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STOCK MARKET REACTIONS TO THE ANNOUNCEMENTS AND EXECUTIONS OF STOCK-SPLITS AND REVERSE STOCK-SPLITS

Summary

The aim of this paper is to analyze the stock market investors reactions to the events of announcement and execution of stock-splits and reverse stock-splits carried out on Warsaw Stock Exchange (WSE) during the period 2004-2012. The study puts the emphasis on the differences between market reactions to standard stock-splits and reverse stock-splits. The results presented in this paper are based on the methodology of event study. The studied data sample consists of 45 instances of stock-splits and 6 instances of reverse stock-splits that took place on WSE in the specified period of time. Results obtained suggest no statistically significant reaction to the events of: split announcement, split execution and reverse split execution and a statistically significant (mostly negative) reaction to the event of reverse split announcement. Although some anomalies can be observed on close inspection of the data, in general the obtained results can be interpreted as evidence of investors' rationality with regards to events connected with stock-splits on the WSE.

Key words: stock-split, reverse stock-split, stock market, event study, Warsaw Stock Exchange, investors rationality

1. Introduction

Stock markets are flooded daily with torrents of information that may significantly influence the values of companies and related financial instruments. Because of that, the topic of measurement of market reactions to certain events is a widely discussed one among the economists. *Event study* is a method that allows to estimate the impact of a specific event on the market value of a joint-stock company. Most probably the procedure of event study was first carried out and published by Dolley in 1933 [Dolley, 1933, pp. 316-326]. A famous study on the impact of splits of shares on their price was also published by Fama, Fisher, Jensen and Roll (FFJR) in 1969 [Fama et. al., 1969, pp. 1-21]. It was one of the first articles in which the methodology of event studies (which remains commonly used at the present time) was applied. It seems logical from the perspective of economic and financial theory, that a stock split should have no effect on the valuation of the company. Because of the developments

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in computing and a wider availability of data, more and more possible applications of event study emerge.

The purpose of this article is to analyse the reaction of share prices listed on the Warsaw Stock Exchange (WSE) on the announcement and the execution of stock-splits and reverse stock-splits. Because the information on the planned stock split is made public well in advance of the event, the division itself should have no significant impact on the share price. Results obtained in this study confirm that hypothesis; however they may suggest some level of irrationality in the behavior of stock market investors. Due to their relative rarity there are not so many studies on reverse stock splits on Polish stock markets. Because reverse stock-splits became more popular in recent years this study is able to investigate the differences between market reactions to splits and reverse splits.

2. Methodology

According to Elton and Gruber [Elton, Gruber, 1998, p. 524] the biggest number of studies conducted in the field of finance utilizes the event study methodology. Event study is based on the assumption that releasing of new information should result in an immediate adjustment in the prices of assets. Apart from the quickness of the reaction the methodology measures the direction of price changes and their magnitude. Because of its versatility event study has a wide scope of applications. Event study methodology can be broken into four phases [Jamroz, 2011, pp. 107-108]:

1. Defining the event, Firstly the event in question needs to be defined and an appropriate event window should be chosen. Event window consists of the day in which the event occurs and usually includes the days after the event in order to capture the demand/supply adjustments after the market have been closed. Sometimes the event window can also include days before the event on the assumption that it can be known in advance for some investors. Criteria for choosing the companies can range from: data availability, size of the market-cap to industry and management specific factors.
2. Calculation of standard and abnormal returns. Standard rate of return can be defined as a rate of return that would occur has the event not taken place. Abnormal rate of return captures the impact of the event on the price of the share. Abnormal return of the i -th stock at time t can be defined as:

$$\varepsilon_{it} = R_{it} - E(R_{it} | X_{t-1}) \quad (1)$$

where: $\varepsilon_{i,t}$ is the abnormal rate of return, $R_{i,t}$ is the actual realized rate of return, and $E(R_{i,t} | X_{t-1})$ is the expected rate of return conditional on the set of information X_{t-1} that is available at time $t-1$ (standard rate of return). There are two basic approaches of estimating the standard rates of return:

- a) By assuming that the standard rate of return is constant and equal to the average rate of return of the particular asset. This approach can be described by the Constant Mean Return Model [MacKinlay, 1997, p. 17];
- b) By utilizing the market model² that relates the return of a given security to the return of a market portfolio $R_{m,t}$ (which consists of all assets in a given market, weighted by their respective market caps). Market model assumes that the relation is linear and constant:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \quad (2)$$

Hence, given the above model, the abnormal rate of return of the i -th asset can be described as:

$$\hat{\varepsilon}_{i,\tau} = R_{i,\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m,\tau} \quad (3)$$

3. Estimation and testing. After choosing the appropriate model its parameters need to be estimated in order to calculate the standard and abnormal returns. Most of the time a period ranging from just over a dozen to over 200 days is chosen for the estimation of the parameters of the model. This period is called the estimation window and should exclude the event window, so that the event would not affect the parameters of the estimated model. Subsequently, a test needs to be established for measuring the statistical significance of abnormal rates of return. Usually the null hypothesis, being verified, states that there is no significance of cumulated (summed) abnormal returns from the event window

(from day τ_1 to day τ_2 : $CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \hat{\varepsilon}_{i\tau}$), with the alternative hypothesis of cumulated abnormal returns significantly different from zero:

$$H_0 : CAR = 0 \quad H_A : CAR \neq 0 \quad (4)$$

4. Results and conclusions. The results are usually presented in an aggregated form, including reactions from all shares in the chosen group of companies. Ideally, the event study would explain the mechanism of the influence of a specific event on the prices of shares. However, results obtained should always be analyzed including other possible events that may have occurred during and before the studied period.

For more detailed descriptions see [Cambell et. al., 1997, chapter 4]. After clearly defining the event that is the topic of the study, an adequate period (event window) for which the influence of the event on the prices of shares will be analyzed, should be chosen. The event window can begin before the event date and may end after it. Only after that the estimation window for the model is chosen. It should not overlap with the event window. Abnormal rates of return (rates of return in excess of normal rates of return as determined by the model) are interpreted as the measure of the events influence on the company's market value. This methodology

² This form of a market model is a single factor model that does not require the assumption of lack of autocorrelation of the random component [See: Elton, Gruber, 1998, p. 178].

of event study assumes that the event is an external factor with regards to the change in the stocks prices. In other words, the event causes the change in the valuation of the company, what is considered to be a correct assumption for most cases [Cambell et. al., 1997, pp. 157-158].

A more complex model can also be adopted for event studies, for example models based on CAPM or APT. It is not entirely clear whether or not such approach is more advantageous, given among others studies on time variation of the beta factor [Fiszeder, Mstowska, 2011, p. 204]. A parametric test described by McKinley [MacKinlay, 1997, p. 24] can be used in order to verify the influence of announcement and execution of stock-split on the prices of shares. Given the null and alternative hypotheses specified in (4), the test will utilize the following statistic [Campbell, Lo, MacKinlay, 1997, p. 162]:

$$J_1 = \frac{\overline{CAR}(\tau_1, \tau_2)}{[\hat{\sigma}^2(\tau_1, \tau_2)]^{\frac{1}{2}}} \sim N(0,1) \quad (5)$$

Where: $\overline{CAR}(\tau_1, \tau_2) = \frac{1}{n} \sum_{i=1}^n CAR_i(\tau_1, \tau_2)$ is the average of cumulative abnormal returns. This distributional result is asymptotic and requires a large sample of events and is not exact because of the estimator of the variance in the denominator. J_1 gives equal weight to all securities.

A second approach gives greater weight to the securities with lower abnormal return variance using the so called standardized cumulative abnormal returns (SCAR). $\overline{SCAR}(\tau_1, \tau_2)$ can be defined as the average CAR over n securities from event time τ_1 to τ_2 :

$$\overline{SCAR}(\tau_1, \tau_2) = \frac{1}{n} \sum_{i=1}^n \frac{CAR_i(\tau_1, \tau_2)}{\hat{\sigma}_i(\tau_1, \tau_2)} \quad (6)$$

In this case the test statistic has the following form:

$$J_2 = \left(\frac{n(L_1 - 4)}{L_1 - 2} \right)^{\frac{1}{2}} \overline{SCAR}(\tau_1, \tau_2) \sim N(0,1) \quad (7)$$

where: L_1 is the size of the estimation window. Those tests assume normally distributed data, which is not always true for market returns. If the null hypothesis gets rejected, then the cumulated abnormal return is significantly different from zero, what indicates that the influence of the event on the prices of shares is statistically significant.

3. Legal regulations regarding stock-splits in Poland

The Code of Commercial Companies (CCC) [Dz. U. z 2000 Nr 94, poz.1037] states, in article 333 § 1, that shares are indivisible. It means that shares cannot be divided into parts neither by the shareholder nor by the company. This restriction renders

the division of a share as a security null and void, along with the division of rights incorporated in equity shares.

There is a distinction between dividing shares and decreasing their nominal value, what increases the number of shares in circulation. Such ‘division’ is possible as long as it does not result in the situation when the same set of stocks has different nominal values. Such procedure, when the nominal value of shares is decreased alongside an issue of new shares is called the stock-split. Splits are carried out in public companies. CCC does not explicitly regulate the procedures for carrying out a split. In order to determine the correct legal procedure for carrying out a split, one must consider regulations from: the CCC, law on public companies [Dz. U. z 2009 r. Nr 185, poz. 1439], and the provisions of the regulations of Central Securities Depository of Poland (CSD) and the Stock Market (in the case of this study the WSE).

Due to CCC regulations on changes in the nominal value of shares, a split requires a change in the companies’ articles of association. “Split can be made only by changing the articles of association involving a change in the structure of joint-stock. This change should involve all shares issued by the company” [Opalski, 2010, p. 240]. This requirement is a consequence of articles 302 and 304 § 1 point 5 of the CCC. The former article states that the share capital of a joint-stock company is divided into shares with equal nominal value, the latter article states that the number of shares and their nominal value is determined by the articles of association. Hence each change in the nominal value of shares requires a change in the articles of association. According to the article 430 § 1 of the CCC, a change in the articles of association may only be made through a resolution of the shareholders general meeting (SGM). The proposed change in the articles of association should explicitly state the new amount of shares and their new nominal value.

According to the law on public companies, every public company is required to release information to: the Polish Financial Supervision Authority (PFSA), the company operating the regulated market (in this case the WSE), and the public. The scope of the information that needs to be released is set by the regulation of the Minister of Finance [Dz. U. z 2009 Nr 33, poz. 259]. The company is required to release information on every change made in the articles of association, in the form of current reports. Apart from the current report the company needs to submit relevant proposals to the WSE and the CSD. Since a change in the articles of association is necessary to carry out a split, the company is required to inform the public and its’ shareholders about the split for the first time when the SGM resolution is passed. Hence for the purpose of this study the date of the SGM at which the split is announced is assumed to be the actual date of the announcement of the split.

The next step in carrying out a split is to submit a request to the CSD to exchange shares due to their new nominal value. Management board of the CSD adopts a resolution in which it establishes the day of the split and the new share code. According to the regulations of the WSE, the company should inform the WSE about the change in the nominal value of shares immediately after registering the change in the articles of association. Later it should deliver the resolution of the CSD management board which sets the day of the split. Shares with old nominal value are listed at the stock market for

the last time at the last session before the split. It is however possible to suspend the trading of shares for a short period of time preceding the split day on a company's request.

4. Previous empirical research on stock-splits

According to the theory of finance, the nominal level of share prices should have no impact on investment decisions. Despite that, the topic of the impact of stock-splits on the prices of assets was researched extensively, even on mature markets. Stock-split means that the number of shares is increased with a corresponding proportional change in the nominal price, so that the overall market value remains unchanged. The opposite of a split is a reverse split, in this case the number of shares is decreased, for example a shareholder may receive one new share for each two previously owned shares. The aim of a reverse split is to increase the price of a single share, without a change in the market value of a company and is often carried out in order to conform with the quantitative requirements of the stock exchange [Martell, Webb, 2005]. It seems as though the stock-split should be a procedure that has no impact on investors attitudes. However some studies indicate otherwise.

An extensive study of 622 companies and 940 splits from a period ranging from January 1927 until December 1959 was carried out by Fama, Fisher, Jensen and Roll (FFJR). According to the authors, splits were carried out in periods when the price of the particular shares grew faster than the prices of other shares listed on the market. 71,5% of all splits were followed by a higher increase in dividends than in other companies. Hence a split could have been perceived as an indication of possible future increase in the dividends. The impact of a split is most apparent in the period preceding the division. Results obtained by the authors show that in the period from the announcement of the split (for example six months before the event) until the month in which the split is carried out (month '0') the cumulated abnormal rate of return averaged 12,96 percent. In their conclusions authors focused mostly on long-term behavior of prices, somewhat omitting this anomaly. In the cases when after the split was carried out there was a decrease in the dividend usually the prices would drop to the level from before the split, what can be considered as an argument for market effectiveness. The authors were criticized for the use of monthly instead of daily rates of returns, and for setting the month of the split as the event date instead of the day in which the split was announced or carried out [Haugen, 1999, p. 745].

Many studies on the topic of splits on the United States stock markets were carried out. Those include: Grinblatt, Masulis and Titman [Grinblatt, Masulis, Titman, 1984, pp. 461-490], McNichols and Dravid [McNichols, Dravid, 1990, pp. 857-879], Brennan and Hughes [Brennan, Hughes, 1991, pp. 1665-1691], Ikenberry, Rankine and Stice [Ikenberry, Rankine, Stice, 1996, pp. 357-375], Ikenberry and Ramnath [Ikenberry, Ramnath, 2002, pp. 489-526], and Byun and Rozeff [Byun, Rozeff, 2003, pp. 1063-1085]. Relatively little studies focus on markets outside of the US, for example for the Canadian market: Kryzanowski and Zhang [Kryzanowski, Zhang, 1993, pp. 57-81], for Swiss

market: Kunz i Rosa-Majhensek [Kunz, Rosa-Majhensek, 2007] and for the German market: Wulff [Wulff, 2002, pp. 270-297].

In the academic literature, the effects of splits are being explained in a couple of different ways. The most famous explanation is the information function of the split according to which, splits are announced in order to signal good perspectives of the company to the shareholders and to attract the attention of market analysts and potential investors. That function may be especially important for less known companies as indicated by Brennan and Hughes [Brennan, Hughes, 1991, pp. 1665-1691]. Conclusions of Brennan and Hughes partially explain motifs of carrying out splits, however, as mentioned in Angel [Angel, 1997, pp. 655-681], it is unlikely that large companies would need to acquire investors attention in that manner. A similarly popular intention for carrying out splits is the desire to increase the liquidity of shares when their market price becomes too high for smaller investments. This explanation is put forward (among others) by: Copeland [Copeland, 1979, pp. 115-141] and Conroy and Harris [Conroy, Harris, 1999, pp. 28-40].

The liquidity motive is related to the optimal price range and tick size. According to some managers, stocks within the optimal price range sell better, hence splits can be utilized in order to decrease the price of shares when they rise above the higher bound of the optimal price range. When the price drops below the lower bound a company can carry out a reverse split. Tick is the lowest possible value by which a shares price can change as a result of transactions. Ticks can be expressed as percentages of current stock prices and as such are important for shares liquidity [Gurgul, 2012, pp. 136-137].

Studies of mature markets indicate conflicting findings on the behavior of transaction volumes in response to market splits. Some authors like Lakonishok and Lev [Lakonishok, Lev, 1987, pp. 913-932] indicate that the announcement of splits is an important factor that generate an increase in the amount of market transactions; others like Conroy, Harris and Benet [Conroy et. al., 1990, pp. 1285-1295] observe a decrease in the volume of transactions as a result of splits. According to a study on the Polish stock market, conducted by Bejger [Bejger, 2001, p. 314], more than 70% of managers that carried out a split, indicated that the optimum price range and liquidity were the most significant reasons for it. Only 14% of managers responded that the split was a means of conveying positive information about the company.

Bejger's is one of the first studies on the topic of splits on the Polish stock market. The results obtained by the author indicate that companies share price policies do affect investors decisions. The main reasons for carrying out splits in Poland are: the increase in liquidity and the existence of an optimal tick size relative to the price of the share.

A study on abnormal returns as a result of splits was carried out by S. Buczek, it was based on the prices of shares of five companies (Farmacol, Getin, Mieszko, Boryszew and Sanwil) in the period 2003-2005. Because of a relatively small amount of splits in the studied sample the author included in his analysis, the so called quasi-splits. Quasi-splits occur when a company issues a large amount of shares with a price equal or very close to the current market price. Author did not conduct an aggregated analysis, instead of that he carried out the study on case-per-case basis. According to the study, it is possible to obtain abnormal returns by investing in shares

before the split day and in case of quasi-splits before the issue of rights. Buczek also points out an increase in the volume of transactions on the day following the split relative to the average price before the split. According to Buczek those findings are contradictory of the efficient market hypothesis and violate the semi-strong form of market efficiency [Buczek, 2005, pp. 128-138].

An extensive research on the topic of splits on Polish stock markets was done by H. Gurgul, for the period of 1995-2005. The author based the research on 11 cases of split announcement and on 17 cases of splits. The average abnormal return on the day of announcement was equal to 2.409%. A market reaction can also be observed 2 days before the announcement of the split, the abnormal return on that day is equal to 2.713% and is statistically significant at a 95% confidence level. The day of execution of the split and its neighboring days do not exhibit any statistically significant abnormal price patterns. In order to verify the results the author utilized a nonparametric test based on ranks (Corrado test) and additionally bootstrapping techniques. The results of those techniques correspond closely to the outcomes based on the analysis of student-t statistics.

Previous research of Jamróz [Jamróz, 2011, pp. 153-161] indicate that the announcement of split do not influence the shares' price significantly. Execution of splits on average results in negative rates of return, what may indicate an irrational reaction of the investors. The author noted the effect of split announcement noticeable two days before the split announcement (what corresponds to the findings of Gurgul) and an effect of split execution noticeable three and one day before the actual day of the split. In the analyzed period it was possible to obtain abnormal rates of return in the case of small and medium companies. However, taking into account the transaction costs of stock operations, obtaining extraordinary profits might not have been possible. Hence splits may not pay an important role in investors decisions.

Results obtained by Fiszeder and Mstowska indicate positive and negative abnormal return rates two days before and two days after the announcement of the stock-split respectively. The effect on the day of announcement was positive but very minor. In the case of the execution of the split, abnormal returns were not significantly different from zero but for the third day after the event when they were negative [Fiszeder, Mstowska, 2011, p. 209].

5. Empirical results

Research in this paper was carried out based on the announcements and executions of stock-splits and reverse stock-splits from the period: 1-January-2004 – 30-September-2012 by companies listed on Warsaw Stock Exchange. In the analyzed period there were 62 instances of stock splits (including reverse splits). The following 8 instances of splits needed to be excluded from this study, due to insufficient data in the estimation window before the announcement of the split: Krosno – July 2005, Estaroil – November 2006, Kruk – June 2007, Famur – August 2007, Pemug – September 2007, Herkules – February 2008, Zremb – October 2008, and Chemoservis – November 2009.

Three additional cases were also excluded due to irregular patterns in prices in the studied period that could not have been the results of stock-splits, those were: Mewa – November 2011 and September 2009, and Wikana – October 2011. The study covers 45 instances of splits and 6 cases of reverse splits (see table 1.). The study utilizes the methodology of event study. Data on splits was obtained from the BOSSA³ brokerage of BOŚ S.A. Stock prices and other information were obtained from the following websites: www.stooq.pl, www.gpwinfostrefa.pl, and www.money.pl. The estimation window (L_1) was set at 250 days preceding the event window and it was repeated for different lengths of the event window ranging from two days to sixteen days. A relatively long estimation window was chosen because of the properties of test statistics, which are only asymptotically normal, hence a large window allows to utilize the central limit theorem. There are some analytical methods of choosing the length of the event window see [Gurgul 2012 p. 39]. In this study a number of event window lengths were chosen in order to capture possible differences in obtained results. In each case the study includes the event of a split and the event of split announcement. Standard rates of return were determined by the market model as described in (2). Returns on WIG index were used as a proxy for market portfolio returns ($R_{m,t}$). All returns were daily logarithmic returns. The software used was MS Excel and Mathworks Matlab.

TABLE 1.
Splits and reverse splits carried out on the WSE in the years 2004-2012 (62)

Company	Split size (1:)	Split announcement	Split execution	Market cap. on the day of the split (mln of PLN)	Business sector
Boryszew	10	20.08.2004	05.11.2004	2306.8	Metal industry
Sanwil	30	09.12.2004	17.01.2005	61.1	Textile industry
Duda	10	18.01.2005	31.03.2005	604.9	Food industry
Krosno	10	12.04.2005	01.07.2005	294.5	Glassware production
Enap	7	12.01.2005	15.07.2005	7.1	Construction industry
Stalprofil	10	29.03.2005	15.07.2005	159.3	Wholesale
Grajewo	8	24.05.2005	30.09.2005	1290.2	Wood industry
Cersanit	10	13.05.2005	17.11.2005	1848	Building materials
Lubawa	10	01.02.2006	10.03.2006	233.5	Light industry
Bioton	5	18.05.2006	26.06.2006	4686.7	Pharmaceutical industry
Kopex	10	20.06.2006	01.08.2006	437.6	Industrial machinery
Echo	4	08.05.2006	02.08.2006	308.7	Housing developer
GTC	10	26.04.2006	09.08.2006	6628.2	Housing developer
Aparator	11	28.02.2006	21.08.2006	734.1	Industrial machinery
Wikana	30	25.05.2006	25.08.2006	45.4	Light industry
LZPS	6	30.05.2006	07.09.2006	48.2	Light industry
Mediatel	5	22.08.2006	30.10.2006	60.4	Telecommunications
Elstaroil	10	31.05.2006	03.11.2006	721.7	Food industry
Energomontaż Pld.	10	20.06.2006	28.12.2006	176.2	Construction industry
TVN	5	06.11.2006	29.12.2006	8553.4	Mass media
PC Guard	100	15.12.2006	25.01.2007	181.1	IT
IDM	10	07.11.2006	08.02.2007	916	Financial services

³ <http://bossa.pl>

Bytom	10	12.03.2007	25.05.2007	35.7	Light industry
Fon	5	15.02.2007	04.06.2007	59.7	Other non-financial services
Kruk	11	20.03.2007	25.06.2007	641.3	Retail
Famur	107	29.05.2007	02.08.2007	2696.4	Industrial machinery
Pepees	100	18.05.2007	27.08.2007	230.5	Food industry
Impexmetal	25	22.05.2007	06.09.2007	2305.9	Metal industry
Vistula	10	30.05.2007	07.09.2007	1259.5	Retail
Polimex-Mostostal	25	04.06.2007	20.09.2007	4857.2	Construction industry
Pemug	10	29.05.2007	24.09.2007	74.1	Construction industry
Synthos	67	14.09.2007	15.11.2007	2117.2	Chemical industry
Mewa	20	23.10.2007	22.11.2007	64.6	Retail
Echo	10	26.09.2007	02.01.2008	3355.8	Housing developer
Fon	10	22.09.2008	09.01.2008	89.6	Other non-financial services
ATM	8	18.10.2007	10.01.2008	248.4	IT
Elkop	29	12.12.2007	01.02.2008	57.9	Construction industry
Herkules	5	08.11.2007	21.02.2008	203.9	Construction industry
Stomil Sanok	10	28.12.2007	22.02.2008	441.6	Automotive industry
Inwestcon	2	15.11.2007	22.02.2008	68.7	Other services
ATM Grupa	20	03.12.2007	14.03.2008	596.8	Mass media
Elzab	10	21.11.2007	30.04.2008	80.5	IT
Asseco Slovakia	10	11.01.2008	07.05.2008	697.6	IT
ZTSERG	5	08.04.2008	02.07.2008	23.2	Manufacture of synthetic materials
Tell	5	16.05.2008	08.08.2008	63.5	Retail
Zremb	100	25.06.2008	01.10.2008	26.7	Industrial machinery
Coliana	20	25.06.2008	14.11.2008	226.4	Food industry
FON†	01:50	27.03.2008	03.06.2009	22.3	Other non-financial services
Izolacja	30	25.06.2009	28.09.2009	14.7	Construction industry
PC Guard†	1:100	07.07.2009	12.11.2009	25.4	IT
Chemoservis	5	24.09.2009	24.11.2009	123	Machine industry
Elkop†	01:50	28.12.2009	16.04.2010	23.3	Construction industry
Sanwil†	01:20	02.09.2009	14.05.2010	38.1	Textile industry
Mewa†	1:106	15.02.2010	02.09.2010	19.1	Retail
Suway	5	24.03.2011	26.04.2011	77.4	Manufacture of synthetic materials
Mennica	10	22.03.2011	30.05.2011	663.1	Metal industry
Wikana†	01:10	29.06.2011	31.10.2011	121	Housing developer
ING BSK	10	24.10.2011	18.11.2011	10121.8	Financial services
Lentex	5	25.05.2011	22.11.2011	251.5	Manufacture of synthetic materials
Unicredit†	01:10	15.12.2011	30.12.2011	57895.5	Financial services
Plastbox	5	31.03.2012	18.05.2012	102.2	Manufacture of synthetic materials
Herkules†	01:05	22.06.2012	19.09.2012	49.9	Construction industry

Cells in grey indicate splits that were excluded from the study as described above.

† indicates a reverse split.

Source: own elaboration based on: <http://www.gpwinfostrefa.pl>, <http://www.money.pl>, <http://bossa.pl>, <http://www.stooq.pl>, retrieved at: 04.05.2013.

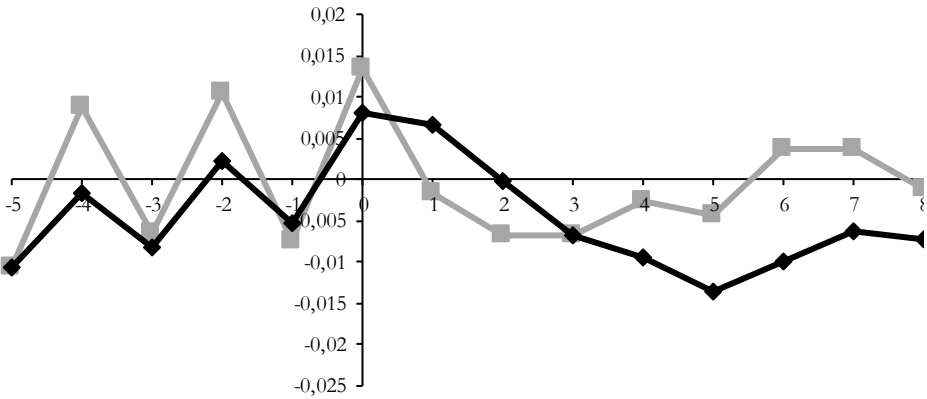
Initial results are presented in graphs 1 – 4. Graph 1 shows the average abnormal returns and average cumulative abnormal returns for the event of split announcement for the data excluding the reverse splits. Graph starts at 5 days before the event and ends 10 days after the event. Graphs 2 – 4 are analogous to graph 1 and present: the event of execution of splits (without reverse splits), the event of reverse split announcement (only reverse splits), and the event of the execution of reverse splits, respectively.

The average abnormal returns for the announcements and executions of standard (non-reverse) splits presented on graphs 1 and 2 seem to be of negligible size. What seems surprising is the fact that average abnormal returns exhibit a higher absolute value before the event of split announcement than immediately after (see graph 1). This may indicate that a significant number of traders possess the knowledge of the upcoming split announcement in advance other explanation might be that an increased number of transactions is taking place due to the upcoming SGM. Either way the alternating pattern of positive and negative abnormal returns suggests that obtaining abnormal profits before the stock-split announcement would be very hard if not impossible. After the event of split announcement, abnormal returns stay very close to zero suggesting that there was no impact on trading patterns of investors. The situation seems similar to the event of split execution, although abnormal returns exhibit similar sizes prior and after the event. There is, however, a no negligible average abnormal return, one day before the split of 2.46%. Because the date of split is publically known in advance it is not unlikely that all trading strategies that are suppose to exploit the event would be executed before it. However, given the efficient market hypothesis, all information should be incorporated into the stock prices without any delay, hence the 2.46% spike might be attributed to some irrational behavior pattern of investors. However the size of the apparent anomaly is small enough that it can be discounted as a random outcome in the sample. The relatively big negative average abnormal return at day 5 after the event is unlikely to be an outcome of the split.

The situation is significantly different with reverse splits. There seem to be a similar pattern in abnormal returns before the event of announcement (alternating positive and negative abnormal returns of modest size), but the reaction on day one after the announcement is very big with the average abnormal return of over 15%. It is important to remember that stock splits are often carried for the so called penny stocks (stocks which market value is very small, in this case below PLN 1), at which point the size of the tick becomes an important factor. In fact only one of the instances of reverse splits in the data was not a penny stock (Unicredit). Three companies Elkop, PCGuard and FON had their share prices at a crucial point of PLN 0.01 prior to the reverse split. Since stock prices cannot drop below the value of 0.01 one might expect a negative return after the reverse split is carried out.

Therefore, the positive reaction after the announcement of the split seems counterintuitive but in this case it was influenced by just one big daily return of 100% on FON shares (a jump in price from PLN 0.01 to 0.02). Still this may be considered irrational behavior by the investors to pay a premium price on a penny stock that is due to be the subject of a reverse split. The overall long term average CAR after the announcement event is negative.

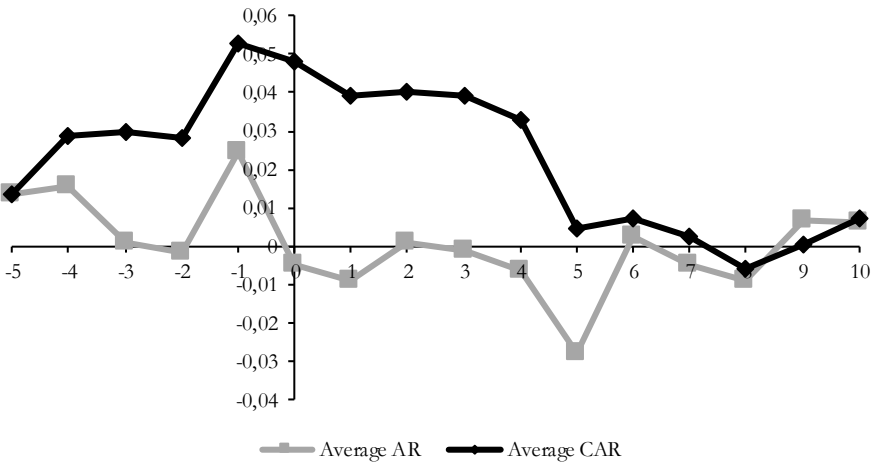
GRAPH 1.
Average ARs and CARs, announcement of a split (without reverse splits)



x-axis – number of days before/after the event, y-axis – average CAR/AR.

Source: own elaboration.

GRAPH 2.
Average ARs and CARs, execution of a split (without reverse splits)

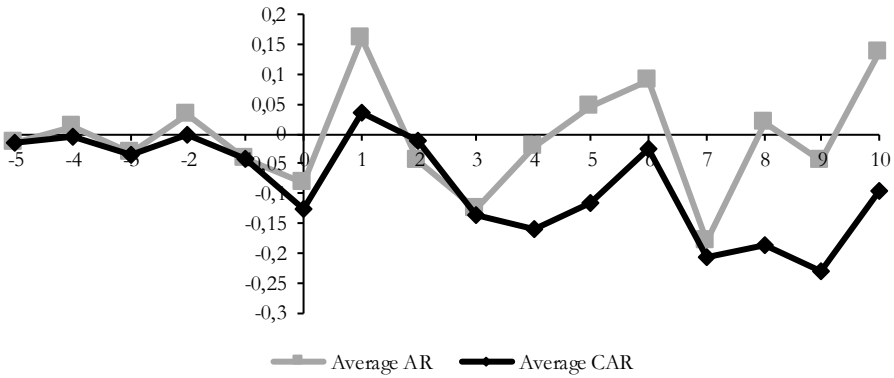


x-axis – number of days before/after the event, y-axis – average CAR/AR.

Source: own elaboration.

GRAPH 3.

Average ARs and CARs, announcement of a reverse split

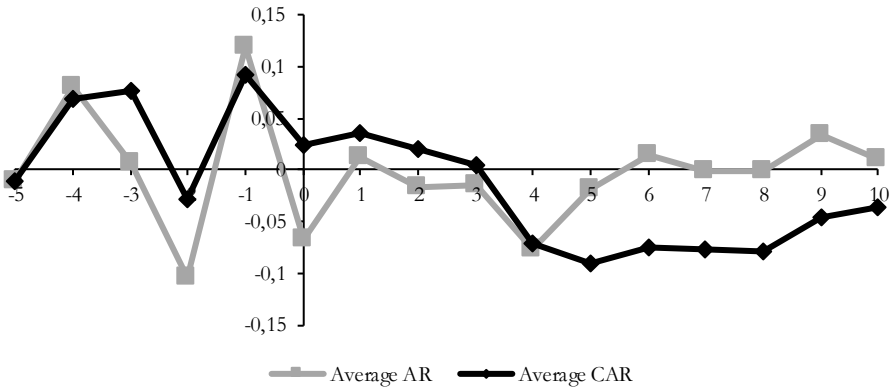


x-axis – number of days before/after the event, y-axis – average CAR/AR.

Source: own elaboration.

GRAPH 4.

Average ARs and CARs, execution of a reverse split



Graphs 1 – 4, x-axis – number of days before/after the event, y-axis – average CAR/AR.

Source: own elaboration.

Tables 2 – 4 summarize the outcomes of the statistical tests as specified in (5) and (7). Tests were carried out in each case (standard/reverse splits, announcement/execution) for ten different time ranges. In the case of standard splits tests show no statistically significant reaction to stock-splits or split announcements in the prices of shares. This suggests that investors do not make investment decisions

based on stock-splits what is consistent with the theory that a split is perceived as a purely technical procedure. The event of reverse split execution also seem to have no statistically significant impact on the prices of shares. The situation is different, however, in the case of reverse split announcement. On several occasions, both in short and long time ranges, the second test showed a significant reaction in the share prices as a result of reverse stock-split announcement. To a certain extent this may be accredited to larger nominal returns as a result of a larger ticker relative to the prices of shares, however, this cannot account for the entirety of the results, especially as there is no similar reaction to the split execution.

Hence it is safe to conclude that WSE investors do react to the event of a reverse stock-split announcement. In 4 out of 5 time ranges in which the test indicated significance. The reaction was negative. A reverse split event is different from a split event in that it allows the prices of some securities (those whose value is close to the ticker size) to drop below their current value, hence this negative reaction might be perceived as rational behavior. Because the date and size of the reverse split is known at announcement. The reaction at execution is not big.

TABLE 2.

Test results (excluding reverse splits)

time range (τ_1, τ_2)	Announcement		Execution	
	J ₁ statistic	J ₂ statistic	J ₁ statistic	J ₂ statistic
(0,1)	0.108	0.724	-0.146	-0.976
(0,2)	0.054	0.360	-0.160	-1.066
(0,3)	-0.013	-0.087	-0.138	-0.924
(-1,1)	0.035	0.236	0.074	0.500
(-1,2)	-0.023	-0.153	0.084	0.562
(-2,2)	0.078	0.526	0.061	0.414
(-3,3)	-0.039	-0.261	0.067	0.453
(-4,4)	0.008	0.058	0.120	0.804
(-5,5)	-0.105	-0.701	0.031	0.209
(-5,10)	-0.126	-0.843	0.035	0.237

Source: own elaboration.

TABLE 3.

Test results (reverse splits only)

time range (τ_1, τ_2)	Announcement		Execution	
	J ₁ statistic	J ₂ statistic	J ₁ statistic	J ₂ statistic
(0,1)	0.229	1.679**	-0.198	-0.483
(0,2)	0.086	0.635	-0.263	-0.641
(0,3)	-0.635	-4.649***	-0.296	-0.723
(-1,1)	0.140	1.027	0.256	0.626
(-1,2)	0.012	0.094	0.160	0.390
(-2,2)	0.108	0.794	-0.195	-0.475
(-3,3)	-0.803	-5.876***	-0.214	-0.521
(-4,4)	-0.763	-5.583***	-0.152	-0.372
(-5,5)	-0.875	-6.407***	-0.229	-0.560
(-5,10)	-0.242	-1.770	-0.118	-0.289

statistically significant at level * 0.1; ** 0.05; *** 0.01.

Source: own elaboration.

TABLE 4.

Test results (all data)

time range (τ_1, τ_2)	Announcement		Execution	
	J ₁ statistic	J ₂ statistic	J ₁ statistic	J ₂ statistic
(0,1)	0.135	0.964	-0.149	-1.058
(0,2)	0.058	0.419	-0.171	-1.215
(0,3)	-0.101	-0.717	-0.168	-1.194
(-1,1)	0.051	0.366	0.107	0.767
(-1,2)	-0.021	-0.148	0.098	0.703
(-2,2)	0.070	0.498	0.010	0.076
(-3,3)	-0.144	-1.021	0.003	0.022
(-4,4)	-0.108	-0.768	0.047	0.335
(-5,5)	-0.195	-1.384*	-0.033	-0.238
(-5,10)	0.009	0.069	0.009	0.069

statistically significant at level * 0.1; ** 0.05; *** 0.01.

Source: own elaboration.

6. Conclusion

Event study statistical tests show a general picture of rational approach of investors toward events related to stock-splits on WSE. On closer inspection of the data, one might find some patterns that might suggest a certain level of irrational behavior, however the scope and size of those anomalies is relatively small. In general, the study shows no statistically significant reactions in stock prices to the events of: split announcement, split execution and reverse split execution; and a statistically significant (mostly negative) reaction to the event of reverse stock-split announcement. Those outcomes can be considered as evidence of rational behavior of investors and are consistent with semi-strong form of market efficiency. It is important to consider the limitations of the approach. The biggest drawback is the assumption of normally distributed market returns which is not always true for the real-life market data. Because of that it might be reasonable to complement the outcomes of this study with non parametric tests.

Due to changing regulations on penny stocks at financial markets one might expect that there will be more events of reverse stock-splits in the future. This will mostly affect companies of medium and small sizes. Because reverse stock-split have some crucial differences from regular splits, this is a potentially interesting area for future research. Authors plan to expand this study in the future with a wider scope of econometric and statistical tools.

Bibliography

- Angel J. J., 1997, *Tick Size, Share Price, And Stock Splits*, "Journal of Finance", 52.
- Bejger P., 2001, *Motyny przeprowadzania podziału akcji i jego wpływ na reakcje inwestorów giełdowych na GPW w Warszawie*, [in:] *Z badań nad rynkiem kapitałowym w Polsce*, W. Frąckowiak (ed.), Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań.
- Brennan M. J., Hughes P. J., 1991, *Stock Prices and the Supply of Information*, "Journal of Finance", 46.
- Buczek S. B., 2005, *Efektywność informacyjna rynków akcji – teoria a rzeczywistość*, Oficyna SGH, Warszawa.
- Byun J., Rozeff M. S., 2003, *Long-Run Performance After Stock Splits: 1927 to 1996*, "Journal of Finance", 58.
- Campbell J. Y., Lo A. W., MacKinlay A. C., 1997, *The Econometrics of Financial Markets*, Princeton University Press, Princeton.
- Conroy R. M., Harris R. S., 1999, *Stock Splits and Information: The Role of Share Price*, "Financial Management", 28.
- Conroy R. M., Harris R. S., Benet B. A., 1990, *The Effects of Stock Splits on Bid-Ask Spreads*, "Journal of Financial Economics", 45.
- Copeland T. E., 1979, *Liquidity Changes Following Stock Splits*, "Journal of Finance", 34.
- Dolley J., 1933, *Characteristics and Procedure of Common Stock Split-Ups*, "Harvard Business Review", 9.

- Elton E. J., Gruber M. J., 1998, *Nowoczesna teoria portfelowa i analiza papierów wartościowych*, WIG-Press, Warszawa.
- Fama E. F., Fisher L., Jensen M. C., Roll R., 1969, *The Adjustment of Stock Prices to New Information*, "International Economic Review", 10.
- Fiszeder P., Mstowska E., 2011, *Analiza wpływu splitów akcji na stopy zwrotu spółek notowanych na GPW w Warszawie*, „Modelowanie i prognozowanie gospodarki narodowej. Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego”, 4/8.
- Grinblatt M. S., Masulis R. W., Titman S., 1984, *The Valuation Effects of Stock Splits and Stock Dividends*, "Journal of Financial Economics", 13.
- Gurgul H., 2012, *Analiza zdarzeń na rynkach akcji. Wpływ informacji na ceny papierów wartościowych*, Oficyna Wolters Kluwer, Warszawa.
- Haugen R. A., 1996, *Teoria nowoczesnego inwestowania*, WIG-Press, Warszawa.
- Ikenberry D. L., Ramnath S., 2002, *Underreaction to Self-Selected News Events: The Case of Stock Splits*, "Review of Financial Studies", 15.
- Ikenberry D. L., Rankine G., Stice E. K., 1996, *What Do Stock Splits Really Signal?*, "Journal of Financial and Quantitative Analysis", 31.
- Jamróz P., 2011, *Metody analizy a efektywność polskiego rynku akcji*, PhD thesis, Faculty of Economics and Management University of Białystok, Białystok.
- Kodeks spółek handlowych*, Dz. U. z 2000 r., Nr 94, poz. 1037.
- Kryzanowski L., Zhang H., 1993, *Market Behavior Around Canadian Stock-Split Ex-Dates*, "Journal of Empirical Finance", 1.
- Kunz R. M., Rosa-Majhensek S., 2007, *Stock Splits in Switzerland: To signal or Not to Signal?*, Working Paper SSRN Electronic Library, electronic document http://papers.ssrn.com/sol3/papers.cfm?abstract_id=872527, retrieved: 16.02.2009.
- Lakonishok J., Lev B., 1987, *Stock Splits and Stock Dividends: Why. Who. and When*, "Journal of Finance", 42.
- MacKinlay A. C., 1997, *Event Studies in Economics and Finance*, "Journal of Economic Literature", 35.
- Martell T. F., Webb G. P., 2005, *The Performance of Stocks that Are Reverse Split*, Working Paper SSRN, electronic document http://papers.ssrn.com/sol3/papers.cfm?abstract_id=899326&rec=1&srcabs=497482, retrieved: 10.12.2009.
- McNichols M., Dravid A., 1990, *Stock Dividends. Stock Splits and Signaling*, "Journal of Finance", 45.
- Opalski A., 2010, *Prawa i obowiązki akcjonariuszy*, [in:] *System prawa prywatnego. Prawo spółek kapitałowych Tom 17B*, S. Soltysiński (ed.), C.H. Beck, Warszawa.
- Rozporządzenie Ministra Finansów w sprawie informacji bieżących i okresowych przekazywanych przez emitentów papierów wartościowych oraz warunków uznawania za równoważne informacji wymaganych przepisami prawa państwa niebędącego państwem członkowskim*, Dz. U. z 2009 r., Nr 33, poz. 259.
- Ustawa o ofercie publicznej i warunkach wprowadzania instrumentów finansowych do zorganizowanego systemu obrotu oraz o spółkach publicznych*, Dz. U. z 2009 r., Nr 185, poz. 1439.
- Wulff C., 2002, *The Market Reaction to Stock Splits: Evidence from Germany*, "Schmalenbach Business Review", 54.