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EMPOWERED BY INFORMATION: INSIDER TRADING ON THE BALTIC STOCK MARKETS

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Abstract

Insider trading has been of interest to financial market participants, regulators and academics due to the contradictory evidence on its effect on the markets. Numerous research papers have analysed insider trading effect, while little is still known about insider trading on the developing markets such as ones in the Baltics. With this paper we aim to analyse market reaction to insider trading in Estonia, Latvia and Lithuania, and discover the possible influence of firm and insider characteristics to the magnitude of the effect. We analyse market and over-the-counter transactions from June, 2004 to October, 2010, employing the classical event study method and the cross-sectional regression analysis. We find weak market reaction to both insider sales and purchases, which takes place towards the end of event window rather than within first five days after the event. We also find liquidity to be related to abnormal stock returns, especially after insider purchases. Insider and firm characteristics seem to be of little importance and do not help to identify informative trading.

Keywords: abnormal returns, Baltic stock markets, event study, insider trading. market reaction

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1 Introduction

Do company insiders, who have access to publicly unavailable company information, benefit from this advantage when trading in their company's stock? How does insider trading affect market performance? Should insider trading be prohibited by law? These are the central questions that financial market participants, regulators and academics have been actively discussing. The ones trading on markets are concerned whether insider trading provides valuable information for constructing profitable strategies; in their turn, regulators and policy makers worry whether regulations on insider trading are necessary to promote fair and equal opportunities for trading; researchers, on their behalf, attempt to provide answers to these concerns by analysing insider trading impact on the financial markets.

Leland (1992) summarizes academic arguments for and against insider trading as such: the upside would be that insider trades help the market absorb information faster; more information would mean less risk, which would facilitate more trading. On the other hand, the presence of the insider could discourage other market participants from trading, which would result in lower liquidity and higher stock price volatility. The two-sidedness of insider trading outcomes has generated a great interest for both theoretical and empirical research, and consequently, numerous studies have examined the evidence of the insider trading effect on stock price movements, short and long term returns and liquidity. Notably, the focus of academic research so far has been on the informational power of insider trades: many researchers have investigated whether insiders bring information to the market when they trade and how they affect market efficiency.

The solid body of research on insider trading has been built using extensive U.S. insider trading data, while more recent studies have also covered European and Asian markets. However, little research has been conducted on small, emerging markets, in which insider trading is also present but is yet an unexplored phenomenon. Among such markets are also the stock markets of Lithuania, Latvia and Estonia, characterized by low frequency of trades and relatively high illiquidity of a number of stocks. While there is a lack of academic research on insider trading in these three markets, it is important to note that this phenomenon has already raised some public concerns and discussions. For instance, in a recent survey of the Lithuanian news portal, 94% of all respondents believed that the abuse of private information in the stock market happens regularly (VZ.lt, 2010a). As well, the Securities Commission of Lithuania has expressed their concerns about the cases of violations of insider

trading and reporting regulations that happen every year (VZ.lt , 2010b). The existing awareness of insider trading gives additional motivation to carry out the research, as its findings might provide important implications for the Baltic market participants and regulators.

For these reasons, we are interested in insiders' role in the three Baltic markets and attempt to make one of the first insights into insider trading impact on them. To reach this purpose, we take the widely used approach of analysing the informativeness of insider trading and pose a question: *How do Baltic stock markets react to insider trades around insider trading events?* We quantify the market reaction by measuring abnormal stock returns after insider trading dates and then analyse the abnormal returns more in detail, aiming to explain their magnitude and answer the following: *How do abnormal stock returns subsequent to insider trading depend on insider and firm characteristics?*

For the first step of our analysis, we use the event study methodology to analyse whether insider trading is followed by significant stock price movements within a relatively short period of up to 20 trading days after the event. Afterwards we employ the cross-sectional analysis to check the sensitivity of returns to a collection of factors. We analyse the insider trading data from June 2004 to November 2010, collected from the publicly available databases of security market regulators in Estonia, Latvia and Lithuania. We find the evidence of the market reaction to both insider sales and purchases, while this effect is weaker than documented in the studies on developed markets. As well, firm and insider characteristics do not explain the magnitude of abnormal returns after insider transactions, while stock liquidity appears to be related to the magnitude of the market reaction.

With this paper we contribute to the existing literature in several ways. First, we provide a comparative analysis of insider trading on three developing markets by using a unique, manually collected and extensive data set. Second, we analyse insider trades both on the stock exchanges and over-the-counter, which has not been done or pointed out in any studies that we are aware of so far. In addition, while several studies focus only on the second-level analysis of insider purchases, finding them to be more informative, we analyse in detail both purchases and sales, regardless of which of the two causes a stronger effect. Finally, we combine several methods of analysis and take into account numerous controlling factors to give a more versatile view on insider trading.

We proceed with providing the background to the study, followed by the review of relevant literature. Based on the findings of the previous research, we then formulate our

hypotheses and present the data and methodology applied. Finally, we provide and discuss our results and conclude with the suggestions for the future research.

2 Background of the Study

2.1 Definition of insider trading

Generally, an insider refers to any person that has access to private information about a company due to corporate relationships, work position or any other close links. The precise definitions of an insider and insider trading are incorporated in countries' laws on financial market regulation, while in the European Union, insider trading is defined in the *Directive 2003/6/EC of the European Parliament and of the Council of 28 January 2003 on insider dealing and market manipulation,* and related directives. According to these directives, we define insiders as: 1) members of the management, executive boards, supervisory bodies and administration of the issuer; 2) large shareholders or blockholders; 3) employees and other issuer-related parties (Directive 2003/6/EC, 2003). The definition also includes spouses, children and other close relatives of the listed above, and legal persons connected with the issuer via management or ownership (e.g., if the executive of the company is also the executive of the issuer, the company is considered as an insider).

Insider trading can be considered as both legal and illegal. As described in the European Union Directives, illegal insider trading refers to the abuse of sensitive information, which would allow insiders to take advantageous positions when trading on the financial markets (Directive 2003/6/EC, 2003). Such information is defined as publicly undisclosed, confidential company- related information, which might significantly affect company's stock price. Financial results, company's future revenue forecasts, a change in the top management and other important events that are known to a company insider prior to public announcements are the examples of such information.

Insiders' abuse of private information when trading on the financial markets has been prohibited in the USA since Securities and Exchange Act in 1934 (Newkirk, 1998). Such trading is also forbidden in the European Union, since the Directive on Insider Dealing and Market Manipulation came into effect in April, 2004 (Directive 2003/6/EC, 2003). However, insiders are still allowed to trade both in the USA and the EU under the restrictions implied by the above-mentioned regulations. Legal insider trading should not be based on any sensitive information that is not disclosed to the public and generally has to be reported to

regulatory bodies of financial markets (ProCon.org, 2008). Throughout this paper we refer to insider trading as legal insider trading.

Insider trading regulations and the requirement to report insider transactions have allowed for researchers to study legal insider activity, using the data from filings to the financial markets regulatory bodies. Interestingly, although legal insider trading should not have any private information content, many studies find that legally reported trades do convey information to the market and that insiders can earn abnormal returns. One reason for that is that insiders can still base their decisions on their better knowledge of the firms in general (Degryse, Jong, & Lefebvre, 2009); another concern is that insiders are able to dissimulate and mix their trades in a way that even under disclosure requirements one cannot distinguish between information-based and non-informative trades (Jaffe, 1974). Thus, despite truly information-based trading being illegal and beyond the scope of quantitative academic work, useful implications also stem from the analysis of legal trading.

2.2 Regulations of insider trading in the Baltic countries

Since 2004, when Baltic countries joined the European Union, the national regulatory and legislative bodies had to incorporate the European directives in the national laws, including the directives related to insider trading regulations. Thus, the directives are implemented in the Law on Financial Instruments of Lithuania, the Securities Market Act of Estonia and the Law on the Financial Instruments Market in Latvia.

According to the law, insider trading based on the abuse of private information is prohibited in all three countries, while insiders have to report their transactions to the corresponding regulatory bodies in each country within five working days of the date when a transaction was made (Commission Directive 2004/72/EC, 2004). However, in Latvia, insiders are not required to report their trades if the total value of trades does not reach amount equivalent to 5000 Euros in a calendar year (Financial and Capital Market Commission, 2003). In all three Baltic countries, the notification about insider trading should include detailed information about a transaction, including the type of a financial instrument, price and volume traded, the date of a transaction and the reason for notification (Commission Directive 2004/72/EC, 2004).

Under the requirements of the European Union directives, the publicly available databases have been created for publishing reports of insider transactions, from which it is possible to compile a data set on insider trading in Estonia, Latvia and Lithuania. Besides, due to the incorporation of the European Union directives in the national laws, we are able to

carry out the research on all three countries without the need to control for differences in legislation, and our analysis is comparable to other research on the European stock markets.

3 Literature Review

3.1 Theoretical modelling of insider trades

The central model for insider trading was built by Kyle in 1985. In his model, an insider trades with other market participants and utilizes his superior information to earn higher returns. The insider is a monopolist, but his advantageous position does not violate the semi-strong form of market efficiency: information is absorbed into prices by the end of the trading session (Kyle, 1985). The initial model has been extended in several ways. Holden and Subrahmanyam (1992) loosen the assumption of a single informed trader in Kyle's model and reach contrasting conclusions. Unlike Kyle, they show that insiders' information is included in prices immediately as a result of intensive competition among informed traders. Huddart, Hughes and Levine (2001) enhance Kyle's model by introducing the requirement of trade disclosure. They infer that due to disclosure, the insider's profits decrease substantially, true prices are discovered more quickly and the cost of trading decreases for uninformed market participants. Thus, Huddart et al. (2001) suggest that regulated insider trading might lead to higher market efficiency.

The most recent work by Buffa (2010) considers another extension of Kyle's model, adding risk aversion of informed traders. Being risk averse, they adjust their trading strategy when disclosure of their trades is required. Traders facing mandatory disclosure choose not to use all their private information immediately, which leads to an increase in information asymmetry; thus, market efficiency deteriorates (Buffa, 2010). The author also argues that due to the prolonged insider trading strategy in the regulated market, liquidity is not enhanced either.

In sum, theoretical modelling shows that insider trading can bring information to the market, but the extent of it depends on the different conditions and regulations applied. Thus, the models in theory have sought for empirical evidence that could justify the informational content of insider trading on markets.

3.2 Empirical research on insider trading in the U.S.

The early examples of insiders' ability to outperform the markets are presented in works by Jaffe (1974) and Finnerty (1976). By analyzing the data from the Official Summary

on Insider Trading in the U.S., Jaffe (1974) defines months of insider selling or purchasing activity as events and discovers that abnormal returns (cumulative average residuals) rise after the event. However, he concludes that taking into account transaction costs, a trading strategy following insiders' trades would be not profitable. Finnerty (1976) uses a portfolio approach and finds that insiders' "buy" portfolios earn positive abnormal returns, while "sell" portfolios underperform the market. Both studies support the idea that insiders can exploit their information to make profitable trades on their own firm stocks.

Seyhun (1988) extends the analysis and examines insiders' ability to predict market returns. He reaches an affirmative conclusion, finding out that insider purchases are correlated with market rises, while their sales are followed by market declines. Seyhun (1988) also suggests that the riskiness and size of the firm might matter for insider returns: the insiders of smaller firms tend to trade more frequently on the basis of firm-level information, while the insiders of riskier firms are better at capturing information concerning the whole market. Many similar studies have also confirmed that insiders can earn abnormal returns from trading (see, for example, Seyhun (1986), Rozeff and Zaman (1988) and Lin and Howe (1990)).

Extensive research, which expands on more aspects of insider trading on the American stock exchanges, has been done by Lakonishok and Lee (2001). The authors examine whether outside traders could use the information about insider trades to earn abnormal returns, and analyse in detail the market's reaction to information signals sent by insiders. The questions of their interest are whether insiders can predict market returns better than contrarian traders, and whether they are able to project cross-sectional variation in stock returns. Lakonishok and Lee (2001) use the data of companies trading on Nasdaq and the NYSE and AMEX markets from 1975 to 1995 to carry out a complex study: an event methodology to estimate short term abnormal results and regression analyses of aggregated insider trading and cross-sectional variation. Lakonishok and Lee (2001) do not discover significant stock price changes around the insider trading/reporting dates, meaning that the market tends to under-react to these trades. However, they find that insiders' abnormal returns materialize over longer time intervals. The underlying reason for this, according to the authors, is that insider regulations prohibit them from earning a short term profit (Lakonishok & Lee, 2001). Other important findings of their research are that insider purchases are more informative than sales; insider returns are higher for smaller firms (due to greater individual power and better flow of information in small firms); managers' trades are more informative than large shareholders' (the likely reasons for this are that shareholders are less involved in

decision making or that they have more serious legal concerns, which causes over-reporting of trades). Finally, the authors find that insiders, especially managers, are contrarian: they tend to buy stocks that have performed poorly in the past and sell stocks that have been top-performing.

Jeng, Metrick, and Zeckhauser (2003) evaluate the performance of the U.S. insider portfolios and, in line with Lakonishok and Lee (2001), find that insider purchase portfolios outperform the market (reaching yearly returns of 11.2%), while sale portfolios do not. They also confirm that insiders follow contrarian strategies. However, in contrast to previous studies, they do not find firm size or insider type (executive or manager) to make a significant difference in returns earned. In addition, an interesting fact that they point out in their paper is that insider trades constitute only a small part of total trades on the U.S. stock markets and therefore imply an economically insignificant increase in trading costs for uninformed investors. Thus, the importance of insider trading and its ability to generate higher returns might be overemphasized (Jeng et al., 2003).

An important problem also discussed in the literature is how to distinguish between profit-seeking, information-based insider trades and other trades, for example, due to diversification or liquidity purposes. In a recent paper, Aktas, Bodt and Oppens (2008) try to overcome this issue by using the relative order imbalance measure, defined as the daily net stock purchases to the daily total stock purchases and sales. Basing their methodology on the literature of market microstructure, they argue that it is possible to separate the part of this measure that provides information from the part that does not. Applying this technique, Aktas et al. (2008) analyse insider trading on the American stock markets from January 1995 to September 1999, aiming to discover how much insiders contribute to making markets more efficient. The results of their analysis show that when insider purchases take place, the returns are more sensitive to trade imbalance, while insider sales do not have any desired effect. Moreover, they repeat the same analysis for the insider reporting days and find that return sensitivity also statistically significantly increases when insider purchases are reported. Aktas et al. (2008) interpret these results as the evidence of information inclusion into prices, which supports the hypothesis that insider trading and disclosure of trades improve market efficiency. The authors also replicate the event study by Lakonishok and Lee (2001) and find that insider abnormal returns are statistically but not economically significant, confirming a weak market reaction to insider trades in the short term (2 to 5 days).

The recent work on insider trading by Cohen, Malloy and Pomorski (2010) provides a novel solution to the problem of distinction between informed and uninformed insiders. The

authors propose grouping insiders into “routine” and “opportunistic” according to their past trading patterns. Their criterion for a “routine” trader is the repeated trading during the last three years, and all other insiders who did not inhibit any trading pattern are defined as “opportunistic” (Cohen et al., 2010). The authors find significant differences in the abnormal returns gained by the two groups of insiders: the first group earns zero returns, while the portfolio based on the trades of the second group can earn monthly returns higher up to 180 basis points. Their criterion seems useful in analyzing highly intensive markets with numerous insider trades; unfortunately, it would be hard to apply for a sample of a shorter time period or less frequent data.

3.3 Insider trading on the European markets

While there are many papers discussing insider trading on the U.S markets, it is also important to review the research on other markets, not only because of differences in market characteristics, but primarily because of differences in insider trading regulations. One of the main differences between American and European (including Baltics) insider trading regulations is the length of the period during which an insider has to report a trade: in the U.S., this period used to be up to 10 days after the end of the month in which the insider traded (Jeng et al., 2003) but since 2002 it has been shortened to only 2 working days (Insider-Monitor, n.a.). In the European countries, for the periods analysed in most papers, the insider reporting deadlines are typically within 5 days of the transaction date. Besides, in the U.S. insider profits within the first six months after a trade are prohibited, while there is no such prohibition in the European countries. Such differences in regulations can result into insider abnormal returns of different magnitude or different market reaction to insider trades (Fidrmuc, Goergen, & Renneboog, 2006). Therefore, we include in our review several studies on insider trading in the European countries, in which insider trading regulations are most similar to these in the Baltics.

To begin with, Biesta, Doeswijk and Donker (2003) use an event study and portfolio forming techniques to analyse stocks listed on Euronext Amsterdam for period from April 1999 to May 2002. They find that in the period of 5 days selling insiders earn abnormal returns, while buying insiders outperform the market only in the longer period of 6 to 20 days. The portfolio analysis also yields economically and statistically significant results, suggesting that insider trading might guide trading strategies of other market participants (Biesta et al., 2004). Bajo and Petracci (2006) apply the event study methodology to the Italian market, and find a positive response in stock price movements for insider purchases,

and the opposite for sales. On the contrary, Eckbo and Smith (1998) find no significant abnormal returns of insiders trading on Oslo Stock Exchange. Even applying several different evaluation methods, the authors confirm their results and explain them by the possible specific features of Swedish insiders, either not possessing valuable information or not exploiting it when trading.

Dymke and Walter (2008) analyse insider trading in Germany from the beginning of July, 2002 till the end of April, 2005. They examine the profitability of trades by corporate insiders and expand the research by looking at which type of insiders – informed the best or tracked by authorities the least – indulge more actively in information based trading. They develop two criteria for the informed traders: if insiders trade before ad hoc news and if they earn systematic profits from such trading, they can be classified as informed. Their conclusion is that German insiders are able to earn higher returns within 20 post-trading days in comparison to the insiders of U.K. or U.S. markets. They also find that company directors gain abnormal returns while senior managers seem not to participate in informed trading as their trades do not outperform the market.

Fidrmuc et al. (2006) focus on the U.K. market from 1991 to 1998 and contribute to the research by examining the firm ownership aspect related to insider trading. They find that short term insider abnormal returns within two days of a transaction date are much higher on the U.K. markets than in the U.S., and speculate that as reporting periods are tighter in the U.K., prices adjust to the insider information faster. Fidrmuc et al. (2006) discover that the presence of a large blockholder in the firm mitigates the returns of insiders and vice versa holds for an institutional investor. Thus, they argue that ownership and control of the firm are important determinants of the informativeness of insider trading. In addition, Fidrmuc et al. (2006) consider a set of factors affecting abnormal returns, including insider position, firm and transaction size, news releases and liquidity of stocks. They find the support for the arguments that several insider trades per day lead to an increase in abnormal returns and that these are lower for less frequently traded stocks. However, unlike in the above-mentioned study on Germany, the authors do not find the differences in returns among different types of insiders and do not discover the significant influence of size factors and news announcements to the strength of insider trading effect.

Finally, a recent paper by Degryse et al. (2009) analyse the Dutch market once again, for the period from 1999 to 2008. Apart from the standard event study approach, Degryse et al. (2009) apply cross-sectional regressions to investigate firm- and insider-specific variables that could have the effects on the profitability of insider trading. At first they analyse

different types of insiders and find that purchasing directors of the firm can earn abnormal returns of 3.4% within 30 days window, while director sales underperform by 2.8%. However, the returns of other insiders are insignificant. Purchases of top executives in small companies generate substantially higher abnormal returns than in large companies; similarly, stock buys of value firms bring higher returns for executives than in growth firms. The differences in returns of executive sales according to size and book-to-market ratio are mixed and not profound, while lower liquidity is associated with higher returns for executive purchases and less negative returns for their sales. Interestingly, Degryse et al. (2009) find that high volume trades do not achieve abnormal returns, suggesting that insiders might cover information-based trades by making more and smaller transactions. Finally, the authors compare insider trading before and after the new EU legislation was adopted and find that executive sales have contained less information after the application of the new laws. Overall, Degryse et al. (2009) conclude that insider trading, in particular that of insiders in top positions, seems to be information-motivated and regulations might have an important impact to the level of information brought to the market place.

Regarding Central and Eastern Europe countries, which are more similar to the Baltics in terms of market development, there is little research on insider trading. To our knowledge, a single study that discusses insider trading effect in some of these countries is developed by Fidrmuc, Korczak and Korczak (2011). They analyse the relation between shareholder protection laws and market reaction to insider purchases in the U.S and 15 European countries, including Czech Republic, Slovenia and Poland. They report that in these three countries the insider trading activity is among the lowest compared to other countries in the sample, in terms of both the number of trades per company and the average transaction volume. They also find that cumulative abnormal stock returns within 5, 10 and 100 days after insider purchases are positive and statistically significant in Poland and Slovenia, but insignificant in Czech Republic. The main finding of the paper is that abnormal insider returns (i.e. market reaction to these trades) are associated with shareholder protection in the country. Thus, the markets of Czech Republic, Slovenia and Poland, considered as countries with relatively poorer corporate governance, absorb less information from insider trading than the markets of other European countries with better shareholder protection.

We are not aware of any academic research on insider trading in the Baltic countries accessible from sources available to us, apart from a mention in several papers discussing insider trading regulations (see, e.g., Bhattacharya and Daouk (2002)). Thus, unfortunately,

we are unable refer to any previous analysis of Baltic insider trading, and in particular, of Baltic market reactions to it.

Overall, there is evidence in the literature that insider trading causes market reaction and that insiders are able to earn higher returns in both U.S. and European markets. However, the time span during which the market reaction to insider trading takes place varies, and in some countries the effect is more prominent than in others. Besides, the main reasons for the abnormal stock returns after insider transactions have not been clarified yet, as different studies have found evidence of the importance of firm size, insider type, liquidity and other factors.

4 Hypotheses

The studies on insider trading in different markets have confirmed that insider purchases (sales) give a positive (negative) information signal to the market and we expect the same result in the Baltics. However, the period within which the effect is found varies in different studies from a single day to one month after the event. While these differences are likely because of different deadlines for insider reporting across markets, in the Baltics one could expect the reaction to take place within first 5 days of the transaction, as according to the regulation the insiders should announce about the trading within this period. However, considering possible delay in reporting/public announcements about the trades and the thin trading on the Baltic stock markets, we expect that insider trading will not cause an effect immediately but rather it will build up over time. Thus, we state the first basic hypotheses for our research as such:

1) *Market reaction is consistent with the direction of an insider transaction:*
    a. *Cumulative abnormal stock returns are positive after insider purchases;*
    b. *Cumulative abnormal stock returns are negative after insider sales.*
2) *Market reaction to insider trading is weaker within first five days after the insider trading event than within first 20 days.*

The previous studies of, e.g., Lakonishok and Lee (2001) and Degryse et al. (2009), have found that firm characteristics matter for insider abnormal returns. In particular, two firm characteristics are emphasized: size and book-to-market (or, in some studies, price-to-book) ratio. The reason for the firm's size to have an effect is that information about larger companies is typically covered better by the market: they are followed more by analysts, make more public announcements, etc.; thus information that can be revealed by insiders is

less likely to be new or unexpected for larger firms relatively to small ones (Lakonishok and Lee, 2001). On the other hand, insider trading can reveal a possible misevaluation by investors: if an insider purchases a stock of a low price-to-book ratio, i.e. poor growth of which is expected by the market, it might find that the company was underestimated; on the contrary, if a stock of a high price-to-book ratio is sold by an insider, investors might lower their expectations of good company's performance (Degryse et al., 2009). We are interested whether these arguments hold true for the Baltic markets and formulate the hypotheses:

3) *The magnitude of the reaction to insider purchases and sales depends on firm's size and its price-to-book ratio:*

    a. Cumulative abnormal stock returns are larger for smaller firms;

    b. Cumulative abnormal stock returns after insider purchases are larger for firms with lower price-to-book ratio;

    c. Cumulative abnormal stock returns after insider sales are larger (in absolute value) for firms with higher price-to-book ratio.

Fidrmuc et al. (2006) include liquidity as a variable in their models because the information from transactions on liquid stocks is more likely to be incorporated quickly and thus to have a stronger impact on returns. As liquidity is an important concern for investors in the Baltics, we would like to take it into account as well and hypothesize the following:

4) *The higher liquidity of a stock is associated with a stronger reaction to an insider transaction.*

Several papers discussed above have also taken into account insider type as a factor possibly affecting abnormal returns. The argument is that persons in the highest positions (e.g. directors, board members) of the company should have better knowledge of the company's performance than an average employee (Fidrmuc et al., 2006). This leads to our next hypothesis:

5) *Cumulative abnormal stock returns are larger (in absolute value) after the transactions of board and supervisory board members of the company, relative to transactions of employees.*

Finally, in relation to Cohen et al. (2010), who find that abnormal returns are because of insiders trading repeatedly, we consider that the trading frequency of an individual insider might be an important factor for the Baltic markets, on which relatively few insiders

trade on relatively few stocks (in comparison to, e.g. the U.S. or the U.K.). Thus, we formulate the next hypothesis as follows:

6) *Cumulative abnormal stock returns are larger (in absolute value) after the trades of frequently trading insiders relative to occasionally trading insiders.*

To test our hypotheses, we estimate the abnormal returns and run regression analyses with extensive list of variables for different sample splits with respect to transaction types and countries. We proceed with presenting our data and the methodology applied.

5 Methodology

5.1 Data sources

5.1.1 Stock data

We have obtained stock data from NASDAQ OMX website on companies currently listed in both Main and Secondary lists on the stock exchanges of NASDAQ OMX Riga, NASDAQ OMX Tallinn and NASDAQ OMX Vilnius. The sample of stocks consists of 88 stocks in total, 36 listed in the Baltic Main list and 52 in the Secondary list. Of them 34 are listed in Riga (5 in the main list), 15 in Tallinn (14 in the main list) and 39 in Vilnius (17 in the main list). The dataset obtained includes best bid and ask prices, adjustment factor for corporate changes (stock splits and emissions of shares), the turnover and the number of shares traded for each stock for period from January 2004 to November 2010.

5.1.2 Insider trading data

The insider trading data include the name of an issuer, the name of an insider, the insider's category (e.g. board member, employee), the date and type (e.g. sale or purchase) of the transaction, the quantity and price of the security traded, the place where the transaction was made (e.g. on the stock market or over-the-counter (OTC)), and the date when the notification of the transaction was published. We have obtained such data for three Baltic countries from several publicly available databases in which insider transactions have to be published according to each country's regulations.

For Estonia, data is obtained from the Estonian Financial Supervision Authority database. There, aggregated data is available, including 825 insider transactions, the first reported on April 4, 2005, and the last – on October 22, 2010.

Insider trading data for Latvia is collected from two sources: the Latvian Central Storage of Regulated Information and NASDAQ OMX Baltic announcement archives. The

earliest report of a transaction was published in the Latvian Central Storage on July 6, 2007. Since then, there are 149 reports published until November 22, 2010. For the dates prior to July 6, 2007, we have collected 41 insider transaction reports published on NASDAQ OMX Baltic website. The first report available on this site is dated June 16, 2004. However, due to missing information about transaction prices in most of the files, only 13 reports from period before July 6, 2007 are included in the dataset.

Insiders of Lithuania have been trading and reporting transactions most intensively of the three Baltic countries. 953 unique insider transactions were reported to The Securities Commission of the Republic of Lithuania from June 7, 2004 to December 21, 2007. In the Securities Commission's database, all insider transactions are put in one file for a company without the date when information about transactions was actually published, while these dates were available in another site of the Securities Commission's webpage. Thus, we had to match every insider transaction included in the database with the corresponding announcement on the webpage. The second part of insider trading reports has been gathered from the Central Storage Facility, which stores data on publicly listed companies in Lithuania, Iceland and Finland. From this database, 3053 unique transactions published from January 3, 2008 to November 14, 2010 have been collected. Unlike in the first source, the dates of the notifications about these transactions are included.

Overall, our initial sample consists of 4993 unique transactions from June 2004 to November 2010, 825 of which are for Estonia, 162 for Latvia and 4006 for Lithuania.

5.1.3 Additional data

To construct our analysis we have also obtained financial company data from Bloomberg Professional database. These data include annual (calculated on December 31st) price to book ratios and market capitalizations for all companies listed on the Baltic stock exchanges.

Finally, SSE Riga graduates Pavels Berezovskis and Veiko Visnapuu have agreed to provide the dataset of earnings announcements, which they used for their Bachelor Thesis. We have updated this dataset with the publishing dates of earnings announcements in 2010 and use it to detect insider trading around dates of earnings announcements. The complete earnings announcements data include the dates of announcements on monthly, quarterly and yearly earnings from 2004 to 2010.

5.1.4 Data adjustments

After aggregating insider trading data from separate report files into a single data set for all three countries, we filter it and exclude trades that have no information about price or/and quantity traded, involves trading instruments other than shares or trade type other than purchase or sale, transactions that had been recorded before the stock was listed on the stock exchange. We also exclude transactions reported to be made because of new emissions of shares and due to the resignation from a position or leaving a company, as such transactions might be related to other company announcements that could affect stock returns. Furthermore, we exclude transactions the dates of which match the dates of earnings announcements to minimize the possibility of estimating effect coming not from insider trading but from other news. Due to the fact that we use stock data which is not available for companies delisted from NASDAQ OMX Baltic stock exchanges, we also exclude insider trades of companies that are not in these listings in November 2010. We also excluded transactions that happened earlier than 140 days after the stock listing as for them we do not have long enough stock returns data.

Furthermore, we sum up trades in the same company's shares on the same day to get daily aggregated trading data. We identify the net direction of daily trading (i.e. net buy or net sell) by comparing the number of shares bought and sold – if there were more shares bought than sold, we consider the net trade as a purchase, and if the opposite is true we classify it as a sale. We exclude from our sample daily trades in which the net number of shares traded equals to zero, as in such cases the information signal is ambiguous (i.e. neither positive as of purchases, nor negative as of sales). Finally, we remove the outliers in our data with respect to the total value of a transaction: we cut 5 percent of transactions on both tails, to reduce the bias due to the smallest (and thus less likely to be considered as important signals) and the largest (and more likely to be due to corporate changes) transactions.

After aggregating and filtering the data, we are left with 1291 unique daily transactions for all three Baltic countries from June 2004 to October 2010, 278 for Estonia, 55 for Latvia, and 958 for Lithuania. 706 transactions were made on the regulated securities market, 143 on Tallinn Stock Exchange, 21 on Riga Stock Exchange and 542 on Vilnius Stock Exchange respectively. The remaining transactions were OTC trades. Some researchers disregard OTC transactions and do not include them in the samples, arguing that they are unlikely to be information-based (Dymke & Walter, 2008). However, we do not exclude OTC trades from our sample, as they constitute a significant proportion of the overall insider

trading activity in the Baltics and may still contain some information that would cause market reaction.

5.2 Event study methodology

To examine market responsiveness to insider trades, we apply standard event study methodology described by Campbell, Lo, and MacKinlay (1997), using insider trading day as the event day. We have chosen to analyse only insider trading days as events due to the limitations to the scope of our study, while the priority to these dates rather than days of notification has been given according to previous studies, majority of which analyse the former. However, as the event window covers also the notification day in the majority of cases, we expect to be able to grasp the market reaction to insider trading starting as soon as after five days of the transaction date, as by that time the transaction should also be reported according to the regulations.

The timeline of an event study consists of an estimation window, in which the normal level of stock returns is estimated, and an event window, during which abnormal returns are calculated. The event window includes days both prior and after the event, so that when the event date t=0, $t=T_1+1$ to $t=T_2$ shows the event window and $t= T_0+1$ to $t=T_1$ is the estimation window.

To estimate the deviations in returns coming from the event, we first have to calculate the normal level of returns of stocks, for which we use the market model, specified as follows:

additional factors have limited ability to improve the event study results as their marginal effect is too small to significantly reduce the deviation of returns. Considering the Baltic markets, there is lack of research on the factor models that could justify the choice of the model. Nevertheless, Lieksnis (2010) investigates the applicability of model by Fama and French in the Baltics and finds that even though the factors are statistically significant, the model is still unable to explain the returns in full and thus, its use cannot be justified. Considering all these arguments, we believe that the contribution of the factors to the model is questionable and stick to using the market model.

For calculations we use stock data adjusted for dividends and corporate effects, while national stock exchange indices, OMX-V, OMX-T, and OMX-R, are taken as a proxy for market returns. To account for the stock price volatility coming from the bid-ask bounce effect, in our computations we use the midquote stock price, calculated as the average of the best bid and ask prices.

To determine the model parameters we take an estimation window, the length of which is equal to $L_1= T_1-T_0$. According to MacKinlay (1997), the estimation window should be long enough to minimize the bias coming from sampling errors. In our model we use $L_1=120$ trading days as the estimation window, an exemplary window proposed by MacKinlay and widely used in other research papers on stock markets. However, in order to check the sensitivity of our results to the length of estimation window, we also recalculate abnormal returns using 240 days.

We have to note that the betas and alphas estimated by ordinary least squares (OLS) regression in the market model are inconsistent due to the low trading activity in the Baltic stock markets. As proven by Scholes and Williams (1977), such highly infrequent trading makes estimations of OLS regressions biased: regression alphas are biased upwards and betas – downwards. To mitigate this problem, we apply the recalculations of betas and alphas according Scholes and Williams proposition. The method of correcting betas and alphas is provided in the Appendix 1, and corrected alphas and betas are further used for the calculation of stock returns.

After estimating parameters from the market model, we compute abnormal returns during the event window, which includes days both prior and after the event. First, excess returns of a stock *i* on the event window time *t* are calculated. Then the cumulative abnormal returns are calculated for selected time periods from t_1 to t_2 and averaged across securities:

To control for the firm size in our regression specification we use the absolute value of market capitalization and alternatively, a set of dummies for a relative comparison. Similarly to Degryse et al. (2009), we divide firms into three groups: small market capitalization companies, mid-caps and large caps. We create dummies SCAP = 1 if a firm is in the first group and LCAP = 1 if it is in the third group. The dummy for mid caps is omitted to avoid multicollinearity.

We take the same approach for the price-to-book ratio and split companies into three groups according to this ratio as well. Thus, we use two dummies: PBL that takes value of one if a company is in the first group of companies, having lowest price-to-book ratios, and PBH that if equals one if a firm is in the group of highest ratios. The middle price-to-book ratios group is our reference group.

To account for stock liquidity, we employ ILLIQ measure, developed by Amihud (2002). We calculate the ILLIQ ratio of the monthly illiquidity of a stock:

set of dummies: FreqH = 1, if insider is among the third of insiders trading the most, FreqS = 1 for the third of insiders trading the least and FreqM = 1 for the middle group. We use the insider group trading the least for the comparison and omit this dummy from the regression.

Regarding other factors that are important to include in the model, Degryse et al. (2009) suggest that smaller insider transactions may contain more information than larger, as insiders prefer to conceal information-based trades among other trades and avoid trading in large volumes at once. On the other hand, Fidrmuc et al. (2006) argue that information signal to the market is stronger when several trades on the same stock take place within the short period of time. To take into account both arguments, we use the volume of a transaction and dummies for clustering as control variables. We create dummy Cluster = 1 if there are more transactions of the same stock within 20 days after the event day, and ClusterSame=1 if the same insider traded in stock within 20 days after her first transaction.

Insider trading regulation, as indicated in previous section, requires an insider to disclose his trades within 5 working days. However, there are many cases when this obligation is not fulfilled, and the reaction to such transactions would therefore be weaker. Due to this reason, we control for the possibility that a delay in notification of an insider trade affects the returns and use a dummy variable Late, which indicates whether an insider disclosed his transactions after a five-day period.

Although we excluded insider transactions that match dates of earnings announcements, the announcements within the event window can still have the effect on the abnormal returns. The exclusion of all transactions for which event windows overlap with earnings announcements would result in a significant reduction of our sample. However, we can control for this factor by using a dummy variable. The dummy EAbefore is equal to one if there were any earnings announcements 20 days before the insider transaction; the dummy EAafter indicates if there were any earnings announcements 20 days after the transaction.

We also use industry dummies to control for the fact that there might be more information-based insider trading in companies of particular industries. We use Global Industry Classification Standard (GICS) and group the companies representing the following industries: Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Materials and Utilities. We classify companies of Media, Telecommunication Services and Information Technology as “Other” as there is only one company per each of these industries. We create a dummy for each of the industry group and choose the group with the largest number of companies – Consumer Discretionary – to be the reference group.

We also control for the crisis period in second half of 2007 and 2008 by a dummy Crisis, as our primary analysis suggests the possible impact of this period on the abnormal returns. Finally check the differences between trading in different countries with dummies for Estonia and Latvia (a dummy for Lithuania omitted), and the differences between OTC and market transactions with the dummy OTC.

6 Empirical Findings

6.1 Summary statistics

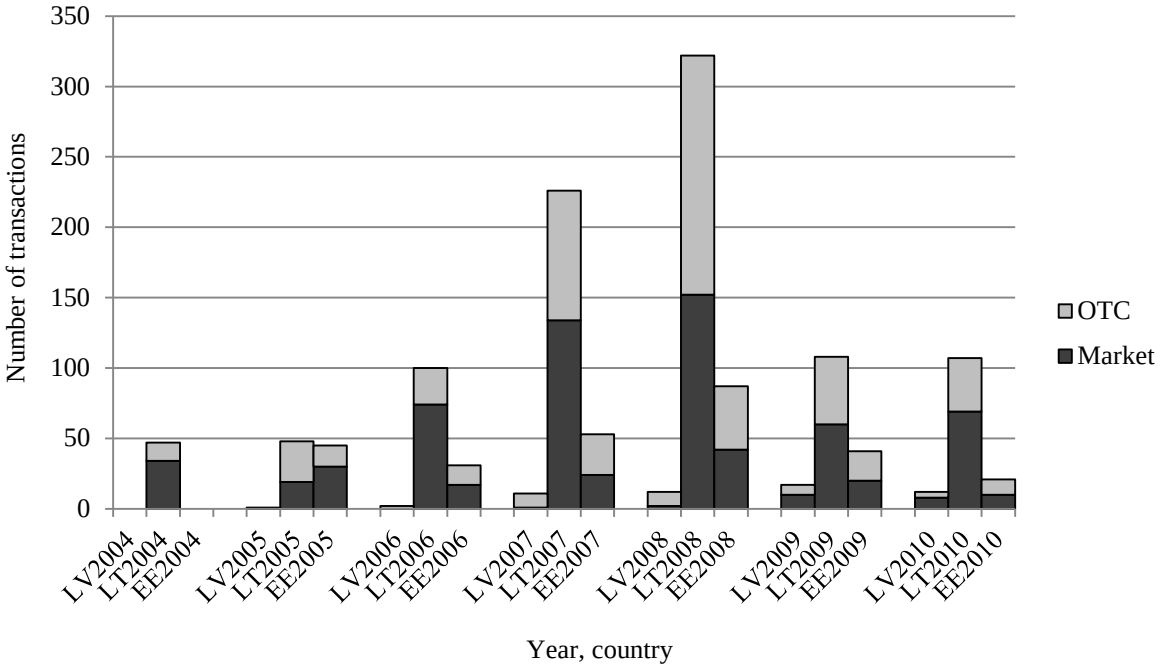

Figure 1. Insiders' trading by countries and years. *Source: created by authors.*

From Figure 1 we can see that insider trading was relatively infrequent in the three Baltic countries, except for high spikes of trading in Lithuania in 2007 and 2008. In general, the trading activity intensified and reached the peak in 2008, when 421 insider transactions were concluded. On average, insiders made 184 daily transactions per year, 84 on OTC and 100 on regulated markets respectively. In Lithuania, the number of market and OTC transactions were nearly equally distributed throughout all years (542 and 416 respectively), while Latvian insiders mostly reported OTC transactions (34 out of 55). In Estonia, insiders completed almost the same number of transactions on the market as on OTC (143 and 135 respectively).

Not all of the publicly listed companies' shares were traded by insiders. Their trading was present in 10 out of 15 listed companies in Estonia, 29 out of 39 in Lithuania, and 14 out

of 34 in Latvia. However, in Estonia and Latvia, only a few companies were exposed to active insider trading. In Estonia, almost two thirds of transactions were concluded by insiders of three companies: Harju Elekter, Tallink Grupp and Baltika (Figure 2). Similarly, insiders of Liepājas metalurgs, Olainfarm, and SAF Tehnika are responsible for two thirds of trades in Latvia. Only in Lithuania the distribution of insider trading across companies is more even, with Apranga and Šiaulių Bankas having the largest shares of trades.

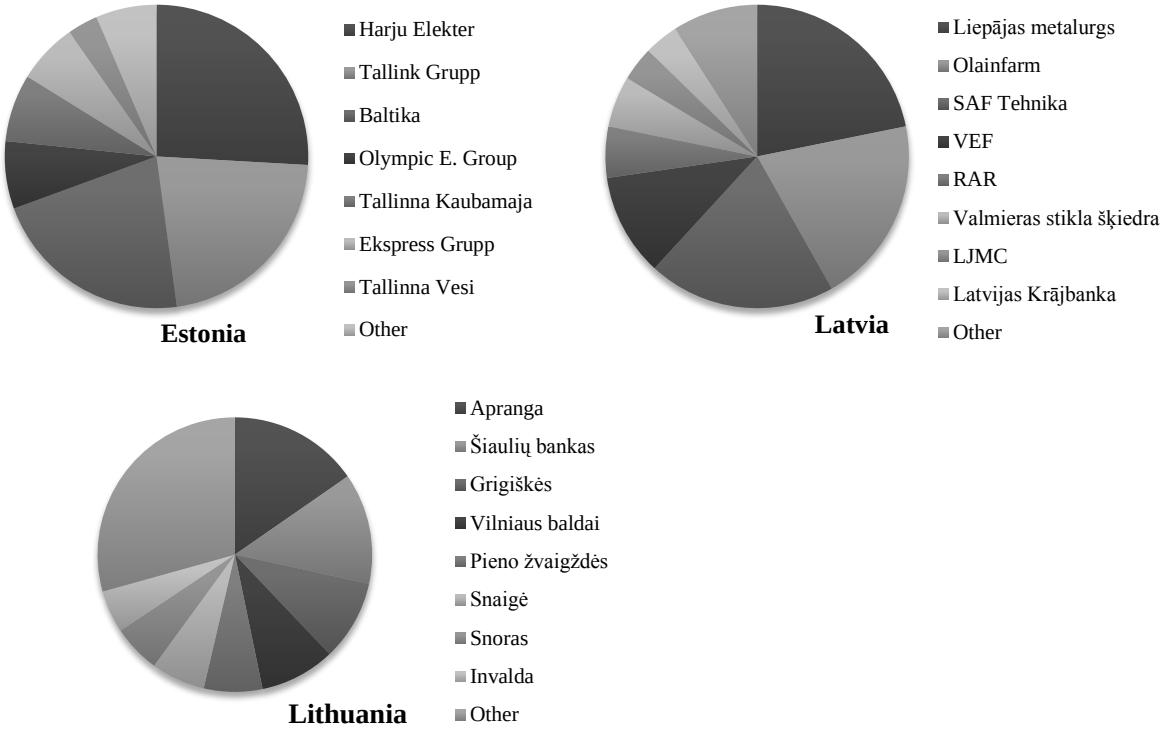

Figure 2. Transactions per company. *Source: created by authors.*

Regarding company size, insiders mostly traded in shares of companies with large or medium market capitalization, while trading in small market capitalization companies was rare (See Appendix 2, Table 1). In Estonia, large companies were exposed to highest insider trading activity both on the market and OTC. In Lithuania, middle size companies were dominant, but closely followed by large market capitalization companies. In Latvia, insiders mostly traded in shares of companies with medium market capitalization. With respect to industries, companies of various sectors exhibit insider trading in both Latvia and Lithuania, while in Estonia companies of just four industries are represented (Appendix 2, Table 2).

In terms of volume of shares traded, Latvian insiders have made quite large transactions, an average OTC transaction being 108,402 EUR and an average market transaction equal to 16,666 EUR. The highest average volume traded OTC is in Lithuania and equals to 269,020 EUR per transaction day, while Estonians have achieved the highest average volume of shares traded in the market, equal to 41,330 EUR per trade. Considering

all types of transactions, in Estonia and Lithuania the mean transaction values are larger than median, suggesting that smaller transactions are more common in the sample, while the opposite holds for Latvian trades (Appendix 2, Table 3).

Insiders tended to buy more than twice as often as sell, both on OTC and stock exchanges, as the numbers for sale and purchase transactions are 382 and 909 respectively (For detailed distribution see Appendix 3, Figure 3). In terms of volume traded, the numbers differ across countries. In Lithuania, insiders bought approximately twice as much as sold on the market (total volume over seven years being 7,114,301 EUR and 4,141,894 EUR respectively), but more purchases than sales where completed OTC (74,441,128 EUR and 37,471,202 EUR respectively). Estonians bought more than sold on the market (5,506,782 EUR vs. 403,489 EUR) and the same holds for OTC trades (18,473,904 EUR vs. 4,167,937 EUR). In Latvia, a substantially larger volume of shares was bought OTC (2,772,008 EUR vs. 913,672 EUR) while there were only buys in the market.

Among different categories of insiders, legal persons made most transactions, while persons related to insiders (i.e. spouses, children, persons sharing the same household) were involved in trading the least. In Lithuania the second most active group of insiders was top management, accounting for 27.8% of all trades, followed by supervisory board members with 12.3%. Similar distribution is in Estonia, where top management and supervisory board members concluded 24.1% and 12.2% of transactions, respectively. In Latvia, the most active traders were supervisory board members, who reported 41.8% of all transactions, while legal persons' transactions accounted for 25.5% of trades.

6.2 Abnormal returns after insider trading days

We begin with the analysis of event study results separately for purchases and sales, including a comparison of market and OTC transactions and of results across countries. The summarizing table of cumulative abnormal returns within different time intervals is provided in Appendix 4. For illustrative purposes, we also include the graphs of abnormal returns within the whole event window; however, note that for the ease of understanding, graphs are provided for insider transactions on the market only (see Figure 4, Appendix 5).

6.2.1 Abnormal returns after insider purchases

First we consider insider trades in all three markets for all the period investigated, which is from June, 2004 to October, 2010. The initial result is quite puzzling: we find that cumulative abnormal returns after insider purchases are negative and statistically significant for 5, 10, 15 and 20 days after the transaction date both on the stock markets and OTC. This

finding is in contrast with the findings of previous research and does not support our first hypothesis. We contemplate that this result might be driven by the significantly higher insider buying activity in years 2007 and 2008 when the crisis hit the stock markets and numbers of recorded transactions almost doubled both in Lithuania and Estonia. The clustering of insider trading activity combined with the thin trading properties of the Baltic markets could hamper the validity of our model and thus the results might be biased. They might also be affected by the skewed abnormal returns in a particular Baltic country. Therefore, we proceed with the analysis of the results for each country separately and discuss the results when transactions during the crisis period are excluded.

When we consider Lithuanian insider purchases only, we see that the negative effect of insider purchases persists for all time intervals, resulting in returns lower by 2.6 % in 20 days after the day of an insider transaction on the market (Table 4, Appendix 4). The result is similar for the OTC deals, although of slightly lower magnitude and lower statistical significance.

However, the split of Estonia shows the opposite results, which are in line with the expectations: before the insider buy event on the market, cumulative abnormal returns are significantly negative and amount to -5.6%, while they start to rise after the transaction and become statistically significantly positive after 15 and 20 days, reaching 2.7% and 3.98% respectively. The cumulative abnormal returns within first 5 and 10 days after the event day are not statistically significant, which also supports our hypothesis that the market reacts to insider transactions relatively slowly. The abnormal returns after OTC transactions are also positive but smaller and not statistically significant, suggesting that informational content of these transactions is lower. Overall, Estonian data seem to exhibit the pattern consistent with findings of Degryse et al. (2009) that insider buys occur at the lowest prices of the event window and generate positive abnormal returns afterwards.

The average insider abnormal returns after transactions on the Latvian stock market are also positive, which is consistent with the results for Estonia. The abnormal returns after OTC trades are smaller, also supporting the argument that OTC transactions give weaker information signals. However, we cannot draw inferences about the statistical significance of these results, as the number of buys amount to merely 21 on the market and 22 for OTC.

Considering that our results for Lithuanian trades might be affected by the clustering of trades during the period of crisis from July 2007 to the end of 2008, we exclude the transactions during this period from our sample and recalculate the average abnormal returns. Consequently, we see that the average cumulative abnormal returns on the Lithuanian market

after the exclusion become positive and statistically significant after both market and OTC transactions (see the graphs for market transactions in Figure 5, Appendix 5). In line with our second hypothesis, both the magnitude and the statistical significance of CARs increase over time and are the highest after 20 days. However, we note that cumulative abnormal returns are also positive and statistically significant prior to the insider trading event, suggesting that information on the basis of which an insider traded had become available to the market prior to the insider transaction date. Thus, it might be the case that insider trades take place due to some kind of other event important to the market and our event window grasps the effect of that other event. An example of such event could be earnings announcements; therefore, we would test the influence of earnings announcements preceding insider transactions to the abnormal returns in the second step of the analysis. An alternative explanation is that the information due to which an insider trades leaks to the market earlier and thus stock prices adjust accordingly. The open question that still remains is why such situation is observed in Lithuania and not in Estonia or Latvia.

After excluding the transactions during recession, the abnormal returns for Estonia and Latvia maintain the expected signs. However, the number of observations for Estonian market and OTC transactions is reduced to 42 and 29 respectively, hampering the validity of the significance tests. Consequently, we observe that abnormal returns after market transactions are insignificant, while the opposite is true for OTC trades. Nevertheless, as the number of observations has fallen more than by half and is close to the rule-of-thumb threshold of 30, we consider the results of the tests as not reliable and restrain from drawing any strong inferences. For the same reason, we do not calculate significance tests for Latvian transactions.

If we take the average of cumulative abnormal returns in all three countries, we also get statistically significant and positive results for all CARs in the event window, which is not surprising as the results are imposed by the large number of Lithuanian transactions.

6.2.2 Abnormal returns after insider sales

When analysing insider sales, we have to point out that there are no insider sales on the Latvian market in our sample, thus we cover only Lithuania and Estonia with the analysis of insider market transactions. The sample of OTC sales, however, includes 12 Latvian transactions but the conclusions with respect to insider selling activity in Latvia still cannot be drawn.

We begin with analyzing the whole sample of insider sales on the market and find that abnormal returns after these transactions have the expected signs and are statistically significant within 15 and 20 days after the transaction: the stock abnormal returns on average fall down by 2% at the end of the event window. The results initially confirm our second hypothesis of the slow incorporation of the information to the stock prices, as CARs are smaller and statistical tests show weaker significance for the first two intervals after the event. Besides, the cumulative abnormal returns prior to the event are statistically significantly positive, which is in line with the findings of other studies that insiders tend to sell stocks that have previously performed well (Lakonishok and Lee, 2001). The effect of OTC transactions is even stronger as CARs are larger and of higher significance. However, the statistically significantly negative returns prior to OTC transactions indicate that these transactions might be related to a particular earlier event, e.g. some corporate changes due to which OTC transactions often take place.

Looking at insider sales in Estonia and Lithuania, we find that CARs maintain the same signs but sales on the market have a statistically significant effect only in Estonia. Overall, we note that the magnitude of market reaction to insider sales is similar to that of purchases, which is in contrast with the findings of previous studies.

Although we do not observe significant differences in insider selling activity during the crisis and in other years, for the sake of consistence we check if our results change when we exclude transactions from July 2007 to the end of 2008. We find that the exclusion does not affect CARs after insider sales: they are of similar magnitude and significance. However, the exclusion eliminates the statistical significance of CARs after OTC sales in Lithuania, which also change signs. Thus, we conclude that the informational signal of OTC sales is mixed and less likely to be reflected in the stock prices compared to the signal of sales on the market.

In sum, we find empirical support for the hypothesis that Baltic markets react negatively to insider sales as cumulative abnormal returns after them are statistically significantly negative. We also conclude that Baltic markets react to insider deals relatively slowly, as the significant effects are found mostly for the time intervals of 15 and 20 days after the event, in comparison to the significant effects within 2 days in the U.K. or 5 days in Germany (as found by Fidrmuc et al. (2006) and Dymke and Walter (2008) respectively). However, the puzzling result with respect to cumulative abnormal returns on the Lithuanian market does not allow us to confirm the first hypothesis that markets react positively to insider purchases. Indeed, the contrary effect was found on the Lithuanian market and even though the results

changed after excluding the years of crisis, the CARs remained significant and of the same sign both prior and after insider trading event. Thus, the underlying reason for market reaction to insider purchases remains ambiguous.

We also note that the results for OTC transactions are mostly consistent with results for market transactions; i.e. they maintain the same signs and statistical significance. Thus, despite the consideration that due to different nature of OTC transactions they might be less informative or more correlated with other corporate events than the market trades, the results suggest that these trades are equally relevant for the analysis.

We further proceed with the cross-sectional analysis, aiming to explain the cumulative abnormal returns with insider and firm characteristics.

6.3 Cross-sectional regression results

We run OLS regressions for both insider purchases and sales to test the importance of market capitalization, price-to-book ratio, stock liquidity, insider type and trading frequency to the magnitude of abnormal returns. We use CAR 10 and CAR 20 as dependent variables to check if any of the effects of interest persist over time. We discuss two main specifications: one with market capitalization, price-to-book ratio and trading frequency as continuous variables and second with dummies for groups based on each of these characteristics. The list of variables used and their definitions are given in Appendix 6, while results are reported in Appendix 7, Tables 5 and 6.

6.3.1 Insider purchases

To begin with, we find that for insider purchases market capitalization does not influence the magnitude of insider abnormal returns, as the variables for it are not significant in any of the specifications and stocks of neither small nor large companies do not exhibit significantly larger returns compared to stocks of medium size companies. It might be due to the fact that as Baltic markets are small, the investors have relatively good coverage of both small and large companies. As well, compared to e.g. U.S. or U.K. companies, Baltic companies even with the largest market capitalization could be considered as small ones. Thus, we consider that access to information for insiders in small and large firms and thus informational content of their trades do not vary much compared to the discrepancies found in studies on U.S. or U.K. markets. Besides, one might note that actually only a few companies classified as of small market capitalization are included in the sample, meaning that insiders of the smallest companies do not trade in their companies' stocks.

The price-to-book ratio also seems to be of little importance to the magnitude of cumulative abnormal returns. However, if we look at the performance of stocks with low price-to-book ratio relative to the medium price-to-book, we see that abnormal returns for the former are statistically significantly lower, while we expected the opposite effect. This result might be related to the consideration that buying insiders in the Baltics do not exhibit contrarian behaviour, which is in contrast to what has been found in other studies. Thus, if they buy stocks with poor perspectives as valued by the market, they are most likely to do it for other reasons than the superior information indicating the misvaluation of a company.

Stock liquidity turns out to be a significant factor for the magnitude of abnormal returns. The variable ILLIQ is negative and statistically significant at 1% level in all specifications, showing that the lower the liquidity, the lower the abnormal stock returns. The variable is also of high economic significance: considering the first model specification with the dependent variable CAR 20, an increase of one standard deviation in the ILLIQ measure results in returns lower by 9.8%. This is in line with our 4^{th} hypothesis and the argument that for more liquid stocks, information from insider trading is incorporated better.

We do not find support for the hypothesis that insiders in top positions earn higher abnormal returns than other employees of the company. Indeed, dummies for top executives and supervisory board members are insignificant and the coefficients of the dummies in different specifications are mixed, not indicating any tendency of a particular group of insiders being able to achieve higher abnormal returns. This might reflect the fact that in the Baltic companies, the access to information about a company is not substantially different among different levels of insiders. However, this result should be treated with caution: the analysis of insider categories with a set of dummies limits the interpretation of the results, as one group is necessary to be referred to and the choice of reference might have influence on the findings.

Insider trading frequency appears to have no important effect on the abnormal stock returns either, as the variable of number of trades per insider is statistically insignificant in both models with the different dependent variable. However, in the specification with dummies and dependent variable CAR10 actively trading insiders appear to outperform rarely trading insiders by 4.3% at 1% significance level. This result is not evident in the specification with longer CAR, thus one might consider that it is due to chance or because of the possibility that the dummies do not reflect well the relation between trading frequency and abnormal returns.

Considering the control factors, we find that late notification about trading reduces market reaction to insider trades, which is highly plausible: the larger gap between trading and notification dates means that outside investors are able to incorporate the information signal only later (Fidrmuc et al., 2011). As well, the relevance of information provided by an insider might diminish over time as new information reaches the market and so the reaction to the transaction reported late might be weaker.

In addition, the variation of abnormal returns across industries appears to be important as dummies for Materials and Consumer Staples are significant, meaning that the former "outperforms" and the latter "underperforms" relatively to the industry Consumer Discretionary. One can argue that some industries are more popular or better followed by investors and analysts, so that insider trading is less informative for them than for companies in other industries (Degryse et al., 2009). On the other hand, the significance is likely due to the fact that the number of insider trades varies across industries and for some industries is quite lower than for others.

Dummies for earnings announcements are not statistically significant; thus, the consideration that abnormal returns around insider purchases might be due to other events cannot be confirmed.

The crisis dummy, as could be expected from event study results, is highly significant and reduces the CARs of 20 days after the transaction by 6.6%. We speculate that the result is due to the possibility that during the crisis insider trades were not informative but took place due to some other reasons. For example, it could be that insiders purchased their own stock after negative news to support its price level or bought stocks at low prices for a long term investment. Nevertheless, we have found negative abnormal returns after insider purchases only for the Lithuanian subsample, and the dummy for Estonia confirms our previous findings, being statistically significant at 6.3%. Why the difference between the countries exists remains a puzzle, as Estonian insiders appear to achieve higher abnormal returns than Lithuanians even when controlling for other factors. The possible reasons might be the different insider trading practices across the countries or the higher efficiency of the Estonian market due to which it is able to incorporate the information from insider trading better. However, these results might also indicate the potential problems with our model, as it might suffer from clustering of insider purchases and lower liquidity effects during the crisis period that result in bias from autocorrelation; we discuss this issue further in the paper.

6.3.2 Insider sales

Analysing insider sales, we do not find the firm characteristics to be of high importance either, as the continuous variables for market capitalization and price-to-book ratio are not statistically significant. The dummies for market capitalization are insignificant as well, and we consider the possible reasons for that to be the same as argued above for insider purchases. The dummy PBH in the second specification is positive and statistically significant, meaning that abnormal stock returns are smaller in absolute value for companies with the highest price-to-book ratio relative to the medium price-to-book ratio companies. As well as for purchases, this is in contrast to our hypothesis and indicates that insiders in the Baltics might not be giving information signals regarding overestimation of company perspectives, as argued by Degryse et al. (2009).

In contrast to the finding for insider purchases, illiquidity in our models for sales turns out to be insignificant for returns of shorter period. Moreover, the weak statistical significance at 10% level and the sign opposite to the expected of ILLIQ measure are discovered when the dependent variable is CAR 20. This indicates that lower liquidity of a stock is associated with higher (in absolute value) abnormal returns after insider sales. One of the explanations for such results might be that an insider sale of a highly illiquid stock discourages outsiders who were already quite unwilling to invest in the stock, and so the stock returns decrease further. As well, in our sample, insiders tend to sell stocks in relatively large quantities, while a large sale can dramatically reduce the price of an illiquid stock, resulting in substantially negative abnormal returns.

Similarly to insider purchases, we do not find the evidence of hierarchy among insiders with respect to abnormal returns. The dummies for insider categories are insignificant, except for the weak significance of the dummy representing supervisory board. Thus, we cannot confirm our 5^{th} hypothesis for sales split either.

Interestingly enough, we find that insider trading frequency is of high statistical significance but with a positive sign. The same results holds if dummies are used instead: CARs 20 for frequently and very frequently trading insiders are higher by respectively 7.7% and 6.2 % compared to CARs of occasional traders. Thus, we get a result opposite to our hypothesis and conclude that most frequently trading insiders sell due to liquidity purposes or portfolio rebalancing and thus do not convey information to the market.

Moreover and most importantly, we find that abnormal returns after sales are affected by earning announcements – the dummies for announcements both prior and after insider transaction dates exhibit statistical significance. Thus, holding other factors constant, an

insider sale prior or after an earnings announcement generates roughly 3% lower returns than other insider sales. Having in mind that the cumulative abnormal returns 20 days after insider sales on the market are estimated to be -2%, the effect of earnings announcements is substantial and mitigates the overall informativeness of insider sales. Unfortunately, the earnings announcements data does not include information on whether announcements were positive or negative and we cannot check whether insiders sell after positive or negative news.

We would also like to note that control variables for clustering or transaction size are not significant in any of the specifications, mitigating the importance of these factors for the case of Baltic markets. Finally, the OTC variable is insignificant, suggesting that controlling for other factors, there is no difference in the effects of market and OTC transactions.

6.4 Robustness and validity of our results

The event study method, although very widely used by researchers, is subject to numerous problems that could lead to invalid inferences. We briefly discuss these problems and other potential threats to the validity of our results.

Firstly, although MacKinlay (1997) documents that event study results are not sensitive to the chosen length of estimation period, we consider that because of thin trading on the Baltic markets, a longer estimation window might give more precise estimates of abnormal returns. Thus, we recalculate abnormal returns using the estimation window of 240 days and test the hypothesis that the mean of these abnormal returns equals the mean of abnormal returns from the first estimation. The tests for equal means have indicated that the null hypothesis cannot be rejected and that our results are indeed not sensitive to the choice of estimation window.

Brown and Warner (1985) discuss the main issues regarding the use of daily stock returns in event studies. These include the non-normality of abnormal stock returns (which is a more severe problem for smaller samples), the increase in variance of abnormal returns around the event day, event clustering, autocorrelation within intervals of cumulative abnormal returns and thin trading. These issues potentially could lead to the biased significance tests or biased parameter estimates. However Brown and Warner (1985) show that despite many possible threats to the validity of event study results, the statistical tests remain fairly well specified in simulations of event studies with different conditions. Moreover, they demonstrate that the possible adjustments to autocorrelation problems are of limited use, as the improvements in the variances are quite small. The adjustment for

clustering, according to Brown and Warner (1985), might even hamper than the model rather than significantly improve it and is necessary only in special cases. Nevertheless, the adjustments might be needed for developing markets such as Baltic ones, in which the likelihood of the above-mentioned biases is higher.

Fidrmuc et al. (2006) argue that to mitigate the above-listed problems, the best approach is to use the rank test developed by Corrado (1989). Besides, Campbell & Wasley (1993) show that the non-parametric rank is in particular useful when non-normality of abnormal returns and clustering are present (as cited in Fidrmuc et al., 2006). Therefore, we use this test as a robustness check to our results. We used the method described by Cowan (1992) and calculate the rank test for the cumulative abnormal returns within 20 days after the event day for the whole sample and for the subsample without transactions during the crisis. The rank test statistic is of slightly lower power but confirms our results for abnormal returns after sales for the whole sample (see Appendix 8, Table 7). The rank tests for purchases are insignificant, which confirms the previous concern about the event clustering effect. However, when the transactions during the crisis period are excluded, the rank tests confirm the results of the parametric tests for insider purchases and indicate the lower significance of the abnormal returns after insider sales, which is in line with our overall findings.

Finally, we must admit that our results might be affected by the sample selection bias and errors in the sample. The reports of insiders could have included various mistakes and misspecifications, while the human error is also unavoidable during the manual data collection process. Besides, our results are skewed by the large number of insider transactions in Lithuania, while relatively few records of insider trading in Latvia could be included in the sample. Unfortunately, no better data have been available to us, which imposes the limitations to our analysis. However, we have made the considerable effort in obtaining the largest possible sample and carefully filtering the data. Therefore, despite the above-listed concerns, we believe to have used the most complete and accurate dataset that could possibly be compiled from the available resources.

7 Conclusions and Suggestions for the Future Research

In this paper we have analysed the Baltic stock markets' reaction to insider trading activity and its relation to insider and firm characteristics. After conducting the event study analysis and performing regressions for the sample of 1291 transactions from June 2004 to

October 2010, we have arrived at the findings that are broadly in line with the previous academic research, while several additional insights have also emerged.

We have recorded the statistically significant market reaction to both insider purchases and sales but we have found that this reaction occurs in the second half of post-event window. This confirms our hypothesis that Baltic stock markets incorporate information from insider trading less effectively in comparison to the more developed European or American markets. The analysis indicates that this might be due to the late notifications about insider trading – in particular, the lower insider abnormal returns after insider purchases are associated with the longer delay of notification.

The abnormal returns after insider purchases in Estonia and Latvia indicate the positive market reaction to insider purchases. However, the overall results are skewed by the larger number of Lithuanian insider transactions that exhibit the opposite pattern. We have speculated that the recession period has affected the results in Lithuania as then insider purchases intensified, while such event clustering might cause bias because of autocorrelation of returns. If transactions during the recession are excluded from analysis, the abnormal returns on the Lithuanian market are positive and statistically significant.

Market reaction to insider sales, as expected, is negative and statistically significant in 20 days after the event. However, the cross-sectional analysis indicates that the abnormal returns after insider sales are magnified by the preceding and subsequent earnings announcements, leading to the consideration that insider sales alone do not provide information signals. This finding is in line with previous studies that also identified weak or non-existent market reaction to insider sales.

We have found that abnormal returns after insider transactions do not differ across stocks of different market capitalization or different categories of insiders, which is in contrast with some previous studies. We explain this result by the fact that Baltic markets are relatively small and therefore the amount of information available on smaller and larger companies does not differ significantly. Following the similar reasoning it could be argued that the control of information among different level of trading insiders does not vary substantially enough to result in stronger market reaction to the trades of a particular type of insiders.

The evidence on the price-to-book ratio effect suggests that trades of Baltic insiders do not provide information about company's under- or overestimated perspectives, as suggested by Degryse et al. (2009). However, as their study has not found the evidence of this effect for insider sales either, our findings are partly in line with the previous research.

In contrast with the expectations, we have found that the frequency of trading by a particular insider is not related with higher abnormal returns after insider purchases and thus it does not help to identify the more informative trading. Furthermore, the evidence from analysing insider sales proves the opposite: it appears that the most frequently trading insiders are most likely to sell the stock due to liquidity or other non-information-related reason.

Finally, we have found the stock liquidity to be important for the magnitude of abnormal return. In line with expectations, more liquid stocks exhibit larger abnormal returns after insider purchases. However, liquidity matters less for insider sales – the weakly statistically significant result with the opposite than expected sign is found only when CARs of 20 days are analysed.

We have also noted that information signals of OTC transactions are consistent with these of the market trades. As well, controlling for other factors, there is no statistically significant difference in abnormal returns after the two types of transactions.

Our estimations are adjusted for the non-synchronous trading with the method documented by Scholes and Williams (1997) and our main results are robust to the use of rank test statistic that mitigates the issues of non-normality, event clustering, and increase in variances. The rank test also supports the explanation of trade clustering affecting our results for purchases, as it confirms the positive abnormal returns after them only when crisis period is excluded.

Our findings provide the valuable overview of insider trading characteristics in the Baltics that could be of use for further research. However, a few insights coming from our study might also be beneficial for market participants and regulators. First, we have found that late notifications reduce the magnitude of abnormal returns and thus might be the reason for the overall weak market reaction to insider purchases. If regulators could monitor the reporting more carefully and enforce notifications on time, any information that insider trades contain could be accounted for more quickly by the market. Secondly, we have found that abnormal returns of insider sales before earning announcements are larger, suggesting the possibility of insiders using the prior knowledge about earnings when trading. Thus, insider actions around earnings announcements could be monitored more carefully to prevent any abuse of information.

Unfortunately, the limitations of our study and data have not allowed for more precise conclusions and a more careful comparison of reaction to insider trading across countries. However, our analysis suggests several directions for the future research. First, the

relation between liquidity and insider trading could be investigated, as insider trading is known to be related to the widening of the bid-ask spreads (Easley et al., 1996), while the link between Baltic insider transactions and liquidity seems to exist. Secondly, the porfolio analysis could be conducted to see whether insiders in the Baltic markets can actually outperform the market over the longer time period and consequently, whether insider trading strategies are worth following. Thirdly, abnormal returns after days of notification about transaction could be examined and the possibility of insiders exploiting the information to earn higher returns could be investigated further. Finally, improvements to our approach could be made to separate the insider transactions that contain valuable information from trades due to other purporses and isolate the effects of purely information-driven insider trading.

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Appendix 1

Scholes-Williams Method of Estimation of Betas and Alphas

The presence of nonsynchronous trading in the Baltic stock markets might lead to inaccurate alpha and beta coefficients, whereas ordinary least squares (OLS) estimators are likely to be biased and inconsistent. The methods used to tackle this issue are either Dimson correction, or Scholes and Williams adjustment. However, Fowler and Rorke (1983) argue that Dimson correction yields less accurate results than the adjustment model of Scholes and Williams. Thus, we choose the latter to reduce the bias and inconsistency coming from nonsychronous trading.

According to Scholes and Williams (1977), we run not only a simple regression, but also additional two regressions with lead and lag market terms:

Appendix 2

Table 1:

Distribution of insider trading across companies with different market capitalization.

	Number of transactions
Estonia	**278**
Market	**143**
Large Caps	111
Middle Caps	32
OTC	**135**
Large Caps	88
Middle Caps	47
Latvia	**55**
Market	**21**
Middle Caps	18
Small Caps	3
OTC	**34**
Large Caps	1
Middle Caps	22
Small Caps	11
Lithuania	**958**
Market	**542**
Large Caps	307
Middle Caps	233
Small Caps	2
OTC	**416**
Large Caps	174
Middle Caps	238
Small Caps	4
Total	**1291**

Table 2

Companies classified by Global Industry Classification Standards (GICS)

	Nr. of companies
Estonia	**10**
Consumer Discretionary	4
Industrials	4
Media	1
Utilities	1
Latvia	**14**
Consumer Discretionary	1
Consumer Staples	1
Financials	1
Health Care	3
Industrials	4
Information Technology	1
Materials	3
Lithuania	**29**
Consumer Discretionary	3
Consumer Staples	8
Energy	3
Financials	4
Health Care	1
Industrials	5
Materials	2
Telecommunication Services	1
Utilities	2
Total	**53**

Table 3:

Summary statistics of insider trading.

	Number of firms	Number of transactions			Mean transaction value (EUR)	Median transaction value (EUR)	Transaction value relative to market capitalization	
		Buy	Sell	Total			Mean	Median
Estonia	10	180	98	278	102338	6425	0.06%	0.01%
Latvia	14	43	12	55	73376	12438	0.45%	0.10%
Lithuania	29	686	272	958	128702	7545	0.17%	0.02%
Total	**53**	**909**	**382**	**1291**	**120648**	**7472**	**0.13%**	**0.02%**

Appendix 3

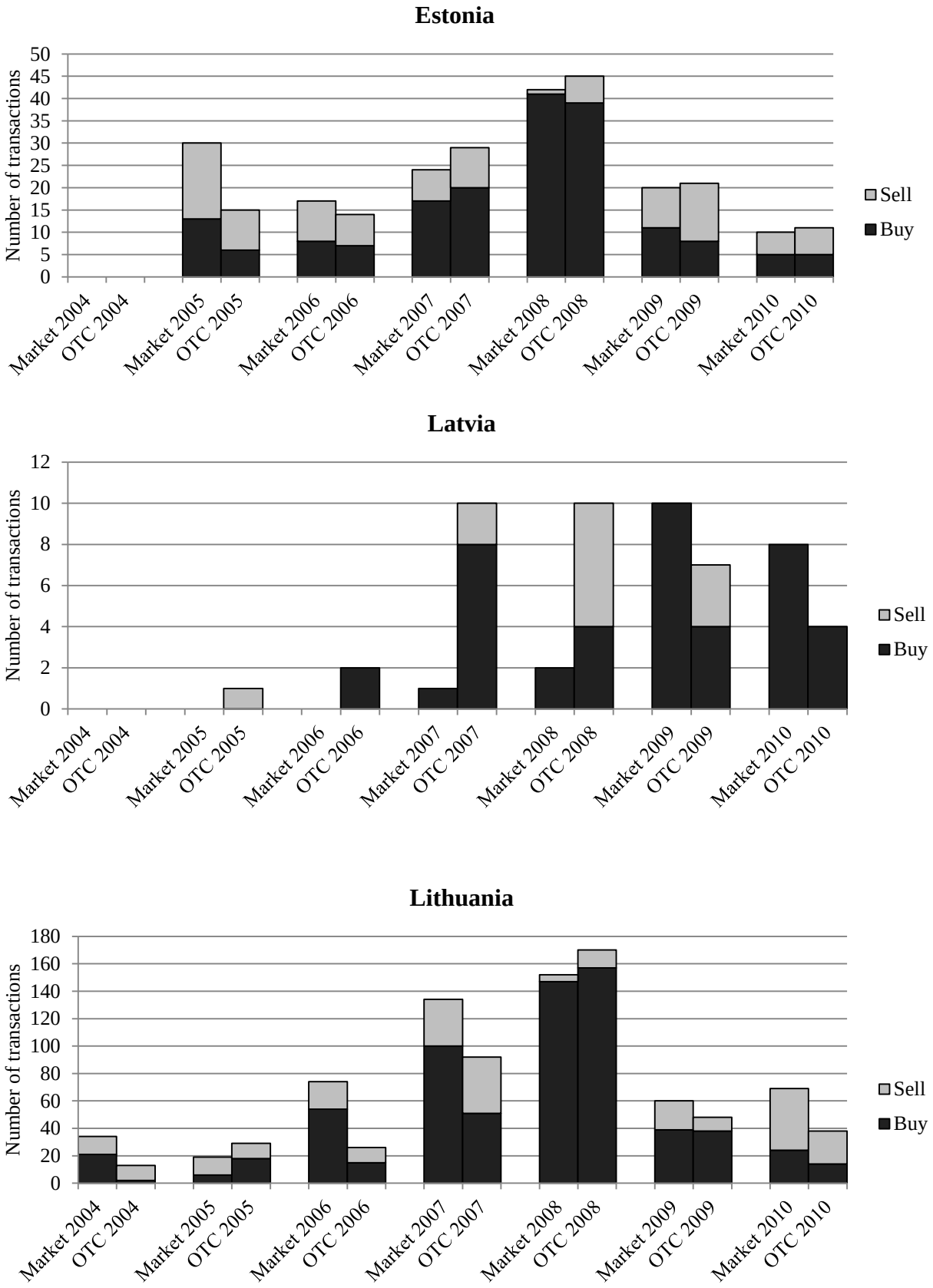

Figure 3: Insider trading by method and years. Source: made by authors

Appendix 4

Table 4

Cumulative abnormal returns after insider transaction days

	Whole sample						Excluding period of July 2007-2008					
Buy	N	CAR-20	CAR5	CAR10	CAR15	CAR20	N	CAR-20	CAR5	CAR10	CAR15	CAR20
All markets												
Market	507	-0.043 ***	-0.003	-0.007 **	-0.011 ***	-0.01 **	256	0.015 **	0.016 ***	0.021 ***	0.021 ***	0.031 ***
		(-9.34)	(-1.27)	(-2.01)	(-2.74)	(-2.11)		(2.09)	(4.05)	(4.00)	(3.29)	(4.35)
OTC	402	-0.016 ***	0.000	-0.006	-0.009 *	-0.013 **	166	0.027***	0.018***	0.027***	0.035***	0.042***
		(-2.93)	(0.03)	(-1.5)	(-1.76)	(-2.30)		(2.70)	(3.28)	(3.66)	(3.84)	(4.03)
Estonia												
Market	95	-0.056 ***	0.009	0.013	0.027 ***	0.04 ***	42	-0.012	0.013	0.010	0.002	0.006
		(-4.87)	(1.43)	(1.52)	(2.64)	(3.39)		(-0.65)	(1.28)	(0.71)	(0.11)	(0.29)
OTC	85	-0.03 ***	0.001	0.005	0.008	0.013	29	-0.046 **	0.018	0.031 *	0.034 *	0.032
		(-2.73)	(0.14)	(0.61)	(0.76)	(1.15)		(-2.05)	(1.51)	(1.90)	(1.69)	(1.42)
Latvia												
Market	21	-0.016	0.039	0.052	0.042	0.06	19	-0.005	0.045	0.057	0.054	0.072
		-	-	-	-	-		-	-	-	-	-
OTC	22	-0.010	0.015	-0.009	0.007	0.021	14	-0.021	0.034	0.027	0.049	0.078
		-	-	-	-	-		-	-	-	-	-
Lithuania												
Market	391	-0.041 ***	-0.008 ***	-0.015 ***	-0.023 ***	-0.026 ***	195	0.022***	0.013***	0.020***	0.021***	0.033***
		(-8.09)	(-3.01)	(-3.92)	(-5.14)	(-4.94)		(2.86)	(3.08)	(3.38)	(3.05)	(4.08)
OTC	295	-0.012 **	-0.001	-0.009 **	-0.014 ***	-0.023 ***	123	0.05 ***	0.016 ***	0.026 ***	0.033 ***	0.04 ***
		(-2.03)	(-0.37)	(-2.03)	(-2.68)	(-3.72)		(4.72)	(2.80)	(3.38)	(3.51)	(3.66)

	Whole sample						Excluding period of July 2007-2008					
Sell	N	CAR-20	CAR5	CAR10	CAR15	CAR20	N	CAR-20	CAR5	CAR10	CAR15	CAR20
All markets												
Market	199	0.043 ***	-0.008 *	-0.006	-0.015 **	-0.02 **	179	0.041 ***	-0.008	-0.005	-0.015 *	-0.02 **
		(5.12)	(-1.83)	(-0.92)	(-2.01)	(-2.29)		(4.57)	(-1.52)	(-0.76)	(-1.83)	(-2.17)
OTC	183	-0.026 ***	-0.007	-0.011 *	-0.019 **	-0.03 ***	139	-0.016	-0.004	-0.002	-0.005	-0.010
		(-2.92)	(-1.48)	(-1.66)	(-2.37)	(-3.28)		(-1.60)	(-0.74)	(-0.25)	(-0.59)	(-1.03)
Estonia												
Market	48	0.035 **	-0.011	-0.006	-0.018	-0.046 ***	47	0.033 *	-0.011	-0.007	-0.019	-0.048 ***
		(2.06)	(-1.21)	(-0.51)	(-1.19)	(-2.64)		(1.92)	(-1.17)	(-0.55)	(-1.25)	(-2.72)
OTC	50	-0.019	-0.013	-0.008	-0.018	-0.039 **	39	-0.019	-0.015	-0.011	-0.020	-0.039 *
		(-1.12)	(-1.38)	(-0.69)	(-1.21)	(-2.27)		(-0.98)	(-1.41)	(-0.74)	(-1.17)	(-1.95)
Latvia												
Market	0	-	-	-	-	-	0	-	-	-	-	-
		-	-	-	-	-		-	-	-	-	-
OTC	12	-0.07	-0.024	-0.023	-0.058	-0.053	4	-0.026	-0.064	-0.016	-0.028	0.015
		-	-	-	-	-						
Lithuania												
Market	151	0.045 ***	-0.007	-0.005	-0.014	-0.011	132	0.044 ***	-0.006	-0.004	-0.013	-0.010
		(4.71)	(-1.41)	(-0.77)	(-1.64)	(-1.13)		(4.17)	(-1.08)	(-0.55)	(-1.39)	(-0.92)
OTC	121	-0.024 **	-0.003	-0.011	-0.015	-0.023 **	96	-0.014	0.003	0.002	0.002	0.000
		(-2.25)	(-0.56)	(-1.31)	(-1.55)	(-2.12)		(-1.2)	(0.47)	(0.26)	(0.18)	(0.01)

J_1 test result reported in parentheses. Asterisks denote 10% (*), 5% (**) and 1% (***) levels of significance.

Appendix 5

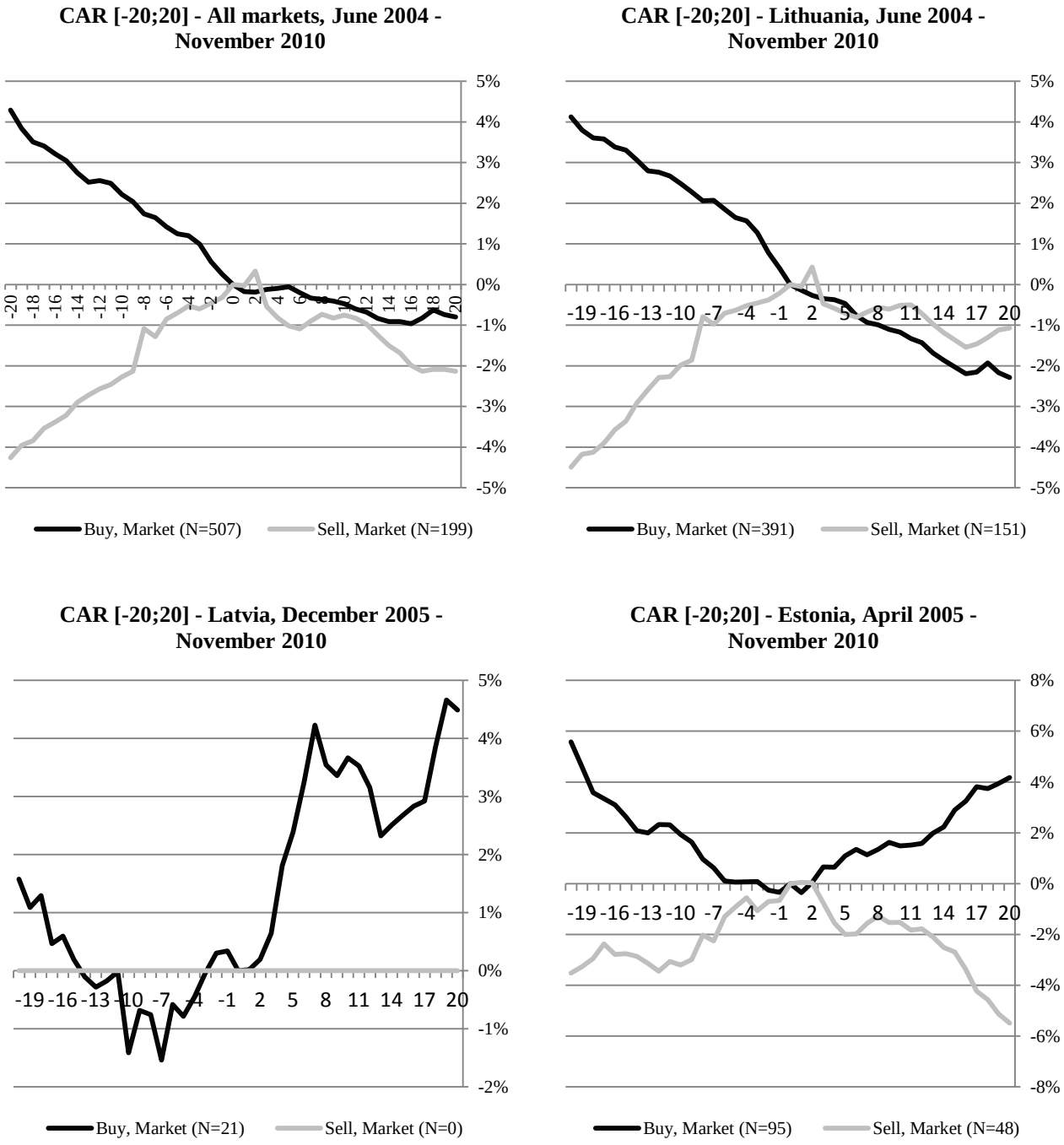

Figure 4. Cumulative abnormal return (CAR) around a transaction on the market day.

Source: made by authors

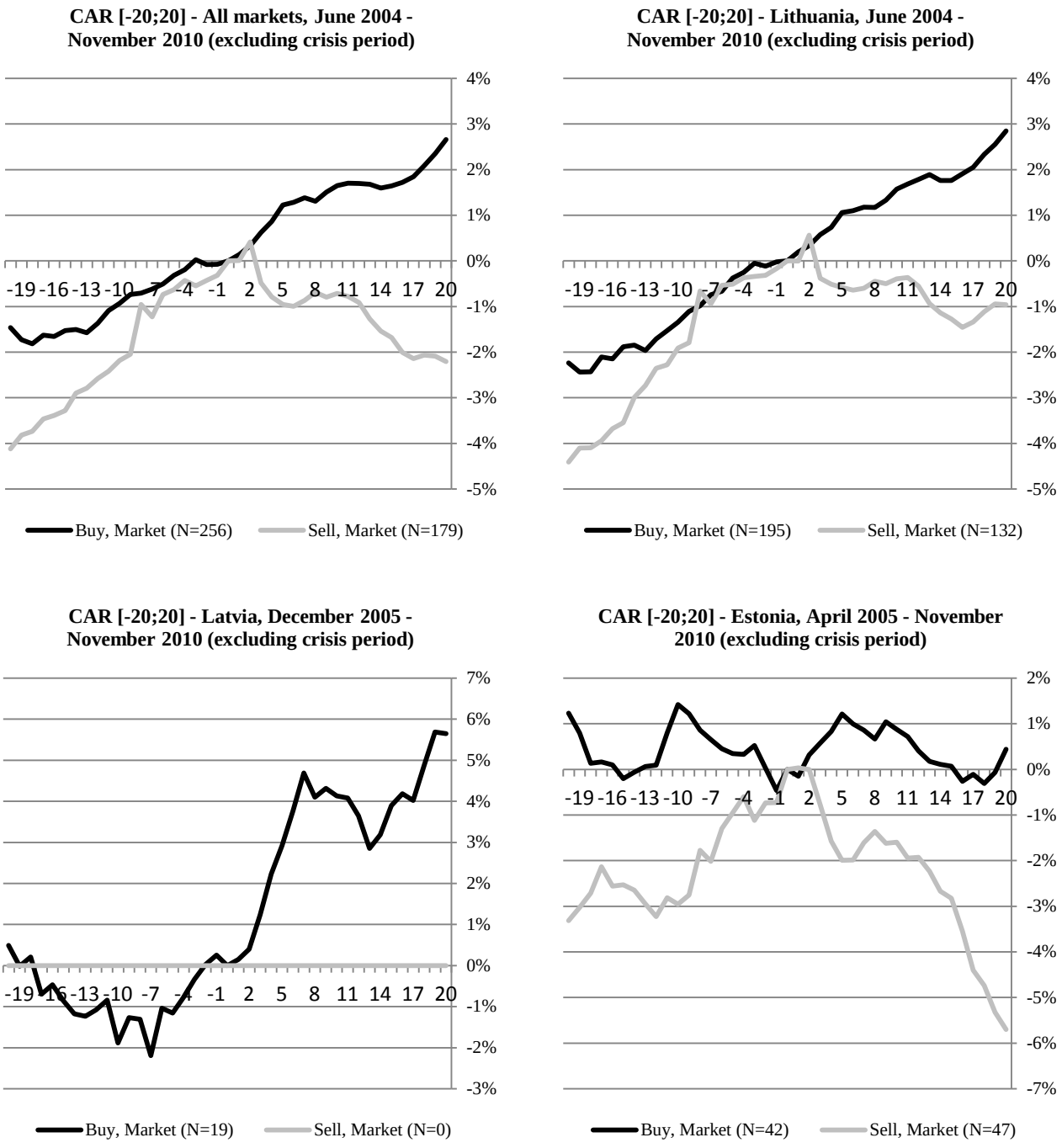

Figure 5. Cumulative abnormal return (CAR) around a transaction on the market day, excluding transactions that occurred during the crisis period.

Source: made by authors

Appendix 6

List of abbreviations and variables

Variable	Description
CAR	Cumulative abnormal return over the event window period
CAP	Market capitalization
SCAP	1 if a company belongs to the group of companies with the smallest market capitalization, 0 otherwise
LCAP	1 if a company belongs to the group of companies with the largest market capitalization, 0 otherwise
PB	Price-to-book ratio
PBL	1 if a company belongs to the group of companies with a low book-to-market ratio, 0 otherwise
PBH	1 if a company belongs to the group of companies with a high book-to-market ratio, 0 otherwise
ILLIQ	Measure of illiquidity for a stock, which is a monthly ratio of daily absolute return over dollar volume
Insider 1	1 if the insider belongs to the top management, 0 otherwise
Insider 2	1 if the insider is a member of supervisory board, 0 otherwise
Insider 4	1 if the insider is a person is related to insiders of the company, 0 otherwise
Insider 5	1 if the insider is a legal person related to company, 0 otherwise
Multiple	1 if more than one insider transaction occurred for the same stock during the same day
FREQ	The number of transactions made by the insider
FreqM	1 if an insider is the second tercile of most frequently traded insiders, 0 otherwise
FreqL	1 if an insider is the tercile of insiders trading the most, 0 otherwise
TotalVol	The volume of a transaction in EUR
Cluster	1 if more transactions of the same stock within 20 days after the event, 0 otherwise
ClusterSame	1 if the same insider traded in stock within 20 days after her first transaction, 0 otherwise
Late	1 if notification of the trade is made later than 5 working days of the trading day
EAbefore	1 if insider transaction was made 20 or fewer days after earnings announcement, 0 otherwise
EAafter	1 if insider transaction was made 20 or fewer days prior to earnings announcement, 0 otherwise
"Industry"	1 if company belongs to the indicated industry, 0 otherwise
Crisis	1 if insider transaction was concluded within the period of July 2007- December 31, 2008, 0 otherwise
LV	1 if insider transaction was concluded in Latvia, 0 otherwise
EE	1 if insider transaction was concluded in Estonia, 0 otherwise
OTC	1 if transaction is made over-the-counter, 0 otherwise

Appendix 7

Table 5

Regression results (Buy split)

Dependent var.	CAR10				CAR20			
Independent var.	1	t-test	2	t-test	1	t-test	2	t-test
CAP	0.000	-0.23			0.000	1.09		
SCAP			0.016	0.51			0.030	0.62
LCAP			0.004	0.49			0.001	0.04
PB	0.003	0.99			-0.003	-0.68		
PBL			-0.027 *	-1.75			-0.074 ***	-2.83
PBH			0.002	0.17			-0.018	-1.2
ILLIQ	-0.045 ***	-4.39	-0.043 ***	-3.93	-0.098 ***	-5.62	-0.097 ***	-5.28
Insider 1	0.005	0.33	-0.001	-0.05	0.032	1.29	0.021	0.78
Insider 2	-0.001	-0.08	-0.018	-0.95	0.028	0.95	-0.004	-0.11
Insider 4	-0.011	-0.53	-0.009	-0.41	-0.015	-0.43	-0.021	-0.59
Insider 5	0.010	0.62	-0.007	-0.40	0.049 *	1.74	0.023	0.75
Multiple	-0.003	-0.18	-0.018	-0.88	0.027	0.75	-0.001	-0.01
FREQ	0.000	1.06			0.000	-0.14		
FreqM			0.010	1.20			0.012	0.8
FreqL			0.042 ***	3.07			0.030	1.25
TotalVol	0.000	0.96	0.000	0.94	0.000	0.86	0.000	0.000
Cluster	0.002	0.18	0.004	0.41	0.003	0.18	0.005	0.28
ClusterSame	-0.006	-0.65	-0.013	-1.37	-0.004	-0.23	-0.010	-0.58
Late	-0.014 **	-2.18	-0.014 **	-2.28	-0.016	-1.49	-0.019 *	-1.84
EAbefore	0.004	0.56	0.008	1.09	0.012	0.94	0.014	1.2
EAafter	-0.003	-0.53	-0.002	-0.40	0.006	0.57	0.007	0.77
Health Care	-0.004	-0.18	-0.004	-0.17	-0.007	-0.25	-0.002	-0.06
Materials	0.055 ***	3.52	0.056 ***	4.26	0.07 ***	2.72	0.092 ***	4.38
Financials	0.000	-0.01	0.002	0.19	-0.021	-0.81	-0.002	-0.09
Consumer Staples	-0.028 *	-1.90	-0.025 **	-2.13	-0.065 **	-2.56	-0.056 ***	-2.99
Other	0.014	0.79	0.010	0.58	0.037	1.26	0.029	0.99
Industrials	-0.009	-0.62	-0.012	-0.88	-0.014	-0.54	-0.017	-0.7
Energy	0.004	0.21	0.004	0.25	-0.050	-1.47	-0.042	-1.36
Utilities	-0.008	-0.33	-0.009	-0.34	-0.007	-0.18	0.014	0.34
Crisis	-0.048 ***	-6.81	-0.049 ***	-7.38	-0.075 ***	-6.63	-0.066 ***	-5.99
EE	0.038 **	2.55	0.049 ***	3.52	0.046 *	1.78	0.063 ***	2.59
LV	0.004	0.23	0.028	1.40	-0.013	-0.46	0.027	0.86
OTC	-0.007	-0.94	-0.007	-0.99	-0.022 *	-1.79	-0.023 *	-1.91
Intercept	0.034	1.47	0.032	1.37	0.071 *	1.77	0.074 *	1.87
N	909		909		909		909	
R2	0.1768		0.19		0.1918		0.2039	

Asterixes *, ** and *** shows levels of significance, 10%, 5% and 1%, respectively.

Table 6

Regression results (Sell split)

Dependent var.	CAR10				CAR20			
Indepentent var.	1	t-test	2	t-test	1	t-test	2	t-test
CAP	0.000	-0.51			0.000	-1.25		
SCAP			-0.006	-0.22			-0.014	-0.28
LCAP			-0.008	-0.56			0.002	0.14
PB	0.002	0.54			0.006	1.47		
PBL			-0.004	-0.18			-0.032	-1.08
PBH			0.036 ***	2.96			0.041 **	2.18
ILLIQ	0.021	0.84	0.022	0.87	-0.051 *	-1.8	-0.051 *	-1.76
Insider 1	0.033	1.45	0.020	0.89	0.007	0.17	-0.009	-0.22
Insider 2	-0.008	-0.37	-0.001	-0.04	-0.083 *	-1.92	-0.065	-1.65
Insider 4	0.026	0.79	0.036	1.22	-0.040	-0.68	0.012	0.22
Insider 5	0.006	0.25	0.016	0.71	-0.047	-1.12	-0.028	-0.72
Multiple	0.035	1.52	0.027	1.08	0.000	-0.01	-0.022	-0.5
FREQ	0.001 ***	2.83			0.001 ***	3.00		
FreqM			0.029 **	2.15			0.077 ***	4.07
FreqL			0.029	1.33			0.062 **	1.97
TotalVol	0.000	-0.87	0.000	-1.12	0.000	-0.59	0.000	-0.98
Cluster	-0.021	-1.28	-0.018	-1.16	-0.026	-0.97	-0.024	-0.97
ClusterSame	0.010	0.61	0.007	0.46	0.004	0.17	0.001	0.05
Late	0.021 *	1.82	0.017	1.57	0.012	0.78	0.010	0.66
EAbefore	-0.015 **	-2.07	-0.011	-1.39	-0.037 ***	-3.44	-0.032 ***	-2.94
EAafter	-0.038 ***	-4.32	-0.035 ***	-3.81	-0.034 ***	-2.86	-0.035 ***	-2.75
Health Care	0.001	0.03	-0.011	-0.48	-0.018	-0.57	-0.036	-1.05
Materials	-0.018	-0.53	-0.023	-0.66	-0.044	-0.81	-0.065	-1.26
Financials	0.031	1.59	0.021	1.1	0.092 ***	3.02	0.078 ***	2.62
Consumer Staples	-0.006	-0.38	-0.024	-1.58	-0.007	-0.32	-0.052 **	-2.39
Other	0.035	1.55	0.012	0.59	0.077 ***	2.74	0.029	1.03
Industrials	0.042 **	2.53	0.038 **	2.21	0.069 ***	3.23	0.058 **	2.44
Energy	0.081 ***	3.43	0.091 ***	3.49	0.124 ***	2.82	0.117 ***	2.71
Utilities	0.115 ***	2.91	0.11 ***	2.89	0.151 ***	3.7	0.151 ***	3.84
Crisis	-0.009	-0.71	-0.017	-1.35	-0.013	-0.7	-0.022	-1.11
EE	0.012	0.67	-0.004	-0.24	-0.010	-0.46	-0.041 *	-1.78
LV	0.018	0.67	0.034	1.07	0.020	0.49	0.051	1.01
OTC	0.002	0.15	0.004	0.34	0.001	0.05	0.007	0.51
Intercept	-0.055 *	-1.91	-0.063 **	-1.99	0.021	0.48	0.003	0.07
N	382		382		382		382	
R2	0.1818		0.1923		0.2518		0.2742	

Asterixes *, ** and *** shows levels of significance, 10%, 5% and 1%, respectively.

Appendix 8

Table 7
Comparison of the results of the rank test and J_1 test

Whole sample		
Market	Rank test	J1 test
Buy	1.072	-2.112**
Sell	-1.692*	-2.287**
OTC		
Buy	-1.345	-2.301**
Sell	-2.240**	-3.280***
Excluding period of July 2007-2008		
Market	Rank test	J1 test
Buy	5.265***	4.346***
Sell	-1.358	-2.165**
OTC		
Buy	3.128***	4.025***
Sell	-0.428	-1.026