UNIVERSITY OF TURKU
Turku School of Economics

Market Reaction to Stock Splits

Evidence from Finland

Accounting and Finance

Bachelor's thesis

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18.4.2024

Turku

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Subject: Accounting and Finance
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Title: Market Reaction to Stock Splits: Evidence from Finland
Supervisor: Doctoral Researcher Md Khaled Hossain Rafi
Number of pages: 40 pages
Date: 18.4.2024

This thesis investigates the impact of stock splits on the Finnish stock markets, focusing on stock volatility, returns, and liquidity. While prior research (see for example Copeland (1979), Fama et al. (1969) and Ohlson & Penman (1985)) has extensively explored this phenomenon in the global stock markets, a notable gap exists in the context of Finland. Leveraging event study methodology and data from 2000 to 2023 sourced by LSEG DataStream, this research unveils intriguing insights. Contrary to conventional expectations, the analysis reveals that stock splits in the Finnish stock markets tend to reduce volatility, returns, and liquidity. These unexpected findings underscore the necessity for further exploration into the underlying mechanisms driving these effects, thereby shedding light on the unique dynamics of stock splits in the Finnish context.

Key words: Stock Split, Volatility, Abnormal Returns, Liquidity, Event study, Efficient Market Hypothesis, Finnish Stock Markets

Kanditutkielma

Oppiaine: Laskentatoimi ja rahoitus
Tekijä: Jonatan Wasenius
Otsikko: Markkinareaktio osakesplittiin: Todisteita Suomesta
Ohjaaja: Väitöskirjatutkija Md Khaled Hossain Rafi
Sivumäärä: 40 sivua
Päivämäärä: 18.4.2024

Tutkielma selvittää osakesplittien vaikutusta osakemarkkinoihin, keskittyen osakkeiden volatiliteettiin, tuottoihin ja likviditeettiin. Aikaisemmat tutkimukset (esimerkiksi Copeland (1979, Fama ym. (1969) ja Ohlson & Penman (1985)) ovat tutkineet laajasti tätä ilmiötä globaaleilla markkinoilla, mutta Suomen osakemarkkinoilla ilmiö on saanut vähän huomiota. Hyödyntämällä tapahtumatutkimus menetelmää ja vuosien 2000–2023 aikasarjadataa LSEG DataStreamista, tämä tutkielma paljastaa mielenkiintoisia löydöksiä. Vastoin odotuksia tutkimus osoittaa, että osakesplitillä on taipumus vähentää volatiliteettia, tuottoja ja likviditeettiä Suomen osakemarkkinoilla. Nämä yllättävät tulokset korostavat tarvetta ymmärtää tämän ilmiön taustalla vaikuttavia syitä, jotta voimme syventää tietämystämme suomalaisten osakemarkkinoiden erityispiirteistä suhteessa osakesplitteihin.

Avainsanat: osakesplit, volatiliteetti, epänormaalit tuotot, likviditeetti, tapahtumatutkimus, tehokkaiden markkinoiden hypoteesit, Suomen osakemarkkinat

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1 Introduction

Stock splits are a corporate action where the existing shares of a company are divided into a greater number of shares, which is announced to the stock markets in advance. Following a stock split, the stock price decreases while the quantity of outstanding shares increases, without affecting the market capitalization. (Brown & Warner, 1985)

Stock splits can be divided into two different kinds. What was previously defined is called the standard stock split. The second type of stock split is the reverse stock split which combines numerous shares meaning it functions contrary to the standard stock split (L. Neuhauser & H. Thompson, 2014).

The number of shares after a split has occurred is dependent on the splitting ratio. Logically for reverse stock split the splitting ratio is in reverse. For example, five stocks become one when the combining ratio is 1:5 which is said to be a one-for-five splitting ratio (L. Neuhauser & H. Thompson, 2014). In other words, the splitting ratio for a standard stock split could be for example 2:1 which is naturally called a two-for-one splitting ratio.

Before a stock split can be executed the company performing the stock split has to announce the stock split as stated before, to communicate the information to market participants (Savitri & Martani, 1989). This announcement provides the information for markets to prevent the stock owners from being caught off guard by the stock split. Additionally, potential investors can take this information into account when planning on buying the share.

Even though there are two types of stock splits the point of interest in this thesis is limited to the standard stock split and its announcement as it is considered to be a rare phenomenon in the Finnish stock market but the reverse stock splits are considered even rarer (Niini, 2001). Therefore, to achieve enough events for credible conclusions without hindering the applicability of the results, the focus will be on the standard stock split. This is because stock markets are constantly changing, and the applicability of the results could be degraded as events that took place, for example, in the 1990s happened in a very different market environment than the events happening in the modern times.

1.1 Background and Motivation of the Study

Stock split is purely a cosmetic change and therefore should not have any effect on stocks according to the Efficient Market Hypothesis (EMH). The only reaction caused by a stock split should be that the stock price decreases by an amount that's dependent on the split ratio. However several former studies have shown that this is not always the case. (Savitri & Martani, 1989)

Studies done for example in the U.S. and Germany have found that the stock split and the announcement of the split do affect stocks in varied ways (Wulff, 2002). This thesis has the goal to explore if this is the case in the Finnish stock market and if this is the case, then to answer how the stock market is affected.

The U.S. stock market is considered the most efficient stock market because of its size and liquidity (Urquhart & McGroarty, 2016). The Finnish stock market as a much smaller and less liquidity having market could be considered less efficient (Virtanen & Yli-Olli, 1987). Therefore, stock splits should have an even bigger impact on the Finnish stocks, hence it's of great interest to explore this topic, especially in Finland.

In deciding the research topic, the main goal was to find something that had not been deeply studied especially in the Finnish stock market. Although the topic of stock splits has been globally widely studied there have not emerged sufficient studies that would create a consensus about the stock splits effect on the Finnish stock market during the 2010s. The scarcity of available studies done in the recent history regarding this topic offers an opportunity to provide new information on how stock split as a phenomenon, should be considered as something more than just a cosmetic adjustment of stock price and quantity in the markets.

Additionally, shedding light to stock market inefficiency induced by stock splits should make this information more available to stock markets. Therefore, making the stock markets perform more efficiently. (Malkiel, 1989) This thesis aims to provide the needed information about stock splits effect on stocks from 2000 to 2023.

Additionally, stock splits and announcements of stock splits could be utilised to achieve abnormal returns if there is found to be an effect on stocks that is caused by stock split. Therefore, there is also financial value that this thesis could provide. However, the possibility of achieving these abnormal returns could disappear as this new information

about stock market behaviour would be reflected in efficient stock markets immediately (Fama, 1970).

Perhaps even more heavily my interest regarding this topic has peaked by observing how ordinary people interpret stock splits. For example, people with limited knowledge of finance and stock markets have experienced stock splits in varied and interesting ways. Some have interpreted the stock split as a negative signal as the share price has fallen and some have thought the stock split has made the stock cheaper and more affordable for them which encourages them to invest more in that stock. The latter is the way even company CFOs have given as the reason for stock splits (Baker & Gallagher, 1980).

Considering that all the market participants in the stock market don't possess theoretical financial knowledge there is a possibility for irrational behaviour. This gives further incentive to study this topic, especially in Finland as the markets are not as closely utilized and there are a lot of investors that may misunderstand information therefore creating inefficiency in the stock market.

1.2 Research Question and Hypothesis

The main research question this thesis aims to answer is: Is there a reaction in stocks after stock split announcement and execution of stock split? Additionally, the research aims to discover how stocks are affected.

The research question is divided into three different study topics: Volatility, Abnormal Returns, and Liquidity. These have been found to have irregular behaviour following stock splits hence they are chosen as the study topics that will give answers regarding the main research question (Savitri & Martani, 1989). These topics will be studied consequently using three different event studies.

The first event study answers if stock splits influence the risk of the stocks. Volatility is considered to be one of the most precise risk measures which is the main reason it is chosen as the variable that will gauge the risk of stocks (French et al., 1987). Whitelaw (2000) states that stock volatility and returns are highly correlated. This gives reasons why this event study is conducted. Finding that the volatility of a stock is affected when the returns are not, would mean that there is an opportunity to achieve returns that are higher than what an investor would expect proportional to the volatility.

The second event study answers if the stock returns increase abnormally following the stock split. Information about stock splits causing abnormal returns could be utilised to achieve abnormal returns in the stock market by investors. Additionally, if this information is utilised, the stock market efficiency will improve.

The third event study answers if the stock liquidity is affected following the stock split. The stock split's goal from the company management point of view has been determined by Baker & Gallagher (1980) to be at least partially to increase the availability of the stock through its price decrease. The completion of this goal will be directly studied through the third event study. If this goal is achieved, it will be shown as an increased trading volume (Baker & Gallagher, 1980).

1.3 Outline of the Study

Before the event studies are conducted there will be a comprehensive literature review that will provide information that is relevant to the topic of stock split affecting the stock markets. First, the EMH will be reviewed in greater detail. This provides further information about the importance of studying the stock split and what the results can mean from the Efficient Market Hypothesis point of view.

Before reviewing past studies made about stock splits some of the main hypotheses that explain why companies execute stock splits will be presented. Later these hypotheses are compared to the results of the event studies that are conducted in this thesis.

Then the most relevant studies made regarding the study topics mentioned before will be reviewed and listed. This will provide some expectations about the results of this thesis and therefore guide the interest regarding the study topics. Additionally, the hypotheses that give reasons for stock splits will also be linked to the studies. Furthermore, the results of the studies conducted in this thesis will be compared and linked with the literature which will provide information about the results being either aligned, or contradicting to the previous literature.

The methodology part will begin by describing in detail how the study will be conducted by providing the relevant formulas and background information about the event studies and the statistical testing of the results.

Then the results of the studies are reviewed, and the conclusions are summarised. After the results are clear there will be some discussion about what could have been behind the results. This is partly to try and motivate some further studies regarding this topic, but mainly to make the results more applicable.

2 Theoretical Background

The main topics from the literature regarding stock splits affecting stock markets are the Efficient Market Hypothesis (EMH), the literature suggested hypotheses that offer possible reasons for performing a stock split, and former studies done on how the stock market reacts to stock splits.

2.1 Efficient Market Hypothesis

The EMH can be split into two components: In an efficient stock market, (1) returns follow a random path, and (2) market participants are unable to achieve abnormal returns (Degutis & Novickytė, 2014).

Fama (1970) defined the three levels of market efficiency while simultaneously creating the market efficiency known by finance theories. These levels of market efficiency are called the weak form efficiency, the semi strong efficiency, and the strong form efficiency (Fama, 1970). EMH is partly related to the topic of this thesis as if stock splits offer opportunities to achieve abnormal returns, the Finnish stock markets can't be considered strong form efficient.

The weak form efficiency has markets utilizing only the information of the historical stock prices while semi-strong efficiency means the markets utilize also other publicly available information. This information includes announcements of stock splits e.g. The markets that have achieved strong form efficiency utilize all the information that is available and no single participant can achieve higher expected returns than others. (Fama, 1970)

An obstacle in moving from weak form efficiency to strong form efficiency could be for example insider trading. An example of insider training is a case where employees of a firm utilize the information they have about the company to trade stocks in the stock market (Moore, 1990). Therefore, they gain an edge in the stock market as they have acquired information about the company stock that isn't at least currently reflected in the value of the stock. This causes inefficiencies in the stock markets which can be manifested as overreactions to information like in Figure 1.

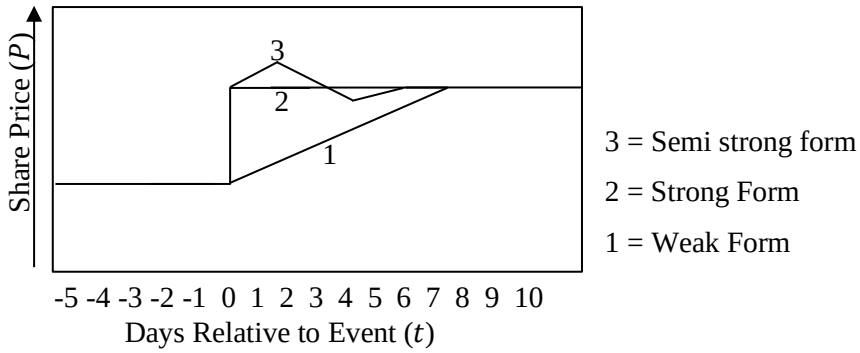

Figure 1: Market reaction relative to event (EMH) (Snyman & Von Leipzig, 2011)

As we can see in Figure 1 at the time point when the event happens $(t = 0)$ the stock market reacts, in this case positively to the event. Markets that have strong form efficiency immediately reflect the new information that has become available, whereas in semi-strong form and weak form efficiency markets the reaction happens so that the stock prices do not instantly reflect the new information. As we can see in Figure 1 the semi strong form efficiency stock markets overreact to the information immediately. The weak form efficiency stock markets react with a significant delay. This way the reaction of the stock markets to stock splits may offer some insight into the efficiency of the Finnish stock market.

2.2 Hypotheses Behind the Stock Split

There are several hypotheses existing in the literature that give rise to reasons why companies carry out stock splits. The main ones are called Liquidity Hypothesis, Trading Range Hypothesis, Signalling Hypothesis and Multiple Event Hypothesis.

In short, the Liquidity Hypothesis presents that stock splits improve stock liquidity and reduce trading costs. The Trading Range Hypothesis suggests that a stock split helps the stock to stay in its optimal trading range. According to this hypothesis, too high of a stock price causes the stock to suffer from illiquidity and larger trading costs. Signalling Hypothesis, on the other hand, presents that stock splits are used by firms to forward information to markets about the firm having a favourable future. The multiple market hypothesis poses that companies use stock splits to communicate information to the market, similar to the Signalling Hypothesis. Following the stock split, they issue stocks and therefore utilise the boosted share price. (Thirunellai, 2014)

2.2.1 Liquidity Hypothesis

Baker & Gallagher (1980) investigated the reasons behind stock splits by capturing and comparing the reasons corporate managers gave for conducting a stock split. They found that 98.4% of companies' Chief Financial Officers (CFOs) answered that the reason for stock splits was to help smaller investors buy the company stocks. Regarding this, a stock split could be considered at least from the CFOs point of view to be a way to make stocks more attractive to more investors. (Baker & Gallagher, 1980)

The goal of stock split can be concluded through the Liquidity Hypothesis to be to increase the number of company shareholders (Baker & Gallagher, 1980). This then increases the liquidity of the company stock as more market participants own and trade the stock.

Additionally, Merton (1987) proposes that a wider shareholder base increases the firm's value. Therefore, using stock splits to make the stock more available for a larger amount of investors could simply be a one way to maximize shareholder value. This is directly aligned with the reason for stock splits being to increase trading liquidity and decrease trading costs (Thirunellai, 2014).

The stock split could simply lead to a wider shareholder base through smaller investors being more able to buy the company stock and doing so drive the company value higher. This will be examined by studying the topics of stock liquidity and abnormal returns following the stock split.

2.2.2 Trading Range Hypothesis

The Trading Range Hypothesis states that the goal of stock split is to keep the stock price at an optimal tick size (Thirunellai, 2014). Which was also the reason 93.7% of CFOs gave for stock split (Baker & Gallagher, 1980).

Tick size means the minimum price variation of a stock. Some findings connect lower tick size to higher trading volume (Ahn et al., 1996). This is sensible as the difference between buy and sell offers is smaller, and consequently more trades are occurring. This hypothesis suggests that with the stock remaining at its optimal tick size, the stock performs better by causing more active pricing of the stock.

2.2.3 Signalling Hypothesis

There is evidence that firms use stock splits to feed information to the markets. Even the choice of the split factor has been determined to give information about the future earnings of a company. Additionally, stock price changes have been noticed to be also highly correlated with the split factor. (Mcnichols & Dravid, 1990)

According to these findings investors use the chosen split factor as information about the future of the company. Investors seem to think that the higher the split factor the better the future of the company, and therefore there are incentives to buy the stock and in consequence increase the stock price to reflect this information.

The findings of Mcnichols & Dravid (1990) additionally support the Trading Range Hypothesis. The announcement of a stock split causes abnormal returns that are correlated with the split factor. This implies that the information about a stock moving to its optimal tick size is interpreted as good news by the market. Which then suggests that there is such a thing as optimal tick size; therefore, further supporting the Trading Range Hypothesis. (Mcnichols & Dravid, 1990)

2.2.4 Multiple Event Hypothesis

The Multiple Event Hypothesis suggests that companies conduct stock splits to gain utility from it when a seasoned equity offering (SEO) is announced. A stock split announcement reflects in the stock price as good news which consequently increases the stock price. Then the firm announces the SEO and sells new equity at the share price that has been boosted by the stock split announcement. (D'Mello et al., 2003; John & Williams, 1985).

Another reason for stock splits comes from the marketability of the stocks. Lower share price is proposed to better attract individuals to invest in the company stock than a higher share price. This is logical, as investors with constrained capital often gravitate towards lower-priced assets, as they offer greater affordability within their limited investment capacity. (D'Mello et al., 2003)

This is also in line with the findings of Baker & Gallagher (1980) that suggested the reason firms perform a stock split is to make the company stock more available to small investors.

2.3 Former Studies

The previous studies done on the topic of stock splits will be reviewed in three sections related to the event study topics studied in this thesis. They will provide expectations for the results of the research conducted in this thesis and link the previous research to the hypotheses that were just reviewed.

2.3.1 Influence of Stock Splits on Stock Volatility

Former studies have shown increases in volatility following the stock split. Ohlson & Penman (1985) analysed the empirical behaviour of stock-return volatilities before and after the executions of stock splits in NYSE. They found a 28%-35% increase in the return standard deviations following the execution in daily returns. The data analysis they performed in which they tried to find reasons for this relatively high increase in stock volatility failed to find any explanations for this significant increase. Without any explanations backed by pricing theories, some explanations have been offered by "folklore". (Ohlson & Penman, 1985)

Additionally, Gumus & Gumus (2021) found that stock volatility increases significantly following the execution of stock split which is caused by a correction in the prices. Note that this correction happened after the stock split so there is no correcting price reaction that is caused by the announcement of the stock split. Although there was a positive and significant increase in volatility following the stock split announcement, their study did not suggest that the price corrected to a new level. (Gumus & Gumus, 2021)

One of the reasons why the volatility of returns increases so significantly could be that there is no consensus among market participants on what the split means regarding the stock price. The absence of market consensus can then have the effect of stock price being volatile because the prices the stock is being traded at vary a lot (Grouard et al., 2003). This could mean that stock market participants, and especially regular people, do not possess the needed knowledge to know how the stock split should be interpreted. This is then linked to the increased volatility in the stocks as there is no consensus about the event.

Koski (1998) also found a significant increase in return volatility but in weekly returns from 1987 to 1989 in NYSE. There was no conclusion found as to what causes this

increase in volatility. The scarcity of available explanations for the increase in stock volatility following stock splits underscores the importance of investigating potential underlying factors driving this phenomenon.

These findings by previous studies establish an expectation that the volatility will likewise increase following the stock split announcement and execution in the Finnish stock market.

2.3.2 Influence of Stock Splits on Stock Returns

Instead, more thoroughly studied are the abnormal returns caused by stock splits. Multiple former studies made on stock split announcement day have found significant abnormal positive returns. (Asquith et al., 1989; Fama et al., 1969; Grinblatt et al., 1984; Hausman et al., 1971; Johnson, 1966; Lakonishok & Lev, 1987; Lamoureux & Poon, 1987)

Therefore, studying this hypothesis in the Finnish stock market is of great interest as this probably will also be the case in the Finnish Stock market due to the market being smaller and less efficient (Hietala, 1989).

One explanation for the abnormal returns may be that stock splits are considered to provide information about some fundamental factors that determine stock prices. Such factors could be for example confidence from management regarding the outlook of the company. (Johnson, 1966)

According to this, investors would interpret a stock split as a positive indicator, and this would then force more demand for the stock and therefore increase the stock price. This is a simple application of the law of supply and demand to stock prices (Gale, 1955). To note, these results and explanations are directly aligned with the Signalling Hypothesis.

Another explanation for the abnormal returns found by Asquith et al. (1989), Fama et al. (1969), Grinblatt et al. (1984), Hausman et al. (1971), Johnson (1966), Lakonishok & Lev (1987), and Lamoureux & Poon (1987) could be provided by the Liquidity Hypothesis which implies that the stock split makes the stock more available to smaller investors (Thirunellai, 2014). As previously presented, the increase in shareholder base then increases the stock value which offers an opportunity to achieve abnormal returns (Merton, 1987). If stock splits are found to be positive news that increase stock prices, there would be an incentive to invest in stocks that are going to split.

Contrary to this there have been findings that the stock price adjusts almost immediately to the announcement, or at least the stock price has adjusted one month prior to the stock split execution (Fama et al., 1969). This would suggest that even though a stock split causes movement in the prices, there are very few chances to gain utility from it as the window of opportunity is very small. Again comparing the Finnish stock market to the New York Stock Exchange where the findings of Fama et al. (1969) were made, there could be a bigger window of opportunity in the Finnish stock market. Except, most of the stock split announcements in the data of this thesis take place under one month of stock split execution which implies that the time frame of the stock split event could be shortened in the Finnish stock markets. This could mean that with less time, the stock price does not adjust as effectively to the information before the stock split. Therefore, some of the announcement information will have an influence even after the execution.

Interestingly Hausman et al. (1971) found that stock prices seem to adjust according to the split announcement even before the stock split has been announced. This would suggest that the information leaks to some investors even before the official announcement of a stock split is made public. Another explanation could be that some stock market participants use data about the company and the stock to predict the stock split which causes the stock price to correct itself in advance. (Hausman et al., 1971) This would mean that there are possibilities to even predict the stock split in advance and gain utility from it. This expands the discussion to abnormal returns being already achieved from stock splits by some market participants.

Aligned with Hausman et al. (1971), Lakonishok & Lev (1987) found there to be 3-4% abnormal returns around the announcement day. Additionally, Lakonishok & Lev (1987) propose significantly growing earnings and dividends to be a possible explanation for the stock split-induced abnormal returns, as stocks that have growing dividends and growing earnings were found to be followed by stocks splits.

These reasons may be of interest in finding out why stock splits cause abnormal returns. Also previously mentioned prediction of stock splits could be a case where this information is already being utilized in predicting the stock splits. Possibly the markets expect a stock split to cause abnormal returns and then predict the stock split successfully. If this is the case in the Finnish stock market it will be presented in the study results as abnormal returns before the announcement date.

2.3.3 Influence of Stock Splits on Stock Liquidity

Trading volume is considered to be one of the main characteristics of stocks (Chai et al., 2010). Being one of the main characteristics makes the data readily available hence creating the interest to find out if it is affected by stock splits. If the trading volume is found to be affected by stock splits, this finding can be utilized as changes in stock trading volume have been linked to company performance and therefore stock returns (Blume et al., 1994; Lee & Swaminathan, 2000)

Some studies done on stock splits influencing stock liquidity have concluded that stock splits are followed by permanently decreased liquidity (Copeland, 1979; Lamoureux & Poon, 1987). Some, on the other hand, have found that stock splits do not affect trading volumes permanently (Lakonishok & Lev, 1987).

These findings are especially of great interest as company CFOs have answered that the reason for stock splits is to make the stock more available, especially for small investors regarding its price (Baker & Gallagher, 1980). Therefore, the increased availability to investors should cause a higher trading volume. Because of this and the previous findings in the literature, there is an opportunity to conclude that stock splits have an opposite effect on the stock market than what the company executives want (Copeland, 1979).

On the other hand Putri & Sihombing (2020) found that stock splits do not affect stock trading volume both before and after stock splits. On the contrary Copeland (1979) found that partly aligned with Lakonishok & Lev (1987) and Lamoureux & Poon (1987), trading volume increases before stock split execution but decreases after a stock split. This further contradicts the idea that stock splits are motivated by the company attempting to increase stock liquidity (Baker & Gallagher, 1980).

Some of the reasons why liquidity would decrease after the stock split could be that companies do not offer as much information after the stock split as they did before the stock split (Copeland, 1979). The shrinking in the stream of information entering the markets, could therefore cause the stock to remain in the same price range. This would consequently encourage market participants to not trade the stock as all the information about the stock is already reflected in the stock price.

Another solution to this would be that investors trade proportionately less shares following the stock split because portfolio rebalancing does not require as much trading

(Copeland, 1979). Smaller stock price makes it easier to rebalance the portfolio as the balancing can be done in more detail with more convenience.

The mentioned findings of previous literature further motivate to study the stock liquidity following stock splits in the Finnish stock markets as there is no clear expected result or even an inclination to expect one concluding result. The contradiction of study results and the reasons company executives have given for stock splits encourages us to study this topic and try to define which findings of previous literature the Finnish stock markets support.

3 Methodology

The method used in this thesis to study the effect of stock splits on the stock market will be the event study technique which has been one of the most commonly used methods in previous studies done on stock splits (see for example, Grinblatt et al. (1984), Koski (1998), Lamoureux & Poon (1987), Ohlson & Penman (1985), Putri & Sihombing (2020), Wulff (2002)).

The sample used will consist of companies that have conducted stock splits in the Finnish stock market from 2000 to 2023, which results in the data consisting of stock splits of the Finnish stock market that have been executed in the last 24 years. Stock splits in the Finnish stock market are rather rare relative to bigger stock markets, therefore the sample time period is quite lengthy.

All data needed for this thesis has been retrieved using the LSEG DataStream. The sample is further restricted by removing companies from a single event study if LSEG DataStream couldn't provide the data needed. This will be seen as a decrease in the sample of companies particularly for the liquidity event studies.

3.1 Event Studies

The course of an event study can be summarized in seven key steps (J. Y. Campbell et al., 1997):

1. Determining the event
2. Gathering the needed data
3. Determination of normal and abnormal behaviour
4. Estimating normal behaviour
5. Calculating the statistical significance of results
6. Empirical returns
7. Interpretation and conclusions

The first step of the event study has already been partly conducted in Chapter 1.2 where the study topics and events were defined. Next, the statistical hypotheses of the study topics are listed to further determine the event:

$H1$ $(volatility)$:

$$H_0 = Stock\ splits\ don't\ affect\ stock\ volatility,$$

$$H_1 = Stock\ splits\ affect\ stock\ volatility$$

$H2$ $(abnormal\ returns)$:

$$H_0 = Stock\ splits\ don't\ cause\ abnormal\ returns,$$

$$H_1 = Stock\ splits\ cause\ abnormal\ returns$$

$H3$ $(liquidity)$:

$$H_0 = Stock\ splits\ don'\ affect\ stock\ liquidity,$$

$$H_1 = Stock\ splits\ affect\ stock\ liquidity$$

The gathering of the data was also described previously. To note there were some difficulties regarding the event day of stock split announcement as there are many ways a company may inform the markets about an upcoming stock split. The announcement day for stock splits was defined as the day of the shareholders' annual meeting. This choice was based on LSEG DataStream's provision of announcement dates, which aligned with the decision to execute a stock split.

The data has also been verified and adjusted with information gathered through companies' websites by revising the given dates of announcements and executions. This way the results will achieve a high reliability which could otherwise be hindered by false dates data in some cases.

The basic timeline of an event study is illustrated in Figure 2:

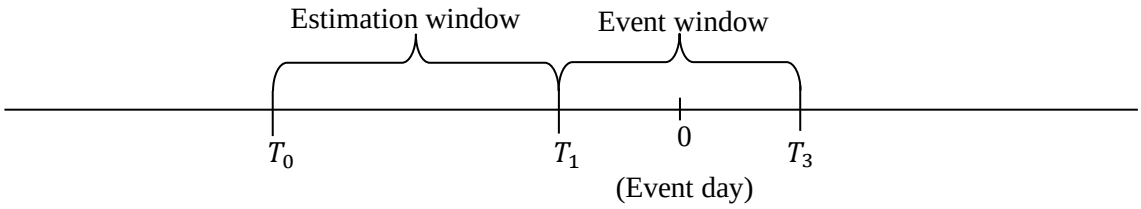

Figure 2: Timeline of event study (Announcement H2 & H3)

The timeline illustrated in Figure 2 will be used for the H2 and H3 study topics' announcement events as the H1 study topic uses Wilcoxon Signed-Rank Test which requires a different timeline. Each event study topic (H1, H2, and H3) will be studied separately using two different event studies. The first event study will be done for each study topic using the stock split announcement as the event day and the second one will be done using the stock split execution as the event day. This means the first event study will examine the effects of stock split announcements and the second study will study the effects of stock split execution.

Every company and every stock split announcement and stock split execution has its own event day $(t = 0)$. To determine if stock splits have effects on stocks the normal behaviour of the stock will be needed which is the 4th step of an event study (J. Y. Campbell et al., 1997). This normal behaviour of each stock will be determined using an estimation window. The estimation window is 100 days starting from 10 days before the event day of the stock split announcement $(t - 10)$ for H2 and H3.

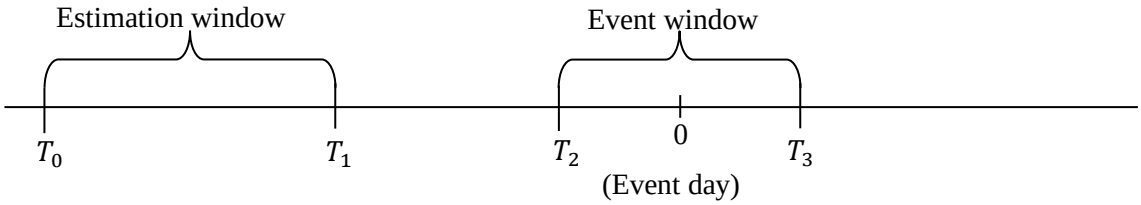

Figure 3: Timeline of event study (Execution H2 & H3)

The event period itself is not included in the estimation window to avoid the event influencing the normal behaviour (MacKinlay, 1997). Overlapping the estimation window and event window could cause the study to miss some of the influence stock

splits may have on stocks as some of this influence would already be included in the normal returns.

Additionally, the announcement of stock split happens naturally before the stock split which can cause problems regarding the determination of the normal behaviour when the stock split execution is studied. To avoid including the announcement in the estimation window in study topics H2 and H3, the estimation window will be the same for the announcement event study and the execution event study. By doing this the methodology of the event study stays consistent and the estimations are defined correctly. For the volatility event study (H1) this is not done as the pre-event window is not methodologically equivalent to the estimation window.

3.1.1 Influence of Stock Splits on Stock Volatility

The volatility of returns is estimated for both firm σ_i and market σ_m on a pre-event window $[-L, 0]$ and post-event window $[0, L]$. The market volatility will be calculated using the OMXH Price Index as all the companies in these event studies were listed on the OMXH.

In this study, the L parameter will be 20, 15, and 10 days as this will be consistent with the event window lengths used in the later study topics, and larger event windows would cause the announcement event to be more often included in the event window of execution.

This is the only study topic in this thesis that has different "estimation windows" (= pre-event window) for the announcement event study and execution event study. This is because the other study topics have relatively long estimation windows which would cause more problems with the execution day event studies.

The pre-event windows $[-L, 0]$ are from 20, 15, and 10 days before the event to the event day. The post-event windows $[0, L]$ are from the event day to 20, 15, and 10 days from the event day.

Next formulas define the pre-event and post-event volatility ratios:

$$\Lambda_i^{pre} \sqrt{\frac{\sigma_i^{pre}}{\sigma_m^{pre}}} \tag{1}$$

$$\Lambda_i^{post} \sqrt{\frac{\sigma_i^{post}}{\sigma_m^{post}}} \quad (2)$$

which are calculated for each firm i (Agrawal et al., 2004).

Then the Wilcoxon Signed Rank Test is used to test the pre-event volatility ratios and the post-event volatility ratios. The non-parametric Wilcoxon test will determine if the post-event volatility is different from the pre-event volatility. (Agrawal et al., 2004) Consequently, the null and alternative hypotheses of the Wilcoxon Signed Rank Test are:

$$H_0: \Lambda_i^{pre} = \Lambda_i^{post}, H_1: \Lambda_i^{pre} \neq \Lambda_i^{post} \quad (3)$$

(Fagerland & Sandvik, 2009).

The samples in this thesis are related which indicates that we need to use the Paired Wilcoxon Signed Rank Test. This test will provide the test statistic which indicates if the null hypothesis of the equality of pre-event and post-event volatilities can be rejected.

3.1.2 Influence of Stock splits on stock returns

Abnormal returns can be defined for firm i and event date t using the following formula:

$$AR_{it} = R_{it} - E(R_{it}|X_t), \quad (4)$$

where AR_{it}, R_{it} and $E(R_{it}|X_t)$ are the abnormal return, actual return, and normal returns respectively, for the time period t, while X_t is the conditioning information for the normal return model. (MacKinlay, 1997)

To define the abnormal return AR_{it} we need the actual return R_{it} and normal return $E(R_{it}|X_t)$ (MacKinlay, 1997). The returns used in this thesis are logarithmic as logarithmic returns improve the statistical properties of the series, like normality (Wells, 2004):

$$R_{it} = ln\left(\frac{P_{it}}{P_{it-1}}\right), \quad (5)$$

where R_{it} is the actual logarithmic return of stock i at time point t, P_{it} is the closing price of a stock i at time point t, P_{it-1} is the closing price the day before t and ln is the natural logarithm. Logarithmic market returns are calculated with the same formula using the closing prices of the OMXH Price Index.

The normal returns are defined using the following formula:

$$E(R_{it}) = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \quad (6)$$

where R_{mt} is the return from the market portfolio in this case the OMXH Price Index and ε_{it} is the zero mean disturbance term. α_i and β_i are the parameters of the market model that are defined using the Ordinary Least Squares (OLS) technique. (MacKinlay, 1997) For firm i the OLS estimators of the market model are calculated with the following formulas:

$$\hat{\beta}_i = \frac{\sum_{t=T_0+1}^{T_1}(R_{it}-\hat{\mu}_i)(R_{rm}-\hat{\mu}_m)}{\sum_{t=T_0+1}^{T_1}(R_{rm}-\hat{\mu}_m)^2} \quad (7)$$

$$\hat{\alpha}_i = \hat{\mu}_i - \hat{\beta}_i\hat{\mu}_m, \quad (8)$$

where

$$\hat{\mu}_i = \frac{1}{L_1}\sum_{t=T_0+1}^{T_1} R_{it} \quad (9)$$

and

$$\hat{\mu}_m = \frac{1}{L_1}\sum_{t=T_0+1}^{T_1} R_{mt}. \quad (10)$$

Here L_1 is the length of the estimation window that the estimators are being estimated for. (MacKinlay, 1997) In the estimation of the normal returns the $L_1 = 100$.

Note that for defining the normal returns the period L_1 is starting from the beginning of the estimation window $(t-10)$ and continuing to $(t-110)$ whereas when calculating the abnormal return, the period is starting from the start of the event window and continuing to the end of the event window for example, $(-10, +10)$.

Rather than restricting the results to single days in the event window, the daily abnormal returns can be combined by calculating the cumulative abnormal returns (CAR). The CARs are given by the following formula (Kothari & Warner, n.d.; MacKinlay, 1997):

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_t \quad (11)$$

However, tests with one event observation are not likely to be useful, as this thesis aims to determine how stocks are or are not affected by stock splits. Therefore, it is useful to aggregate the abnormal returns across companies. The aggregation can be done utilizing the abnormal returns AR_{it} that have been defined previously. Given N companies, the sample aggregated abnormal returns for event period $t = T_1 + 1, \ldots, T_2$ is:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (12)$$

(Kothari & Warner, n.d.; MacKinlay, 1997)

The statistical significance of AAR_t is then calculated using the following test statistic (MacKinlay, 1997):

$$\frac{AAR_t}{SE_{(AAR_t)}} \sim t(n-1) \quad (13)$$

The AARs can be aggregated over the event window to achieve more concluding results. This can be done by using a same kind of formula as when calculating the cumulative abnormal return for each security i:

$$CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t, \quad (14)$$

(MacKinlay, 1997)

Statistical significance of the $CAAR$s is then calculated using the following formula:

$$\frac{CAAR_{(t_1,t_2)}}{SE_{(CAAR_{(t_1,t_2)})}} \sim t(n-1) \quad (15)$$

(MacKinlay, 1997).

3.1.3 Influence of Stock Splits on Stock Liquidity

Stock liquidity will be studied in this thesis using the stock trading volume data as it is considered to be one of the main characteristics of stocks. Therefore if stock liquidity is affected by stock splits it will be displayed as a change in the stock trading volume. (Chai et al., 2010).

Ajinkya & Jain (1989) noticed that raw trading volume tends to be highly non-normally distributed. Therefore, the volume data in this thesis has been log-transformed to achieve higher normality and consequently more credible results.

The trading volume will be studied using a trading volume metric proposed by C. Campbell & Wasley (1996). The metric for company i at time point t is given by the following formula:

$$V_{it} = \frac{(n_{it} \times 100)}{S_{it}} \quad (16)$$

where n_{it} is the number of shares traded for firm i on day t, and S_{it} is the firm's outstanding shares on the day t (C. Campbell & Wasley, 1996). The market model for defining the abnormal trading volume is:

$$v_{it} = V_{it} - (\alpha_i + \beta_i V_{mt}), \tag{17}$$

where α_i and β_i are obtained by using the OLS estimation technique presented before. The market volume measure V_{mt} for a given day t is measured as:

$$V_{mt} = \frac{1}{N}\sum_{i=1}^{N} V_{it}, \tag{18}$$

where N is the number of securities in the market index. (C. Campbell & Wasley, 1996)

Then to measure the statistical significance of the results we use the portfolio parametric test statistic which requires the data to be normally distributed which is attempted to achieve by the log transformation mentioned before (Ajinkya & Jain, 1989):

$$\frac{\bar{v}_t}{s(\bar{v}_t)} \sim t(N-1) \tag{19}$$

where $\bar{v}_t$ is the equal-weighted portfolio mean abnormal trading volume on the event day which combines the abnormal volatilities over companies and $s(\bar{v}_t)$:

$$\bar{v}_t = \frac{1}{N}\sum_{i=1}^{N} v_{it}, \tag{20}$$

$$s(\bar{v}_t) = \sqrt{\frac{1}{T}\sum_{t=f}^{t=1}(\bar{v}_t - \bar{\bar{v}})^2} \tag{21}$$

$\bar{\bar{v}}$ is the mean of the $\bar{v}_t$ over the estimation period. The standard deviation is estimated using time-series data from the estimation period, which means it explicitly accounts for any cross-sectional dependence in abnormal trading volume (C. Campbell & Wasley, 1996).

4 Results

From the event studies there were findings that the Finnish stock markets are affected by stock splits in ways that are not typical for efficient stock markets. Even though some of these changes in the stocks' main characteristics are subtle there were interesting and quite significant findings about the effect of stock splits on stocks. Note that the company sample size is different for the announcement event studies ($n = 54$) and execution event studies ($N = 51$) . This is because some of the stock splits in this data did not take place even though they were announced or have yet taken place. Additionally, for the volume event study, the volume data was not available for some companies and therefore, the company sample size was further restricted for the announcement study ($N = 49$) and execution study ($N = 46$).

4.1 Volatility

The main findings regarding stock volatility following the announcement of stock split are illustrated in Table 1. Stock volatility was not affected by the stock split announcement in any of the chosen windows (10, 15, 20). This can additionally be seen from the means and medians of the differential of post and pre-volatility as they were close to 1. This implies that the means and medians of pre-event window and post-event window volatilities are equal.

Table 1: Announcement event volatility

Stock Split Announcement Abnormal Volatility									
	Pre-event	Post-event	$\frac{\Lambda_i^{post}}{\Lambda_i^{pre}}$					Test statistic	
Window	Avg Λ	Avg Λ	Mean	Median	Max	Min	Std.Dev	*Z*	*p*
10	1.470	1.454	1.091	1.032	4.222	0.471	0.547	0.133	0.897
15	1.460	1.390	1.021	0.930	3.701	0.567	0.448	1.52	0.13
20	1.455	1.391	0.998	0.965	1.886	0.538	0.277	1.3	0.197

The p-values the Wilcoxon Signed Rank Test gave for the event windows were 0.897, 0.13, 0.197. Even though the results are not statistically significant, there seems to be a decrease in the p-values relative to the window length. The reason for this could be that a portion of the stock split executions took place under 15 or 20 days after the announcement. Therefore, windows 15 and 20 could include some stock split execution

caused change in volatility which interferes with the study of announcement event volatility.

The results presented in Table 1 propose that the stock split announcement does not affect stock volatility. Therefore, we fail to reject the null hypothesis that stock split announcement does not affect the stock returns volatility.

Another reason for the equality of return volatilities regarding the announcement event could be that as proposed before, information about the stock split is leaked to the stock markets, or the stock split is predicted by some stock market participants as proposed by Hausman et al. (1971).

On the contrary to the results on announcement day, there were statistically very significant differences in the volatility before and after the stock split execution. The Wilcoxon test p-value for the execution day was 0.0273 which is statistically significant at the 5% level. This suggests that the stock split execution day affects stock return volatility.

Table 2: Execution event volatility

Stock Split Execution Abnormal Volatility									
Window	Pre-event	Post-event	$\frac{\Lambda_i^{post}}{\Lambda_i^{pre}}$					Test statistic	
	Avg ʎ	Avg ʎ	Mean	Median	Max	Min	Std.Dev	*Z*	*p*
10	1.629	1.475	0.957	0.929	1.517	0.384	0.244	2.21**	0.0273
15	1.578	1.445	0.950	0.889	1.637	0.526	0.245	2.67***	0.00766
20	1.578	1.454	0.940	1.343	6.399	0.689	0.821	2.7***	0.00704

*** - *Significant at 1% Statistical significance*

** - *Significant at 5% Statistical significance*

Additionally, both other p-values are statistically significant (0.00766, 0.00704) which implies that the volatilities before and after the event day are different in these windows.

Considering these results, the null hypothesis that stock volatility isn't affected by stock split executions can be rejected but the null hypothesis that stock volatility isn't affected by stock split announcements cannot as seen in Table 1 and Table 2.

4.2 Abnormal Returns

Stock split announcement event and execution event AARs are illustrated in Table 3. Stock split announcement date caused statistically very significant abnormal returns of 1,78% which is aligned with the previous studies conducted on stock split announcement day abnormal returns (Asquith et al., 1989; Fama et al., 1969; Grinblatt et al., 1984; Hausman et al., 1971; Johnson, 1966; Lakonishok & Lev, 1987; Lamoureux & Poon, 1987).

Table 3: Abnormal returns relative to Event Date

Average Abnormal Returns				
	Announcement		Execution	
Event date	AAR	t-value	AAR	t-value
-10	-0.00165	-0.563	-0.00740	-1.29
-9	-0.00626	-1.449	-0.00106	-0.249
-8	-0.000365	-0.158	0.000787	0.179
-7	-0.00765	-1.435	-0.00455	-1.071
-6	-0.00259	-0.111	-0.00771	-2.735***
-5	0.00413	1.354	-0.000621	-0.161
-4	-0.00371	0.895	-0.0281	-0.855
-3	-0.00194	-0.523	-0.0232	-0.858
-2	0.00202	0.579	0.00899	1.177
-1	0.00431	1.635	-0.000475	-0.103
0	0.0177	2.879***	0.0202	-0.72
1	0.00238	0.353	0.000392	0.101
2	-0.00484	-1.133	-0.00645	-1.768*
3	-0.00555	-1.225	-0.00408	-1.45
4	-0.00163	-0.387	-0.00904	-2.306**
5	0.00535	1.344	0.00332	0.7996
6	-0.0002	-0.0821	-0.00249	-0.692
7	-0.00495	-1.326	-0.0018	0.661
-8	0.000964	0.363	-0.00497	0.122
9	0.00338	0.977	-0.00185	0.556
10	0.00439	1.228	-0.00661	0.143

*** - Significant at 1% Statistical significance*

** - Significant at 5% Statistical significance*

* - Significant at 10% Statistical significance*

This finding also supports the view suggested by the Signalling Hypothesis and Multiple Event Hypothesis that a stock split announcement delivers positive information about the future of the company and therefore the future of the stock (D'Mello et al., 2003; John & Williams, 1985; Johnson, 1966; Mcnichols & Dravid, 1990).

Relative to this result the stock split execution event did not cause any abnormal positive returns but negative returns at six days before the stock split, and two and three days after the stock split. These could be a result of the stock price adjusting to the split information suggested by Hausman et al. (1971). Contrary to Hausman et al. (1971), there does not seem to be any abnormal returns caused by predictions of the stock split in these event windows.

Regarding the $CAAR$s presented in Table 4 there seems to be positive abnormal returns around the announcement day at (-1, +1) and (-5, +5) windows. Contrary to this, after the execution of stock split there seems to be negative abnormal returns in windows (+1, +5), (+1, +10) and (-10, +10).

Table 4: Cumulative Average Abnormal Returns by Event Windows

Cumulative Average Abnormal Returns				
	Stock Split Announcement		Stock Split Execution	
Window	CAAR	t-value	CAAR	t-value
(-10, -1)	-0.0137	-1.550	-0.0380	-1.357
(-5, -1)	0.00481	0.600	-0.0181	-0.650
(-1, +1)	0.0243	2.0959**	0.0201	0.731
(+1, +5)	-0.00429	-0.557	-0.0159	-2.00368*
(+1, +10)	-0.000706	-0.0612	-0.0336	-2.374**
(-5, +5)	0.0182	1.491*	-0.0138	-1.289
(-10, +10)	0.00324	0.197	-0.0514	-2.776***

****-Significant at 1% Statistical significance*
***-Significant at 5% Statistical significance*
**-Significant at 10% Statistical significance*

The finding that stock split execution causes negative abnormal returns could originate from the failed creation of coherent consensus on the stock market about the stock split. This has also been proposed as a possible reason for stock split induced abnormal returns by Grouard et al. (2003). This could additionally give information about the inefficiency of the Finnish stock markets. The information about stock split possibly

isn’t interpreted correctly or at all after the announcement and therefore the stock split execution causes irrational behaviour.

According to the findings presented the null hypothesis that stock returns aren’t affected by stock splits can be rejected because both the announcement and execution of stock splits caused abnormal returns.

4.3 Liquidity

Aligned with previous literature the stock split announcement and execution caused negative abnormal trading volume. The changes in trading volume were very minimal as the largest abnormal trading volume was -6E-06. These findings are partly aligned with the findings of Copeland (1979), Lakonishok & Lev (1987) and Lamoureux & Poon (1987). The inconsistency with the previous studies comes from the trading volume decreasing already before the announcement event day. On the other hand, the only positive abnormal trading volume that was found was eight days before the execution of the stock split even though, overall, the abnormal trading volume decreased before the stock split.

Table 5: Abnormal Trading Volume Relative to Event Date

	Abnormal Trading Volume			
	Announcement		Execution	
Event date	ATV	t-value	ATV	t-value
-10	-0.0000032	-1.283	-0.000003	-1.114
-9	-0.0000056	-2.23**	-0.0000058	-2.150**
-8	-0.0000030	1.200	0.0000047	1.734**
-7	-0.00000088	-0.348	-0.00000093	-0.344
-6	-0.0000011	-0.443	-0.0000007	-0.258
-5	-0.00000011	-0.0447	0.00000065	0.240
-4	-0.0000034	-1.346*	-0.0000028	-1.0271
-3	-0.00000049	0.195	0.00000095	0.351
-2	-0.0000054	-2.132**	-0.000005	-1.854**
-1	-0.000003	-1.184	-0.0000022	-0.808
0	-0.0000036	-1.435*	-0.0000024	-0.887
1	-0.0000027	-1.0878	-0.0000027	-0.994
2	-0.00000057	0.225	0.00000020	0.75
3	-0.0000021	-0.831	-0.00000086	-0.318
4	-0.0000058	-2.316**	-0.0000057	-2.098**

	Abnormal Trading Volume			
5	-0.0000016	-0.644	-0.00000091	-0.338
6	-0.00000067	0.267	0.00000079	0.292
7	-0.0000012	0.460	0.0000019	0.689
8	-0.0000014	0.543	0.0000019	0.705
9	-0.000006	-2.390**	-0.0000048	-1.798**
10	-0.0000022	-0.889	-0.0000013	-0.5

*** - Significant at 1% Statistical significance

** - Significant at 5% Statistical significance

* - Significant at 10% Statistical significance

According to these results, we can reject the null hypothesis that stock liquidity isn't affected by the stock split as the stock split affected trading volume negatively.

5 Conclusions

In conclusion, this thesis attempted to find out if the Finnish stock markets are affected by the company's decision to split its stocks, while increasing the awareness about stock splits and their implications for company stock volatility, returns, and liquidity.

It was discovered that stock volatility is affected by stock splits. The execution of stock split caused the volatility to change but the announcement wasn't found to influence volatility. This suggests that Finnish stock markets may exhibit inefficiency due to lack of understanding of stock splits. Additionally, the announcement of stock split was found to cause positive abnormal returns and the execution negative abnormal returns. Therefore, confirming that the announcement may be interpreted as good news by the stock markets but then the execution is interpreted inefficiently as the stock market may be missing a consensus about the stock split as a phenomenon. Concerning these findings, stock liquidity was found to be negatively affected by stock splits which further supports the view that stock splits contradict the CFOs view of stock splits (Baker & Gallagher, 1980).

With limitations to what could be achieved in this thesis, there were shortcomings in discovering deeply what could be the reason behind these irregular behaviours in the Finnish stock markets. Therefore, further development of the study of stock splits in the Finnish stock markets would require finding variables that explain the irregularities to better determine what is behind this inefficiency.

This thesis was not conducted without obstacles as particularly the data required verifying to ensure trustworthiness. Additionally, some data was not available and therefore could not be collected which limited the study, but still sufficient samples were achieved. The process of data handling and verification made the research process especially rewarding.

Throughout studying the Finnish stock market's reaction to stock splits this thesis has shed light on the new information about how the market reacts inefficiently to stock splits. Closing this thesis, it is now clear that the implications of stock splits in the Finnish stock markets are far from efficient stock market behaviour.

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