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The effect of stock splits on stock prices in German market

Osake splittien vaikutus osakekursseihin Saksan markkinoilla

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ABSTRACT

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This study researches the short-term stock price reaction on stock splits in German market. Data used in the study consists of 57 splits announced by 49 companies from January 2000 to December 2019. This research investigates the stock price reaction on the two event dates, the split announcement day and the split execution day. In addition, the effect of split ratio on abnormal returns is researched as well. In this study, only pure splits are examined which are not announced at the same time with other significant news of the company. Event study methodology is used to research the stock price reaction on German stock splits.

The results show that on the split announcement day any immediate stock price reaction is not observed in German market, except for 3:1 splits. This study found clear statistical differences only for 3:1 split announcements to imply positive stock price reaction, in addition that the stock price reaction is considerable high. On the split execution day, results show that splits generate abnormal returns. Significant 1.5 % [-1, +1] cumulative average abnormal return is found for total sample in this study which implies considerable high stock price reaction on the split execution day. Findings of this study show that the selected split ratio by the company has statistically significant impact on abnormal returns on the split execution day as well. Results for 3:1 splits show considerable high abnormal returns on the event day and each pre-event period compared to 2:1 splits, implying that higher split ratios appear to generate higher abnormal returns. Unlike on the split execution day, the split ratio has statistically insignificant impact on the split announcement day. In total, results obtained from this study show that the benefit of splits seem to be quite short-lived as abnormal returns reduce quickly after the split execution day.

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Tämä tutkimus tutkii lyhyen aikavälin osakekurssireaktiota osake splitteihin Saksan markkinoilla. Aineisto koostuu 57 splitistä, jotka on toteutettu 49 yrityksen toimesta aikavälillä 1.1.2000−31.12.2019. Tämä tutkimus tutkii osakekurssireaktiota kahtena eri tapahtumapäivänä, splitin ilmoituspäivänä ja splitin toteutumispäivänä. Sen lisäksi tässä tutkimuksessa tutkitaan myös split suhteen vaikutusta epänormaaleihin tuottoihin. Tässä tutkimuksessa tutkitaan vain splittejä, joiden ilmoituksen ja toteutumispäivän yhteydessä yritys ei ole ilmoittanut muista merkittävistä tapahtumista, jotka voisivat vaikuttaa osakekurssireaktioon. Osakekurssireaktiota Saksan osake splitteihin tutkitaan tapahtumatutkimuksella.

Tulokset osoittavat, että splitin ilmoituspäivänä osakekurssit eivät reagoi tilastollisesti merkitsevästi splittien ilmoitukseen. Tässä tutkimuksessa havaittiin selviä tilastollisesti merkitseviä eroja vain 3:1 spliteille, joille osakekurssireaktio oli myös huomattavan korkea. Tulokset osoittavat, että splitin varsinaisena toteutumispäivänä splitit aiheuttavat epänormaaleja tuottoja. Keskimääräinen kumulatiivinen epänormaali tuotto 1,5 % aikavälillä [-1, +1] on tilastollisesti merkitsevä koko otokselle. Tämä viittaa suhteelliseen voimakkaaseen osakekurssireaktioon splitin toteutumispäivänä. Tulokset osoittavat myös, että yrityksen asettamalla split suhteella on myös tilastollisesti merkitsevä vaikutus splitin toteutumispäivänä. Tulokset 3:1 spliteille osoittavat suhteellisen korkeita epänormaaleja tuottoja tapahtumapäivänä sekä aikavälillä ennen, verrattuna 2:1 splitteihin, osoittaen korkeampien split suhteiden aiheuttavan korkeampia epänormaaleja tuottoja. Toisin kuin splitin toteutumispäivänä, split suhteella ei ole tilastollisesti merkitsevää vaikutusta splitin ilmoituspäivänä. Kaiken kaikkiaan spliteistä saatava hyöty osoittautuu tulosten perusteella lyhytaikaiseksi, epänormaalien tuottojen hävitessä nopeasti.

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1. INTRODUCTION

In recent years, researchers have become increasingly interested in stock splits, more specifically the market reactions on splits. Stock split is described as the least understood phenomena in stock market, though it has been researched the most (Guo, Zhou & Cai 2008). Commonly it is suggested that stock splits are rare events in stock markets which increase the number of shares without changing the book value or investment opportunities of the company or even without cash inflow or outflow (Wulff 2002). Lamoureux and Poon (1987) consider splits as purely cosmetic changes which are followed by a significant stock price reaction. Increasing evidence supports this as significant positive stock price reaction on the split announcement day has been noted widely.

According to Huang, Liano and Pan (2015) stock split is announced when companies experience a substantial increase in price in the year before the split announcement. Yagüe, Gómez-Sala and Poveda-Fuentes (2009) suggest that managers prefer to turn the share price over to preferred price range with stock splits when the value of the stock is high. According to Fama, Fisher, Jensen and Roll (1969) the period of high returns tends to begin for long before any rumours or information about a possible forthcoming split have reached the markets. Increasing evidence also suggest that the timing of stock splits is connected to economic development as well. It appears that stock splits are executed when the economy is doing well as companies seem mostly to follow same pattern as market. According to Minnick and Raman (2014) there seems to be a significant relation between stock splits and economic development as they found evidence that the percentage of stock splits have decreased to less than 1 % in 2009 from a peak of 23 % in 1982. (Minnick & Raman 2014)

In practice stock splits indicate the division of the nominal value of a share in certain proportion. After split new stocks appear to market at lower nominal value. The proportion of ownership does not increase after the split but the number of shares held by the individual investor will increase by the split ratio. For instance, if the split ratio is 2:1 after the split one old stock is equivalent to two new stocks. If the nominal value of the stock is for instance 100 euros and the share capital is 1000 stocks, after split the nominal value of the stock is 50 euros and the share capital is 2000 stocks. Split can be also reverse split which is a corporate measure where given number of shares are combined. For instance, if managers decide to execute reverse split 1:3, three old stocks are combined into one new stock. Reverse split is rarer in stock markets but in effect it can remove so called penny stock image for stocks at lower price and makes them more attractive for investors. (Chung & Yang 2015)

Under certain assumptions stock splits do not affect the financial structure of the company or any activities, in theoretical opinion they seem to be irrelevant decisions (Yagüe et al. 2009). However, increasing evidence supports the hypothesis that the split announcement is followed by a positive stock price reaction. Stock splits are often seen as a desire of managers to signal to market expectations of the future profitability of the company (Wulff 2002). Theories also propose that a stock split decreases stock price at lower level and attracts new investors to market and thus the liquidity of the stocks increases. In short, managers are using stock splits to improve the liquidity of the stock. (Banerjee & Banerjee 2012) Small investors prefer stocks at lower prices more than high-priced stocks, hence split attracts new small investors to stock market (Guo et al. 2008).

It is also considered that stock splits can be seen as a strategic move by the company to help shareholders earn capital gains. One way to approach this research field is that stocks splits are also seen as an alternative for dividends. Evidence suggests that the nature of stock's clientele appear to change as split generate tax-option impact. As it is suggested that individuals are under higher taxation and institutions lower, tax-option impact will result in an increase in the number of shareholders. Therefore, increase in trading volume should be noticed after the split announcement. (Lamoureux & Poon 1987) According to Lamoureux and Poon (1987) positive market reaction on split announcement is related to the tax-option impact as well. However, if the capital gain tax rate is higher than dividend tax rate, stock splits do not work well as the investors have to pay more taxes if they decide to sell their shares after the split. Consequently, taxation may complicate investors to benefit from stock splits like the expected market reactions based on the hypotheses may be affected as well. In Germany the capital gain and dividend tax rate are same, 25 % and with the solidarity surcharge 26,375 % (Deloitte 2020). Therefore, Germany is relevant market area to this study as taxation should not make splits inefficient.

This research focuses on to study whether stock splits have effect on stock prices in German market around both the split announcement day and the execution day. Especially the interest is to research the stock price reaction on the event day itself. As it is suggested the split ratio can be a possible factor to have effect on abnormal returns (Kalotychou, Staikouras & Zagonov 2009) this has been taken into a closer look in this research as well. The study is executed with event study methodology based on historical stock market data collected from Thomson Reuters Datastream and Thomson One database.

1.1 Previous research

There are several researches that investigate market reactions on stock splits. One of the foremost researches in this research field is studied by Fama et al. (1969). They research, are there any abnormal behaviour in the return rates of stock in the months surrounding the split. Their findings indicate positive market reaction on the announcement day of the split and suggest that market is also efficient as the market reacts to new information rapidly and reflects all the new available information on stock prices. Fama et al. (1969) argue also that stock splits tend be followed by dividend increases, and related to earlier experiences changes in dividends are not unusual to be announced at the same time with splits. It is suggested that market recognizes splits related to higher dividend payments and it is seen as a positive signal in markets. (Fama et al. 1969) Yagüe et al. (2009) research instead whether companies in Spain use stock splits to signal to market the evolution of their earnings. The study is executed as an event study including 45 splits from 1997 to 2005 from listed companies on the Spanish Stock Market Interconnection System (SIBE). They argue in the paper that the split announcement is followed by a positive stock market reaction on the announcement day and support the hypothesis that managers are using splits as a signal to market on the evolution of their earnings. (Yagüe et al. 2009)

Guo et al. (2008) research information asymmetry, changes in investors' behaviour, liquidity and the trading activity around stock splits in Tokyo Stock Exchange during 1996−2005. The results indicate that the information asymmetry tends to reduce and the market liquidity enhances after the split. Interesting finding is that results indicate that the trading activity tends to increase significantly after the split. Investors are more likely to buy than sell stocks. (Guo et al. 2008) Kalotychou et al. (2009) instead research market behaviour on stock splits in the UK market. The study includes stock splits from 1990 to 2007, from companies listed in the London Stock Exchange. Their findings indicate positive abnormal returns on the ex-split date and around it. In the paper they also argue that the market reaction is stronger for the companies executing stock split at higher split ratios which implies that investors prefer stock prices at lower level (Kalotychou et al. 2009) which is consistent with the findings of Baixauli (2007). McNichols and Dravid (1990) report similar findings in their research that includes splits during 1976−1983. They report positive abnormal returns on the announcement day as well as stronger market reaction for the companies executing split at higher split ratios. (McNichols & Dravid 1990)

In informationally efficient markets any significant stock price reaction should not be observed on the split execution day (Fama et al. 1969). However, several studies have shown a significant and positive abnormal return on the execution day as well. Lamoureux and Poon (1987) found statistically significant 0.6 % abnormal return on the split execution day which is consistent with the findings of Huang et al. (2015). Fama (1998) reports converse findings and supports the efficient market hypothesis.

1.1.1 German market

It appears that stock splits are uncommon research subject in German market and only few researchers have examined German splits. Wulff (2002) researches market reaction on stock splits during 1994−1996 in German market. The study includes 83 German splits and the results are compared to U.S market. As a result, from the study he found positive abnormal returns both around the announcement day of the split and the execution day. Wulff (2002) found the individual announcement event day market reaction to be considerably low and insignificant. However, German market appears to react positively and highly significantly on the day after the split announcement. Wulff (2002) argues that on the execution day daily abnormal returns appear insignificant as well but clear statistically significant differences on cumulative abnormal returns occur. Notable issue in results is that the market reaction on the announcement day is much lower in German market compared to U.S market, as the ability of managers to use stock splits as a signal to market for future profitability of the company is limited by legislation. (Wulff 2002)

The German stock corporation code (8 Aktiengesetz) has restrictions, which limits German companies from splitting their stocks. As the stock split increases the number of shares, the par value of the share will reduce accordingly. The section 8 of the German Stock Corporation Act requires minimum par value per share. The minimum par value was marked down from 50 DM (Deutsche mark) to 5 DM in 1994, leading immediately increasing number of stock splits. (Wulff 2002) The idea of this regulatory reform in 1994 was to improve the attractiveness of German stocks, especially to strengthen the position in international capital markets (Bley 2002). For the stock splits, this led to increasing number of splits (Wulff 2002). However, companies can have no-par value shares and par value shares. Par value shares must today have a value of at least one euro and non-par value shares represent equal portions of the share capital, which the portion allocated for individual share cannot be lower than one euro. In conclusion, par value shares and non-par value shares are regulated equally, and may restrict companies from splitting stocks. (Bundesministerium der Justiz und fur Verbraucherschutz 2020) Further splits are not possible, once the stock is traded at the minimum par value (Wulff 2002).

Bley (2002) researches stock splits with smaller sample in German market during 1994−1996. The study includes only 10:1 splits after a legislative initiative in 1994 to improve the attractiveness of German stock market over international investors. The study is executed with the event study methodology and splits are divided into two groups by market capitalization. Bley (2002) reports decrease in daily trading volume for high market capitalization stocks and suggests inverse correlation between the change in trading volume and firm size. Unlike Wulff (2002), Bley (2002) was unable to find any significant abnormal returns around the announcement day to imply positive market reaction on splits. Andres, Betzer, van den Bongard, Haesner and Theissen (2013) instead research market reaction on dividend announcements in German market. They found significant share price reactions after the dividend announcements and evidence to support dividend clientele effects. (Andres et al. 2013) As the split can be seen as an alternative for dividends, the market reaction could be expected to be positive on splits as well. Wulff (2002) argues that unlike stock splits, dividends can reduce the financial flexibility of a company and suggests that the signaling content of a German dividend announcement should be higher than that of a split announcement.

In Germany stock splits have been executed the fifth most in Europe during 2000−2019, as can be seen in appendix 1. In UK 1000 splits have been executed in this particular period which is the highest in Europe and substantially more compared to German 274 splits. In Sweden 592 splits have been executed which is the second most in Europe and considerably more compared to Germany as well. It appears that in total splits are executed above the European average (120) in Germany. Therefore, motivation to execute splits in Germany exists as the split execution rate is above the European average.

There are increasing evidence that the split announcement is followed by a positive market reaction. However, uncertainty still exists among previous research about the market reaction on stock splits on the execution day as some of the studies have not found any significant stock price reaction after the announcement day (Fama 1998) and some have (Huang et al. 2015; Lamoureux & Poon 1987). Surprisingly, stock splits have not been either common research subject in German market although splits are executed there above the average in Europe. Previous researches in German market have also concentrated on the same period and any recent studies in 21st century have not been executed to the knowledge of the author. Results of the previous research in German market have not been fully consistent with each other either, which makes it important to research more. As the market reaction has been reported to be stronger for the companies executing split at the higher split ratios (Kalotychou et al. 2009; McNichols & Dravid 1990) and little is also known about the effects of split ratio on abnormal returns in German market, this research aims to fill this gap as well.

1.3 The aim of the study and research questions

The aim of this study is to research short-term stock price reaction on stock splits from 2000 to 2019 in German market. Companies selected for this study are listed companies in the Frankfurt Stock Exchange which have intended to increase their share capital. Earlier introduction has given several reasons to research stock splits and the stock price reaction on splits. This paper focuses to research stock price reaction around both on the announcement day and the execution day. Especially the interest is to research the stock price reaction on the two event days in this study, the announcement day of the split and the split execution day. The announcement day is defined as a day when the company announces the forthcoming split and the execution day is defined as an actual split date. In this paper the stock price reaction on stock splits is analysed with three research questions. First of them focuses on to research stock price reaction on the announcement day of the split. The first research question of the study is defined as follows:

1. *Is the split announcement followed by a positive stock price reaction?*

As uncertainty still exists about the market reaction on the execution day, the second research question has its focus on this. The second research question of the study is defined as follows:

2. *Do stock splits generate abnormal returns on the execution day?*

Previous researches have argued that the stock price reaction is stronger for the companies that execute split at the higher split ratios (Baixauli 2007; Kalotychou et al. 2009; McNichols & Dravid 1990). As little is known about the effects of split ratios on abnormal returns in German market it makes it important and interesting phenomena to research more. The third and last research question of the study is:

3. *Does the split ratio have an effect on abnormal returns?*

1.4 Limitations

This paper has its focus on to research listed companies in Frankfurt Stock Exchange in German market. Other exchanges are excluded from this study. The stock price reaction for stock splits is studied from January 2000 to December 2019. Stock splits seem to be rare phenomena in the market and to ensure sufficient number of observations for event study the time period is selected to be wide. As the study will focus on to research only splits from German companies that are increasing the share capital, reverse splits are excluded from this study. execution rate is above the European average.

This study investigates the market reaction only in short-term using a 11-day event window. Consequently, the long-term market reaction is excluded from this study. As limitations for finding reliable split announcements occurred, this study has its focus on to research only splits that are available in Thomson One database.

1.5 Structure of the paper

The overall structure of this research takes the form of five chapters. Chapter two begins by laying out the theoretical framework of the study, introducing the main hypotheses to explain split executions and market reaction on them. As the splits can be seen as an alternative for dividends in German market the clientele effect theory has been taken also under review. Chapter two ends by the definitions of the research hypotheses taken in this study.

After the theoretical framework has been introduced and the research hypotheses of this study are defined, the paper proceeds to the empirical part of this study. The third chapter is concerned with the methodology used for this study and introduces the data. In chapter four the results of the empirical study are presented. The last chapter of the study summarizes the results and highlights the main findings of this study, and compares the findings to previous research and other European market areas as well. The further research ideas are also suggested in the last chapter.

2. THEORETICAL FRAMEWORK

Chapter two begins by laying out the theoretical framework of the research. There are mainly three hypotheses to explain the motivation of the company for splitting its stocks: trading range hypothesis (known also as liquidity hypothesis), signaling hypothesis and tick size hypothesis. Trading range hypothesis suggests that by splitting stocks of the company managers intend to decrease the stock price to an optimal price range and to increase the liquidity of the stock. The signaling hypothesis proposes that managers use stock splits as a signal to market that the company is expected to enjoy increasing income as the tick size hypothesis instead suggests that managers are using stock splits in order to obtain that the minimum tick size is optimal relative to the stock price. (Guo et al. 2008) Other theories that are relevant for this study are efficient market hypothesis and clientele effect theory. The remaining part of this chapter proceeds as follows: the theories are introduced and discussed with previous studies and afterwards the research hypotheses of this study are defined.

2.1 Trading range hypothesis

Trading range hypothesis suggests that by splitting the stocks of the company managers intend to decrease the stock price to an optimal price range (Guo et al. 2008). Stock splits tend to be executed when the stock price is high and over the optimal price range. Traded stock in this optimal range is assumed to have lower brokerage fees as a percent of value traded and for that seem to be more liquid. The optimal price range is considered as a compromise between a willingness of small investors who intend to minimize odd-lot brokerage costs if securities are low-priced, and the willingness of institutions and wealthy investors who intend to minimize brokerage costs if securities are high-priced. (Copeland 1979) Baker and Gallagher (1980) executed a survey that was sent to chief financial officers of companies listed in New York Stock Exchange. The results present that managers tend to keep stock prices in an optimal price range using stock splits and to increase the number of shareholders. Managers also tend to believe that by increasing the number of shares outstanding, stocks seem more attractive to investors. In the paper Baker and Gallagher (1980) also argue that by executing stock split managers tend to increase the ownership base and marketability. Interesting observation is that managers seem to be more concerned on small investors compared to institutional investors. (Baker & Gallagher 1980)

Trading range hypothesis is also known as a liquidity hypothesis. The hypothesis suggests that managers are using stock splits to decrease stock price at lower level and improve the liquidity of the stock. Stock prices at lower level attract new small investors to markets and thus the liquidity of the stock increases. (Banerjee & Banerjee 2012) Small investors tend to prefer stocks at lower price more than high-priced stocks (Guo et al. 2008). The theory suggests that after split the liquidity will always improve because there is increase in the number of shares outstanding. Dennis and Strickland (2003) found evidence in their recent research that support the liquidity hypothesis. The study includes stock split announcements from companies that trade on American Stock Exchange (AMEX), the New York Stock Exchange (NYSE) or Nasdaq from 1990 to 1993. Dennis and Strickland (2003) argue in the paper that liquidity gains occur for companies that split their stock. Interesting finding is that results indicate that liquidity gains are contingent on the level of institutional ownership and liquidity before the split. (Dennis & Strickland 2003) Huang et al. (2015) instead report increasing liquidity significantly around the stock split announcement but after the execution day, the liquidity decreases below the pre-split level. In the paper they argue that the liquidity impact tends to be therefore short-lived. (Huang et al. 2015)

Guo et al. (2008) report in their study that the number of trades increase substantially after the split. They argue that the stocks are traded more actively only on small trades (Guo et al. 2008) which implies similar findings with Baker and Gallagher (1980), and Yagüe and Gómez-Sala (2005). Guo et al. (2008) report also that there are increase both in trades and quotations, and in market liquidity and the findings are highly consistent with the hypotheses. Unthought Guo et al. (2008), Copeland (1979) and Lamoureux and Poon (1987) report decrease in liquidity after the split which appears to be anomalous. Wulff (2002) researches the validity of liquidity hypothesis in German market. He argues in the paper that despite there is increase in liquidity after the split, he cannot find evidence to support the liquidity hypothesis in German market in his research. He suggests that it appears that the improved liquidity is not valued by the market participants. (Wulff 2002)

2.2 Signaling hypothesis

Second one of the hypotheses as well as one of the most researched one, to explain the motivation of managers to split stocks is a signaling hypothesis. The signaling hypothesis proposes that managers use stock splits as a signal to market that the company is expected to enjoy increasing income (Guo et al. 2008). As managers have private information about the value of the company, asymmetric information exists in markets. The signaling hypothesis suggest that the asymmetric information should be reduced after stock split. (Banerjee & Banerjee 2012) One of the foremost researches in this research field is by Fama et al. (1969). They research, is there any abnormal behaviour in the return rates of stock in the months surrounding the split. They argue in the paper that stock market seems to react rapidly to new information on the announcement day which is consistent with the idea of signaling hypothesis. As noted in the first chapter, Fama et al. (1969) also suggest that stock market recognizes splits related to higher dividend payments and uses the announcement to re-estimate the flow of expected income from the shares. (Fama et al. 1969)

Banerjee and Banerjee (2012) report strong evidence that supports the signaling hypothesis. Their research includes 664 splits from 2002 to 2008 in Indian markets. In the paper they argue that Indian managers tend to use splits as a signal to markets about the expected future profitability of the company, as they found significant and positive stock price on the announcement day of the split. (Banerjee & Banerjee 2012) Guo et al. (2008) report also findings that support the signaling hypothesis. They suggest in the paper that in a condition of a semi-strong form of market efficiency, the announcement of split will affect uninformed investors and actuates them to purchase the stock in the short-term. The results also indicate that investors are more likely to buy stocks than sell them. (Guo et al. 2008) Yagüe et al. (2009) research also the validity of the signaling hypothesis and found positive stock price reaction on the announcement day in Spanish market. They argue in the paper that managers use stock splits as a signal to market the future profitability of the company (Yagüe et al. 2009) which implies similar findings with Guo et al. (2008) and Banerjee and Banerjee (2012).

2.3 Tick size hypothesis

The tick size hypothesis suggests that managers are using stock splits in order to obtain the optimal minimum tick size relative to the stock price. The hypothesis suggest that the optimal tick size attracts liquidity providers, or uninformed traders, to participate in transactions. (Guo et al. 2008). Companies can affect the tick size, or the relative minimum price variation, of their stocks with stock splits. Angel (1997) suggests that stock splits can be used to expand the relative tick size and increase it to the optimal level. Angel (1997) also reports evidence that the optimal relative tick size exists in stock markets and could be used to balance the profits of increased liquidity against the higher costs paid by liquidity demanders. (Angel 1997) It is suggested that stock splits will expand clientele as splits will increase relative tick sizes back to the optimal level. Lipson and Mortal (2006) argue that optimized liquidity will tempt more traders, both institutions and individuals to the stock markets which implies similar findings with Guo et al. (2008). They also suggest that optimized liquidity tends to lead to more analytic following as analysts prefer to follow more active stocks. (Lipson & Mortal 2006)

Tick size varies among countries but the tick size is remarkably consistent as a percentage of stocks across countries. The majority of the equity markets have either informal customs or formal rules on the minimum price variation. Angel (1997) reports in his research that the smallest relative tick sizes were noted in Germany in January 1994. He suggests in the paper that the regulation of the minimum nominal value per share can be one reason for the small relative tick. (Angel 1997)

2.4 Efficient market hypothesis

According to Fama (1970) market is efficient when security prices always reflect all the available information at any time. When new information arises in markets, the news spread quickly and it should be reflected without delay on stock prices. The efficient market hypothesis is related to the idea of a random walk that is commonly used to describe price series where the subsequent price changes illustrate random departures from previous prices. The logic of the random walk is that if the information is fully reflected on stock prices and the flow of information is unrestricted, then price changes of today and tomorrow are independent and tomorrow's price change will reflect only tomorrow's information. (Malkiel 2003) In short, the prices change only when new information has reached the markets. Market efficiency do not require that market prices are equivalent to the true value of the investment all the time. It represents that departure in market prices from true value are random and unpredictable. (Knüpfer & Puttonen 2018, 168-172)

Fama (1970) defines efficient market with three subsets of efficiency that are weak form, semi-strong and strong form. In weak form stock prices include all the information of historical stock prices. (Fama 1970) Review of past returns does not provide any significant information as it is not possible to predict future returns (Knüpfer & Puttonen 2018, 171). Concern in semi-strong form is whether prices efficiently adapt to other publicly available information, for instance stock splits. Last subset of efficiency is strong form. In strong form, stock prices reflect all the information defined earlier and the relevant information where given groups or investors have monopolistic access. (Fama 1970)

The previous finance literature has seemed to produce various long-term return anomalies. Fama (1988) defends efficient market hypothesis and suggests that apparent overreaction of stock prices to new information is as common as underreaction, as the efficient market hypothesis indicates that the anomalies are chance results. Long-term return anomalies are faint and tend to disappear. (Fama 1998) Malkiel (2003) argue that a generation ago, the efficient market hypothesis was widely accepted in academic research but recently it has encounter criticism about its validity. Some of the financial economist have begun to believe that stock prices are partially predictable and enable investors to earn excess returns. Critics of market efficiency argue that several instances of recent market history exist where market prices have not credible been set by rational investors. It is also suggested that psychological considerations have played the significant role. (Malkiel 2003)

2.5 Clientele effect theory

Stock splits can be seen as an alternative for dividends of the company as shareholders will receive capital gains after the split in efficient market. Clientele effect theory suggests that individual investors prefer low-dividend-paying stocks as the dividend tax rate is higher for individual investors than corporate investors. It is suggested that corporate investors prefer more high-dividend-paying stocks based on the theory but it does not necessarily mean that higher dividends are desired. Different tax rates can be a criterion for the choice of desirable level of the cash flow but it cannot determine the optimal level of cash flow on each day. Unlike dividend tax rates, tax rates on capital gains tend to be higher for corporate investors than individual investors. (Mori 2010) Mukherji, Kim and Walker (1997) propose that stock splits will reduce the equilibrium expected return as the investors under higher taxation are more likely to trade off the increased tax-option value of the stock against a decrease in the return. This predicts a clientele shift to individual shareholders, who are under higher taxation, from institutional shareholders, who are either under low taxation or tax-exempt. Consequently, stock splits should decrease the number of institutional investors and increase the number of individual investors. (Mukherji et al. 1997)

Lamoureux and Poon (1987) report similar findings with Mukherji et al. (1997) and propose that the expected return under high tax-bracket decreases as investors are more likely to forego return in exchange for the tax option. They also show in their study that the splits tend to be followed by positive market reaction because of its tax-option impact. (Lamoureux & Poon 1987)

2.6 Research hypotheses

There are several hypotheses to explain the announcement effect on stock splits, such as trading range hypothesis which suggest wealth gains to investors because of the liquidity impact of splits (Wulff 2002). Signaling hypothesis suggests that managers have private information about the value of the company (Banerjee & Banerjee 2012) and stock splits are used as a signal to market that the company is expected to enjoy increasing income (Guo et al. 2008). It is suggested that the split announcement is followed by a positive stock price reaction as market recognizes split as a positive information flow. Related to efficient market hypothesis all the new available information should be reflected immediately on stock prices. (Fama 1970) Clientele effect theory suggests positive stock price reaction on the split announcement day as well, because of its tax option impact (Lamoureux & Poon 1987). The tick size hypothesis assumes as well that the split is followed by a positive stock price reaction as it decreases relative tick size back to an optimal level and therefore attracts investors. Based on the hypotheses, the stock price reaction on German stock splits could be expected to be positive. First research hypothesis of the study is defined as follows:

H1: The split announcement is followed by a positive stock price reaction

Related to the efficient market hypothesis all the new available information should have been reflected immediately on stock prices on the announcement day of the split and abnormal returns should not be reported on the execution day (Fama 1970). Based on this, stock splits should not generate abnormal returns on the execution day. Second research hypothesis is defined as follows:

H2: Stock splits do not generate abnormal returns on the split execution day

According to trading range hypothesis, managers use their private information about the company to set the split ratio which allows investors to make inferences about this private information from the observed split ratio (McNichols & Dravid 1990). Hypothesis suggest as well that managers intend to use stock splits to decrease the stock price to an optimal price range and with this attract new investors, especially small investors. Theories suggest that small investors tend to prefer stocks at lower price more than high price. (Guo et al. 2008) When the split ratio is higher, stock prices will decrease more. Higher split ratios contain stronger signaling effect and are seen more valuable in stock market and therefore the stock price reaction is stronger for them (McNichols & Dravid 1990). Based on the hypotheses the stock price reaction on German splits could be expected to be stronger for the companies executing split at higher split ratios. The last research hypotheses of the study are defined as follows:

H3: If H1 is accepted, higher split ratios have higher stock price reaction

H4: If H2 is rejected, higher split ratios generate higher abnormal returns

3. RESEARCH METHODOLOGY

This chapter covers the methodological approach taken in this study and presents the data as well the exclusions. As the purpose of this study is to research the short-term stock price reaction on stock splits, the methodological approach taken in this study is the event study methodology with market model approach. Data for this study is collected from Thomson Reuters Datastream and Thomson One database. First the final data is presented and described with graphs. After that the event study methodology is presented and finally the problems with event study methodology are discussed.

3.1 Data

The data used in the study has been collected from Thomson Reuters Datastream and Thomson One database. As noted earlier, this study has its focus on to research listed companies in Frankfurt Stock Exchange. The split announcements have been collected from Thomson One database from January 2000 to December 2019. As limitations for finding reliable split announcements occurred, this study focuses on to research only splits that are available in Thomson One database. In particular, however, it is worth mentioning that as the split announcements have been collected only from Thomson One database, the actual number of splits in Germany might be higher if not all the announcements are available in Thomson One. The execution dates and the announcement dates have been obtained from Thomson One database, as well as the split ratios. For few announcements, unclear information occurred for the split ratios, in which case Thomson Reuters Datastream was used to obtain available data.

In total, 274 split announcements were found in Germany from January 2000 to December 2019. Noteworthy is that these 274 involves splits also for other exchanges than Frankfurt Stock Exchange. After removing splits from other exchanges, 176 split announcements were found for listed companies in Frankfurt Stock Exchange. As the study does not focus on to research reverse splits, 85 split announcements had to be eliminated from the sample leaving 91 splits to study.

From the 91 splits sample, 12 were eliminated because of the data limitations. Other significant news of the companies during the event window were noted as this study focuses on to research only pure splits. Other significant news, such earnings announcements, were announced along with 22 splits in the sample. For gathering only pure splits to study the final data consists of 57 splits which are executed by 49 companies.

In figure 1, distribution of the splits during the research period has been visualized. The vertical axis describes the number of splits as the horizontal axis describes the year. As can be seen there seems to be clear relation between splits and economic development. Splits tend to be executed on uptrend which is consistent with the findings of Minnick and Raman (2014). At the beginning of the 21st century just before the IT-bubble, splits seem to be executed widely. Similar observations can be noticed just before the Financial crisis and economic collapse, as well as with the Dept crisis after the Financial crisis. The peak of splits can be observed on 2000 and 2006 when seven splits were executed on both years as the lowest observations can be observed just after the economic collapse in 2002 and 2009 as well as also some other years after the Financial crisis. In 2004 zero splits were executed based on the data of this study. After the Financial crisis splits seem to be much more rare phenomena in German market which could be explained with the economic difficulties faced by Germany. All the global crises have affected German economy as well as the German companies.

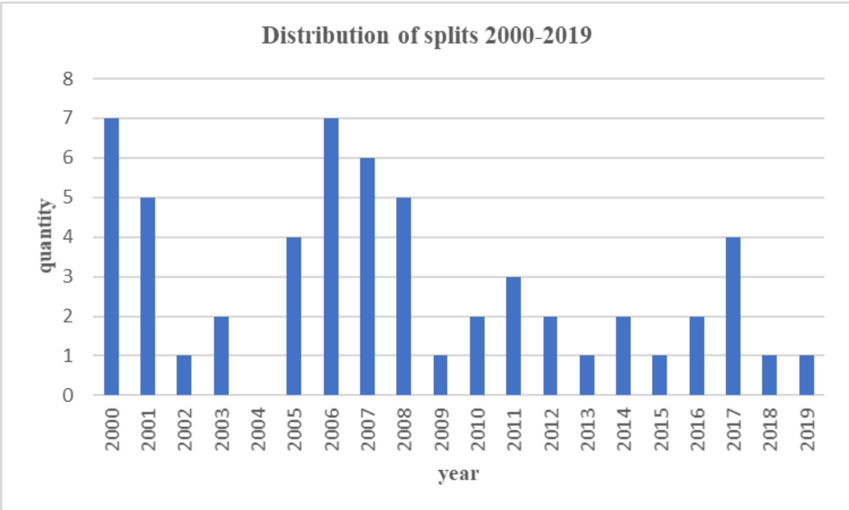

Figure 1 Distribution of splits 2000-2019

Figure 2 presents the executed splits by split ratios between 2000 and 2019. The vertical axis describes the number of splits executed as the horizontal axis describes split ratio. As can be seen in Germany 3:1 split has been favoured the most along with 24 splits executed. German companies also seem to favour 2:1 split as it has been executed the second most. Considerable is that from the higher split ratios, German companies seem to prefer 10:1 split but considerably higher split ratios appear to be preferred less which can be consequence of the required minimum par value per share in Germany.

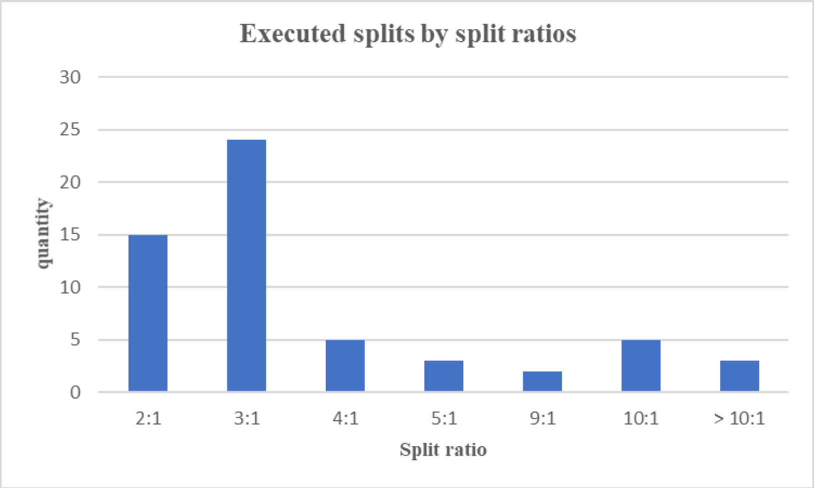

Figure 2 Executed splits by split ratios

For the study splits were divided into three categories by split ratios. This enables analysing the differences between categories and draw conclusions from the impacts of split ratios. In table 1 the categories are presented. Category one involves 2:1 splits along with 15 splits executed as category 2 involves 3:1 along with 24 splits. Category three involves all the remaining splits higher than 3:1 as the analysis of individual split ratios would not have been no longer sensible as the quantity of splits decreased considerable for higher split ratios. Category 3 involves 18 splits.

Table 1 Split categories

	Split ratio	**number of splits**
Category 1	2:1	15
Category 2	3:1	24
Category 3	> 3:1	18

Daily stock prices used in the study are the closing prices from each exchange day which either do not include dividends or splits. DAX 30 Performance index was used as a benchmark index in this study. The DAX 30 is the leading index for the stock market in Germany which involves the 30 most liquid and the largest Prime Standard companies listed in the Frankfurt Stock Exchange (Qontigo 2020) and is well suitable for this study. The daily scores of market index and the daily stock prices were collected from Thomson Reuters Datastream.

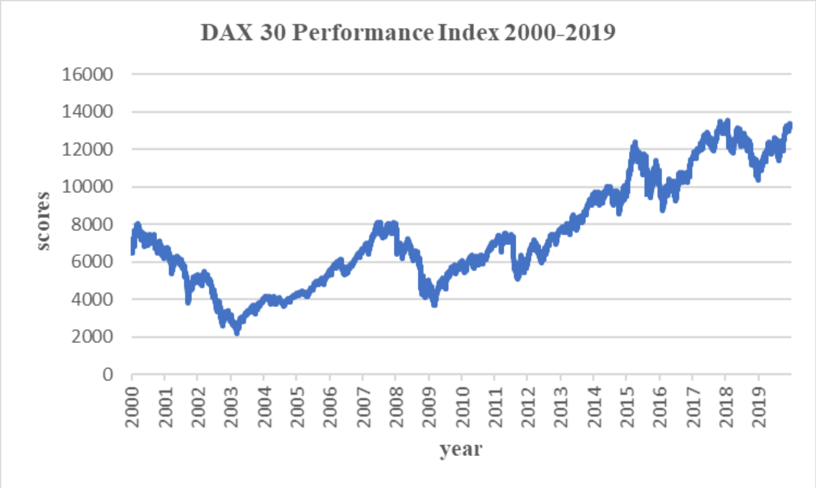

Figure 3 DAX 30 Performance Index 2000-2019

In figure 3, the DAX 30 Performance index has been visualized during the research period. The vertical axis describes daily scores of index as the horizontal axis describes the year. As can be seen from figure 3 the years after the IT-bubble and the Financial crisis have not been successful for the stock market development. Clear upward and downward trends can be observed from the figure. Also noteworthy is that splits seem mostly to follow same pattern as market, when the market rises splits increase and wise versa on the downward trends.

3.2 Event study

The event study methodology is commonly used in finance literature and has many applications. The majority of the applications have focused on the effect of a specific event on the price of a certain class of securities of the company, generally common equity. (MacKinlay 1997) Much of the previous research has used event study for estimating abnormal returns as well testing their significance (Armitage 1995). The advantage of the event study relies on market efficiency as the effects of a certain event are expected to reflect immediately in prices of securities (MacKinlay 1997). Wells (2004) proposes also that the event study methodology assumes that individual stock returns are predictable to some degree. For that it is proposed that relevant investment strategies can be based on the information given from the results on relatively short period and managers can take advantage of the results in decision making as well (Vaihekoski 2004, 230).

Event study investigates the impact of a specific exogenous event on the value of a company (Vaihekoski 2004, 230), using financial market data. For conducting an event study, an initial task is to specify the event of interest and identify the time period over which the security prices of the company included in this event will be examined. This is referred to as an event window. The event window is more often defined to be wider than the certain period of interest in order to examine periods surrounding the event. Generally, the interest is also to examine especially period before the specific event. Sometimes the period after is also an interest to examine depending on the sensibility of the event and circumstance. The minimum event window involves at least the day of the announcement and the day after the announcement. (MacKinlay 1997) The typical event window is 10 days before and 10 days after the event [-10, +10] or five days before and five days after the event [-5, +5] (Brown & Warner 1985; Vaihekoski 2004, 231). After specifying the event window, the other significant news of the company shall be review. The event window should be cleared from other news expect the one under investigation. (Campbell, Lo & MacKinlay 1997, 151) In addition, that the event window needs to be defined, it is necessary to define an estimation window. The period prior to event window is most often used for the estimation window which is commonly 120−250 days (MacKinlay 1997; Vaihekoski 2004, 231).

In this research a 11-day event window [-5, +5] is used to analyse short-term stock price reaction on stock splits. As investigating the stock price reaction on the announcement day of the split, the event day is the day when the company announces the forthcoming split. While investigating instead the stock price reaction on the execution day, the event day is the actual split date when the split will be effective. The estimation window used in this study is 250 days prior the event window. In figure 4, estimation window and event window have been visualized. τ is the event date both on the announcement day and on the execution day as the length of the estimation window and event window are same on both research periods.

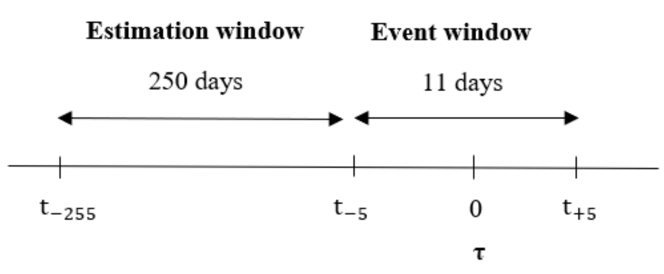

Figure 4 Time line for event study (MacKinlay 1997)

In order to measure the impact of the certain event it is required to measure abnormal return. The abnormal return is defined as the ex-post return of the stock over the event window subtracted from normal return of the company over the event window. The normal return is specified as the expected return without the certain event of interest taking place (MacKinlay 1997). In the event study the methodological approach is to remove the expected return from the actual return of the stock and research the remaining residual (Vaihekoski 2004, 230). Abnormal return for any given company *i* and event date τ is:

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau) \tag{1}$$

In formula 1, $AR_{i\tau}$ is the abnormal return for company *i* and $R_{i\tau}$ is the actual return while $E(R_{i\tau}|X_\tau)$ is the expected returns respectively for period τ. For the expected return model X_τ is the conditioning information. (MacKinlay 1997)

There are three choices for modelling the expected returns. These models are the constant mean return model, the market adjusted return model and the market model. (Brown & Warner 1985) The market model presumes that there is a stable linear relation between the security return and the market return, while the constant mean return model assumes that the mean return is constant through time (MacKinlay 1997). According to Brown and Warner (1985) the market model is relatively efficient and well-specified under a wide array of conditions. It is proposed that the market model is the best to model the expected returns in event studies supported by the evidence (Armitage 1995). It is also suggested that the market model represents improvement over the constant mean return model. In the market model approach, the variance of the abnormal return is reduced as the portion of the return related to variation in the return of market will be removed. This has been proved to lead to increased ability to observe event effects. (MacKinlay 1997)

3.2.1 Measuring normal and abnormal returns

In this study, the market model approach is applied to estimate the expected returns as it has been the best to model them related to previous studies (Armitage 1995). The initial stage of the study is to determine the returns for each company *i* and the return of market *m*. The returns are calculated from daily closing stock prices with the following formula:

$$R_{it} = \ln\left(\frac{P_{it}}{P_{it-1}}\right) \tag{2}$$

Where R_{it} is the actual return for company *i* on period *t*. P_{it} is the closing price on period *t* for company *i* and P_{it-1} is the closing price for company *i* on the day before *t – 1*. *ln* is the natural logarithm. As calculating the market return, calculation follows the same pattern as above, expect the R_{it} is replaced by R_{mt}. In this study the DAX 30 Performance Index is used to calculate the market return:

$$R_{mt} = \ln\left(\frac{P_{mt}}{P_{mt-1}}\right) \tag{3}$$

In formula 3, R_{mt} is the return of market m on period *t*. P_{mt} is the closing price on period *t* for market *m* and P_{mt-1} is the closing price for market *m* on the day before $t-1$. After calculating the actual returns the following stage of estimation is to measure Alpha and Beta from daily actual returns for each company using the following market model regression:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{4}$$

In formula 4, R_{it} and R_{mt} are the returns of period *t* for stock *i* and the market respectively. α_i and β_i are the Alpha and Beta parameters of the market model, and ε_{it} is the error term. The α and β are estimated from the estimation period (MacKinlay 1997; Vaihekoski 2004, 232) that is in this study earlier mentioned 250-days prior the event window. The market model Beta is the measure of a stock's market risk relative to the average risk. β < 1 indicates lower risk as β > 1 indicates higher risk. (Wells 2004) After estimating α and β the following step is to estimate expected returns. Expected returns are estimated for each day on estimation window and event window using the Capital Asset Pricing Model (CAPM):

$$E(R_{it}) = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{5}$$

In formula 5, R_{it} is the expected return for stock *i* on period *t* as R_{mt} is market return on period *t*. ε_{it} is the zero mean disturbance term and variables α_i and β_i are the market model parameters. After estimating the expected returns for each stock, the daily abnormal returns are estimated with the following formula:

$$AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \tag{6}$$

Where AR_{it} is the daily abnormal return for the stock *i* on time *t*. Abnormal return is simply estimated by reducing expected return from actual return. After estimating the daily abnormal returns for each stock, the average abnormal return (AAR) can be estimated for each day on the event window. Average abnormal returns are estimated with the following formula:

$$\mathrm{AAR_t} = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \tag{7}$$

In formula 7, AAR_t is the average abnormal return on period *t*. *N* is event number which is in this study the number of splits. AR_{it} is the abnormal return for each stock *i* on period *t* calculated in formula 6.

In addition, that the interest is on testing individual daily returns most often the interest is also explore behaviour of returns on certain period. In order to proceed this, the returns need to be aggregated through time. Therefore, the concept cumulative abnormal return (CAR) becomes under consideration. (Vaihekoski 2004, 233) Cumulative abnormal return is the sum of involved abnormal returns from period t_1 to t_2:

$$CAR(t_{1,}t_2) = \sum_{t=t_1}^{t_2} AR_t \tag{8}$$

Where $CAR(t_{1,}t_2)$ is the cumulative abnormal returns from period t_1 to t_2 and AR_t is the abnormal return on period *t*. In order to conclude general assumptions about the results cumulative average abnormal return (CAAR) is estimated as follows:

$$CAAR(t_{1,}t_2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i(\,t_{1,}t_2) \tag{9}$$

In formula 9 $CAAR(t_{1,}t_2)$ is the cumulative average abnormal return from period t_1 to t_2.

3.2.2 Statistical testing

According to Armitage (1995) the evidence favours t-test in event studies to test the statistical significance of the abnormal returns. In this study the cross-sectional t-test based on t-distribution is used to test the significance of abnormal returns as the estimation window is different for each event. In other words, events do not occur during the same period for each company. The null hypothesis (H0) is that the certain event of interest has no impact on the behaviour of the returns. The test statistics for testing the significance of the individual daily abnormal returns is:

$$t_{AAR_t} = \sqrt{N}\,\frac{AAR_t}{\sigma_{AAR_t}} \tag{10}$$

In formula 10 AAR_t is the average abnormal return on period *t*, *N* is the number of splits and σ_{AAR_t} is the standard deviation of the abnormal returns on period *t* which is defined as a square root of the sample variance:

$$\sigma^2_{AAR_t} = \frac{1}{N-1}\sum_{i=1}^{N}(AR_{i,t} - AAR_t)^2 \tag{11}$$

Where N is the number of splits. In order to test the significance of the cumulative average abnormal returns in different periods, test statistics for CAAR is:

$$t_{CAAR_t} = \sqrt{N}\,\frac{CAAR(t_{1,}t_2)}{\sigma_{CAAR_{(t_1,t_2)}}} \tag{12}$$

In formula 12, $CAAR(t_{1,}t_2)$ is the cumulative average abnormal return from period t_1 to t_2, N is the number of splits and $\sigma_{CAAR_{(t_1,t_2)}}$ is the standard deviation of the cumulative abnormal returns from period t_1 to t_2 which is defined as a square root of sample variance:

$$\sigma^2_{CAAR_{(t_1,t_2)}} = \frac{1}{N-1}\sum_{i=1}^{N}(CAR_t - CAAR_t)^2 \tag{13}$$

In the following chapter, the p-value is calculated from t-distribution and it is used to describe the statistical significance of the abnormal returns. P-value is the smallest significance level to reject the null hypothesis. Significance levels in this study are 0.01 (1 %), 0.05 (5 %) and 0.1 (10 %). If p-value is under the selected significance level, the null hypothesis (H0) can be rejected and event has statistically significant impact.

3.2.3 Problems with event study methodology

Event study is widely used in the research field of finance, however as well as the other research methods it involves some problems that need to be considered. The major problem is related to the definition of exact date of the event. According to Vaihekoski (2004, 236) the author has to often take advantage of subjective judgement in decision making of the event day. For instance, the decision of the exact event day of dividend announcement and split announcement is mostly made between the proposal and the decision of the general meeting. (Vaihekoski 2004, 236) The definition of the event day is vital for obtaining reliable results. According to MacKinlay (1997) one cannot however be certain has the new information reached market before the event day which is one of the problems with event study.

According to Vaihekoski (2004, 236) the event study assumes that the events are distinct from other events. However, it is possible and not unusual that companies announce several significant news at the same time. Market reaction may therefore be result of the other news of the company rather than the certain event under investigation and falsify the results. On the other hand, the assumption of the distinct events refer that events are independent and uncorrelated. (Vaihekoski 2004, 236) MacKinlay (1997) suggests also that the daily stock prices used in event study for calculating returns are mostly closing prices from each day. Therefore, it is incorrectly and implicitly assumed that the stock prices are equally set at 24-hour interval. (MacKinlay 1997) The event study assumes also that the beta of the market model is constant through time (Wells 2004). However, some of the previous studies suggest that betas of the event period may differ from estimation period betas and for that the assumption of the constant beta may falsify the results (Armitage 1995).

Maynes and Rumsey (1993) argue that results from event study can be strongly affected by return measurement errors as well, which may occur when trading is thin. Wulff (2002) suggest that the proportion of infrequently traded shares is higher in German market than in the U.S. market and argues that return measurement errors may occur using German market data. (Wulff 2002)

4. RESULTS

In this chapter the results of the event study are presented. The short-term stock price reaction was examined on two different event dates, the split announcement day and the split execution day using 11-day event window. The process followed the event study methods shown in chapter 3 for both events. Same length of estimation window and event window were used in both research periods. Event study was first executed for total sample which included 57 splits in order to make general assumptions. After that same was replicated for each category presented in chapter three in table 1 in order to conclude the effect of split ratio on abnormal returns. The statistical significance was tested for daily average abnormal returns (AAR) on each day during the event window and for cumulative average abnormal returns (CAAR) on seven different periods.

4.1 Stock price reaction on the announcement day

In table 2 the results of the average abnormal returns for the individual days during the event window are presented. As can be seen abnormal return is statistically insignificant for total sample on the split announcement day which is consistent with findings of Wulff (2002) as he reports insignificant daily abnormal return also on the event day in German market as well. For total sample only five days prior the event day AAR is statistically significant at level 10 % and similar findings can be noticed in category 3. It appears that German market predicts split announcement to some extent as positive abnormal returns are observed prior the event day. For category 2 which involves 3:1 splits statistically significant AAR is found on the announcement day at level 5 % which implies that German market appears to react to 3:1 split announcement positively. In category 2, AAR is also significant and positive (0.63 %) two days after the event day. Results in category 3 as well as in category 1 show that AAR is negative on the event day implying negative market reaction on the split announcement but nonetheless insignificant. Results in category 1 present also significant and negative AAR four days prior the event day in addition that AAR is mostly negative in this category during the event window. Results suggest that on the announcement day there is not a significant immediate stock price reaction on German split announcements, except in category 2 where the reaction is highly significant and positive.

Table 2 Daily average abnormal returns (AAR) of the split announcement. Statistical significance levels are presented: *** 1% level, ** 5% level and * 10% level.

	Total sample (n=57)			*Category 1 2:1 (n=15)*			*Category 2 3:1 (n=24)*			*Category 3 > 3:1 (n=18)*		
Event day	*AAR*	*p-value*		*AAR*	*p-value*		*AAR*	*p-value*		*AAR*	*p-value*	
-5	0.413 %	0.076	*	0.036 %	0.911		0.671 %	0.180		0.382 %	0.061	*
-4	-0.245 %	0.282		-0.930 %	0.062	*	0.437 %	0.260		-0.585 %	0.033	**
-3	0.068 %	0.837		1.070 %	0.319		-0.357 %	0.308		-0.202 %	0.539	
-2	0.061 %	0.923		-1.579 %	0.401		0.129 %	0.633		1.338 %	0.285	
-1	0.310 %	0.274		0.715 %	0.320		-0.015 %	0.966		0.407 %	0.430	
0	**0.309 %**	**0.397**		**-0.325 %**	**0.524**		**1.055 %**	**0.024**	**	**-0.156 %**	**0.862**	
1	0.082 %	0.747		-0.302 %	0.384		0.159 %	0.734		0.301 %	0.511	
2	0.177 %	0.489		-0.566 %	0.375		0.628 %	0.046	**	0.195 %	0.675	
3	0.457 %	0.214		0.389 %	0.686		0.563 %	0.277		0.370 %	0.509	
4	0.388 %	0.509		1.087 %	0.475		0.625 %	0.122		-0.512 %	0.698	
5	0.127 %	0.701		0.896 %	0.228		0.114 %	0.807		-0.496 %	0.414	

In table 3 the results of cumulative average abnormal returns are presented for different periods. CAARs of the total sample can be seen in figure 5 as well. In this study the stock price reaction were under review on seven different periods which are seen in table 3 on left column where $[t_1, t_2]$ indicates the period under review. For total sample CAAR is positive but nevertheless insignificant during the research period which implies that it cannot be concluded that German market reacts on the split announcement positively. Results in category 2 instead present strong statistical significance at level 5 % on the event day which implies positive stock price reaction on 3:1 splits as noted earlier. In category 2 results also show that 2.4 % post-event [0, +3] CAAR is also significant at level 5 % as well as 3.1 % post-event [0, +5] CAAR which is statistically significant even at level 1 %. Statistically significant and positive post-event CAARs could imply increasing trading activity after the announcement as investors desire to get benefit from splits. However, this can be noted only in category 2. Results in category 1 and 3 show statistically insignificant CAARs on all periods. In German market only 3:1 splits appear to cause any considerable stock price reaction on split announcement. Wulff (2002) found statistically significant 0.74 % [-2, +3] CAAR in German market which is inconsistent of the findings of this study as category 2 is only one to show any significant CAARs on the research period. However, in total Wulff (2002) reports considerably low and mostly insignificant stock price reaction on the split announcement which supports the results of this study.

Table 3 Cumulative average abnormal returns (CAAR) of the split announcement. Statistical significance levels are presented: *** 1% level, ** 5% level and * 10% level.

	Total sample (n=57)		***Category 1 2:1 (n=15)***		***Category 2 3:1 (n=24)***			***Category 3 > 3:1 (n=18)***	
[t_1,t_2]	*CAAR*	*p-value*	*CAAR*	*p-value*	*CAAR*	*p-value*		*CAAR*	*p-value*
[-5,-1]	0.606 %	0.404	-0.689 %	0.757	0.865 %	0.288		1.339 %	0.173
[-3,-1]	0.439 %	0.546	0.205 %	0.932	-0.243 %	0.671		1.542 %	0.120
[-1,+1]	0.702 %	0.218	0.087 %	0.934	1.198 %	0.118		0.552 %	0.664
[0,0]	0.309 %	0.397	-0.325 %	0.524	1.055 %	0.024	**	-0.156 %	0.862
[0,+1]	0.392 %	0.425	-0.627 %	0.256	1.213 %	0.108		0.145 %	0.897
[0,+3]	1.025 %	0.110	-0.804 %	0.485	2.405 %	0.012	**	0.710 %	0.578
[0,+5]	1.540 %	0.173	1.180 %	0.633	3.144 %	0.006	***	-0.298 %	0.909

Results of this study do not truly support the hypothesis that splits are followed by a positive stock price reaction on the announcement day of the split. Only category 2 presents results to support this. Figure 5 shows that investors appear to see splits as a positive impact on their future expectations. However, it appears that German market reacts on split announcement slowly and with a delay as can be seen from figure 5. In conditions of semi-strong form of market efficiency, German market is not working efficiently as the information reflects on stock prices with a delay. According to the findings from this study stock price reaction on split announcement is positive but nonetheless statistically insignificant. The first research hypothesis (H1) of this study is therefore rejected as clear statistically significant differences do not occur on the event day, except in category 2. Results of this study are not truly consistent with previous studies as the abnormal returns have mostly been reported statistically significant on the announcement day and around it as well, pointing to a positive stock price reaction on split announcements. Kunz and Rosa-Majhensek (2008) report positive abnormal returns on the announcement day in Switzerland as Yagüe et al. (2009) found similar findings in Spanish market. Wulff (2002) reports higher abnormal returns for German stock splits that coincide with dividends than pure splits. This study involved only pure splits and the stock price reaction was considerable low and mostly insignificant abnormal returns are found on the event day. Although findings of this study suggest statistically insignificant stock price reaction on the split announcement, economic significance appears to be good as results suggest considerable return for investors especially after the announcement day, as can be seen in figure 5.

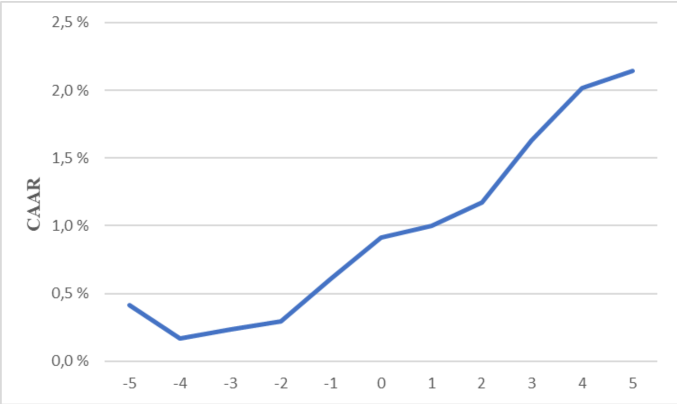

Figure 5 Cumulative average abnormal returns of total sample

Results are not consistent among the categories as category 2 is the only one to present any statistical significance on the event day as well as on the period after, as seen in table 2 and 3. The third research hypothesis (H3) is therefore rejected as well. Findings of this study are not line with the findings of McNichols and Dravid (1990) as they found evidence that changes in stock prices at split announcement is significantly correlated with split ratios. Kalotychou et al. (2009) report strong statistical significance for different groups divided by split ratios except for 2:1 splits in UK market. The results of this study are partly consistent with their findings as this study did not find any statistical significance for 2:1 splits either. However, Kalotychou et al. (2009) report statistical significance for all other split factors. Baixauli (2007) reports similar findings as he found statistically significant abnormal returns only for splits over 2:1 ratio.

4.2 Stock price reaction on the execution day

In table 4 the results of the average abnormal returns for the individual days during the event window are presented. As can be seen AARs are statistically insignificant on the event day for total sample and each category except for the category 2. In category 2 results present 1.4 % statistically significant AAR at level 5 % on the event day. Day prior the event day AAR is also highly significant suggesting 1.0 % abnormal return for 3:1 splits. However, results suggest 0.73 % negative AAR on the day after the split which is statistically significant even at level 1 %. It appears that on the split execution day stock price reaction on 3:1 splits is considerable high causing positive return for investors. Perhaps the most remarkable finding is that on the day after, abnormal return seems to be already negative for 3:1 splits suggesting negative return for investors. Although 3:1 splits seem to make positive returns for investors, benefit of splits appears to be relatively short-lived. In addition, that AAR is negative on the day after the event day, negative and statistically significant AAR is found five days prior the event day as well in this category. However, AAR shifts positive already on the day after.

Table 4 Daily average abnormal returns (AAR) of the split execution day. Statistical significance levels are presented: *** 1% level, ** 5% level and * 10% level.

	Total sample (n=57)		*Category 1 2:1 (n=15)*		*Category 2 3:1 (n=24)*			*Category 3 > 3:1 (n=18)*	
Event day	*AAR*	*p-value*	*AAR*	*p-value*	*AAR*	*p-value*		*AAR*	*p-value*
-5	-0.153 %	0.740	-0.444 %	0.569	-0.761 %	0.029	**	0.739 %	0.551
-4	-0.383 %	0.506	-2.185 %	0.277	0.707 %	0.185		-0.204 %	0.582
-3	0.077 %	0.770	-0.075 %	0.745	0.494 %	0.278		-0.439 %	0.443
-2	0.125 %	0.728	-0.595 %	0.430	0.571 %	0.289		0.255 %	0.710
-1	0.431 %	0.294	-0.578 %	0.656	1.004 %	0.020	**	0.568 %	0.275
0	**0.674 %**	**0.329**	**1.418 %**	**0.114**	**1.396 %**	**0.021**	**	**-0.820 %**	**0.674**
1	0.392 %	0.577	0.960 %	0.402	-0.728 %	0.009	***	1.407 %	0.488
2	0.318 %	0.578	0.677 %	0.683	0.489 %	0.509		-0.088 %	0.911
3	0.171 %	0.828	-0.046 %	0.949	-0.218 %	0.715		0.881 %	0.709
4	0.150 %	0.775	0.856 %	0.395	0.378 %	0.680		-1.049 %	0.185
5	-0.045 %	0.896	0.678 %	0.390	-0.004 %	0.995		-0.508 %	0.371

Cumulative average abnormal returns of seven different periods can be seen in table 5. CAARs of total sample can be seen in figure 6 as well. As it can be noticed from table 5, 1.5 % [-1, +1] CAAR is statistically significant for total sample, yet at level 10 %. Based on the CAARs, German splits seem to generate significant abnormal returns. Results in category 2 show that positive pre-event CAARs occur on period prior the event day which could imply increase in trading activity between the announcement day and execution day which is supported by the findings on the announcement day in this category as well. Statistically significant pre-event [-5, -1] CAAR at level 5 % are found as well as on the event day [0, 0] and around it [-1, +1] alternating between 1.4 % and 2.1 %. Positive 2.1 % pre-event [-3, -1] CAAR is highly significant even at level 1%. Nonetheless CAARs appear to be significant period prior the event day only in category 2. In total, findings of this study suggest significant stock price reaction on 3:1 splits on the split execution day and on the pre-event period as well, in addition that investors seem to get benefit from German 3:1 splits as splits generate considerable high return for investors. In category 1 results show 2.4 % post-event [0, +1] CAAR which is statistically significant at level 10 %. Based on the CAARs results suggest that splits generate abnormal returns in German market, except in category 3.

Table 5 Cumulative average abnormal returns (CAAR) of the split execution day. Statistical significance levels are presented: *** 1% level, ** 5% level and * 10% level.

	Total sample (n=57)			***Category 1 2:1 (n=15)***			***Category 2 3:1 (n=24)***			***Category 3 > 3:1 (n=18)***	
[t_1,t_2]	*CAAR*	*p-value*		*CAAR*	*p-value*		*CAAR*	*p-value*		*CAAR*	*p-value*
[-5,-1]	0.099 %	0.924		-3.878 %	0.183		2.014 %	0.048	**	0.918 %	0.609
[-3,-1]	0.634 %	0.358		-1.248 %	0.482		2.068 %	0.009	***	0.384 %	0.760
[-1,+1]	1.498 %	0.052	*	1.800 %	0.349		1.671 %	0.036	**	1.155 %	0.477
[0,0]	0.674 %	0.329		1.418 %	0.114		1.396 %	0.021	**	-0.820 %	0.674
[0,+1]	1.066 %	0.104		2.378 %	0.060	*	0.668 %	0.326		0.587 %	0.715
[0,+3]	1.555 %	0.119		3.009 %	0.206		0.939 %	0.473		1.380 %	0.461
[0,+5]	1.660 %	0.177		4.542 %	0.179		1.314 %	0.231		-0.176 %	0.941

Figure 6 shows that German splits generate positive abnormal returns close to the event day and after it. It appears that abnormal returns begin to increase significantly two days prior the split execution day and four days after the event day they stabilize, with positive CAAR still remaining. In total, results in tables 4 and 5, and figure 6 suggest that splits generate abnormal returns on the execution day in German market, except in category 3. Therefore, the second research hypothesis (H2) of this study is rejected as clear statistically significant differences occur.

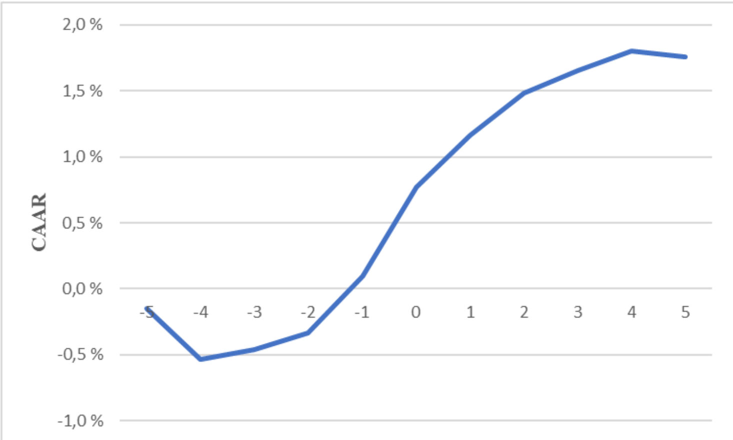

Figure 6 Cumulative average abnormal returns of total sample

Unlike on the split announcement day, the split ratio has statistically significant impact on abnormal returns on the execution day. It appears that split ratio has effect on abnormal returns as the impact is statistically significant in categories 1 and 2 as it can be seen from table 5. Findings in category 2 suggest considerable high and significant abnormal returns as well. Based on the findings, the fourth research hypothesis (H4) is accepted as higher split ratios appear to generate higher abnormal returns. Findings of this study are consistent with the findings of Kalotychou et al. (2009) and Baixauli (2007) as they suggest higher abnormal returns for higher split ratios as well. As noted earlier in this study in category 3, splits do not generate any statistically significant abnormal returns on neither the split execution day or during the event window. Results support the findings of Bley (2002) as he reports insignificant abnormal return for considerably higher split ratio in German market. It appears that to some extent higher split ratios generate higher abnormal returns as the findings from this study present more statistically significant abnormal returns for 3:1 splits than 2:1 splits. However, results in category 3 show that the impact is no longer significant. It should be still noted that category 3 involves more split ratios than just one and the variety in this category is therefore wider which can have effects on results. One possible issue to consider as well is the required minimum par value per share which limits the ability to use considerably higher split ratios in Germany.

The results of this study are mostly in line with previous research in German market as Wulff (2002) found insignificant daily abnormal returns on the execution day as well. However, he reports significant CAAR on period [-1, +1]. Findings of this study support this as well, as significant [-1, +1] CAAR for total sample is found in this study, yet it is significant only at level 10 %. Kalotychou et al. (2009) found positive abnormal returns on the split execution day in UK market and significant post-event CAARs as well, which is inconsistent with the findings of this study as this study did not find any significant abnormal returns on period after the event day expect in category 1. Based on the CAARs of this study, economic significance appears to be good as results suggest considerable high return for investors, as can be seen in figure 6. Statistical significance is found in this study as well, to support that splits generate abnormal returns in German market. As noted earlier efficient market hypothesis states that any stock price reaction on the execution day should not be observed. However, findings of this study show that significant abnormal returns occur on the execution day which implies that in conditions of semi-strong form of market efficiency German market is not working efficiently.

5. CONCLUSIONS

The aim of this study was to research the effect of stock splits on stock prices in German market, more specifically how stock market reacts on split announcements and whether splits generate abnormal returns on the split execution day in short-term research period. Event study was used to measure abnormal returns and cross-sectional t-test to test the statistical significances around both the announcement day and the execution day using 11−day event window. The total sample used in the study involves 57 splits executed by 49 companies during the 2000‒2019 research period. Splits were divided into three categories by split ratios to test the impact of split ratio on abnormal returns as well. The study intends to answer three research questions which were formulated as follows:

1. *Is the split announcement followed by a positive stock price reaction?*
2. *Do stock splits generate abnormal returns on the execution day?*
3. *Does the split ratio have an effect on abnormal returns?*

Based on the theories and previous research this study tested four research hypotheses in order to answer the formulated research questions above. The summary of the results can be seen in table 6.

Table 6 Summary of the results

Hypothesis	**Results**		**Evidence**
	Total sample	**Categories**	
H1: The split announcement is followed by a positive stock price reaction	Rejected	Category 2 Accepted, Categories 1 & 3 Rejected	*Positive stock price reaction is found on the split announcement day but nonetheless abnormal returns are statistically significant only for 3:1 splits on the event day and period after.*
H2: Stock splits do not generate abnormal returns on the split execution day	Rejected	Categories 1 & 2 Rejected, Category 3 Accepted	*Statistically significant [-1, +1] CAAR is found for total sample. Statistically significant abnormal returns are found in categories 1 and 2.*
H3: If H1 is accepted, higher split ratios have higher stock price reaction	-	Rejected	*Clear statistically significant differences are found only in category 2. Categories 1 and 3 do not show any significant results on the split announcement day.*
H4: If H2 is rejected, higher split ratios generate higher abnormal returns	-	Accepted	*Clear statistically significant differences are found in categories 1 and 2. Results in category 3 do not show any significant abnormal returns on the split execution day.*

In this study positive abnormal returns were found for total sample and in category 2 on the announcement day and around it. Results in category 2 show statistically significant 1.1 % AAR on the split announcement day and significant [0, +3], [0, +5] post-event CAARs after the event day pointing to positive stock price reaction on the split announcement. However, clear statistically significant differences are found only in category 2. It appears that only 3:1 splits cause any significant stock price reaction on the split announcement day in German market. Therefore, the answer for the first research question is that the split announcement does not cause significant stock price reaction in German market based on the results of this study. Results of this study suggest that in Germany investors do not see splits as a positive sign from companies about the expected future profitability of the company. Clear assumptions to support the tax-option impact are not found either. As the dividend and capital gain tax rates are same in Germany, it should be considered that investor can be indifferent between dividends and splits as well.

Findings of this study do not support the signaling hypothesis in German market as stock splits appear not to cause any significant stock price reaction on the split announcement day, except for 3:1 splits. This is line with the findings of Wulff (2002) as he found insignificant daily abnormal returns on the announcement day in German market as well. However, Wulff (2002) found statistically significant [-2, +3] CAAR which differs from the findings of this study as statistically significant CAARs were found only in category 2. Previous studies in German market have mostly suggested considerable low market reaction on split announcement compared to other markets suggesting insignificant abnormal returns as well (Bley 2002; Wulff 2002). Findings of this study are consistent with this. Kunz and Rosa-Majhensek (2008) report positive abnormal returns on the announcement day in Switzerland, as Yagüe et al. (2009) found similar findings in Spanish market suggesting positive market reaction on the split announcement as well. Results of this study as well as previous studies in German market suggest that the market reaction on German splits is lower compared to other markets in Europe. Reasons for relatively low market reaction on German stock splits can be the limited ability of German companies to use splits as a signal to market the positive future expectations as it is suggested by Wulff (2002).

The results of this study suggest that German splits generate positive abnormal returns on and around the split execution day. In this study positive and significant abnormal returns are found for total sample and each category, except for category 3 which involves splits over 3:1. For total sample significant 1.5 % CAAR on period [-1, +1] was found. Results in category 2 suggest 1.4 % abnormal return on the event day for 3:1 splits and significant positive CAAR on each pre-event period as well. Significant 2.4 % post-event [0, +1] CAAR was found in category 1 which implies positive abnormal returns after the execution day. However post-event [0, +3] CAAR is no longer statistically significant in this category. Results suggest that significant abnormal returns occur but they appear to reduce quickly after the event day. According to the trading range hypothesis abnormal returns should occur only on the period from the split announcement day to the split execution day (Guo et al. 2008). Findings of this study support this as abnormal returns appear to be short-lived. Based on the findings, the answer for the second research question is that German splits generate abnormal returns on the execution day as clear statistically significant differences occur.

Previous research in German market has presented similar findings as results of this study. Wulff (2002) found abnormal returns for German splits around the split execution day. He found insignificant 0.25 % daily AAR on the execution day which is consistent with the findings of this study as the 0.68 % daily AAR on the event day is insignificant for total sample in this study as well. Based on the CAARs in this study, 1.5 % [-1, +1] CAAR around the split execution day is considerably higher compared to the findings of Wulff (2002) as he found only 0.56 % [-1, +1] CAAR. Yagüe and Gómez-Sala (2005) found significant execution day effect in Spanish market as Kalotychou et al. (2009) show similar findings in UK. Kunz and Rosa-Majhensek (2008) instead report insignificant abnormal returns on the execution day in Switzerland. It appears that stock price reaction is not similar on the execution day in all European markets as some researchers have found execution day effect and some of them suggest insignificant abnormal returns on the split execution day.

On the announcement day, the split ratio has statistically insignificant impact on abnormal returns in this study as category 2 was only one to present clear statistically significant differences. As for on the execution day split ratio has statistically significant impact on abnormal returns as categories 1 and 2 show clear statistically significant differences. Answer for the third research question of this study is that split ratio has effect on abnormal returns on the split execution day but not on the split announcement day. Findings of this study suggest that on the execution day higher split ratios appear to contain stronger signaling effect in stock market which could be one explanation for the execution day effect. Kalotychou et al. (2009) suggest similar findings as they report higher abnormal returns for higher split ratios. It appears that investors see higher split ratios more valuable in stock market containing more information.

The main findings of this study are that German splits generate abnormal returns on the split execution day, but on the split announcement day any immediate stock price reaction is not observed, except for 3:1 splits. As argued earlier some legal restrictions limits the ability to use German splits as a positive signal to stock market. Although statistical significance is not found on the split announcement day, economic significance appears relatively good in this study. As a consequence, there seem to be motivation to execute stock splits in Germany and investors can get wealth gains of German splits as well. Results obtained from this study show as well that the benefit of splits seem to be quite short-lived as abnormal returns reduce quickly after the split execution day.

One of the main findings of this study is that in German market the selected split ratio has statistically significant impact on abnormal returns on the split execution day. As argued earlier higher split ratios appear to generate higher abnormal returns as well, as abnormal returns are higher for 3:1 splits than 2:1 splits. Executed splits with ratio 3:1 appear to cause significant stock price reaction on the execution day and on the announcement day as well. Findings also revealed significant positive abnormal returns also on post-announcement period and pre-event period on the execution day pointing to increasing trading activity between the split announcement and the split execution day in this category. Although 3:1 splits cause considerably return for investors on the split execution day, benefit of them seem relatively short-lived. Another finding of this study is that 3:1 splits appear to be preferred in German market over other split ratios based on the data of this study and market reaction appears to be more intense on them as well. It appears that lower stock prices attract investors more as the market reaction is stronger for 3:1 splits than 2:1 splits. However, results in category 3 show that the impact is no longer significant. As argued earlier, one possible issue to consider is the required minimum par value per share which limits German companies to use considerably higher split ratios.

5.1 Limitations of the study and future research

Results of this study may be affected by some potential biases. In this study there are three clear limitations to consider. First of them is the relatively small data size as the data involves only 57 splits. As noted earlier, sample size decreased considerably as dividing splits into categories as well. As it has been proved that larger sample size result in more reliable and improved results this should be taken into account. According to Vaihekoski (2004, 230−232) data of 30 observations in event studies is sufficient to study but sample over 100 observations is recommended to obtain more reliable result. Despite the small data size, findings of this study support previous research in German market. Second limitation to consider is the DAX 30 Performance Index which was used as a benchmark index in this study. Since DAX 30 is a blue-chip index and consists of only 30 companies it can be assumed that it is not presentative and using another benchmark index may result in different outcome. It should also be noticed that since the DAX 30 consists of only 30 companies all the companies in this particular study are not part of it. Finally, to consider, the results of this study cannot be generalized in other markets.

Possible future research areas arose in this study as well. As this study focused on to research only short-term stock price reaction with relatively small data size, in future research the research period could be expanded along with larger data size if possible. Also, as reverse splits seem to be quite common in Germany based on the data, those could be included in the study as a separate category. Including company specific factors such as company size to research as well as earlier performance in market could be considered as well. Finally, the impact of split ratio on abnormal returns in German market should be researched more in future as evidence exists that split ratio has impact on abnormal returns. Including 4:1 and 5:1 splits separately on their own categories could be reasonable as well, as category 3 involved several split ratios.

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APPENDICES

Appendix 1. Executed splits in Europe during 2000−2019 by country. The following figures include reverse splits as well and are based on the data in Thomson One database.

Country	*Executed splits*
Austria	82
Belgium	72
Bosnia & Hertsegovina	2
Bulgaria	18
Croatia	23
Cyprus	37
Czech Republic	8
Denmark	107
Estonia	2
Finland	102
France	484
Germany	274
Greece	258
Hungary	50
Iceland	4
Ireland	95
Italy	182
Kazakhstan	5
Latvia	1
Lithuania	10
Luxembourg	36
Malta	10
Montenegro	2
Netherlands	154
Norway	135
Poland	276
Portugal	33
Romania	36
Russia	79
Serbia	1
Slovak Republic	3
Slovenia	23
Spain	100
Sweden	592
Switzerland	195
Turkey	55
Ukraine	6
United Kingdom	1000
Total in Europe	**4552**