%	0,15%	0,31%	0,17%
18-06-2003	1,08%	0,76%	0,23%	0,09%	0,24%	0,17%
19-06-2003	1,28%	0,80%	0,26%	0,14%	0,26%	0,16%
20-06-2003	1,07%	0,80%	0,23%	0,12%	0,33%	0,19%
23-06-2003	1,16%	0,70%	0,24%	0,13%	0,27%	0,19%
24-06-2003	1,10%	0,80%	0,27%	0,17%	0,26%	0,19%
25-06-2003	1,00%	0,62%	0,28%	0,17%	0,27%	0,20%
26-06-2003	0,96%	0,67%	0,31%	0,20%	0,27%	0,19%
27-06-2003	0,91%	0,68%	0,28%	0,18%	0,26%	0,18%
30-06-2003	1,35%	0,74%	0,30%	0,16%	0,27%	0,17%

For the whole month the mean of mean daily relative bid-ask spread is 1.082%, while it's 0.272% for Euronext Ex-Portugal and 0.275% for All Ex-Portugal. The parametric test undertaken to test these mean differences resulted, for both cases, in a p-value smaller than 0.0001, thus leading to the rejection of the null hypothesis of mean equality.

5.7 Survey on the Motivations of Stock Splitting Firms

[36] There is, however, a potential limitation in drawing this conclusion: the PSI 20 does not coincide with our sample of splitting firms. Nonetheless, the splitting firms are well represented in the index, since 13 out of the 20 firms in the index have split, thus giving some comfort to our conclusions.

In this section of our empirical work we tried to unveil managers' intentions when executing stock splits. To achieve this goal, a survey was prepared and sent to the Investor Relations Department of the splitting firms. The original Portuguese and English versions may be found in the Annexes. Alongside the questionnaire a letter was sent explaining the purpose of the research.

The questionnaire was sent in mid April 2003 to the sample firms that still existed as autonomous legal entities[37]. This resulted in 23 questionnaires. At the end, eight responses were received. For confidentiality reasons, the names of those that responded are not disclosed (this is why the following tables shown have the companies' names substituted by C1 to C8). Firms were asked a total of ten questions and told to rate, for questions 2, 5, 8 and 10, in a scale going from 0 (unimportant) to 5 (very important) a number of possible responses[38]. The remaining questions had a qualitative nature.

The first question asked firms the time length between the decision to do the split and its announcement. Seven companies responded. Among these, three reported a period larger than 3 months, three reported a period between 1 and 3 months and one reported a period between 15 days and one month. This relatively long time frame, added to the long time span between the announcement and execution dates confirm the validity of some choices made in the empirical analyses reported in earlier sections.

Question 2 asked firms their views on the objectives of the split operation. Table 11 reports the answers received:

Table 11 – Answers to Question 2 of the Questionnaire
Objectives of the Split Operation
(0=unimportant; 5=very important)

	C1	C2	C3	C4	C5	C6	C7	C8	Mean
a) Liquidity increases	5	5	0	4	4	5	5	2	3,750
b) Increase in the number of shareholders	1	2	3	3	4	4	3	3	2,875
c) Create wealth for shareholders	1	4	0	0	0	0	5	0	1,250
d) Place the price closer to an "ideal" value, lower than the previous	1	0	0	0	0	0	0	0	0,125
e) Signal confidence	1	0	0	1	1	0	0	0	0,375
f) Structure simplification (e.g., 1 EUR per share)	5	3	5	3	5	0	4	5	3,750
g) Allow a more favourable price evolution	5	1	0	3	2	4	0	0	1,875
h) Facilitate changes in dividend policy	1	0	0	0	0	0	0	0	0,125
i) Other reasons (specify)	0	0	0	0	0	0	0	0	0,000

[37] This left out BPA and Colep.
[38] Question 8 required a slightly different scale, going from 0=failure to 5=fully met. See table 13.

Companies placed “Liquidity increases” and “Structure simplification” at the top of the list with a mean value of 3.75[39]. The “Increase in the number of shareholders” had a mean score of 2.875. To “Allow a more favorable price evolution” had a 1.875 mean score. Finally, “Create wealth for shareholders” recorded a 1.250 mean score.

These results suggest that liquidity increases and structure simplification seem to be the most important determinants from the firms’ standpoint. This is interesting for two reasons. First, our empirical analysis reported earlier showed no clear evidence in support of significant liquidity improvements. Second, in what concerns the issue of “structure simplification”, we cannot think of any rational motive to fundament this view. No theoretical arguments have been found in the literature to support a specific share par value objective.

Some wealth effects - options c) and g) - were apparently intended by the managers of two firms only as the result of the split, but signaling effects or changes in dividend policy were generally not considered relevant. This raises the question as to how to rationally explain the abnormal returns described previously.

Regarding the costs of assembling the operation (Question 3) the companies refused to respond or gave indication that the costs were negligible.

Reinforcing our conclusions from our earlier empirical analysis which revealed that liquidity improvements were far from clear, the answers to question 4 showed that five out of the eight companies considered that liquidity indeed had not improved after the split[40]. Question 5 tried to shed some further light on this issue by asking firms their view on the indicators on which they based their conclusion on liquidity. The answers to this question are presented in the following table.

Table 12 – Answers to Question 5 of the Questionnaire
Liquidity indicators considered by firms to be relevant

	C1	C2	C3	C4	C5	C6	C7	C8
Relative bid-ask	5	3		0				0
Number of shares traded	3	5		5		5	4	2
Daily transaction volume (EUR terms)	3	4		5		5	4	3
Simple/weighted spread cost								
Others (specify)								

[39] For those companies that didn’t place a score in a particular objective “0” was considered to compute the mean score for the sample.
[40] Other events could have determined no liquidity increases, not directly related to the stock split itself (for example, the beginning of a bear market could have started a period of lower liquidity).

The results in Table 12 coupled with the answers to question 2 showed that three firms considered that liquidity improvements had resulted from increases in the number of shares and volume (euro) traded while only one considered that liquidity had increased due to changes in the relative bid-ask spread.

Of the four responses obtained concerning volatility changes (Question 6), all the firms agree in the inexistence of any observable volatility increases after the split.

The answers to Question 7 revealed that no company was planning to engage in new stock splits in the coming months.

Table 13 shows the results for Question 8, which asked firms whether their split objectives had been met in practice:

Table 13 – Answers to Question 8 of the Questionnaire
Stated Success in meeting the split's objectives
(0=failure; 5=fully met)

	C1	C2	C3	C4	C5	C6	C7	C8	Mean
a) Liquidity increases	5	0	0	2	3	5	4	0	2,375
b) Increase in the number of shareholders	1	0	4	0	3	5	0	3	2,000
c) Create wealth for shareholders	1	1	0	0	0	0	2	0	0,500
d) Place the price closer to an "ideal" value, lower than the previous	1	0	0	2	0	0	0	0	0,375
e) Signal confidence	1	0	0	0	0	0	0	0	0,125
f) Structure simplification (e.g., 1 EUR per share)	5	3	5	4	5	0	5	5	4,000
g) Allow a more favourable price evolution	5	2	0	0	0	5	0	0	1,500
h) Facilitate changes in dividend policy	1	0	0	0	0	0	0	0	0,125

As to the success in reaching the objectives, the above responses concerning structure simplification were a self-fulfillment. The mean score was high and each individual score obtained in question 2 was almost replicated in this matter for Question 8. Coherently, companies that claimed that liquidity had increased (C1, C6 and C7) after the split gave a mean 4.66 score to option a). Increase in the number of shareholders had a weak 2.0 mean score while all other objectives had negligible mean scores.

Concerning the issue of a possible optimal trading range for prices in the Portuguese stock market (Question 9), three firms responded that they believed such range did not exist. Two didn't respond. Each of the other three gave different answers. None of these claimed the optimal trading range to be above the EUR 10.00 threshold (where the mean price levels are found for the other international exchanges analyzed in the previous section).

Finally, Question 10 inquired firms on the importance of stock splits in different cycles of price changes (bull versus bear markets). The mean scores for the companies that responded gave a clearer importance to splits during periods of rising prices (2.86 versus 1.86). Thus, it seems that firms think that that when prices go higher in absolute terms this will be apparently the most appropriate time to reduce the absolute values of their shares.

In brief, it seems that "structure simplification" was the most important objective stated by firms (and the one really achieved). Liquidity changes were far from being confirmed as a main accomplished objective. There is no evidence pointing to the existence of signaling motivations surrounding splits. Since structure simplification (as defined) should have no material effect on prices it is indeed hard to explain the observed abnormal returns.

6. Summary and conclusions

For a simple "cosmetic" event, stock splits are quite a puzzling event. Our paper confirmed the existence of relevant wealth effects associated with stock splits in the Portuguese market. So the answer to the question in the title of this paper is at least partially achieved.

The existing body of literature (mainly concerning U.S. markets) is extensive and has been especially dedicated to the liquidity effects and abnormal returns around announcement and ex-dates.

Our evidence concerning liquidity changes induced by splits has allowed us to conclude that there are some weak effects only. Our sample of Portuguese splits shows no significant increase in volume, either measured in adjusted (by the split factor) number of shares or the amount traded. Similar to what has been found by most authors, the number of trades seems to increase, lending some support to the hypothesis that the trading by small investors increases post-split. In terms of relative bid-ask spreads, the results do not support the occurrence of statistically significant changes. Removing from the sample the companies that had pre and/or post-split relative bid-ask spreads higher than 3.5% shows significant increases both for the mean as well as for the median. This is in agreement to what is commonly reported in the literature.

Our research documents important price effects around stock splits at the announcement (5-day CAR of 3.8%) and ex-dates (7.3%), which is consistent with much previous literature. A puzzling feature in our results, however, is that the ex-date CAR are larger than those observed at the announcement day. There is no parallel for this in the available literature. These results are robust to the removal of the most obvious outliers from the sample.

We also show that changes in liquidity do not seem to be correlated with abnormal returns. Several possible alternative explanations related to potential signaling effects were investigated. None of those explanations was supported by our data. These were the changes in the companies' systematic risk, changes in EPS growth rates and the prediction of a continuum upward momentum for the shares' price. A comparison of mean and median price levels for several stock exchanges showed that the price level for the Portuguese market is clearly below that of its European counterparts. This excludes the hypothesis of splits being a device used by managers to place the share price closer to European levels. This is even more surprising since the minimum tick size rules are relatively similar across countries. In fact these rules are identical for Euronext, the platform which is shared by the Portuguese stock exchange.

Our survey directed at the sample firms confirmed the importance stated by splitting firms of the objective of liquidity improvements. Consistent with our findings, the majority of companies admitted, however, that the split had not caused liquidity improvements. The other major objective pointed out by companies was that of share capital simplification. That possibility was included in the survey, since most companies have a par value for each share of EUR 1, when previously all firms (with just one exception) had a share par value of 1,000 PTE (or 4,99 EUR). The importance granted by managers to this objective is puzzling, since the par value of each share should be completely irrelevant in real terms, especially since we found no clear liquidity benefits.

Our research leaves us with several unanswered questions. We believe that intra-day trading analysis of microstructure effects is a possibility that might help us to understand the puzzling feature of positive ex-date price effects that outpace those observed for the announcement date. Another area that could be promising and where little work has been produced is the international comparison of different Eurozone markets.

Appendix

Brown and Warner (1985) test statistic formula

The authors propose this statistic in the case where cross-sectional dependence in excess returns is suspected to exist. The average abnormal return (AAR) at moment t is computed as follows (N represents the number of events, i.e. in my work the number of stock splits in the sample):

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$$

The Cumulative Average Abnormal Return (CAAR) for up to T periods after the event is calculated as follows:

$$CAAR_T = \sum_{t=+1}^{T} \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$$

The test statistic is (L is the number of trading days used in the estimation of the model that leads to the calculation of the abnormal returns):

$$test - statistic = \frac{CAAR_T}{\sqrt{T * \left(\sum_{t=+1}^{L} \left(\overline{AR}_t - \frac{1}{L}\sum_{t=+1}^{L} \overline{AR}_t \right)^2 \right) \Big/ L}}$$

With: $\overline{AR}_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$

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Annexes

Annex 1 – Abnormal Returns using Trade-to-Trade Approach and Last Bid Prices

	Non-Adjusted CumulativeAbnormal Returns				Adjusted Cumulative Abnormal Returns			
	Announcement		Ex-date		Announcememt		Ex-date	
	3 days	5 days	3 days	5 days	3 days	5 days	3 days	5 days
BCP	-1,249%	-1,403%	-1,338%	-2,178%	-1,266%	-1,366%	-0,277%	-1,118%
t observed	-0,550	-0,478	-0,345	-0,753	-0,558	-0,467	-0,128	-0,400
BPA	-1,692%	0,559%	9,726%	8,890%	-1,847%	0,581%	9,699%	9,262%
t observed	-0,281	0,072	2,405	2,949	-0,307	0,075	4,266	3,155
BPI	1,218%	2,162%	-2,422%	0,936%	2,405%	3,166%	-3,077%	-0,306%
t observed	0,434	0,596	-0,463	0,240	0,879	0,897	-1,045	-0,081
Brisa	3,456%	4,165%	-3,360%	-6,303%	3,318%	3,380%	-2,358%	-5,475%
t observed	1,438	1,342	-0,831	-2,092	1,627	1,283	-1,054	-1,895
Brisa Priv	0,425%	1,867%	-0,956%	-2,940%	0,164%	0,488%	1,085%	-1,289%
t observed	0,112	0,381	-0,160	-0,662	0,053	0,123	0,341	-0,314
Celulose Caima	1,187%	2,804%	-1,040%	-2,212%	1,216%	2,600%	-2,059%	-0,771%
t observed	0,278	0,509	-0,068	-0,193	0,295	0,489	-0,236	-0,068
Cimpor	-0,311%	0,379%	-0,821%	0,344%	-0,215%	1,303%	0,040%	1,439%
t observed	-0,117	0,110	-0,184	0,104	-0,090	0,423	0,018	0,510
CIN	-3,649%	-6,564%	-0,358%	0,968%	-2,396%	-4,978%	1,052%	4,514%
t observed	-0,882	-1,229	-0,054	0,197	-0,596	-0,958	0,288	0,956
Cires	17,507%	9,610%	-7,353%	-6,686%	19,174%	10,408%	-7,602%	-6,686%
t observed	3,198	1,360	-0,735	-0,897	3,545	1,490	-1,369	-0,933
Cofina	6,881%	15,847%	1,628%	1,843%	7,962%	17,485%	1,528%	2,977%
t observed	1,386	2,473	0,135	0,204	1,633	2,778	0,224	0,338
Cort Amorim	4,123%	4,298%	4,663%	5,949%	3,902%	3,609%	3,918%	3,600%
t observed	1,593	1,287	1,042	1,784	1,932	1,384	1,950	1,388
Colep	1,281%	0,595%	3,623%	6,475%	1,529%	0,621%	4,023%	7,150%
t observed	0,419	0,151	0,593	1,421	0,501	0,158	1,192	1,641
EDP	2,056%	3,306%	-1,001%	-0,938%	2,130%	3,540%	-0,479%	-0,440%
t observed	0,892	1,111	-0,240	-0,302	0,942	1,212	-0,210	-0,149
Finibanco	4,432%	4,258%	0,952%	4,735%	1,644%	2,702%	1,416%	5,656%
t observed	1,188	0,884	0,206	1,377	0,462	0,588	0,620	1,917
Ibersol	-6,473%	0,463%	-4,562%	-0,426%	-6,450%	-0,268%	-4,621%	-0,173%
t observed	-1,365	0,076	-0,648	-0,081	-1,376	-0,044	-1,156	-0,033
Modelo Continente	0,027%	-0,290%	2,056%	0,267%	-1,048%	-1,889%	1,685%	0,340%
t observed	0,010	-0,085	0,399	0,070	-0,414	-0,578	0,577	0,090
Mota Engil	-4,762%	-3,650%	-1,281%	-4,195%	-7,554%	-5,016%	-1,305%	-4,230%
t observed	-1,056	-0,627	-0,137	-0,604	-1,836	-0,944	-0,255	-0,639
Portucel	7,341%	4,787%	1,749%	-0,370%	6,959%	5,132%	1,133%	-0,293%
t observed	2,403	1,214	0,379	-0,108	2,340	1,337	0,457	-0,092
Portugal Telecom	-8,756%	-10,518%	2,995%	0,828%	-9,251%	-9,738%	2,551%	0,456%
t observed	-2,977	-2,770	0,610	0,227	-3,276	-2,671	0,903	0,125
SAG	1,352%	0,279%	-0,080%	0,862%	1,082%	-0,010%	-1,023%	-0,854%
t observed	0,446	0,071	-0,014	0,201	0,360	-0,002	-0,329	-0,213
Salvador Caetano	2,075%	4,073%	-15,096%	-12,000%	0,523%	1,096%	-11,508%	-7,382%
t observed	0,435	0,661	-1,854	-1,977	0,115	0,187	-2,515	-1,250
Semapa	-4,176%	-4,760%	-1,359%	-3,572%	-2,073%	-2,053%	-1,583%	-4,551%
t observed	-1,646	-1,453	-0,278	-0,979	-0,911	-0,699	-0,643	-1,433
Sonae SGPS	0,312%	-0,026%	-2,717%	-3,311%	-0,716%	-0,545%	-1,653%	-1,429%
t observed	0,116	-0,007	-0,474	-0,774	-0,272	-0,160	-0,522	-0,350
Teixeira Duarte	3,596%	-0,612%	0,095%	3,349%	-0,981%	-7,470%	-0,446%	1,657%
t observed	1,215	-0,160	0,013	0,623	-0,442	-2,605	-0,126	0,362
Telecel	2,516%	2,365%	7,248%	7,996%	2,718%	2,658%	6,729%	7,133%
t observed	0,581	0,423	1,257	1,861	0,634	0,480	2,039	1,674
V&A	-1,600%	-0,279%	7,986%	28,539%	-0,216%	1,826%	8,189%	29,002%
t observed	-0,413	-0,056	1,133	5,430	-0,062	0,408	2,122	5,822
Average Ab. Return	3,158%	2,817%	4,619%	7,887%	3,115%	2,788%	7,738%	7,615%
t observed	2,43	1,68	3,20	4,23	2,51	1,74	5,78	4,40
p-value	0,0149	0,0926	0,0014	0,0000	0,0122	0,0822	0,0000	0,0000

Annex 2A – Survey sent to Stock Splitting Firms – Original (Portuguese) Version

Questionário

1 – Em termos aproximados, qual o tempo que mediou entre o início dos estudos da operação e o seu anúncio?

a) inferior a 15 dias;
b) superior a 15 dias e inferior a 1 mês;
c) superior a 1 mês e inferior a 3 meses;
d) superior a 3 meses.

2 – Qual os principais objectivos que estiveram na base da decisão (0 = sem importância; 5 = Muito importante)?

a)	aumentar a liquidez	
b)	aumentar a base de accionistas	
c)	criar valor para os accionistas	
d)	aproximar o preço de um "valor ideal", mais baixo que o actual	
e)	transmitir um sinal de confiança ao mercado	
f)	simplicação de estrutura (ex: 1 EUR por acção)	
g)	permitir uma evolução mais favorável da cotação	
h)	facilitar uma eventual alteração da política de dividendos	
i)	Outros (especificar)	

3 – Quais os custos directos e indirectos (em EUR) de montagem da operação?

4 – Consideram que o nível de liquidez em bolsa aumentou após a operação?

5 – Em relação à resposta à questão anterior, que indicadores a fundamentam? (0 = sem importância; 5 = Muito importante)

a)	*bid-ask* relativo[1]	
b)	nº de acções transaccionadas	
c)	volume de transacções diário (medido em EUR)	
d)	custo simples/ponderado do *spread*[2]	
g)	outros (especificar)	

[1] Medido por: a diferença entre o preço ask (melhor preço de venda) e o preço bid (melhor preço de compra), no fecho da sessão, dividida pelo preço bid no fecho

[2] Custo simples: medido pelo valor absoluto da diferença entre o preço de fecho e o preço médio (entre o preço bid e o preço ask), dividido por este preço médio. Se medido para várias sessões de bolsa, a ponderação atribuída a cada uma é idêntica. Custo ponderado: o mesmo que o anterior, mas cada sessão é ponderada pelas quantidades ou montante transaccionados nessa sessão em relação às quantidades ou montantes transaccionados durante o perído em análise.

6 – Consideram que a volatilidade aumentou após a realização da operação? Que indicadores fundamentam a V. resposta?

7 – Planeiam realizar algum *stock split* nos próximos meses? Se sim, qual o *split factor* que estão a pensar utilizar?

8 – Que grau de sucesso atribuem ao cumprimento dos objectivos identificados acima? (0 = nada atingido; 5 = completamente atingido)

a)	aumentar a liquidez	
b)	aumentar a base de accionistas	
c)	criar valor para os accionistas	
d)	aproximar o preço de um "valor ideal", mais baixo que o actual	
e)	transmitir um sinal de confiança ao mercado	
f)	simplicação de estrutura (ex: 1 EUR por acção)	
g)	permitir uma evolução mais favorável da cotação	
h)	facilitar uma eventual alteração da política de dividendos	
i)	Outros (especificar)	

9 – Qual pensam ser o *range* óptimo de preço na bolsa nacional em (EUR)?

a) Inferior a 2,50;
b) Igual ou Superior a 2,50 e inferior a 5,00;
c) Igual ou superior a 5,00 e inferior a 10,00;
d) Igual ou superior a 10,00 e inferior a 15,00;
e) Igual ou superior a 15,00 e inferior a 20,00;
f) Igual ou superior a 20,00
g) Não existe um *range* óptimo para o preço da acção.

10 – Qual a importância global que atribui às operações de *stock split*? (0 = sem importância; 5 = Muito importante)

a)	Numa conjuntura altista das cotações (*bull market*)	
b)	Numa conjuntura de depressão das cotações (*bear market*)	

Annex 2B – Survey sent to Stock Splitting Firms – English Version

Questionnaire

1 – Approximately how long did it take between the initiation of the stock split studies and its announcement?

e) less than 15 days;
f) more than 15 days but less than a month;
g) more than a month but less than 3 months;
h) more than 3 months.

2 – What were the major objectives behind the decision to split shares? (0 = unimportant; 5 = very important)?

a)	liquidity increases	
b)	increase the number of shareholder	
c)	create wealth for shareholders	
d)	place the price closer to an "ideal" value, lower than the previous	
e)	signal confidence	
f)	structure simplification (e.g., 1 EUR per share)	
g)	allow a more favourable price evolution	
h)	facilitate changes in dividend policy	
i)	other reasons (specify)	

3 – What were the direct and indirect costs of the split transaction (in EUR)?

4 – Do you feel that the liquidity levels of your firm's shares increased after the split?

5 – Regarding your answer to 4., on which indicators did you base your opinion? (0 = unimportant; 5 = very important)

a)	Relative bid-ask [1]	
b)	Number of shares traded	
c)	Daily volume (in EUR)	
d)	Simple / weighted spread cost[2]	
g)	other (specify)	

[1] Measured as: difference between the ask price (better selling price) and bid price (better buying price) at the end of the trading session, divided by the closing bid price.

[2] Simple cost: measured as the absolute value of the difference between the closing price and the mean price (of the bid and ask prices) , divided by such mean price. If measured for several trading sessions, identical weights are given to each session. Weighted costs: the same as before, but each session is weighted by trading volume.

6 – Do you feel that price volatility increased following the stock split? On which indicators do you base your answer?

7 – Is your firm planning to do a stock split in the coming months? If so, what split factor are you intending to use?

8 – How successful was the stock split operation in reaching the objectives identified in question 2? (0 = failure 5 = fully reached)

a)	liquidity increases	
b)	increase the number of shareholder	
c)	create wealth for shareholders	
d)	place the price closer to an "ideal" value, lower than the previous	
e)	signal confidence	
f)	structure simplification (e.g., 1 EUR per share)	
g)	allow a more favourable price evolution	
h)	facilitate changes in dividend policy	
i)	other reasons (specify)	

9 – Which of the following do you think is an ideal price range for shares in the Portuguese exchange (EUR)?

h) Less than 2,50;
i) Equal to or more than 2,50 but less than 5,00;
j) Equal to or more than 5,00 but less than 10,00;
k) Equal to or more than 10,00 but less than 15,00;
l) Equal to or more than 15,00 but less than 20,00;
m) Equal to or more than 20,00
n) There is not ideal price *range*.

10 – What is the global importance of stock split transactions? (0 = unimportant; 5 = very important)

a)	In an environment where the stock market is generally buoyant (*bull market)*	
b)	In an environment where the stock market is generally depressed (*bear market)*	