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The influence of information of corporate insider trading on the value of German industrial companies

carried out for the purpose of obtaining the degree of a

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(E330 Institute of Management Science – Department of Finance and Corporate Control)

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I declare in lieu of oath, that I wrote this thesis and performed the associated research myself, using only literature cited in this volume

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Felix Aumair

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I want to thank my family and friends for the great support over the whole time I was writing this thesis. My working colleagues for the freedom and understanding it needs to write an academic thesis.

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Kurzfassung

Insiderhandel in seiner legalen Form, genannt Directors‘ Delaings, existiert bereits seit den Anfängen des Finanzmarktes. Manche Länder wie die USA haben schon früh Regularien und Gesetze eingeführt, um Missbrauch und Betrug zu vermeiden, während andere lange Zeit ungeordnet zusahen wie das System ausgenutzt wurde. Der anglo-amerikanische Raum war schon seit jeher führend in diesem Thema, bis auch die Europäer aufholten und ein robustes und sicheres System eingeführt haben.

Während bei legalem Insiderhandel meist der Focus auf den USA lag, zeigen neuere Studien den Einfluss solcher Transaktionen auf den europäischen Aktienmarkt. Durch sechs Hypothesen soll in dieser Arbeit der Informationsdissens zwischen den Insidern und dem Markt analysiert und getestet werden. Dabei wurden Cumulative Abnormal Returns und das Markt Modell aus der Literatur verwendet.

Die zur Verfügung gestellten Daten sind aus dem deutschen Aktienmarkt und fokussieren sich auf den Industrie-Sektor. Die Ergebnisse werden in vier Zeitabschnitten präsentiert und sowohl für Verkäufe als auch für Käufe getrennt aufbereitet dokumentiert.

Allgemein wurde für die meisten Zeitabschnitte und für alle Hypothesen, eine Signifikanz gefunden. Die Null- Hypothese wird meistens für die erste Teststatistik verworfen, während weniger oft eine Signifikanz für die zweite Teststatistik gefunden wurde. Die aufgestellten Hypothesen bestätigen teilweise die in der Literatur gefundenen Annahmen. Weitere Forschungen, mit einem größeren Datensatz und ähnlichen Annahmen, können einen Beweis für die Ergebnisse liefern, wo keine Signifikanz gefunden wurde.

Abstract

Insider trading in its legal form, called corporate insider trading or Directors' Dealings, is around the financial market, since stock markets have existed. Some countries established earlier than others regulations, to prevent abuse and fraud. While the Anglo-American area was leading on this field for a long time, the European mainland caught up and invented a statistically significant regulation system.

While the focus for corporate insider trading was long in the USA, recent studies also focused on the influence of such transactions on the European stock market. Through six hypotheses, the informational gap between insiders and the market is analyzed and tested, by using cumulative abnormal returns and the market model following literature.

The data provided is from the German stock market and focusses on the industry sector. The results are presented in four time spans, as well as for sales and purchases separately.

In general significance is found during most time periods for all hypothesis. The null hypothesis gets mostly rejected by the first test statistic, while less significance is found for the second. The formulated hypotheses are partly confirmed as in the literature. Further research, with a bigger sample and similar allegations, can prove evidence for results, where no significance is found.

Content

List of Figures

List of Tables

List of Abbreviations

AR	Abnormal Return
BaFin	Bundesanstalt für Finanzdienstleistungsaufsicht, German Market Authority
CAR	Cumulative Abnormal Return
CDAX	Composite DAX, German Stock Market Index
CEO	Chief Executive Officer
DAX	Deutscher Aktien Index, German Stock Market Index
EC	European Commission
EEC	European Economic Community/ European Community, later EU
EU	European Union
FMA	Financial Market Authority, Austrian Market Authority
ICB	Industry Classification Benchmark
IPO	Initial Public Offering
ISIN	International Securities and Identification Number
MAD	Market Abuse Directive
MAR	Market Abuse Regulation
NASDAQ	National Association of Securities Dealers Automated Quotations, US American Stock Exchange
PDMR	Person Dispensing Managerial Responsibility
SEC	Securities and Exchange Commission
UK	United Kingdom
USA	United States of America

1 Introduction

This thesis comprises on corporate insider trading in its legal form, the Directors Dealings. Although there are many different forms of insider trading, just a limited amount is legal and regulated by authorities. An inside trade is, buying or selling corporate stock by a corporate officer or other insider on the basis of information that has not been made public. There are different types of insiders, such as the executive board members, supervisory board members, former executives, etc., which may have a diversified insight in the corresponding firm (Riedl and Marten, 2010).

The history of regulating insider trading is contrary, when comparing different markets and actions which have been taken over the years. There has been regulation of insider trading for a long time in the United States of America. The first act was signed in 1933, amended and put into force in 1934. Over the years till the beginning of the second world war, the USA established a very strict law, compared to the rest of the world, which lasted in its regulations till the beginning of this century (SEC, 2013). As the economy slowly rose after world war two, so did the stock market and outside of the USA, the call for regulations started again in the 1960s. In the UK the first regulations were established in 1976, after years of discussions, while the European Union released its first directive in 1989 (Council of the European Union, 1989). By doing so, also the UK had to renew its inside trading laws. Compared to the USA, the directive from the Europeans already better fit the new market requirements and had unified trading laws in the entire community. This directive was replaced by the Market Abuse Directive in 2003 (European Parliament, Council of the European Union, 2003), which is important for this thesis, as the investigated time period on the German stock market was under this directive. The observed time span in this work is from 2005 till 2013. A renewed Market Abuse Regulation was issued in 2014, to fit higher standards and was put into force in July 2016.

For investigating corporate inside trades, the event study methodology is a highly suitable tool, for doing so. This method allows to observe via estimation and event windows, to show the effect of the change in information has on the stock market and therefore, on the market value of a firm. Such a method is also beneficial when working with abnormal and cumulative abnormal returns, to compare the different values and their change over time, with the difference in information inequality. When analyzing the information inequality through corporate inside trading, one follows a model to estimate the return of the observed portfolio, in order to find abnormal returns. Different models are represented in literature, while the market model has been chosen for this work. The market model is a one factor model which estimates the return of the market portfolio via a linear regression factor, in order to calculate the abnormal return.

Estimated abnormal returns results have to be tested, in order to provide an objective view and compare the results among them. In the literature it is documented that some events may cause the null hypothesis to be rejected when there is a minor increase in variance, even though it is true (Boehmer et al., 1991). Out of this reason, two tests are used. A cross- sectional correlation test by Boehmer et al. (1991), who also claim that considering the size and power of the adjusted test, that both are unaffected when they are applied to portfolios who are subject to event- date clustering. The second test statistic from Kolari and Pynnönen (2010) is based on the first used test statistic, and is adjusted using cross correlations of the estimation period residuals. While the first test statistic controls the conditions of event- induced variance, the second controls cross- sectional correlation of abnormal returns. Especially when testing cumulative abnormal returns in multiple day windows, this method also dominates nonparametric tests as the window is lengthened (Kolari and Pynnönen, 2010).

For defining the scope of the data set and this work, companies which are listed in the German stock market, especially in the CDAX are selected. This also aligns well with the Institute of Management Science, as European stock markets and the influence of corporate insider trading are investigated in previous published papers and works (e.g. Aussenegg et al. (2017); Aussenegg and Ranzi (2008)).

The used data set is provided by the Institute of Management Science of the Vienna University of Technology and contains information about Directors' Dealings from 2005 till 2013. After analyzing this data set, three time periods are determined in which the described hypotheses are tested. The amount of executed trades is changing over time and correlating with events that happened in the investigated time period. The first sub-period is before the financial crisis from 2005 till June 2007. The second is from July 2007 till 2010 during the financial crisis and the third sub-period is from 2011 till 2013 after the financial crisis and during the governmental debt crisis. All three sub-periods will also be compared to the overall time span of the data set, in order to visualize the different effects from those periods.

In contemplation of finding substantial effects in the performance of a stock, six hypotheses are described in this thesis. Based on literature several aspects are investigated: The effects of the size of a company and therefore higher abnormal returns, the position of an insider in a firm, the date when a company had its IPO and the transaction volume of an inside trade. Also new hypotheses are formulated, as no evidence for inspection is found in already existing literature, such as if the quantity of Directors' Dealings which are executed by an insider per trading day or in the last 12 months have an influence on abnormal returns, but also the absolute and relative size of inside trades compared to the market capitalization.

This thesis is structured as follows. It begins in Section 2 by a review of the relevant literature and motivation of the research hypotheses. The hypotheses are formulated also in this section, which are described after findings from literature. In Section 3 the history and development of regulatory standards, directives and regulations in the USA, UK and European Union from its beginning till today are described, with also describing the differences in the acts. In Section 4 the used methodology is presented and used formulas are described. In Section 5 both test statistics which are selected for this work are described and presented. Section 6 describes the used data set and presents descriptive statistics of the same. The empirical results are discussed in Section 7, including the test statistic findings. Concluding remarks over the whole thesis are exhibited in Section 8.

2 Literature Review and Hypotheses

According to Jeng et al. (2003) there are three good reasons in being interested in inside trades and their information: profit, science and policy. Even though profit is the hope in gaining additional or crucial information for developing or optimizing trading strategies, the focus on science and policy determines the effectiveness of a strategy or hypothesis. They also report that it is important to find evidence, of insiders having advantages and about the fairness of the market and its performance.

Most of previous academic research focused on the US market for corporate insider trading. One of those studies is from Seyhun (1986), who presents evidence that insiders can predict abnormal future returns, when they are purchasing or selling prior to an abnormal increase or decrease of the stock market value of their firm. But he also claims that the negative abnormal returns and the size of the firm are negatively correlated. More recently Lakonishok and Lee (2001) but also Jeng et al. (2003) state that the majority of the market ignores information about insiders even though insiders are useful indicators for timing the market and predicting cross-sectional variations in stock returns. They also say that, when insiders are purchasing, the markets on average do well, a fact that is not found significantly in this thesis when comparing chapter 6.2, and it is also stated that the markets on average do poorly when insiders sell. But their finding is, that in large stocks, insider activity seems to have limited value. This finding will be tested again in this work, especially when taking Aussenegg and Ranzi (2008) into consideration who also report their observations, that inside information in small firms has more value than in large companies. Out of this Aussenegg and Ranzi (2008) conclude, that this might be because more analysts follow large companies and out of this reason are under bigger surveillance by the public, which might force those companies to publish more (public) relevant information.

These studies lead to the first hypothesis formulated in this thesis:

Hypothesis 1 – Company Size

> *The size of a company matters substantially in the outcome of possible abnormal returns. The lower the market capitalization of a company, the higher might be the value of information out of Directors Dealings publication, because an information asymmetry between insiders and the public exists. Therefore, higher abnormal returns are expected, for companies with lower market capitalization. (Lakonishok and Lee, 2001)*

The findings from the studies above are also partially found by Fidrmuc et al. (2005) in studies regarding the UK and the US. A major focus of their research is a focus on the managing level and who is executing inside trades. Out of this reason they report, that a trade, executed by directors, affects the market significant immediately while the abnormal returns of CEO's is lower than from other directors. They state, that this can be explained through a bigger focus on their actions by authorities and the market and the CEO's therefore trade more cautiously. In this thesis this allegation is tested in the German stock environment again to report on the differences or similarities of the outcome.

This study is the main reason for the second hypothesis, to find substantial evidence for the German stock market:

Hypothesis 2 – CEO

Depending on who is executing a Directors Dealing, whether a CEO or Non- CEO, the abnormal returns will differ. A CEO has a more profound understanding of his company and therefore higher abnormal returns are expected, if a CEO is executing a Directors Dealing, than a Non- CEO (Fidrmuc et al., 2005)

Finding evidence of studies which focus on European mainland is given by Fidrmuc et al. (2013) and Dardas and Güttler (2011) for the biggest economies in Europe, where both report significant price effects around announcement days for different countries. Nonetheless, those studies mark an important investigation in the European stock market. Also Aussenegg and Ranzi (2008) investigate the same market and report, that insiders act contrary to investors. It is interesting to notice that they found evidence on negative market reactions for inside sales and positive market reactions for inside

purchase transactions. In their study the negative abnormal performance followed insider sale transactions and is mainly for German firms observed.

When looking closer on the work of Dardas and Güttler (2011), they report and confirm already existing findings that inside sales transactions have lower informational value than purchase transactions, and further it is assumed this is because of the big variety of reasons to sell stocks and fewer reasons to purchase them. It is also stated that markets react stronger on large trade announcement than small trade announcements, which is due to the higher signaling effect of large.

Out of this allegation, for this work it is expected, that a higher transaction volume as fraction of market capitalization generates higher abnormal returns which leads to two hypotheses as follows:

Hypothesis 3 – Relative Transaction Value

> *The transaction volume of a Directors' Dealing is an indicator, if the respective insider believes in its abilities and advantage of inside knowledge of the market, the transaction volume of a Directors' Dealing influences the stock value of a firm. Therefore, the higher the transaction volume of a Directors' Dealing relative to the firm value of the observed stock, the higher abnormal returns are expected. The lower the transaction volume relative to the firm value, the lower the abnormal returns are expected.*

Even though according to Aussenegg and Ranzi (2008), smaller transactions seem to be more informative for outside investors than larger transactions. This finding should now be tested with a different observed time span. Stating the next hypothesis to amplify the allegation:

Hypothesis 4 – Absolute Transaction Value

> *The transaction volume of a Directors' Dealing is an indicator, if the respective insider believes in its abilities and advantage of inside knowledge of the market, the transaction volume of a Directors' Dealing influences the stock value of a firm. Therefore, the higher the transaction volume of a Directors' Dealing absolute to the firm value of the observed stock, the higher abnormal returns are expected. The lower the transaction volume absolute to the firm value, the lower the abnormal returns are expected.*

A study from Hsieh et al. (2005) reports that insider trades and analyst recommendations are contrarian in producing informative signals for outside traders. They specifically say, that insiders trade against negative recommendations of financial analysts and tend to purchase in aggregate more shares of their security when it is unfavorably recommended or downgraded. When the stocks are favorably recommended or upgraded, insiders then tend to hold or not purchase shares. Hsieh et al. (2005) also find that, a signal for purchasing a stock after an upgrade by an analyst is just given, when insiders are also actively buying their own stock. When an analyst downgrades a stock, it contains an investment signal when insiders are calm and not actively or less likely to act on their own stock.

Other parts of the literature like Cohen et al. (2012) focus on the insiders itself, when investigating if there are two groups of inside traders, such as the “routine” and the “opportunistic” traders. When determining routine traders, one can strip away those to find all opportunistic trades, which contain a lot of important information that can be an indicator for future firm returns, news and events. They also show that abnormal returns which are associated with routine traders, are about zero and in opposite to this, a portfolio of just opportunistic traders yields value weighted abnormal returns of eighty-two basis points per month. Stating this, the amount of trades by an inside trader can be one of many signals, which determines a routine trader from an opportunistic trader and therefore, if higher abnormal returns are expected.

An allegation which cannot be found in the literature, that focuses on the frequency of trades which are executed by an insider and therefore the following hypothesis is formulated:

Hypothesis 5 – Transaction Frequency of Insiders

> *The frequency of Directors’ Dealings, executed by an insider compared to other insiders is an indicator, if the insider has more informational knowledge than the public. For that reason, the higher the frequency of Directors’ Dealings per insider, the higher the abnormal returns are expected of a firm in an observed time period. Whereas a low frequency of Directors’ Dealings executed by an insider, expects low abnormal returns.*

The last hypothesis is a narrow definition of the previous one and focuses on the frequency of a calendar year:

Hypothesis 6 – Transaction Frequency of Insiders in the Last Calendar Year

> *The frequency of Directors' Dealings, executed by an insider in the last calendar year also indicates, if the insider has more informational knowledge about the respective company than the public. Therefore, higher abnormal returns are expected if the frequency of Directors' Dealings, executed by an insider compared to other insiders in the last calendar year is high. Whereas a low frequency of Directors' Dealings executed by an insider compared to other insiders in a calendar year, expects low abnormal returns.*

This thesis is also focusing on three periods in the data set: before, during and after the 2008-2010 financial crisis. Aussenegg et al (2017) investigate especially on those periods in the EU. Their main finding is, that German legal countries score significantly worse in terms of their created index, than French legal countries, because of a higher information asymmetry. However, this study does not focus on the German stock market alone and neither compares the insider stocks with the CDAX. Aussenegg et al (2017) established an own index for comparing the results, as several countries are observed and out of this reason, the findings from this thesis cannot be directly compared.

3 History and development of corporate insider trading

3.1 Definition of Corporate Insider Trading

What is corporate insider trading? Also known as Directors Dealings, and what differentiates it to illegal activities? This question has long been discussed in different countries and is a relatively ethic question. Riedl and Marten, (2010) define Directors Dealings in Directors Dealings PBW Stichwort, as a securities transaction which has been executed by persons who have a special relation to the issuer. Such a relation exists, when a person because of its occupation within a company, has a privileged access to information, compared to other participants at the equity market.

The existence of such an asymmetry distribution of information, is because of the separation of equity and control of the company, especially at firms who are enlisted at the stock exchange. The online dictionary Investopedia describes insider trading as "*the buying or selling of a security by someone who has access to material nonpublic information about the security"*[1]. But the resource also specifies that "*Insider trading can be illegal or legal depending on when the insider makes the trade. It is illegal when the material information is still nonpublic"*[2] (Investopedia, 2003). As the online dictionary is based in the United States of America, this understanding also reflects U.S. law. Out of this reason, it is specified, that it is illegal when tipping others with any sort of non- public information.

[1] Investopedia, I., 2003. Insider Trading. Investopedia. URL: https://www.investopedia.com/terms/i/insidertrading.asp (accessed 10.29.18)
[2]Investopedia, I., 2003. Insider Trading. Investopedia. URL: https://www.investopedia.com/terms/i/insidertrading.asp (accessed 10.29.18)

In opposite to this, legal insider trading happens when directors of companies purchase or sell securities or shares but disclose the transactions legally. In Austria the Austrian Financial Market Authority (FMA) defines legal insider trading as[3]:

"When information constitutes insider information is defined in the Market Abuse Regulation (MAR)… Accordingly, it applies that:

- *It must be information of a precise nature that has not been made public.*
- *It must be directly or indirectly related to one or more issuers or to one or more financial instruments.*
- *It must be capable of having a significant effect on the price of a security in the event of it being published.*
- *It must be such in its nature that an informed investor would be likely to use it as part of the basis of their investment decisions."*

Furthermore, illegal insider trading is defined as[4]:

"Misuse of insider information is an offence, relevant both in terms of administrative penal law as well as a crime under penal law. The legislator prohibits the misuse of inside information pursuant to Article 154 para. 1 nos. 1 and 2 of the Stock Exchange Act 2018 (BörseG 2018; Börsegesetz 2018) or Article 163 BörseG 2018.

This offence coves any person making use of insider information for themselves or for a third party. This may be by buying, selling, changing or cancelling trading orders or recommending securities or by disclosing the information to third parties.

In the case of there being a well-grounded suspicion of a breach of market abuse provisions, pursuant to Article 167 para. 1 BörseG 2018 the Financial Market Authority is required, provided that the breach lies within the competence of the courts, to notify the Public Prosecutor's Office, and may be appointed by the Public Prosecutor's Office to conduct further investigations."

[3] FMA, 2018. Insider Dealing. FMA - Finanz. Österr. URL https://www.fma.gv.at/en/capital-markets/market-abuse/insider-dealing/ (accessed 10.29.18).
[4] FMA, 2018. Insider Dealing. FMA - Finanz. Österr. URL https://www.fma.gv.at/en/capital-markets/market-abuse/insider-dealing/ (accessed 10.29.18).

Compared to Austrian law requirements (FMA, 2018), the German definition of insider trading and Directors' Dealings is, due to the fact of a membership in the European Union, similar. The Bundesanstalt für Finanzdienstleistungsaufsicht (further called BaFin) also differentiates between illegal and legal forms of insider trading. The illegal use of information which is accessible to person who are not in the public domain and are potentially significant responsible for the value of the share price of a security, are not under any circumstances allowed to use that information for their or anyone else benefit. If those persons do so, they make themselves reliable of prosecution and it is not of interest, how this person gained this inside information. Out of this reason it is also prohibited to share any inside information with third parties or others and to recommend or induce to buy or sell any security based on such inside information (BaFin, 2017a).

The transparency requirements of the BaFin allow insider trading, as it is regulated by the European Union with the Market Abuse Regulation (EU) No 596/2014, in the form of Directors' Dealings. Managers' transaction should not be hidden to the public if a person discharging managerial responsibilities and trades with financial instruments which are issued by the issuer, respectively the company itself. That is valid for all kinds of financial instruments, such as bonds, stocks, derivates, etc. The transparency requirements and therefore the notification requirements oblige also to spouses, registered civil partners, dependent kids and any other living relatives who shared the same household in the last year. The issuer is also responsible to ensure that the information is disclosed to a public relevant media, which is suitable for dissemination throughout the whole European Union, without a delay of no longer than three days after the transaction. This information has additionally to be transmitted to the company register, which stores it (BaFin, 2017b).

The transparency requirements of the European Union are therefore a tool to ensure a high standard of transparency and equality in the market, without limiting the issuers to trade their own securities. It also allows the market to monitor the actions over a long time and gain new or different knowledge, to better act or react on Directors' Dealings. Especially for statistical or mathematical traders, this monitoring provides an important information value (Cohen et al., 2012).

The European regulations and the Market Abuse Directive will be explained in detail in the following section. In this thesis we focus on the legal form of insider trading and therefore on the so-called corporate insider trading or Directors Dealings. The regulation of such trades differs between most countries and unions, where the two most important areas in the world are the U.S.A. and the European Union. As this thesis is just handling data from a country of the European Union, no further and detailed description of insider trading in the U.S. is given. A detailed description of what the current state of law and a detailed explanation of the historical development of regulatory standard, is given in the next section 3.3 Historical Development of Regulatory Standards.

3.2 History of Corporate Insider Trading

There is a long tradition of regulating insider trading and reporting Directors' Dealings in the United States, when the first duty was enacted by the Congress in 1934, creating the Securities and Exchange Commission (SEC). Through this act, the SEC is empowered with broad authority over all aspects of the securities industry. This power includes to register, regulate, and oversee brokerage firms, transfer agents, and clearing agencies, but also the nation's securities self-regulatory organizations. Self-regulatory organizations are the New York Stock Exchange, the NASDAQ, the Chicago Board of Options or the Financial Industry Regulatory Authority. This was the worldwide first and for a long time only country which regulated insider trading. Regarding insider trading the act states[5]:

"AN ACT To provide for the regulation of securities exchanges and of over-the-counter markets operating in interstate and foreign commerce and through the mails, to prevent inequitable and unfair practices on such exchanges and markets, and for other purposes."

Furthermore, as an abstract of this act, it is written on the homepage of the SEC[6]:

"The securities laws broadly prohibit fraudulent activities of any kind in connection with the offer, purchase, or sale of securities. These provisions are the basis for many types of disciplinary actions, including actions against fraudulent insider trading. Insider trading is illegal when a person trades a security while in possession of material nonpublic information in violation of a duty to withhold the information or refrain from trading."

The act from 1934 got expanded over the years and its last modification was in 2012. The first European country to implement insider trading laws was the United Kingdom. It implemented the Model Code in 1977 which went into effect in 1979 (Dardas and Güttler, 2011).

In this implementation, a black out period was imposed, where corporate insiders are banned from trading in their own company's securities. The purpose of the London

[5] Senate and House of Representatives of the and United States of America, 1934, p. 1
[6] SEC, 2013. The Laws That Govern the Securities Industry. SEC. URL https://www.sec.gov/answers/about-lawsshtml.html#secexact1934 (accessed 10.29.18)

Stock Exchange Model Code (1977) is that insiders do not abuse, and do not place themselves under suspicion of abusing, price sensitive information that they may have or thought to have, especially in the periods, leading up to the announcement of results (Hillier and Marshall, 1997). In 1985 the Companies Act extended the Model Code regulatory framework by among other things, requiring reporting of insider transactions no later than the fifth business day after an insider trade has been made. Moreover, it contained a thin definition of who is considered a company insider: only executive board members and non-executive directors were required to report their trades; large shareholders were excluded from reporting.

A remarkable characteristic of the U.K. regulation is its extensive blackout periods. Explicitly, the U.K. regulator requires a two-month trading gap prior to final and interim earnings announcements. Till the 1990s the rest of the European countries did implement any form of Directors Dealings regulations. The EU introduced its first plan for a harmonization of the regulations of all member states in 1992, which gave each member state a wide range of possibilities. In 2004 the Market Abuse Directive was introduced with the directive MAD 2003/6/EC (2004/72/EC). This led to strict regulations and forced each member state to implement minimum standards to regulate insider trading (European Parliament, Council of the European Union, 2003).

In this directive, the member states must ensure that directors dealings reports are made within five business days. These reports must contain crucial information such as the size, the price, and characteristics of the transaction. It is also regulated who is obliged to report the transactions: all persons in managerial positions, as well as their families and institutions associated with these persons, are required to report their transactions. Moreover, companies are required to report all the names of insiders and to update the provided information frequently. The member states also have a possibility to implement a five-thousand Euro notification barrier, as a result, smaller transactions only have to be reported when their annual, in a calendar year, accumulated transaction size exceeds five-thousand Euro (Dardas and Güttler, 2011).

3.3 Historical Development of Regulatory Standards

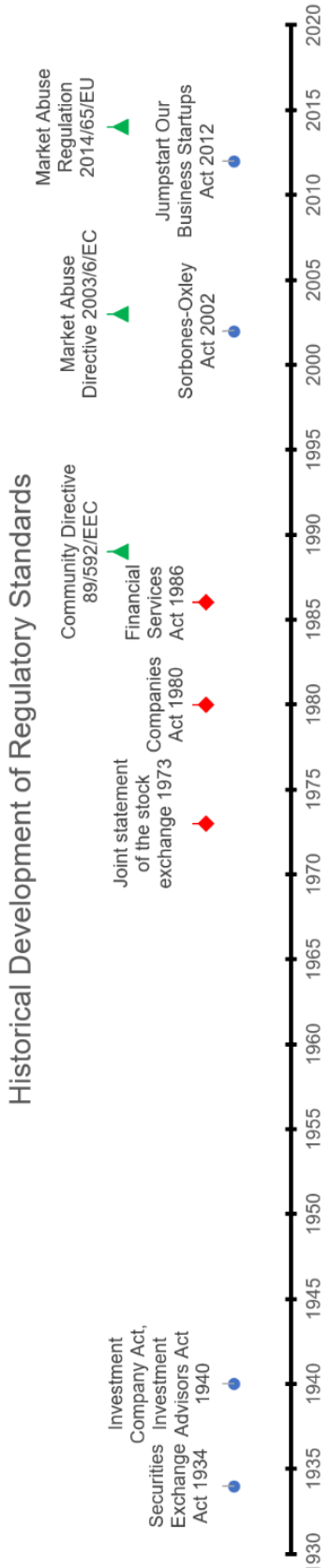

Figure 1 Historical Development of Regulatory Standards in the USA, UK and EU since 1934

The first country which developed standards and regulations for insider trading is the USA with the Security Exchange Act of 1934. Those regulations were developed after the stock exchange crash from 1929 and the worldwide financial crisis in the 1930's, to prevent future inside trading and to prevent market abuse. To this act, many amendments were added but just few substantially influenced it. Before the US entered the second world war in 1941, three acts were added to the 1934 regulations. The Trust Indenture Act from 1939 applies to debt securities, which are bonds, debentures, and notes that are offered for public sale. Even though those securities are already covered in the act of 1934, such securities need to have a formal agreement (know as the trust indenture) between the issuer and the bondholder and may not be offered for sale to the public. The Investment Company Act of 1940 regulates along others, the organization of companies and trading in securities, and whose own securities are offered to the investing public. By this act, companies are required to disclose their information about which stock is initially sold and their financial condition. The focus of this act is on disclosure of information about the structure and investment policies of companies and their structure and operations. The Investment Advisors Act which was also inducted in 1940, regulates investment advisors and was amended in 1996 and 2010 to be fit for modern trading (SEC, 2013).

More than thirty years later, the UK, as the first major European country started to induct regulations for insider trading with the Joint Statement of the Stock Exchange in 1973 and called for criminal sanctions. But just in 1980 the companies Act was introduced to British law, making insider trading an illegal action and a criminal offence. This formulation was re-enacted in 1985 with the Company Securities Act. An amendment for insider trading was added in 1986 after a suggested reform of law, dealing with the investment industry, the Financial Services Act (LawTeacher, 2013). The UK joined the EU (former European Community) in 1973, with a membership confirmed in 1975 by a referendum, but inducted laws for insider trading before the EU did. When the EU also started to establish insider trading laws in the 1980's, the UK had the obligation to follow those regulations in the agreed time frame.

The first directive by the European Union was established in 1989 with the Community Directive 89/592/EEC which established a minimum uniform standard for legislation in each member country and could even solve problems of regulations, such as the extent to which the prohibition extends to persons not in a fiduciary or other special

relationship to the entity whose information is being used, US courts could not solve. The member states of the European Union had three years to conduct the directive which marked the beginning of European insider regulations as we know it today (Council of the European Union, 1989; Hazen, 1992).

After this regulation the United States of America continued to work on a substantial improvement of the laws before the second world war and inducted the Sarbanes-Oxley Act of 2002. The reforms stated in this act enhance corporate responsibility, enhance financial disclosures, combat corporate and accounting fraud and created the "Public Company Accounting Oversight Board", which shall oversee activities of auditing (SEC, 2013). The Sarbanes- Oxley Act also states under Section 403, that the disclosure for insider trading by the insiders must be submitted to the SEC on a form within two business days. This is a major change, as till August 2002, the requirement for such disclosures by insiders via a form to the SEC, was ten days after the close of the calendar month in which the transaction had occurred (Senate and House of Representatives of the United States of America, 2002).

The following year the European Union formulated the Market Abuse Directive 2003/6/EC which replaced the old directive from 1989 and had an overall objective to establish a pan European standard for insider trading and market manipulation. Additionally, the aim was to promote market integrity and ensure investor confidence in the financial markets. The genuine single market for financial services was also described as a crucial element for job creation and economic growth within the community of the European Union (Aussenegg et al., 2017; European Parliament, Council of the European Union, 2003). In 2008 the Amending Market Abuse Directive 2008/26/EC supplemented the existing law for market manipulation and insider dealing, as regards the implementing powers conferred on the Commission (European Parliament, Council of the European Union, 2008).

After the financial crisis of 2009 the Dodd-Frank Wall Street Reform and Consumer Protection Act was signed in 2010. The aim is to reshape the US regulatory system in the areas of consumer protection, trading restrictions, credit ratings, regulation of financial products, corporate governance and disclosure, and transparency. By this act it was prohibited for any federal employee or agent, who acquires information, is therefore an insider, and may affect the price of any financial product, to execute a trade (Senate and House of Representatives of the United States of America, 2010).

Just two years after, the Jumpstart Our Business Startups Act in 2012 sets legislation to help raising funds in public capital markets by businesses and minimizing regulatory requirements (SEC, 2013).

In 2014 the European Union inducted the Market Abuse Regulation 2014/65/EU which turned the directive from 2003 into a regulation which had to be fulfilled by every member state by 3rd of July 2016. A more trustworthy and transparent framework should be installed, in order to fight insider dealing and market manipulation in Europe's financial markets (European Commission, 2016; European Parliament, Council of the European Union, 2014).

3.4 The Information Value of Directors' Dealings

Insider trading is one of the most investigated details in the everyday stock market. Numerous analysts, traders, inspectors, regulators, media members, academics and fund managers, pay attention to such deals, which probably could influence the stock market value of a security. Out of this big interest in insider trading, a big amount of publications in the academic field also analyzed the impact of Directors' Dealings, where most of those analysis are based on the cross- sectional return forecasting ability of insider trades accumulated at firm level (Cohen et al., 2012).

Through the information of Directors Dealings which can be gathered, after the announcement of a trade, it is possible to either investigate meta data or micro data. The micro data determines single specifications of the inside trade such as relation of the insider to the issuing firm, value of the trade, amount of inside trades in a specific time span, use of a specified financial product and/ or its effects on the market value of a security. The meta data specifies on when an inside trade was conducted, if it was a selling or purchasing transaction and when the transaction was announced (Cohen et al., 2012).

4 Methodology

4.1 Event Study Methodology

One of the common questions to economists, is to measure the effects of an economic event on the value of a firm. This task can be answered simpler than most commonly believed, when using an event study. It is beneficial to use financial market data to measure the impact on the value of a specific event on a firm. The profound and simple value of using financial market data comes from the point, that the effects of an event on a firm, are immediately and directly represented in security prices, if rationality of the markets is given. (MacKinlay, 1997)

When security prices are observed over a relatively short period, the same cannot be done with productivity related measures of a firm, as that would require months up to years to gather the needed information. Out of this reason, an event study has many different applications. They are used from accounting and finance research, in the field of law and economics and in legal liability cases. There is no unique structure of an event study but a general flow of analysis. The starting point of an event study is to determine the event and the period over which the security prices of the involved firms of the respective event will be observed – the so-called event window (MacKinlay, 1997).

The event window can be defined customarily, which means, that it can be extended or shortened to any specific time span of interest. See Figure 2 for details. In practice it is common, that the time span of interest is expanded several days, including at least the event day and the day after the event. The day after the event captures all effects which happen after the stock closes on the event day. In some cases, the days before or after the event are also of interest. This might be the case when the market acquires information regarding an event upfront. One might observe changes in returns or other indicators prior to the event. After the identification of an event, the selection criteria for the firms has to be defined.

The criteria may involve restrictions regarding the listing place of a security, such as the New York Stock Exchange, the German Stock Exchange or any other place in the world, but the criteria may also involve a membership to a special industry or market capitalization of a firm.

It is also important to summarize some characteristics of the selected firms and note any eventual biases which occurred or arose during the selection process (MacKinlay, 1997).

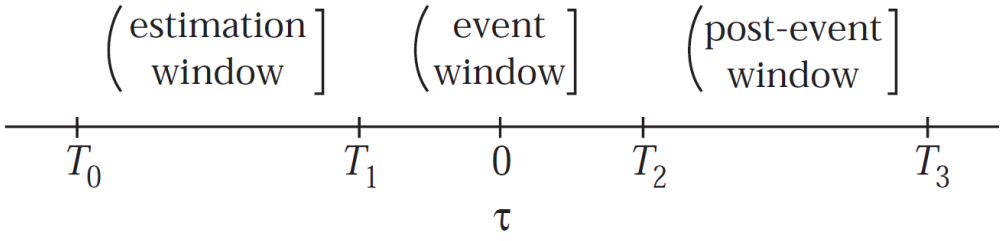

Figure 2 Time line for an event study according to MacKinlay (1997)

It is the objective of an event study to assess the extent to which investors earn excess or abnormal stock returns from an event which carries new informational content. This objective is used to show the price differences of corporate insider trading. The difference between the observed return and the return expected in the absence of the event, predicted by an appropriate benchmark asset pricing model, is called abnormal return. A semi-strong form of market efficiency is the underlying of this methodology, which according to that makes two assumptions. The first assumption is that, stock prices reflect all publicly available information. The second assumption, stock prices instantly change, to reflect new information when it becomes available (Fama, 1970). Following these assumptions, investors use the provided information to instantly adjust their expectations of a firm's future cash flow. Therefore, as a result, the price of the firm's stock changes accordingly to the expectations by the investors. The price change captures the added value given by the new information contained in the announcement (Sorescu et al., 2017).

4.2 Abnormal Returns

MacKinlay (1997, p. 15) defines abnormal returns as "*the actual ex post return of the security over the event window minus the normal return of the firm over the event window*." A normal return can be described as the expected return where no conditioning on the event is taking place. The abnormal return according to MacKinlay (1997) can also be written in the formula[7]

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

The abnormal return $AR_{i\tau}$ of firm i on event date τ or the time period τ, is the difference of the actual return $R_{i\tau}$ and the normal return (expected return) $E(R_{i\tau}|X_\tau)$, where X_τ is the conditioning information for the normal return model. Several mutual possibilities are given for generating the normal return model, such as the constant mean return model and the market model. If it is not possible to have a pre-event estimation period for the normal model parameters, another option is to use the market adjusted return model. In the constant mean return model, the mean return of a security is constant through the event period. The market model assumes a stable linear relation of the security return and the market return.

In order to calculate the mean abnormal return of every firm per trading day t, it is necessary to weight and sum all calculated abnormal returns according to Campbell et al. (1997), where AR_t is the mean abnormal return per trading day[8]:

$$AR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i\tau} \quad (2)$$

Another possible model is the market adjusted return model, which can be viewed as a restricted model. This model can be used when it is not feasible to have a pre-event estimation period for the normal parameters. Out of this reason a market-adjusted return is used. The restriction of this model implies that α is zero and β is one. Due to

[7] MacKinlay, (1997), p. 15
[8] Campbell et al., (1997), p. 161

the pre-specification of the parameters, an estimation period is not required to obtain parameter estimates (MacKinlay, 1997).

4.3 Cumulative Abnormal Returns

According to Mackinlay (1997) it is important to find conclusions over the event window of interest, to aggregate abnormal returns. In order to do so, the abnormal returns can be aggregated via time, across securities or combined of these two dimensions. A well-known and widely used concept are cumulative abnormal returns (CAR). The CAR is defined as the sum of abnormal returns over an event window, between T_1 and T_2 ($T_1 < \tau_1 \leq \tau_2 \leq T_2$). In MacKinlay (1997) the CAR from τ_1 to τ_2 is the sum of the daily abnormal returns[9]:

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_t \qquad (3)$$

If there is just one trade in the event period, only one observation window is given. Therefore, tests are not useful, and aggregating is necessary in order to work with plausible results. For the event window and across observations of the event, the abnormal return observations must be aggregated. For this aggregation it is assumed that there is not any clustering, which induces that there is no overlapping in the event windows of observed securities. If there is no overlapping in event windows and with maintained distributional assumptions, it is implied that abnormal returns and the cumulative abnormal returns will be independent across securities (MacKinlay, 1997).

To gain a better understanding of the influence of insider trades and the dynamics of the stock market, different time periods for calculating CARs are chosen in this thesis. To show the effects prior and after the announcement date of inside trades as well as on the announcement date, five periods are chosen as the following: $CAR_{-20,-1}, CAR_{-10,-1}, CAR_0, CAR_{0,10}, CAR_{0,20}$

[9] MacKinlay, (1997), p. 21

4.4 Market Model

The market model relates the return of any security that is given to the return of the market portfolio. The market model is an example for a one factor model and its linear specification follows from the assumed joint normality of asset returns. The benefit from using this model will depend upon the R^2 of the market model regression. The higher the R^2 the greater is the variance reduction of the abnormal return and the larger is the gain (Mackinlay, 1997).

To calculate the return of a security in the market model at period t after MacKinlay (1997, p. 18) one follows:

$$R_{it} = \alpha_i + \beta_i * R_{mt} + \varepsilon_{it} \quad (4)$$

$$E(\varepsilon_{it} = 0)$$

$$var(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2$$

Any security is i, where R_{it} and R_{mt} are the period- t returns on security i and the market portfolio, respectively, and ε_{it} is the zero mean disturbance term. α_i, β_i and $\sigma_{\varepsilon_i}^2$ are the parameters of the market model.

In this thesis the approach of the market model is being used in order to evaluate the influence of the information of Directors' Dealings on the stock value of examined companies. This approach considers, when looking at the transactions, that the respective has been trading for at least 200 days. β_i is the risk factor which will be estimated with a linear regression in a 200-day time period prior to the event window. The considered risk factor beta is an indicator for the sensitivity of a security while alpha is a measure of the active return of an investment. α_i is being estimated equivalent to beta.

5 Test statistics

Out of numerous test statistics, the following two techniques are taken into consideration, to test the statistical significance of CARs. While Boehmer et al., (1991) describe the basis of cross-sectional tests, Kolari and Pynnönen, (2010) further developed this method.

5.1 Conditions of Event- Induced Variance

The necessity to control for variance changes to acquire appropriate tests of the null hypothesis that the average abnormal return is zero, is shown by Boehmer et al. (1991). They also found, when comparing numerous tests, that when an event causes minor increases in variance, the most commonly used methods, even though it is true, frequently cause the null hypothesis of zero average abnormal returns to be rejected. Boehmer et al. (1991) show in their paper through a simple adjustment, that the cross-sectional method results in equally- powerful tests, when the null hypothesis is false, and it results in appropriate rejection rates when the null is true. Considering the size and the power of the adjusted test, they are both unaffected when they are applied to portfolios who are subject to event-date clustering.

Boehmer et al. (1991) are using six different test statistics to compare their results. Where one test statistic is newly introduced and developed. The standardized cross-sectional test combines two already existing test statistics, to eliminate the misspecification problem of the ordinary cross-sectional test. This combination of the ordinary cross-sectional approach and the standardized-residual, is a formed hybrid, which is called standardized cross-sectional test. A standardization of the residuals is done by the estimation-period standard deviation, to eliminate the misspecification problem of the ordinary cross-sectional technique. After this, the ordinary cross-sectional technique is applied to the standardized residuals.

The test statistic t_B[10] of Boehmer et al., (1991) is defined by formula 5 as follows:

$$t_B = \frac{\frac{1}{N}\sum_{i=1}^{N} AR_{i\tau}}{\sqrt{\frac{1}{N(N-1)}\sum_{i=1}^{N}\left(AR_{i\tau} - \sum_{i=1}^{N}\frac{AR_{i\tau}}{N}\right)^2}} \quad (5)$$

N is the number of trades which are taken into consideration in a time period and $AR_{i\tau}$ is the abnormal return of firm i on event date τ or the time period τ, is the difference of the actual return $R_{i\tau}$ and the normal return (expected return) $E(R_{i\tau}|X_\tau)$. To estimate this test statistic t_B, the average event-period standardized residual is divided by its contemporaneous cross-sectional standard error. Information from the estimation period, which may increase its efficiency and power, is also incorporated by the test statistic. Additionally, this method requires cross-sectionally uncorrelated security residuals. Boehmer et al. (1991) also state, that their introduced standardized cross-sectional technique is similar to the test statistic derived by Ball and Torous (1988). Even though several different cases of event-induced variance are considered, and the standardized cross-sectional technique is compared to all the standard methodologies.

5.2 Cross-Sectional Correlation of Abnormal Returns

It is noted by Kolari and Pynnönen (2010), that event studies are likely to cross-sectional correlation among abnormal returns, when the event day is the same for sample firms. This leads to the result, that test statistics cannot undertake independence of abnormal returns. Event- date clustering is serious in terms of over-rejecting the null hypothesis of zero average abnormal returns, when it is true, even when cross- correlation is relatively low. This is also true, when testing cumulative abnormal returns in multiple- day windows. This method then also dominates nonparametric tests as the window is lengthened.

[10] Boehmer et al., (1991), p. 270

5.2.1 Scaled Test Statistics

Boehmer et al. (1991) uses scaled abnormal returns to find a definition of the t-statistic, which is described in Kolari and Pynnönen (2010), where $\bar{A}$ is the mean abnormal return[11]:

$$t_B = \frac{\bar{A}\sqrt{n}}{s} \quad (6)$$

n is the number of trades and s is the cross-sectional standard deviation of the event-day scaled abnormal returns, defined as the square root of the sample variance. It can also be written as[12]:

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(A_i - \bar{A})^2 \quad (7)$$

Also according to Kolari and Pynnönen (2010), for the variance of abnormal returns, it is easily shown that[13]

$$E\left[\frac{s^2}{(1-\bar{\rho})}\right] = \sigma_A^2 \quad (8)$$

and therefore, a feasible estimator of the variance σ_A^2 is[14]:

$$s_A^2 = \frac{s^2}{1-\bar{r}} \quad (9)$$

[11] Kolari and Pynnönen, (2010), p. 4002
[12] Kolari and Pynnönen, (2010), p. 4002
[13] Kolari and Pynnönen, (2010), p. 4002
[14] Kolari and Pynnönen, (2010), p. 4003

$\bar{r}$ is the average of the sample cross correlations of the estimation-period residuals. Using respective estimators for the variance of the mean abnormal return, to estimate the variance for that gives back a t-ratio scaled test statistic for both cross-correlation and event-induced volatility[15]:

$$t_{AB} = \frac{\bar{A}}{s_{\bar{A}}} = \frac{\bar{A}\sqrt{n}}{s_A\sqrt{1 + (n-1)\bar{r}}} \quad (10)$$

The t-statistic t_B of Boehmer et al. (1991) is adjusted by Kolari and Pynnönen (2010, p. 4003) to:

$$t_{AB} = t_B\sqrt{\frac{1 - \bar{r}}{1 + (n-1)\bar{r}}} \quad (11)$$

Is the average return cross-correlation $\bar{r}$ zero, the test statistic of Boehmer et al. (1991) and the adjusted statistic t_{AB} by Kolari and Pynnönen (2010) yield the same results. And that even if the event days are clustered with cross-correlated returns.

[15] Kolari and Pynnönen, (2010), p. 4003

6 Data

The first data set used for this thesis, the Directors' Dealings in the time period from 1st of January 2005 till 31st of December 2013, is provided as a Microsoft-Excel file by the Institute of Management Science at the Vienna University of Technology and can be found and accessed on the public webpage of the BaFin via a linked data base.

This first table contains all Directors' Dealings of German companies in the industry, "Industrials". All of the insider trades are listed by their official company name and their ISIN (International Securities and Identification Number). Important for this work is the announcement date, i.e. when the insiders publish the information about their trade. The job function of the insiders is listed as well as their executive status, the number of shares purchased or sold, as well as the transaction value in Euro and in percentage, relative to the market capitalization.

The second data set used in this work is downloaded from Thomson Reuters Datastream of the Institute of Management Science at the Vienna University of Technology, using the Thomson Reuters Datastream ad-in in Microsoft-Excel. This table contains the total returns of the benchmark, CDAX, and of all companies in the first table from 1st of January 2004 till 31st of December 2013. The year prior to the first inside trades in 2005 is necessary in order to have enough data to estimate the market model parameters alpha and beta.

Depending on the test hypotheses, the Directors' Dealings provided in the first data set, are filtered in sub-samples. Every hypothesis is tested separately for purchase and sales transactions. The goal is to find the abnormal and cumulative abnormal returns of companies in the selected time horizons and test them with the selected test statistics.

6.1 Definition of the executive status

In the first data set, the acting persons are categorized into five groups as the following: Executive, Former, Non- Executive, PDMR (Person Dispensing Managerial Responsibility), Supervisory and Unknown.

- Executive

  According to Thomson Reuters (2019a)[16] an executive is "*a director who is a full or part-time employee of the company"*. In Europe it is common to name someone executive if this person is part of the executive board.

- Former

  Persons of this category are no longer part of the executive board. Usually these people do not have to publish their transactions to the responsible authority, but there are exceptions. Such exceptions can be according to the European Parliament, Council of the European Union (2003) in the market abuse directive, that if a person still has close relations and/or access to inside information, this person must publish its transactions.

- Non- Executive

  These persons are defined by Thomson Reuters (2019b)[17] as a person *"who is not a full or part-time employee of the company or holder of an executive office. There is no statutory definition of a non-executive director, but such a director will usually devote part of his time to the affairs of the company as an independent adviser or supervisor".*

[16] Thomson Reuters, (2019a), URL: http://uk.practicallaw.thomsonreuters.com/, accessed 11.1.19
[17] Thomson Reuters, (2019b), URL: http://uk.practicallaw.thomsonreuters.com/, accessed 11.1.19

- PDMR

  A person dispensing managerial responsibility is defined by Thomson Reuters (2019c)[18] *"as defined in Article 3(1)(25) of the Market Abuse Regulation (MAR), a person within an issuer, an emission allowance market participant or another entity referred to in Article 19(10) of MAR who is either of the following:*

  - *A member of the administrative, management or supervisory body of that entity (that is, a director).*
  - *A senior executive who is not a member of the bodies referred to above but who has regular access to inside information relating directly or indirectly to that entity and has power to take managerial decisions affecting the future developments and business prospects of that entity.*

- Supervisory

  Persons listed as "Supervisory" are members of the supervisory board and therefore obliged to the same rules as members of the executive board according to European Parliament, Council of the European Union (2003). These persons have access to highly sensitive information and areas of a company.

- Unknown

  The group of unknown executive status lists all people who have not displayed their status, or it was not recognized by the system. For all investigations in which the executive status is important, this group is excluded of observations. As can be also seen in Figure 3, the ratio between known and unknown executive status is relative to the sample size small.

[18] Thomson Reuters, (2019c), URL: http://uk.practicallaw.thomsonreuters.com/, accessed 11.1.19

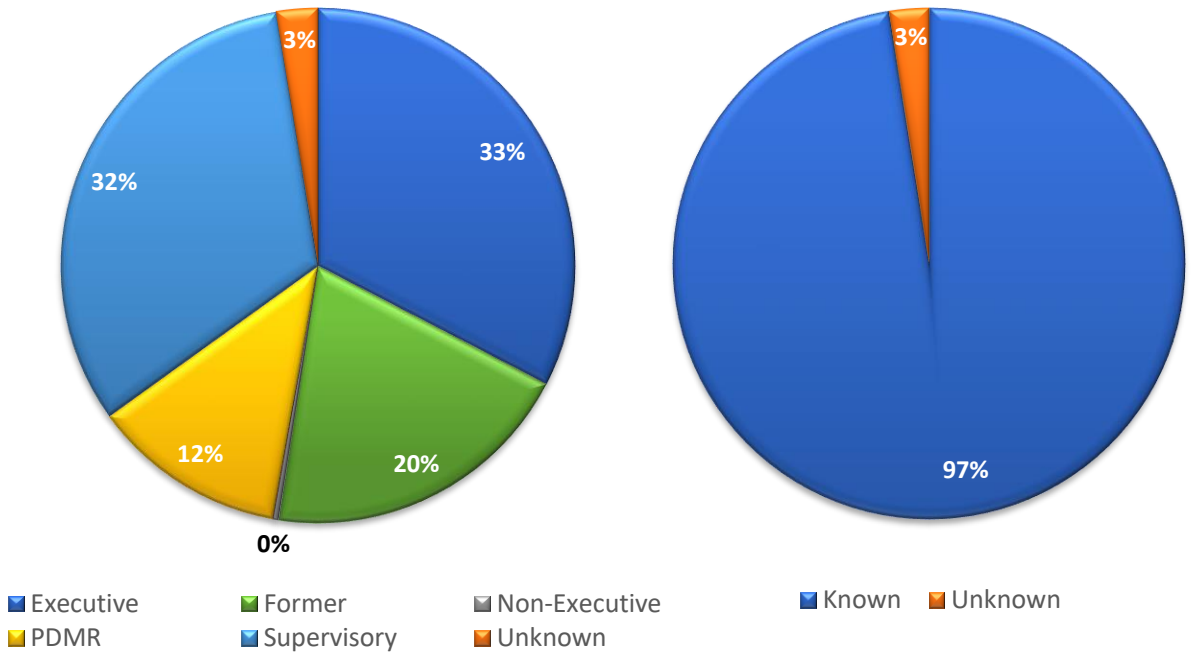

Figure 3 Distribution of executive status over the whole sample and the ratio of known and unknown executive status

The whole sample has 2,742 transactions of which are 33% or 905 trades executed by executive insiders, 32% or 878 by supervisory board members, 20% or 548 by former executive board members, 12% or 329 by PDMR and 3% or 82 are insider trades of unknown executive status. There are no non-executive transactions in the given sample. According to Figure 3, 97% or 2660 transactions are of known executive status.

6.2 Analyzed Data and descriptive analysis

The announcement date is the focus in this work, as effects of the insider trades might influence the stock market just after their announcement. Therefore, all periods and sample data are based on the announcement date of the data set. The market abuse regulation (MAR) which was signed by EU member countries in 2014, entered into force on the 3rd of July 2016 and unified the announcement date within the EU and obliged the persons who are object to reporting, to submit their Directors' Dealings to the authorities (BaFin, FMA, etc.). Through this regulation, insiders must report without delay at latest three business days following the transaction date to the issuers and

authorities. As this regulation was not signed and enforced in the investigated data set, the announcement dates of insider trades are often more than 3 business days after the transaction day. In Figure 4 the distribution of days between the transaction date and announcement date is shown. The majority of announcements happens between the first and eight business day, after the transaction.

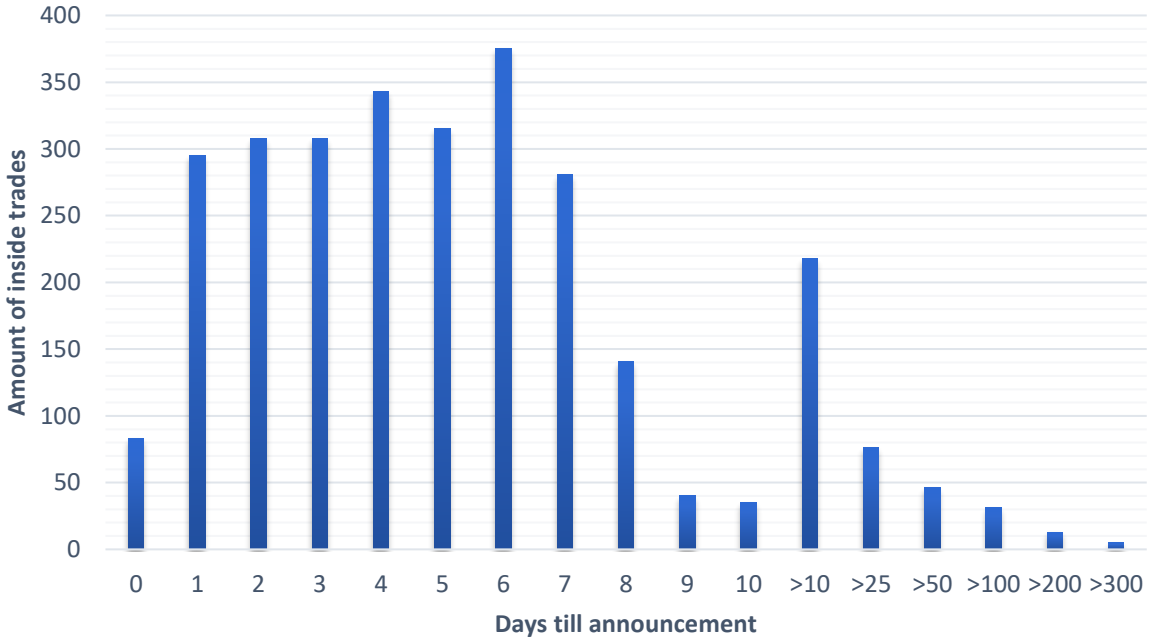

Figure 4 Distribution of the amount of days between the transaction date and the announcement date

The number of trades over 25 days between transaction date and announcement date is compared to the sample relatively low. It is also visible that the amount of transactions, which are announced later than 10 business days, drops almost exponential, the more days pass.

In Figure 5 the development of executed Directors' Dealings for the total sample period is shown. This graph shows that purchases and sales are higher before the year of 2010, than afterwards. Especially the purchases increase significantly at the beginning of the crisis in July 2007 and last till the end in August 2009. Sales on the other hand, decrease tremendously at the same time and just rise shortly in summer 2008 before falling again. Out of this graph, three distinct sub-periods are determined: before the financial crisis (2005- June 2007), during the financial crisis (July 2007-2010) and after the financial crisis and during the government debt crisis (2011-2013).

There are 2,742 deals in the whole sample, whereas are 1,708 executed purchase orders and 1,034 executed sales orders. In the first sub- period, before the financial crisis, are 1,010 deals identified, whereas are 468 purchases and 542 sales.

In the second sub-period, during the financial crisis, are 1,146 deals identified, whereas are 907 purchases and 239 sales. In the third sub-period, after the financial crisis and during the government debt crisis, are 586 deals listed, whereas are 333 purchases and 253 sales.

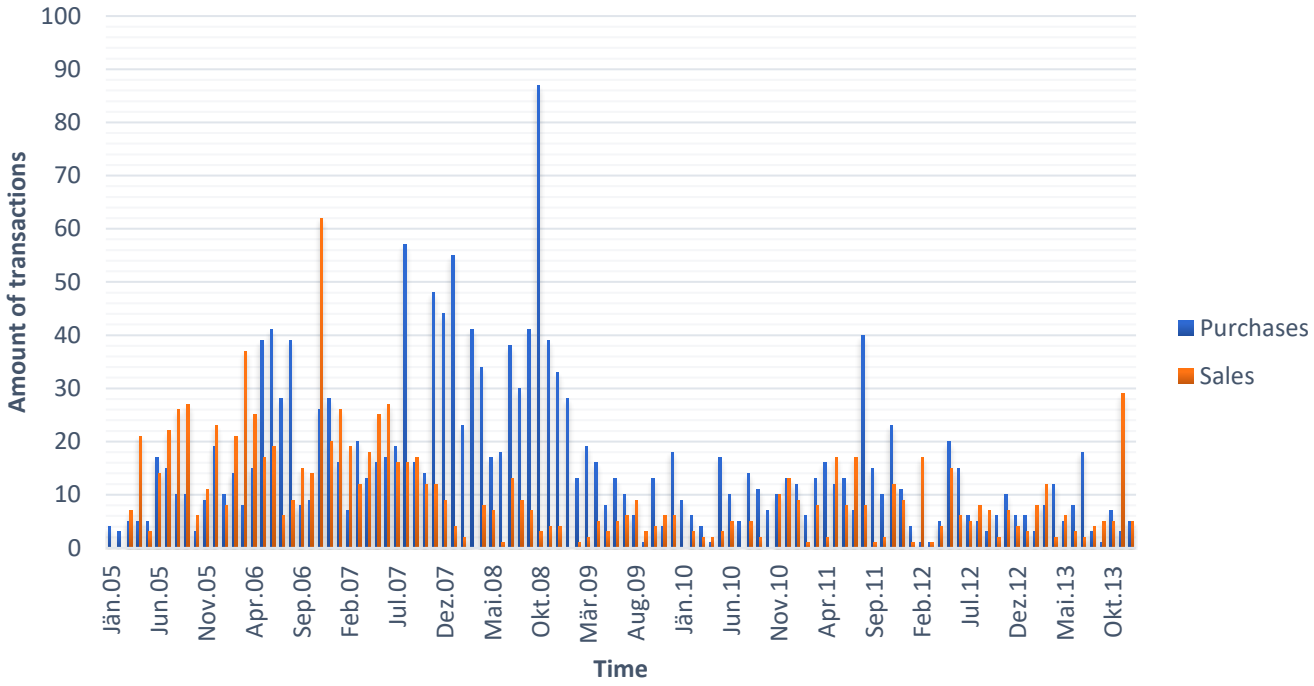

Figure 5 Insider transactions during the sample period out of the provided data set. The figure provides monthly based numbers of insider sales and purchases transactions.

In general, Figure 5 shows clearly more purchases (62% of the transactions) than sales (38% of the transactions).

	Number of companies	Number of disclosures	Volume per disclosure (in €)		Total volume of disclosed transactions (in million €)
			Mean	Median	
Purchase transactions	118	1,708	516,508.38	38,000.00	3,475.76
Sale transactions	102	1,034	2,508,285.55	160,364.50	882.20
All transactions	130	2,742	1,267,601.59	56,009.50	2,593.57

Table 1 Sample descriptive statistics for the whole data set

Table 1 presents descriptive statistics for the whole data set and sums up the already described data for purchases and sales transaction over the whole time period. One can additionally see, that not just more purchase transactions than sales transactions are executed over the whole time, but also that the total volume of those purchase transactions is almost four times higher than those of sales.

6.3 CDAX

The CDAX was first introduced on 17th of September 1993 and is calculated as a performance and price index by the Deutsche Börse AG. As a base date of the calculations, the 30th of December 1987 is being used for the index, with a value of 100 points that day. The historical data has been calculated back till 1970. Compared to the DAX, where just the 30 largest and most actively traded companies are represented, the CDAX contains a bigger spectrum of the German stock market. In the CDAX are companies represented, which fulfill the criteria of the Prime Standard and General Standard market. Therefore, this index represents the whole spectrum of the German stock market and can be used as an indicator for economic developments (Deutsche Börse AG, 2019).

7 Results

The results are structured by hypotheses, in total, over the three determined time periods described in 6.2. The whole sample has 2,742 transactions of which are 33% or 905 trades executed by executive insiders, 32% or 878 by supervisory board members, 20% or 548 by former executive board members, 12% or 329 by PDMR and 3% or 82 are insider trades of unknown executive status. There are no non-executive transactions in the given sample. According to Figure 3, 97% or 2660 transactions are of known executive status.

Analyzed Data and descriptive analysis, and each for purchase and sales orders. For all observations listed below, the market model is used.

7.1 Overall Analysis of the Sample

The total sample is analyzed in the following sub chapter. Errors are excluded for this observation. The split for analyzing periods is the same as for all hypotheses in total, before the crisis, during the crisis and after the crisis.

7.1.1 Purchase Transactions

7.1.1.1 Total sample 2005 – 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.461	-0.203	1.058	-0.369	-3.760
Median	-1.129	-0.261	-0.074	1.132	-0.155
Percentage of positive CARs	43.54%	45.38%	51.82%	55.32%	54.82%
Standard deviation	11.855	9.558	3.808	13.946	21.077
Böhmer et. al - t_B	-1.5613	-0.8531	11.0079	-1.0644	-7.1617
Kolari and Pynönnen - t_{AB}	-0.2384	-0.1774	5.7331	-0.2098	-1.2300
p-Value t_B	0.1179	0.2772	0.0000	0.2264	0.0000
p-Value t_{AB}	0.3878	0.3927	0.0000	0.3903	0.1872

Table 2 Mean, Median, Percentage of positive CARs and Standard Deviation for Purchase Transactions in Total

Overall the total sample concludes 1,708 purchase transactions with 98 exclusions due to insufficient estimations periods. The mean value of the CARs peaks on the event

day, leading to the assumption, that an information asymmetry between insiders and the public exists. See Table 2 for the displayed values.

The results are significant on the event day for both test statistics. On the last time period the test statistic by Boehmer is also significant and the null hypothesis can be rejected.

7.1.1.2 Before Crisis Period 2005 – 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.357	0.186	0.063	2.563	3.453
Median	-0.652	-0.390	-0.025	2.163	2.651
Percentage of positive CARs	45.43%	47.12%	48.32%	62.98%	66.35%
Standard deviation	11.865	9.578	3.811	13.919	21.042
Böhmer et. al - t_B	-0.6182	0.1359	0.1342	1.9982	1.9618
Kolari and Pynönnen - t_{AB}	-0.4871	0.0944	0.0967	1.0984	0.9849
p-Value t_B	0.3295	0.3953	0.3954	0.0542	0.0582
p-Value t_{AB}	0.3543	0.3972	0.3971	0.2182	0.2456

Table 3 Mean, Median, Percentage of positive CARs and Standard Deviation for Purchase Transactions before the crisis

Before the crisis 459 transactions and 43 exclusions occur. The mean value increases towards the end of the observed time. This could imply that the information gap is closed, see Table 3.

There are no statistically significant results and the assumption cannot be confirmed. The null hypothesis cannot be rejected either.

7.1.1.3 Crisis Period 07/2007 – 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.910	-0.434	0.438	-2.648	-6.875
Median	-1.358	-0.798	0.102	0.146	-0.953
Percentage of positive CARs	43.72%	45.77%	52.08%	50.69%	47.34%
Standard deviation	11.901	9.597	3.802	13.974	21.125
Böhmer et. al - t_B	-2.1785	-1.2181	2.8753	-4.5350	-7.8002
Kolari and Pynönnen - t_{AB}	-0.4148	-0.2803	1.6325	-0.9784	-1.4272
p-Value t_B	0.0372	0.1900	0.0064	0.0000	0.0000
p-Value t_{AB}	0.3661	0.3836	0.1052	0.2472	0.1441

Table 4 Mean, Median, Percentage of positive CARs and Standard Deviation for Purchase Transactions during the crisis

During the crisis 910 transactions and 50 exclusions are analyzed. The mean value peaks on the event day before falling dramatically. The values are displayed in Table 4. For the first test statistic are statistically significant results calculated from the event day on. The null hypothesis can be rejected for those.

7.1.1.4 Post Crisis Period 2011 – 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.657	-0.674	0.681	0.697	1.639
Median	-1.328	-0.807	0.111	0.828	2.159
Percentage of positive CARs	40.72%	42.22%	55.52%	57.74%	59.82%
Standard deviation	11.937	9.620	3.812	14.015	21.156
Böhmer et. al - t_B	-1.1022	-1.5841	4.8408	1.5643	2.5701
Kolari and Pynönnen - t_{AB}	-0.3303	-0.5429	3.1826	0.5058	0.6810
p-Value t_B	0.2173	0.1138	0.0000	0.1174	0.0147
p-Value t_{AB}	0.3778	0.3443	0.0025	0.3510	0.3164

Table 5 Mean, Median, Percentage of positive CARs and Standard Deviation for Purchase Transactions after the crisis

After the crisis 339 transactions and five exclusions are listed. The mean value increases constantly over time with an exception in the second time period. The median increases too and gives also a good signal for closing the information gap between insiders and the public, see Table 5.

The results are statistically significant for both test statistics at the event day. For the last time period the results are also statistically significant for the first test statistic.

7.1.2 Sales Transactions

7.1.2.1 Total sample 2005 – 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	3.106	-0.010	0.098	1.352	1.432
Median	1.016	0.062	-0.176	1.564	2.773
Percentage of positive CARs	51.91%	49.85%	47.27%	58.19%	55.57%
Standard deviation	13.100	10.889	4.051	15.946	36.123
Böhmer et. al - t_B	7.2851	-0.0285	0.7559	2.6264	1.2315
Kolari and Pynönnen - t_{AB}	2.6487	-0.0121	0.4726	1.0125	0.4000
p-Value t_B	0.0000	0.3988	0.2998	0.0127	0.1869
p-Value t_{AB}	0.0120	0.3989	0.3568	0.2389	0.3683

Table 6 Mean, Median, Percentage of positive CARs and Standard Deviation for Sales Transactions in Total

The total sales transactions are 1,034 with 63 exclusions because of insufficient estimation periods in the total sample. The mean value of the CARs is lowest in the second time period, see Table 6.

The results are statistically significant for the first time period for both test statistics. The first test statistic by Boehmer is also statistically significant for the fourth time period.

7.1.2.2 Before Crisis Period 2005 – 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	1.010	0.162	-0.078	1.115	1.456
Median	0.313	-0.067	-0.105	1.967	2.336
Percentage of positive CARs	50.63%	49.79%	46.25%	64.38%	61.46%
Standard deviation	13.181	10.959	4.071	16.043	36.391
Böhmer et. al - t_B	1.6497	0.0975	-0.1788	0.8312	0.6330
Kolari and Pynönnen - t_{AB}	0.5591	0.0394	-0.0994	0.3200	0.2049
p-Value t_B	0.1023	0.3970	0.3926	0.2824	0.3265
p-Value t_{AB}	0.3412	0.3986	0.3970	0.3790	0.3907

Table 7 Mean, Median, Percentage of positive CARs and Standard Deviation for Sales Transactions before the crisis

Before the crisis are 540 transactions and 60 exclusions analyzed. The mean value is the lowest on the event day. The first and last time period are similar but not when looking on the median. See Table 7 for displayed values.

The results are not statistically significant for any time period and the null hypothesis cannot be rejected.

7.1.2.3 Crisis Period 07/2007 – 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	3.179	1.533	-0.046	-3.063	-6.097
Median	1.549	0.672	-0.102	-0.785	-1.234
Percentage of positive CARs	57.38%	55.27%	46.84%	45.99%	46.19%
Standard deviation	13.253	11.023	4.096	16.125	36.646
Böhmer et. al - t_B	3.9615	2.6484	-0.1377	-1.6953	-1.4027
Kolari and Pynönnen - t_{AB}	2.7697	1.9585	-0.1191	-1.2528	-1.0412
p-Value t_B	0.0002	0.0120	0.3952	0.0948	0.1492
p-Value t_{AB}	0.0086	0.0586	0.3961	0.1820	0.2320

Table 8 Mean, Median, Percentage of positive CARs and Standard Deviation for Sales Transactions during the crisis

During the crisis 239 transactions and two exclusions are listed. The mean value falls constantly over time, leading to a possible information asymmetry during this time.

The results are significant in the first time period for both test statistics. The first test statistic is also statistically significant in the second time period. The null hypothesis can be rejected.

7.1.2.4 Post Crisis Period 2011 – 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-1.436	-1.139	0.191	-0.757	-1.590
Median	-0.090	-0.367	-0.025	1.208	1.116
Percentage of positive CARs	49.21%	44.88%	49.61%	57.87%	53.15%
Standard deviation	13.329	11.059	4.125	16.247	36.936
Böhmer et. al - t_B	-1.7823	-1.4003	0.6281	-1.1733	-1.2375
Kolari and Pynönnen - t_{AB}	-1.2362	-1.0227	0.7413	-0.8208	-0.8976
p-Value t_B	0.0815	0.1497	0.3275	0.2004	0.1855
p-Value t_{AB}	0.1858	0.2365	0.3031	0.2849	0.2667

Table 9 Mean, Median, Percentage of positive CARs and Standard Deviation for Sales Transactions after the crisis

After the crisis 255 sales transactions with one exclusion is analyzed. The mean peaks again on the event day, which is similar to the purchase analysis.

The results are not significant at any time period. The null therefore, cannot be rejected.

7.2 Hypothesis 1 – Company Size

Out of the given data for insider trades, for hypothesis 1 the company size in terms of market capitalization is used to sort out the data. All inside trades without an entry or a value of zero in the market capitalization, are not taken into consideration. After this pre- selection, all corporate inside trades which have a lower market capitalization than the mean, then are chosen for this sample.

7.2.1 Purchase Transactions

7.2.1.1 Total Sample 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.231	-0.027	0.422	-0.505	-2.121
Median	-1.076	-0.469	0.080	0.744	1.016
Percentage of positive CARs	44.96%	46.85%	51.75%	55.25%	53.98%
Standard deviation	12.158	9.809	4.014	13.997	20.163
Boehmer et. al - t_B	-0.6727	-0.0991	3.7297	-1.2799	-3.7278
Kolari and Pynönnen - t_{AB}	-0.1540	-0.0272	2.2199	-0.3272	-0.8147
p-Value t_B	0.3182	0.3970	0.0004	0.1759	0.0004
p-Value t_{AB}	0.3942	0.3988	0.0340	0.3781	0.2863

Table 10 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Purchase Transactions in Total

In total are 1323 purchased inside trades over the whole time period, of which 73 are excluded, because of an insufficient estimation period. As can be seen in Table 10, the mean value changes over the periods of time from negative 20 days prior to the event to positive at the event date and again negative after 20 days of the event.

The data is tested with two described test statistics in chapter 5 Test statistics, to determine whether the CARs are significant of zero or not and if a cross correlation of the trades exists. The interpretation of the p-value: Is the value of *p* lower than 0,05, the CARs are significant different than zero out of the data analysis and therefore the publication of the Directors' Dealings would achieve significant different CARs from zero. Is the *p-value* higher than 0,05, there cannot be made any statement regarding the significance of the CARs.

The null hypothesis is two times rejected, for the event date and 20 days after the event.

7.2.1.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.058	0.520	0.120	2.439	3.212
Median	-0.496	-0.390	-0.015	2.052	2.422
Percentage of positive CARs	47.03%	47.59%	49.01%	63.46%	65.72%
Standard deviation	11.649	8.877	3.158	8.309	11.192
Boehmer et. al - t_B	0.0934	0.4046	0.2628	2.0265	1.9809
Kolari and Pynönnen - t_{AB}	0.0714	0.3036	0.2072	1.2802	1.1490
p-Value t_B	0.3972	0.3676	0.3854	0.0512	0.0561
p-Value t_{AB}	0.3979	0.3810	0.3905	0.1758	0.2062

Table 11 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Purchase Transactions before the Crisis

For the period before the crisis 388 deals are taken into consideration, of which 35 are excluded, due to an insufficient estimation period. In Table 11 can be seen, that the mean value of the CARs is increasing over time. It can be assumed, that a full exchange of information is established.

The null hypothesis cannot be rejected for any time period or test statistic.

7.2.1.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.322	-0.089	0.454	-2.347	-6.046
Median	-1.240	-0.163	0.114	0.110	-0.918
Percentage of positive CARs	44.86%	48.07%	51.85%	50.66%	47.42%
Standard deviation	12.292	10.574	4.679	17.304	24.835
Boehmer et. al - t_B	-0.6789	-0.2183	2.5264	-3.5288	-6.3346
Kolari and Pynönnen - t_{AB}	-0.1537	-0.0598	1.5790	-0.9055	-1.3630
p-Value t_B	0.3168	0.3895	0.0164	0.0008	0.0000
p-Value t_{AB}	0.3943	0.3982	0.1147	0.2648	0.1576

Table 12 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Purchase Transactions during the Crisis

During the crisis, 709 transactions are reported for the criteria of company size, of which, 38 are excluded. This table looks familiar to the total purchase sample. Due to the high number of transactions in this period, this is also plausible.

According to Table 12, the null hypothesis can be rejected from the third time period on, for the test statistic by Boehmer.

7.2.1.4 Post Crisis Period 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.439	-0.743	0.801	0.427	1.327
Median	-1.876	-1.239	0.169	0.560	1.408
Percentage of positive CARs	41.78%	41.78%	55.56%	56.44%	55.56%
Standard deviation	12.598	8.757	2.874	7.791	10.784
Boehmer et. al - t_B	-0.5226	-1.2723	4.1831	0.8215	1.8463
Kolari and Pynönnen - t_{AB}	-0.2326	-0.6470	3.2062	0.3864	0.7170
p-Value t_B	0.3480	0.1776	0.0001	0.2847	0.0726
p-Value t_{AB}	0.3883	0.3236	0.0023	0.3702	0.3085

Table 13 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Purchase Transactions after the Crisis

In the post crisis period, 226 transactions are taken into consideration and one is excluded. In Table 13 can be seen, that the longer the time period goes on, the higher the mean value, with a slight decrease in the fourth period.

The null hypothesis can just be rejected for both test statistics for the event date period.

7.2.2 Sales Transactions

7.2.2.1 Total Sample 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.738	0.030	-0.024	-0.890	-1.900
Median	0.058	-0.131	-0.136	1.150	1.469
Percentage of positive CARs	50.24%	49.16%	46.53%	56.58%	55.50%
Standard deviation	13.877	11.599	4.344	16.906	38.599
Boehmer et. al - t_B	1.5387	0.0742	-0.1615	-1.5221	-1.4232
Kolari and Pynönnen - t_{AB}	0.6105	0.0364	-0.1157	-0.6263	-0.4558
p-Value t_B	0.1221	0.3978	0.3938	0.1253	0.1449
p-Value t_{AB}	0.3311	0.3987	0.3963	0.3279	0.3596

Table 14 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Sales Transactions in Total

There are 879 sales transactions taken into consideration, which met the requirements of hypothesis 1. Out of those, 43 transactions are excluded because of an insufficient estimation period. In Table 14 a decrease of the mean over time can be seen.

The null hypothesis cannot be rejected for any time period and no significant results are given.

7.2.2.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.705	-0.045	-0.139	0.854	0.617
Median	-0.072	-0.275	-0.140	1.913	2.087
Percentage of positive CARs	48.44%	47.96%	45.80%	62.59%	58.99%
Standard deviation	14.058	11.071	2.930	8.641	14.782
Boehmer et. al - t_B	1.0243	-0.0257	-0.2985	0.6226	0.2631
Kolari and Pynönnen - t_{AB}	0.4437	-0.0133	-0.1894	0.2922	0.0992
p-Value t_B	0.2361	0.3988	0.3816	0.3287	0.3854
p-Value t_{AB}	0.3615	0.3989	0.3919	0.3823	0.3970

Table 15 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Sales Transactions before the Crisis

In the before the crisis period, the mean of the CARs drops till the event date, just to rise again in the following two periods, as shown in Table 15. There are 458 transactions listed, of which 41 are excluded due to an insufficient estimation period.

For all estimation periods, the null hypothesis cannot be rejected.

7.2.2.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	3.327	1.699	-0.033	-4.229	-7.581
Median	1.797	1.169	-0.210	-1.445	-1.602
Percentage of positive CARs	58.17%	58.65%	44.23%	42.79%	44.71%
Standard deviation	12.984	9.372	5.489	29.365	70.843
Boehmer et. al - t_B	3.6953	2.6150	-0.0861	-2.0771	-1.5434
Kolari and Pynönnen - t_{AB}	3.0438	2.1700	-0.0752	-1.4287	-1.0256
p-Value t_B	0.0004	0.0131	0.3975	0.0461	0.1212
p-Value t_{AB}	0.0039	0.0379	0.3978	0.1438	0.2358

Table 16 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Sales Transactions during the Crisis

During the crisis 209 sales transactions, of which one is excluded, are analyzed. In Table 16 it is clearly seen that the mean of the CARs is decreasing over time. This can be interpreted as a shifted information gap, between insiders and the market.

For three time periods, the results are statistically significant and can be interpreted as stated above according to the Boehmer test statistic. Following the test statistic of Kolari and Pynönnen, just two time periods are statistically significant.

7.2.2.4 Post Crisis Period 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-1.747	-1.468	0.211	-1.045	-1.274
Median	-1.016	-0.880	0.008	1.386	1.797
Percentage of positive CARs	45.97%	42.18%	50.24%	58.29%	59.24%
Standard deviation	13.970	14.163	5.313	11.022	22.345
Boehmer et. al - t_B	-1.8167	-1.5056	0.5758	-1.3766	-0.8281
Kolari and Pynönnen - t_{AB}	-0.8190	-0.7556	0.4494	-0.6823	-0.3578
p-Value t_B	0.0766	0.1284	0.3380	0.1547	0.2831
p-Value t_{AB}	0.2853	0.2999	0.3606	0.3161	0.3742

Table 17 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 1 for Sales Transactions after the Crisis

For the post crisis period, 212 transactions with one exclusion are analyzed. The mean for this period rises till the event date to fall afterwards again, as can be seen in Table 17.

The results for the post crisis period are not statistically significant for any time period and therefore the null hypothesis cannot be rejected at any time or test statistic.

7.3 Hypothesis 2 - CEO

In hypothesis 2, the job function and executive level of the insider is important and is sorted out of the given data set. All insider transactions without a job description, as well as all insiders who are not clearly marked as a CEO, are not taken into consideration for this hypothesis.

7.3.1 Purchase Transactions

7.3.1.1 Total Sample 2005 - 2013

There are 155 purchase transactions of which 11 are excluded because of an insufficient estimation period. In Table 18 the mean value of the CARs peaks at the event day and falls again towards the end of the observed time windows.

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-1.031	-0.799	1.753	-0.710	-2.610
Median	-1.644	-0.821	0.873	1.071	-1.302
Percentage of positive CARs	43.06%	47.59%	64.14%	56.55%	47.59%
Standard deviation	14.599	12.631	6.575	13.680	17.751
Boehmer et. al - t_B	-0.8472	-0.7617	3.2103	-0.6252	-1.7704
Kolari and Pynönnen - t_{AB}	-0.1136	-0.3820	2.7372	-0.3046	-0.7897
p-Value t_B	0.2787	0.2985	0.0023	0.3281	0.0832
p-Value t_{AB}	0.3964	0.3709	0.0094	0.3809	0.2921

Table 18 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Purchase Transactions in Total

The null hypothesis can just be rejected for both test statistics for the event day period.

7.3.1.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-1.569	-0.282	1.586	1.282	1.561
Median	-7.479	-3.010	0.855	2.659	2.516
Percentage of positive CARs	37.50%	37.50%	58.33%	62.50%	66.67%
Standard deviation	16.602	12.349	5.099	8.165	9.877
Boehmer et. al - t_B	-0.4629	-0.6140	8.3493	4.2151	4.2407
Kolari and Pynönnen - t_{AB}	-0.4084	-0.5287	7.2284	3.6758	3.8507
p-Value t_B	0.3584	0.3304	0.0000	0.0001	0.0000
p-Value t_{AB}	0.3670	0.3469	0.0000	0.0005	0.0002

Table 19 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Purchase Transactions before the Crisis

Before the crisis 26 transactions happened, of which are two excluded. The mean value increases over time and indicates, that the informational gap between the insiders and the market equalizes over time. Table 19 lists the values for the mean and median values of the CARs over the time periods.

The results for the indication stated above are statistically significant for both test statistics from the event day on.

7.3.1.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.470	-0.350	1.912	-1.833	-4.980
Median	-0.708	0.515	0.873	0.659	-2.567
Percentage of positive CARs	47.78%	56.04%	65.93%	53.85%	40.66%
Standard deviation	16.032	14.320	7.704	16.127	21.132
Boehmer et. al - t_B	-0.2782	-0.2335	2.3681	-1.0843	-2.2480
Kolari and Pynönnen - t_{AB}	-0.1192	-0.1162	2.1176	-0.5271	-0.9729
p-Value t_B	0.3838	0.3882	0.0242	0.2216	0.0319
p-Value t_{AB}	0.3961	0.3963	0.0424	0.3472	0.2485

Table 20 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Purchase Transactions during the Crisis

During the crisis period 99 transactions with nine exclusions are analyzed. In Table 20, the mean value peaks for the event day and decreases afterwards again.

The results for the crisis period are statistically significant in two time periods for Boehmer and for the event day for Kolari and Pynnönen and therefore reject the null hypothesis.

7.3.1.4 Post Crisis Period 2011 - 2013

2011 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-2.281	-2.573	1.403	1.101	1.243
Median	-1.646	-1.932	0.955	0.865	0.534
Percentage of positive CARs	33.33%	30.00%	63.33%	60.00%	53.33%
Standard deviation	6.381	5.058	2.957	7.508	7.115
Boehmer et. al - t_B	-1.9583	-2.7860	2.5981	0.8033	0.9565
Kolari and Pynönnen - t_{AB}	-1.6349	-2.6239	2.4739	0.7950	0.7565
p-Value t_B	0.0586	0.0082	0.0136	0.2889	0.2525
p-Value t_{AB}	0.1048	0.0128	0.0187	0.2909	0.2997

Table 21 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Purchase Transactions after the Crisis

After the crisis 30 trades and zero exclusions are analyzed and summed up in Table 21. The full informational gap closes steadily over time, between the insiders and the market.

The results for this finding are statistically significant in two time periods. Therefore, the null hypothesis can be rejected.

7.3.2 Sales Transactions

7.3.2.1 Total Sample 2005 - 2013

2005 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	1.888	1.877	-0.212	-6.669	-19.795
Median	1.080	0.924	-0.383	1.387	0.836
Percentage of positive CARs	54.72%	52.83%	41.51%	56.60%	54.72%
Standard deviation	14.815	8.766	3.306	54.309	135.266
Boehmer et. al - t_B	0.9277	1.5587	-0.4670	-0.8939	-1.0654
Kolari and Pynönnen - t_{AB}	0.7829	1.3116	-0.4368	-0.7696	-0.9065
p-Value t_B	0.2594	0.1184	0.3577	0.2675	0.2262
p-Value t_{AB}	0.2936	0.1688	0.3626	0.2967	0.2645

Table 22 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Sales Transactions in Total

There are 65 sales transactions in total with 12 exclusions due to an insufficient estimation period for hypothesis 2. The mean value decreases over time dramatically, as shown in Table 22.

The results for the total sales sample are not statistically significant and can be seen above.

7.3.2.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	2.793	1.226	-1.798	4.064	5.718
Median	-0.382	-1.507	-1.552	4.960	9.302
Percentage of positive CARs	35.71%	42.86%	14.29%	78.57%	85.71%
Standard deviation	11.278	10.151	2.095	5.103	10.529
Boehmer et. al - t_B	0.9268	1.5581	-11.0713	10.2702	7.0028
Kolari and Pynönnen - t_{AB}	0.8506	1.4862	-10.7570	9.9040	6.5018
p-Value t_B	0.2597	0.1185	0.0000	0.0000	0.0000
p-Value t_{AB}	0.2778	0.1322	0.0000	0.0000	0.0000

Table 23 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Sales Transactions before the Crisis

There are 26 transactions and 12 exclusion before the crisis. The mean value drops to the lowest point on the event day before rising again afterwards, as seen in Table 23.

The null hypothesis can be rejected from the event day on for both test statistics.

7.3.2.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	7.550	7.983	-0.195	-30.262	-85.419
Median	8.925	3.123	-0.383	-0.544	-4.914
Percentage of positive CARs	69.23%	84.62%	30.77%	46.15%	30.77%
Standard deviation	23.930	10.585	1.251	108.567	269.272
Boehmer et. al - t_B	1.1375	2.7193	-0.5629	-1.0050	-1.1438
Kolari and Pynönnen - t_{AB}	1.0062	2.0778	-0.4805	-0.8112	-0.9598
p-Value t_B	0.2089	0.0099	0.3405	0.2408	0.2074
p-Value t_{AB}	0.2405	0.0461	0.3554	0.2871	0.2517

Table 24 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Sales Transactions during the Crisis

There are 13 sales transactions and no exclusions during the crisis. The mean value drops over time dramatically, which can be a reason for the outcome of the total sample. The values for the mean and median as well as the results are in Table 24.

The results are statistically significant for both test statistics for the second time period and the null hypothesis can be rejected.

7.3.2.4 Post Crisis Period 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-1.431	-0.826	0.634	-0.652	-0.720
Median	0.597	-0.639	0.310	0.436	0.118
Percentage of positive CARs	57.69%	42.31%	61.54%	50.00%	50.00%
Standard deviation	9.322	5.025	4.188	8.497	14.637
Boehmer et. al - t_B	-0.7825	-0.8383	0.7715	-0.3910	-0.2507
Kolari and Pynönnen - t_{AB}	-0.6862	-0.7860	0.8288	-0.3552	-0.2049
p-Value t_B	0.2937	0.2807	0.2963	0.3696	0.3866
p-Value t_{AB}	0.3153	0.2929	0.2830	0.3746	0.3907

Table 25 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 2 for Sales Transactions after the Crisis

In the post crisis period are 26 transactions listed and zero exclusions. In this time period, the mean value peaks at the event date, to drop again afterwards, as can be seen in Table 25.

No time period of the post crisis time is statistically significant, and the null hypothesis cannot be rejected.

7.4 Hypothesis 3 – Relative Transaction Value

For hypothesis 3 all transactions which have relative to the market value zero percent, an error occurs and either the market value or the transaction volume is missing, are excluded. After the exclusion, transactions which have higher relative transaction to market value than the mean, are taken into consideration for this hypothesis.

Due to the small sample size, the counterpart of the selected sample is also investigated in this section. Headers stating *"above the mean"* conclude results for transactions, which are relative higher than transaction to market values

7.4.1 Purchase Transactions

7.4.1.1 Total Sample above the mean 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-2.880	-1.862	0.077	-1.211	-3.158
Median	-1.489	-1.256	-0.087	0.089	1.924
Percentage of positive CARs	39.67%	42.56%	46.31%	50.41%	56.97%
Standard deviation	8.238	7.141	2.577	13.157	22.500
Boehmer et. al - t_B	-5.4382	-4.0568	0.4685	-1.4381	-2.1924
Kolari and Pynönnen - t_{AB}	-1.8808	-1.7283	0.3362	-0.5712	-0.7278
p-Value t_B	0.0000	0.0001	0.3575	0.1418	0.0361
p-Value t_{AB}	0.0680	0.0896	0.3770	0.3389	0.3061

Table 26 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions in Total

There are 255 purchase transactions with eleven exclusions because of an insufficient estimation period in total for this hypothesis. In Table 26 can be seen, that the mean value for the CARs increases over the time periods, before it falls again in the end, while the median increases constantly over the time periods.

The results are statistically significant for the Boehmer test statistic for the first two and the last time periods and the null hypothesis can be rejected.

7.4.1.2 Total Sample below the mean 2005 – 2013

2005 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-1.022	-0.215	1.013	-0.738	-4.092
Median	-1.786	-0.452	-0.194	1.353	-0.041
Percentage of positive CARs	44.28%	46.00%	52.85%	56.34%	53.88%
Standard deviation	12.178	9.762	4.005	14.225	20.705
Böhmer et. al - t_B	-2.9713	-0.7815	8.8954	-1.8428	-6.9998
Kolari and Pynönnen - t_{AB}	-0.4330	-0.1827	5.0549	-0.4090	-1.3556
p-Value t_B	0.0048	0.2940	0.0000	0.0730	0.0000
p-Value t_{AB}	0.3632	0.3923	0.0000	0.3669	0.1592

Table 27 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions in Total

The counterpart sample has 1,329 transactions in total and 71 exclusions due to insufficient estimation periods. The mean of the CARs peaks at the event day and falls again to the end. This is similar to its counterpart.

The null hypothesis can be rejected for three time periods for the first test statistic and once for the second, see Table 27.

7.4.1.3 Before Crisis Period above the mean 2005 - 06/2007

2005 - 06/2007	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-1.567	-0.512	-0.031	2.859	4.841
Median	0.348	0.340	-0.087	2.660	6.890
Percentage of positive CARs	50.00%	54.41%	45.59%	60.29%	76.47%
Standard deviation	7.035	4.139	1.281	5.832	7.963
Boehmer et. al - t_B	-1.8366	-2.0045	-0.3946	8.0552	9.9891
Kolari and Pynönnen - t_{AB}	-1.0887	-1.2463	-0.2875	4.7563	5.3825
p-Value t_B	0.0739	0.0535	0.3691	0.0000	0.0000
p-Value t_{AB}	0.2206	0.1835	0.3828	0.0000	0.0000

Table 28 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions Before the Crisis

Before the crisis are 72 transactions with four exclusions and the mean value increases constantly over time, leading again to the assumption, that the informational gap is closed over time. The values are displayed in Table 28.

For the finding above, just the last two time periods are statistically significant for both test statistics.

7.4.1.4 Before Crisis Period below the mean 2005 - 06/2007

2005 - 06/2007	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.114	0.334	0.180	2.606	2.948
Median	-0.713	-0.544	0.004	2.227	1.920
Percentage of positive CARs	44.88%	45.48%	50.00%	64.46%	64.16%
Standard deviation	12.195	9.789	4.011	14.195	20.655
Böhmer et. al - t_B	-0.1725	0.2602	0.3969	2.1488	1.8467
Kolari and Pynönnen - t_{AB}	-0.1414	0.1910	0.3008	1.2744	1.0062
p-Value t_B	0.3931	0.3857	0.3687	0.0397	0.0725
p-Value t_{AB}	0.3950	0.3917	0.3813	0.1771	0.2405

Table 29 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions Before the Crisis

Before the crisis the counter sample has 364 transactions and 32 exclusions. The mean value increases over the time periods with a short decrease on the event day. The informational gap is closed as stated above in Table 29.

Only one time period for the first test statistic has a statistically significant result and the null hypothesis can be rejected.

7.4.1.5 Crisis Period above the mean 07/2007 - 2010

07/2007 - 2010	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-4.278	-3.051	0.099	-3.975	-8.547
Median	-3.555	-2.503	-0.138	-1.469	-2.549
Percentage of positive CARs	32.58%	34.85%	47.01%	44.78%	44.78%
Standard deviation	9.394	8.734	3.239	16.032	27.528
Boehmer et. al - t_B	-5.2327	-4.0142	0.3526	-2.8703	-3.5942
Kolari and Pynönnen - t_{AB}	-1.9159	-1.7526	0.2625	-1.1103	-1.1409
p-Value t_B	0.0000	0.0001	0.3749	0.0065	0.0006
p-Value t_{AB}	0.0637	0.0859	0.3854	0.2154	0.2081

Table 30 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions during the Crisis

During the crisis 141 transactions with nine exclusions are analyzed. The mean value peaks during the event day and falls again afterwards as is shown in Table 30.

The results are statistically significant for the Boehmer test statistic, except for the event day period.

7.4.1.6 Crisis Period below the mean 07/2007 - 2010

07/2007 - 2010	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.305	-0.056	0.474	-2.346	-6.535
Median	-0.948	-0.141	0.133	0.324	-0.850
Percentage of positive CARs	45.70%	48.30%	52.95%	52.06%	47.64%
Standard deviation	12.244	9.815	4.002	14.267	20.759
Böhmer et. al - t_B	-0.6460	-0.1404	2.6498	-3.4853	-6.6708
Kolari and Pynönnen - t_{AB}	-0.1382	-0.0362	1.6291	-0.8444	-1.3731
p-Value t_B	0.3238	0.3950	0.0119	0.0009	0.0000
p-Value t_{AB}	0.3951	0.3987	0.1058	0.2793	0.1554

Table 31 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions during the Crisis

A total of 710 transactions and 36 exclusions are taken into consideration during the crisis. The mean value changes for transactions below the mean similar to transactions above the mean and is displayed in Table 31.

For the first test statistic are statistically significant results calculated from the event day on.

7.4.1.7 Post Crisis Period above the mean 2011 - 2013

2011 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.609	-0.310	0.184	1.017	1.086
Median	-0.619	-0.064	-0.172	2.080	4.225
Percentage of positive CARs	45.24%	47.62%	45.24%	52.38%	64.29%
Standard deviation	4.649	4.192	1.605	8.841	14.746
Boehmer et. al - t_B	-0.8496	-0.4793	0.7436	0.7458	0.4772
Kolari and Pynönnen - t_{AB}	-0.5662	-0.3548	0.6662	0.5475	0.3017
p-Value t_B	0.2781	0.3556	0.3026	0.3021	0.3560
p-Value t_{AB}	0.3398	0.3746	0.3195	0.3434	0.3812

Table 32 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions after the Crisis

After the crisis 42 transactions occur with zero exclusions. The mean value increases constantly over the time periods leading to the assumption, that the informational gap is being closed at the end, as seen in Table 32.

The results for the post crisis period are not statistically significant and the assumption can therefore not be made.

7.4.1.8 Post Crisis Period below the mean 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_0	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.809	-1.033	0.771	0.339	1.316
Median	-2.178	-1.307	0.193	0.704	1.549
Percentage of positive CARs	39.68%	40.48%	56.35%	57.14%	57.14%
Standard deviation	12.294	9.847	4.017	14.322	20.795
Böhmer et. al - t_B	-1.0565	-1.9278	4.3633	0.6651	1.8473
Kolari and Pynönnen - t_{AB}	-0.3592	-0.7465	3.0946	0.2441	0.5587
p-Value t_B	0.2283	0.0622	0.0000	0.3198	0.0724
p-Value t_{AB}	0.3740	0.3019	0.0033	0.3872	0.3413

Table 33 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Purchase Transactions after the Crisis

After the crisis 255 transactions and three exclusions occur for transactions above the mean. The mean value is increasing over the time periods like its counterpart, see Table 33.

Both test statistics have statistically significant results on the event day and reject the null hypothesis.

7.4.2 Sales Transactions

7.4.2.1 Total Sample above the mean 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_0	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.761	0.769	-0.259	1.577	1.678
Median	0.514	0.349	-0.104	2.171	1.512
Percentage of positive CARs	58.60%	53.50%	47.13%	60.51%	57.96%
Standard deviation	6.905	4.677	1.514	7.895	12.343
Boehmer et. al - t_B	1.3807	2.0598	-2.1421	2.5023	1.7031
Kolari and Pynönnen - t_{AB}	0.7683	1.1733	-1.4004	1.4652	0.9556
p-Value t_B	0.1538	0.0478	0.0402	0.0174	0.0936
p-Value t_{AB}	0.2970	0.2004	0.1496	0.1364	0.2527

Table 34 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions in Total

164 sales transactions with seven exclusions because of insufficient estimation periods are analyzed for hypothesis 3 in total. The mean value has its lowest value, as well as the median at the event day, which can be seen in Table 34.

The results are statistically significant for three time periods for the first test statistic and the null hypothesis cannot be rejected for the rest of the time period.

7.4.2.2 Total Sample below the mean 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	3.106	-0.010	0.098	1.352	1.432
Median	1.016	0.062	-0.176	1.564	2.773
Percentage of positive CARs	51.43%	49.52%	47.19%	58.54%	55.57%
Standard deviation	13.162	10.974	4.098	16.091	36.514
Böhmer et. al - t_B	7.1373	-0.0278	0.7362	2.5652	1.2009
Kolari and Pynönnen - t_{AB}	2.6280	-0.0120	0.4644	1.0012	0.3950
p-Value t_B	0.0000	0.3988	0.3042	0.0149	0.1940
p-Value t_{AB}	0.0126	0.3989	0.3582	0.2417	0.3690

Table 35 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions in Total

The total sales sample counterpart concludes of 986 transactions and 43 exclusions. After a drastic drop of the mean value in the first two time periods, the CAR values increase again, see Table 35.

The results show a significance for both test statistics in the first time period. In the third time period is just a significance for the first test statistic given.

7.4.2.3 Before Crisis Period above the mean 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.336	0.627	-0.184	1.891	3.381
Median	0.690	0.508	-0.142	2.555	4.208
Percentage of positive CARs	59.46%	55.41%	44.59%	62.16%	71.62%
Standard deviation	5.997	4.654	1.435	6.885	12.602
Boehmer et. al - t_B	0.4825	2.1671	-2.0676	4.4202	4.3178
Kolari and Pynönnen - t_{AB}	0.3451	1.5872	-1.5847	3.2308	3.0076
p-Value t_B	0.3551	0.0381	0.0471	0.0000	0.0000
p-Value t_{AB}	0.3759	0.1132	0.1137	0.0022	0.0043

Table 36 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions before the Crisis

There are 81 transactions before the crisis and seven exclusions, resulting in a mean value low at the event day, before rising towards the end of the time period, as can be seen in Table 36.

The results are statistically significant for the first test statistic and the null hypothesis can be rejected, except the first time period. The second test statistic is statistically significant for the last two time periods.

7.4.2.4 Before Crisis Period below the mean 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.774	-0.019	-0.134	1.107	1.159
Median	-0.041	-0.261	-0.142	1.967	2.252
Percentage of positive CARs	49.67%	49.02%	45.34%	64.86%	61.17%
Standard deviation	13.246	11.048	4.119	16.193	36.793
Böhmer et. al - t_B	1.2362	-0.0114	-0.3091	0.8536	0.5230
Kolari and Pynönnen - t_{AB}	0.4266	-0.0047	-0.1743	0.3343	0.1723
p-Value t_B	0.1858	0.3989	0.3803	0.2771	0.3479
p-Value t_{AB}	0.3643	0.3989	0.3929	0.3773	0.3931

Table 37 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions before the Crisis

Before the crisis 502 transactions with 41 exclusions occur. The mean value of the CARs drops till the event day before rising again, as is shown in Table 37

The null hypothesis cannot be rejected for any time period or test statistic.

7.4.2.5 Crisis Period above the mean 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	2.278	1.993	-0.388	0.822	2.459
Median	0.302	-0.282	0.031	4.916	8.033
Percentage of positive CARs	51.61%	48.39%	58.06%	54.84%	61.29%
Standard deviation	9.709	6.043	1.726	13.394	18.155
Boehmer et. al - t_B	1.3063	1.8359	-1.2531	0.3418	0.7541
Kolari and Pynönnen - t_{AB}	0.7504	1.2071	-0.9698	0.2216	0.4632
p-Value t_B	0.1700	0.0740	0.1819	0.3763	0.3002
p-Value t_{AB}	0.3011	0.1925	0.2493	0.3893	0.3584

Table 38 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions during the Crisis

During the crisis 31 transactions and zero exclusions occur. The mean value dropped from a beginning high, to its lowest at the event day and rising again after, which can be seen in Table 38. The null hypothesis cannot be rejected for any time period.

7.4.2.6 Crisis Period below the mean 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	3.195	1.502	-0.037	-3.133	-6.081
Median	1.546	0.623	-0.091	-0.861	-0.883
Percentage of positive CARs	57.26%	55.13%	47.44%	45.73%	46.58%
Standard deviation	13.321	11.115	4.146	16.279	37.058
Böhmer et. al - t_B	3.9321	2.5648	-0.1080	-1.7127	-1.3872
Kolari and Pynönnen - t_{AB}	2.7581	1.9022	-0.0936	-1.2694	-1.0316
p-Value t_B	0.0002	0.0149	0.3966	0.0920	0.1524
p-Value t_{AB}	0.0089	0.0653	0.3972	0.1782	0.2343

Table 39 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions during the Crisis

There are 231 transactions and one exclusion during the crisis for sales. The mean value falls constantly over time leading to the assumption, that the informational gap between insiders and the market grows. See Table 39 for the results and values.

For the test statistic by Boehmer, the first two time periods have significant results. The test statistic by Kolari and Pynnönen has statistically significant results for the first time period. The null hypothesis can be rejected for those periods. The assumption from above cannot be clearly confirmed.

7.4.2.7 Post Crisis Period above the mean 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.461	0.241	-0.288	1.579	-1.212
Median	0.113	0.313	-0.183	1.491	-1.759
Percentage of positive CARs	61.54%	53.85%	44.23%	61.54%	36.54%
Standard deviation	6.097	3.632	1.515	4.097	5.629
Boehmer et. al - t_B	0.5449	0.4792	-1.3695	2.7791	-1.5532
Kolari and Pynönnen - t_{AB}	0.2377	0.2204	-0.6829	1.3168	-0.6892
p-Value t_B	0.3439	0.3557	0.1562	0.0084	0.1194
p-Value t_{AB}	0.3878	0.3894	0.3160	0.1677	0.3146

Table 40 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions after the Crisis

After the crisis 52 transactions with zero exclusion are analyzed. The mean value changes unsymmetrically over time and no clear assumption can be made, as seen in Table 40.

For the post crisis period, just one time period has statistically significant results and the null hypothesis can be rejected.

7.4.2.8 Post Crisis Period below the mean 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-1.421	-1.149	0.198	-0.606	-1.506
Median	-0.090	-0.367	0.017	1.388	1.397
Percentage of positive CARs	49.19%	45.16%	50.40%	58.87%	53.63%
Standard deviation	13.400	11.153	4.176	16.406	37.361
Böhmer et. al - t_B	-1.7253	-1.3794	0.6371	-0.9231	-1.1455
Kolari and Pynönnen - t_{AB}	-1.2041	-1.0130	0.7484	-0.6497	-0.8356
p-Value t_B	0.0901	0.1541	0.3257	0.2605	0.2070
p-Value t_{AB}	0.1932	0.2388	0.3015	0.3230	0.2814

Table 41 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 3 for Sales Transactions after the Crisis

The counterpart of the after-crisis sample has 249 transactions and one exclusion. The mean value peaks at the event day, which can be seen in Table 41.

There are no statistically significant results for neither one of the test statistics given.

7.5 Hypothesis 4 – Absolute Transaction Value

For hypothesis 4 all transactions where an error occurs and either the market value or the transaction volume is missing, are excluded. After the exclusion, transactions which have higher absolute transaction to market values than the mean, are taken into consideration for this hypothesis.

Due to the small sample size, the counterpart of the selected sample is also investigated in this section. Headers stating *"above the mean"* conclude results for transactions, which are absolute higher than transaction to market values.

7.5.1 Purchase Transactions

7.5.1.1 Total Sample above the mean 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.103	0.589	0.009	-4.040	-8.946
Median	-0.907	0.334	-0.100	1.064	-1.369
Percentage of positive CARs	42.86%	51.43%	47.14%	52.86%	48.57%
Standard deviation	8.839	6.907	2.535	17.132	24.299
Boehmer et. al - t_B	-0.0974	0.7130	0.0304	-1.9732	-3.0802
Kolari and Pynönnen - t_{AB}	-0.0475	0.4249	0.0273	-1.0898	-1.4256
p-Value t_B	0.3971	0.3094	0.3988	0.0569	0.0035
p-Value t_{AB}	0.3985	0.3645	0.3988	0.2203	0.1444

Table 42 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions in Total

For the total sample 74 purchase transactions with four exclusions due to insufficient estimation periods for hypothesis 4 are analyzed. The mean value, untypically for purchase transactions, decreases over time in total, which can be seen in Table 42.

The first test statistic shows a statistically significant result for the last time period, and the null hypothesis can be rejected.

7.5.1.2 Total Sample below the mean 2005 - 2013

2005 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.461	-0.203	1.058	-0.369	-3.760
Median	-1.129	-0.261	-0.074	1.132	-0.155
Percentage of positive CARs	43.54%	45.38%	51.82%	55.32%	54.82%
Standard deviation	11.855	9.558	3.808	13.946	21.077
Böhmer et. al - t_B	-1.5613	-0.8531	11.0079	-1.0644	-7.1617
Kolari and Pynönnen - t_{AB}	-0.2384	-0.1774	5.7331	-0.2098	-1.2300
p-Value t_B	0.1179	0.2772	0.0000	0.2264	0.0000
p-Value t_{AB}	0.3878	0.3927	0.0000	0.3903	0.1872

Table 43 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions in Total

There are 1,633 transactions and 93 exclusions because of insufficient estimation periods for the total purchase transactions. The mean value of the CARs is changing unsymmetrically over the time periods and can be seen in Table 43.

For the event day both and for the last time period the first test statistic has statistically significant results. The null hypothesis can be rejected for those.

7.5.1.3 Before Crisis Period above the mean 2005 - 06/2007

2005 - 06/2007	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	1.250	3.352	0.000	10.647	8.805
Median	0.478	4.626	-0.025	11.907	7.125
Percentage of positive CARs	71.43%	71.43%	42.86%	85.71%	100.00%
Standard deviation	6.128	3.595	1.221	5.818	5.443
Boehmer et. al - t_B	0.5396	9.3382	-0.0030	18.3260	16.2009
Kolari and Pynönnen - t_{AB}	0.4617	7.9037	-0.0022	14.2290	11.9765
p-Value t_B	0.3449	0.0000	0.3989	0.0000	0.0000
p-Value t_{AB}	0.3586	0.0000	0.3989	0.0000	0.0000

Table 44 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions before the Crisis

Before the crisis period, 8 transactions with one exclusion is observed. The mean value is changing over the time periods and no clear assumption can be made. Although due to the small sample of eight transactions, a limited statement is possible. The values for the mean and median CARs are listed above in Table 44.

For the limited sample, clear statistically significant results are calculated for three time periods.

7.5.1.4 Before Crisis Period below the mean 2005 - 06/2007

2005 - 06/2007	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.357	0.186	0.063	2.563	3.453
Median	-0.652	-0.390	-0.025	2.163	2.651
Percentage of positive CARs	45.43%	47.12%	48.32%	62.98%	66.35%
Standard deviation	11.865	9.578	3.811	13.919	21.042
Böhmer et. al - t_B	-0.6182	0.1359	0.1342	1.9982	1.9618
Kolari and Pynönnen - t_{AB}	-0.4871	0.0944	0.0967	1.0984	0.9849
p-Value t_B	0.3295	0.3953	0.3954	0.0542	0.0582
p-Value t_{AB}	0.3543	0.3972	0.3971	0.2182	0.2456

Table 45 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions before the Crisis

There are 451 transactions and 42 exclusions before the crisis. The mean value of the CARs increases over the time periods while dropping slightly at the event day, which can be seen in Table 45.

The results are not significant at any time or for none of the two test statistics.

7.5.1.5 Crisis Period above the mean 07/2007 - 2010

07/2007 - 2010	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	0.210	0.601	-0.260	-7.030	-12.061
Median	-2.207	-0.017	-0.175	-0.627	-4.307
Percentage of positive CARs	39.13%	50.00%	45.65%	47.83%	43.48%
Standard deviation	10.311	7.960	2.704	18.892	26.672
Boehmer et. al - t_B	0.1384	0.5124	-0.6510	-2.5239	-3.0669
Kolari and Pynönnen - t_{AB}	0.0691	0.3398	-0.6557	-1.5371	-1.4759
p-Value t_B	0.3951	0.3499	0.3228	0.0165	0.0036
p-Value t_{AB}	0.3980	0.3766	0.3218	0.1224	0.1342

Table 46 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions during the Crisis

During the crisis period, 49 transactions with three exclusions are analyzed. The mean value decreased over time and an informational gap developed over the time

For two time periods the null hypothesis can be rejected, and the results are statistically significant, seen in Table 46.

7.5.1.6 Crisis Period below the mean 07/2007 - 2010

07/2007 - 2010	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.910	-0.434	0.438	-2.648	-6.875
Median	-1.358	-0.798	0.102	0.146	-0.953
Percentage of positive CARs	43.72%	45.77%	52.08%	50.69%	47.34%
Standard deviation	11.901	9.597	3.802	13.974	21.125
Böhmer et. al - t_B	-2.1785	-1.2181	2.8753	-4.5350	-7.8002
Kolari and Pynönnen - t_{AB}	-0.4148	-0.2803	1.6325	-0.9784	-1.4272
p-Value t_B	0.0372	0.1900	0.0064	0.0000	0.0000
p-Value t_{AB}	0.3661	0.3836	0.1052	0.2472	0.1441

Table 47 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions during the Crisis

The crisis period has 860 transactions and 46 exclusions for transactions below the mean of the transaction value. The mean peaks at the event day and drops dramatically at the end of the time periods, leading to the assumption, that there is a information asymmetry, see Table 47.

The first test statistic has four statistically significant results which can be a confirmation for this assumption. But the cross-correlation is likely to be high, otherwise the second test statistic would display statistically significant results too.

7.5.1.7 Post Crisis Period above the mean 2011 - 2013

2011 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-1.508	-0.584	0.740	-1.999	-7.826
Median	-0.330	-0.715	0.015	1.435	-1.841
Percentage of positive CARs	41.18%	47.06%	52.94%	52.94%	41.18%
Standard deviation	4.542	4.132	2.391	11.074	19.114
Boehmer et. al - t_B	-1.3686	-0.5827	1.2768	-0.7441	-1.6881
Kolari and Pynönnen - t_{AB}	-0.9742	-0.3953	1.1391	-0.4775	-1.0104
p-Value t_B	0.1564	0.3367	0.1766	0.3025	0.0960
p-Value t_{AB}	0.2482	0.3690	0.2085	0.3560	0.2395

Table 48 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions after the Crisis

17 transactions with zero exclusions are analyzed for the post crisis period. In this period, the mean value peaks at the event day period, listed in Table 48.

For the last time period the null hypothesis can be rejected for the test statistic by Boehmer.

7.5.1.8 Post Crisis Period below the mean 2011 - 2013

2011 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.657	-0.674	0.681	0.697	1.639
Median	-1.328	-0.807	0.111	0.828	2.159
Percentage of positive CARs	40.72%	42.22%	55.52%	57.74%	59.82%
Standard deviation	11.937	9.620	3.812	14.015	21.156
Böhmer et. al - t_B	-1.1022	-1.5841	4.8408	1.5643	2.5701
Kolari and Pynönnen - t_{AB}	-0.3303	-0.5429	3.1826	0.5058	0.6810
p-Value t_B	0.2173	0.1138	0.0000	0.1174	0.0147
p-Value t_{AB}	0.3778	0.3443	0.0025	0.3510	0.3164

Table 49 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Purchase Transactions after the Crisis

During the post crisis period 322 transactions and five exclusions are analyzed. The mean value increases over time with a slight drop in the second time period. An information asymmetry is closed. The values are displayed in Table 49.

The event day has significant results for both test statistics. Additionally, the first test statistic has statistically significant results in the last time period.

7.5.2 Sales Transactions

7.5.2.1 Total Sample above the mean 2005 - 2013

2005 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	2.055	0.953	-0.127	-1.240	-4.505
Median	1.651	0.380	-0.197	2.283	3.814
Percentage of positive CARs	55.47%	53.28%	43.80%	62.77%	63.50%
Standard deviation	9.598	6.531	2.141	34.762	85.173
Boehmer et. al - t_B	2.5057	1.7078	-0.6918	-0.4175	-0.6191
Kolari and Pynönnen - t_{AB}	1.3545	1.0926	-0.5954	-0.2627	-0.3466
p-Value t_B	0.0173	0.0928	0.3140	0.3656	0.3294
p-Value t_{AB}	0.1594	0.2196	0.3341	0.3854	0.3757

Table 50 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions in Total

The total sample for sales transactions concludes 151 with fourteen exclusions because of insufficient estimation periods. The mean value is constantly decreasing over the time periods and a discrepancy between the insiders and the market can be assumed as shown in Table 50.

For the first time period a statistically significant result is calculated for the first test statistic, and the null hypothesis can be rejected. Nevertheless, the assumption from above cannot be shown significantly over the whole time periods.

7.5.2.2 Total Sample below the mean 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	3.106	-0.010	0.098	1.352	1.432
Median	1.016	0.062	-0.176	1.564	2.773
Percentage of positive CARs	51.91%	49.85%	47.27%	58.19%	55.57%
Standard deviation	13.100	10.889	4.051	15.946	36.123
Böhmer et. al - t_B	7.2851	-0.0285	0.7559	2.6264	1.2315
Kolari and Pynönnen - t_{AB}	2.6487	-0.0121	0.4726	1.0125	0.4000
p-Value t_B	0.0000	0.3988	0.2998	0.0127	0.1869
p-Value t_{AB}	0.0120	0.3989	0.3568	0.2389	0.3683

Table 51 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions in Total

The total sales sample has 883 transactions and 49 exclusions due to insufficient estimation periods. The mean value changes untypically and no clear assumption can be made, which can be seen in Table 51.

The test statistic by Boehmer has two significant results and the test statistic by Kolari and Pynnönen has one statistically significant result. The null hypothesis can be rejected for those.

7.5.2.3 Before Crisis Period above the mean 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	2.231	0.628	-0.297	3.912	6.098
Median	1.584	0.942	-0.283	2.283	4.288
Percentage of positive CARs	52.83%	62.26%	41.51%	73.58%	69.81%
Standard deviation	6.105	4.055	1.449	6.298	11.254
Boehmer et. al - t_B	2.6607	2.5232	-3.3337	10.1215	8.8287
Kolari and Pynönnen - t_{AB}	1.6525	1.5906	-2.7994	6.4313	5.3219
p-Value t_B	0.0116	0.0165	0.0015	0.0000	0.0000
p-Value t_{AB}	0.1018	0.1126	0.0079	0.0000	0.0000

Table 52 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions before the Crisis

Before the crisis 66 transactions and 13 exclusion are analyzed. The mean value has its low on the event day as can be seen in Table 52.

The first test statistic has statistically significant results for all time periods and the second test statistic has statistically significant results for three time periods and the null hypothesis can be rejected for those.

7.5.2.4 Before Crisis Period below the mean 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	1.010	0.162	-0.078	1.115	1.456
Median	0.313	-0.067	-0.105	1.967	2.336
Percentage of positive CARs	50.63%	49.79%	46.25%	64.38%	61.46%
Standard deviation	13.181	10.959	4.071	16.043	36.391
Böhmer et. al - t_B	1.6497	0.0975	-0.1788	0.8312	0.6330
Kolari and Pynönnen - t_{AB}	0.5591	0.0394	-0.0994	0.3200	0.2049
p-Value t_B	0.1023	0.3970	0.3926	0.2824	0.3265
p-Value t_{AB}	0.3412	0.3986	0.3970	0.3790	0.3907

Table 53 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions before the Crisis

There are 474 transactions and 47 exclusions before the crisis. The mean value is the lowest on the event day and can be seen in Table 53.

There are no significant results for one of the time periods.

7.5.2.5 Crisis Period above the mean 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	2.363	1.032	0.404	-8.210	-21.788
Median	2.189	0.338	0.038	0.560	3.186
Percentage of positive CARs	59.52%	52.38%	52.38%	52.38%	57.14%
Standard deviation	12.629	6.601	3.174	61.092	152.145
Boehmer et. al - t_B	1.2128	1.0135	0.8246	-0.8710	-0.9281
Kolari and Pynönnen - t_{AB}	1.0463	0.8894	0.7374	-0.7735	-0.6005
p-Value t_B	0.1912	0.2387	0.2840	0.2730	0.2593
p-Value t_{AB}	0.2308	0.2686	0.3040	0.2958	0.3331

Table 54 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions during the Crisis

During the crisis 43 transactions and one exclusion are observed for hypothesis 4. The mean value decreases over the time periods as can be seen in Table 54.

For all time periods and test statistics no statistical significant results are calculated. Therefore, the null hypothesis cannot be rejected.

7.5.2.6 Crisis Period below the mean 07/2007 - 2010

07/2007 - 2010	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	3.179	1.533	-0.046	-3.063	-6.097
Median	1.549	0.672	-0.102	-0.785	-1.234
Percentage of positive CARs	57.38%	55.27%	46.84%	45.99%	46.19%
Standard deviation	13.253	11.023	4.096	16.125	36.646
Böhmer et. al - t_B	3.9615	2.6484	-0.1377	-1.6953	-1.4027
Kolari and Pynönnen - t_{AB}	2.7697	1.9585	-0.1191	-1.2528	-1.0412
p-Value t_B	0.0002	0.0120	0.3952	0.0948	0.1492
p-Value t_{AB}	0.0086	0.0586	0.3961	0.1820	0.2320

Table 55 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions during the Crisis

The crisis period concludes 196 transactions and one exclusion. The mean value constantly decreases over the time periods. This leads to the assumption, that insiders have more information than the public. For values see Table 55.

Although the decrease of the mean is high, there is just significance for the first time period in both test statistics.

7.5.2.7 Post Crisis Period above the mean 2011 - 2013

2011 - 2013	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	1.524	1.283	-0.443	-0.771	-0.602
Median	0.401	-0.297	-0.197	2.366	2.465
Percentage of positive CARs	54.76%	42.86%	38.10%	59.52%	61.90%
Standard deviation	9.920	8.763	1.429	11.898	16.974
Boehmer et. al - t_B	0.9954	0.9492	-2.0063	-0.4198	-0.2300
Kolari and Pynönnen - t_{AB}	0.7126	0.7409	-1.6566	-0.3108	-0.1561
p-Value t_B	0.2431	0.2542	0.0533	0.3653	0.3885
p-Value t_{AB}	0.3095	0.3032	0.1012	0.3801	0.3941

Table 56 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions after the Crisis

After the crisis 42 transactions without exclusions are analyzed for hypothesis 4. The mean value constantly decreases over the time periods as shown in Table 56.

For none of the time periods and test statistics a statistically significant result is being calculated and therefore the null hypothesis cannot be rejected.

7.5.2.8 Post Crisis Period above the mean 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-1.436	-1.139	0.191	-0.757	-1.590
Median	-0.090	-0.367	-0.025	1.208	1.116
Percentage of positive CARs	49.21%	44.88%	49.61%	57.87%	53.15%
Standard deviation	13.329	11.059	4.125	16.247	36.936
Böhmer et. al - t_B	-1.7823	-1.4003	0.6281	-1.1733	-1.2375
Kolari and Pynönnen - t_{AB}	-1.2362	-1.0227	0.7413	-0.8208	-0.8976
p-Value t_B	0.0815	0.1497	0.3275	0.2004	0.1855
p-Value t_{AB}	0.1858	0.2365	0.3031	0.2849	0.2667

Table 57 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 4 for Sales Transactions after the Crisis

There are 213 transactions and one exclusion after the crisis. The mean value peaks at the event day before falling again to about the same level as the beginning of the observation period, see Table 57.

There are no statistically significant results given and the null hypothesis cannot be rejected at any time.

7.6 Hypothesis 5 – Transaction Frequency of Insiders

For hypothesis 5 the frequency of transactions executed by an insider is important. Therefore, insiders who bought or sold more than others, when considering the mean, are taken into consideration. This means, that over the whole sample, the mean of transactions per insider is calculated. All transactions of insiders who have a higher transaction rate than this mean, are used in the following hypothesis.

7.6.1 Purchase Transactions

7.6.1.1 Total Sample 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.887	-0.343	0.499	-0.767	-2.699
Median	-1.160	-0.935	0.147	1.217	1.318
Percentage of positive CARs	43.27%	44.27%	54.08%	56.98%	55.39%
Standard deviation	11.380	8.990	4.005	14.536	22.118
Kolari and Pynönnen - t_{AB}	-0.5409	-0.3165	2.3951	-0.4118	-0.8250
p-Value t_B	0.0158	0.1836	0.0001	0.0903	0.0001
p-Value t_{AB}	0.3446	0.3795	0.0227	0.3665	0.2839

Table 58 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Purchase Transactions in Total

For the total sample of purchase transactions more than 1107 transactions and 40 exclusions because of insufficient estimation periods are analyzed. The mean value increases over the time periods constantly before dropping in the last period, to about the same level of the beginning, and can be seen in Table 58.

For three time periods, statistically significant results are given for the first test statistic by Boehmer and for one time period by Kolari and Pynnönen. The null hypothesis can be rejected in those cases.

7.6.1.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-0.204	0.335	0.271	3.036	3.660
Median	-0.654	-0.675	0.102	2.551	2.150
Percentage of positive CARs	45.13%	45.13%	52.35%	68.95%	66.79%
Standard deviation	12.172	8.987	3.355	8.444	11.453
Boehmer et. al - t_B	-0.2788	0.3010	0.6532	2.9060	2.5825
Kolari and Pynönnen - t_{AB}	-0.2254	0.2309	0.5389	1.7412	1.5212
p-Value t_B	0.3837	0.3813	0.3223	0.0058	0.0142
p-Value t_{AB}	0.3889	0.3884	0.3450	0.0876	0.1254

Table 59 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Purchase Transactions before the Crisis

Before the crisis 293 purchase transactions with 16 exclusions are analyzed for hypothesis 5. The mean value changes to positive over the time periods and insiders perform better than the market, the longer the event window is open, compare Table 59.

Before the crisis the last time period has statistically significant results for the test statistic by Boehmer.

7.6.1.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	CAR$_{-20,-1}$	CAR$_{-10,-1}$	CAR$_{0}$	CAR$_{0,10}$	CAR$_{0,20}$
Mean	-1.005	-0.407	0.540	-2.760	-6.646
Median	-1.330	-0.858	0.154	0.404	-0.520
Percentage of positive CARs	43.88%	45.28%	53.90%	52.44%	48.86%
Standard deviation	11.994	9.731	4.616	17.379	26.544
Boehmer et. al - t_B	-2.0745	-1.0351	2.9051	-3.9409	-6.2139
Kolari and Pynönnen - t_{AB}	-0.4441	-0.2749	1.8104	-0.9744	-1.2841
p-Value t_B	0.0464	0.2335	0.0059	0.0002	0.0000
p-Value t_{AB}	0.3615	0.3842	0.0775	0.2482	0.1749

Table 60 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Purchase Transactions during the Crisis

During the crisis 640 transactions and 27 exclusions are observed and analyzed. The mean value peaks to the event day before dropping towards the end of the time periods. Leading to the assumption, that insiders who trade often perform worse than the market, the longer the observed time period is, see Table 60.

For the above-mentioned assumption, statistically significant results are being calculated for the first time period and from the event day on, for the test statistic by

Boehmer. This means, that insiders do perform worse than the market during the crisis, if they trade more than the average. No statistically significant results are calculated for the second test statistic.

7.6.1.4 Post Crisis Period 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-1.562	-1.205	0.715	0.232	1.150
Median	-1.729	-1.239	0.240	0.368	1.823
Percentage of positive CARs	38.15%	39.31%	57.47%	54.02%	60.34%
Standard deviation	6.987	5.522	2.220	8.710	12.827
Boehmer et. al - t_B	-2.9405	-2.8700	4.2460	0.3516	1.1828
Kolari and Pynönnen - t_{AB}	-1.1108	-1.2399	3.1494	0.1447	0.3957
p-Value t_B	0.0053	0.0065	0.0000	0.3750	0.1982
p-Value t_{AB}	0.2153	0.1850	0.0028	0.3948	0.3689

Table 61 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Purchase Transactions after the Crisis

The post crisis period observed 174 transactions with one exclusion. The change of the mean value is similar to the period prior to the crisis. Insiders perform slightly better than the market the longer the event window, and a full informational exchange is established, see Table 61.

For Boehmer, the first three time periods have statistically significant results and the null hypothesis can be rejected for those. For Kolari and Pynnönen the event day has statistically significant results.

7.6.2 Sales Transactions

7.6.2.1 Total Sample 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.031	0.027	-0.072	-0.010	-0.397
Median	0.167	-0.194	-0.047	1.426	1.324
Percentage of positive CARs	51.87%	49.43%	48.29%	56.26%	54.63%
Standard deviation	11.379	10.877	3.129	10.329	18.896
Boehmer et. al - t_B	0.0682	0.0613	-0.5745	-0.0239	-0.5204
Kolari and Pynönnen - t_{AB}	0.0303	0.0330	-0.4174	-0.0119	-0.2093
p-Value t_B	0.3980	0.3982	0.3383	0.3988	0.3484
p-Value t_{AB}	0.3988	0.3987	0.3657	0.3989	0.3903

Table 62 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Sales Transactions in Total

For the total sample, 661 sales transactions of which 46 are excluded due to insufficient estimation periods, are analyzed for hypothesis 5. The mean value rises and falls over the observed time periods and no clear statement can be made, as can be seen in Table 62.

For the total sales sample, no statistically significant results are being calculated for both statistics and the null hypothesis cannot be rejected.

7.6.2.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.616	0.654	-0.240	1.037	0.945
Median	0.555	-0.327	-0.120	2.283	1.869
Percentage of positive CARs	51.58%	48.42%	46.52%	62.03%	60.13%
Standard deviation	10.973	10.295	2.530	9.180	15.632
Boehmer et. al - t_B	0.9980	0.4636	-0.6927	0.8242	0.4412
Kolari and Pynönnen - t_{AB}	0.4204	0.2378	-0.4733	0.4195	0.1823
p-Value t_B	0.2424	0.3583	0.3138	0.2841	0.3620
p-Value t_{AB}	0.3652	0.3878	0.3567	0.3653	0.3924

Table 63 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Sales Transactions before the Crisis

Before the crisis 361 transactions and 45 exclusions are analyzed. The mean value has its lowest at the event day, rises after that higher than before the event, as can be seen in Table 62.

For the before crisis period, same as for the total sample, no statistically significant results are calculated.

7.6.2.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	1.674	1.320	0.027	-0.710	-0.607
Median	1.016	0.575	-0.058	-0.292	-0.041
Percentage of positive CARs	55.63%	53.64%	48.34%	46.36%	47.68%
Standard deviation	8.677	7.184	2.635	10.368	17.302
Boehmer et. al - t_B	2.3706	2.2582	0.1276	-0.8414	-0.4310
Kolari and Pynönnen - t_{AB}	2.0826	2.0482	0.1154	-0.7195	-0.3412
p-Value t_B	0.0240	0.0312	0.3957	0.2800	0.3636
p-Value t_{AB}	0.0456	0.0490	0.3963	0.3080	0.3764

Table 64 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Sales Transactions during the Crisis

The crisis period concludes 152 transactions with one exclusion. The mean value drops over time, leading to the assumption, that insiders perform worse than the market and that an informational gap is existing, see Table 64.

For the crisis period, the first two time periods have statistically significant results for both test statistics and the null hypothesis can be rejected.

7.6.2.4 Post Crisis Period 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-2.893	-2.632	0.184	-1.531	-3.047
Median	-0.371	-0.367	0.035	0.585	0.165
Percentage of positive CARs	48.65%	47.30%	52.03%	54.05%	50.00%
Standard deviation	13.923	14.307	4.467	12.253	25.521
Boehmer et. al - t_B	-2.5281	-2.2378	0.5007	-1.5200	-1.4523
Kolari and Pynönnen - t_{AB}	-1.7965	-1.5524	0.3886	-1.0442	-0.9749
p-Value t_B	0.0163	0.0326	0.3519	0.1257	0.1390
p-Value t_{AB}	0.0795	0.1196	0.3699	0.2313	0.2480

Table 65 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 5 for Sales Transactions after the Crisis

After the crisis 148 transactions without exclusions are analyzed for this sub period. The mean value peaks at the event day, showing a diametric picture over all time periods, without clear statement in Table 65.

For the first and second time period, statistically significant results are given for the test statistic by Boehmer.

7.7 Hypothesis 6 – Transaction Frequency of Insiders in Last Calendar Year

For hypothesis 6 the frequency of transactions executed by an insider in the last calendar year is important. Therefore, insiders who bought or sold more than others in the last calendar year, when considering the mean, are taken into consideration. In detail this means that every calendar year the mean transaction rate over all insiders is calculated. For the whole sample nine times and insiders who have a higher transaction rate per year than the mean of the year, are used for this calculation.

7.7.1 Purchase Transactions

7.7.1.1 Total Sample 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.179	1.018	-0.180	1.997	1.632
Median	-0.953	-0.862	-0.230	1.759	1.625
Percentage of positive CARs	42.52%	43.57%	54.19%	54.96%	55.37%
Standard deviation	11.502	9.215	4.103	13.114	22.052
Boehmer et. al - t_B	-0.4810	3.3988	-1.3450	4.6308	2.2470
Kolari and Pynönnen - t_{AB}	-0.0943	0.9012	-0.8331	1.1648	0.4941
p-Value t_B	0.3554	0.0012	0.1615	0.0000	0.0320
p-Value t_{AB}	0.3972	0.2658	0.2820	0.2024	0.3531

Table 66 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Purchase Transactions in Total

For the total sample 1002 purchase transactions with 34 exclusions because of insufficient estimation periods are analyzed. No clear statement can be made according to the change of the mean value over the time periods, as it is too inconsistent in its values and compared to the median, seen in Table 66.

Three time periods of the first test statistic have statistically significant results and the null hypothesis can be rejected. This is interesting, as no significant results are expected.

7.7.1.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.101	0.837	0.121	2.741	3.526
Median	-0.628	-0.457	-0.005	2.391	2.867
Percentage of positive CARs	44.54%	45.80%	49.58%	67.65%	68.91%
Standard deviation	11.367	9.150	4.108	13.095	22.130
Boehmer et. al - t_B	-0.1266	0.8379	0.3952	3.1516	2.7274
Kolari and Pynönnen - t_{AB}	-0.1090	0.6596	0.3194	2.0687	1.6605
p-Value t_B	0.3958	0.2808	0.3690	0.0028	0.0097
p-Value t_{AB}	0.3966	0.3209	0.3791	0.0470	0.1005

Table 67 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Purchase Transactions before the Crisis

Before the crisis 247 transactions and nine exclusions are observed and analyzed. The mean value shows a clear tendency towards a total informational exchange over all time periods. This allegation gets strengthened, through the rising number of positive CARs and a similar behavior of the median value in Table 67.

For the finding above, statistically significant results are given for the last two time periods of the first test statistic and for the fourth time period of the second test statistic. The null hypothesis can be rejected for those.

7.7.1.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.943	-0.533	0.686	-2.574	-7.285
Median	-1.600	-0.977	0.195	0.234	-0.787
Percentage of positive CARs	42.50%	44.14%	54.94%	51.17%	48.65%
Standard deviation	11.207	9.064	4.115	13.168	22.151
Boehmer et. al - t_B	-1.9315	-1.2538	3.2717	-3.9132	-6.4885
Kolari and Pynönnen - t_{AB}	-0.4541	-0.3546	2.1334	-1.0394	-1.4668
p-Value t_B	0.0618	0.1818	0.0019	0.0002	0.0000
p-Value t_{AB}	0.3599	0.3746	0.0410	0.2324	0.1361

Table 68 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Purchase Transactions during the Crisis

During the crisis 582 transactions and 29 exclusions are analyzed for the findings. The mean value peaks at the event day before falling again in Table 68.

The first test statistic has from the event day on, statistically significant results. The second test statistic has for the event day statistically significant results and the null hypothesis can be rejected.

7.7.1.4 Post Crisis Period 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_0	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-0.603	-0.776	0.691	-0.229	0.160
Median	-1.273	-1.239	0.164	-0.048	1.502
Percentage of positive CARs	39.77%	38.60%	58.14%	49.71%	58.38%
Standard deviation	11.252	9.112	4.140	13.224	22.273
Boehmer et. al - t_B	-0.7566	-1.5857	4.1604	-0.3441	0.1705
Kolari and Pynönnen - t_{AB}	-0.3041	-0.7203	3.2153	-0.1479	0.0610
p-Value t_B	0.2996	0.1135	0.0001	0.3760	0.3932
p-Value t_{AB}	0.3809	0.3078	0.0023	0.3946	0.3982

Table 69 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Purchase Transactions after the Crisis

After the crisis 173 transaction occurred of which two are excluded. As during the crisis, the mean value peaks at the event day. But the fall till the end of the time periods does not continue after the crisis and can be seen in Table 69.

Just for the event day significant results are given and the null hypothesis can be rejected.

7.7.2 Sales Transactions

7.7.2.1 Total Sample 2005 - 2013

2005 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_0	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.519	0.023	-0.155	0.671	1.548
Median	0.496	0.108	-0.313	1.967	2.252
Percentage of positive CARs	50.93%	50.74%	49.26%	54.83%	54.28%
Standard deviation	13.600	12.627	4.753	10.828	20.133
Boehmer et. al - t_B	0.8850	0.0426	-0.7558	1.4278	1.7712
Kolari and Pynönnen - t_{AB}	0.4110	0.0227	-0.5537	0.6989	0.7417
p-Value t_B	0.2697	0.3986	0.2998	0.1440	0.0831
p-Value t_{AB}	0.3666	0.3988	0.3422	0.3125	0.3030

Table 70 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Sales Transactions in Total

For the total sample 583 sales transactions and 45 exclusions because of insufficient estimation periods are analyzed for hypothesis 6. The mean value has its lowest at the event day and rising again till the end of the time periods, as can be seen Table 70.

No significant results are being calculated for the total sales sample. Therefore, no assumption can be made, whether insiders perform better or worse than the market.

7.7.2.2 Before Crisis Period 2005 - 06/2007

2005 - 06/2007	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	0.213	0.066	-0.191	0.543	0.227
Median	-0.041	-0.257	-0.044	2.136	1.724
Percentage of positive CARs	49.32%	49.66%	47.95%	61.30%	58.56%
Standard deviation	12.970	12.772	4.811	10.929	20.327
Boehmer et. al - t_B	0.2615	0.0360	-0.4811	0.3894	0.0966
Kolari and Pynönnen - t_{AB}	0.1096	0.0177	-0.3133	0.1836	0.0388
p-Value t_B	0.3855	0.3987	0.3554	0.3698	0.3971
p-Value t_{AB}	0.3966	0.3989	0.3798	0.3923	0.3986

Table 71 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Sales Transactions before the Crisis

Before the crisis, 337 transactions and 45 exclusions are analyzed. The mean value changes inconsistent over the observed time periods, leading to no clear assumption, see Table 71.

Before the crisis no statistically significant results are found and the null hypothesis cannot be rejected.

7.7.2.3 Crisis Period 07/2007 - 2010

07/2007 - 2010	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	2.549	1.978	0.592	-0.851	-1.286
Median	0.576	0.406	0.031	-1.370	-0.022
Percentage of positive CARs	55.83%	52.50%	51.67%	45.83%	48.33%
Standard deviation	13.042	12.783	4.837	10.908	20.405
Boehmer et. al - t_B	2.5611	2.1961	1.0078	-0.8434	-0.6914
Kolari and Pynönnen - t_{AB}	2.0708	1.8433	0.9317	-0.7075	-0.5814
p-Value t_B	0.0150	0.0358	0.2401	0.2795	0.3141
p-Value t_{AB}	0.0467	0.0730	0.2585	0.3106	0.3369

Table 72 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Sales Transactions during the Crisis

During the crisis 120 transaction without exclusions occurred and are analyzed. The mean value constantly drops over the observed periods of time leading to the

assumption, that insiders who trade more than others in the last 12 months perform worse during the crisis the longer the observed time period is. See Table 72 for the numbers.

For the first two time periods for the Boehmer test and for the first time period for Kolari and Pynnönen, statistically significant results are given. The null hypothesis can be rejected in these cases.

7.7.2.4 Post Crisis Period 2011 - 2013

2011 - 2013	$CAR_{-20,-1}$	$CAR_{-10,-1}$	CAR_{0}	$CAR_{0,10}$	$CAR_{0,20}$
Mean	-2.548	-2.716	0.562	-2.657	-2.931
Median	0.002	0.010	0.002	-0.561	0.118
Percentage of positive CARs	50.00%	51.59%	50.00%	48.41%	50.00%
Standard deviation	13.158	12.882	4.851	11.017	20.654
Boehmer et. al - t_B	-1.9352	-2.0035	0.9898	-2.2253	-1.1841
Kolari and Pynönnen - t_{AB}	-1.5619	-1.6731	1.0673	-1.8064	-0.9844
p-Value t_B	0.0613	0.0536	0.2444	0.0335	0.1979
p-Value t_{AB}	0.1178	0.0984	0.2257	0.0780	0.2457

Table 73 Mean, Median, Percentage of positive CARs and Standard Deviation of Hypothesis 6 for Sales Transactions after the Crisis

After the crisis 126 transactions without exclusions are analyzed. The mean value peaks at the event day and continues again on the same level as before. This assumes that, insiders therefore perform better on event days, but worse prior and after the event, see Table 73.

After the crisis one time period of the Boehmer test statistic has statistically significant results and the null hypothesis can be rejected in this case.

8 Conclusion

In this thesis the influence of information of corporate insider trading on the value of German industrial companies is examined. The sample consists of 130 companies in a time span from 2005 to 2013. An event study approach including the market model is used. The results are tested with two test statistics and to find statistical significance of cumulative abnormal returns, the p value is calculated for both approaches.

The first test statistic is developed by Boehmer et al. (1991). They show in their paper that when an event causes minor increases in variance, the most commonly used methods, even though it is true, frequently cause the null hypothesis of zero average abnormal returns to be rejected. Through a simple adjustment Boehmer et al. (1991) show, that the cross- sectional method results in powerful tests, when the null hypothesis is false. Considering the power and size of the adjusted test, they are both unaffected when they are applied to portfolios who are subject to event- date clustering.

The second test statistic is established by Kolari and Pynnönen (2010). They note, that event studies are likely to cross- sectional correlation among abnormal returns, when the event day is the same for sample firms. Event- date clustering is serious in terms of over- rejecting the null hypothesis of zero average abnormal returns, even when cross- sectional correlation is relatively low. This is also true, when testing cumulative abnormal returns in multiple- day windows. This method then dominates nonparametric tests as the window is lengthened.

To examine whether the influence of information of insiders is substantial and which aspects are influencing the value of a company, six hypotheses are formulated.

In hypothesis 1, the size of a company is investigated. The lower the market capitalization of a company, the higher might be the value of information out of corporate insider trades. Lakonishok and Lee (2001) say, that insider activity seems to have limited value in large stocks. Aussenegg and Ranzi (2008) conclude, that this might be because more analysts follow large companies and out of this reason are under bigger surveillance by the public. Therefore, higher abnormal returns are expected for companies with lower market capitalization. For purchase transactions is significant evidence found over the total sample and especially in the defined crisis

period the first test statistic shows statistically significant results. For sales transactions, just during the crisis period significance is shown. Both test statistics display statistically significant results and reject the null hypothesis.

In hypothesis 2, the position of an insider who is executing a transaction has influence on the abnormal returns. A CEO might have a more profound understand of his company and therefore, higher abnormal returns are expected. Fidrmuc et al. (2005) state that the influence of a trade executed by directors affects the market significant immediately while the abnormal returns of CEO's is lower than from other directors. They report, that this might be explained through a bigger focus on their actions by authorities. The market and the CEO's therefore, might trade more cautiously. At the event day, statistically significant results are found for the total sample and both test statistics, when looking on purchase transactions. In the sub periods, those results are confirmed several times and for both test statistics. The purchase transactions show less significance. In the pre-crisis period, statistically significant results are given from the event day on for both test statistics.

Hypothesis 3 focusses on the transaction volume of a Directors' Dealing. If an insider believes in its abilities and advantage of inside knowledge of the market, the transaction volume of an inside trade influences the abnormal returns. The higher the transaction volume of a Directors' Dealing relative to the firm value of the observed stock, the higher the abnormal returns expected. This is contrary to Aussenegg and Ranzi (2008), who state, that smaller transactions seem to be more informative for outside investors than larger transactions. Due to the small sample size, both sides of the hypothesis, low volume and high-volume transactions are examined. It can be stated, that the results show for both, high and low volume, significant results throughout purchase transactions. Sales transactions show significance for high volume transactions, especially for the pre-crisis period. But as the sample size is relatively small, no clear statement can be made. The low volume transactions show statistically significant results for the total period and the crisis period for both test statistics.

Hypothesis 4 is similar to hypothesis 3 but takes the absolute transaction volume of an inside trade into consideration. Therefore, the higher the transaction volume of a Directors' Dealing absolute to the firm value of the observed stock, the higher abnormal returns are expected. It is also important to mention, that Hsieh et al. (2005) report,

that insiders buy more of their own company stocks, after a financial analyst downgraded the security. Same as for hypothesis 3, also high and low volume transactions are examined. Purchase transactions are statistically significant for high volume transactions, especially in the pre-crisis period for both test statistics. There is also significance throughout the sample for low volume transactions. The sales transactions show in general less statistically significant results. The pre-crisis period for high volume transactions has significant results for all time periods. Low volume transactions reject the null for the total time period and during the crisis.

The frequency of inside trades executed by an insider compared to other insiders is examined in hypothesis 5. The higher the frequency of Directors' Dealings per insider, the higher abnormal returns are expected, because the insider might has more informational knowledge than the public. Cohen et al. (2012) report, that there are two groups of inside traders, such as the "routine" and the "opportunistic" traders. A portfolio of just opportunistic traders yields value weighted abnormal returns of eighty-two basis point per month, whereas the routine traders were about zero. As there is no significant evidence of these results and no cross-sectional test are used, this hypothesis is examined. Purchase transactions show statistically significant results throughout the total time period, but only once for the second test statistic. Therefore, high cross- sectional correlation of the transactions is likely. Sales transactions are less likely to be significant and show just few statistically significant results

In hypothesis 6 the previous allegation of hypothesis 5 is examined with an additional aspect. The frequency of Directors' Dealings executed by an insider in the last calendar year compared to other insiders, might indicates, if the insider has more informational knowledge than the public. Especially for purchase transactions this hypothesis rejects the null, during all time periods several times and both test statistics. Sales transactions are partly significant during the crisis.

In general significance is found during most time periods for all hypothesis. The null hypothesis gets mostly rejected by the first test statistic by Boehmer et al. (1991), while less significance is found for the test statistic by Kolari and Pynnönen (2010). This implies that cross- sectional correlation is true and existing in this sample. The formulated hypotheses are partly confirmed as in the literature. Further research, with a bigger sample and similar allegations, can prove evidence for results, where no significance is found.

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