Insider Trading Before Stock Splits: Predictive of Future Stock Performance?[1]

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Abstract

The objective of the thesis is to test the effect of combining insider trading with stock splits on long-term abnormal returns. From most recent literature on stock splits, we find that splits in most cases are followed by positive abnormal long-term returns. Insider trading can be described as trading by insiders (employees, shareholders, or stakeholders) who have access to insider firm information, and who trade in the stock which they are affiliated with. Insider trading, taking advantage of the inside knowledge, may also derive abnormal long-term returns.

Extensive research has been conducted on stock splits and insider trading on a stand-alone basis, but long-term horizon studies of the combination of stock splits and insider trading has not previously been carried out. We hypothesise that insider trading, when associated with stock splits, will provide the market with additional information about the long-term stock performance, compared with the information derived from either stock splits or insider trading separately. In order to test our hypothesis we analyse data similar to the sample used by Devos, Elliott, and Warr (2015), covering the period from 1986 to 2014. The data comprises stock split announcements, stock returns, and reporting of insider actions. Two groups of insider traders (i.e., routine and opportunistic insiders) are identified and analysed. In order to study the abnormal returns following stock splits, we apply the event-time study methodology introduced by Fama, Fisher, Jensen, and Roll (1969) and a calendar-time study.

We do find that stock splits exhibit abnormal returns in the period subsequent to the splits, which is in line with the general expectations. We also find evidence of insiders behaving opportunistically by using only insider information in trading. Analyses carried out on either stock split or insider trading, as stand-alone events, do in most cases confirm the general expectations. When it, however, comes to the predictive effect of the combination of stock splits and insider trading, we are not able to find conclusive results showing evidence of abnormal returns subsequent to the split. Some of the results are unexpected as, e.g., studies showing evidence of abnormal positive returns after *insider sales*, whereas we do not correspondingly find significant evidence of abnormal results after insider purchases. We find significant abnormal returns from portfolios of insider sales, even after controlling for returns related only to stock splits and only to insider trades. These results are counter-intuitive, as we would expect insider sales to predict a decrease of future returns, whereas we would expect an increase of returns after purchases. Similarly it is surprising to find that insider trades conducted by routine traders result in abnormal returns, while this is not the case for opportunistic insiders. Hence, the results from our studies are inconclusive, and in some cases contradicting our initial expectations.

Resumé

Formålet med specialet er at teste, hvilken effekt en kombination af insiderhandel og aktiesplit vil have på de langsigtede abnormale afkast. Med udgangspunkt i den seneste litteratur omkring aktiesplit ved vi, at sådan en aktieopdeling i de fleste tilfælde efterfølges af positive langsigtede abnormale afkast. Insiderhandel kan beskrives som handel foretaget af insidere (ansatte, aktionærer, og interessenter i firmaet), der har adgang til interne selskabsspecifikke oplysninger, og som handler aktier i selskabet hvortil de er tilknyttet. Insiderhandel, hvor man udnytter den interne viden om firmaet, kan resultere i abnormale langsigtede aktieafkast.

Der foreligger omfattende studier af henholdsvis aktiesplit og insiderhandel; men der er ikke tidligere gennemført specifikke studier af langsigtede abnormale afkast ved en kombination af aktiesplit og insiderhandel. Vores hypotese er, at den kombinerede effekt af aktiesplit og insiderhandel – set i forhold til henholdsvis aktiesplit og insiderhandel isoleret betragtet - vil signallere ekstra information til markedet om aktiernes langsigtede udvikling. Med henblik på at teste vores hypotese anvender vi et datagrundlag som også blev anvendt af Devos, Elliott, and Warr (2015), og som dækker perioden fra 1986 til 2014. Datagrundlaget omfatter oplysninger om aktiedelings-erklæringer, aktieafkast samt indrapportering af insidernes handlinger. Der er til vore studier udvalgt to grupper insidere, nemlig såkaldte "rutine-insidere" og "opportunistiske insidere". Med henblik på at analysere de abnormale aktieafkast, som følger efter aktiedesplit og insiderhandel, anvender vi en "event studie" metodik, som oprindeligt blev introduceret af Fama, Fisher, Jensen, and Roll (1969). Analyserne omfatter både "event-time" og "calendar-time" studier.

Vi finder, at aktiesplit resulterer i abnormale afkast i perioden efter aktiesplittet, hvilket er i overensstemmelse med vores hypotese. Vi finder også, at insidere opfører sig opportunistisk ved kun at udnytte interne selskabsoplysninger. Analyser som foretages enten på aktiesplit eller på insiderhandel isoleret betragtet, bekræfter i de fleste tilfælde vores generelle forventninger om effekten på de fremtidige abnormale afkast. Når det derimod kommer til forudsigelser baseret på kombinationen af aktiesplit og insiderhandel, er vi ikke i stand til at finde endegyldige resultater, som viser abnormale afkast efter aktiesplittet. Nogle af resultaterne er uventede, eksempelvis at insidernes aktiesalg efterfølgende resulterer i positive abnormale afkast, mens der ikke ses nogen effekt af aktiekøb. Resultaterne er imod vore forventninger, hvor insidersalg ville resultere i et fald i fremtidige afkast og insiderkøb i et øget afkast. De abnormale afkast for insidersalg er signifikante, selv efter kontrol for afkast knyttet kun til aktiesplit eller kun til insiderhandel. På samme måde er det overraskende, at insiderhandel som gennemføres af rutine-insidere giver abnormale afkast, mens det samme ikke er tilfældet for opportunistiske insidere. Konklusionen er, at analyserne ikke giver entydige resultater, og i nogle tilfælde modsiger vore forventninger.

Contents

Chapter 1

Introduction

This thesis studies the effect of combined insider transactions and stock splits on long-term abnormal returns (stock performance). By carrying out a stock split, a firm is dividing its current number of shares outstanding into multiple shares, without altering the fundamental value of the firm.[2] Insider trading can be described as trading by individuals affiliated with a firm and having access to firm information not available to the public.

The underlying reasons for firms to conduct stock splits remain ambiguous and the topic is widely debated. According to the literature there are three main motives for stock splits (Baker and Powell, 1993): Firstly, the signalling motive, where the management of a firm signals private information to the market by attracting attention to the stock through a split. Secondly, the optimal trading range motive, where stock splits may realign stock prices to an optimal trading range, which again would be associated with increased interest and research analyst coverage. Thirdly, the liquidity effect, where stock splits increase the liquidity in a stock through an expanded number of individual shareholders and increased trading in the stock. We find the signalling motive most appropriate when studying insider trades before a stock split.

The overall result of the literature review reveals that stock splits are usually preceded by pre-split run-up of firm earnings and returns. There is also clear association between stock splits and the future performance of the stocks, and there is substantial evidence that stock splits may be associated with abnormal returns following a stock split (Desai and Jain, 1997; Grinblatt, Masulis, and Titman, 1984; Ikenberry and Ramnath, 2002; McNichols and Dravid, 1990). Abnormal return specifies the returns generated by a given security or

[2] A stock split can be regarded as slicing a cake into multiple pieces, where the size of the cake is unchanged.

portfolio that is different from the expected rate of return. As a consequence, stock splits may, on a stand-alone basis, therefore exhibit significant predictability of the future stock returns.

The insiders comprise employees, stakeholders, and/or significant shareholders of the firm. Academics generally divide insiders into non-informed and informed insiders, and the trading behaviour can according to Cohen, Malloy, and Pomorski (2012) be classified as routine trading or opportunistic trading. There is evidence that some insiders benefit personally from participating in insider trading (Jaffe, 1974; Seyhun, 1986). It is also documented that insiders conduct trading at an elevated level before stock splits, thus indicating the trader's opportunistic behavior (Devos, Elliott, and Warr, 2015).

Like for stock splits there is evidence that the future abnormal returns may be associated with trading conducted by insiders. Trading by informed insiders with an opportunistic trading behaviour normally exhibits abnormal returns and significant predictability of future events following the trade. In contrast, non-informed / routine traders exhibit only weak predictability (Cohen, Malloy, and Pomorski, 2012).

Extensive research has been conducted on stock splits as well as on insider trading, usually on a stand-alone-basis. In one case, however, a study does include insider trading together with stock splits, but is limited to include only the *short-term* returns and only a part of the potential insiders (e.g., CEOs in Devos, Elliott, and Warr (2015)). On a stand-alone basis, there is, as mentioned above, evidence for abnormal returns, both for stock splits and insider trading. Based on the findings of Devos, Elliott, and Warr (2015), we thus hypothesise that additional information may be achieved by studying the interaction between stock split and insider trading from a long-term perspective. We therefore suspect that additional information about future abnormal returns may be revealed by analysing the combined effect of stock splits and insider trading before the splits. Such studies of the combined effect has to the best of our best knowledge not previously been carried out, and our motivation is therefore to find evidence for additional valuable information deriving from the combination of stock splits and insider trading. We therefore hypothesise that the actions of insiders, when associated with a stock split, will provide the market with predictive information about the subsequent long-term performance, which is different from the long-term performance derived from the stock split or the insider trading on a stand-alone basis.

In our study we use a similar data sample as Devos, Elliott, and Warr (2015) by using

data from the Center for Research in Security Prices (CRSP).[3] The data comprises stock split announcements, stock returns, and actions by insiders reported to the Securities and Exchange Commission (SEC).[4] While Devos, Elliott, and Warr (2015) focus solely on the behaviour of CEOs, we take into consideration the behaviour of all insiders.

Fama, Fisher, Jensen, and Roll (1969) introduce the event study to illustrate abnormal returns around a stock split, and we apply the methodologies described by Cohen, Malloy, and Pomorski (2012). In order to test whether insiders' trading behaviour before a stock split provide information to the market, we study the trading actions taken by insider agents in the period 1986 - 2014. We use insider trade actions in open market purchases or sales of the stock up to 24 months before the stock split as a proxy for inside information. We evaluate the significance of the signal by forming a calendar-time portfolio of stock splits with insider trading actions and regressing it against a multi-factor model with common risk factors in stock returns. We furthermore assess the implications of stock splits and insider trading by using cumulative abnormal return in the months around the event to see the post-split development for stock splits with insider trading. Implicitly, we test whether the market is efficient in fully incorporating insiders' actions around stock splits and whether the abnormal returns from the combined effect of both events, a stock split and an insider transaction, differs from the abnormal returns from each as well as the sum of the two events.

Through the thesis we will contribute to the existing literature by providing new evidence within the research areas of both stock splits and insider trading, namely that stocks show positive abnormal returns subsequent to a split for both purchases and sales made by insiders before the split. However, after adjusting returns for a control group of insider trades, we still find significant abnormal returns from insider *sales*.

The thesis proceeds as follows. In the remainder of this chapter, we present our research question and hypotheses. **Section 2** provides a review of the literature. **Section 3** presents the framework of the thesis. The section is organised into three groups; participating agents, signals, and empirical predictions. The review describes two groups of literature, namely, stock splits and insider trading. **Section 4** explains our sample selection and research design. We present our analyses and empirical results in **section 5** and discuss possible implications of our findings as well as potentially new research areas in **section 6**. Finally, we conclude on our paper in **section 7**.

[3]Please refer to the following website for further information: http://www.crsp.com/.

[4]Please refer to the following website for further information: https://www.sec.gov/.

1.1 Research Question

Our main objective of this thesis is to provide an answer to the following research question:

> *Will the combined information about a stock split and insider trading generate different information about a stock's long-term abnormal return, than the abnormal return from insider trading or stock splits on a stand-alone basis?*

In order to answer our research question we test the following hypotheses:

i) *Hypothesis 1: Insiders have access to insider information and behave opportunistically based on this information through insider trading.*

ii) *Hypothesis 2: Stocks exhibit abnormal returns in the period subsequent to a stock split.*

iii) *Hypothesis 3: The combination of both stock splits and insider trading entails information about the future abnormal return of stocks that is different from the information on stock splits alone and insider trades alone.*

iv) *Hypothesis 4: The market is in-efficient in incorporating insider trading around stock splits into the pricing of a stock.*

1.2 Delimitations

In order to answer the research question, we find it necessary to apply the following delimitations. First of all, our study does not include reverse stock splits[5] as they are relatively rare compared to ordinary stock splits.

Furthermore, we exclude stock grants and stock options from our study, as we do not have access to information about the time when insiders received their stock holdings through stock grants or option exercises (Jeng, Metrick, and Zeckhauser, 2003). Including stock grants and stock options in our study will also introduce the literature on remuneration, making the interpretation less clear compared to open market trades. Thus, in order to ensure clear interpretation and simplify the analysis, we have chosen to only consider open market shares. We hypothesise that studying stock grants and stock options would provide us with somewhat similar conclusions as the conclusions in our study. Moreover, as

[5] A reverse stock split decreases the number of shares outstanding by a factor, i.e., the opposite of a stock split.

we only use open market transactions, we do not consider private transactions, primarily due to lack of data and difficulties in conducting quality control.

We use monthly returns as we study the return of stocks over a long-horizon. We do not study the returns in the immediate days surrounding a stock split, as a large number of articles already deal with abnormal returns in the days around a stock split, see e.g., Desai and Jain (1997).

We do not cleanse the data set by removing any stock splits deemed contaminated by other contemporaneous corporate announcements as per Grinblatt, Masulis, and Titman (1984). The authors identify other announcements around the time of the stock split and isolate the stock splits that are uncontaminated. However, the two samples, i.e., the contaminated and uncontaminated sample, exhibit similar abnormal returns, and we have therefore not conducted a separate analysis on an uncontaminated sample. Furthermore, as we are analysing long-term returns, it is not meaningful for us to create such a sample as other contemporaneous corporate announcements inevitably will occur.

Finally, we ignore trading costs.[6] We are not testing whether or not trading strategies based on the information evident in insider trading around stock splits is profitable for outside investors. In addition, trading costs change over time as markets evolve, and investors have different trading costs, which makes it difficult to generalise the trading costs.

[6]Brennan and Copeland (1988b) suggest that one cost of splits is the increase in investors' transaction costs because of fixed commissions and the odd lots created by the splits.

Chapter 2

Literature Review

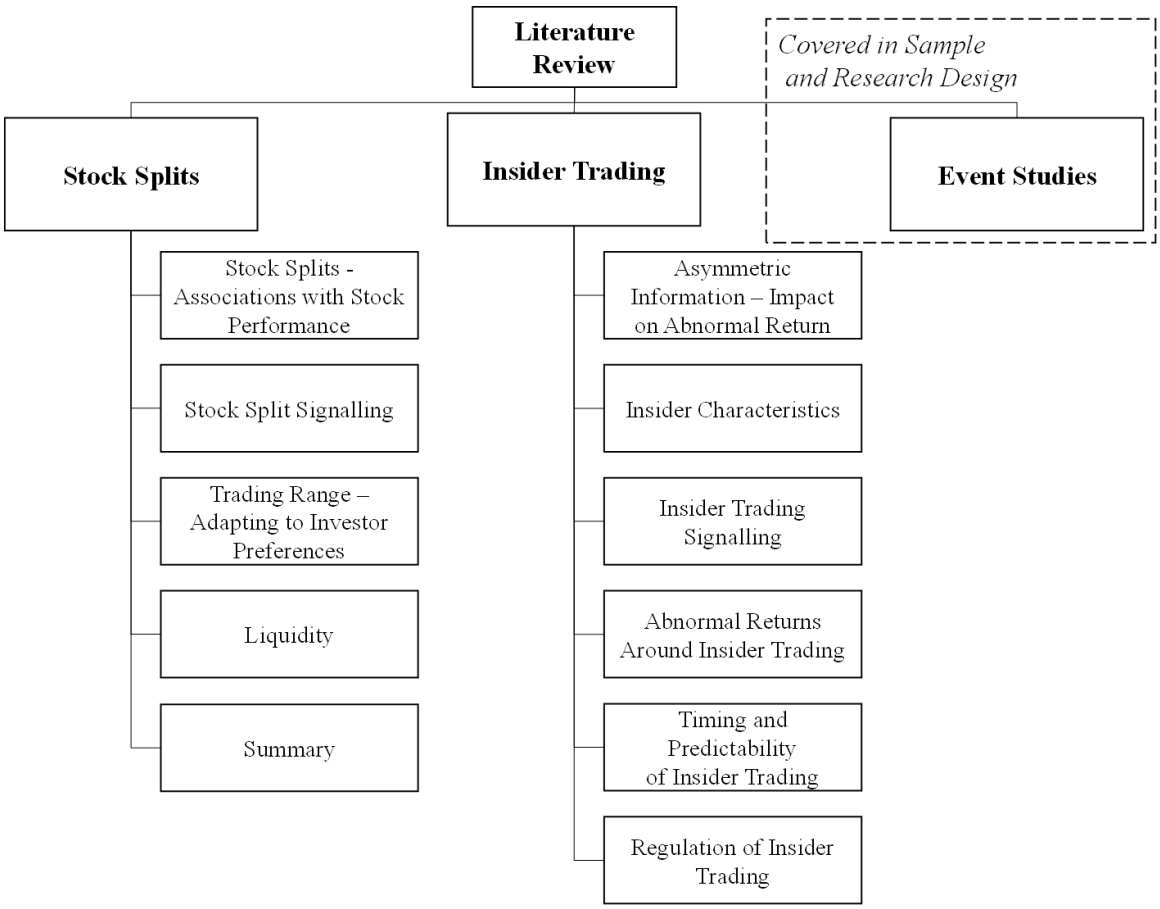
In the following, we conduct a literature review covering the research within the academic fields of stock splits and insider trading. The following sections regarding short- and long-term abnormal returns associated with stock splits and insider trading is pivotal to our analyses, however we nevertheless consider it relevant for the reader to understand the underlying reasons for managers and insiders to conduct stock splits and engage in insider trading, respectively. The literature review is structured as shown in **figure 2.1**.

2.1 Stock Splits

The abnormal returns associated with stock splits will be elaborated in **section 2.1.1**, after which the three main motives, namely the signalling motive (**2.1.2**), trading range motive (**2.1.3**), and the liquidity motive (**2.1.4**) will be elaborated. The signalling motive will receive most attention in the following chapter, as we do not find the trading range relevant for our analyses and since the liquidity motive is inconclusive to such an extent that we do not find it applicable. We finish the chapter by summarising the findings in regards to the insider trading literature.

Stock splits are of a purely 'cosmetic' nature as they imply no fundamental changes to the firm's value. Hence, the evident increase in a given firm's share price at the time of announcement of stock splits, assuming the market is efficient, reflects the release of new information (Asquith, Healy, and Palepu, 1989). Although a stock split does not directly affect a firm's cash flows, it can however be beneficial to the investors (Crawford and Franz, 2001).

Figure 2.1: Overview of Literature Review



The figure depicts stock split and insider trading literature reviews that will be elaborated in the following section and the event study literature review, which will be elaborated in ***section 4*** *The figure depicts stock split and insider trading literature reviews that will be elaborated in the following section and the event study literature review, which will be elaborated in* ***section 4***

2.1.1 Stock Splits - Associations with Stock Performance

Stock splits generally occur when the stock returns as well as earnings have experienced an abnormal increase *pre-split* (Asquith, Healy, and Palepu, 1989; Bar-Yosef and Brown, 1977; Carey and de Souza, 1975; Charest, 1978; Lakonishok and Lev, 1987; Devos, Elliott, and Warr, 2015; Fama, Fisher, Jensen, and Roll, 1969; Grinblatt, Masulis, and Titman, 1984).[7,8] As an example, Ikenberry, Rankine, and Stice (1996) find that four out of five of their sample firms conducting a stock split, during the period 1975 to 1990, traded

[7]Usually annual earnings follow a random walk (Ball and Watts, 1972; Watts and Leftwich, 1977), thus pre-split run-ups should not be evident in the market.

[8]Benartzi, Michaely, and Thaler (1997) find similar result when studying dividend changes.

at prices at or above the 80th percentile 12 months prior to the stock split compared to the non-splitting control group.[9] The majority of most recent research shows that stock splits imply statistically significant stock price revaluations, changes in trading volume, increases in systematic risk, as well as changes in trading variance (Brennan and Copeland, 1988b; Lakonishok and Lev, 1987; Ohlson and Penman, 1985). This market reaction is more pronounced for small firms and low book-to-market firms (Atiase, 1985; Ikenberry, Rankine, and Stice, 1996; Lakonishok and Vermaelen, 1990).

In the period *following* a stock split, Fama, Fisher, Jensen, and Roll (1969) find no further increase in the cumulative abnormal return. In line with Fama, Fisher, Jensen, and Roll (1969), Bishara (1977); Millar and Fielitz (1973) find no excess returns associated with stock split proposal announcements. Later research, however, contradicts these findings as the majority of recent literature finds positive short-term and long-term abnormal returns around the announcement date (Desai and Jain, 1997; Foster III and Vickrey, 1978; Grinblatt, Masulis, and Titman, 1984; Ikenberry and Ramnath, 2002; McNichols and Dravid, 1990; Ohlson and Penman, 1985; Woolridge, 1983). According to Ikenberry, Rankine, and Stice (1996), these pre-split and post-split excess returns are inversely related, implying that high abnormal return prior to the split results in low abnormal return following the split, and vice versa. Thus, the authors conclude hat the evident abnormal return following stock splits is not caused by momentum.[10]

Several studies also show evidence of a relationship between stocks' risk and stock splits. Brennan and Copeland (1988a) find evidence that the systematic risk is higher at the announcement date as well as for the ex-split dates, and Aggarwal and Son-Nan (1989); Ohlson and Penman (1985); Sheikh (1989) find that the stock price volatility increases around the stock split announcement date. Ohlson and Penman (1985) find that there is an approximately 30% increase in the return standard deviations following the stock split, based on data of the period 1962-1981.[11] Lamoureux and Poon (1987) suggest that this increase in volatility is due to a higher number of transactions and outstanding shares following the stock split. However, not all academics agree, and e.g., Bar-Yosef and Brown (1977) find that the systematic risk decreases in the months after a stock split. The primary reason for this inconsistency between academics as well as between academics and practitioners is the

[9]Investors implicitly conclude that the split decisions imply stock prices will continue to increase (Muscarella and Vetsuypens, 1996).

[10]Momentum can be characterised as the rate of acceleration of a security's price or volume. Investors take short or long position in the belief that this rate of acceleration will continue.

[11]The increase holds for both daily and weekly data, and it is not temporary (Ohlson and Penman, 1985).

use of different risk and liquidity measures in the analyses. These inconsistencies imply that it is important to adjust our analyses according to the evident abnormal risk and volatility fluctuations around stock splits.

Given that a stock split does not alter a firm's fundamental value, the question at hand is then why stock splits are implemented in the first place, considering the costs that are incurred in the process.[12] The market reaction around stock distribution announcements has historically been attributed to three main motives (Baker and Powell, 1993), namely *signalling* (Crawford and Franz, 2001),[13] *trading range* (Grinblatt, Masulis, and Titman, 1984; Lakonishok and Lev, 1987; McNichols and Dravid, 1990),[14] and *liquidity* (Lakonishok and Lev, 1987).[15] In the following we describe and elaborate on the motives most relevant for our study in explaining the reasoning for conducting stock splits and the evident long-term abnormal returns (pre-split as well as following the stock split).

2.1.2 Stock Split Signalling

The signalling motive argues that due to information asymmetry between management and investors, the management may seek to communicate the favourable information about the current value of the firm to the public market through stock splits (Brealey, Leland, and Pyle, 1977; Ross, 1977). Thus, stock splits can be regarded as signalling favourable future prospects of the firm, assuming significant costs associated with false signalling (Brennan and Copeland, 1988a; Lakonishok and Lev, 1987).[16]

Extensive research has been conducted on the signalling motive. Desai and Jain (1997) and Fama, Fisher, Jensen, and Roll (1969) find evidence of signalling being associated with changes in ex-split dividends. Grinblatt, Masulis, and Titman (1984) find evidence for signalling associated with future cash flows. Lakonishok and Lev (1987) find that stock splits signal stabilisation of earnings growth following the abnormal pre-split growth and/or improved cash dividend prospects. In conclusion, there is empirical evidence for stock splits being associated with various elements having influence on the future operational measures.

[12] E.g., stock issue taxes, listing fees, mailing costs, etc. (Bar-Yosef and Brown, 1977).

[13] Insiders may signal private information to the market through a split, which would be costly to disclose otherwise.

[14] By engaging in stock splits, managers can realign prices to an optimal trading range, which e.g., is associated with more research analyst coverage and makes it easier for small investors to purchase round lots.

[15] Stock splits may increase the liquidity in a stock through increased trading in the stock and through an expanded number of individual shareholders.

[16] Brennan and Copeland (1988a) suggest that one cost of splits is the increase in investors' transaction costs because of fixed commissions and the odd lots created by the splits.

Fama, Fisher, Jensen, and Roll (1969) introduce the event study methodology to illustrate abnormal returns around a stock split. The methodology used in the event study is described in detail in section **4.2.3**. The paper is pivotal in understanding the market's reaction to stock splits and by far the most important piece of literature regarding stock splits and the signalling effect. The authors conduct one of the first event studies, applying the capital asset pricing model developed by Lintner (1965) and Sharpe (1964), and examine how common stock prices adjust to the implicit information in a stock split. The empirical results of the study show that stock splits, as described above, are usually *preceded* by high abnormal returns (including dividend and capital appreciation), long before news of a potential stock split has reached the market. The authors find that the market interprets the stock split as an indication of a near-term *dividend increase*, relative to the market (i.e., dividend hypothesis).[17] This results in abnormal returns, as expectations of dividend increase causes stock prices to increase (Aharony and Swary, 1980; Asquith and Mullins Jr., 1983). The price increase at the stock split is due to revised expectations regarding future dividend payments and not due to any other intrinsic effects of the split itself, backed by Barker (1956a,b).

In the months prior to the split announcement there may arise uncertainty in the market concerning the higher level of earnings forecast, and investors will attempt to remove the uncertainty through new firm-specific information. The signalling effect from stock splits may be one source of such information. According to Fama, Fisher, Jensen, and Roll (1969), the market realizes this and uses the announcement of a split to revaluate the future stream of expected income. The cumulative abnormal return, as calculated based on a single index model (Fama, Fisher, Jensen, and Roll, 1969), is increasing up until the stock split, however, following the stock split this stays more or less constant for the sample as a whole, which eliminates any possible trading strategies. Hence, the market correctly interprets the stock split as improving the probability that dividends will increase considerably in the near future, but the stock split itself does not convey any new information that the market has not already taken into consideration. The authors find the cumulative average return in the 30 months following a stock split to be different when looking at increases and decreases in dividends. The stocks with a relative dividend increase did increase slightly after a stock split, but more interestingly, the stocks with a relative dividend decrease after a stock split, have substantial decreasing cumulative abnormal return in the 30 months following the stock split. As the market, following a stock split, will anticipate a dividend increase, news

[17] 71.5% of their sample firms experience a dividend increase in the year after the stock split.

of a dividend decrease will cause the share price to plummet. The authors show that new information from the stock split announcement is almost immediately reflected in the price after the announcement date, or at least within the initial month following the stock split. This implies that the market is efficient in the sense that stock prices adjust very rapidly to new information. Fama, Fisher, Jensen, and Roll (1969) do not consider any other events in between the stock split announcement and the dividend changes, which could predict whether the dividends and/or the future abnormal returns will relatively increase or decrease.

As simultaneous announcements of stock splits and dividends might have biased the results of Fama, Fisher, Jensen, and Roll (1969), Grinblatt, Masulis, and Titman (1984) examine the reaction to *uncontaminated* stock split announcements. Over the 1967-1976 period examined, they find that over 80% of NYSE stocks announcing splits had cash dividend announcements in the three days surrounding the split announcement. Grinblatt, Masulis, and Titman (1984) show that there exists a significant positive abnormal return at the two-day window around the *stock split* and *stock dividend* announcement date, as well as for the following 40 days. The authors differ between stock splits and stock dividends to evaluate the signals deriving from changing the book value of retained earnings (stock dividends decrease this value, whereas stock splits do not). Ongoing, we will refer to stock splits as including both stock splits and stock dividends, as this is also how the literature refers to the topic. If we deliberately refer to only one of the two types of stock distributions, we clearly state this. They report a two-day return around the announcement date of 3.41% for the overall sample of combined splits and stock dividends and 3.29% for the 244 uncontaminated split announcements. The majority of the split events are contaminated by contemporaneous announcements, i.e., dividend announcements, earnings announcements, etc. Grinblatt, Masulis, and Titman (1984) conclude that contemporaneous announcements cannot account for the increase in firm value around stock splits. As the two samples (stock splits and stock dividends) result in similar abnormal returns around the announcement date, we will in our study not conduct a similar analysis of an uncontaminated sample or as a robustness test. We delimit our analysis from considering an uncontaminated sample, but we do recognise that our data set could yield different results for a pure sample. According to the authors, these returns are not attributable to changes in cash dividend policy, since they observe similar stock price behaviour in firms that do not pay dividends three years prior to the stock split announcement (control group).[18]

[18]However, Nayak and Prabhala (2001) find that about 54% of stock split announcement effects can be attributed to dividend information in splits.

Firms normally choose to participate in stock splits after a significant increase in earnings, which pre-split may be expected by the market to be transitory in nature (Beaver, Lambert, and Morse, 1980; Brooks and Buckmaster, 1980; Ohlson and Penman, 1985).[19] In case split decisions are based on managers' insider information, the market will anticipate past earnings increases as permanent and the split announcement will lead investors to revalue the pre-split earnings growth (Asquith, Healy, and Palepu, 1989). The authors find that stock splitting firms experience an increase in earnings for several years before the split, which are due to both industry and firm-specific factors. Asquith, Healy, and Palepu (1989) find that these earnings are permanent following the stock split, as they are not reversed for at least four years subsequent to the split. Lastly, Kadiyala and Vetsuypens (2002) argue that there is weak evidence that stock splits convey a positive announcement effect, but instead signal managers' confidence in that the pre-split exceptional performance will continue.

The results of Fama, Fisher, Jensen, and Roll (1969) have, in addition to abovementioned criticism by Grinblatt, Masulis, and Titman (1984), further been questioned by Desai and Jain (1997); Ikenberry, Rankine, and Stice (1996), who find that the market under-reacts at the announcement of stock splits, resulting in abnormal excess returns in the three years following the split. Ikenberry and Ramnath (2002) also find evidence that the positive drift in the share price is due to market under-reaction, estimating buy-and-hold abnormal returns of 9% in the year following firms announcing stock splits. Eaton (1999) agrees and argues that there is a predictable lagged price response following corporate events, not only stock splits. Baker, Greenwood, and Wurgler (2009) find split activity to be a predictor of relative returns at long horizons, indicative of a slow price correction. The authors see this evidence of return predictability as an argument against rational-expectations of signalling.

Finally, Huang, Liano, and Pan (2006); Huang, Liano, Manakyan, and Pan (2008); Huang, Liano, and Pan (2005) find evidence contrary of the signalling motive, namely that the operating performance and profitability (measured by return on assets) deteriorate in the four years following the announcement.[20] This may result in, that the management of their sample's firms undertake stock splits based on current and past earnings, and tend to be too optimistic regarding the firm's long-term performance and profitability. The authors

[19] Earnings increases in one year are usually followed by earnings decreases in the subsequent year, thus earnings are expected to be transitory (Beaver, Lambert, and Morse, 1980; Brooks and Buckmaster, 1980; Freeman, Ohlson, and Penman, 1982).

[20] According to Huang, Liano, and Pan (2005) the positive announcement effect can be explained by lower share prices and improved market liquidity following stock splits, but not by future profitability and split signals.

therefore argue that stock splits are not useful signals of a firm's future earnings (Huang, Liano, and Pan, 2006).

In conclusion, there is substantial evidence that stock splits are preceded by a run-up in the cumulative abnormal return, however academics have historically found contradicting evidence for post-split abnormal returns. In most cases splits result in an increased abnormal return following the split, but there are cases of no or limited impact on the future stock performance. However, most recent research finds that stock splits exhibit abnormal returns subsequent to the announcement, which prevails in the long-term. Apart from the abnormal returns, signalling of stock splits may also be associated with future firm-specific operational measures, e.g., dividend changes, earnings, and cash flows.

2.1.3 Trading Range – Adapting to Investor Preferences

The trading range motive argues that stock splits realign prices to an optimal or preferred trading range (McNichols and Dravid, 1990).[21] As the realignment of the share price is due to an abnormal run-up in pre-split prices (Lakonishok and Lev, 1987), the motive is thus more motivated by past performance than by future performance.

According to Baker and Gallagher (1980); Baker and Powell (1993); Lakonishok and Lev (1987) managers' main motive for stock splitting, after an unusual growth period, is to move the stock price into a trading range, that will make it easier for small investors to purchase round lots. As stated by Lamoureux and Poon (1987), *"this presumes an affinity for (small) round-lot trading"*. In addition to these motives, Barker (1956a,b) also include greater diversification for small investors.

McNichols and Dravid (1990) find that split factors exhibit a function of pre-split share prices. This finding implies that managers have some preferred trading range in mind when issuing stock splits and the split factor will therefore increase as the share price increases. They also find an inverse relationship between split factors and the market value of a firm's equity.[22] The authors suggest that a firm's desire to keep its stock price in a certain range may outweigh its desire to signal inside information to investors. That is, a firm's pre-split price and market value of equity explain more of the variance of split factors than information signalling variables, thus implying that the trading range motive outweighs the signalling effect.

[21] The trading range that management is targeting is, according to Lakonishok and Lev (1987), a function of market-wide, industry-wide and firm-specific prices.

[22] I.e., a higher market value of equity will result in a lower split factor and a lower split factor results in a higher preferred trading range for larger firms.

Baker, Greenwood, and Wurgler (2009) introduce the theory of catering. The authors describe it as a behaviour of supplying more of a given characteristic valued by investors, even if the characteristic does not increase the intrinsic value. The catering theory of nominal share prices, i.e., catering through price management, therefore concerns supplying securities of different price ranges as a response to investor demand for such securities. The authors find splits to be more frequent and to lower trading ranges, when valuations for small- and low-priced firms are more attractive relative to large- and high-priced firms. Furthermore, the authors find split activity to be a predictor of relative returns of cheap and expensive stocks, and small and large stocks at long horizons, indicative of a slow price correction.

Lowering the share price will draw attention to the stock *(attention hypothesis)*. According to Brennan and Hughes (1991), a manager with positive insider information has the incentive to attract the attention of research analysts through stock splits (similar to the signalling motive). A lower stock price leads to an increase of the commission earned by brokerage firms, as commissions are based on the number of shares traded. The manager will therefore seek to reduce the price in order to communicate the insider information most efficiently to the investors. Grinblatt, Masulis, and Titman (1984) further elaborate this through implying that the intention of managers is not to signal but to reduce informational asymmetries and attract market attention, especially from institutional investors and financial analysts, thus reducing the price to a level that makes trading more profitable for brokers and provoking a share revaluation.

The trading range hypothesis is questioned by Branch (1985); Copeland (1979), who argue that transaction costs are an inverse function on the share price. Woolridge and Chambers (1983) show that the attention hypothesis does not apply for reverse-split announcements, providing evidence to reject the attention and trading range motives.

We do not consider the trading range motive to be a motive of specific relevance for the long-term abnormal returns, as we regard the information implied by the trading range motive to be incorporated shortly after the announcement date. We are therefore more inclined towards the signalling motive.

2.1.4 Liquidity

A stock is said to be liquid if the shares can be rapidly sold in the market and if selling shares has little impact on the stock price. Liquidity measures include trading volume, number of shareholders, bid/ask spread, etc. Liquidity is a qualitative measure, and there

is not one definitive measure of liquidity that can exactly describe how liquid a stock is.

Anshuman and Kalay (2002); Bacon and Shin (1993); Baker and Phillips (1993); Schultz (2000) argue that managers frequently justify stock splits based on improved liquidity and marketability. There is, however, inconsistency in the perception of liquidity.[23] Empirical studies use trading volume and percentage bid-ask spreads as measures of liquidity, whereas managers perceive liquidity in terms of the number of shareholders. According to Baker and Powell (1993), management views liquidity as the ease of selling shares with as little a price change as possible. Barker (1956a); Dolley (1933); Lamoureux and Poon (1987) are the only empirical studies that find consistency between managers' perception of improved liquidity, namely increases in stock ownership and the number of transactions.

The conclusions on the effect of stock split on liquidity is contradicting. Kryzanowski and Zhang (1996); Lamoureux and Poon (1987); Maloney and Mulherin (1992) report that the number of shareholders and trading volume increase post-split, whereas Conroy, Harris, and Benet (1990); Copeland (1979); Lakonishok and Lev (1987); Mohanty and Moon (2007) find limited evidence of an increase in trading volume. Other research has found that stock splits actually decrease liquidity, as both bid-ask spreads (Conroy, Harris, and Benet, 1990; Copeland, 1979) and return volatility increase (Conroy, Harris, and Benet, 1990; Koski, 1998; Ohlson and Penman, 1985). Huang, Liano, and Pan (2005); Muscarella and Vetsuypens (1996) argue that by realigning the share price, the clientele is enlarged, trading costs are reduced, and the liquidity of a certain stock is increased.

Conroy, Harris, and Benet (1990); Copeland (1979); Lamoureux and Poon (1987) measure liquidity using the trading volume and the percentage bid-ask spreads and find that trading liquidity decreases following a stock split. However, Lamoureux and Poon (1987) argue that there is no evidence that this decrease in liquidity is reflected in the ex-split share price. Murray (1985) finds that stock splits do not adversely impact the trading volume nor the percentage bid-ask spreads and Lakonishok and Lev (1987) find that there is no permanent effect on the trading volume following the stock split. Lastly, Baker and Powell (1993) also do not find evidence in line with the liquidity motive.

The literature on the effect of stock splits on the liquidity, and secondly on the stock

[23]The academic community does not agree among themselves, and the management naively use the liquidity motive as one of their arguments for conducting stock splits. Baker and Powell (1993) show through survey studies that managers use the liquidity motive as a reason for conducting stock splits. Thus, the management disagrees with empirical findings since they argue in the survey studies that that volatility will decrease following a stock split, whereas most studies find increases. This discrepancy is most likely due to the different risk measures that the empirical studies have tested in order find a relationship between idiosyncratic risk and the stock split, and the risk measures that the management argue proxy for liquidity and volatility.

performance, is inconsistent and inconclusive, which is mainly due to different perceptions of the liquidity measures. The liquidity motive is contradicting to such as an extent, that we find it questionable to apply this motive as a valid argument for conducting stock splits.

2.1.5 Summary

There are clear associations between stock splits and the performance of the stocks. There is overall evidence that stocks splits will be followed increasing cumulative abnormal returns.

The main motives for conducting stock splits are closely tied and not necessarily mutually exclusive (Ikenberry, Rankine, and Stice, 1996).[24] Practitioners and academics have differing views on the motives, where practitioners are in favour of the trading range and liquidity motives and academics are inclined towards the signalling motive (Kadiyala and Vetsuypens, 2002). According to the seminal study by Fama, Fisher, Jensen, and Roll (1969), signalling and trading range motives have been the leading motives for stock splits. Baker and Powell (1993) conduct an email survey targeting practitioners in the period 1987 to 1990 and find, that the main reasoning for stock split is trading range motive, closely followed by the liquidity motive. All above-mentioned empirical and survey studies report that providing a better trading range, improving the trading liquidity, as well as attracting more investors, are among the most important motives for stock splits.

Thus, there is no fixed ranking of the three main motives for pursuing a stock split. The signalling motive is crucial in providing information to the market about the stock splits. The trading range motive is similarly important in attracting attention to the stock split, but for our study is considered of less importance. The liquidity motive, although frequently favoured by practitioners, is contradicting, and therefore considered of less importance. There are other motives, such as the tax-option and optimal tic-size-option, but they are considered of less importance for our study and therefore not further elaborated.[25]

[24] E.g., according to Kadiyala and Vetsuypens (2002) it is difficult to separate the stock split announcement return into the signalling effect and the liquidity effect at the announcement period.

[25] Examples of other motives include increased marketability of firms' shares, conveyance of information regarding superior investment opportunities, increased ownership base to avoid mergers, increased product sales, and improved employer/employee relations (Bar-Yosef and Brown, 1977; Bellmore and Blucher, 1959). Additional hypotheses include the desire by the brokerage community to preserve commission income (Brennan and Hughes, 1991) and a desire by managers to increase ownership by individual investors (Lakonishok and Lev, 1987). Management may for instance prefer to increase the number of small investors in the investor base, i.e., investors who tend not to exercise too much control, in order to create a more controllable ownership mix (Powell and Baker, 1993).

2.2 Insider Trading

We will elaborate on the asymmetric information that insiders may exploit to personal benefit in **section 2.2.1** and present the literature concerning insider characteristics in **section 2.2.2**. Next, we elaborate on the insider trading signalling literature in **section 2.2.3**, how insider trading impact the abnormal returns in the following time period in **section 2.2.4**, as well as the literature regarding the timing and predictability of insider trading in **section 2.2.5**. We finish by elaborating on the regulation of insider trading in **section 2.2.6**.

As earlier described, insiders comprise a firm's employees, shareholders, or stakeholders who have access to material non-public information. Insider trading entails trading activity conducted by these agents, and insider trading may include both legal and illegal trading.

2.2.1 Asymmetric Information – Impact on Abnormal Return

The empirical literature on insider trading concludes that insiders possessing special information can earn abnormal return in one of two ways (Kallunki, Nilsson, and Peltoniemi, 2009; Piotroski and Roulstone, 2005). Firstly, insiders can benefit in cases of mispricing, where outside investors are applying inferior valuation models and/or biased judgements (Jenter, 2005; Piotroski and Roulstone, 2005; Rozeff and Zaman, 1988).[26] Secondly, the insiders' access to private information about future cash flows allow the insiders to capitalise on future price changes (Huddart and Ke, 2007; Ke, Huddart, and Petroni, 2003; Piotroski and Roulstone, 2005).[27]

Veenman (2012) examines whether abnormal returns following insider transactions may be explained by insiders' private information or by mispricing based on public information. The author finds that purchase decisions made by managers are associated with positive future abnormal returns as well as with equity undervaluation, and the author concludes that the abnormal returns following insider purchases are reflecting both private information and a reaction to mispricing in the market. This conclusion is supported by Piotroski and Roulstone (2005) who find that *"insiders capitalize on both outside investors' valuation*

[26]Research shows that corporate trading activities is associated with mispricing (Baker and Wurgler, 2002; Grullon and Ikenberry, 2000), and more specifically that managers repurchase shares (Brav, Graham, Harvey, and Michaely, 2005), issue new equity (Graham and Harvey, 2001), or engage in takeovers (Dong, Hirshleifer, Richardson, and Teoh, 2006) in response to mispricing.

[27]Ben-David and Roulstone (2010) show that regulation of market participations has forced insiders to trade partially on mispricing as opposed to trading solely on private information of short-term cash flow news.

errors and their own superior private information when making their trading decisions."

This asymmetric information between insiders and other investors implies that insider trades help push prices towards their fundamental values (Aboody and Lev, 2000; Huddart and Ke, 2007; Myers and Majluf, 1984). The price reactions will depend on the market efficiency, and according to Fidrmuc, Goergen, and Renneboog (2006) market efficiency in relation to insider trading can be viewed from two mind-sets, one assuming market inefficiency and one assuming market efficiency. The first, assuming that markets are inefficient, argues that the price reaction to insider transactions is gradual, e.g., measured by using long-term Cumulative Abnormal Returns (CAR) for e.g., 6-12 months following the transaction. Significant abnormal returns over the period is considered proof of superior insider information (Gregory, Matatko, and Tonks, 1997; Jaffe, 1974; Lakonishok and Lee, 2001; Lin and Howe, 1990; Rozeff and Zaman, 1988). The second, assuming that markets are efficient, argue that share prices adjust rapidly to insider transactions. The supporters of this approach will most often measure the short-term abnormal return around the insider transaction, e.g., on a daily or inter-monthly period (Chang and Suk, 1998; Friederich, Gregory, Matatko, and Tonks, 2002; Jaffe, 1974).

2.2.2 Insider Characteristics

Cohen, Malloy, and Pomorski (2012) divide insider traders into *informative* and *non-informative* traders, which the authors characterise as *"opportunistic"* and *"routine"* insider traders, respectively.

Routine insider traders are identifiable and predictable, and their trading habit is therefore not directly informative in regards to future stock returns. They may never the less be indirectly informative, if they are able to influence the timing of the stock splits (cf. **section 3.2**). Routine insiders may sell due to diversification or liquidity reasons, and purchases can occur e.g., as part of bonus schemes. By identifying routine insider traders, the authors are capable of excluding uninformative signals. In this way it is possible to isolate the information-rich traders that the authors find to contain all of the predictive power in the insider trading universe. A portfolio strategy based on routine insider traders yields an equal-weighted abnormal returns of 43 basis points (statistical significant at 10%)[28,29] whereas a portfolio strategy based on opportunistic traders yields 180 basis points per month

[28] One basis point is equivalent to 0.1 percent.

[29] A portfolio strategy based on routine insider traders yields a value-weighted abnormal return of -20 basis points (statistical insignificant).

(statistical significant at 1%).[30] Opportunistic trades are also statistically significant after controlling for size, book-to-market, previous year returns, and date fixed effects. Although statistically significant, it may still be difficult for investors to interpret informativeness of insider transactions, as other motives such as liquidity and diversification, as well as regulatory issues will affect the timing and reasoning of insider trades.

Prior research finds that managers in some cases behave opportunistically around stock split announcements for personal gain (Devos, Elliott, and Warr, 2015), and that opportunistic insider trading conveys information that the market has not taken into consideration. Such opportunistic insider traders can predict future firm news and firm events (Cohen, Malloy, and Pomorski, 2012).[31]

Devos, Elliott, and Warr (2015) examine the trading behaviours of CEOs in the 20 days around a stock split. The findings indicate opportunistic behaviour, and the CEOs are characterized as opportunistic traders. The opportunistic trading behaviour is indicated by trading showing significantly higher levels of buying before the stock split compared to after the stock split (64% vs. 36%), and vice versa for the levels of selling (35% vs. 65%). It is also evident from the study that the level of trading around stock splits is approximately four times higher compared to the trading in the prior year for the same calendar time period.[32]

Baesel and Stein (1979); Seyhun (1986) consider all insiders in differential management positions, and find that they possess different private information and hence earn varying abnormal returns. However, Jeng, Metrick, and Zeckhauser (2003) do not find that top executives earn higher abnormal returns compared to other senior-level employees. Furthermore, subsequent research indicates weak evidence of opportunistic insider actions by non-managers (Cheng and Lo, 2006; Ke, Huddart, and Petroni, 2003; McVay, Nagar, and Tang, 2006), which is contradicting Cohen, Malloy, and Pomorski (2012), who find local non-senior insiders to be the most informative insider traders.[33]

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[30] A portfolio strategy based on opportunistic insider traders yields a value-weighted abnormal return of 82 basis points (statistical significant at 5%).

[31] In addition, Malmendier and Tate (2005) show that the CEOs in their study sample engage in irrational behaviour by keeping vested and "in the money" (ITM) options beyond rational threshold due to overconfidence in the future performance of their firm.

[32] The authors are not capable of testing the intent of the CEOs, prove the existence of grant backdating, nor find evidence of whether the timing of grants is merely used for bonus schemes.

[33] According to Cohen, Malloy, and Pomorski (2012) the opportunistic local non-senior traders can be characterised in the following manner; 1) they tend to have longer tenure at the firm than the average insider, 2) they are likely to be from geographically concentrated firms, 3) they are likely to be from poorly governed firms, and 4) they come from firms with more product offerings.

In order to isolate the routine traders in their study, Cohen, Malloy, and Pomorski (2012) analyse the traders' past trading history, more specifically the patterns in timing of trades. The authors consider insiders as insider traders with three years of consecutive insider trading. This classification procedure requires three years of past trading history, which limits the sample to about one-third of their entire sample of insider transactions. All insiders with three years of past trading history are then characterised as either routine or opportunistic traders at the beginning of each year. A routine trader's trading pattern is characterised by trades occurring in the same month during at least three consecutive years in a row. Opportunistic traders include traders that engage in three consecutive years trading, but without a distinct past trading pattern. The classification used in their analyses is further elaborated in **section 4.1.4**, as it is also used in our study. Cohen, Malloy, and Pomorski (2012) classify roughly 64% of insider purchases and 52% of insider sales as routine trades; hence, 36% of insider purchases and 48% of insider sales are classified as opportunistic trades. Overall, trades made by routine traders comprise 55% of the total sample, while trades made by opportunistic traders represent 45% of the total sample.

The returns of the opportunistic portfolio continues to rise for roughly six months following the classification and trading month, and then levels off, implying no future reversal (Cohen, Malloy, and Pomorski, 2012). This indicates that the market is not efficient in fully incorporating the information from the trades of opportunistic insiders. Lastly, the authors find that only the trades of opportunistic insiders have predictive power of future news announcements about the firm, being mostly shorter-term news.[34]

Scott and Xu (2004) characterise insiders in a different manner compared to Cohen, Malloy, and Pomorski (2012). The authors divide insider sales into *information-driven sales* and *sales driven by liquidity or risk-reduction needs*. The authors conclude that large insider sales that account for a large percentage of insiders' holdings, predict significantly negative future abnormal returns, thus characterised as information-driven sales. In contrast, small sales that account for minor percentages of insider's holdings do not predict poor performance, but are instead correlated with significantly positive abnormal returns. The authors argue that when insider sales have positive information about the firm's future prospects, their insider transactions will be small in volume and account for a small part of their holding, while negative information will result in larger insider transactions and account for a large part of their holding. Furthermore, the authors find evidence for the

[34]Examples of future news announcements of the firm are future analyst recommendations, future analyst earnings forecasts, future management forecasts, and future earnings announcements (Cohen, Malloy, and Pomorski, 2012).

fact that the larger the percentage of shares owned, the larger the magnitude of excess returns. Furthermore, Han and Suk (1998) find that the abnormal excess return at the announcement date for stock splits is positively related to the level of insider ownership. This relationship is strongest for small firms. The authors argue that since stock splits signal management's insider information, the credibility of the signal is enhanced as the level of managerial ownership increases.

2.2.3 Insider Trading Signalling

There may be several reasons for insider trading to occur. It could e.g., be due to change in wealth and consumption preferences, diversification (portfolio rebalancing), increased liquidity, or tax considerations (Cohen, Malloy, and Pomorski, 2012; Elliott, Morse, and Richardson, 1984). Insider transactions communicate new private information to the market, even if preceded by firms-specific news, because insiders do not represent the typical investor (Fidrmuc, Goergen, and Renneboog, 2006). The authors find that insider trading signals are considered credible signals to outsiders, since they are costly to the insiders as they put their own wealth at stake and bear the risk of holding a non-diversified investment portfolio. We, however, believe that this finding oversimplifies the situation. Insiders are not just employees of the firm, as the findings of Fidrmuc, Goergen, and Renneboog (2006) primarily relate to, but they can also be characterised as either a significant shareholder[35] or a stakeholder with access to material information (Seyhun, 1998). The shareholders with a large holding in the firm can for example include institutional investors that will easily be able to diversify their portfolio despite engaging in insider trades, and they typically invest on behalf of other people. Therefore, we argue that the insider trading signal may be stronger for employed insiders, as they increase their firm specific risk as they are both employed in the firm and furthermore invest in the firm.

Academics in favour of legalising all insider trading argue that insider trading contributes to more informative stock prices, as their actions reveal the firm's true value (Carlton and Fischel, 1982; Leland, 1992; Manne, 1966). Accordingly, they infer that market professionals devote fewer resources to collecting information once they know that insiders have superior private information, and they tend to replicate the insiders' actions. However, critics emphasise multiple consequences by allowing all insider trading to take place: information asymmetries widens, investments are discouraged (Ausubel, 1990), and stock market participation and liquidity decreases (Leland, 1992), and adverse selection problems occur

[35] A shareholder with more than 10% ownership in the firm.

alongside inefficient corporate behaviour (Manove, 1989).

According to Bettis, Vickrey, and Vickrey (1997); Fidrmuc, Goergen, and Renneboog (2006), it is important to consider the difference in information and signalling value between purchases and sales of shares. While an insider purchase conveys positive information regarding a firm's prospects, information from an insider sale is less clear (Bettis, Vickrey, and Vickrey, 1997; Fidrmuc, Goergen, and Renneboog, 2006). An insider sale can convey negative information about the firm's prospects, but it can also be less informative if the motives for trading are personal consumption, diversification, or liquidity needs (Jeng, Metrick, and Zeckhauser, 2003; Lakonishok and Lee, 2001; Ofek and Yermack, 2000).[36,37] In general, insider purchases are typically associated with positive future abnormal returns, whereas insider sales tend to predict smaller, sometimes insignificant, future abnormal returns (Scott and Xu, 2004). Jeng, Metrick, and Zeckhauser (2003) find that insider purchases constitute positive abnormal return of more than 6% per year and insider sales do not earn any significant abnormal returns.

Cohen, Malloy, and Pomorski (2012); Jenter (2005); Lakonishok and Lee (2001); Piotroski and Roulstone (2005); Rozeff and Zaman (1988, 1998); Scott and Xu (2004); Seyhun (1992a) find evidence that top managers exhibit contrarian views on the valuation of their own firms, thus affecting both private trading and corporate decision making.

2.2.4 Abnormal Returns Around Insider Trading

Several publications show that insiders can earn abnormal returns through insider transactions (Betzer and Theissen, 2009; Chang and Suk, 1998; Fidrmuc, Korczak, and Korczak, 2011; Finnerty, 1976b,a; Friederich, Gregory, Matatko, and Tonks, 2002; Givoly and Palmon, 1985; Hillier and Marshall, 2002; Jaffe, 1974; Jeng, Metrick, and Zeckhauser, 2003; Lakonishok and Lee, 2001; Lin and Howe, 1990; Lorie and Niederhoffer, 1968; Pope, Morris, and Peel, 1990; Pratt and DeVere, 1978; Rozeff and Zaman, 1988; Seyhun, 1986, 1992b). Previous research has concluded that insiders possessing special information can predict the development in share prices six months subsequent to insider trading (Glass, 1966; Lorie and Niederhoffer, 1968; Rogoff, 1964), and that the returns of insiders exceed market returns (Glass, 1966; Rogoff, 1964).[38] Similarly, Lorie and Niederhoffer (1968) find that a

[36] Insiders receive a large portion of their shares through initial ownership and stock grants (Cohen, Malloy, and Pomorski, 2012).

[37] Furthermore, insiders often conduct option-related sales of shares to pay taxes (Linney and Marshall, 1987) and insider purchases are likely to be due to revaluation of future cash flows (Seyhun, 1986, 1992b).

[38] We apply a similar methodology as Glass (1966); Lorie and Niederhoffer (1968); Rogoff (1964).

security that experienced an intensive buying month is prone to experience an increase in share price in the six months subsequent to the insider trade. According to Bettis, Vickrey, and Vickrey (1997); Jaffe (1974); Lorie and Niederhoffer (1968); Pratt and DeVere (1978) outsiders can earn similar return through mimicking the trades of insiders.

Research has primarily formed portfolios based on insider transactions as reported in the *"SEC Official Summary of Insider Trading"* (Jaffe, 1974). Research has shown that portfolios long[39] in firms where the number of insider buyers exceed the number of insider sellers and short[40] in the opposite direction result in abnormal returns (Finnerty, 1976a,b; Jaffe, 1974; Lorie and Niederhoffer, 1968; Pratt and DeVere, 1978). Jaffe (1974); Seyhun (1986, 1998, 1988) find stock price under-performance following insider sales and stock price appreciation following insider purchases. Seyhun (1992a) conducts a study on the power in the predictability of the future abnormal stock returns when considering the previous twelve-month aggregate insider trading. The author finds that up to 60 percent of the variation in abnormal stock return twelve months after the split and up to 25 percent of the variation in six-month-ahead abnormal stock returns can be forecasted using the twelve-month pre-split aggregate insider trading. Other studies by Jeng, Metrick, and Zeckhauser (2003); Lakonishok and Lee (2001), who control for size, book-to-market and past returns, show that insider sales are not predictive of future abnormal returns.

Seyhun (1983) finds that a trading strategy of buying when insiders buy and selling when insiders sell yields an abnormal return of 3-4%. In addition, he finds that insiders in small firms tend to purchase more compared to insiders in large firms, while insiders in large firms tend to sell more. Lastly, he shows that the majority of the abnormal returns in his portfolios stemmed from small firms. This suggests that the pricing of small firms is less efficient, thus, traders can more easily trade on this inefficiency.

However, some studies oppose to these findings and argue that insiders do not earn abnormal returns (Eckbo and Smith, 1998). When controlling for transaction costs (Jaffe, 1974; Rozeff and Zaman, 1988) and for transaction costs as well as the bid-ask spread (Seyhun, 1986), they find that outsiders' profits are eliminated. However, a later study by Bettis, Vickrey, and Vickrey (1997) shows that outsiders can earn abnormal profits, net of transaction costs. Furthermore, Lakonishok and Lee (2001) find that insider transactions do not predict subsequent returns once size and book-to-market effects are controlled for.

[39] Going long in a portfolio means purchasing a portfolio.

[40] Going short in a portfolio means borrowing a portfolio from an investor, selling it in the market and eventually purchasing it in the market, in order to return it to the investor. Short positions benefit from a drop in share prices.

We are not seeking to test a trading strategy for outsiders replicating insiders, but merely testing the long-term abnormal return stemming from the combination of stock splits and insider trading – thus, we will not consider transaction costs or other related assumptions (cf. **section 1.2**).

Driscoll (1956); Wu (1963) find no evidence of successful forecasting by insiders nor a relationship between insider trading and subsequent stock price movement. Moreover, Lakonishok and Lee (2001) find very little market movement when insiders trade and Wu (1963) notes *"there is very little evidence that a definite relationship exists between insider transactions and subsequent price movements."*

Thus, the evidence for future predictability of abnormal returns when considering insider trading is ambiguous. However, the majority of the recent research finds evidence for abnormal returns.

2.2.5 Timing and Predictability of Insider Trading

Insiders are often aware of forthcoming price-relevant events months and even years before the public disclosure (Beneish, 1999; John and Lang, 1991; Karpoff and Lee, 1991; Ke, Huddart, and Petroni, 2003; Lee, Mikkelson, and Partch, 1992; Seyhun and Bradley, 1997; Seyhun, 1990). There are several studies of insiders' trading behaviour around quarterly and yearly earnings announcements (Allen and Ramanan, 1995; Huddart, Ke, and Shi, 2007; Roulstone, 2008; Udpa, 1996). Huddart, Ke, and Shi (2007) find that insiders condition their trades on accounting disclosures, but avoid trades immediately before earnings announcements due to high legal risk, such as litigation from the SEC. Furthermore, Ke et al. (2003) find an increase in the frequency of net insider sales 9 to 24 months before a break in a string of consecutive increases in quarterly earnings, but little evidence for net sales trading activity close to the break. This implies that insiders anticipate future earnings up to two years into the future and trade to profit from this information. Furthermore, Elliott, Morse, and Richardson (1984) find that insiders increase/decrease their exposure to purchases/sales 12 months prior to *"extreme earnings increases"*. Marin and Olivier (2008) document that insider sales peak many months before an evident large drop in the specific share, while insider purchases peak only the month before a large jump. This reflects insiders' desire to avoid the implied potential costs stemming from adverse publicity or litigation (Ke, Huddart, and Petroni, 2003).

Managers trade before and/or contemporaneous to corporate events in order to time the market (Chan, Ikenberry, and Lee, 2003; Kahle, 2000; Karpoff and Lee, 1991; Lee, 1997;

Seyhun, 1988, 1998). The managers take advantage of the perceived mispricing through their capital structure and investment decision making (Jenter, 2005), e.g., opportunistic share buybacks or equity issuances. Marin and Olivier (2008) find strong evidence that insiders participate in strategically planned sales preceding corporate events. However, the above-mentioned publication can be criticised by considering managers' overconfidence, which may distort the findings (Brav, Geczy, and Gompers, 2000; Eckbo, Masulis, and Norli, 2000; Malmendier and Tate, 2005; Schultz, 2003). Managers' overconfidence may imply that managers engage falsely in insider trades believed to be opportunistic or falsely believe that their own optimistic perception of the firm's valuation implies mispricing by the market.

Penman (1982) examined insider trading before management forecasts and found some evidence that insiders are trading based on this information, thus timing trades relative to announcements of their firms' earnings prospects. The author found that insiders buy more before forecasts associated with a price increase and sell more before forecasts associated with a price decrease.

Lastly, research shows that some insiders act as contrarians by selling more shares after good news than after bad news and similarly by buying more shares after bad news than after good news (Noe, 1999). Managers may even increase the number of bad disclosures before purchases (Cheng and Lo, 2006) and thus releasing bad news opportunistically (Aboody and Kasznik, 2000; Cheng and Lo, 2006; Kraft, Lee, and Lopatta, 2014; Rogers and Stocken, 2005).

2.2.6 Regulation of Insider Trading

Insider trading is closely monitored by regulators (e.g., SEC) and if carried out on the basis of private information it is considered illegal and unfair to outside investors. Such insider trading would undermine rational outsiders' confidence, thereby deteriorating their willingness to trade, and reducing the liquidity as well as the efficiency of capital markets (Fishman and Hagerty, 1992; Jeng, Metrick, and Zeckhauser, 2003).

Despite of the SEC regulations and an increased federal enforcement of insider trading sanctions (Bettis, Coles, and Lemmon, 2000), it is not sufficient to withhold insiders from trading for their own gain. Despite of this fact, Fernandes and Ferreira (2009) find that stock prices convey more information about future earnings when insider trading laws are enforced in developed markets, hence the enforcement of SEC regulation is not without reasoning. Furthermore, the application of the Insider Trading and Securities Fraud Enforcement Act

of 1988 (ITSFEA) constraining insider trading and insider trades 30 days prior to earnings announcements, has become less frequent compared to before (Garfinkel, 1997).

Some observers consider insider trading to be unjust enrichment (Fishman and Hagerty, 1990), whereas other observers believe that it should be legal, as it makes stock markets more efficient and should be regarded as part of management remuneration (Carlton and Fischel, 1982; Jeng, Metrick, and Zeckhauser, 2003; Manne, 1966). Whether or not observers agree with the interference of regulators in the market, Seyhun (1992b) finds that changes and enforcement of insider trading laws in the US severely affected the trading behaviour of insiders, which resulted in decreased willingness of insiders to trade before earnings announcements.

Chapter 3

Framework

Below, we introduce the context in which we conduct our empirical study, i.e., investor and insider characteristics and regulatory rules, and we illustrate the implications of combining stock splits and insider trading actions. We apply rules from the Securities and Exchange Commission (henceforth SEC) in the United States, as our thesis revolves around US stock returns and insider trading data. To understand our study and empirical analyses, we therefore introduce the agents participating in the market in **section 3.1** as well as the signals implied by stock splits and insider trading in **section 3.2**. We finish the chapter by making empirical predictions for our study in **section 3.2**.

In the following section, we refer to insiders as being informed, non-informed, or infrequent traders. These denominations are based on *theoretical* principles concerning the knowledge possessed by the given insiders. We denote insiders through the denominations by Cohen, Malloy, and Pomorski (2012) (Opportunistic, Routine, and Non-classified insiders), as these denominations are based on their *practical* application.

3.1 Participating Agents

We identify three agents of relevance for our study: investors, regulators, and insiders.

i) *Investors* include individual investors and institutional investors who aggregated can be denominated as the market. We assume that investors act economically rational and utility maximising.

ii) *Regulators* include both the government body responsible for regulating the financial markets, such as the SEC, as well as the stock exchanges, where individual stocks

are listed. The regulators' main objective is to ensure that trading in the regulated financial markets is transparent and legal.

iii) Finally, of particular interest for our studies, the *insiders* who have access to material non-public information.[41] Material non-public information is information that an investor, would reasonable, consider important when assessing the value of a stock, e.g., information on upcoming dividend announcements or other significant firm specific news.

Material non-public information is defined by the SEC as follows:

> *"Information is material if 'there is a substantial likelihood that a reasonable shareholder would consider it important' in making an investment decision. To fulfill the materiality requirement, there must be a substantial likelihood that a fact 'would have been viewed by the reasonable investor as having significantly altered the 'total mix' of information made available.' Information is nonpublic if it has not been disseminated in a manner making it available to investors generally."* (SEC A, 2016)

> *"Illegal insider trading refers generally to buying or selling a security, in breach of a fiduciary duty or other relationship of trust and confidence, while in possession of material, nonpublic information about the security. Insider trading violations may also include 'tipping' such information, securities trading by the person 'tipped', and securities trading by those who misappropriate such information."* (SEC B, 2016)

We use the term *insider trading*, which includes both legal and illegal insider trading.

Insiders with access to material non-public information, henceforth referred to as *insider information*, are by the regulators required to report their trades in the firm. As insiders are not permitted to trade while in possession of material non-public information about the stock, a pivotal job of the regulators is to oversee the reported trades and make sure that the insiders do not engage in trading based on insider information, i.e., equivalent to illegal

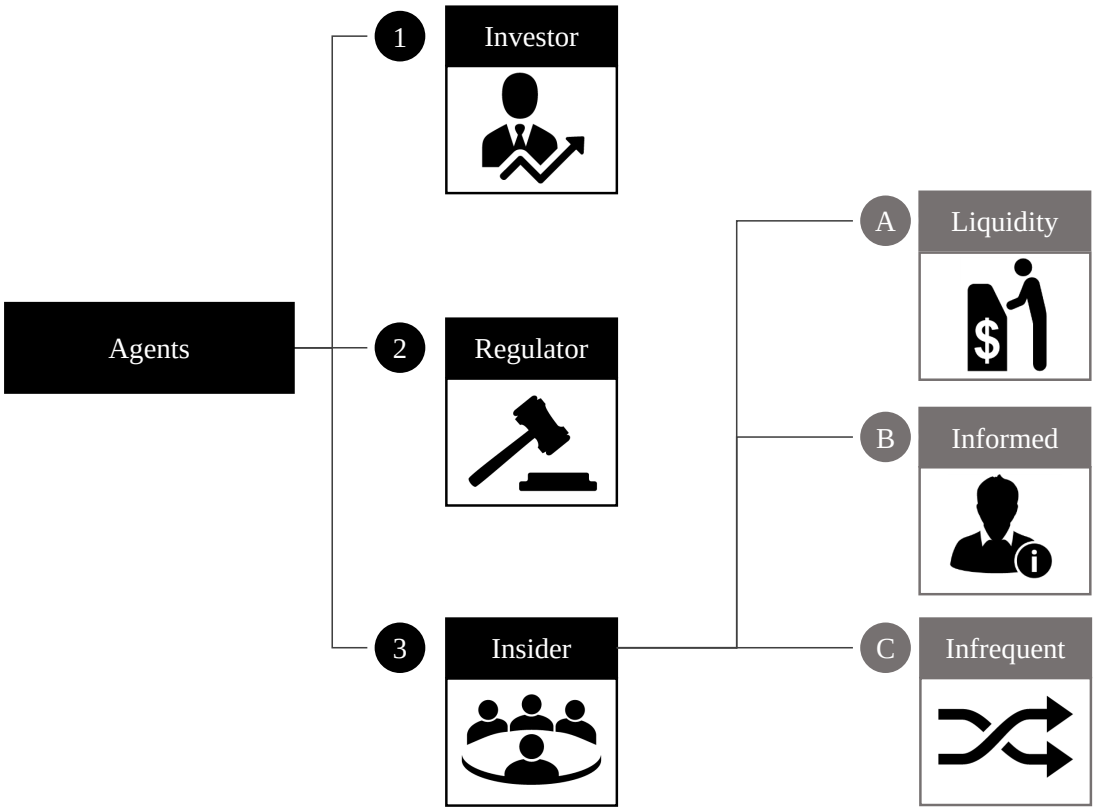
[41] Insider affiliation with a firm may be in the form of 1) employment with access to material non-public information, e.g., being part of the management team, the board of directors, or a business division with material non-public information; 2) individuals affiliated with clients/suppliers; 3) shareholders, who are deemed insiders through a significant size of their ownership in the firm. From the U.S. Securities and Exchange Commission website: http://www.sec.gov/about/whatwedo.shtml#intro, and Section 16(a) of the Securities and Exchange Act of 1934, respectively.

insider trading. If regulators are perfectly effective in identifying and prosecuting illegal insider trading, the absolute number of illegal insider trades will diminish and approach zero over time, assuming insider rationality. At that point, there would be no information content by studying reported insider trades, as in principle there would only *remain legal trades*. However, if an investor is able to create a trading strategy exhibiting an abnormal return by mimicking the trading behaviour of insiders, this would imply that the regulators are being ineffective in limiting illegal insider trading. Thus, by studying the information content of all reported insider trades, we implicitly assume some insider trades to be illegal. We therefore assume that the regulators are not fully effective in identifying and prosecuting illegal insider trades.

The thesis fundamentally depends on the materiality of the insider information and the implications it may have on the future return of a stock. If the information has no implications for the return of a stock, then there is no basis for studying the effect of the agents using the information. Our study is furthermore dependent on the actual use of the information through insider trades. If the insiders having insider knowledge do not trade, then no inference can be drawn. Finally, information about the insider trades needs to be obtainable through a source in a timely manner to assess any implications in the return of a stock, i.e., the trade should be disclosed within reasonable time of the actual insider transaction.

Studying the implications of insider trades is based on the above assumptions about insiders and the information they may or may not possess. It is crucial for our study that we are able to identify the insider agents in order to analyse if they have material information. We therefore segment the insiders into three archetypes: liquidity insiders, informed insiders, and infrequent insiders (cf. **figure 3.1**).

Figure 3.1: Segmentation of Agents and Insiders



The above figure provides an overview of the various agents and insiders present in the financial market.

3.1.1 Liquidity Insiders

Liquidity insiders may be described as insiders, who primarily trade as part of their employment arrangement or who on a recurring basis purchase or sell stocks to generate liquidity or diversification. In the literature review this group of agents would be denominated as "routine" or "non-informative" insiders (cf. **section 2.2.2**). Liquidity traders are in principle not involved in opportunistic trading based on insider knowledge about their firm, but we hypothesise that they may be able to benefit e.g., from predetermined insider trading plans (cf. **section 3.2**).

Many employees of a firm receive stock and/or stock grants as part of their compensation package. The employees, often being senior executives of a firm, are remunerated in this

way to align the interest of the shareholders and the management/employees of a firm. To realise their compensation package and by converting stock into cash, insiders sell their stock in the open markets.[42] Bill Gates, the founder and former CEO of Microsoft, is a frequently used example of an insider agent, who regularly sells his shares in open market sales in order to generate cash and provide liquidity for himself. Another reason for selling the stock may simply be to generate cash in order to diversify the risk towards multiple companies and/or assets. Because the trading behaviour is motivated by liquidity and/or diversification reasons for this archetype, the market cannot know if it can obtain any information by observing their trading on a stand-alone basis.[43]

If employees are compensated through stock in their firm on a recurring basis, we correspondingly expect them to engage in selling the stock on a recurring basis. Thus, if they engage in recurring sales of the stock in their firm and their trades are reported to the regulators and subsequently made public we may be able to identify such agents. Cohen, Malloy, and Pomorski (2012) use the term *routine traders* to identify these liquidity insiders who trade on a routine basis in the same month for three consecutive years.

An important rule to consider in regards to liquidity insiders is the 10b5-1 SEC rule, adopted in 2000 (SEC A, 2016).

The 10b5-1 rule *"protects corporate insiders against allegations of illegal trading if their trades conform to a pre-arranged written trading plan that was set up at a time when the insider had no material non-public information."* (Sen, 2008). In 2006, about 45% of all sale transactions by top management were carried out through 10b5-1 plans (Sen, 2008).[44]

The 10b5-1 rule includes plans that can be executed according to a specific date or according to a certain stock price level (resembling a stock option). A substantial part of 10b5-1 plans incorporate limit orders that execute when the stock price reaches a predetermined level, thus a certain part of the 10b5-1 plans are executed following share price run-ups. This implies that a parts of insider sales and purchases from 2000 and onwards may be pre-determined and they therefore do not necessarily entail any new insider information to the market. The empirical findings of the 10b5-1 rules are however ambiguous, and Cohen, Malloy, and Pomorski (2012) find that the introduction of the 10b5-1 plan does not significantly alter their own findings, as they find similar differential performance between opportunistic and routine trades pre-2000 compared to post-2000. Other literature

[42]As delimited earlier, we focus our study on open market purchases and sales, thus not considering stock grants and stock options.

[43]However, liquidity and diversification are not mutually exclusive reasons.

[44]Lower bound according to the authors.

find evidence of strategically timed sales executed under 10b5-1 plans (Jagolinzer, 2008),[45] but Sen (2008) finds no such evidence.

Like other insiders, liquidity insiders may or may not have insider information about their firm. Even if the insiders have knowledge of insider information, they may choose not to engage in trading behaviour based on this knowledge.

3.1.2 Informed Insiders

In contrast to liquidity insiders, we classify informed insiders as agents who may trade on insider information. In the literature review this group of agents have been denominated as "informed" or "opportunistic" insiders (cf. **section 2.2.2**). A pivotal assumption to our thesis is that the informed insiders possess insider information about their firm, and that some of the informed insiders even trade, based on insider information. A motivation for engaging in such behaviour may be of economic reasons, and Cohen, Malloy, and Pomorski (2012) use the term *opportunistic traders* for insiders who trade for three consecutive years, in a different month compared with the previous year, and who seem to earn an abnormal return in their trading behaviour.

Thus, if informed insiders are exploiting their insider knowledge, they may be able to earn an abnormal return by trading in the stock compared to investors who do not have access to the insider information. An example of such opportunistic trade would be a purchase before an announcement of positive information or a sale before an announcement of negative information, as expressed by Elliott, Morse, and Richardson (1984):

> *"If insiders are using early access to publicly announced information, then issuance of good news should be preceded by insider buying activity, while public announcements of bad news should be preceded by insider selling activity. If insiders have taken speculative positions preceding a public announcement, then, subject to an aforementioned six-month constraint,*[46] *insiders should reverse their positions following the public announcement."*

We expect the timing of insider trades before the stock split announcements to lie where the regulators would not identify them as illegal insider trading. As an example, a significantly large purchase by the CEO in his firm's stock ahead of a positive earnings announce-

[45] Sen (2008) shows that the event-study methodology applied by (Jagolinzer, 2008) leads to downward biased estimates of abnormal returns.

[46] Before the public disclosure of information, companies may constraint insiders from trading in a given period (i.e., blackout period), as they have access to non-public material information (Elliott, Morse, and Richardson, 1984).

ment would attract the attention of the regulators. In order to avoid such illegal insider trades, companies may voluntarily mandate blackout periods for which SEC prohibits insiders from engaging in insider transactions.[47] We therefore expect the CEO to purchase shares in sufficient time ahead of the corporate announcement, taking into consideration the blackout period.

To mitigate the asymmetric information between the informed insiders and the investors, the regulators require insiders to report their trades and subsequently disclose them to the public. Even if the regulators are not able to identify illegal insider trades effectively, the investors have access to the insider trades and can make their own analysis on the informational content of such reported insider trades.

Lastly, we believe that some of insider trades carried out in accordance with a 10b5-1 plan, labelled as liquidity insiders, may share characteristics with informed insiders as the trades may exhibit opportunistic behaviour. Even though informed insiders to some extent will include pre-determined insider trades based on 10b5-1 plans, they will still be able to provide us with valuable information.

3.1.3 Infrequent Insiders

Infrequent insiders are the remaining insiders, who regulators require to report their trades, and who we are not able to classify as neither liquidity insiders nor informed insiders. Similar to liquidity traders, infrequent traders do not trade based on insider information. Their purchasing or selling behaviour are either on a systematic annual basis, a single trade with no subsequent trades, or by other random occurrences not motived by liquidity and diversification reasons.

3.2 Signals

Essentially, our study revolves around two signals observable to an investor: 1) Announcement of a stock split in a given security and 2) Reporting of insider trading in the security. If an investor observes both signals, he or she may make certain inferences about the combination of the signals.

i) The first signal (the stock split announcement) is a corporate event, where the management of the firm has discretion in determining its timing.

[47]The motive for companies to mandate blackout periods is to prevent insiders from engaging in insider trading based on material non-public information, thus preventing insiders from being prosecuted by regulators.

ii) The second signal (disclosure of insider trade) stems from insider trades that are reported to the regulators, because the traders may be in possession of insider information. Insiders are free to decide the timing of the trades unless regulatory requirements or the firm governance structures (e.g., firm voluntary blackout periods) prevent insiders from trading. Rule 10b5-1, however, permits insiders to engage in planned trades, which will not lead to prosecution by the SEC:

> *"The rule permits persons to trade in certain specified circumstances where it is clear that the information they are aware of is not a factor in the decision to trade, such as pursuant to a pre-existing plan, contract, or instruction that was made in good faith." (SEC B, 2016)*

Based on this rule, liquidity insiders are allowed to have recurring trades in the same period each year, e.g., put in place through 105b-1 plans, and therefore reported before they are executed. We therefore place less emphasis on the timing that liquidity traders have in their insider trades, but rather that the trades are on a fixed schedule compared to e.g., trades executed by an informed insider.

Several studies have provided evidence of opportunistic insider trading exhibiting positive abnormal returns and managers opportunistically timing corporate events other than stock splits (Chan, Ikenberry, and Lee, 2003; Cohen, Malloy, and Pomorski, 2012; Kahle, 2000; Karpoff and Lee, 1991; Lee, 1997; Seyhun, 1988, 1998). These traders would primarily be the informed insiders exploiting insider information, but it could potentially also be liquidity insiders that through internal influence could time a corporate event such as a stock split in the period before/after they would otherwise be executing their planned liquidity and/or diversification trades. Trades by liquidity insiders conducted on an isolated basis should not provide any new information to an investor, but we argue that trades by liquidity insiders in conjunction with a stock split may in some cases provide information to investors.

Therefore, in regards to signalling, there may occur an overlap between the strict characterisation of the two archetypes, liquidity traders and informed traders, when introducing stock splits.

3.3 Summary

In summary, it is most important to identify and isolate trades that convey information to the market, and the study therefore focuses primarily on the informed insider trades.

However, we will also consider liquidity insiders, as they may generate information to the market due to the traders' potential influence on the timing of stock splits, thus enabling them to benefit from their predetermined liquidity insider trades. To be able to infer any information from any of the insider agents, it is central to our study that investors are able to identify the informed insiders (and potentially also liquidity insiders) in order to see their trading actions.

3.4 Empirical Predictions

Below, we introduce possible combinations of signals and discuss which potential inferences can be made from observing a particular set of signals. Thus, we use this section to outline our prediction of the empirical results based on the motives that the insiders may have and the signals they send to the market.

An insider may execute either a purchase or a sale in the stock where they are deemed an insider, in the period before the split. **Figure 3.2** illustrates an issue tree with the possible signals we may observe. We interpret each signal independently, because they may be based on different motivations.

The above figure provides an overview of the signals in the financial market.

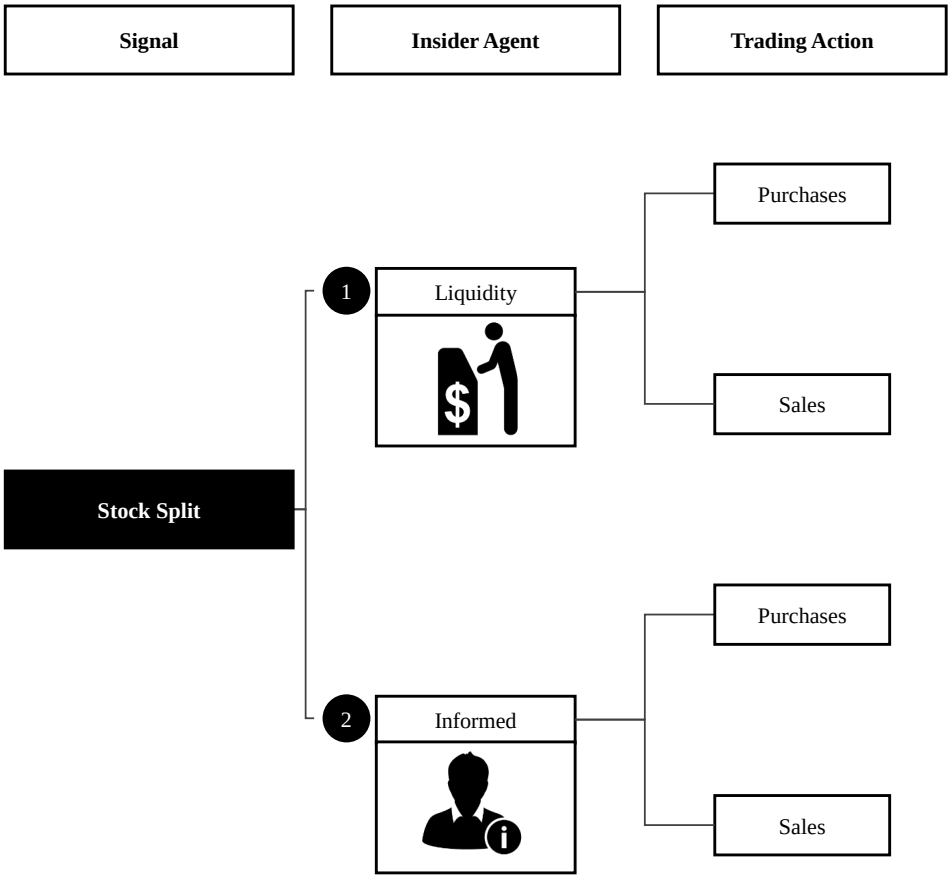
Liquidity insiders, as mentioned earlier may trade in their usual predictive and recurring way, but may at the same time have influence over the timing of a stock split. Thus, their trading behaviour around a stock split may signal valuable information, which under normal circumstances (without a corporate event) provides no valuable information.

We expect to obtain the most valuable information by observing the trading actions of informed insiders as they may trade based on insider information. We hypothesise that both purchasing and selling behaviour of informed insiders are easier to interpret compared to liquidity insiders.

3.4.1 Long-Term Performance

Insider purchases and insider sales may provide information on the direction of the firm's long-term return performance. A purchase may indicate positive abnormal performance whereas a sale may indicate negative abnormal performance, independent of the trade being before or after the stock split. We expect trades based on insider information about the long-term performance of the stock to be in periods where the regulators would not naturally suspect illegal insider trading. This would e.g., be trading in the period long ahead of a split

Figure 3.2: Overview of Possible Signals



as well as in the period just after the split. We expect trades well ahead of the stock split, because it may be in a period where the insider already has insider information that may be materialised at the time of the split or in a period after the split. Next, we expect trading in the period just after the split, as insiders may not be permitted to trade in the months before the split due to, e.g., a blackout period caused by simultaneous announcements (e.g., earnings, dividends etc.).[48] We furthermore hypothesise that regulators may not scrutinise trades post-split because it is after the corporate event. In this thesis, we choose to study insider trades only in the period before the split and its relation to subsequent stock returns.

[48]Over the 1967-1976 period examined, Grinblatt, Masulis, and Titman (1984) find that over 80% of NYSE stocks announcing splits had cash dividend announcements in the three days surrounding the split announcement.

Chapter 4

Sample and Research Design

In this chapter, we introduce the procedures used for the sample selection and the methodologies applied. In general, we use the methodologies described in Kothari and Warner (2006), which is also applied by Cohen, Malloy, and Pomorski (2012). Kothari and Warner (2006) aggregate the previous literature on the statistical methodologies of event studies and discuss the advantages and disadvantages of applying them to different types of event studies. Based on their empirical review of methodologies, we use both an event-time study and a calendar-time study to structure our empirical analysis and to test the significance of the results. Furthermore, we use a similar selection procedure for informed and liquidity insiders as Cohen, Malloy, and Pomorski (2012). In addition, we replicate the findings of Fama, Fisher, Jensen, and Roll (1969) to ensure the procedures used for event-time studies (cf. **section A.1**).

We first present the sample selection procedures for insider trades, stock splits, and monthly returns in **section 4.1**. Next, we describe the procedures for the identification of informed, liquidity, and infrequent insider traders as well as the merging of the data sets. We finally present the research design applied in **section 4.2** to estimate the input variables in the event-time study and the calendar-time study in order to analyse and interpret the data.

Overall, we look at US data for the period 1986 to 2014, comprising stock split announcements, stock returns, and actions by insiders.

4.1 Sample

4.1.1 Insider Filings

We use a similar data set for insider trading as Devos, Elliott, and Warr (2015) to identify stock splits in which insiders engage in buying or selling stocks in the months around it. The data set differs from Devos, Elliott, and Warr (2015) by including all relevant insiders who trade, such as members of the Board of Directors and the Chief Financial Officer, and not only the Chief Executive Officer (CEO). We choose to include all insiders, and not just the CEO, in order to see a holistic picture of the knowledge the key insiders possess, expressed in their trading actions associated with stock splits. We therefore differentiate us from Devos, Elliott, and Warr (2015) who consider the opportunistic behaviour and economic gains strictly for the CEOs around stock splits and not the informational content available to the market from all insider trades.

Additionally, as Agrawal and Cooper (2015), we consider only corporate insider trades registered with the SEC and therefore leave out unregistered and potentially informed parties, such as auditors who are not required by law to report their trading actions. Furthermore, the insiders may trade through other intermediaries such as friends or extended family members who likewise are not required to report their trades to the SEC (Lorie and Niederhoffer, 1968).

In order to study the opportunism of insiders and the incorporation of the trades by the market, we need to obtain the reported insider trades. As per section 16(a) of the Securities and Exchange Act of 1934, corporate insiders are required to report trades in the open market within 2 days after the day of the transaction.[49] Thus, the market should be able to incorporate the trades almost immediately after the trades are executed, as the trades become publicly available after they are reported. The reporting therefore have practically no influence on our study, as we take a longer horizon perspective.

The sample period chosen for the insider trades includes all available data, namely from 1986 to 2015. The data for stock trades made by the insiders of a firm is accessible through WRDS where Thomson Reuters Insider Filings is available for SEC filings made by the insiders of listed companies in the United States in their stock transactions.

We only include either "Open Market Sale" or "Open Market Purchase" in stocks (transaction code P or S) and aggregate the trades done on a single day by each individual insider.

[49]Regulation was changed in 2002 and the number of days was altered from 10 days after the month end of the trade to 2 days after the day of the transaction (Cohen, Malloy, and Pomorski, 2012).

We assess that there are negligible implications of aggregating multiple trades on a single day by each insider, because we are interested in the signal of trading, not the details of the intra-day execution of the trades.

4.1.2 Stock Splits and Monthly Stock Returns

For the stock splits, we use the CRSP Monthly Stock file including both information on monthly stock returns and distribution information covering dividends, liquidations, acquisitions/reorganizations, rights, stock splits, and offer issuances. The distribution codes relevant to our study are codes 5523 and 5533, representing non-taxable stock splits and non-taxable stock dividends, respectively. We include stock splits or stock dividends with a minimum factor to adjust price (henceforth FACPR) of 0.1.[50] For a comparison, Fama, Fisher, Jensen, and Roll (1969) use a minimum of 0.25, which is equivalent to four stocks outstanding before a split and five stocks outstanding after a split. By using a minimum value of 0.1, we primarily avoid reverse stock splits, which by nature have negative value, as well as smaller and less significant stock splits. Furthermore, we are able to analyse the effect of classifying our sample into stock splits ($FACPR \leq 0.25$ or distribution code 5523) and stock dividends ($0.1 < FACPR < 0.25$ or distribution code 5533) as per the methodology of Grinblatt, Masulis, and Titman (1984).

We choose to use stocks listed on the New York Stock Exchange (NYSE), NASDAQ OMX, or American Stock Exchange (AMEX) and therefore use the CRSP exchange code 1, 2, and 3 for the above mentioned exchanges. Thus, we are able to conduct our analysis using a representative and broad sample, and also excluding low-liquidity stocks from minor US exchanges.

4.1.3 Merging Thomson Reuters Insider Filings with CRSP Monthly Stock Return Data

To be able to assign the insider trading actions to the correct stock splits we merge the data sets using CUSIP numbers.[51] The Thomson Reuters Insider Filings contain both CUSIP-6 (issuer) and CUSIP-2 (issue) numbers, which combined is matched with the equivalent CUSIP-8 numbers in the CRSP Monthly Stock return data (WRDS, 2016). Additionally,

[50] CRSP denotes the size of the stock split through the FACPR value (factor to adjust price), which is basically the percentage of additional share distributed to the shareholders through the stock split or stock dividend. $FACPR = \frac{S(t)-S(t')}{(S(t')} = \frac{S(t)}{S(t')} - 1$, where S(t) is the number of shares outstanding, t is ex-post stock split, and t' is ex-ante the stock split.

[51] CUSIP stands for the Committee on Uniform Security Identification Procedures.

we include the NCUSIP-8 numbers available in the CRSP data set as these numbers serve as a historical CUSIP number if a stock issue experiences a name change or a change in its capital structure (CRSP, 2016).

We do not use the TICKER[52] of a firm to merge the data sets, as the same TICKER typically is present at multiple exchanges (NYSE, NASDAQ, and AMEX). Hence, manual checking is needed to compare TICKER with the correct firm for each TICKER match. The remaining TICKERs could be hand checked to expand the data set marginally, as the majority of insider trades were matched between the CRSP and Thomson Reuters data sets using CUSIP numbers. We assign the equivalent PERMNO[53] number available in the CRSP data set to the matched insider trading actions. The PERMNO is a unique permanent number for each security in the CRSP data set, thus the number does not change, as may the CUSIP number.

4.1.4 Identifying Certain Types of Insider Traders and Trading Behaviour

We use a similar approach as Cohen, Malloy, and Pomorski (2012) to identify specific types of insider traders. We use the term informed insiders whereas they use the term opportunistic insiders. Similarly, we use the term liquidity insiders where they use the term routine insiders. They furthermore exclude the remaining insiders ("non-classified" insiders) from their sample – which we call infrequent insiders.

Cohen, Malloy, and Pomorski (2012) first identify insiders, who have been trading for three consecutive years. They then divide this sample of insiders into two groups: 1) routine insiders, who have traded in the same month for three consecutive years, and 2) opportunistic insiders who have three years of trading, but not in the same month for three consecutive years. Thus, opportunistic insiders are the remaining insiders of the sample with three years of trading history, not classified as routine insiders. The authors then assign routine/opportunistic traders in the beginning of each year. One could also identify insiders based on a trade-level classification as suggested by the authors themselves. This trade-level classification assumes that an insider can have both liquidity trades and informed trades during a year, instead of classifying all trades at the beginning of the year as either opportunistic or routine. It is therefore not at the individual level of the insiders, but at the

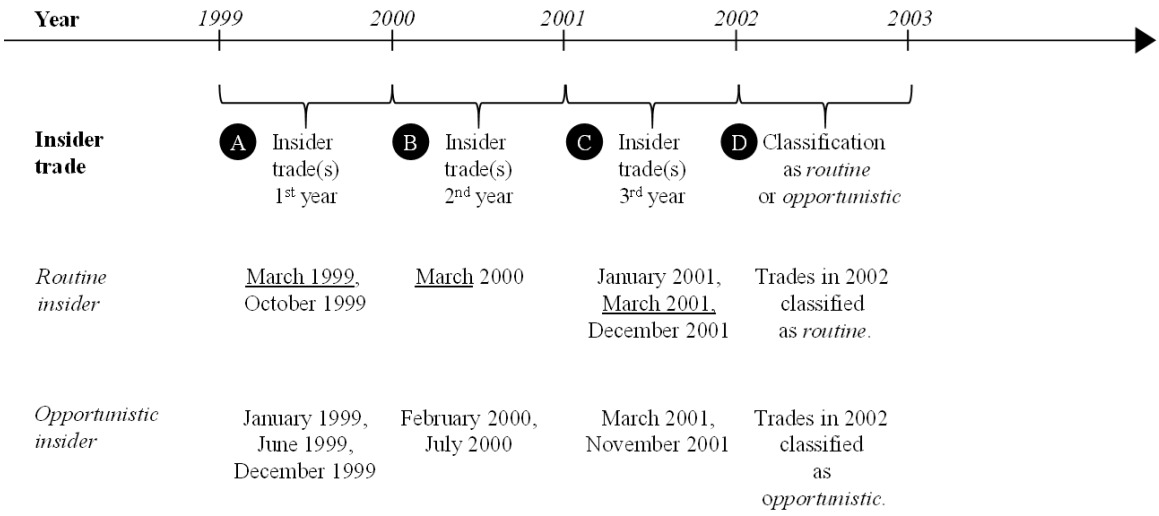
[52] Arrangement of a unique set of characters representing a security listed on an exchange.

[53] *"PERMNO is a unique permanent security identification number assigned by CRSP to each security. Unlike the CUSIP, Ticker Symbol, and Company Name, the PERMNO neither changes during an issue's trading history, nor is it reassigned after an issue ceases trading. The user may track a security through its entire trading history in CRSP's files with one PERMNO, regardless of name or capital structure changes".* (CRSP, 2016)

trade level. E.g., an insider in a given year can engage in the same recurring sales as he or she have executed for the past five years, and furthermore engage in a large purchase trade before an earnings announcement. However, the authors find similar results using this type of insider classification, and we therefore leave out this analysis.

An advantage of classifying the insider traders into routine or opportunistic traders is that the individual traders in the sample can only be part of one of the groups during one year and are thus mutually exclusive. However, the identification is not collectively exhaustive, as it excludes the remaining insiders (i.e., infrequent insiders), not classified into either of the groups.

Figure 4.1: Classification of Insiders



Individual-level classification of routine and opportunistic insiders (Illustrative Example).

A different way of identifying informed insiders is by considering the size of the insider trade relative to the insider's wealth, as suggested by Scott and Xu (2004). We provide an elaboration of this analysis in the robustness tests (cf. **section 5.3**).

4.1.5 Identifying Splits with Associated Stock Trades

In below section, we describe the procedure for selecting stock splits with surrounding insider trades. We describe the relevant dates for the approval process of a stock split as well as the selection procedure for identifying trades around a stock split.

Relevant Dates Specific to Stock Split Approval

Stock splits generally go through an approval process, both internally and externally. Charest (1978) decompose the approval process of stock splits into following: 1) public proposal of a stock split, 2) approval by shareholders, and 3) realisation of split. The author finds no significant returns for a trading strategy using approval or realisation months, but only for a strategy using the proposal month and by *investing in three months* beyond the proposal. Applying only a CRSP dataset and not including the information from the Wall Street Journal as Charest (1978) restrict us in differing between split proposals and split approval announcements in the data sample. Instead, we use the announcement date, as this date is available as the declaration date in the CRSP data set compared to the effective date.[54] In addition to the dates identified by Charest (1978), we add two dates for discussion purposes specific to our study. First, insiders of a firm may have knowledge of a potential stock split long before the split itself. This date is regarded as an illustrative date for discussion purposes. As predicted by the insider trading signalling theory discussed in the literature review (cf. **section 2.2.3**), the relevant information about future performance may be a reason for engaging in a stock split in the first place. Second, the date of management's internal approval of the stock split. We consider the date of the internal approval relevant as the insiders may be part of the management, and may take action based upon their knowledge of the upcoming stock split and/or any additional material non-public information about the firm stock.

The above dates are specific to insider trades, but not material compared to the points identified by Charest (1978). In the period before a stock split, insiders may have information about the forthcoming stock split and an indication of the future performance of the stock. If the insiders engage in trading based on this information, their trades in the period around the split may convey information about the post-split stock performance. Therefore, studying the insider trades in the period before a split may convey information about the future stock performance.

Thus, we consider the following time points relevant when studying insider trades around splits (cf. **figure 4.2**):

i) Insiders' knowledge of an upcoming stock split

ii) Internal approval of stock split by management

iii) Announcement date by management

[54] *"Declaration date is the date on which the board of directors declares a distribution"* (WRDS, 2016).

iv) External approval by shareholders[55]

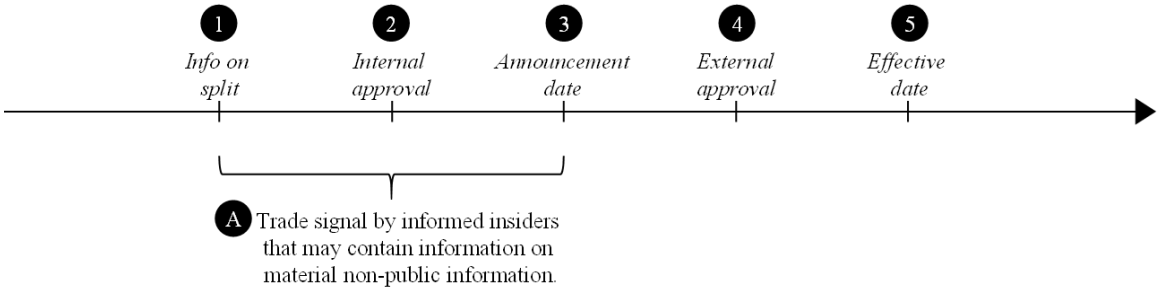
v) Effective date of stock split

The period between the time when management becomes aware of an upcoming split and the subsequent public announcement probes the following question:

> *For how long do insiders have knowledge of an upcoming stock split or other material non-public information about the firm before the information is disseminated to the public?*

In order to test the question, we analyse the insider trades in the period around the stock split.

Figure 4.2: Time Points for the Stock Split Process



The figure depicts the relevant dates concerning a stock split process, whereas we are primarily concerned with 1-3.

Which Insider Trades Convey Information and Predictability About Future Performance

In assessing which past trades carry information about the future performance of the stock, we first elaborate on previous literature. Ke, Huddart, and Petroni (2003) provide evidence in favour of using long windows to study insider trades and find a period of 9 to 24 months *before* earnings break to contain information. They furthermore provide evidence that both insider sales and insider purchases convey information, wheareas insider purchases have previously been emphasised (Seyhun, 1998). Applying their results on stock splits imply studying trades 9 to 24 months before the split. However, as this thesis concerns the return after a stock split, and not the return in the days of the announcement, nor the prediction of the split itself, we use the 9 to 24 months to study the return *after* the split.

[55]If a stock split is finalised without the external approval by shareholders, as in Charest (1978), then point four will not exist for a given stock split.

Seyhun (1992b) finds the highest degree of predictability for 12 month abnormal stock return by using previous 12 month aggregate insider trading. Applying his findings to our study imply using insider trades of up to 12 months *before* the stock split. In addition, Marin and Olivier (2008) document that insider sales peak many months before an evident large drop in the specific share, while insider purchases peak only the month before a large jump. This imply studying insider sales in a *long-term window* and insider purchases in a *short-term window*. Jaffe (1974) concludes that insiders possessing special information can predict the development in share prices six months subsequent to their trades, with the insider returns exceeding the market returns. Lastly, Lorie and Niederhoffer (1968) find that a security that experienced an intensive buying month is prone to experience an increase in share price in the six months subsequent to the stock split.

In addition to the above, Jeng, Metrick, and Zeckhauser (2003) remark:

> *"'Rule 16(b) of the SEC, the short-swing rule, states that "profits made by insiders from transactions involving equity securities of publicly held companies, when a purchase and a sale are made less than 6 months apart, must be disgorged and paid over to the issuer' (Soderquist, 1998). Thus, any profits realised for holding periods less than 6 months would have to be returned to the company."*

The above rule implies that abnormal returns deriving from an insider engaging in both *insider purchases* and an *insider sales* should be studied with a minimum of 6 months. However, we only consider if there are purchases or sales, and not whether the insider trades derive from a prior transaction. Above literature findings imply studying trades for both *short-* and *long-term windows*. We expand the study of insider to include medium-term as well, and thus use three different windows in order to incorporate information from insider trades:

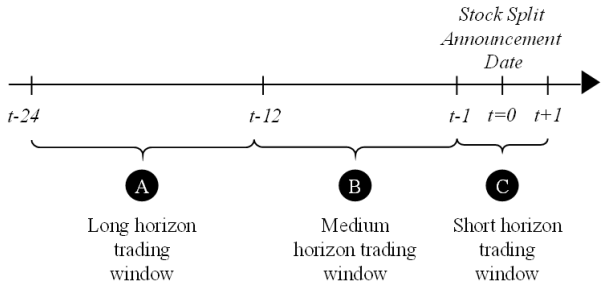
i) Short-term window: 1 month before the split and 1 month after the split

ii) Medium-term window: 1 month before to 12 months before the split

iii) Long-term window: 24 months to 12 months before the split

Figure 4.3 shows the applied insider trading windows in our sample, where $t = 0$ is equal to the stock split announcement date.

Figure 4.3: Trading Windows for Insiders



Classification of trading windows applied in our analyses.

4.2 Research Design

4.2.1 Introduction

Event studies examine the impact of corporate events on one of a firm's specific factors, e.g., stock price, return variance, trading volume, operating performance, etc. Event studies are useful in measuring the impact of unanticipated, i.e., abnormal, return behaviour for a sample of firms at the time of events, e.g., stock split announcements. The following section deals with event studies that focus on stock price effects.

Events can take place at different times or they can all occur at a single date. Event studies are often used to test market efficiency (Brown and Warner, 1980; Fama, 1991). Usually, the underlying hypothesis for event studies is the assumption of markets being efficient, i.e., new information is instantaneously incorporated in the share price (Fama, 1998). Fama, Fisher, Jensen, and Roll (1969) found evidence for market efficiency around stock splits (at least within a month of the event), but later event studies have found abnormal long-term returns following stock splits, e.g., Grinblatt, Masulis, and Titman (1984).

Fama, Fisher, Jensen, and Roll (1969) was essential to the event study literature, and the overall basic statistical format of event studies has not changed significantly since. Evident changes to the format include the application of more sophisticated methods for estimating abnormal returns as well as calibrating their statistical significance. The key focus is still the measurement of securities' mean and cumulative mean abnormal return around the time of a corporate event (Kothari and Warner, 2006).

Research is more inclined towards short-term event studies, representing the *"cleanest evidence we have on efficiency"* (Fama, 1991), whereas the interpretation of long-term

results is problematic. The literature has introduced the limitations that long-term event study methods suffer from, e.g., in regards to lack of reliability (Brown and Warner, 1980).[56] The main issue in regards to long-term methods concerns low power[57] in detecting abnormal performance and that they are highly susceptible to the joint-test problem. It includes testing both whether the abnormal return is zero and whether the model of expected returns is correct.[58]

We use two methods for evaluating the event study: event-time study and calendar-time study. Event-time studies use the event date, in our case the stock split announcement, and find the abnormal return (AR) from the market in the months around the event date for each stock. The event-time study allows us to visualise the mean abnormal returns around the event date in an intuitive way after controlling for market risk-adjustment factors through a linear regression model on each stock.[59] By illustrating the abnormal return, we are able to interpret if the returns exhibit a non-zero distribution in the cross-section[60] of stocks. On the other hand, calendar-time studies create a portfolio of event stocks. By controlling for similar market risk-adjustment factors as in the event-time study, we are able to test the significance of any abnormal returns of the portfolio during the sample period. Thus, if the event stocks exhibit any abnormal returns, the portfolio's alpha value in a time-series regression model should be significantly different from zero.

4.2.2 Specification and Power

In the following, we discuss and elaborate on the degree of specification and power for short- and long-term study methods. We consider short-term as below 12 months and long-term as 12 months or above.

The specification of the event study tests are highly dependent on whether the underlying assumptions for the estimates are correct. This is problematic, as event studies are joint tests of 1) the null hypothesis that the average abnormal return is zero and 2) whether

[56] Long-term studies *"require extreme caution"* (Kothari and Warner, 1997) and *"the analysis of long-run abnormal returns is treacherous"* (Lyon, Barber, and Tsai, 1999).

[57] The power of event study tests is the ability to detect a presence of abnormal performance (Kothari and Warner, 2006).

[58] All market efficiency tests are joint-tests, i.e., joint-tests are only well-specified to the extent that the underlying assumptions are correct.

[59] A typical example of risk-adjustment factors is the factors in the Fama-French 5-factor model, such as the excess return of the market or the difference in returns on a portfolio of stocks with a small and big market capitalisation (SMB) etc.

[60] Analysis across different stocks or portfolios at one point in time (e.g., cross-section abnormal returns across portfolios)

the model of expected returns (e.g., the CAPM, Fama-French 3/4/5 factor model, etc.) is correct. In addition, the following assumptions are also critical to any event study tests: 1) the mean abnormal performance for the cross-section of securities follow a normal distribution (standard assumption under a student's t-test), and 2) the abnormal return data is independent in the time-series and cross-section calculations.

There exists a significant difference between short- and long-term event study methods. Kothari and Warner (2006) generally find short-term event study methods well specified, which they do not find evident for in regards to long-term event study methods. Next, the authors find short-term event study methods to be powerful, but only if the abnormal performance is concentrated in the event window (e.g., insider trading within one month period around a stock split). Long-term event study methods have low power in detecting abnormal performance, both in the event window and around it. Lastly, with short-term methods, the test statistic specification is not very sensitive to the benchmark model of normal returns applied nor the assumptions concerning the cross-sectional or time-series dependence of abnormal returns. This is unfortunately not evident for long-term event study methods, where the specification is very sensitive to the underlying assumptions.

An issue regarding both short- and long-term event study methods is that when the variance for the abnormal returns around the specified event increases, the test statistics can be misleading, and the null hypothesis can be falsely rejected (Brown and Warner, 1985; Corrado, 1989). The power of the event study is increasing with the sample size, regardless of the time horizon, and depends on the characteristics of the individual firms in the sample. The power for both short- and long-term event study methods is inversely related to the variance of each individual firm's returns. In addition, the volatility of security returns (mean daily standard deviation) has increased over time (Brown and Warner, 1985; Campbell and Wasley, 1993; Camphell, Lettau, Malkiel, and Xu, 2001), and this increase in volatility implies a lower power during more recent periods.

The tests of specification and power will be further elaborated for event-time studies and calendar-time studies in **sections 4.2.4** and **4.2.5**.

4.2.3 Long-Term Event Studies

Long-term event studies were initially introduced by Fama, Fisher, Jensen, and Roll (1969), and has later been summarised by Fama (1998), Kothari and Warner (1997), and Schwert (2002).

It is critical to apply the appropriate risk adjustments when calculating the long-term

abnormal returns. First, a minor error in risk adjustment can have an economically large impact on abnormal return over a period of one year or longer. As the events often follow unusual stock price run-ups and operational improvements as well as differing firm characteristics, the risk estimation will be biased. Thus, it is important that the risk estimation is based on post-event performance (Ball, Kothari, and Shanken, 1995; Ball and Kothari, 1989; Chan, 1988; Chopra, Lakonishok, and Ritter, 1992). Second, the abnormal returns over a long horizon are highly sensitive to the expected return model applied. According to Fama (1998) *"all models for expected returns are incomplete descriptions of the systematic patterns in average returns"*. The Capital Asset Pricing Model (Lintner, 1965; Sharpe, 1964) has been heavily criticised by academics and discredited as a result of the increasing anomalies evidence. Thus, factor models have historically been applied in event studies, namely 1) the Fama and French (1993) three-factor model, 2) the Carhart (1997) four factor model, and lately 3) the Fama and French (2015) five-factor model. The factors are crucial in measuring abnormal performance, regardless of whether they are considered a proxy for risk or an indication of market inefficiency (Kothari, Leone, and Wasley, 2005; Kothari and Warner, 2006). We are aware that no statistical model fully explains the truth, Howeve we consider the combination of the Fama-French 5 factor model and the momentum risk-adjustment factor to constitute a sufficient proxy for the expected return on a security (Carhart, 1997).

We use the Fama-French 5 factor model as a base point for assessing the statistical significance of the alpha in our linear regression model and add a momentum factor (Carhart, 1997):

"While I believe that Professor Fama and I agree on much more than we disagree (my own nuanced, perhaps cowardly, position on EMH is detailed here) and we would ultimately recommend very similar investments (at least when confined to the traditional world of long-only investments), I have differed with him on momentum before - most notably, ***I'm still somewhat befuddled how one stops at a five-factor model and doesn't make momentum the sixth.****"* (Asness, 2016)

We will apply the factor model on both individual stocks in the event-time studies and for portfolios in the calendar-time studies. See below model:

$$R_{i,t} - R_{ft} = \alpha_{pf} + \beta_1(R_{m,t} - r_f) + \beta_2(SMB_t) + \beta_3(HML_t) + \beta_4(RMW_t) + \beta_5(CMA_t) + \beta_6(UMD_t) + e_{i,t} \quad (4.1)$$

i) $R_{i,t}$ is the return on an individual stock or a portfolio of stocks exhibiting a stock split with certain insider trading actions at time t.

ii) R_{ft} is the risk-free rate proxied with the one-month Treasury bill rate (from Ibbotson Associates) at time t and is obtained through Kenn French's data library online.

iii) α_{pf} is the abnormal return or alpha for the portfolio.

iv) β_{1-10} are sensitivities (betas) of the event portfolio to the factors.

v) R_{mt} is the market return from stocks on NYSE, AMEX and NASDAQ firms at time t and is obtained through Kenn French's data library online.

vi) SMB_t is the small-minus-big factor adjusting for firm size at time t and is obtained through Kenn French's data library online.

vii) HML_t is the high-minus-low factor adjusting for high minus low book-to-market at time t and is obtained through Kenn French's data library online.

viii) RMW_t is the robust-minus-weak factor adjusting for firm operating profitability at time t and is obtained through Kenn French's data library online.

ix) CMA_t is the conservative-minus-aggressive factor adjusting for firm investment policy at time t and is obtained through Kenn French's data library online.

x) UMD_t is the up-minus-down factor adjusting for momentum in stock prices at time t and is obtained through Kenn French's data library online.

We thus interpret our results primarily, through the statistical significance from the Fama-French 5-factor model including momentum (henceforth Fama-French 6-factor model).

4.2.4 Event-time Study

An event-time study seeks to establish whether the cross-sectional distribution of returns at the time of an event is abnormal (Kothari and Warner, 2006). The generalised event study model applied in the thesis will be elaborated in the following section. The model is based on the framework developed by Brown and Warner (1980); Y., Lo, and MacKinlay (1997).

For each sample security i, the rate of return on the security around the event, $R_{i,t}$, is

$$R_{i,t} = K_{i,t} + e_{i,t} \tag{4.2}$$

where $t = 0$ is the time of the event, $K_{i,t}$ is the expected return given a capital markets model of expected returns, and $e_{i,t}$ is the component of returns which is abnormal or unexpected (Kothari and Warner, 2006). Thus, the abnormal return $e_{i,t}$ can be regarded as the difference between the realised and expected return.

$$e_{i,t} = R_{i,t} - K_{i,t} \tag{4.3}$$

The abnormal return measured through the residuals, i.e., $e_{i,t}$, is the unexpected return conditional on the event. Investors perceive that the event will have an impact on the future cash flows, thus resulting in a price revaluation, above/below the expected capital market return (Groening and Kanuri, 2013). In order to calculate the abnormal return, a model of normal returns must be specified (e.g., market model, constant expected returns model, capital asset pricing model) (Kothari and Warner, 2006).

Event-time studies focus on the mean of the cross-sectional distribution of abnormal returns. The cross-sectional mean abnormal return for any period t is:

$$AR_t = \frac{1}{N} \sum_{i=1}^{N} e_{i,t} \tag{4.4}$$

It is necessary in order to ensure high power to examine whether mean abnormal returns over a multi-period interval around the event are equal to zero (null hypothesis). There are various methods to calculate the time-series aggregation over a multi-period interval, where one of them, namely the cumulative abnormal return method (CAR), entails the sum of each month's average abnormal performance. CAR at time t_1 through t_2 is calculated as:

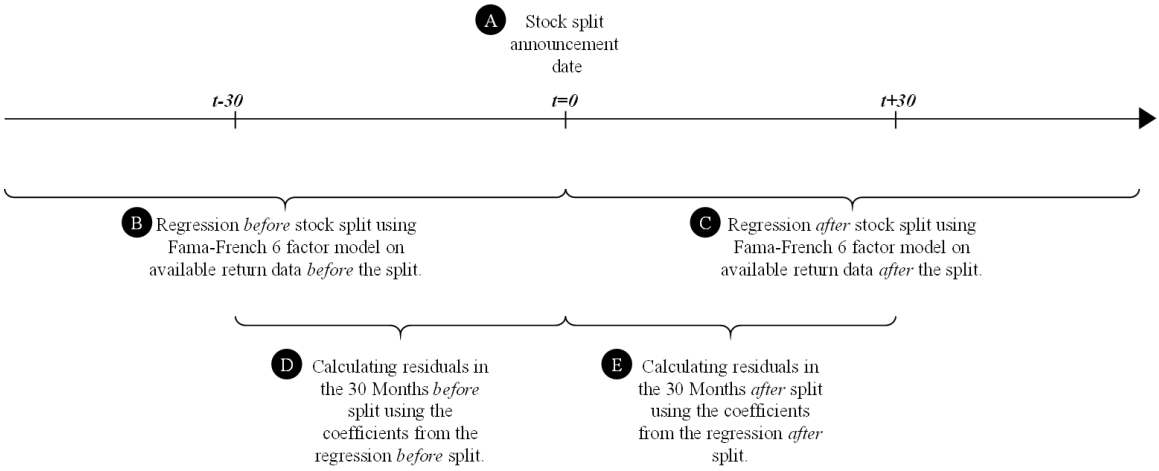
$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_t \tag{4.5}$$

CAR is applied to post-event periods in order to test for market efficiency, since systematically nonzero abnormal returns following an event are inconsistent with market efficiency and imply a profitable trading rule (ignoring trading costs).

In order to estimate the CARs, we first identify stock splits (A) with insider trades in the relevant trading window (B). Next, we apply two regressions on each stock against a 6 factor model using return data only before the stock split (C) and only after the stock split (D). Finally, we calculate the residuals using the estimated coefficients in the regression models before (E) and after the split (F). By using the post-split regression estimates to

calculate the residuals, we take into account the post-split increase in the variability of the stock returns.

Figure 4.4: Event-time Study



Regression procedure for each stock with stock splits and insider trades in the trade window. We calculate the abnormal return by averaging the residuals in the cross-section and cumulate them to show the cumulative abnormal return. By running a separate regression for each stock before and after the split, we hereby take into account the bias in the regression coefficients deriving from higher return variance after the split event.

In order to test the statistical significance of the cumulative abnormal returns using the event-time methodology we use a bootstrap methodology. Each sample is resampled 10,000 whereafter a two 95% confidence levels for each average residual is calculated. This confidence interval is then cumulated from point *t=0*. The 95% confidence intervals will appear as lines around the CAR for each individual sample. Based on the confidence bands, we can conduct a simple null hypothesis, whether the confidence levels combined are either both above or below the 0 line, indicating that the cumulative abnormal return is significantly different from zero.

4.2.5 Calendar-Time Study

The calendar-time study, also known as the Jensen-alpha approach, calculates calendar-time portfolio returns for sample firms experiencing a corporate event and calibrates for abnormal returns in a multi factor regression. In order to apply the methodology, a new portfolio is constructed every month. Since the number of events is not uniformly distributed for the sample period, the number of sample firms in the portfolio will differ every month. Thus,

the portfolios are rebalanced every month and an equal/value-weighted portfolio excess return is calculated. The time series of monthly excess returns derived are regressed on a factor model, e.g., the Fama-French 5 factor model and momentum (Fama and French, 2015; Carhart, 1997).

Inferences about the abnormal performance are based on the estimated intercept, namely Jensen's alpha (α), and its statistical significance. Academics do not agree on the application of the Jensen-alpha approach. Brav and Gompers (1997); Mitchell and Stafford (2000) argue in favour of applying the methodology, whereas Loughran and Ritter (2000) argue against using the Jensen-alpha approach. Loughran and Ritter (2000) argue that managers time corporate events in their own favour, thus the Jensen-alpha approach has lower power and might be biased towards finding results consistent with market efficiency, as the methodology under-weights managers' timing decisions and over-weights other observations. The authors state that *"If there are time-varying misvaluations that firms capitalize on by taking some action (a supple response), there will be more events involving larger misvaluations in some periods than in others... In general, tests that weight firms equally should have more power than tests that weight each time period equally."* (Loughran and Ritter, 2000). In order to mitigate this, the researcher should weight calendar months by their statistical precision, which various with sample size Fama (1998)

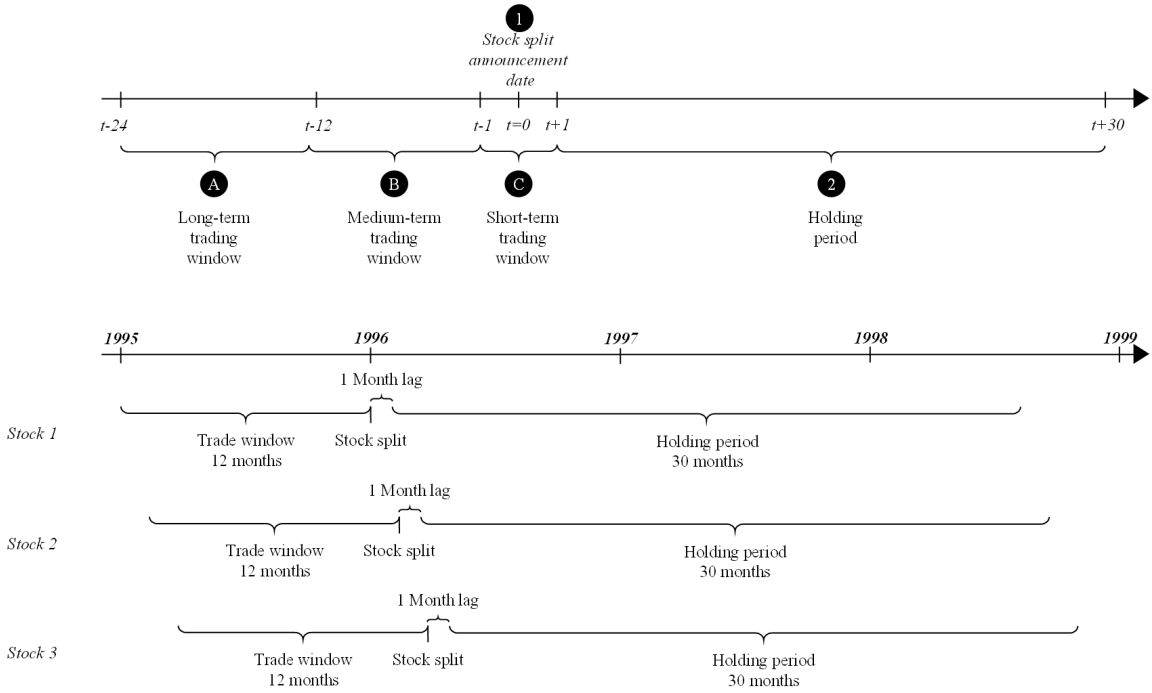
First, we form portfolios for the relevant event stocks using the following procedure. For all months, we identify stocks that split (1) and have insider trades in the relevant trading window (A, B, or C). In the month *after* the stock split, each stock is included in the portfolio and held for 30 months (2). Second, we use a time-series regression to regress the monthly returns of the portfolio against a model of expected returns. Here, we test whether there is significance in the alpha and ,specifically, if a portfolio of stock splits with certain insider trading actions have abnormal returns. By only using the returns ex-post a stock split in our portfolio, we naturally avoid the misspecification from the change in variance after the event date by regressing on returns ex-ante a stock split, as discussed by Kothari and Warner (2006).

In assessing the statistical power of the calendar-time methodology, we furthermore use the Wilcoxon signed rank test to test the difference in the median return of different portfolios. The test is advantageous to our study, because it is able to test whether the distributions in two populations are identical without the assuming them to follow a normal distribution.

Figure 4.5 shows the procedure of the portfolio formation and give a theoretical example of a portfolio of 3 stocks between 1995 and 1999 held for 30 months after it is included

in the portfolio.[61]

Figure 4.5: Calendar-time Case Study (Illustrative Example)



Trade window of 12 months before split with holding period 30 months in each stock. Portfolio of 3 stocks between 1995 and 1999.

4.2.6 Cross-correlation, Serial-correlations, and Bias

The tests may be subject to both cross-correlation and serial-correlation, or biased due to the characteristics of our sample. Below discuss the implications of these, and any tests conducted to address the issues.

Stock splits and insider trades are specific events that are endogenous (i.e., subject to self-selection). The events may be differently anticipated by the market, with some firms being followed by more analysts than others, which should make these events more predictable. It is important to stress that it is the unexpected information stemming from the events that cause the stock price effect. The abovementioned self-selection and partial anticipation issues are critical, as they may cause the estimates of cross-sectional coefficients

[61] Please notice that the portfolio is formed in the month *after* the stock split and therefore do not include the announcement return.

to be biased (Eckbo, Maksimovic, and Williams 1990; Li and Prabhala 2007). Our sample may furthermore exhbit a skewness in the returns, which may cause cross-correlation (Malmendier and Moretti..., 2012). The skewness derives from returns of the individual stocks being bound at minus 100% whereas they are unbound above. Thus, if a firm goes bankrupt and the return is -100%, this is the lower bound. In contrast, the stock price can potentially increase by an infinite amount and the return is therefore not upwards bound. Furthermore, there may be cross-correlation and serial-correlation due to overlapping event periods. Long-term abnormal returns tend to be cross-correlated because the sample exhibit waves (Kothari and Warner 1997). We address the issue of cross-correlation by analysing the annual frequency of stock splits.

4.2.7 Significance Tests to Abnormal Performance Measurements

The choice between the two above mentioned abnormal performance measurement approaches depends not only on choosing the approach with the highest statistical significance, but also on calculating the statistical significance correctly. Unbiased standard errors are difficult to calculate and may lead to misspecification. Assessing the statistical significance of long-term event studies is difficult due to the three following factors (Kothari and Warner, 2006):

i) Long-term returns depart from the normality assumption.

ii) Long-term returns exhibit considerable cross-correlation because the return horizon of many event firms overlap and because many event firms are drawn from a few industries.

iii) Volatility of the event firm returns exceeds that of matched firms because of event-induced volatility.

It is also important to note that the assumption of normal distribution is not applicable to long-term buy-and-hold abnormal returns. The returns, even after adjusting for the performance for a matched buy-and-hold portfolio, tend to be right-skewed (Brav, 2000; Mitchell and Stafford, 2000). The right-skewness is primarily due to the lack of independence arising from overlapping long-term return observations in event portfolios, i.e., due to cross-correlated data on portfolio level Kothari and Warner (2006). This also stems from the fact that you can only lose what you invested as an investor, thus downside has a lower bound of -100%, but returns are unbounded on the upside. Thus, the Student t-distribution is asymmetric with a mean below zero Brav (2000). However, the skewness bias decreases with

sample size (Barber and Lyon, 1997; Neyman and Pearson, 1928; Pearson and Adyanthya, 1928, 1929).

Specification bias arising due to cross-correlation is evident for long-term test of abnormal return. This is primarily due to the fact that researchers *"maintain the standard assumptions that abnormal returns are independent and normally distributed, although these assumptions fail to hold even approximately at long horizons"* Brav (2000). Cross-correlation is negatively correlated with the effectiveness of the risk-adjustment approach and positively correlated with the homogeneity of the sample firms. Long-term abnormal returns tend to be cross-correlated of following reasons Kothari and Warner (2006):

i) Abnormal returns for subsets of the sample firms are likely to share a common calendar period due to the long measurement period.

ii) Corporate events like mergers and share repurchases exhibit waves (for rational economic reasons as well as opportunistic actions on the part of the shareholders and/or management).

iii) Some industries might be over-represented in the event sample (e.g., merger activity among technology stocks).

The Jensen-alpha approach applies calendar-time portfolios, whereby we account for cross-correlation in the abnormal returns. In addition, as the returns in an efficient market are serially uncorrelated, the independence assumption in calculating the standard error and the test statistics for the Jensen alpha are acceptable. However, it is not important to note that the Jensen-alpha approach is misspecified in non-random samples, for reasons unclear to the academia (Lyon, Barber, and Tsai, 1999).

Chapter 5

Empirical Results

In the following chapter we initially present a summary of the data statistics we have applied throughout our analyses in **section 5.1**. Next, we present and comment on the empirical results from our event-time and calendar-time studies in **section 5.2**. We finish the chapter by elaborating on relevant robustness tests in **section 5.3**.

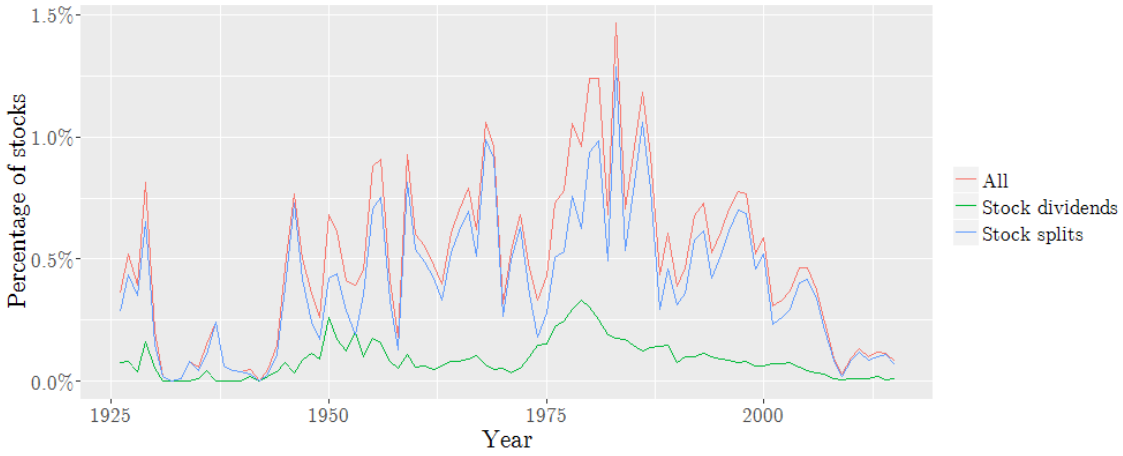
5.1 Summary Statistics

This section includes summary statistics concerning stock splits, insider trading actions, and lastly stock splits with insider trading actions.

5.1.1 Stock Splits

In **figure 5.1** we plot the annual frequency of stock splits and stock dividends compared to the total number of listed stocks in the given year ($\frac{numberofstocksplits}{numberofstocks,yearend}$). We use the FACPR value for dividing the sample into stock splits and stock dividends, respectively.

Figure 5.1: Annual Frequency of Stock Splits and Stock Dividends



The figure shows the historical development in stock splits and stock dividends. The numbers are reported as a fraction of the total number of listed stocks at the end of a year. Thus, the number of stock splits or stock dividends are normalised compared to the total number of listed stocks in our sample (NYSE, AMEX, and NASDAQ stocks).

Figure 5.1 shows that the annual frequency of stock splits and stock dividends have developed somewhat similar throughout the sample period, albeit at clearly different levels. Stock dividends have throughout the sample period moved within the interval between 0.0% and 0.3%, whereas stock splits have shown a higher volatility, namely in the range between 0.0% and 1.5%. The data shows a large peak in stock splits between the 1980s and 1990s, followed by a large drop in the percentage of stock splits. Overall, stock splits and stock dividends have become less frequent in the past 30 years, enduring high volatility in the annual frequency of stock splits over the sample period. Most recently, the frequency of stock splits has significantly dropped following the recession in the beginning of the 2000s in the US and later during the the financial crisis in 2007 to 2008. Thus, when considering the annual frequency of stock distributions in **figure 5.1**, stock splits and stock dividends may have become less relevant compared to historical levels. However, managers and board of directors may stille be cautious as the markets have been through challenging periods since the beginning of the 2000s with recurring financial crises. In addition, firms are entering a new level of low market growth for the coming years, which has moved a potential stock split lower down on the corporate agenda. Lately, managers have instead favoured stock buybacks as the preferred corporate action. We still regard stock splits as important in the financial markets and hypothesise that stock splits will return as the markets normalise.

Next, **table 5.1** shows that 83% of the stock splits during the entire sample period

is derived from companies that split multiple times. Thus, a significant part of the companies engaging in stock splits will be recurring throughout the sample period. Krieger and Peterson (2009) argue that firms that have already conducted a stock split are more likely to split again, and that the prior stock split's announcement effect is a useful predictor of future splits. This implies that the market will partially incorporate the information implied by a stock split based on the abnormal returns evident from the previous stock split.

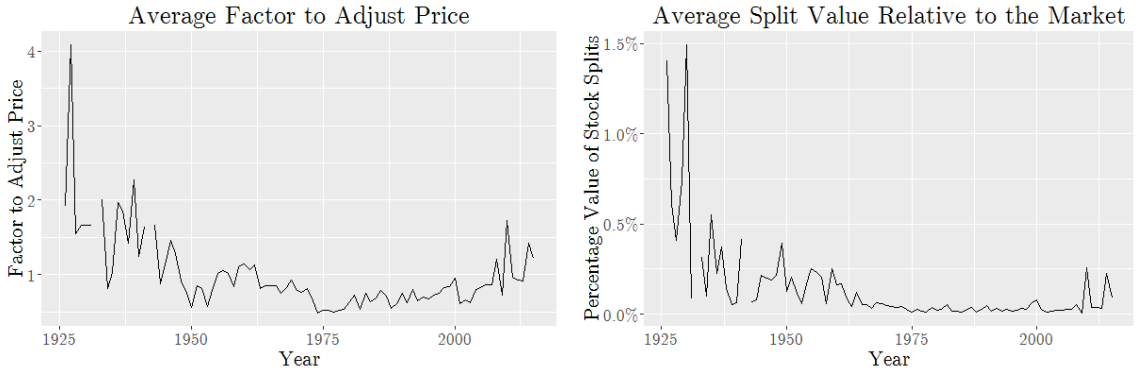
Table 5.1: Frequency of Splits and Number of Firms

Number of splits	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23
Number of firms	3909	1930	1118	683	441	270	200	119	87	47	30	16	18	15	6	2	4	3	2	2	2	1

The table shows the sample firm's frequency of splits during the period 1926-2015. Throughout the period, a total of 8,905 firms conducted 22,638 splits with 83% of the stock splits stemming from firms splitting multiple times.

Next, we present the development in the split factor in relation to the average FACPR value as well as the size of the stock split compared to the general market.

Figure 5.2: Average Size of Split Factor (FACPR Value) and Normalised Split value



The two figures show the average FACPR value as well as a measure of the value of the stock distributions. The right hand side of the figure shows the percentage size of annual stock splits in dollar value divided by the end of year total market capitalisation. The figures show a higher FACPR value when less firm split their stocks. Similarly, there is a higher average split size relative to the market when there is a fewer number of firms splitting.

Figure 5.2 shows the historical average size of the factor to adjust price (FACPR).[62] The

[62]Everything else equal, a higher split factor increases the number of outstanding shares issued when a firm undertakes a stock split.

peak in the beginning of the period is prone to outliers, as the number of splitting firms was very low. Similarly, we see a slight increase in the factor to adjust price after the decrease in the number of splits per year (cf. **figure 5.1** and **5.2**). Thus, we argue that the evidence suggest a higher split factor when less firms are undertaking stocks splits.

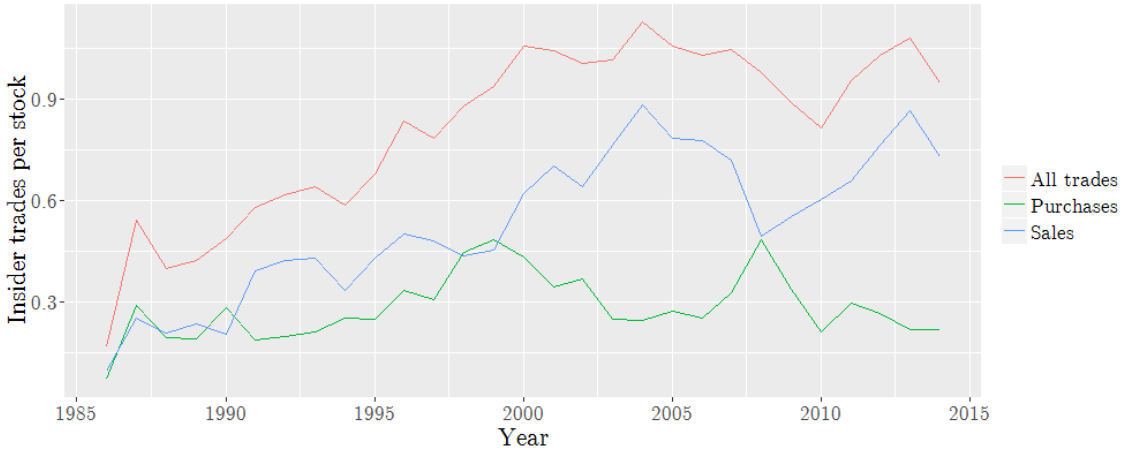
However, by just looking at the factor to adjust price in the stock split we can infer limited information about the size of the stock splits themselves. We can only obtain information about the size of the split by looking at the size of the firms that undertake a stock split. In **figure 5.2** we also present the market value of the stock splits compared to the market value of the entire market capitalisation. Thus, we multiply the factor to adjust price with the stock's market capitalisation at the day of the stock split. We then aggregate the annual market capitalisation stemming from stock splits and divide the dollar amount (value) with the total market capitalisation at the end of the year.

Figure 5.2 shows that the relative size of a stock split (market value of additional stocks issued at the stock split) compared to the market is between 0 and 1.5% of the total market capitalisation throughout the sample period. However, in recent years, the market value of the stock splits has been more volatile and peaked twice towards the 2010s. This may reflect the fact that a few large corporations has undertaken large stock splits. E.g., Apple engaged in a 7-for-1 stock split in 2014. Because of the size of the stock splits in recent years (2008 to 2015), we still find it very relevant to study stock splits.

5.1.2 Insider Trading Actions

In this section we present summary statistics of insider trades. Firstly, we present the types of trades (purchases and sales) in the market, and secondly we present the types of traders (opportunistic and routine) in the market as well as their annual trading frequency.

Figure 5.3: Annual Insider Trades Divided into Open Market Purchases and Open Market Sales

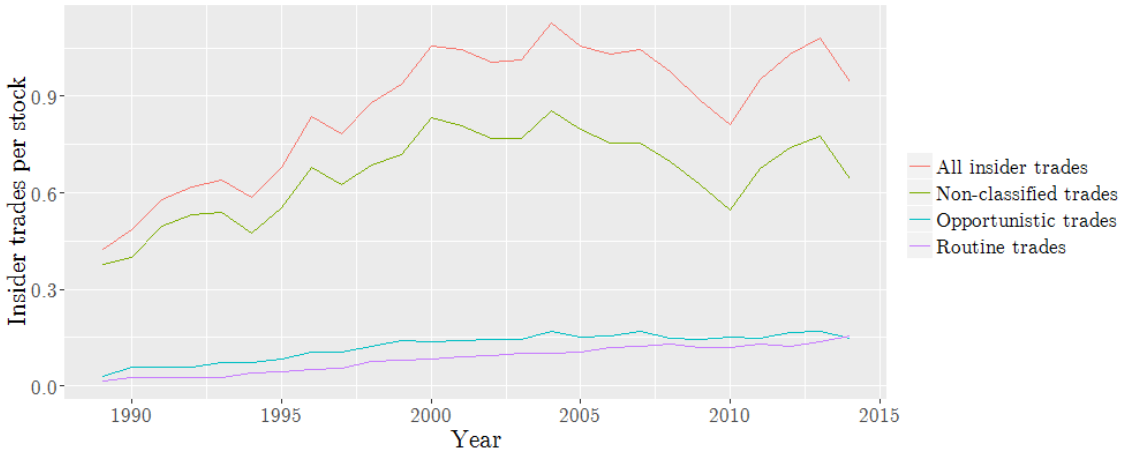


The figure shows the historical development in annual insider trades divided into open market purchases and sales, respectively. The annual number of trades are taken as a fraction of the number of stocks at year end. The figure shows an increase in insider trades throughout the sample period, and an increase in insider purchases as well a decrease in insider sales just before the two recessions in the 2000s.

Figure 5.3 shows a relative measure for annual insider trades, more specifically for open market purchases and sales. In the entire period, there has been a total of 1,928,433 purchase or sale trades, made by 205,688 individuals. Thus, on average, a person trades 9.3 times throughout the sample period. In the sample, there are 24,249 stocks with an average of 79.5 trades per stock during the period. **Figure 5.3** shows an overall increase in the number of transactions by insiders during the sample period. The annual number of insider trades per stock has increased for both purchases and sales from 1986 to the 1990s. Hereafter, purchases and sales has diverged significantly, most likely due to the evident financial crises. Purchases have increased and sales have decreased up until the two financial crises in the 2000s, and decreased and increased thereafter, respectively. This implies that insiders revert their trading behaviour once the stock market re-evaluates the firms' future performance potential.

Next, we apply the methodology by Cohen, Malloy, and Pomorski (2012) to divide the insiders into three types of insiders in order to show their historical trading frequency.

Figure 5.4: Opportunistic, Routine, and Non-Classified Insiders



The figure shows the number of trades classified as either opportunistic or routine trades using the methodology by Cohen, Malloy, and Pomorski (2012). It is evident from the figure that the majority of trades are not classified using their selection procedure as the methodology classifies insiders each year based on past trading behaviour in three consecutive years. The figure begins in 1989, as the procedure uses three years to classify insiders as opportunistic or routine.

Figure 5.4 shows that the two subsets of interest, namely opportunistic trades and routine trades, constitute a limited part of the entire sample of insider trades per stock. However, the absolute number of trades for the two subsets is still sufficient for us to apply it in our analyses. There seems to be a marginally higher number of insiders being classified as opportunistic traders compared to being classified as routine traders, when applying the methodology by Cohen, Malloy, and Pomorski (2012).

5.1.3 Stock Splits with Insider Trading Actions

We find 10,070 stock splits in our sample period between 1986 and 2014 for a total number of 5,415 stocks. Thus, each stock on average split 1.86 times. Moreover, there are a total of 24,249 stocks in the sample, equivalent to 22% of the stocks splitting during the sample period. Of those 22%, we identify 81% to have insider trades 30 months before or 30 months after the stock split.

5.2 Empirical Results

This section include empirical results from our event-time and calendar-time studies.

5.2.1 Event-Time Study

Below, we present the results of applying the event-time study methodology. We begin by presenting event-time results for only stock splits. Afterwards, we present results by using insider trades as the event, and finally, we present stock splits with surrounding insider trades. All figures are equal weighted and regressed against a Fama-French 6 factor model (i.e., Fama-French 5 factor model including momentum). In **figure 5.5** we present the cumulative abnormal return for all the stock splits in our sample period, normalised to zero at $t = 0$. We initiate the analysis by dividing the stock distributions into stock splits and stock dividends to study any potential differences between the two subsamples.

Figure 5.5: All Stock Distributions, Stock Splits, and Stock Dividends

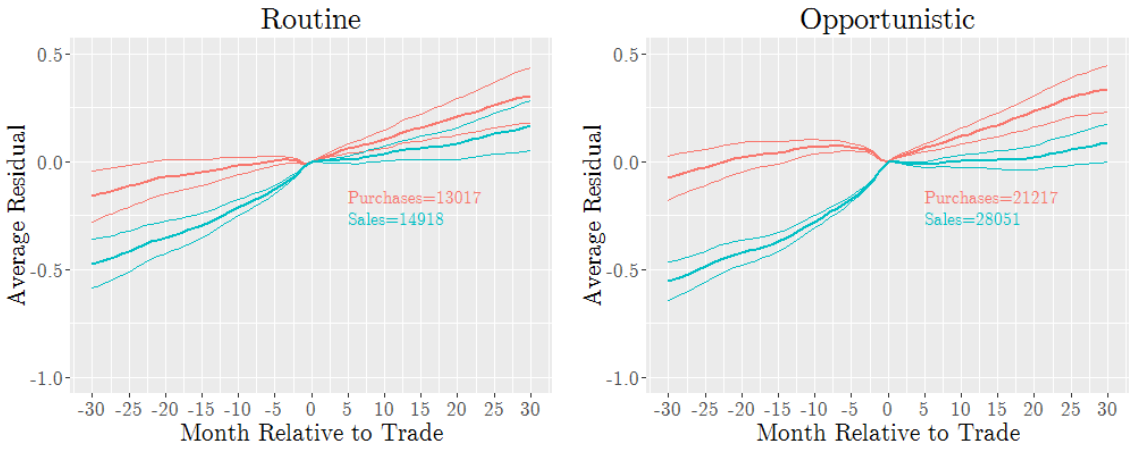
This figure depicts the cumulative abnormal returns for the both stock splits and stock dividends (i.e., "All"), stock splits, stock dividends. The outer bands constitute the 95% confidence intervals, calculated through the application of bootstrapping. As zero is included in the confidence intervals for all three stock distribution groups, the cumulative abnormal returns are not significant at 5%.

Figure 5.5 shows that our sample exhibits similar pre-split run-up in cumulative abnormal returns as evident in recent literature (cf. **section 2.1.1**), albeit the cumulative abnormal returns are not statistically significant. The cumulative abnormal returns for stock dividends ($0.1 < FACPR < 0.25$) exhibit a positive drift and outgrow the cumulative abnormal returns for stock splits ($FACPR \leq 0.25$) as well as for the entire sample from month +8 to month +30. The divergence in cumulative abnormal returns between stock splits and stock dividends can be due to the difference in how the two types of stock distributions are handled from an accounting point of view as well as due to the retained earnings hypothesis.[63] Next, for stock splits, we witness no drift in the cumulative abnormal returns in the 20 months after the split for stock splits, and therefore implicitly for for all stock distributions as the majority of the stock distributions are stock splits. This finding corresponds partly with Fama, Fisher, Jensen, and Roll (1969), thus partly implying semi-strong market efficiency within the 20 months following the stock split.

In **figure 5.6** we use the methodology by Cohen, Malloy, and Pomorski (2012) to analyse the cumulative abnormal returns for two different insider types, namely routine and opportunistic insiders.

[63]Grinblatt, Masulis, and Titman (1984) discuss several signalling-based explanations for their empirical results, where the retained earnings motive is amongst one of them. The retained earnings motive only regards stock dividends, i.e., only partially applicable to our study as we include both stock splits and stock dividends. The retained earnings motive (retained earnings equal accumulation of profit (and losses) over time, net of dividends (Petersen and Plenborg, 2012)) predicts that stock distributions accounted for by reducing retained earnings are more credible signals of managerial optimism than stock distributions that do no reduce retained earnings. The authors show that a distribution accounted for as a stock dividend is a stronger signal of managerial confidence than a signal provided via a stock split. Next, we argue that the stronger signal of managerial confidence should be interpreted by the market as a positive indication of future performance, thus implying a positive reevaluation of the firm value.

Figure 5.6: Insider Trades as the Event Using Opportunistic and Routine Insiders Methodology (Cohen, Malloy, and Pomorski (2012))

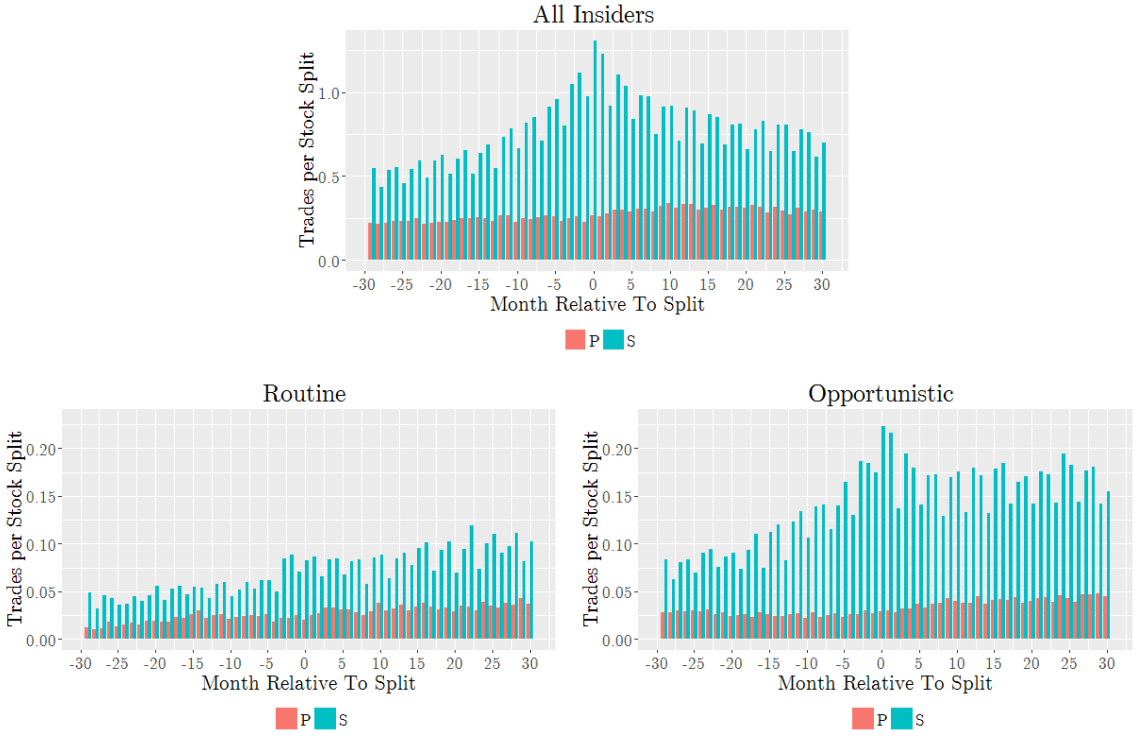


This figure depicts the cumulative abnormal returns for routine and opportunistic trades, both for purchaes and sales. The outer bands constitute the 95% confidence intervals, calculated through the application of bootstrapping. As zero is not included in the confidence intervals for all four types of trades, the cumulative abnormal returns are significant at 5%.

In contrast to the findings by Cohen, Malloy, and Pomorski (2012), we find positive abnormal return performance using a Fama-French 6 factor model for all four combinations of insider and trade types following the stock split. Both types exhibit similar patterns in cumulative abnormal returns in the 60 months period, however the cumulative abnormal returns are generally more abnormal/stronger for opportunistic insiders. In addition, opportunistic sales do not exhibit a change in cumulative abnormal returns for the initial 18 months following the stock split. Lastly, purchases by the two types exhibit similar development in the cumulative abnormal returns, but only differ in the pre-split performance, where opportunistic insiders tend to have a higher return.

We continue by combining insider trading with stock splits. We start by showing the distribution of the trades for all insiders and for the two types of insiders in our study, namely opportunistic and routine insiders, in the period around the stock split. **Figure 5.7** illustrates the frequency distribution of all insider trades, for routine insiders, and for opportunistic trades.

Figure 5.7: Stock Splits with Trades in the 30 Months Before and After a Stock Split



The above figure shows the insider trading activity per stock split around stock splits, for a trading windows 30 months before and after the announcement date. Insider purchases are denominated as "P" (red) and insider sales are deonominated as "S" (blue).

It is evident from **figure 5.7** that the level of insider purchases per stock split is lower than insider sales throughout the entire sample period. Firstly, the elevated level of insider sales may be due to insiders receiving stock grants and stock options through remuneration packages, which are exercised through stock sales. Secondly, the higher number of annual insider sales is also depicted in this figure, however, to a larger extent than the average insider sales per year as seen in **figure 5.3**.

In addition, the level of insider purchases per stock split is unchanged up until the stock split, experiencing a slight increase in the level of trades per stock split post-split and a flat development from month +10 and hereafter. Insider sales per stock split however increase for all insiders up until the stock split, and hereafter decrease in the following 30 months, implying that insiders' trading behaviour concerning sales *change* around stock splits. One reason we see a higher number of sales before and/or close to the announcement date of a stock split may be the 10b5-1 plan. The pre-split run-up leading up to the split month for especially insider trade sales may be triggered by a specific price planned in advance in the

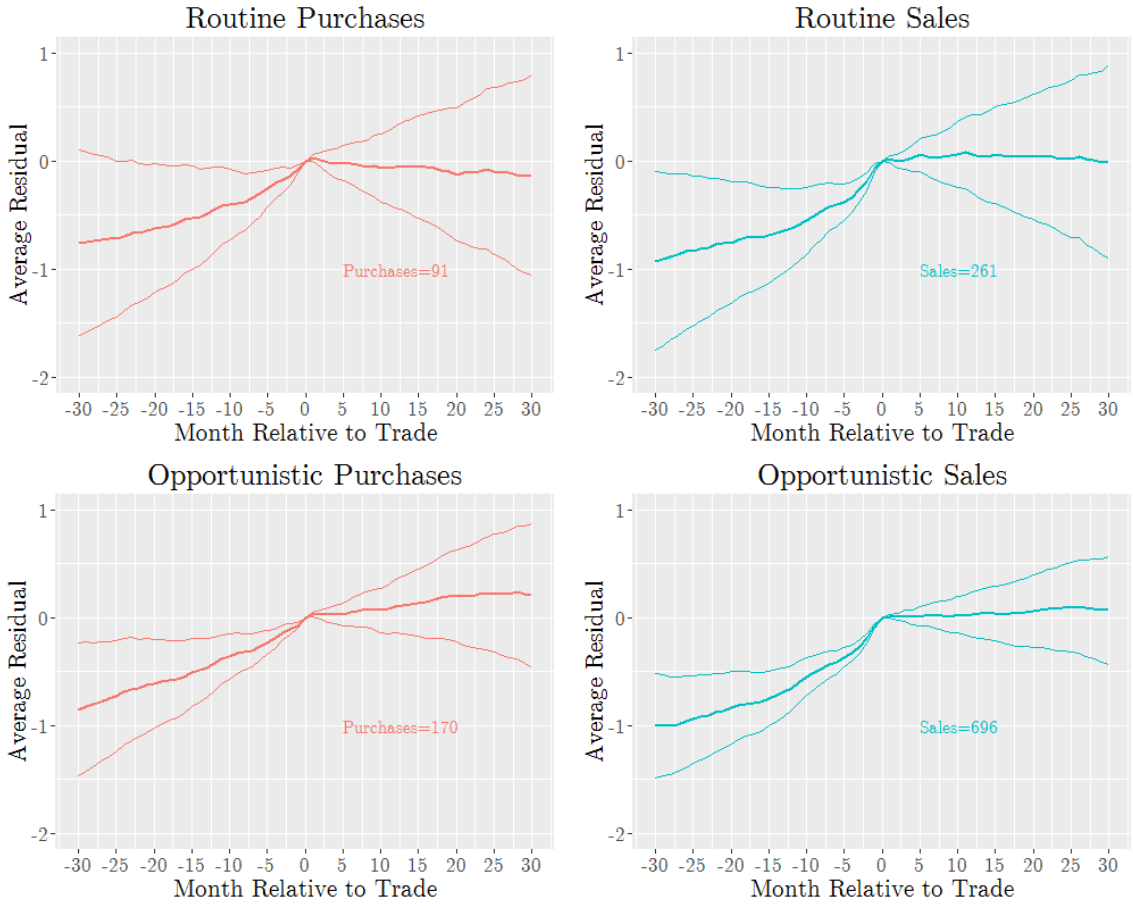
10b5-1 plan.

By comparing the trades of routine and opportunistic trades in **figure 5.7**, it is evident that they exhibit different developments in the 60 month sample period. Routine purchases and sales per stock split exhibit an upward drift throughout the sample period, however the level of routine sales per stock split shifts upwards approximately 3 months before the stock split announcement date and continues rising at the pre-split rate. It is evident that the level of routine sales per stock split changes around the stock split announcement date and continues to shift upwards, implying that routine insiders may alter their trading behaviour following a stock split. Opportunistic purchases is flat pre-split and increases from the announcement date up until month +8, whereas it remains flat thereafter. Lastly, opportunistic sales increase up until the stock splits and decreases until month +5, remaining flat up until month +30. The peak in sales around stock split for opportunistic insiders indicates that the stock splits provide information to the market, which the opportunistic insiders seek to benefit from.

It is evident from the figures that the trades are following a systematic pattern throughout the 60 months, namely that the level of trades drops every third month. This indicates that the level of trades is subdued every quarter. This may either be due to predetermined trading plans put in place, internal remuneration plans, or blackout periods around corporate events (such as quarterly earnings announcements).

We continue our analysis for the combination of insider trading and stock splits, by presenting below, the results from the event-time studies, using several trading window horizons to classify purchases or sales around stock splits. Initially, we present results from using a 1 month trading window for insider trades *before* a stock split in order to create four signals and present their cumulative abnormal return in the months around the stock split (cf. **figure 5.8**). Moreover, we present results using trading windows of 12 to 1 month (cf. **figure 5.9**) and 24 to 12 months (cf. **figure 5.10**) *before* the stock split. All of the different combinations of the two types of insiders, trading types (purchases and sales), and trading windows exhibit an increase in cumulative abnormal returns prior to the stock split, implying a clear evidence for an increase in share price across the various groupings.

Figure 5.8: Combination of Stock Split and Insider Trading, 1 Month Trading Window

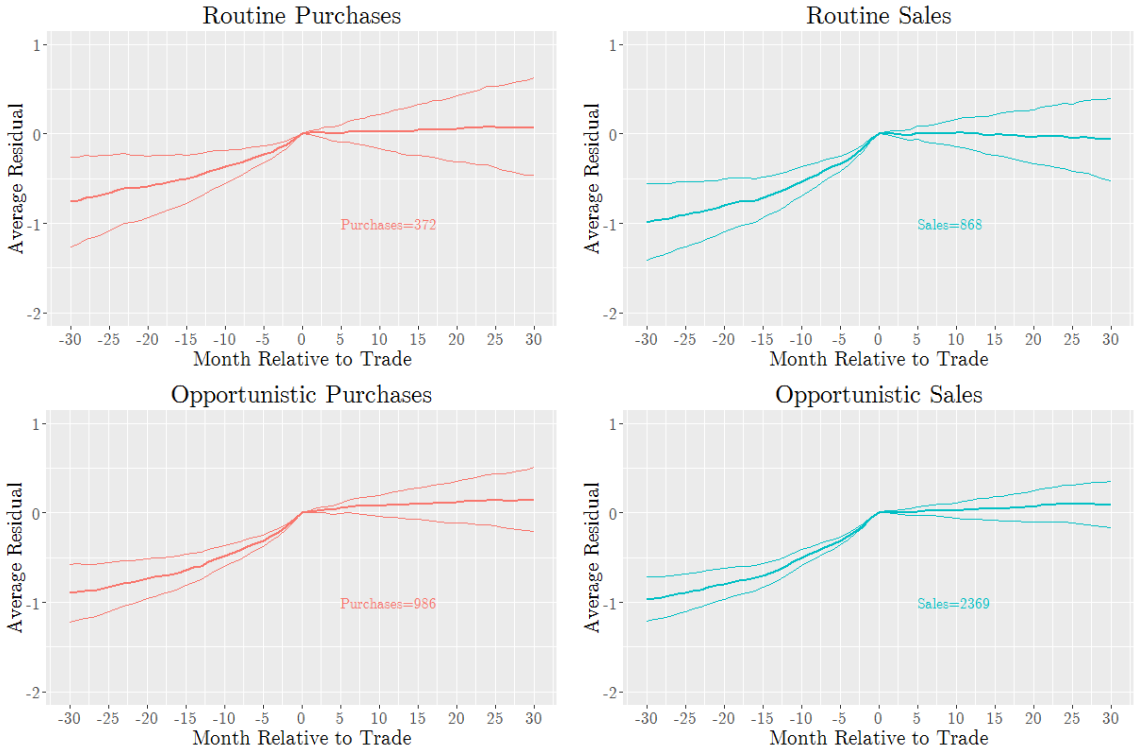


The above figures depict the cumulative abnormal returns for routine purchases, routine sales, opportunistic purchases, and opportunistic sales during the trading window 1 month before the stock split until the announcement date. The outer bands constitute the 95% confidence intervals, calculated through the application of bootstrapping. As zero is included in the confidence intervals for all four combination groups, the cumulative abnormal returns are not significant at 5%.

It is evident from **figure 5.8** that routine purchases exhibit a decrease in cumulative abnormal returns, which implies that the market may perceive routine purchases trades to be a negative signal of future firm performance. Routine sales exhibit a slight increase in cumulative abnormal returns following the split, which then slowly decreases to 0 at month +30. This is somewhat in line with Cohen, Malloy, and Pomorski (2012), i.e., that routine insider trading is not informative for the predictability of future cumulative abnormal returns. These two findings can be considered counter-intuitive to prior research, as insider purchases usually imply a positive signal and insider sales imply a negative signal. This will

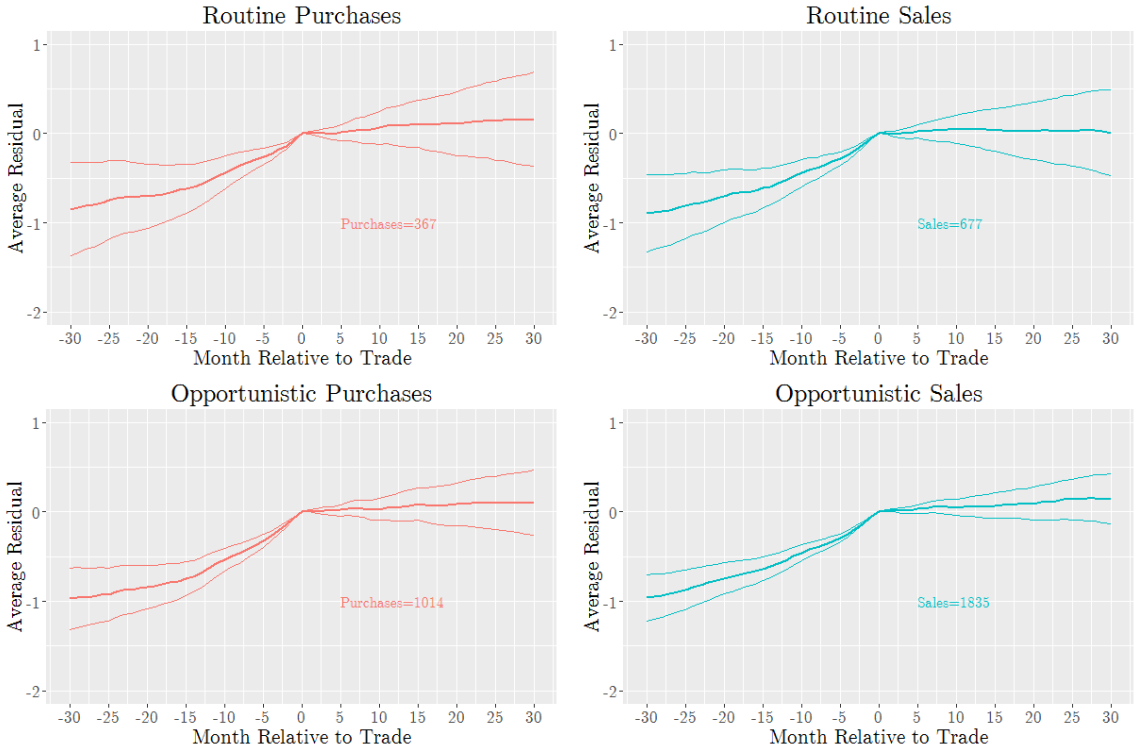
be further elaborated in the discussion (cf. **chapter 6**). Next, both purchases and sales for opportunistic insiders exhibit an increase in cumulative abnormal returns post-split, however purchases endure a stronger signal to the market. This implies that the market considers all trading behaviour by opportunistic traders to be perceived as a positive signal.

Figure 5.9: Combination of Stock Split and Insider Trading, 12 Months to 1 Month Trading Window



The above figures depict the cumulative abnormal returns for routine purchases, routine sales, opportunistic purchases, and opportunistic sales during the trading window 12 months before the stock split until 1 month before the stock split. The outer bands constitute the 95% confidence intervals, calculated through the application of bootstrapping. As zero is included in the confidence intervals for all four combination groups, the cumulative abnormal returns are not significant at 5%.

Figure 5.10: Combination of Stock Split and Insider Trading, 24 Months to 12 Months Trading Window



The above figures depict the cumulative abnormal returns for routine purchases, routine sales, opportunistic purchases, and opportunistic sales during the trading window 24 months before the stock split until 12 months before the stock split. The outer bands constitute the 95% confidence intervals, calculated through the application of bootstrapping. As zero is included in the confidence intervals for all four combination groups, the cumulative abnormal returns are not significant at 5%.

The development in the cumulative abnormal returns is somewhat similar when considering the trading windows for 12 to 1 month (cf. **figure 5.9**) and 24 to 12 months (cf. **figure 5.10**) *before* the stock split.

Routine purchases exhibit a positive drift in the cumulative abnormal returns, albeit the signal is stronger for the 24 to 12 months trading window compared to the 12 to 1 month and 1 month trading windows. This contradicts the findings for the 1 month trading window, implying that the market perceives the signalling value differently according to the trading window. A progressively stronger positive drift for a trading window further away from the stock split indicates that the market perceives earlier routine purchases to entail a strong signalling value. It is of course questionable whether routine insiders are aware of

the stock split 12 or 24 months prior to the split. However, even though we characterise these insiders as routine insiders, they may exhibit opportunistic behaviour in regards to the timing of the stock split. As an example, their purchase behaviour may be due to predetermined 10b5-1 plans that are exercised at certain dates.

Routine sales for the 12 to 1 month trading window (cf. **figure 5.9**) exhibit negative drift in cumulative abnormal returns following the stock split, whereas the 24 to 12 months trading window increases slightly from the stock split up until month +12 and approaches zero at month +30.

The findings for the three trading windows concerning routine sales indicate the market quickly incorporates the information embedded in the stock split and the routine sale. It may also imply that the market does not perceive the routine sale to reveal any additional information on top of the information revealed from the stock split.

All insider trading combinations for the opportunistic insiders exhibit an increase in cumulative abnormal returns following the stock split. Purchases exhibit the strongest signal value 1 month before the stock split and the weakest for 24 to 12 months before the split. Hence, the market perceives opportunistic purchases closer to the stock split to reveal a more informative signal to the market. It should however be noted that the trading behaviour around stock splits may be affected by potential blackout periods in regards contemporaneous firm events such as earnings announcements. It may seem counter-intuitive that opportunistic sales results in an increase in the cumulative abnormal returns following the stock splits, as it should be regarded as a negative signal. The potential reason for this finding will be further elaborated in **chapter 6**.

In conclusion, all insider combinations exhibit an increase in cumulative abnormal returns up until the stock split. Following the stock split, all insider combinations except routine sales exhibit positive cumulative abnormal returns, emphasising the fact that the market does not efficiently incorporate the information derived from the insider trades in the three specified window horizons before the stock split.

We are fully aware of the fact that the long-term event-time study by nature is problematic. This is also evident in the figures as the confidence bands for all three trading windows have cumulative abnormal returns overlapping with zero. Thus, it cannot be rejected that the cumulative abnormal returns in the event-time study are significantly different from zero. However, we have included the event-time study for the sake of discussion and in order to test prior research, namely Fama, Fisher, Jensen, and Roll (1969) and Cohen, Malloy, and Pomorski (2012).

In order to be able to draw statistically significant conclusions from our analyses, we

have included a calendar-time study, as it is more robust and exhibits a higher power, compared to the event-time study.

5.2.2 Calendar-time Study

In this section, we present the results from the calendar time study based on the methodology applied by Cohen, Malloy, and Pomorski (2012). A major difference between the studies of Cohen, Malloy, and Pomorski (2012) and our studies (aside from including stock splits) is that we include additional factor loadings and expand the analysed period in order to include updated data. First, we present the results from regressing a portfolio of only insider trades or only stocks splits against different factor loadings (i.e., Fama-French 6 factor model factor loadings). Afterwards, we present the results from combining stock splits with insider trading actions for similar trading windows as in the event study. We conduct the analysis to see whether the effect derives strictly from insider trading, from stock splits, or finally if it derives from a combination of both.

In the following section we primarily comment on the Fama-French 6 factor model, but include the CAPM and Fama-French 3/4/5 factor model for discussion purposes. We also include the results from a simple regression of the combination of insider and stock split portfolio against two benchmark portfolios of the events on a stand-alone basis. The benchmark portfolios (stand-alone stock splits and stand-alone insider trades) will be be analysed separately before being included in the analysis of the stock split and insider portfolio. We furthermore use monthly data in our study, thus, the alpha values after risk-adjustment may be interpreted on a monthly basis.

Table 5.2: Calendar Time Study, Insider Portfolios

Only insiders	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of trades	3,650			4,260			7,041			7,118		
Mean return	1.85%			1.13%			2.11%			0.96%		
Standard deviation	4.83%			5.86%			5.41%			5.36%		
CAPM alpha	1.03%	5.64	0.00	0.09%	0.51	0.61	1.20%	6.06	0.00	-0.03%	-0.21	0.84
Fama-French 3-factor alpha	0.87%	6.02	0.00	0.10%	0.85	0.39	1.05%	6.69	0.00	-0.04%	-0.49	0.62
Fama-French 4-factor alpha	1.04%	7.53	0.00	0.14%	1.20	0.23	1.34%	10.03	0.00	-0.04%	-0.54	0.59
Fama-French 5-factor alpha	0.92%	6.07	0.00	0.17%	1.41	0.16	1.11%	6.75	0.00	0.02%	0.20	0.84
Fama-French 6-factor alpha	1.04%	7.21	0.00	0.19%	1.59	0.11	1.31%	9.40	0.00	0.01%	0.11	0.91
Fama-French 6-factor beta	0.76	20.47	0.00	1.00	32.97	0.00	0.83	23.03	0.00	0.96	44.98	0.00
Fama-French 6-factor smb	0.59	11.87	0.00	0.69	16.99	0.00	0.71	14.80	0.00	0.66	23.09	0.00
Fama-French 6-factor hml	0.31	4.54	0.00	-0.10	-1.84	0.07	0.20	3.09	0.00	-0.03	-0.82	0.41
Fama-French 6-factor rmw	-0.02	-0.22	0.82	-0.06	-0.96	0.34	0.07	1.10	0.27	-0.07	-1.76	0.08
Fama-French 6-factor cma	0.03	0.31	0.76	-0.13	-1.67	0.10	-0.00	-0.03	0.97	-0.10	-1.86	0.06
Fama-French 6-factor umd	-0.19	-6.44	0.00	-0.04	-1.50	0.14	-0.33	-11.42	0.00	0.01	0.75	0.45

The above figure depicts the calendar-time study for insider trading portfolios for routine purchases, routine sales, opportunistic purchases, and opportunistic sales.

Table 5.2 presents the results from regressing a portfolio of only insider trades against different factor loadings (i.e., Fama-French 6 factor model factor loadings). It is evident from the figure that the alpha value for both routine and opportunistic purchases exhibit positive and statistically significant values at a significance level of 5% (henceforth "at 5%"). The alpha values for both routine and opportunistic sales are positive, but insignificant at 5%. For both routine and opportunistic insider portfolios, the SMB and HML factor loadings are positive and significant at 5%, indicating that the stocks in the portfolios may consist of small value firms. In addition, UMD is significant at 5% and exhibit a negative coefficient, implying negative momentum. The RMW and CMA factor loadings are insignificant at 5%.

Based on the abnormal returns, identified through Jensen's alpha in **Table 5.2** we use a portfolio of opportunistic purchases minus opportunistic sales as a benchmark portfolio for insider trades. We use this exact combination, as such a portfolio shows the highest abnormal returns in a long-short portfolio compared to the a long-short routine portfolio (long in purchases, short in sales). With this approach, we risk not explaining the variation in the returns from a portfolio using routine insider trades, which may bias our results towards higher abnormal returns for routine insider trades when isolating the effect of insider trades and stock splits. Cohen, Malloy, and Pomorski (2012) use a portfolio long in a portfolio with opportunistic purchases minus sales and short a portfolio of routine purchases minus sales. However, based on our findings, such a portfolio may not provide the highest abnormal returns, and would therefore serve as a poor benchmark portfolio.

Table 5.3: Calendar Time Study, Stock Split Portfolios)

Only stock splits	**Stock splits**		
	Estimate	**t value**	**Pr(>|t|)**
Number of splits	15,799	15,799	15,799
Mean return	0.97%	0.01	0.01
Standard deviation	5.28%	0.05	0.05
CAPM alpha	0.02%	0.16	0.87
Fama-French 3-factor alpha	0.01%	0.15	0.88
Fama-French 4-factor alpha	0.14%	1.90	0.06
Fama-French 5-factor alpha	0.12%	1.44	0.15
Fama-French 6-factor alpha	0.19%	2.65	0.01
Fama-French 6-factor beta	0.96	55.25	0.00
Fama-French 6-factor smb	0.53	21.08	0.00
Fama-French 6-factor hml	0.09	2.73	0.01
Fama-French 6-factor rmw	0.05	1.36	0.18
Fama-French 6-factor cma	-0.30	-6.19	0.00
Fama-French 6-factor umd	-0.14	-9.33	0.00

The above figure depicts the calendar-time study for stock splits portfolios for routine purchases, routine sales, opportunistic purchases, and opportunistic.

In **table 5.3**, we present data that only regresses a portfolio of stock splits onto different combinations of risk adjustment factors. The alpha value for the Fama-French 6 factor model is barely positive, but significant at 5%. The SMB and HML factor loadings exhibit positive and statistically significant coefficients at 5%, thus indicating that the stocks included in the portfolio may be small value firms. In addition, the CMA and UMD factor loadings are negative and statistically significant at 5%, implying that the stocks in the portfolio may have an aggressive investment policy and exhibits negative momentum.

We similarly use above portfolio as a benchmark in order to isolate the effects of the combination of insider trades and stock splits. The return from above stock split portfolio, and similarly for the insider portfolio in **table 5.2** are used as explanatory variables on the right hand side of the linear regressions in addition to the Fama-French 6 factors. We also include the alpha value for regressions only on one of the benchmark portfolios and the Fama-French 6 factor model. However, we only include the full number factors in the below regression tables for both benchmark portfolios (called $\text{split}_i nsPFinthetables.$).

Moreover, we include a paired Wilcoxon signed rank test in order to test the benchmark

portfolios directly against the stock split and insider trade portfolio. The Wilcoxon signed rank test is advantageous as it is not dependant on the same normality assumptions as the Student's t-tests used in regressions. Where the Student's t test if the mean of the coefficient is significantly different from zero, the Wilcoxon signed rank test determine if the median is different from two populations. We report the p value for the Wilcoxon test and similarly the 95% confidence intervals.

Table 5.4: Calendar Time Study, Portfolio of Combining Insider Trades with Stock Splits (1 Month Trading Window Before Stock Split)

Trading window: 1 Month	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	91			261			170			696		
Average excess return	-0.02%			1.07%			0.70%			1.03%		
Standard deviation	7.16%			7.05%			4.75%			6.28%		
CAPM alpha	-0.49%	-1.31	0.19	0.17%	0.75	0.45	0.29%	1.29	0.20	0.20%	1.12	0.26
Fama-French 3-factor alpha	-0.67%	-1.86	0.06	0.26%	1.34	0.18	0.13%	0.63	0.53	0.25%	1.68	0.09
Fama-French 4-factor alpha	-0.58%	-1.57	0.12	0.34%	1.71	0.09	0.14%	0.65	0.52	0.40%	2.70	0.01
Fama-French 5-factor alpha	-0.53%	-1.39	0.16	0.42%	2.02	0.04	0.01%	0.07	0.95	0.36%	2.40	0.02
Fama-French 6-factor alpha	-0.48%	-1.24	0.21	0.45%	2.20	0.03	0.02%	0.11	0.92	0.45%	3.04	0.00
Fama-French 6-factor beta	0.67	6.78	0.00	1.16	21.70	0.00	0.70	12.30	0.00	1.05	27.61	0.00
Fama-French 6-factor smb	0.37	2.81	0.01	0.41	5.81	0.00	0.31	4.12	0.00	0.57	11.28	0.00
Fama-French 6-factor hml	0.59	3.25	0.00	-0.23	-2.36	0.02	0.40	3.79	0.00	-0.15	-2.10	0.04
Fama-French 6-factor rmw	-0.13	-0.70	0.48	-0.08	-0.75	0.45	0.32	2.96	0.00	0.11	1.50	0.13
Fama-French 6-factor cma	-0.21	-0.82	0.41	-0.36	-2.65	0.01	-0.07	-0.47	0.64	-0.43	-4.35	0.00
Fama-French 6-factor umd	-0.09	-1.14	0.25	-0.07	-1.53	0.13	-0.01	-0.32	0.75	-0.14	-4.70	0.00
Split PF + Insider Trades PF alpha	-1.12%	-2.78	0.01	-0.05%	-0.20	0.84	-0.29%	-1.19	0.24	-0.24%	-1.17	0.24
Split PF + Insider Trades PF split_coefficient	0.57	8.64	0.00	0.99	23.51	0.00	0.46	11.34	0.00	0.96	28.60	0.00
Split PF + Insider Trades PF ins_coefficient	0.32	2.87	0.00	-0.14	-1.88	0.06	0.35	5.05	0.00	0.04	0.68	0.50
Fama-French 6-factor + split PF alpha	-0.61%	-1.56	0.12	0.35%	1.66	0.10	0.00%	0.02	0.99	0.31%	2.11	0.04
Fama-French 6-factor + ins PF alpha	-0.63%	-1.48	0.14	0.62%	2.71	0.01	-0.33%	-1.37	0.17	0.46%	2.84	0.00
Fama-French 6-factor + split_ins PF alpha	-0.70%	-1.65	0.10	0.54%	2.40	0.02	-0.33%	-1.34	0.18	0.37%	2.36	0.02
Fama-French 6-factor + split_ins PF beta	0.41	2.07	0.04	0.88	8.19	0.00	0.75	6.60	0.00	0.73	9.80	0.00
Fama-French 6-factor + split_ins PF smb	0.22	1.35	0.18	0.27	3.20	0.00	0.31	3.34	0.00	0.40	6.66	0.00
Fama-French 6-factor + split_ins PF hml	0.56	3.07	0.00	-0.20	-2.03	0.04	0.33	3.17	0.00	-0.14	-2.06	0.04
Fama-French 6-factor + split_ins PF rmw	-0.13	-0.70	0.48	-0.04	-0.42	0.67	0.28	2.60	0.01	0.13	1.82	0.07
Fama-French 6-factor + split_ins PF cma	-0.16	-0.61	0.54	-0.29	-2.10	0.04	-0.10	-0.68	0.50	-0.35	-3.64	0.00
Fama-French 6-factor + split_ins PF umd	-0.11	-1.10	0.27	-0.17	-3.14	0.00	0.08	1.43	0.15	-0.22	-5.84	0.00
Fama-French 6-factor + split_ins PF split_pf	0.26	1.56	0.12	0.26	2.89	0.00	-0.01	-0.15	0.88	0.30	4.92	0.00
Fama-French 6-factor + split_ins PF ins_pf	0.08	0.55	0.58	-0.16	-2.17	0.03	0.27	3.40	0.00	-0.06	-1.07	0.29

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.0002	-0.0167	-0.0056	0.6657	-0.0049	0.0034	0.2659	-0.0071	0.0019	0.6478	-0.0041	0.0026
Wilcoxon Rank Test Insider portfolio	0.0394	-0.0150	-0.0003	0.6602	-0.0071	0.0105	0.8711	-0.0066	0.0058	0.3611	-0.0044	0.0116

The above figure depicts the calendar-time study for portfolio of combining insider trades with stock splits for routine purchases, routine sales, opportunistic purchases, and opportunistic.

Next, we consider stock splits with insider trades in the months before the announcement date in **table 5.4**. Thus, insider classifications are made based on trades in the month prior to the stock split announcement and the portfolio itself is formed one month after the stock split announcement date.

Table 5.4 shows that only routine and opportunistic sales have statistically significant alpha values when regressing onto the Fama-French 6 factor model and when regressing onto the Fama-French 6 factor model including either the stock split control group portfolio, insider trading control group portfolio, or the combined stock split and insider trading

portfolio.[64] In addition, we find that the Wilcoxon rank test split portfolio is significant at 5% for routine purchases. The majority of the alpha values for routine and opportunistic purchases (albeit insignificant at 5%) result in predominantly negative values and the alpha values for routine and opportunistic sales have predominantly positive values. This finding may seem counter-intuitive and it will be further discussed in **chapter 6**.

It is evident from **table 5.4** that the SMB factor loadings for most of the combinations[65] are positive and statistically significant at 5%, thus the stocks included in the portfolios can for the majority of the regressions be regarded as smaller companies. Next, all of the HML factor loadings are statistically significant at 5%, however the signs are opposite when comparing purchases and sales. The HML factor loading for routine and opportunistic purchases exhibits a positive value, thus insiders in value firms are purchasing within 1 month prior to the stock split. The HML factor loadings for the routine and opportunistic sales are however negative, indicating that insiders in growth firms may be selling in the period within 1 month prior to the stock split. Next, the RMW factor loading is only statistically significant for opportunistic purchases portfolio, at a significance level of 5%. The coefficients for the RMW factor loading are negative (or equal to zero) for routine trades and positive for opportunistic trades, indicating that the routine inside traders may be affiliated with companies having low profitability and opportunistic insiders may be affiliated with companies having high profitability. However, the RMW factor loadings are only statistically significant at 5% for opportunistic purchases. Next, the CMA factor loading is negative for all of the portfolios, but only statistically significant for routine and opportunistic sales. This implies that insiders selling within 1 month prior to the stock split may be affiliated with companies that have an aggressive investment policy. Lastly, there is no clear pattern for the UMD factor loadings. When only regressing the portfolios onto the Fama-French 6 factor model, all UMD coefficients are negative, implying negative momentum.

In the following we comment on the 12 to 1 month (cf. **figure 5.5**) as well as 24 to 12 months (cf. **figure 5.6**) calendar-time trading windows tables.

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[64] When regressing the combined portfolio of insider trades and stock splits onto the Fama-French 6 model as well as the stock split control group portfolio, the alpha value is only statistical significant at a significance level of 10%.

[65] When regressing the routine purchases portfolio onto the Fama-French 6 factor model and the stock split control group portfolio, and when regressing the routine purchases portfolio onto the Fama-French 6 factor model and the combined insider trading and stock split portfolio, the SMB factors are not statistically significant at 5%.

Table 5.5: Calendar Time Study, Portfolio of Combining Insider Trades with Stock Splits (12 Months to 1 Month Trading Window Before Stock Split)

Trading window: 12Months to 1Month	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	372			868			986			2,369		
Average excess return	0.80%			1.04%			0.79%			0.96%		
Standard deviation	5.01%			6.14%			4.68%			5.75%		
CAPM alpha	0.22%	1.18	0.24	0.21%	1.29	0.20	0.20%	1.32	0.19	0.16%	1.17	0.24
Fama-French 3-factor alpha	0.15%	0.81	0.42	0.29%	2.15	0.03	0.10%	0.79	0.43	0.17%	1.64	0.10
Fama-French 4-factor alpha	0.22%	1.24	0.21	0.38%	2.90	0.00	0.23%	1.76	0.08	0.32%	3.34	0.00
Fama-French 5-factor alpha	0.16%	0.87	0.38	0.37%	2.69	0.01	0.14%	1.04	0.30	0.23%	2.25	0.03
Fama-French 6-factor alpha	0.21%	1.13	0.26	0.43%	3.14	0.00	0.22%	1.67	0.10	0.33%	3.44	0.00
Fama-French 6-factor beta	0.82	17.06	0.00	1.08	30.71	0.00	0.82	24.25	0.00	1.06	43.08	0.00
Fama-French 6-factor smb	0.43	6.75	0.00	0.43	9.21	0.00	0.48	10.64	0.00	0.52	16.02	0.00
Fama-French 6-factor hml	0.20	2.33	0.02	-0.25	-3.94	0.00	0.23	3.67	0.00	-0.10	-2.31	0.02
Fama-French 6-factor rmw	0.16	1.78	0.08	0.02	0.36	0.72	0.12	1.89	0.06	0.10	2.24	0.03
Fama-French 6-factor cma	-0.24	-1.91	0.06	-0.24	-2.68	0.01	-0.20	-2.24	0.03	-0.24	-3.77	0.00
Fama-French 6-factor umd	-0.08	-2.14	0.03	-0.10	-3.47	0.00	-0.13	-4.86	0.00	-0.16	-8.01	0.00
Split PF + Insider Trades PF alpha	-0.23%	-1.07	0.28	-0.05%	-0.24	0.81	-0.46%	-2.74	0.01	-0.28%	-1.67	0.10
Split PF + Insider Trades PF split_coefficient	0.66	18.66	0.00	0.92	28.01	0.00	0.69	25.12	0.00	0.90	32.51	0.00
Split PF + Insider Trades PF ins_coefficient	0.16	2.67	0.01	-0.08	-1.40	0.16	0.32	6.70	0.00	0.07	1.48	0.14
Fama-French 6-factor + split PF alpha	0.13%	0.68	0.50	0.34%	2.48	0.01	0.14%	1.04	0.30	0.22%	2.39	0.02
Fama-French 6-factor + ins PF alpha	0.16%	0.80	0.42	0.55%	3.68	0.00	-0.05%	-0.38	0.70	0.36%	3.46	0.00
Fama-French 6-factor + split_ins PF alpha	0.11%	0.55	0.58	0.49%	3.32	0.00	-0.09%	-0.66	0.51	0.30%	2.95	0.00
Fama-French 6-factor + split_ins PF beta	0.64	6.65	0.00	0.85	12.19	0.00	0.71	10.76	0.00	0.81	17.15	0.00
Fama-French 6-factor + split_ins PF smb	0.33	4.26	0.00	0.32	5.67	0.00	0.39	7.40	0.00	0.39	10.34	0.00
Fama-French 6-factor + split_ins PF hml	0.20	2.23	0.03	-0.23	-3.59	0.00	0.18	2.96	0.00	-0.09	-2.19	0.03
Fama-French 6-factor + split_ins PF rmw	0.17	1.83	0.07	0.05	0.77	0.44	0.10	1.58	0.11	0.12	2.75	0.01
Fama-French 6-factor + split_ins PF cma	-0.20	-1.58	0.12	-0.18	-2.03	0.04	-0.18	-2.16	0.03	-0.18	-2.92	0.00
Fama-French 6-factor + split_ins PF umd	-0.11	-2.26	0.02	-0.18	-5.13	0.00	-0.09	-2.73	0.01	-0.22	-9.37	0.00
Fama-French 6-factor + split_ins PF split_pf	0.17	2.12	0.03	0.21	3.60	0.00	0.13	2.41	0.02	0.23	5.93	0.00
Fama-French 6-factor + split_ins PF ins_pf	0.01	0.16	0.87	-0.13	-2.57	0.01	0.19	4.11	0.00	-0.06	-1.88	0.06

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.0521	-0.0072	0.0000	0.8168	-0.0032	0.0025	0.1633	-0.0052	0.0009	0.4374	-0.0031	0.0014
Wilcoxon Rank Test Insider portfolio	0.9761	-0.0065	0.0063	0.4415	-0.0050	0.0112	0.6919	-0.0048	0.0073	0.4289	-0.0045	0.0106

The above figure depicts the calendar-time study for portfolio of combining insider trades with stock splits for routine purchases, routine sales, opportunistic purchases, and opportunistic.

Table 5.6: Calendar Time Study, Portfolio of Combining Insider Trades with Stock Splits (24 Months to 12 Months Trading Window Before Stock Split)

Trading window: 24M to 12Months	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	367			677			1,014			1,835		
Average excess return	0.79%			1.08%			0.71%			1.06%		
Standard deviation	4.90%			5.81%			5.09%			5.64%		
CAPM alpha	0.26%	1.31	0.19	0.33%	1.86	0.06	0.07%	0.40	0.69	0.29%	1.96	0.05
Fama-French 3-factor alpha	0.21%	1.08	0.28	0.40%	2.59	0.01	-0.02%	-0.16	0.88	0.29%	2.26	0.02
Fama-French 4-factor alpha	0.26%	1.33	0.18	0.53%	3.50	0.00	0.12%	0.86	0.39	0.43%	3.39	0.00
Fama-French 5-factor alpha	0.21%	1.02	0.31	0.51%	3.17	0.00	0.08%	0.55	0.58	0.31%	2.32	0.02
Fama-French 6-factor alpha	0.24%	1.17	0.24	0.59%	3.75	0.00	0.17%	1.18	0.24	0.39%	3.10	0.00
Fama-French 6-factor beta	0.77	14.66	0.00	0.95	23.53	0.00	0.86	23.13	0.00	1.04	31.78	0.00
Fama-French 6-factor smb	0.34	4.85	0.00	0.41	7.60	0.00	0.49	9.94	0.00	0.49	11.43	0.00
Fama-French 6-factor hml	0.14	1.50	0.13	-0.23	-3.11	0.00	0.25	3.71	0.00	-0.09	-1.45	0.15
Fama-French 6-factor rmw	0.19	1.97	0.05	0.00	0.02	0.98	0.04	0.56	0.58	0.20	3.28	0.00
Fama-French 6-factor cma	-0.25	-1.84	0.07	-0.26	-2.47	0.01	-0.29	-3.02	0.00	-0.22	-2.63	0.01
Fama-French 6-factor umd	-0.05	-1.28	0.20	-0.14	-4.21	0.00	-0.15	-4.96	0.00	-0.15	-5.59	0.00
Split PF + Insider Trades PF alpha	-0.17%	-0.79	0.43	-0.05%	-0.27	0.79	-0.55%	-2.91	0.00	-0.10%	-0.51	0.61
Split PF + Insider Trades PF split_coefficient	0.61	16.74	0.00	0.85	25.39	0.00	0.74	24.05	0.00	0.85	27.38	0.00
Split PF + Insider Trades PF ins_coefficient	0.16	2.55	0.01	0.03	0.59	0.55	0.26	5.00	0.00	0.05	1.03	0.30
Fama-French 6-factor + split PF alpha	0.13%	0.65	0.52	0.47%	2.99	0.00	0.09%	0.60	0.55	0.31%	2.41	0.02
Fama-French 6-factor + ins PF alpha	0.12%	0.52	0.60	0.55%	3.18	0.00	0.01%	0.04	0.97	0.48%	3.42	0.00
Fama-French 6-factor + split_ins PF alpha	0.06%	0.25	0.80	0.48%	2.79	0.01	-0.04%	-0.24	0.81	0.42%	3.05	0.00
Fama-French 6-factor + split_ins PF beta	0.57	5.38	0.00	0.70	8.63	0.00	0.72	9.68	0.00	0.82	12.70	0.00
Fama-French 6-factor + split_ins PF smb	0.22	2.57	0.01	0.27	4.12	0.00	0.40	6.69	0.00	0.39	7.45	0.00
Fama-French 6-factor + split_ins PF hml	0.12	1.28	0.20	-0.24	-3.19	0.00	0.22	3.29	0.00	-0.07	-1.17	0.24
Fama-French 6-factor + split_ins PF rmw	0.19	1.96	0.05	0.01	0.16	0.87	0.03	0.43	0.67	0.22	3.68	0.00
Fama-French 6-factor + split_ins PF cma	-0.21	-1.53	0.13	-0.20	-1.92	0.06	-0.26	-2.77	0.01	-0.17	-1.99	0.05
Fama-French 6-factor + split_ins PF umd	-0.07	-1.30	0.19	-0.18	-4.58	0.00	-0.14	-3.77	0.00	-0.21	-6.61	0.00
Fama-French 6-factor + split_ins PF split_pf	0.20	2.34	0.02	0.25	3.74	0.00	0.15	2.44	0.02	0.20	3.65	0.00
Fama-French 6-factor + split_ins PF ins_pf	0.06	0.86	0.39	-0.01	-0.13	0.89	0.10	1.98	0.05	-0.09	-2.06	0.04

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.3902	-0.0056	0.0023	0.9799	-0.0033	0.0031	0.0656	-0.0059	0.0002	0.5495	-0.0032	0.0018
Wilcoxon Rank Test Insider portfolio	0.9499	-0.0065	0.0070	0.4655	-0.0050	0.0105	0.8350	-0.0060	0.0069	0.4359	-0.0045	0.0104

The above figure depicts the calendar-time study for portfolio of combining insider trades with stock splits for routine purchases, routine sales, opportunistic purchases, and opportunistic.

When considering longer trading horizons further away from the stock split announcement date, the statistical significance for the alpha values regarding the sales portfolios is stronger. However, when considering the Wilcoxon rank test, the split portfolio is continously the routine purchaes portfolio is the only significant portfolio at 5%. Again, alpha values for the insider purchase portfolios are statistically insignificant at the 5% level. The SMB factor loadings are positive and statistically significant for all of the portfolios across the 24 to 12 and 12 to 1 month trading windows, implying that all of the portfolios may include small firms. In regards to the HML factor loading, all of the factor loadings are statistically significant at 5% for the 12 to 1 month before the split trading window, but only statistically significant at 5% for routine sales and opportunistic purchases for the 24 to 12 months before the split trading window. Again, the HML factor loadings are positive for purchases and negative for sales, implying that insiders in value firms tend to engage in insider purchasing, while insiders in growth firms tend to engage in insider selling, up to two years before the stock split. Next, the RMW factor loading is positive for all portfolios across the longer

trading windows and statistically significant at 5% for opportunistic sales, both for 12 to 1 month and 24 to 12 months before split trading windows. The RMW factor loading for opportunistic purchases is only statistically significant at 5% for the 12 to 1 month trading window when regressing the portfolio the Fama-French 6 factor model and the stock split control group portfolio. When considering the routine purchases portfolio, the RMW factor loadings are statistically significant at 5% for almost all of the regression for the 24 to 12 months before the split, albeit not applicable for the 12 to 1 month trading window. Routine sales has no statistical significant RMW factor loadings at 5%. The positive RMW factor loadings indicate that the stock included in the portfolios may be profitable. Next, the CMA factor loadings are negative for all for the regressions, but are not all statistically significant at 5%. The routine purchases portfolio has no statistically significant CMA factor loadings at 5%, across both trading windows, however the majority of the RMW factor loadings are statistically significant for the other portfolios. This implies that the stocks included in the portfolios across the two trading windows may have an aggressive investment policy. Lastly, the UMD factor loading is statistically significant across both trading windows for almost all portfolio regressions for routine sales, opportunistic purchases and opportunistic sales, however not evident for all of the various regressions for routine purchases. The UMD factor loadings are all negative, implying negative momentum.

5.3 Robustness Tests

In the following we present different robustness tests in order to validate our findings. The robustness tests are based in the existing format of the calendar-time study, where we use the 12 to 1 month trading window as the *base* portfolio for the tests. We evaluate the robustness of the results by assessing the significance of the alpha value in the base Fama-French 6 factor model used throughout the thesis. First, we control for B/M and size in **section 5.3.1**. Next, we test a different insider characterisation methodology in the **section 5.3.2**, sample period in **section 5.3.3**, and finally splits/dividends in **section 5.3.4**.

5.3.1 Controlling for B/M and Size

In above empirical results, we find evidence in favour of the stocks with abnormal returns for insider *sales* are small value firms. We use below robustness tests to identify if the stocks exhibit similar characteristics as suggested by the factor loadings in the linear regression model used in the calendar-time study.

We divide the portfolios into sub-samples using NYSE Breakpoints for book to market

value and market capitalisation. For size and for book to market ratio, we divide the stocks into three different samples using the NYSE breakpoints. Next, we discard the 33% in the middle for each of the two sub-samples, leaving us with value and growth stocks and small and large stocks, respectively. We thereafter divide the sample with the 12 month and 1 month trading window into four samples, and run similar calendar-time analysis on the returns from these portfolios. Below are the results for regressing these portfolios on the base case Fama-French 6 factor model with additional control groups of both stock splits and insider trades.

Table 5.7: Abnormal Return for Portfolios of Different Firm Characteristics

	Routine		**Opportunistic**	
	Purchases	**Sales**	**Purchases**	**Sales**
Low B/M	0.53%	0.60%	0.26%	0.53%
t-test	1.60	3.04	1.20	4.02
p-value	0.11	**0.00**	0.23	**0.00**
High B/M	-0.82%	0.77%	0.26%	0.36%
t-test	-1.63	1.18	0.66	0.73
p-value	0.10	0.24	0.51	0.47
Small ME	-0.18%	0.09%	-0.27%	-0.17%
t-test	-0.69	0.39	-1.47	-1.00
p-value	0.49	0.70	0.14	0.32
Large ME	0.84%	0.45%	0.23%	0.71%
t-test	1.97	2.25	1.06	4.43
p-value	**0.05**	**0.03**	0.29	**0.00**

The above figure depicts the abnormal return for portfolios with low B/M, high B/M, small ME, and Large ME.

We compare this results to the base case of the 12 month to 1 month portfolio with insider sales. Here, we had an monthly abnormal return for insider sales of approximately 0.5% per month for routine sales. Similarly, we had an abnormal return, measured by the alpha value, of 0.3% monthly for opportunistic sales. In contrast to the findings of the factor loadings, the results become insignificant for small stocks (small ME) and similarly

for value stocks (High B/M). Instead, we see statistical significance for stocks with large market capitalisation (large ME) and also for growth stocks (low B/M). The stocks may therefore not derive from small value stocks as indicated by the factors, and similarly also by the literature on both insider trading and for stock splits. Instead, the results suggest evidence that the abnormal returns from insider sales are more common for large growth stocks, which is counter-intuitive to our expectations.

5.3.2 Choice of Informed and Liquidity Traders

We use the size of a given trade compared to the insider's holding in order to test the robustness of our empirical findings as a result of the selection procedure for opportunistic and routine insiders. We use the size of the trade in relation to the insiders' holding in the firm as suggested by Scott and Xu (2004). We use a similar methodology, where insider trades are divided into two categories. Trades that are above or less than 50% of the resulted holding of shares in the firm, which are rough estimates of their sample selection criteria.

Table 5.8: Classification of Routine and Opportunistic Insiders Using Trade Size

Trade size classification	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	3,890			5,588			1,908			3,691		
Average excess return	0.75%			0.81%			0.68%			0.86%		
Standard deviation	4.59%			5.41%			5.27%			5.72%		
CAPM alpha	0.13%	1.06	0.29	0.05%	0.44	0.66	-0.03%	-0.22	0.83	0.06%	0.43	0.67
Fama-French 3-factor alpha	0.03%	0.34	0.74	0.03%	0.35	0.73	-0.10%	-0.87	0.38	0.06%	0.60	0.55
Fama-French 4-factor alpha	0.16%	1.88	0.06	0.18%	2.26	0.02	0.06%	0.52	0.60	0.22%	2.48	0.01
Fama-French 5-factor alpha	0.07%	0.80	0.42	0.10%	1.09	0.27	-0.02%	-0.15	0.88	0.14%	1.45	0.15
Fama-French 6-factor alpha	0.15%	1.87	0.06	0.19%	2.48	0.01	0.08%	0.76	0.45	0.24%	2.81	0.01
Fama-French 6-factor beta	0.86	40.09	0.00	1.00	51.14	0.00	0.94	33.82	0.00	1.04	46.94	0.00
Fama-French 6-factor smb	0.52	18.34	0.00	0.55	21.24	0.00	0.55	14.89	0.00	0.54	18.45	0.00
Fama-French 6-factor hml	0.25	6.35	0.00	0.02	0.52	0.60	0.21	4.09	0.00	-0.05	-1.19	0.23
Fama-French 6-factor rmw	0.15	3.80	0.00	0.13	3.58	0.00	0.15	2.84	0.00	0.13	3.04	0.00
Fama-French 6-factor cma	-0.25	-4.63	0.00	-0.28	-5.63	0.00	-0.38	-5.34	0.00	-0.33	-5.70	0.00
Fama-French 6-factor umd	-0.14	-8.08	0.00	-0.16	-10.02	0.00	-0.17	-7.52	0.00	-0.17	-9.52	0.00
Split PF + Insider Trades PF alpha	-0.50%	-3.62	0.00	-0.45%	-2.93	0.00	-0.66%	-3.80	0.00	-0.40%	-2.40	0.02
Split PF + Insider Trades PF split_coefficient	0.73	31.88	0.00	0.87	34.36	0.00	0.81	28.58	0.00	0.90	32.55	0.00
Split PF + Insider Trades PF ins_coefficient	0.28	7.17	0.00	0.13	3.07	0.00	0.26	5.25	0.00	0.09	1.92	0.06
Fama-French 6-factor + split PF alpha	0.05%	0.67	0.50	0.08%	1.16	0.25	0.00%	-0.01	0.99	0.14%	1.72	0.09
Fama-French 6-factor + ins PF alpha	-0.02%	-0.23	0.82	0.18%	2.12	0.03	-0.06%	-0.48	0.63	0.28%	2.91	0.00
Fama-French 6-factor + split_ins PF alpha	-0.08%	-0.89	0.37	0.11%	1.44	0.15	-0.10%	-0.88	0.38	0.21%	2.36	0.02
Fama-French 6-factor + split_ins PF beta	0.68	16.94	0.00	0.77	20.94	0.00	0.80	14.42	0.00	0.81	19.08	0.00
Fama-French 6-factor + split_ins PF smb	0.41	12.67	0.00	0.43	14.43	0.00	0.46	10.34	0.00	0.42	12.37	0.00
Fama-French 6-factor + split_ins PF hml	0.22	5.96	0.00	0.02	0.55	0.58	0.19	3.66	0.00	-0.04	-1.03	0.30
Fama-French 6-factor + split_ins PF rmw	0.14	3.87	0.00	0.14	4.19	0.00	0.14	2.78	0.01	0.14	3.61	0.00
Fama-French 6-factor + split_ins PF cma	-0.22	-4.30	0.00	-0.23	-4.85	0.00	-0.36	-5.02	0.00	-0.27	-4.91	0.00
Fama-French 6-factor + split_ins PF umd	-0.14	-6.80	0.00	-0.21	-11.21	0.00	-0.17	-6.10	0.00	-0.23	-10.75	0.00
Fama-French 6-factor + split_ins PF split_pf	0.19	5.69	0.00	0.22	7.30	0.00	0.16	3.43	0.00	0.22	6.13	0.00
Fama-French 6-factor + split_ins PF ins_pf	0.11	3.81	0.00	-0.02	-0.94	0.35	0.08	2.17	0.03	-0.06	-1.94	0.05

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.0058	-0.0052	-0.0009	0.0071	-0.0043	-0.0007	0.0013	-0.0063	-0.0016	0.0509	-0.0043	0.0000
Wilcoxon Rank Test Insider portfolio	0.8291	-0.0055	0.0068	0.6444	-0.0057	0.0087	0.9947	-0.0066	0.0067	0.6349	-0.0056	0.0093

The above figure depicts the classification of routine and opportunistic insiders using trading size, considering risk adjustment factor loadings.

Figure 5.8 shows that opportunistic sales exhibit positive and statistically significant return, which we would not have expected to see, as the trading sizes are very large. Thus, even after controlling for large portions of shares traded, we still find significant positive returns for sales. In addition, we find that (almost) all of the portfolios are significant when considering the Wilcoxon rank test split portfolio at 1%.

The results are robust to this classification of insider traders, although we had expected a stronger positive abnormal return for routine sales due to the lower size, and similarly a negative and large coefficient on the opportunistic sales, as the sales account for a much larger share of the insiders holding in the firm. Further analysis is needed here to test trade size classifications more.

Finally, we also test for the robustness for different time periods in our sample. We divide the sample into two periods, before and after 2000, which is the the year the 105b-1 plans were introduced. We find less significant results for the smaller sub-samples, but with coefficients in the same direction as the base case of 12 months to 1 months insider trades.

5.3.3 Choice of Sample Period

Table 5.9: Sub-period: 1989-1999

Sub-period: 1989 to 1999	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	201			416			617			1,237		
Average excess return	1.17%			1.52%			0.87%			1.34%		
Standard deviation	4.42%			5.64%			3.85%			4.93%		
CAPM alpha	0.27%	0.98	0.33	0.19%	0.69	0.49	0.02%	0.11	0.91	0.10%	0.49	0.62
Fama-French 3-factor alpha	0.37%	1.44	0.15	0.43%	1.81	0.07	0.11%	0.65	0.52	0.33%	2.49	0.01
Fama-French 4-factor alpha	0.48%	1.78	0.08	0.33%	1.28	0.20	0.31%	1.69	0.09	0.37%	2.69	0.01
Fama-French 5-factor alpha	0.32%	1.23	0.22	0.39%	1.56	0.12	0.05%	0.26	0.80	0.27%	2.10	0.04
Fama-French 6-factor alpha	0.41%	1.44	0.15	0.26%	0.99	0.32	0.22%	1.16	0.25	0.28%	2.04	0.04
Fama-French 6-factor beta	0.83	10.42	0.00	1.03	13.71	0.00	0.83	15.67	0.00	1.00	26.10	0.00
Fama-French 6-factor smb	0.47	4.82	0.00	0.48	5.26	0.00	0.50	7.76	0.00	0.62	13.26	0.00
Fama-French 6-factor hml	0.18	1.13	0.26	-0.41	-2.77	0.01	0.20	1.90	0.06	-0.17	-2.23	0.03
Fama-French 6-factor rmw	0.28	1.70	0.09	0.19	1.22	0.22	0.23	2.14	0.03	0.34	4.21	0.00
Fama-French 6-factor cma	-0.04	-0.15	0.88	0.02	0.09	0.93	0.09	0.58	0.56	-0.03	-0.26	0.80
Fama-French 6-factor umd	-0.07	-0.84	0.40	0.11	1.39	0.17	-0.15	-2.65	0.01	-0.01	-0.22	0.83
Split PF + Insider Trades PF alpha	-0.27%	-0.93	0.35	0.31%	1.13	0.26	-0.74%	-3.75	0.00	-0.30%	-1.85	0.07
Split PF + Insider Trades PF split_coefficient	0.74	13.42	0.00	0.95	18.46	0.00	0.75	20.09	0.00	0.97	31.37	0.00
Split PF + Insider Trades PF ins_coefficient	0.06	0.71	0.48	-0.50	-5.93	0.00	0.21	3.46	0.00	-0.15	-2.90	0.00
Fama-French 6-factor + split PF alpha	0.10%	0.31	0.76	-0.03%	-0.10	0.92	-0.20%	-1.06	0.29	-0.02%	-0.16	0.87
Fama-French 6-factor + ins PF alpha	0.41%	1.24	0.22	0.81%	2.77	0.01	0.05%	0.25	0.80	0.41%	2.63	0.01
Fama-French 6-factor + split_ins PF alpha	0.14%	0.41	0.68	0.51%	1.66	0.10	-0.29%	-1.36	0.18	0.14%	0.92	0.36
Fama-French 6-factor + split_ins PF beta	0.38	1.75	0.08	0.47	2.44	0.02	0.26	1.92	0.06	0.54	5.55	0.00
Fama-French 6-factor + split_ins PF smb	0.15	0.90	0.37	0.13	0.86	0.39	0.09	0.84	0.40	0.30	4.00	0.00
Fama-French 6-factor + split_ins PF hml	0.10	0.64	0.52	-0.38	-2.71	0.01	0.07	0.71	0.48	-0.22	-3.05	0.00
Fama-French 6-factor + split_ins PF rmw	0.20	1.18	0.24	0.14	0.94	0.35	0.11	1.10	0.27	0.26	3.53	0.00
Fama-French 6-factor + split_ins PF cma	0.04	0.18	0.85	0.13	0.63	0.53	0.18	1.29	0.20	0.06	0.55	0.59
Fama-French 6-factor + split_ins PF umd	-0.16	-1.63	0.11	-0.09	-1.03	0.31	-0.23	-3.85	0.00	-0.12	-2.82	0.01
Fama-French 6-factor + split_ins PF split_pf	0.45	2.21	0.03	0.52	2.88	0.00	0.59	4.63	0.00	0.46	5.09	0.00
Fama-French 6-factor + split_ins PF ins_pf	-0.03	-0.31	0.76	-0.38	-4.12	0.00	0.06	0.95	0.34	-0.12	-2.50	0.01

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.3806	-0.0068	0.0024	0.7721	-0.0037	0.0056	0.0378	-0.0075	-0.0002	0.5315	-0.0037	0.0019
Wilcoxon Rank Test Insider portfolio	0.2934	-0.0044	0.0149	0.1547	-0.0036	0.0223	0.3088	-0.0045	0.0132	0.1527	-0.0029	0.0192

The above table depicts the 12M to 1M trading window for the period of 1989 to 1999. before the introduction of the 10b5-1 plans.

Table 5.10: Sub-period: 2000-2014

Sub-period: 2000 to 2014	Routine						Opportunistic					
	Simple Purchases before			Simple Sales before			Simple Purchases before			Simple Sales before		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	171			452			369			1,132		
Average excess return	0.53%			0.69%			0.73%			0.68%		
Standard deviation	5.40%			6.46%			5.22%			6.28%		
CAPM alpha	0.22%	0.86	0.39	0.26%	1.30	0.20	0.40%	1.99	0.05	0.26%	1.45	0.15
Fama-French 3-factor alpha	0.02%	0.09	0.93	0.26%	1.64	0.10	0.19%	1.02	0.31	0.18%	1.18	0.24
Fama-French 4-factor alpha	0.05%	0.20	0.85	0.30%	2.08	0.04	0.23%	1.23	0.22	0.23%	1.76	0.08
Fama-French 5-factor alpha	0.04%	0.16	0.87	0.37%	2.39	0.02	0.22%	1.14	0.26	0.27%	1.84	0.07
Fama-French 6-factor alpha	0.03%	0.13	0.89	0.36%	2.48	0.01	0.21%	1.12	0.27	0.25%	1.98	0.05
Fama-French 6-factor beta	0.82	11.90	0.00	1.09	28.28	0.00	0.87	17.68	0.00	1.08	31.59	0.00
Fama-French 6-factor smb	0.45	4.84	0.00	0.49	9.26	0.00	0.51	7.59	0.00	0.52	11.30	0.00
Fama-French 6-factor hml	0.21	1.77	0.08	-0.21	-3.20	0.00	0.19	2.35	0.02	-0.08	-1.43	0.15
Fama-French 6-factor rmw	0.18	1.36	0.18	0.05	0.62	0.53	0.19	2.05	0.04	0.10	1.57	0.12
Fama-French 6-factor cma	-0.31	-1.99	0.05	-0.34	-3.96	0.00	-0.32	-2.89	0.00	-0.32	-4.16	0.00
Fama-French 6-factor umd	-0.08	-1.70	0.09	-0.14	-5.10	0.00	-0.11	-3.17	0.00	-0.17	-7.20	0.00
Split PF + Insider Trades PF alpha	-0.27%	-0.88	0.38	-0.22%	-0.83	0.41	-0.29%	-1.18	0.24	-0.29%	-1.11	0.27
Split PF + Insider Trades PF split_coefficient	0.62	13.47	0.00	0.89	22.08	0.00	0.67	17.86	0.00	0.87	22.41	0.00
Split PF + Insider Trades PF ins_coefficient	0.21	2.67	0.01	0.11	1.59	0.11	0.37	5.64	0.00	0.18	2.59	0.01
Fama-French 6-factor + split PF alpha	-0.01%	-0.02	0.98	0.30%	2.10	0.04	0.18%	0.98	0.33	0.19%	1.52	0.13
Fama-French 6-factor + ins PF alpha	-0.01%	-0.02	0.98	0.34%	2.22	0.03	-0.07%	-0.39	0.70	0.27%	1.94	0.05
Fama-French 6-factor + split_ins PF alpha	-0.03%	-0.09	0.93	0.31%	2.08	0.04	-0.07%	-0.39	0.70	0.23%	1.76	0.08
Fama-French 6-factor + split_ins PF beta	0.71	5.40	0.00	0.91	12.73	0.00	0.91	10.26	0.00	0.87	13.99	0.00
Fama-French 6-factor + split_ins PF smb	0.40	3.69	0.00	0.40	6.87	0.00	0.47	6.53	0.00	0.43	8.52	0.00
Fama-French 6-factor + split_ins PF hml	0.21	1.76	0.08	-0.19	-3.00	0.00	0.14	1.72	0.09	-0.06	-1.08	0.28
Fama-French 6-factor + split_ins PF rmw	0.17	1.29	0.20	0.04	0.61	0.54	0.14	1.54	0.13	0.11	1.68	0.09
Fama-French 6-factor + split_ins PF cma	-0.28	-1.78	0.08	-0.29	-3.43	0.00	-0.35	-3.29	0.00	-0.26	-3.49	0.00
Fama-French 6-factor + split_ins PF umd	-0.10	-1.49	0.14	-0.18	-4.97	0.00	-0.01	-0.14	0.89	-0.23	-7.35	0.00
Fama-French 6-factor + split_ins PF split_pf	0.11	1.10	0.27	0.16	3.06	0.00	0.00	0.08	0.94	0.18	3.96	0.00
Fama-French 6-factor + split_ins PF ins_pf	0.02	0.23	0.82	-0.01	-0.27	0.79	0.27	4.44	0.00	-0.04	-1.03	0.31

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.1294	-0.0100	0.0014	0.5217	-0.0048	0.0025	0.8600	-0.0054	0.0044	0.6450	-0.0043	0.0027
Wilcoxon Rank Test Insider portfolio	0.3440	-0.0130	0.0045	0.8054	-0.0115	0.0090	0.7484	-0.0098	0.0070	0.9118	-0.0113	0.0092

The above table depicts the 12M to 1M trading window for the period of 2000 to 2014.

As can be seen from above two tables, the statistical significance is changed when dividng the sample into two sub-periods. The statistical significance falls for the return in the Fama-French 6 factor model when comparing this figure for the two numbers of alpha, where there are strongest statistical significance for the later period, which is also the period for the introduction of the 105b-1 plans.

5.3.4 Choice of Stock Splits

Table 5.11: Only Stock Splits: $(0.1 < FACPR < 0.25$

Stock Splits	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	255			771	771	771	700			2,072		
Average excess return	0.89%			1.01%			0.74%			1.00%		
Standard deviation	5.82%			6.45%			5.35%			5.99%		
CAPM alpha	0.22%	1.00	0.32	0.15%	0.84	0.40	0.05%	0.29	0.77	0.17%	1.18	0.24
Fama-French 3-factor alpha	0.16%	0.76	0.45	0.26%	1.78	0.08	-0.02%	-0.16	0.87	0.21%	1.87	0.06
Fama-French 4-factor alpha	0.34%	1.61	0.11	0.37%	2.48	0.01	0.15%	1.11	0.27	0.36%	3.51	0.00
Fama-French 5-factor alpha	0.20%	0.93	0.36	0.36%	2.34	0.02	0.06%	0.39	0.70	0.29%	2.57	0.01
Fama-French 6-factor alpha	0.32%	1.47	0.14	0.42%	2.76	0.01	0.17%	1.21	0.23	0.39%	3.71	0.00
Fama-French 6-factor beta	0.92	16.60	0.00	1.12	28.39	0.00	0.94	25.55	0.00	1.08	40.23	0.00
Fama-French 6-factor smb	0.45	6.07	0.00	0.38	7.32	0.00	0.44	8.93	0.00	0.51	14.26	0.00
Fama-French 6-factor hml	0.11	1.11	0.27	-0.35	-4.88	0.00	0.16	2.40	0.02	-0.17	-3.49	0.00
Fama-French 6-factor rmw	0.18	1.76	0.08	0.01	0.11	0.91	0.08	1.22	0.22	0.08	1.61	0.11
Fama-French 6-factor cma	-0.25	-1.77	0.08	-0.26	-2.53	0.01	-0.24	-2.50	0.01	-0.26	-3.76	0.00
Fama-French 6-factor umd	-0.19	-4.31	0.00	-0.10	-3.26	0.00	-0.19	-6.49	0.00	-0.16	-7.56	0.00
Split PF + Insider Trades PF alpha	-0.28%	-1.11	0.27	-0.05%	-0.23	0.82	-0.61%	-3.20	0.00	-0.23%	-1.26	0.21
Split PF + Insider Trades PF split_coefficient	0.75	17.79	0.00	0.94	25.99	0.00	0.79	25.20	0.00	0.93	31.32	0.00
Split PF + Insider Trades PF ins_coefficient	0.19	2.61	0.01	-0.13	-2.02	0.04	0.30	5.49	0.00	0.03	0.55	0.58
Fama-French 6-factor + split PF alpha	0.24%	1.08	0.28	0.34%	2.20	0.03	0.07%	0.46	0.65	0.28%	2.75	0.01
Fama-French 6-factor + ins PF alpha	0.32%	1.35	0.18	0.57%	3.41	0.00	-0.02%	-0.14	0.89	0.46%	4.02	0.00
Fama-French 6-factor + split_ins PF alpha	0.27%	1.13	0.26	0.51%	3.08	0.00	-0.08%	-0.52	0.60	0.39%	3.55	0.00
Fama-French 6-factor + split_ins PF beta	0.74	6.58	0.00	0.89	11.41	0.00	0.76	10.37	0.00	0.83	15.90	0.00
Fama-French 6-factor + split_ins PF smb	0.35	3.87	0.00	0.28	4.40	0.00	0.32	5.44	0.00	0.38	9.07	0.00
Fama-French 6-factor + split_ins PF hml	0.11	1.12	0.26	-0.32	-4.49	0.00	0.13	1.92	0.06	-0.16	-3.28	0.00
Fama-French 6-factor + split_ins PF rmw	0.19	1.85	0.07	0.04	0.50	0.62	0.07	1.09	0.27	0.10	2.13	0.03
Fama-French 6-factor + split_ins PF cma	-0.21	-1.45	0.15	-0.20	-1.94	0.05	-0.20	-2.17	0.03	-0.20	-2.93	0.00
Fama-French 6-factor + split_ins PF umd	-0.23	-4.15	0.00	-0.19	-4.82	0.00	-0.19	-5.13	0.00	-0.24	-9.13	0.00
Fama-French 6-factor + split_ins PF split_pf	0.17	1.86	0.06	0.20	3.05	0.00	0.20	3.29	0.00	0.24	5.47	0.00
Fama-French 6-factor + split_ins PF ins_pf	-0.03	-0.36	0.72	-0.15	-2.64	0.01	0.12	2.36	0.02	-0.09	-2.51	0.01

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.2245	-0.0064	0.0015	0.9134	-0.0030	0.0035	0.1273	-0.0052	0.0007	0.8471	-0.0027	0.0022
Wilcoxon Rank Test Insider portfolio	0.7967	-0.0063	0.0081	0.4849	-0.0053	0.0113	0.7659	-0.0058	0.0074	0.3664	-0.0042	0.0115

Table 5.12: Only Stock Dividends: FACPR ($FACPR \leq 0.25$)

STOCK DIVIDENDS	Routine						Opportunistic					
	Purchases			Sales			Purchases			Sales		
	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)	Estimate	t value	Pr(>|t|)
Number of splits	117			97			286			297		
Average excess return	0.53%			1.02%			0.86%			0.76%		
Standard deviation	5.33%			6.76%			4.94%			5.29%		
CAPM alpha	0.15%	0.56	0.57	0.58%	1.65	0.10	0.46%	1.91	0.06	0.22%	0.96	0.34
Fama-French 3-factor alpha	-0.03%	-0.10	0.92	0.39%	1.20	0.23	0.28%	1.30	0.19	0.00%	0.01	0.99
Fama-French 4-factor alpha	-0.07%	-0.26	0.79	0.30%	0.90	0.37	0.31%	1.38	0.17	0.07%	0.36	0.72
Fama-French 5-factor alpha	-0.09%	-0.34	0.73	0.21%	0.63	0.53	0.19%	0.84	0.40	-0.12%	-0.63	0.53
Fama-French 6-factor alpha	-0.12%	-0.45	0.66	0.16%	0.46	0.65	0.21%	0.91	0.36	-0.07%	-0.36	0.72
Fama-French 6-factor beta	0.61	8.87	0.00	0.73	8.21	0.00	0.63	10.68	0.00	0.86	16.93	0.00
Fama-French 6-factor smb	0.52	5.69	0.00	0.77	6.50	0.00	0.57	7.29	0.00	0.65	9.59	0.00
Fama-French 6-factor hml	0.49	3.86	0.00	0.39	2.38	0.02	0.41	3.78	0.00	0.44	4.77	0.00
Fama-French 6-factor rmw	0.18	1.41	0.16	0.33	1.99	0.05	0.27	2.41	0.02	0.31	3.29	0.00
Fama-French 6-factor cma	-0.11	-0.62	0.54	0.01	0.05	0.96	-0.06	-0.42	0.68	0.04	0.32	0.75
Fama-French 6-factor umd	0.05	0.86	0.39	0.10	1.35	0.18	-0.03	-0.65	0.51	-0.09	-2.19	0.03
Split PF + Insider Trades PF alpha	-0.32%	-1.11	0.27	0.22%	0.58	0.57	-0.26%	-1.03	0.30	-0.55%	-2.32	0.02
Split PF + Insider Trades PF split_coefficient	0.48	10.12	0.00	0.55	8.96	0.00	0.51	12.49	0.00	0.66	17.03	0.00
Split PF + Insider Trades PF ins_coefficient	0.20	2.49	0.01	0.08	0.77	0.44	0.40	5.72	0.00	0.40	6.00	0.00
Fama-French 6-factor + split PF alpha	-0.21%	-0.79	0.43	0.14%	0.40	0.69	0.15%	0.65	0.51	-0.17%	-0.86	0.39
Fama-French 6-factor + ins PF alpha	-0.22%	-0.73	0.46	0.21%	0.55	0.58	-0.21%	-0.86	0.39	-0.33%	-1.51	0.13
Fama-French 6-factor + split_ins PF alpha	-0.27%	-0.92	0.36	0.20%	0.52	0.60	-0.23%	-0.92	0.36	-0.38%	-1.75	0.08
Fama-French 6-factor + split_ins PF beta	0.43	3.05	0.00	0.68	3.76	0.00	0.62	5.27	0.00	0.70	6.94	0.00
Fama-French 6-factor + split_ins PF smb	0.41	3.66	0.00	0.75	5.12	0.00	0.53	5.57	0.00	0.54	6.60	0.00
Fama-French 6-factor + split_ins PF hml	0.47	3.68	0.00	0.40	2.39	0.02	0.33	3.10	0.00	0.40	4.29	0.00
Fama-French 6-factor + split_ins PF rmw	0.18	1.40	0.16	0.34	2.02	0.04	0.22	2.04	0.04	0.30	3.13	0.00
Fama-French 6-factor + split_ins PF cma	-0.07	-0.39	0.70	0.03	0.12	0.91	-0.08	-0.54	0.59	0.07	0.51	0.61
Fama-French 6-factor + split_ins PF umd	0.03	0.44	0.66	0.07	0.80	0.42	0.07	1.16	0.25	-0.06	-1.22	0.22
Fama-French 6-factor + split_ins PF split_pf	0.19	1.61	0.11	0.04	0.28	0.78	0.05	0.56	0.58	0.17	2.07	0.04
Fama-French 6-factor + split_ins PF ins_pf	0.05	0.49	0.62	-0.05	-0.38	0.71	0.32	3.83	0.00	0.17	2.40	0.02

	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI	P value	Lower CI	Upper CI
Wilcoxon Rank Test Split portfolio	0.0455	-0.0107	-0.0001	0.5947	-0.0067	0.0039	0.4034	-0.0067	0.0028	0.1646	-0.0070	0.0012
Wilcoxon Rank Test Insider portfolio	0.1895	-0.0098	0.0020	0.8783	-0.0068	0.0078	0.8162	-0.0065	0.0052	0.9613	-0.0062	0.0060

Finally, comparing the statistical significance for a division into stock dividends and stock splits show that the alpha value for the insider sales derive from the stock splits, which is also the largest subgroup in our study.

Chapter 6

Discussion

In this chapter, we relate the empirical results to the initial hypotheses and research question. Initially, we summarise our findings to answer our research question through the initial hypothesis. Next, we elaborate on the limitations to our findings in **section 6.2**. We continue by interpreting our findings in **section 6.3** and relate these to the literature on stock splits and insider trading in **section 6.4**. Finally, we elaborate on potentially future work on our subject in **section 6.5**.

6.1 Results in Relation to Research Question and Hypotheses

In order to answer our research question, we have stated five hypotheses to structure our empirical analyses. The first two hypotheses discuss the events of stock split and insider trading on a stand-alone basis. Here, we have tested abnormal returns of the events through an event-time study and a calendar-time study. The next two hypotheses discuss the combination of the two events, in order to see if insider trades before a stock split has any addFitional valuable information about the future return of the stock, and specifically, if there is any abnormal return compared to the market. The final hypothesis discuss whether the returns from the combination of the events provide evidence in favour of or against market efficiency.

- *Hypothesis 1: Insiders have access to insider information and behave opportunistic based on this information through insider trading.*

The empirical results provide evidence of abnormal returns for insiders, both in the month after the insider trades, but also long-term as shown by the event-time study. Using

the *calendar time study*, we see especially that purchases are significant for both informed and liquidity insiders. The *event-time study* shows that stocks with purchases by insiders exhibit statistical significant positive abnormal returns throughout the 30 months after their trades.

We find evidence of a relationship between abnormal returns and insider purchases, although we cannot say that the abnormal returns are derived directly from the information nor insider purchases. By the identification of abnormal return from insider trades (after adjusting for multiple risk factors), we therefore find evidence suggesting that insiders have access to insider information and exploit this information through insider purchases. We therefore **fail to reject hypothesis 1** of opportunistic insider trading based on insider information.

- *Hypothesis 2: Stocks exhibit abnormal returns in the period subsequent to a stock split.*

Using a *calendar-time study* we find significant abnormal returns after controlling for risk-adjustment factors, although the results become less significant after controlling for a momentum factor. Using the *event-time study*, we find no abnormal return in the 20 months after the split. Based on the results, we find contradicting evidence in favour of abnormal returns for stocks in the period subsequent to the announcement of the split. However, as we rely more on the calendar *event-time studies* and we therefore put more emphasis on the *calendar-time study* results on abnormal performance, and subsequently **fail to reject hypothesis 2.**

- *Hypothesis 3: The combination of both stock splits and insider trading entails information about the future abnormal return of stocks that is different from the information on stock splits alone and insider trades alone.*

Using an *event-time study* we find positive abnormal returns for stock splits with previous opportunistic purchases and sales but only for routine purchases. The results provide evidence of stock splits with insider trades exhibit abnormal performance that are greater than stock splits alone.

The results from the *calendar-time study* show a higher positive abnormal return for stock splits coupled with insider *sales*, than considering only stocks splits and/or insider trades on an isolated basis. The positive return is counter intuitive, as we expect the sign of the coefficient to be negative when looking at sales. No purchases are significant in our portfolio by combining stock splits and insider trades. Above results provide evidence of a stock split coupled with insider *sales* which provide inferior information in terms of

predicting abnormal returns compared to stock splits and/or insider trading information on a stand alone basis. Considering insider trades on a stand-alone basis, we find positive abnormal returns, especially for insider purchases, and we are therefore surprised to find abnormal returns for insider *sales* around a stock split.

Using an *event-time study*, we furthermore find insider *purchases* to be superior to the combination of stock splits coupled with insider trades, when considering the post-split development in the cumulative abnormal return. Thus, this is further evidence against our hypothesis of abnormal returns different from the control groups on a stand alone basis.

We do not find conclusive evidence of abnormal returns for stock splits coupled with insider trades to be superior to abnormal returns of insider trades or stock splits alone. The results show evidence of statistically significant positive returns from *insider sales*. However, as the results' significance disappears after conducting several robustness tests, we therefore **reject hypothesis 3**.

- *Hypothesis 4: The market is in-efficient in incorporating insider trading around stock splits into the pricing of a stock.*

Stock splits

The *event-time study* exhibits evidence of semi-strong efficiency by considering all stock splits. Thus, there is no drift in the cumulative abnormal returns residuals in the post-split period. Using the *calendar-time study*, we find statistical significant abnormal returns (3% annually on an equal weighted portfolio) and hence evidence of market inefficiency. Altogether, the methodologies have contradicting findings.

Insider trades

Both methodologies used to assess post-event abnormal returns shows evidence of market inefficiency. The *event-time study* shows abnormal returns especially for insider purchases with a large upward-drift after the month of the insider trade. Similarly, the *calendar-time study* shows abnormal returns of a portfolio of insider purchases. A surprising finding is also, that a portfolio using insider sales earn statistical abnormal returns after risk-adjustments for *both* event-time studies and calendar-time studies on a stand-alone basis for *routine insiders*.

Combination of stock splits and insider trades

As we find evidence of market in-efficiency for insider trades on a stand alone basis as well as partially for stock splits, it is not surprising that if we find evidence of market inefficiency,

when we combine the two.

The stocks with both signals show abnormal returns post-split (drift upward/downward depending on the type of insider) for *event-time studies* which are statistically insignificant. Due to the statistically insignificant results, it suggests evidence of semi-strong market efficiency. Using the *calendar-time study* we find statistically significant results of abnormal return for insider *sales* and thus evidence of market inefficiency. As noted in **chapter 4** a test of market efficiency is a joint test problem, where we are testing if the average abnormal return is zero and whether the model of expected returns is correct. We furthermore rely on that the mean abnormal performance in the cross-section of securities follows a normal distribution and is independent of return data in the time-series and cross-section. As the evidence favours market inefficiency over market efficiency, we **fail to reject hypothesis 4**, i.e., that the average abnormal return is different from zero and implicitly assume that the model for expected returns is correct.

- *Research question: Will the combined information about a stock split and insider trading, generate more valuable information about a stock's long-term abnormal return, than the abnormal return from insider trading or stock splits on a standalone basis?*

We find mixed evidence of abnormal return of stocks that exhibit a split combined with insider trades in comparison to stocks with split or stocks with insider trades on a stand-alone basis. Evidence found in favour of above using a *calendar-time study* may be overestimated by relying on an insider trade portfolio only held for 1 month, compared to our 6 month holding period and similarly a portfolio with [Opportunistic trades minus routine trades], which may be higher for opportunistic purchases alone. We are therefore not able to find evidence for a definitive answer to the research question with the applied methodologies.

6.2 Limitations of Results

In the following we elaborate on the limitations to our findings, firstly for the sample that our analyses are based upon and secondly for the methodology we have applied.

6.2.1 Sample

We have included all stock distributions with a minimum FACPR value of 0.1, thus including both stock dividends ($0.1 < FACPR < 0.25$) and stock splits. We have not chosen to include stock distributions with a FACPR value below 0.1, as this would also include reverse

stock splits ($FACPR \leq 0$). Reverse stock splits should be analysed on a stand-alone basis as they in theory should exhibit opposite results to ordinary stock splits. However, an analysis to compare the two types of stock distributions is considered out of scope for this thesis and left for future work.

Since we have included all stock distributions with a minimum FACPR value of 0.1 this increases our dataset, but also includes stock dividends, which are treated differently from an accounting point of view. We have conducted robustness tests for samples including both stock splits and stock dividends, and found that our conclusions are derived from the information embedded in stock splits, not stock dividends. In addition, the absolute number of stock splits outweights stock dividends, thus this limitation does not interfere with our conclusions.

Next, our sample period is limited to the period from 1986 to 2014 as there is no available insider filing data prior to 1986 and as we do not have available data post 2014 for all of our different data inputs. We have included robustness tests for two sample periods in order to test for variations and significance across the sample period, and find that the statistically significance is lowered for our results in the period before the introduction of the 105b-1 plans in 2000 (1989-1999). The rule allows management to plan their trades in advance based on a set price or date. Thus, the statistically significance seen in the period after the introduction of the rule (2000-2014) may indicate that the results are derived from more recent periods. It can also indicate that there has been an increase in the use of stocks in the compensation of insiders, and that they are now selling more frequently to provide liquidity.

Finally, we have only studied US data as the data input necessary for our analyses is disclosed, accessible, and of high quality. We have built on top of other papers studying US data, thus we have also been able to quality check our work on an ongoing basis. An out-of-sample analysis for other relevant markets would be interesting to conduct, but we consider this to be out of scope for this thesis and is left for future work.

6.2.2 Methodology

First of all, the methodologies we have applied in order to identify informed insiders, i.e., Cohen, Malloy, and Pomorski (2012) and Scott and Xu (2004), leave out a noteworthy subset of insiders. This is due to the fact that we cannot fully classify the insiders into the relevant subsets. When applying the methodology put in place by Cohen, Malloy, and Pomorski (2012), a subset of insiders classified as "non-classified" are excluded from their analysis.

However, the authors find that these insiders can be characterised as either opportunistic or routine traders without affecting their results. In addition, they find that these insider trades in their sample appear to resemble opportunistic trades. Due to poor and inadequate reporting by insiders, Scott and Xu (2004) exclude 12% of transactions when applying their classification methodology. The missing data is holdings data, more precisely shares held and shares traded. When we apply their methodology to our dataset, the insider reporting is inadequate to such an extent that we exclude 66% of the transactions. Nevertheless, the sample shows small significant positive returns for large insider sales and insignificant results for small sales. This finding is very critical to our analysis, as we predicted that we would see a higher alpha value from insiders with smaller trade sizes.

We apply both an event-time study and a calendar-time study in order to compare our findings with prior literature, e.g., Cohen, Malloy, and Pomorski (2012) and Fama, Fisher, Jensen, and Roll (1969). When applying long-term event-time studies, we are aware of the low power associated with the methodology and at the same time have lower confidence in the results from the event-time studies for two reasons. Firstly, the event-time studies have been criticised by the literature for being subject to low statistical power and often exhibit cross-correlation. Secondly, all statistical tests using the 95% confidence intervals show insignificant statistical significance, except for the insider control group. Therefore, the event-time methodology shows no evidence of significance for the combination of stock splits and insider trades on a stand-alone basis. Either the model is poorly specified, or there are no significance in our results. We do however, include the analysis as a supplement to our calendar-time studies as well as for discussion purposes. We have, throughout our analyses included confidence intervals for the event-time cumulative abnormal returns, highlighting the fact that we are aware of the lower power. We have more confidence in the results from the calendar-time methodology as the methodology is better recognised and because we use both a Student's t test and similarly the Wilcoxon signed rank test to test significance of the results under the assumption of the returns being normally distributed (Student's t-test) and without assuming normal distribution (Wilcoxon rank test). Both the event-time study and the calendar-time study results may be subject to model specification problems or omitted variable bias. The specification problem has previously been outlined as the joint test problem, which we use in the factor models applied in both methodologies. Furthermore, a portfolio of insider sales before a stock split showing abnormal returns in the 30 months after the stock split, may be better explained by other variables than insider sales and/or the classification into routine and opportunistic insiders. We hypothesise that stock options and stock grants are examples of omitted variables, which may bias our re-

sults. Including the effects of above omitted variables and thereafter still finding significant abnormal returns for insider *sales* may suggest evidence of positive effects from specific types of stock compensation.

6.3 Interpretation of Results

We find evidence of *positive* abnormal returns for insider sales that is not explained in the event studies by control portfolios or risk adjustment factors. The result is counter intuitive to our understanding of insiders, as insider sales by an insider acting opportunistically would signal information of negative abnormal performance. This finding does not provide evidence in favour of opportunism and lead us to ask new questions on inferences made from insider sales. Possible explanations for seeing a positive sign for insider sales is three-fold. Positive abnormal insider sales may derive from insider trades alone, not controlled for correctly by our insider portfolio control group or stock split control group. It may be due to a mis-specified model, or finally, it may be evidence in favour of insider sales before a stock split as a sign of positive future abnormal returns.

Moreover, the results show that stocks with insider purchases before a stock split do not exhibit an abnormal return after risk-adjustment and control groups. Instead, the insider benchmark portfolio of opportunistic purchases minus opportunistic sales explains the variation in the returns from purchases through a positive and significant coefficient in all the analysed trading windows. Recall that we used this particular portfolio composition as the opportunistic purchases and sales respectively showed the highest extreme values in the alpha coefficients for just insiders values and thus highest abnormal returns in a long-short portfolio.

Comparing results on the magnitude of abnormal returns, we find that insider trades tend to have a higher abnormal return on a stand alone basis than after including information on stock splits. We do not find any notable effects of insider purchases with stock splits, as the control portfolio of insider trades is statistically significant in explaining the variation in abnormal return.

For all calendar-time studies, the factor loadings indicate that insider firms are small and typically have a low book to market value, which however, is contradicted in the robustness tests using firm characteristics. Here, we find evidence suggesting that that the stocks with instider sales and stock splits are large growth stocks, as the alpha value is only significant for these firm characteristics. On the other hand, the analysis of factor loadings suggests evidence of stocks with insider trades before a stock split being profitable,

but with negative factor loadings on investments and momentum across all sub-samples. This provides evidence that the stocks invest more heavily and similarly exhibit a negative momentum subsequent to a stock splits. Positive momentum indicate an under reaction to firm specific news, whereas a negative momentum factor indicate an overreaction to firm specific news. As the portfolio of stocks are formed in the month subsequent to a stock split, the portfolio returns may be subject to negative momentum. The large pre-run up in the cumulative abnormal return as seen in the CAR plots in the empirical results (cf. **chapter 5**), may be causing the negative momentum sign.

We do not assess the magnitude of trades sizes in our main study, but only in our robustness tests, where we use the trade as a percentage of the resulted holding. Here, small sized sales could signal information about positive abnormal returns, as the insider chooses not to sell a significant part of his or hers holding in the firm, and therefore may benefit from future abnormal returns. We find small statistically significant positive alpha value for large sales (above 50% of the insiders' holding in the company) and insignificant results for small sales for a portfolio of stocks with stock splits and a trading window of 12 months to 1 month before the stock split, not explained by the control groups. Large sales should indicate future negative performance, which is therefore counter-intuitive to above explanation of small insider trades. Reasons for the positive abnormal return could be due to our sample selection on insider trades around stock splits. In the empirical results (cf. **chapter 5**) we provide evidence of an elevated level of insider trades around stock splits, and we therefore synthesise that the abnormal return from insider sales could be related to our sample selection of firms conducting stock splits.

6.4 Results in Relation to Literature

As there has been limited literature in regards to the combination of stock splits and insider trading, we elaborate our findings to each of the stand alone literature and seek to draw parallels to our findings for combining the two events.

6.4.1 Stock Splits

The vast majority of prior literature find evidence that stock splits occur subsequent to a run-up in share prices and operational measures (e.g., earnings) (Fama, Fisher, Jensen, and Roll, 1969; Grinblatt, Masulis, and Titman, 1984; Ikenberry, Rankine, and Stice, 1996). This indicates that companies who split their shares have performed abnormally well in the period prior to the split. Our event-time studies across all stock distributions, insider

characterisations, and portfolios combining both stock splits and insider trading, exhibit a pre-split run-up in share prices. This implies that the companies included in our sample have performed abnormally well in the time period -30 months up until the split. However, we are very doubtful of the strict causality between the knowledge of the forthcoming stock split and the evident positive cumulative abnormal return prior to the stock split. Instead, we argue that the pre-split run-up in share prices is mainly caused by the abnormal firm performance. The pre-split run-up in share prices is in favour of the trading range motive Lakonishok and Lev (1987), however we are inclined towards the signalling motive as we do not consider the trading range motive to convey a strong signal to the market.

As spelled out in the stock split literature review, the majority of recent literature find positive abnormal short-term returns around the stock split announcement date and positive long-term cumulative abnormal returns following the stock split, e.g., (Desai and Jain, 1997; Grinblatt, Masulis, and Titman, 1984; Ikenberry and Ramnath, 2002). We are fully aware that there is evidence of the contrary, namely no further increase in cumulative abnormal returns (Fama, Fisher, Jensen, and Roll, 1969; Bishara, 1977; Millar and Fielitz, 1973), however we rely on the most recent findings, as the methodologies and risk adjustments factors are continuously improved. We find similar findings for our stock split control groups, for all stock distributions, stock splits, and stock dividends, namely that they exhibit positive cumulative abnormal returns following the stock split. However, our findings from the calendar-time studies for the combined portfolios of stock splits and insider trading is not strictly in line with majority of prior research, as we find positive and statistically significant alpha values at 5% for both routine and opportunistic sales, which is counter-intuitive, as one would expect insider sales to be a signal of negative future firm performance. However, there is evident ambiguity within the literature of stock splits, thus others have previously found similar alpha values.

Ikenberry, Rankine, and Stice (1996) find evidence that pre- and post-split returns are inversely related, i.e., high pre-split returns are followed by lower post-split returns, and argue that the post-split returns can therefore not be explained by momentum. It is evident from our event-time studies that the development, albeit not strictly significant according to the 95% confidence interval bands, prevails an inverse relationship between the pre- and post-split returns. In addition, the calendar-time studies find similar conclusion, namely that the UMD factor loadings in our calendar-time studies are negative and statistically significant at 5% across the majority of the portfolios (stronger significance at wider trading windows further away from the stock split). Thus, we can conclude that our event-time and calendar-time findings do not necessarily exhibit momentum.

Lastly, our findings across both stock splits and the combination of stock split and insider trading can be regarded as evidence of market underreaction throughout the 30 months following the stock split. This finding is in line with previous literature (Desai and Jain, 1997; Ikenberry, Rankine, and Stice, 1996; Ikenberry and Ramnath, 2002; **?**; Baker, Greenwood, and Wurgler, 2009), thus implying that the market is not efficient.

6.4.2 Insider trading

As our literature review reveals, insiders can earn positive abnormal returns (Lakonishok and Lee, 2001; Seyhun, 1986; Fidrmuc, Korczak, and Korczak, 2011). We find evidence that insider transactions on a stand-alone basis reveal positive abnormal returns, however for both purchases and sales. This contradicts prior literature (and common sense), as insider sales are usually associated with negative signalling value. However, academics do not fully agree on the information embedded in insider sales (Bettis, Vickrey, and Vickrey, 1997; Fidrmuc, Goergen, and Renneboog, 2006). An insider sale can either convey negative information to the market concerning the firm's future prospects or be regarded as less informative if the motive does not specifically concern the firm as per se (e.g., diversification or liquidity needs). This implies that the market will be able to perceive an insider sale as a positive signal, assuming that the market can fully decipher the motive and the embedded signalling value, which provides rationale for why insider sales may exhibit positive abnormal returns.

A relevant article that finds evidence of positive abnormal return for insider sales is the publication by Scott and Xu (2004). The authors find that small sales that account for a small percentage of the investor's holdings is correlated with positive abnormal returns. They argue that these insider traders are characterised as liquidity or non-informed insiders, as they may need to raise money but are still positive of the firm's future prospects. Thus, they only sell a minor part of their holdings. Our *routine* sales is therefore seem line with the findings by Scott and Xu (2004), which we however, did not find evidence for in our robustness tests using their simplified methodology. However, a positive alpha value for our categorisation of opportunistic sales may be hard to grasp, as Scott and Xu (2004) argue that opportunistic sales exhibit negative abnormal returns as they are based on negative information, and that these traders' sales are likely to be large in volume and account for a large portion of their holdings. Thus, our findings for *opportunistic* sales contradict the findings by Scott and Xu (2004).

When applying the insider characterisation methodology developed by Cohen, Malloy,

and Pomorski (2012), they characterise 55% of their total sample, excluding non-classified insiders, as routine trades and 45% as opportunistic trades. We characterise 40% as routine trades and 60% as opportunistic trades. In addition, we obtain positive and statistically significant alpha values for routine and opportunistic purchases at 5% and statistically insignificant alpha values for sales (cf. **figure 5.2**). Cohen, Malloy, and Pomorski (2012) also obtain positive and statistically significant alpha values at 5%. When combining stock splits with insider trading, we only obtain positive and statistically significant alpha values for routine and opportunistic sales at 5%. Our findings for the combination of stock splits and insider trading for routine sales is in line with Cohen, Malloy, and Pomorski (2012). This implies that the market perceives insider sales, albeit only routine sales in the example of Cohen, Malloy, and Pomorski (2012), to convey positive information to the market. The cumulative abnormal returns for our event-time studies continue to rise or stay flat throughout the 30 months following the insider trade, thus our sample returns do not exhibit future reversal. This is again in line with Cohen, Malloy, and Pomorski (2012).

Devos, Elliott, and Warr (2015) find that 36% of all insider trades take place pre-split, of which 35% are insider sales and 65% are insider purchases. Compared to Devos, Elliott, and Warr (2015), we find that 45% of all insider trades occur in the 30 months prior to the stock split compared to after, whereas 25.4% insider purchases and 74.6% insider sales take place pre-split. We take a substantially longer horizon than Devos, Elliott, and Warr (2015) but also find a higher level of sales. In addition, we find that the sales per stock split increase gradually prior to a stock split, peaks at the announcement date, and then decreases gradually throughout the following 30 months, albeit to a higher base level than pre-split. This implies opportunistic behaviour by the insiders in our sample, evident from **figure 5.7**. It is also clearly evident that the peak in insider trading around the announcement date is caused by opportunistic insiders, whereas the level of routine insider sales increases throughout the sample period, although from a low level. The level of insider purchases is flat or increasing by a very low degree throughout the entire sample period. Devos, Elliott, and Warr (2015) only studies the short-term effect of the stock split (+/- 10 days around the announcement date), but finds similar results as the level of insider sales is at a lower level before the stock split compared to after the stock split. Once again, they find that the level of insider purchases is very low and flat throughout the period. This implies, purely for discussion purposes, that our sample of insiders' trading behaviour mimics the behaviour found by Devos, Elliott, and Warr (2015), who study CEO grants.

When only considering our replication of Cohen, Malloy, and Pomorski (2012), we find positive abnormal return for both our event-time and calendar-time studies, indicating

market inefficiency as well as proof of superior insider information (Gregory, Matatko, and Tonks, 1997; Jaffe, 1974; Lakonishok and Lee, 2001; Lin and Howe, 1990; Rozeff and Zaman, 1988).

Lastly, our sample exhibits a higher level of insider trading around the stock splits. The prior run-up in share prices and earnings or knowledge of the forthcoming stock split may explain this finding. However, this leaves out a noteworthy potential explanation, namely contemporaneous events around the stock split. Grinblatt, Masulis, and Titman (1984) find that over 80% of the stock splits in his 1967-1976 NYSE sample announcing stock splits had cash dividend announcements in the three days around the announcement date. Thus, insiders' fear of litigation from the SEC and the implied cost may cause insiders to trade in sufficient time ahead of the announcement date or only engage in trades following the stock split, assuming that contemporaneous sensitive corporate events take place. It is not evident from our sample that the insiders engage in relatively high level of insider trading pre-split compared to the insider trading activities across the sample period. This may be evidence of the insider sales being predetermined according to the 10b5-1 plan, as the SEC will not able to prosecute and litigate the insiders. Ke, Huddart, and Petroni (2003) finds that insiders anticipate future earnings up to two years into the future and opportunistically trade based on this information. Elliott, Morse, and Richardson (1984) find evidence that insider increase/decrease their exposure to purchases/sales 12 months prior to earnings increases. We do not find evidence in line with these findings, as the insider trading during the two years prior to the stock split does not reveal an elevated level.

6.5 Future Work

An interesting subject for further research could be to apply other insider characterisation methodologies or deep dive further into the methodologies currently applied, in order to test the validity of the Cohen, Malloy, and Pomorski (2012) and Scott and Xu (2004) methodologies. It could be relevant to allocate the non-classified insiders stemming from the Cohen, Malloy, and Pomorski (2012) insider characterisation methodology as either routine or opportunistic traders. The authors test and argue that the non-classified insiders can be characterised as either routine or opportunistic insiders without altering their results. Therefore, it would be interesting to test for this insider characterisation for our sample now that we find somewhat different results compared to Cohen, Malloy, and Pomorski (2012). In addition, it would be interesting to further study the insider characteristics (e.g., level of seniority, local presence, etc.), similar to the Devos, Elliott, and Warr (2015) methodology.

We regard it as interesting to expand the sample to also include stock grants, stock options, and reverse stock splits, in order to so test if our findings are also valid for other types of stock distributions. This would somewhat resemble the methodology applied by Devos, Elliott, and Warr (2015), as they consider only stock grants. We would indeed find it greatly interesting to analyse the insider trading behaviour around reverse stock splits, as they should (at least in theory) reveal opposite findings compared to our findings.

Generally, it would be of interest to expand our robustness tests in order to further validate our findings. As an example, it would be noteworthy to test for industry clustering in event firms, as cross-correlation may be caused due to uneven representation of certain industries. In addition, broadening the robustness test to also consider operational firm measures, e.g., earnings, dividends, and cash flow, would be beneficial for obtaining a better understanding of the included firms and degree of future predictability. Next, it could be interesting to expand the trading windows in our event-time analyses to 60 or 90 months post-split, in order to see if the market fully incorporates the events after the current trading window, or to repeat our analysis for a random sample. Lastly, it could be interesting to supplement our event-time and calendar-time studies conducting a buy-and-holding analysis.

In addition to regulation, it would be interesting to further study the impact from the SEC regulations and especially the 10b5-1 plan, as it seems to have grown in popularity since it was introduced and since insiders seem to trade throughout potential blackout periods.

Finally, we find it interesting to conduct an out-of-sample study for markets outside the US, e.g., in Denmark or Scandinavia, assuming that data is available.

Chapter 7

Conclusion

We have throughout our thesis studied the combination of insider trading and stock splits. We initially hypothesised that the combination of the two signals would exhibit additional abnormal returns compared to the two events on a standalone basis. We have applied event-time studies, albeit enduring low power, as well as calendar-time studies in order to test this hypothesis. Initially we find evidence that both insider trading and stock splits result in positive abnormal long-term stock returns, which is in line with recent literature. However, when we combine the two events, the results are inconclusive in regards to future predictability. In addition, we obtain findings that may seem counter-intuitive. According to the calendar-time studies, we find that both opportunistic and routine sales exhibit positive abnormal returns, whereas purchases are not significant. This finding is further proven by the event-time study, albeit insignificant, exhibiting positive abnormal cumulative abnormal returns for all groups throughout the sample period. We argue that the routine traders engage in opportunistic behaviour, which e.g., may be executed through 10b5-1 plans. Our findings also imply market inefficiency. Further analysis is necessary in order to pinpoint what causes the positive abnormal returns stemming from opportunistic and routine sales.

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Appendix A

Appendix

A.1 Replicating Results of Fama, Fisher, Jensen, and Roll (1969)

As a starting point for our analysis, we decided to replicate the results of Fama, Fisher, Jensen, and Roll (1969) as this is a major motivation for our study. Our study differs primarily from theirs is the time-period and how we test the long-term performance of the splits. Fama, Fisher, Jensen, and Roll (1969) study stocks listed on NYSE between 1926 and 1960. They require a minimum of 12 months consecutive listing on the exchange as well as 12 months available price information. Next, they divide their sample into two groups based on the relative dividend change to the market index and observe a difference in subsequent performance. They furthermore use the effective date of the split and not the announcement date, although it has little implications on their findings. They use a single index model to regress the returns of the individual stocks against an equally weighted market index developed by Fisher and Lorie (1964),Fisher (1965),Fisher (1966). They subsequently remove the returns in the 15 months before the split for all stocks and the returns in the 15 months after the split for stocks with decreasing dividends relative to the market. The exclusion procedure is due to non-zero residuals in the months close to the split and thus trying to avoid a serious specification error and a bias in the results. [66] They thereafter use the coefficient (beta) and the intercept (alpha) from the individual regressions to create an average residual and equivalently a cumulative average residual in

[66]Modern methodologies apply a multi-factor regression model using multiple risk adjustment factors in addition to the general market return. Furthermore, modern methodologies also ascribe that the regressions are on a ex-post event period compared to the total due to increasing volatility in the returns ex-post the event. Thus, the regression would only be on the returns subsequent to the stock split.

the 60 months around the stock splits. In our replication of their results, we used the equal weighted market return provided in the CRSP Monthly Stock return data set (including dividends) as a close approximation the Fisher's market index and find similar results.

Aside from an updated statistical methodology (using a 6 factor instead of the CAPM, and separate regressions of each stock into ex-ante and ex-post the stock split, we divide the sample of stock splits into dividend increases and decreases. This allows us to see if there is a difference in the cumulative average residual in a more recent sample (1986-2015) compared to the time period when Fama, Fisher, Jensen, and Roll (1969) conducted their study (1927-1959). The procedure aggregates the dividends for a stock distributed during 12 months after the split and compare it with the dividends for a stock distributed during 12 months before the split. Next, the dividend ratio for a stock is compared with a similar ratio for the aggregated market and the sample of stock splits is divided into dividend increasing firms and dividend decreasing firms. Using above method ensures that every stock is assigned either a dividend increase or a decrease classification relative to the market at any given point in time. Mathematically, it can be formulated as follows:

$$\Delta D_t = \frac{\sum_{t=1}^{12} DIV_t}{\sum_{t=-11}^{0} DIV_t} \tag{A.1}$$

Thus, we evaluate whether above dividend ratio for each stock, is larger than the ratio for the aggregated market. Thus, a stock split can be classified at the month of the stock split, i.e., $t = 0$, in one of the two classifications (dividend increasing or decreasing). However, this methodology can be criticised for using data 12 months ahead of the stock split to classify the stock split. Furthermore, we see a bias in the approach, as the stock splits exhibiting a dividend increase relative to the market also tend to be performing well in the first place and vice versa for the dividend decreasing stocks. Thus, we would expect them to have abnormal returns compared to the market in the direction of the relative dividend ratio. The dividend increase may also be one of the reasons for the increase in the stock price in the first place. Therefore, it is not interesting to see that the dividend increasing stocks also tend to be the stocks with abnormal positive performance.

Figure A.1: Cumulative Average Residauls (CAR) of All Stock Splits 1927-1959

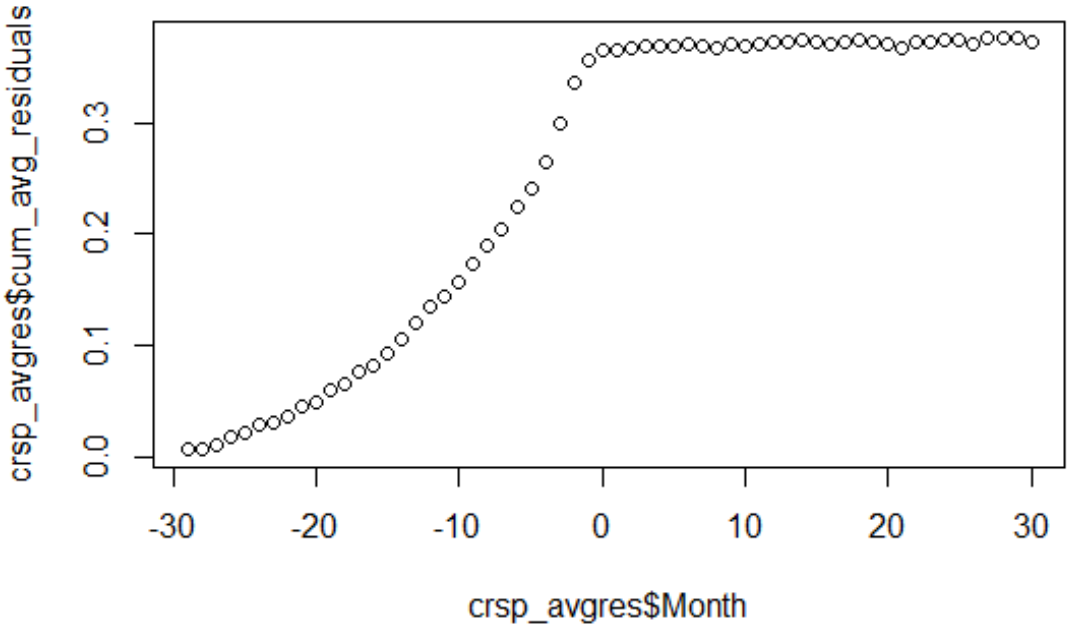


Figure A.2: Stock Splits with an *Increasing* Dividend Compared to the Market

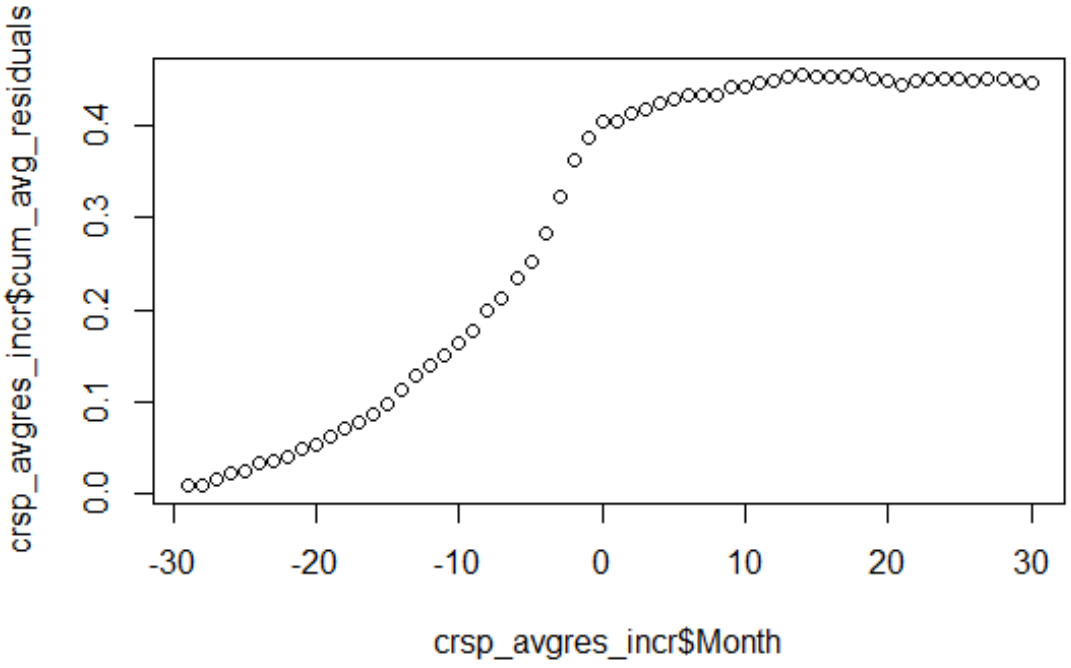


Figure A.3: Stock Splits with a *Decreasing* Dividend Compared to the Market

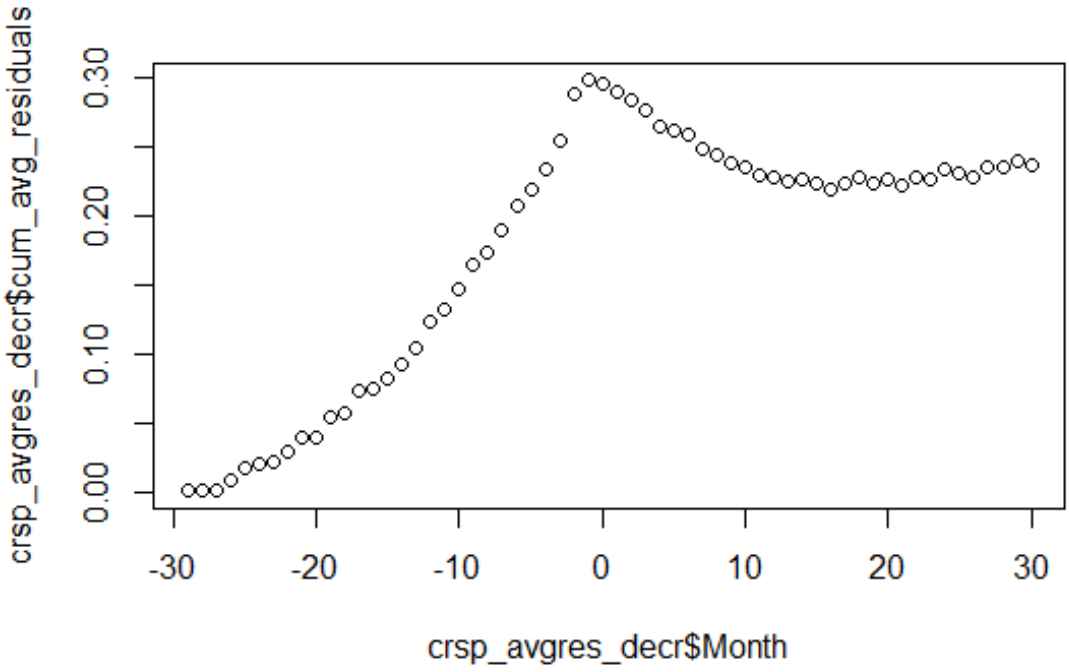
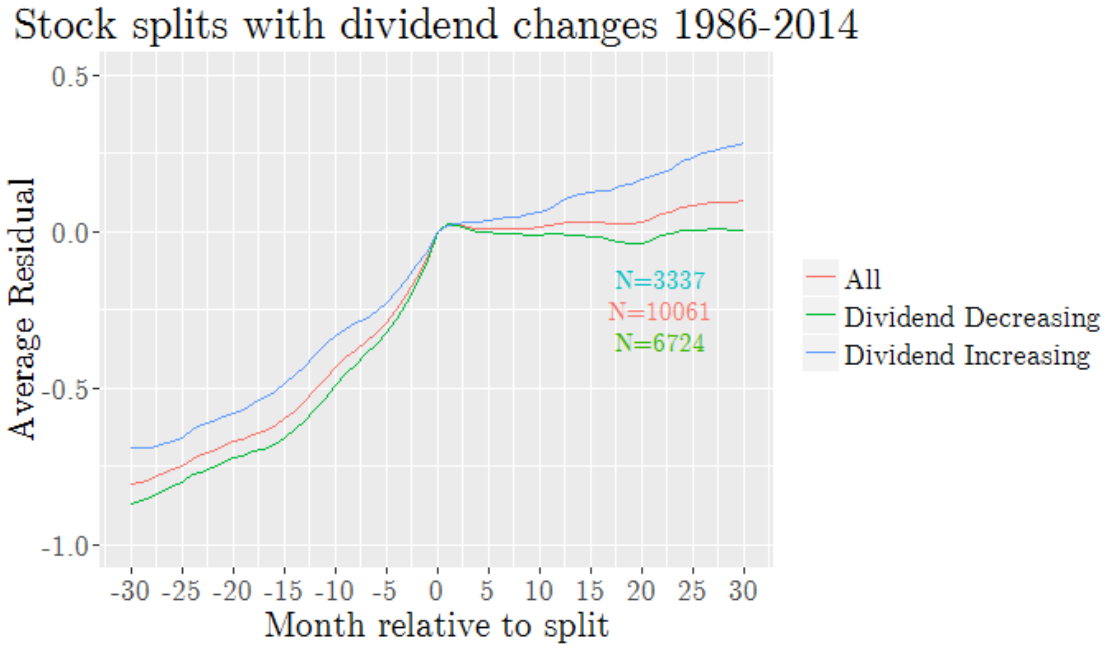


Figure A.4: Stock Splits with a *Increasing* or *Decreasing* Dividend Compared to the Market between 1986-2014



In contrast to the findings of Fama, Fisher, Jensen, and Roll (1969), we find that stocks splits exhibiting dividend increases relative to the market outperform the market during the 30 months after a stock split. Thus, there still seems to be stocks with abnormal performance relative to the general market, which confirms that some stocks exhibit a drift after a stock split.