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FURTHER EVIDENCE OF THE IMPACT OF STOCK SPLITS ON TRADING LIQUIDITY

Introduction

Although a stock split is a relatively simple corporate event that does not change the claims of equity holders or future cash flows of a company it ceaselessly captures the attention and interest of academicians and practitioners. The puzzle is the fact that different research provides evidence on the anomalous behavior of different stock characteristics following the actual stock split from the perspective of the hypothesis of market efficiency. Some of the researchers have attempted to explain the stock split phenomenon using different argumentation. One of them proclaims that managers split the stock to increase the stake of the small investors who are perceived as liquidity providers. Moreover, in line with the liquidity explanation of stock splits is another argument that the more dispersed the ownership structure the harder it is for a potential bidder to oust the incumbent managers. Even though no new information is conveyed on the ex date the literature abounds with evidence on improvement or worsening of the trading volume in the aftermath of the stock split.

Review of the Literature on Trading Liquidity

There exist different theories that attempt to explain the phenomenon of stock splits. In particular, some of them revolve around the impact on liquidity. Starting from the beginning, Copeland (1979), Lamoureux and Poon (1987) or Murray (1985) observed declining liquidity as measured with dollar trading volume. One of the properties mentioned that supports the usage of dollar trading volume as a proxy of liquidity is the fact of a negative relationship between this measure and bid-ask spread.[1] Furthermore, some of the authors use bid–ask spread as a proxy of liquidity. The rationale behind this measure of liquidity is the fact that the spread can be tapped to gauge the cost of liquidity defined as the "ease or rapidity with which a financial instrument can be exchanged for currency."[2] Conroy, Harris and Benet (1990) based their research of 143-stock-splits-events sample containing stock splits performed between 1981 and 1983 found that the percentage bid-ask spread widened

[1] See the findings of Demsetz (1968), Tinic (1972) or Benston and Hagerman (1974) for reference.
[2] Hicks J.R., *Value and Capital*, 2nd ed. (Oxford University Press, London).

following stock splits from a level of 0.951% to 1,229%. Moreover, the deterioration in the spread in the wake of the split can be attributed to the slippage in stock price that occurs after splitting the shares. On the other hand, Conroy, Harris and Benet (1990) document a rise in the variability of the stock price in the aftermath of stock splits that can be related to some extent to increased bid-ask spreads.

In their study Maloney and Mulherin (1992) examine 446 stock-splits events by companies listed on NASDAQ (National Association of Securities Dealers Automated Quotations). The authors investigated the behavior of stock price and liquidity around announcement dates as well as execution dates. Maloney and Mulherin (1992) found that the absolute bid–ask spread narrow but the relative spread head towards highs. The liquidity around stock splits have also been examined with the metric of value per trade, i.e. the total value of a stock traded daily by the number of trades that day. This ratio after rising before the split returns to the level at which it was observed two years prior to the split following the ex date. The pullback ensues from a growth in the number of trades recorded after splitting the shares. On the other hand, another consequence of a stock split event is improved trading volume along with daily trading activity. Both of them remain relatively high after the execution date. The authors conclude that the changes in various measures of liquidity, inter alia greater dollar trading volume or a greater number of trades, are linked to the ex–day price movements. In sum, Maloney and Mulherin (1992) concur that no new information is conveyed through the actual execution. Moreover, Maloney and Mulherin (1992) argue that stock splits bring about a discrete change in patterns of trading activity. Nevertheless, as a result of splitting the shares the number of shareholders is increased, mostly by institutions. Very importantly, no anomalous rules of trading have been identified with respect to the execution day.

Kadapakkam, Krishnamurthy and Tse (2005) studied 1,248 stock splits performed between 1995 and 2002, 526 splits for the NYSE (New York Stock Exchange) and 722 for the NASDAQ, respectively, that were divided into three analyzed time periods: the *1/8th Pricing Era* (the 1st of January 1995 to the 31st of December 1996), *1/16th Pricing Era* (the 1st of January 1998 to the 31st of December 1999), and *Decimal Pricing Era* (the 1st of February 2001 to the 31st of December 2002 and the 1st of May 2001 to the 31st of December 2002 for NYSE and NASDAQ, respectively). The main criterion of the latter classification is the minimum tick size in effect in particular time periods. The authors observed a significant rise in the relative spread following the stock split for the first interval under consideration, i.e. an increase of the magnitude 67 bps (i.e. basis points). Similarly, the relative spread grows in the aftermath but this time not as sharply as for the *1/8th Pricing Era* – the relative spread widens by 33 bps. In turn, within the last time period the relative spread increases by 20 bps. Additionally, Kadapakkam, Krishnamurthy and Tse (2005) consider the behavior of turnover defined as the trading volume divided by the number of shares outstanding. The results indicated that this liquidity measure materially worsens following stock splits.

Contrary to the aforementioned research studies, Lipson (1999) contributed to the research studies that confirm liquidity enhancement as a result of stock splits.[3] The sample researched includes two-for-one or of a greater split factor, stock-splits events from the period of 1995–1996 in the case of companies listed on the NYSE. The measures used for the purposes of the analysis of the impact of stock splits on subsequent liquidity are: changes in the limit order book, execution costs and trading activity. Lipson (1999) reports an increase in the depth available in the limit order book at diverse dollar distances from the mid-quote following a stock split. On the contrary, he documents a considerable drop in the depth available at different percentage (split-adjusted). On the one hand, the realized execution cost in percentage terms of limit orders slumps and, on the other hand, one may observe a rising realized execution cost with regard to market orders. Nonetheless, there is no decided evidence on the change in execution costs for the whole order sample. In contrast, the orders submitted soar as the proportion of trading volume originating from individual investors does among which the buy orders increase as opposed to trading activity which typically deteriorates following a split.

Other supporting evidence of the liquidity hypothesis on stock splits is given by Dennis (2003). Owing to the specificity of the sample, i.e. tracking stock, in particular it refers to the two-for-one stock split for the NASDAQ-100 Index Tracing Stock traded on the AMEX (American Stock Exchange) with the effective date of the split on the 20th of March 2000, where the results exclude any possibility of a signaling effect of the split due to the fact that it pertains to an Electronically Traded Fund (ETF) that represents the portfolio of stocks from NASDAQ-100 Index. In other words, the executives of the trust are not privy to the information on the companies comprising the index, and so the signaling cannot be viewed as a reason for spitting the shares. In order to test the liquidity explanation of the stock split phenomenon around the actual split date Dennis (2003) analyzes the following gauges of liquidity: turnover, frequency of trading, share volume, dollar volume, and bid-ask spreads. The results point out that the daily volume has not increased in the wake of the split, and that it has remains steady. Furthermore, the trading intensity of the smallest trading category, i.e. the trades of 500 shares or smaller lots, edges higher. The share and dollar volumes of small trades advance after a stock split. Summarizing, the liquidity of small-size trades improves following a stock split.

Sample and Method

The initial sample encompasses 629 stock-split events performed by NYSE-listed companies between the 1st of January 2000 and the 31st of May 2011. After exclusion of stock splits with a statistically insignificant outcome or those for which the full data was not available, the resulting sample analyzed includes 471 splits. In order to examine the behavior of

[3] See also T. Słoński, J. Rudnicki: *Wpływ podziału akcji na płynność spółek*, Zeszyty Naukowe Uniwersytetu Szczecińskiego, Finanse, Rynki Finansowe i Ubezpieczenia nr 25, Szczecin 2010, s. 137–146.

share volume that proxies for liquidity, a Market Model Method has been utilized. The event window includes 81 session days, i.e. 40 session days before and 40 session days after the execution day including the execution day itself. The data provider used for the purposes of the paper is Yahoo! Finance, in particular its section devoted to stock splits, i.e. Financial Calendars of Stock Splits.

Table 1

Yearly distribution of NYSE stock-split sample

Year	Number of stock splits	Percentage
2000	69	11,15
2001	45	7,27
2002	49	7,92
2003	40	6,46
2004	83	13,41
2005	117	18,90
2006	79	12,76
2007	66	10,66
2008	18	2,91
2009	3	0,48
2010	23	3,72
May 2011	27	4,36
Total	619	100,00

Source: `own study.

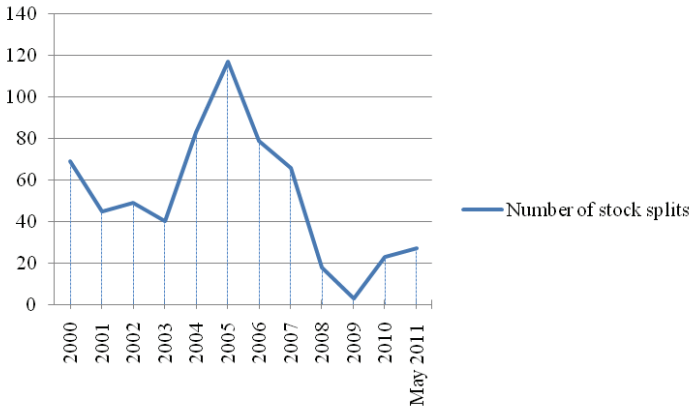

Figure 1. Yearly distribution of NYSE stock-split sample

Source: own study.

Market Model Method

This method is most commonly used due to the fact that it factors into the mean returns and the risk that accompanies the market. At the very beginning of the estimation procedure within this model, a clean period should be selected and then a regression for each day in the period is performed. The excess rate of return equals to:

$$r_{it} = R_{it} - \hat{\alpha}_j - \hat{\beta}_j R_{mt},$$

where:

R_{it} – rate of return on *i* stock on *t* day;
R_{mt} – the return on a market index on day *t*;
$\hat{\alpha}_j$ – intercept resulting from the regression analysis;
$\hat{\beta}_j$ – slope coefficient resulting from the regression analysis;
ε_{it} – statistical error for which the following holds $\Sigma\varepsilon_{it} = 0$.

Test Statistics Used in the Calculation of the Statistical Significance of Event Returns

To check the level of confidence, whether excess returns (residuals) differ significantly from zero, a statistic which tests the null hypothesis that the 1-day residual for a given firm equals zero, can be used; if one makes an assumption that the returns for that firm are independently and identically normally distributed then one can say that:

$$\frac{r_{jt}}{\hat{S}(r_j)}$$

can be described by means of a *t*-distribution where:

r_{jt} – the residual for *i* company at the moment *t*,
$\hat{S}(r_j)$ – the evaluated standard deviation of the residuals for *i* company utilizing data from an estimation interval:

$$\sqrt{\frac{1}{199}\sum_{t=-240}^{-41}\left(r_{jt} - \bar{r}_j\right)^2}$$

with 199 degrees of freedom. When there are more than 30 degrees of freedom then the *t*-statistic has a standard normal distribution. The procedure for rendering the results of this test is: the null hypothesis can be declined only when the ratio $\frac{r_{jt}}{\hat{S}(r_j)}$ is greater than the critical value which means that the 1-day residual at a significance level of 5% differs from zero. The procedure for testing the null hypothesis as stated above can be extended for a group of companies. The 1-day abnormal return averaged over firms is defined as:

$$AR_t = \frac{1}{N}\sum_{j=1}^{N} r_{jt}$$

and consecutively the extended form of $\frac{r_{it}}{\hat{S}(r_1)}$ ratio is:

$$t = \frac{AR_t}{\hat{S}(AR)} = \frac{\frac{1}{N}\sum_{j=1}^{N} r_{jt}}{\sqrt{\frac{1}{199}\sum_{t=-240}^{-41}\left(AR_t - \overline{AR}\right)^2}},$$

where:

$\hat{S}(AR) = \sqrt{\frac{1}{199}\sum_{t=-240}^{-41}\left(AR_t - \overline{AR}\right)^2}$ is the standard deviation of the entire sample (the same for each day in the event period as a consequence of usage of the same estimation period for a sample ensuing from independent and identically distributed abnormal returns) and:

$$\overline{AR} = \frac{1}{200}\sum_{t=-240}^{-41}\left(AR_t\right).$$

For the event window the test statistic takes on the following form:

$$\frac{CAR}{\hat{S}(AR)} = \frac{\sum_{t=-40}^{+40} AR_t}{\hat{S}(AR)},$$

where:

$$\hat{S}(AR) = \sqrt{\frac{1}{80}\sum_{t=-40}^{+40}\left(AR_t - \overline{AR}\right)^2}$$

Results and Conclusions

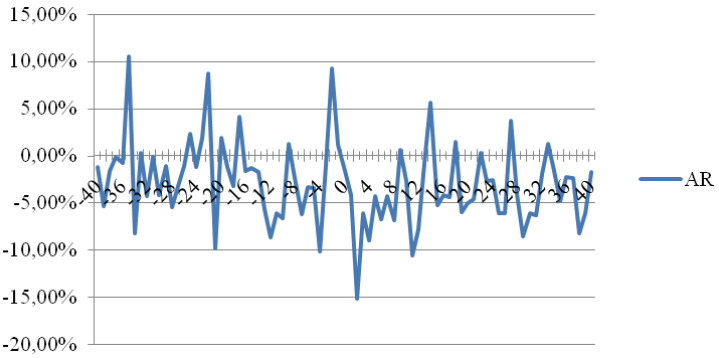

Figure 2. Abnorml rates of change in trading volume for Market Model Method

Source: own study.

All of the results are 1-percent significant. The amplitude of fluctuations of abnormal rates of change in trading volume is marked by two boundaries, i.e. 10% and –15% (the exact numbers are 9.22% and –15.19%, respectively). Within the entire event window the extreme points are reached within a close vicinity of the split ex date, i.e. in the window [–2;+2]. The distance between these two extremes equals 24.42%. More interestingly, a similar property can be found in the case of stock splits for NYSE-listed companies from the period of 2009 – June 2011. However, extremes occur in even closer proximity, i.e. a steep slide is observed between the last trading session before splitting the shares and the actual split date. In fact, in both cases, even though they pertain to diverse time intervals and various samples the common finding is that the greatest amplitude of abnormal changes of trading volume is reported around the execution day from which this measure of liquidity plummets.

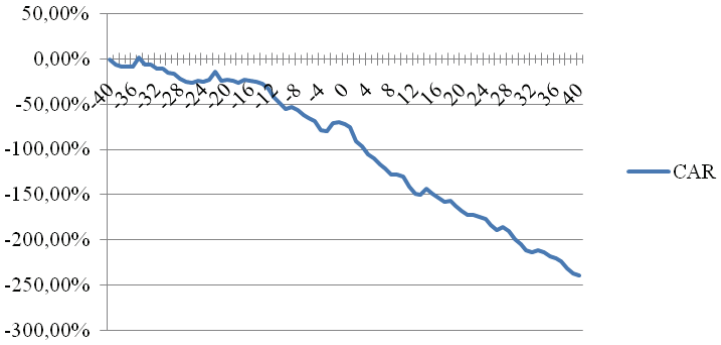

Figure 3. Cumulative abnorml rates of change in trading volume for Market Model Method

Source: own study.

By observing the above graph, it indicates that trading volume nosedives for the event window under consideration. The decline becomes even more pronounced after the execution date. The results based on the analysis of the data including different phases of market cycles, i.e. the economic slumps of the *internet bubble* or the global financial crisis 2007–2009 or in a strong bull market, i.e. the period of 2003–2007 interlaced with smaller corrections, are indicative of liquidity deterioration as measured with trading volume following a stock split which is consistent with prior research and raises questions about the assumption of market efficiency. In sum, stock splits bring about the contrary results to the expectation of managers from the perspective of a liquidity hypothesis. The prior statement concerns overall liquidity. To explore the issue more deeply one must examine whether there are more trades and/or whether the number of individual investors has changed in the wake of the split date.

Appendix

Table 2

Statistical significance for the sample of 471 stock-split events in the time span [–41;+41]

Day	AR	CAR	Day	AR	CAR
–40	–1,27%	–1,27%	0	–1,62%	–71,83%
–39	–5,42%	–6,69%	1	–4,25%	–76,08%
–38	–1,65%	–8,34%	2	–15,19%	–91,27%
–37	–0,18%	–8,52%	3	–6,14%	–97,41%
–36	–0,78%	–9,30%	4	–8,98%	–106,40%
–35	10,51%	1,21%	5	–4,33%	–110,72%
–34	–8,23%	–7,02%	6	–6,74%	–117,46%
–33	0,27%	–6,76%	7	–4,29%	–121,75%
–32	–4,28%	–11,03%	8	–6,88%	–128,63%
–31	–0,11%	–11,15%	9	0,63%	–128,01%
–30	–4,17%	–15,31%	10	–2,74%	–130,74%
–29	–1,11%	–16,43%	11	–10,65%	–141,39%
–28	–5,52%	–21,94%	12	–7,79%	–149,18%
–27	–3,30%	–25,24%	13	–0,77%	–149,95%
–26	–1,08%	–26,32%	14	5,65%	–144,30%
–25	2,29%	–24,03%	15	–5,33%	–149,63%
–24	–1,21%	–25,24%	16	–4,22%	–153,85%
–23	1,86%	–23,38%	17	–4,46%	–158,31%
–22	8,65%	–14,73%	18	1,47%	–156,84%
–21	–9,88%	–24,61%	19	–5,99%	–162,84%
–20	1,84%	–22,77%	20	–5,08%	–167,91%
–19	–1,20%	–23,97%	21	–4,65%	–172,56%
–18	–3,22%	–27,19%	22	0,31%	–172,25%
–17	4,15%	–23,04%	23	–2,77%	–175,01%
–16	–1,68%	–24,72%	24	–2,63%	–177,65%
–15	–1,34%	–26,06%	25	–6,13%	–183,78%
–14	–1,79%	–27,85%	26	–6,18%	–189,96%
–13	–5,73%	–33,57%	27	3,64%	–186,32%
–12	–8,73%	–42,30%	28	–4,12%	–190,44%
–11	–6,16%	–48,46%	29	–8,55%	–199,00%
–10	–6,69%	–55,15%	30	–6,17%	–205,17%
–9	1,26%	–53,89%	31	–6,39%	–211,56%
–8	–2,35%	–56,24%	32	–1,99%	–213,55%
–7	–6,20%	–62,44%	33	1,24%	–212,31%
–6	–3,38%	–65,82%	34	–1,60%	–213,91%
–5	–3,51%	–69,33%	35	–4,88%	–218,78%
–4	–10,20%	–79,53%	36	–2,32%	–221,10%
–3	–1,03%	–80,56%	37	–2,44%	–223,54%
–2	9,22%	–71,34%	38	–8,27%	–231,82%
–1	1,13%	–70,21%	39	–6,11%	–237,93%
			40	–1,74%	–239,66%
			CAR		–239,66%
			Standard deviation		0,0440
			t–statistic		–54,47

Source: own study.

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Summary

Stock splits have attracted the attention of academicians and practitioners for a long time. Many debates revolve around these often called „cosmetic" events that do not bring about any direct valuation implications. In spite of their simplicity and theoretically non-motivation of any potential reaction, this corporate procedure exerts influence inter alia on trading liquidity. Through the assessment of the period between 2000–May 2011 the author examines the behavior of share volume following the stock splits of companies listed on NYSE (New York Stock Exchange) and reports a 1-percent significant deterioration of this proxy of liquidity. Additionally, the greatest amplitude of abnormal change in liquidity is observed during the two trading sessions surrounding the actual stock split, even though there is no new information provided through the physical split of the shares which is known in advance.

WPŁYW PODZIAŁU AKCJI NA PŁYNNOŚĆ OBROTU – PRZYKŁAD NOWOJORSKIEJ GIEŁDY PAPIERÓW WARTOŚCIOWYCH W OKRESIE 2000–MAJ 2011

Streszczenie

Tematyka podziału akcji od dawna przyciąga uwagę badaczy akademickich oraz praktyków. Wiele dyskusji toczy się wokół tego często określanego mianem kosmetycznego [zabiegu] zdarzenia, które nie powoduje bezpośrednich konsekwencji w odniesieniu do wyceny spółki. Pomimo swojej prostoty oraz teoretycznie braku przyczyn potencjalnej reakcji podział akcji wywiera wpływ m.in. na płynność obrotu. Autor, analizując podziały akcji przeprowadzone w przedziale czasu 2000– maj 2011 roku przez spółki notowane na Nowojorskiej Giełdzie Papierów Wartościowych, obserwuje statystycznie istotne (na poziomie 1%) pogorszenie płynności obrotu mierzonej wolumenem. Ponadto, największa amplituda ponadprzeciętnych zmian wolumenu obrotu, tj. w odniesieniu do zmian indeksu giełdowego S&P500, jest notowana podczas dwóch sesji giełdowych wokół daty faktycznego podziału akcji, choć sam fizyczny podział akcji nie stanowi nowej informacji, gdyż jest ona znana z wyprzedzeniem.