The Signaling Effect of Insider Trading on the Swedish Stock Market

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Abstract

This paper investigates the signaling effect of insider trading by analyzing the market reaction to 147 insider transactions executed within the period 2014-2016 on the Stockholm Stock Exchange. We present three major findings. First, we find significant market reactions for both insider purchases and insider sales, suggesting a signaling effect of insider trading. Second, we find the signaling effect to be similar for both insider purchases and insider sales. Third, we find that firm size has an influence on the signaling effect. Our findings indicate that the market values information about insider trading and that firm size has an effect on this informative value.

Keywords: Insider trading, signaling effect, event study, abnormal returns, Swedish stock market

Sammandrag


Nyckelord: Insynshandel, signaleringseffekt, eventstudie, abnorm avkastning, svenska aktiemarknaden
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1. Introduction

Does the stock market value information about insider transactions? Insider trading has been a field of interest for investors, academics and regulators alike for several decades and is still of interest to this day. Corporate insiders are a class of investors who, by the nature of their position in the firm, have access to information not available to outside investors. For example, corporate insiders may know that earnings are likely to increase or that a product is likely to be successful based on internal reports or conversations with other corporate insiders (Fried, 2000). Evidence suggests that the informational advantage corporate insiders have gives them a good understanding of the near-term developments within their own firm (Jeng et al, 2003) and that they are timely informed both when their firm is performing well and also when it is performing poorly (Ravina and Sapienza, 2010).

As a result of this information asymmetry, corporate insiders have a better insight about the future prospects of their own firm compared to outside investors and can thereby make better assessments concerning the true value of it. As a consequence, insider transactions serve as signals that reveal private information to outside investors and that indicate whether the stock of a firm is overpriced or underpriced (Leland, 1992; Fried, 2000). A significant purchase transaction by a corporate insider reveals private information that suggests the future prospects of a firm to be positive and therefore signals that the stock is underpriced, since the market has not incorporated this information in the stock price before. On the contrary, a significant sale transaction by a corporate insider reveals private information that suggests the future prospects of a firm to be negative and therefore signals that the stock is overpriced. In this way, insider transactions reveal private information and send signals about the firm's future prospects and value to outside investors. As a result of this signaling effect, insider transactions push the price of a stock in the correct direction, moving it closer to its true value and thereby contributing to the efficiency of stock market pricing (Manne, 2005). Indeed, the trades of corporate insiders are widely examined by media members, investment managers, academics and regulators alike with the aim of seeing signs of illegal activity or for detecting signals about the future prospects of companies (Cohen et al, 2012).

The signaling effect of insider trading activity has mostly been studied on major markets such as the UK and US markets but we are only aware of little research conducted on the Swedish market.
This paper therefore takes the opportunity to further investigate the signaling effect of insider trading and, thereby, provide additional evidence from the Swedish stock market.

We study the market reaction to the announcement of 147 insider transactions executed within the period 2014-2016 by insiders in 99 public firms traded on the Stockholm Stock Exchange. We measure the market reaction in terms of abnormal returns on the announcement day and the subsequent trading day. By studying the market reaction to insider transactions at the time they are announced, we are able to see if they are considered informative and send signals about a firm's future prospects to the market. Our findings suggest that insider trading on the Swedish market does have a significant signaling effect and that the magnitude of the signaling effect is similar for both insider purchases and insider sales. We also find that firm size has a certain influence on the signaling effect.

The results of this paper have two applications in existing and future research on insider trading. First, our findings serve as a benchmark for how well the regulatory development has countered the information asymmetry existing between inside and outside investors on the Swedish stock market. By comparing the results of our paper with previous studies conducted on the Swedish stock market, it is possible to distinguish how the informational value of insider trading has changed over time which in turn gives indications on whether the information asymmetry has been shrinking or expanding. Future studies on insider trading can do the exact same comparison with the results of this paper to examine the regulatory development that have occured after this study was conducted. Second, the findings of this study can be compared to the findings of similar studies on insider trading conducted on other markets. In this way, it is possible to examine the effectiveness of different regulatory approaches for countering the information asymmetry existing between inside and outside investors, since no homogeneous legislation covering insider trading exists between countries today.
2. Literature Review

Previous research on insider trading acknowledges that corporate insiders have an informational advantage over outside investors and that they use this advantage to earn abnormal returns by trading their own company's shares (e.g., Finnerty, 1976; Seyhun, 1986; Howe and Lin, 1990). In addition, by mimicking insider transactions, previous research also suggest that it is possible for outside investors to earn abnormal returns as well (Bettis et al., 1997; Seyhun, 2000). These previous studies on insider trading have focused on examining abnormal returns for holding periods of several months and not only do they find the abnormal returns to be statistically significant, but also to be economically significant. However, even though previous studies find corporate insiders to have an informational advantage that both the corporate insiders themselves and outside investors can both benefit from in terms of abnormal returns, the informational value seen in insider trading is questionable. For example, Rozeff and Zaman (1988) and Friederich et al. (2002) find that outside investors cannot earn economically significant abnormal returns by mimicking the trades of corporate insiders and Seyhun (2000) concludes that many insider transactions are not informative at all and are, therefore, ignored by the market.¹

More recent studies take the approach of studying the immediate market reaction to the announcement of insider transactions as a means of assessing its informational value and also its signaling effect to the market. In general, studies have been congruent with presenting significant abnormal returns following the announcement of insider transactions, suggesting that there is indeed an informational value in insider trading. However, some studies present contradictory results.

Lakonishok and Lee (2001) investigate the abnormal returns for a five-day period following the announcement of over a million insider transactions on the New York Stock Exchange, AMEX, and Nasdaq. The study presents evidence of limited abnormal returns following both insider purchases and insider sales.² This evidence suggests a very limited market reaction to the announcement of insider transactions which is why the authors suggest that the abnormal returns

¹ Seyhun (2000) finds that large transactions executed by large shareholders are not informative for investors. Further, the study also finds small sale transactions to lack predictive ability for a firm's future share price.
² These findings are for managers and large shareholders. The study defines managers as CEOs, CFOs, Chairmen of the board, directors, officers, presidents and vice presidents. The study defines large shareholders as those who own more than 10% of shares and are not in management.
around the announcement day are not economically meaningful and that the market therefore initially dismisses information about insider trading. In contrast, for a similar five-day period, Fidrmuc et al. (2006) find significant abnormal returns following the announcement of both insider purchases and insider sales on the U.K market.³ On the announcement day itself, Fidrmuc et al. (2006) also find significant abnormal returns for both purchases and sales, indicating an immediate market reaction to the announcement of insider transactions. The compiled evidence of the study therefore contradicts the statements made by Lakonishok and Lee (2001) that the market initially dismisses information about insider trading. Further, more recent studies investigating the signaling effect of insider trading have also found significant abnormal returns on the announcement day of insider transactions. Betzer and Theissen (2009) find significant abnormal returns for both insider purchases and sales in their study conducted on the German market using the same sample definition as Fidrmuc et al. (2006). Dardas and Güttler (2011) investigate the signaling effect of insider trading on a variety of European stock markets and also find significant market reactions on the announcement day. They find the strongest reactions on the U.K, Swedish and German market.

Indeed, previous evidence do support the notion that the market deem insider trading to be information of significant value since it reacts to it at the time it is announced. This further indicates that insider trading sends signals to the market concerning the future prospects of a firm. By further investigating the signaling effect of insider trading, this paper makes a contribution to existing research by presenting additional recent evidence found on the Swedish market.

³ The U.K legal framework does not define large shareholders as insiders. The sample used in the study therefore differs from the study of Lakonishok and Lee (2001) regarding this aspect.
Table 1. Results from previous studies on the signaling effect of insider trading. This table shows the cumulative average abnormal returns, CAR, that previous studies have found. Sample (N) is the amount of transactions included in the study. Days is the days for which the CAR is reported. Purchases is for CARs following insider purchases. Sales is for CARs following insider sales. Event day is either trading day, which refers to the day the transaction is executed, or the announcement day, which is the day the information about the trade is announced. *Results for large transactions (transaction value >0.1% of market capitalization).

<table>
<thead>
<tr>
<th>Study</th>
<th>Market</th>
<th>Time period</th>
<th>Sample (N)</th>
<th>Days</th>
<th>Purchases</th>
<th>Sales</th>
<th>Event day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakonishok and Lee (2001)</td>
<td>U.S.</td>
<td>1975-1995</td>
<td>102802</td>
<td>0;4</td>
<td>0.13</td>
<td>-0.23</td>
<td>Trading day and announcement day</td>
</tr>
<tr>
<td>Fidrmuc et al. (2006)</td>
<td>U.K.</td>
<td>1991-1998</td>
<td>3865</td>
<td>0;1</td>
<td>3.12*</td>
<td>-0.37*</td>
<td>Announcement day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0;4 4.62* -0.53*</td>
</tr>
<tr>
<td>Betzer and Theissen (2009)</td>
<td>Germany</td>
<td>2002-2004</td>
<td>1355</td>
<td>0;1</td>
<td>1.12*</td>
<td>-0.65*</td>
<td>Announcement day</td>
</tr>
<tr>
<td>Dardas and Güttler (2011)</td>
<td>Sweden</td>
<td>2003-2009</td>
<td>2001</td>
<td>0;1</td>
<td>1.27*</td>
<td>-0.82*</td>
<td>Announcement day</td>
</tr>
<tr>
<td></td>
<td>Germany</td>
<td></td>
<td>2307</td>
<td>0;1</td>
<td>1.11*</td>
<td>-0.68*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U.K.</td>
<td></td>
<td>1763</td>
<td>0;1</td>
<td>6.12*</td>
<td>-0.41*</td>
<td></td>
</tr>
</tbody>
</table>

3. Hypothesis Development

Our approach to investigating the signaling effect of insider trading is by studying abnormal returns following the announcement of insider transactions. If it is true that corporate insiders have an informational advantage that gives them a better insight about the future developments within their own firm, their transactions should be considered informative since they would reveal private information to outside investors (Leland, 1992). This, in turn, would make the market push the price of a stock towards its true value (Manne, 2005). Considering that rational market participants react to new information immediately at the time it is announced, we assume an instant market reaction to the announcement of informative insider transactions as well. In accordance with the signaling theory and results from previous studies (e.g. Fidrmuc, 2006; Betzter and Theissen, 2009;
Dardas and Güttler, 2011), we assume insider purchase transactions to signal positive future prospects of a firm, thus resulting in an immediate positive market reaction at the time they are announced. On the contrary, we assume insider sale transactions to signal negative future prospects of a firm, thus resulting in an immediate negative market reaction at the time they are announced. Consequently, we formulate the following hypotheses to be tested in our study:

**Hypothesis 1:** The announcement of insider purchases leads to immediate positive abnormal returns.

**Hypothesis 2:** The announcement of insider sales leads to immediate negative abnormal returns.

There can be many reasons behind why insiders decide to sell their shares but the only reason to purchase shares is to earn a return on investment. For example, sales made by insiders may be driven by personal liquidity or portfolio diversification motives and not solely because of negative future prospects of a firm. This makes insider sales less informative compared to insider purchases (Jeng et al., 2003). Indeed, Lakonishok and Lee (2001) suggest that insider purchases are more useful than insider sales and previous research (e.g. Friederich et al., 2002; Jeng et al., 2003; Fidrmuc et al., 2006; Dardas and Güttler, 2011) partially supports this notion by presenting evidence of larger abnormal returns following insider purchases than sales. Because of this, we assume that insider purchases bear a higher informational value than insider sales, thus resulting in larger abnormal returns on the day they are announced.

**Hypothesis 3:** The announcement of insider purchases leads to larger abnormal returns than the announcement of insider sales.

Previous research finds evidence suggesting that the signaling effect of insider trading differs depending on the market capitalization of a firm. Several studies (e.g. Lakonishok and Lee, 2001; Aussenegg and Ranzi, 2008; Betzer and Theissen, 2009; Dardas and Güttler, 2011) find that the signaling effect is greater for smaller firms than for larger firms. This is most likely due to a greater information asymmetry in smaller firms since larger firms are more followed by financial analysts, have a larger proportion of institutional shareholders and have more efficient information policies which makes them more efficiently priced (Lakonishok and Lee, 2001; Aussenegg and

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4 In terms of market capitalization.
Ranzi, 2008; Betzer and Theissen, 2009). Under this pretext, we assume insider transactions made within smaller firms to bear a higher informative value and thereby lead to a stronger signaling effect than insider transactions made within larger firms.

**Hypothesis 4:** The announcement of insider purchases (sales) in smaller firms leads to larger positive (negative) abnormal returns than the announcement of insider purchases (sales) in larger firms.

By testing these four hypotheses, this paper seeks to further investigate the market reaction to the announcement of insider transactions. In doing so, we hope to provide insights of the value seen in information about insider trading on the Swedish stock market which we believe can be of interest for academics and investors alike.

4. Swedish Regulation on Insider Trading

As a member of the European Union, Sweden is subject to directives enacted on EU level. An EU-directive is a legislative act that specifies certain goals that all member states must achieve. However, the way in which these goals are achieved is up to each individual member state (European Union, 2018). Because of this, the specific regulations included in the directives are not directly applicable to Swedish law.

The first EU-directive that Sweden became subject to was Council Directive 89/592/EEC which took force in 1992 as an attempt to harmonize financial market regulations and control insider trading within the European Union. In 2004, Council Directive 89/592/EEC was replaced by the Market Abuse Directive 2003/6/EC (2004/72/EC)\(^5\) which can be seen as a further and more comprehensive step towards controlling the financial markets and insider trading within the European Union. This directive was the first to harmonize the definition of an insider within the European Union by defining it as a “person discharging managerial responsibilities” or a person closely associated with such a person.\(^6\) In addition, the directive required investors defined as

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\(^5\) The Commission Directive 2004/72/EC is an extension of directive 2003/6/EC that specifies the requirements for insider trading reporting.

\(^6\) According to 2004/72/EC, Art. 1(1), a “person discharging managerial responsibilities within an issuer shall mean a person who is (a) a member of the administrative, management or supervisory bodies of the issuer; (b) a senior executive, who is not a member of the bodies as referred to in point (a), having regular access to inside information
insiders to report their investment transactions within five business days after executing them. The reporting had to include information such as transaction volume, price and type. This is something all insiders were obliged to do given that their accumulated transactions within a calendar year exceeded 5000 euros. Further, the directive required firms to report the names of all insiders and to regularly update this information. Following this directive taking effect, Sweden did adjust its legal framework to comply with the goals set by the European Union. However, Sweden did not include all regulations of the directive and excluded the 5000 Euro notification-barrier and also the requirement for insiders to report transaction price.\footnote{7}

On 3rd of July 2016, Market Abuse Directive 2003/6/EC (2004/72/EC) was replaced by Regulation (EU) No 596/2014 which is the directive currently valid for all EU member states. This directive did not include any changes concerning the definition of an insider but it did however include a modest change in the rules on reporting insider transactions. With this directive, an insider transaction must be reported within three business days compared to the previously required five business days. Otherwise, most requirements in the reporting of insider transactions remain the same. However, concerning the possibility for insiders to trade their own firms shares, the directive includes a new addition which prohibits insiders to trade their own firms share within 30 days before the announcement of a year-end or interim financial report. Aside from that, insiders are allowed to trade freely given that they do not trade on private information.

Following this new directive, Sweden again adjusted its legal framework to comply with the goals of the European Union. However, Sweden now fully implemented the regulations within the directive and, therefore, started to implement the previously suggested 5000 euro notification-barrier and also the requirement for insiders to report transaction price.\footnote{8}

In addition to the market abuse directives, the EU also issued the Transparency Directive 2004/109/EC in 2004 which was later revised in 2013.\footnote{9} The purpose of the Transparency Directive

\footnote{7} The Swedish law enacted to achieve the goals of the Market Abuse Directive 2003/6/EC (2004/72/EC) was called “Lag (2000:1087) om åmälningsskyldighet för vissa innehav av finansiella instrument”.
\footnote{8} The Swedish law enacted to achieve the goals of Market Abuse Directive 2003/6/EC (2004/72/EC) was repealed and replaced by the requirements of Regulation (EU) No 596/2014.
\footnote{9} The regulations of the Transparency Directive became part of the Swedish legal framework through changes in the law called “lagen (2007:528) om värdepappersmarknaden (VpmL)”.

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is to “ensure transparency of information for investors through a regular flow of disclosure of periodic and on-going regulated information and the dissemination of such information to the public” (ESMA, 2018). The Transparency Directive requires corporate filings to be reported electronically and that each member state also ensures that there is an official central storage for this information. Even though the Transparency Directive puts most emphasis on the reporting of shareholding disclosures and financial reports, the regulations in the directive also apply to the reporting of insider transactions. The general aim of the Transparency Directive is to ensure that all financial markets participants have access to the same relevant information about the securities traded and, as with Regulation (EU) No 596/2014, Sweden is subject to the objectives of the Transparency Directive 2004/109/EC as well.

5. Data

5.1 Data Sources
The data for insider transactions used in this paper are obtained from the Swedish financial supervisory authority’s insider registry called the PDMR transactions register (Swedish: Insynsregistret). The data we obtain from the PDMR transactions register includes information about firm name, insider position, transaction date, and transaction type. Daily return data for shares and for the market are obtained from Thomson Reuters Datastream and is adjusted for dividends, SEOs and stock splits over the sample period. In addition, market capitalization data for firms included in our data sample are also obtained from Thomson Reuters Datastream.

5.2 Sample Selection
Since this study is conducted on the Swedish stock market, we include all transactions that fall under the EU-definition of an insider transaction and thereby include transactions made by all “people discharging managerial responsibilities” and people closely associated with such people. We look at insider transactions executed in the domestic currency SEK in all firms traded on the

10 The PDMR transactions register contains data about persons discharging managerial responsibilities and the transactions that they and persons closely associated with them have performed in shares and debt instruments issued by the issuer and other related financial instruments” (Finansinspektionen, 2017).
11 Since Sweden did not require insiders to report the price of which they purchased or sold their shares before 3rd of July 2016, we do not have access to this information (See Swedish Regulation on Insider Trading).
12 See the exact definition under the header “Swedish Regulation on Insider Trading”.
Stockholm Stock Exchange (Nasdaq Stockholm) during the period 2014-2016. The original data set contains a total of 14,098 insider transactions with 8,856 being insider purchases and 5,242 being insider sales.

Previous research studying the informativeness of insider trading (e.g. Bettis et al., 1997; Lakonishok and Lee, 2001; Fidrmuc et al., 2006) suggest that many insider transactions are not considered informative and are, therefore, ignored by the market. Because of that, these studies disregard such transactions and instead focus on the more meaningful events within the sample period.13 By excluding less meaningful events from the data set, these studies are able to examine whether insider transactions can be informative at all for the market. We follow the same principle in this paper but use a different approach for defining meaningful events. The underlying premise used for defining more meaningful events in this paper is the notion that insider transactions resulting in published announcements made by major Swedish business newspapers are more likely to bear an informational value for investors compared to transactions that have not been published in these newspapers.14 This is because these newspapers choose to publish certain insider transactions over others, as they see them as more meaningful for investors. By using published announcements as a way of constructing a sample, we take a similar sample selection approach as Chang and Suk (1998).15

We are aware of the potential risk of getting biased results by using published announcements as a sample selection method. Chang and Suk (1998) find that the market reacts to published insider transactions both when they become public, but also at the time they are published in newspapers. The publishing of an insider transaction, therefore, gives the transaction a stronger market reaction compared to if the transaction would not have been published.

13 For example, Lakonishok and Lee (2001) define more meaningful events as transactions with a transaction volume of 100 shares or more. All transactions with a transaction volume below 100 shares are excluded from the data set. Fidrmuc et al. (2006) define more meaningful events as transactions with a transaction volume involving at least 0.1% of total shares outstanding. All transactions with a transaction volume involving less than 0.1% of total shares outstanding are excluded from the data set. Bettis (1997) only focus on studying large-volume transactions by high-ranking insiders.

14 An announcement is a single news item containing a short message describing the characteristics of one specific insider transaction by including information such as insider name, position, transaction date, transaction price (starting from 3rd of July 2016) and transaction volume.

In this paper, the published announcements we use to identify meaningful transactions contain the same information as reported in the PDMR transactions register. Because of that, a possible second market reaction due to the transactions being published is not a result of any change in their informational value. Consequently, the published announcements in themselves do not bias the results of the study as they do not contain any additional information from the one reported in the PDMR transactions register. Nonetheless, the fact that the transactions have resulted in published announcements might contribute to the validity of our results since they have a high reach and therefore help distribute the same information as in the PDMR transactions register to more market participants. In other words, by having more market participants react to the same information, we might get a more accurate picture of the informational value seen in insider trading by investors.

To identify the more meaningful transactions in the original data set, we use Retriever Research\textsuperscript{16} where we select every insider transaction on Nasdaq Stockholm that have resulted in announcements made by four major business newspapers in Sweden. We use the business newspapers Affärsvärlden, Dagens Nyheter, Dagens Industri and Fastighetsnytt as these four business newspapers together provide a substantial coverage of insider trading in firms across all industries traded on Nasdaq Stockholm. Further, these four newspapers do not publish every new transaction that appears in the PDMR transactions registry but instead select specific transactions to be published based on what they find to be of highest interest for investors.\textsuperscript{17} In this way, by only including transactions published in these four newspapers, we automatically implement the newspapers’ own selection criteria for identifying relevant and informative transactions. This, in turn, gives us a data set consisting of the more meaningful events within the sample period, thereby following the same sample selection principle as previous research on insider trading (e.g. Bettis et al., 1997; Lakonishok and Lee, 2001; Fidrmuc et al., 2006).

After identifying the more informative insider transactions in our original data set, we have a total of 94 insider purchases and 64 insider sales in our sample. However, some of these transactions are removed from the sample since they occurred quite early after the firm became public, resulting in an absence of all data necessary for conducting our study with them. In addition, some insider

\textsuperscript{16}Retriever research is a digital news archive containing articles and similar media from both physically and digitally published sources. See https://bit.ly/2sbhU7x for more information.

\textsuperscript{17}This is an assumption we make since we do not possess any information about the criteria used by the business newspapers for selecting the insider transactions they choose to publish.
transaction in the data set were removed after conducting the study since these were considered outliers. After adjusting for these transactions, the final data set consists of 147 transactions with 86 being insider purchases and 61 being insider sales, which is a transaction decrease of 99.0% from the original data set.

5.3 Descriptive Statistics

Table 2 shows the descriptive statistics for our sample, which covers net purchases, sales, year of transaction and firm market capitalization. Our sample consists of more insider purchases than insider sales where purchases account for 58.5% of the total amount of transactions (86 out of a total of 147) and sales account for 41.5% (61 out of a total of 147). The highest number of transactions (67 out of 147) take place in year 2016 and make up 45.6% of all transactions. 51 out of 147 transactions (34.7%) take place in year 2015 and only 29 out of 147 transactions (19.7%) take place in year 2014. The date of execution for the sample transactions are therefore skewed to the later years of the sample period. In addition, the distribution of firm size based on market capitalization in the sample is also skewed as seen in the rather large difference between the median and mean size of the sample firms but also in the standard deviation.

Table 2. Summary of the final sample data. This table summarizes the (net) insider purchases and sales made by insiders in Sweden within the period 2014-2016 that are included in our final data set. Year is the calendar year in which the trade was executed. Market capitalization is the consolidated market value for all equity classes in each firm.

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>Mean</th>
<th>Median</th>
<th>St.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>2014</td>
<td>2015</td>
<td>2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>86</td>
<td>17</td>
<td>27</td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td></td>
<td>61</td>
<td>12</td>
<td>24</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>147</td>
<td>29</td>
<td>51</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of firms</td>
<td></td>
<td>99</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We consider transactions resulting in CAR >10% on day (0;1) to be outliers.
6. Methodology

6.1 Event Study
We investigate the signaling effect of insider trading activity by analyzing share price movements following the announcements of insider transactions. To capture the impact of insider transactions on firms’ share price, we adopt a standard short-term event study. In general, if market participants act rationally, they will react to new information at the time it is announced causing the share price of a firm to change and, using event study methodology, it is possible to capture and measure that reaction (MacKinlay, 1997). In our case, if there is informational value in insider trading activity, the market participants will react to it at the time it is announced and the event study will be able capture this reaction and allow us to measure it. The event study methodology is optimal for understanding the informativeness of insider trading activity for future returns (Jeng et al., 2003) and is in general a good measure for the effect new information has on a firm's share price (MacKinlay, 1997). For these reasons, we find the event study methodology to be optimal for the purpose of this study.

6.2 Event Definition
We define the event day in our study as the announcement day of the insider transactions by the Swedish financial supervisory authority. Using event-study methodology, we first study the development of the sample firms’ share price ten trading days preceding the announcement of an insider transaction. Next, we study the development of the share price at the day of the announcement and ten trading days subsequent to the day of the announcement. This gives us an event window of 21 trading days which is sufficient to capture any possible signaling effect of insider trading activity. Since we examine both insider purchases and sales, we perform two separate event studies for these two types of transactions. To estimate normal returns, we use an estimation window of 120 trading days which is the recommended estimation window for event studies examining daily returns (MacKinlay, 1997).
6.3 Abnormal Returns

To measure the impact insider transactions have on a firm's share price, we calculate the cumulative average abnormal returns (CAR) for our sample firms during the event window for each insider transaction. The CAR represents the difference between the actual returns and the returns one would expect without the event occurring. Since this paper investigates the signaling effect of insider transactions, we examine the CAR on the trading day on which the insider transactions are announced and also the subsequent trading day to it¹⁹ (CAR (0;1)). To calculate the CAR for each firm, we first estimate normal returns using the market model parameters presented by MacKinlay (1997). The normal return for firm i and observation t is

\[ R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \] (1)

\( R_{it} \): Returns on security i period t  
\( \alpha_i \): Parameter from the market model  
\( \beta_i \): Parameter from the market model  
\( R_{mt} \): Returns on market portfolio period t  
\( \varepsilon_{it} \): Zero mean disturbance term (=0)

where \( R_{mt} \) corresponds to the market returns. We use the SIX Return Index (SIXRX) as a proxy for market returns since SIXRX constitutes of the average total return of all firms traded on the

¹⁹ We examine the subsequent day because some transactions are reported after the market has closed and the impact these transactions have on a firm’s share price will therefore only be reflected on the following trading day.
Stockholm Stock Exchange and is therefore an adequate proxy for market returns in this study.\textsuperscript{20} To estimate the parameters $\alpha$ and $\beta$, a linear OLS regression in our 120 day estimation window is used where the method to calculate parameter $\alpha$ and $\beta$ is presented in equation 2 and 3 respectively.

$$\hat{\alpha}_i = \hat{\mu}_i - \hat{\beta}_i \hat{\mu}_m$$ \hspace{1cm} (2)

$\hat{\alpha}_i$: Estimated Alfa for observation $i$

$\hat{\mu}_i$: Estimated average return for observation $i$

$\hat{\beta}_i$: Estimated Beta for observation $i$

$\hat{\mu}_m$: Estimated average market return

$$\hat{\beta}_i = \frac{\sum_{\tau=T_0+1}^{T_1} (R_{i\tau} - \hat{\mu}_i)(R_{m\tau} - \hat{\mu}_m)}{\sum_{\tau=T_0+1}^{T_1} (R_{m\tau} - \hat{\mu}_m)^2}$$ \hspace{1cm} (3)

After calculating the normal returns for each firm experiencing the event, we calculate their average abnormal returns during the event windows of each insider transaction as presented in equation 4 and equation 5.

$$AR_{i\tau} = R_{i\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m\tau}$$ \hspace{1cm} (4)

$AR_{i\tau}$: Abnormal return for observation $i$ for period $\tau$

$$\overline{AR}_\tau = \frac{1}{N} \sum_{i=1}^{N} AR_{i\tau}$$ \hspace{1cm} (5)

$\overline{AR}_\tau$: The sample aggregated abnormal returns for period $\tau$

$N$: Number of observations

\textsuperscript{20} SIXRX is a gross index, meaning that the index takes the maximum possible reinvestment of dividend into account when computing returns.
Having calculated the average abnormal returns during the event windows for each firm experiencing the event, we then accumulate the abnormal returns for each individual firm to get the cumulative average abnormal returns during the event windows as presented in equation 6.

\[
\overline{CAR}(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau
\]  

\(\overline{CAR}(\tau_1, \tau_2)\): Cumulative average abnormal returns for period \(\tau_1, \tau_2\)

### 6.4 Significance of Abnormal Returns

We perform a two-tailed t-test as suggested by MacKinlay (1997) to test the statistical significance of our results. This is done by calculating the variance of the abnormal returns and CAR using equation 7 and 8 and then testing the null hypothesis that the abnormal returns are zero using equation 9.

\[
\text{var}(\overline{AR}_\tau) = \frac{1}{N^2} \sum_{i=1}^{N} \sigma_{\epsilon_t}^2
\]  

\(\text{var}(\overline{AR}_\tau)\): The variance for abnormal returns period \(\tau\)

\(\sigma_{\epsilon_t}^2\): Standard error from the estimation window (OLS regression for each security)

\[
\text{var}\left(\overline{CAR}(\tau_1, \tau_2)\right) = \sum_{\tau=\tau_1}^{\tau_2} \text{var}(\overline{AR}_\tau)
\]  

\(\text{var}(\overline{CAR}(\tau_1, \tau_2))\): The variance for cumulative average abnormal returns period \(\tau_1-\tau_2\)

\[
\theta_1 = \frac{\overline{CAR}(\tau_1, \tau_2)}{\text{var}(\overline{CAR}(\tau_1, \tau_2))^{1/2}} \sim N(0,1)
\]  

\(\theta\): Test statistic for period \(\tau_1, \tau_2\)
Further, we perform a one-sample Wilcoxon signed rank test on CAR day (0;1) to see if the statistical significance of these results are robust to non normality. In addition, we perform independent samples t-tests to confirm whether there is a significant difference between CARs following insider purchases and sales but also to confirm whether there is a significant difference in CARs based on firm size. To test if the statistical significance of these results are robust to non normality, we perform a nonparametric Wilcoxon rank-sum test.21

### 6.5 Event Clustering

When insiders purchase or sell shares in their own firm, they tend to do it in tranches and not in one single transaction. These tranches together are commonly referred to as clusters and to adjust for clusters, we aggregate all transactions executed by the same insider on the same trading day and count them as one single insider transaction. The reason for this is that such trading patterns is likely a result of partial fulfillment of orders and therefore do not convey any additional information (Aussenegg and Ranzi, 2008).

However, in some cases, trades by insiders can be scattered over several days leading to event contamination. This is because the cumulative average abnormal returns (CAR) for later trades will include the possible price reaction of preceding trades within the event window and thereby bias CAR estimates. In addition, cluster transactions may also result in cross-sectional dependence since different event windows will overlap, making t-stat calculations inaccurate.22 These potential problems that cluster transactions may result in are mitigated through the use of daily data (Brown and Warner, 1985) but have usually been disregarded in previous research on insider trading. The reason for this is that studies (e.g. Friederich et al, 2002; Fidrmuc et al. 2006; Betzer and Theissen, 2009) have found cluster transactions to not be a serious problem for the robustness of the results when studying the market reaction to insider transactions. Because of that, this paper takes the same approach as previous studies by including cluster transactions in its sample.

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21 The results of our statistical tests are presented in Appendix B and C.
22 When event windows overlap, single firms for which the covariance is not 0 will become correlated which in turn distorts the variance of the aggregated cumulative returns and therefore also t-values. In contrast, when event windows do not overlap, the covariance between firms will always be 0 and will therefore not distort t-values (MacKinlay, 1997).
6.6 Portfolio Formation Based on Firm Size

In order to see the effect of firm size on the signaling effect of insider trading activity, we form two portfolios; one for insider purchases and one for insider sales. Within these portfolios, we divide the included firms into two groups based on the median market capitalization of the portfolio. We name the first group “smaller firms” and the second group “larger firms”.\textsuperscript{23} We then repeat the event study for each portfolio which gives us the CAR for insider purchases and insider sales in both smaller and larger firms. This further allows us to investigate the impact firm size has on the abnormal returns following insider trades and thereby test hypothesis 4 in this paper.

The approach we take to investigate the effect of firm size on abnormal returns is congruent with the approach taken by Aussenegg and Ranzi (2008). However, several previous studies (e.g. Lakonishok and Lee, 2001) take a different approach by dividing their firms into three groups; small, medium and large firms. This has been possible due to a significantly larger sample size than that of this study. Therefore, given the rather limited sample size of this study, we find it more suitable to take a similar approach as Aussenegg and Ranzi (2008) and divide our sample into two groups based on the median market capitalization of the portfolios.

7. Results and Analysis

7.1. Insider Purchases

Table 3 presents the compiled results of our study. For purchases, we find significant positive CARs of 1.27% on day (0;1). However, in the preceding (-10;-1) and subsequent period (2;10), we find no significant abnormal returns. These findings suggest that the announcement of insider purchases do lead to immediate positive abnormal returns, which confirms hypothesis 1 of this paper. Our results are consistent with previous research (e.g. Fidrmuc et al., 2006; Betzer, Theissen, 2009; Dardas, Güttler, 2011) as these studies also find significant abnormal returns following the announcement of insider purchases on day (0;1).

\textsuperscript{23} In the portfolio for insider purchases, firms exceeding the portfolio median (3.367 billion SEK) make up the group “larger firms” and firms with a market value below the portfolio median make up the group “smaller firms. In the portfolio for insider sales, firms exceeding the portfolio median (4.481 billion SEK) make up the group “larger firms” and firms with a market value below the portfolio median make up the group “smaller firms.
Table 3. Cumulative Average Abnormal Return (%) for purchases and sales. This table presents the cumulative average abnormal returns (CAR) for the period preceding the announcement day (-10; -1), on the announcement day and the subsequent trading day (0;1) and for the subsequent period to the announcement day (2;10). Larger firms refers to the group of firms with a market capitalization equivalent to or higher than the portfolio median. Smaller firms refers to the group of firms with a market capitalization lower than the portfolio median. *N* is the number of observations. *** indicate significance at the 1% level. ** indicate significance at the 5% level.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Days</th>
<th>-10;-1</th>
<th>0;1</th>
<th>2;10</th>
</tr>
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<tr>
<td>Purchases</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>86</td>
<td>-0.61</td>
<td>1.27***</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>t-statistic</td>
<td>-1.810</td>
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<td>1.639</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larger firms</td>
<td>43</td>
<td>0.11</td>
<td>0.66***</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>t-statistic</td>
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<td>0.295</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smaller firms</td>
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<td>-1.26**</td>
<td>1.90***</td>
<td>0.60</td>
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</tr>
<tr>
<td>t-statistic</td>
<td>-2.279</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
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<td>0.73</td>
<td>-1.03**</td>
<td>0.65</td>
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<td>Larger firms</td>
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<td>-0.48</td>
<td>0.01</td>
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<td>t-statistic</td>
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<td>-1.362</td>
<td>0.049</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smaller firms</td>
<td>30</td>
<td>1.80**</td>
<td>-1.60**</td>
<td>1.32**</td>
<td></td>
</tr>
<tr>
<td>t-statistic</td>
<td>2.311</td>
<td>-2.360</td>
<td>2.137</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of our study provide further evidence that insider purchases send signals to the market that the future prospects of firms are positive since they lead to immediate positive market reactions. As suggested by Jeng et al. (2003), the positive market reactions indicate that outside investors value information about insider purchases because they assume that insider buyers have a better insight of the near-term developments within their own firm. This in turn further supports the notion proposed by Leland (1992) that insider transactions reveal private information to outside investors. If this is the case, information about insider trading makes firms more efficiently priced and share prices, therefore, reflect the true value of them better. The market reaction at the day of announcement can therefore also be seen as a price correction as a result of private information becoming public.
7.2. Insider Sales

For insider sales, we find significant negative CARs of -1.03% on day (0;1). For the period preceding the announcement day (-10;-1), we find significant positive CARs of 0.73% but in the subsequent period to the announcement day (2;10), we find no significant CARs. These findings suggest that the announcement of insider sales transactions lead to immediate negative abnormal returns which confirms hypothesis 2 in this paper. In addition, our findings are also consistent with previous evidence presented by Fidrmuc et al. (2006), Betzer and Theissen (2009) and Dardas and Güttler (2011) as they also find significant negative CARs following the announcement of insider sales on day (0;1). However, the results of this paper find a significantly stronger market reaction in terms of CARs compared to these studies which might be a result of the different sample selection method used in this study.

As with insider purchases, our study provides further evidence that insider sales also send signals to the market. Due to the negative market reaction following insider sales, outside investors seem to value information about insider sales and view them as signals that the future prospects of firms are negative.

Our results support the notion that an information asymmetry does exist between insider and outside investors and that, by selling shares, insider sales reveal private information to outside investors, as proposed by Leland (1992). Just like with insider purchases, the market reaction following insider sales can be seen as a price correction as a result of private information becoming public, making firms more efficiently priced.

7.3 Difference Between Purchases and Sales

The findings of our study seem to suggest a stronger signaling effect for insider purchases than for insider sales since we find CARs of 1.27% on day (0;1) for insider purchases and CARs of -1.03% on day (0;1) for insider sales. However, we do not find this difference to be of statistical significance\(^{24}\) and can, therefore, not confirm hypothesis 3 in this paper. Consequently, the results of our study contradicts previous studies (e.g. Lakonishok and Lee, 2001; Fidrmuc et al., 2006; Betzer, Theissen, 2009; Dardas, Güttler, 2011;) which find significant evidence suggesting that

\(^{24}\) Test statistics are presented in Appendix B.
the announcement of insider purchases leads to larger abnormal returns than the announcement of insider sales. According to these studies, this is a consequence of insider purchases being more informative about the future prospects of a firm than insider sales since there can be many reasons behind why insiders decide to sell their shares but only one reason to purchase shares which is to earn a return on investment.\textsuperscript{25} In contrast, our results suggest that the informative value of insider sales is similar to the informative value of insider purchases and therefore have a similar signaling effect.

There is a possibility that the divergence of our results from previous studies’ results can be explained by the sample and methodology of our study. Since we do not take transaction size\textsuperscript{26} into account, there is a risk that the results we present are biased since previous research have found transaction size to have an influence on CARs following the announcement of insider transactions (e.g. Fidrmuc et al., 2006; Dardas and Güttler 2011). If the sales transactions in our sample are relatively large compared to the purchase transactions, CARs following insider sales will be biased and, therefore, indicate a stronger signaling effect as a result of their transaction size and not their transaction type. In this way, the transaction size will compensate for the informative value that insider sales transactions lack compared to insider purchases, thus, giving both transaction types a similar signaling effect in our study.

\textbf{7.4 Firm Size}

Similar to previous studies, this paper also investigates the effect of firm size on the signaling effect of insider trading. These results are also presented in Table 3.

For smaller firms, we find CARs of 1.9\% for purchases and -1.6\% for sales on day (0;1). For larger firms, we find CARs of 0.66\% for purchases and -0.48\% for sales on day (0;1).\textsuperscript{27} As our results suggest, there are notable differences between larger and smaller firms in terms of CAR on day (0;1). These findings indicate that the signaling effect of insider transactions are stronger for smaller firms than for larger firms. However, we only find the difference in CARs based on firms

\textsuperscript{25} For example personal liquidity and diversification reasons that have little to do with the future prospects of the firm.

\textsuperscript{26} Transaction size refers to the amount of shares bought or sold times the average price paid per share.

\textsuperscript{27} The result (-0.48\% CAR for sales in larger firms) is not statistically significant (t-statistics of -1.362).
size to be of statistical significance\textsuperscript{28} for purchases and can, therefore, not confirm hypothesis 4 in this paper.

Since we find firm size to impact CARs for purchase transactions, our findings are partially consistent with previous research (e.g. Fidrmuc et al., 2006; Aussenegg and Ranzi, 2008; Dardas and Güttler, 2011) which suggests that firm size have a significant impact on the signaling effect of insider trading. However, our results are not fully consistent with these studies since we do not find statistically significant differences for insider sales transactions as well.

Because of this, our findings do not fully support the notion suggested by previous research (Lakonishok and Lee, 2001; Aussenegg and Ranzi, 2008; Betzer and Theissen, 2009) that insider transactions made within smaller firms bear a higher informative value compared to transactions made within larger firms, as a result of a higher information asymmetry in smaller firms. Instead, our results suggest that this only applies to insider purchases and that insider sales are just as informative regardless of firm size. The explanation behind this might be the fact that we are unable to completely isolate the effect of firm size on CAR estimates and that other factors such as transaction size therefore bias our results. Further, another explanation behind our results being inconsistent with previous research concerning the firm size effects on insider sales might be the limited sample size of our study.

8. Conclusion

In this paper, we study the signaling effect of insider trading on the Swedish stock market. We find strong evidence of a signaling effect for both insider purchases and insider sales. Due to the magnitude of the CARs found, our results indicate that the abnormal returns following insider purchases and sales are not only statistically significant but also economically significant. Surely, given the market reaction we find evidence for, market participants do seem to value information about insider trading and thereby use it to better assess the future prospects of firms. In this way, our paper contradicts the evidence and statements of Lakonishok and Lee (2001) which suggest that the abnormal returns around the announcement day of insider transactions are not economically meaningful and that the market therefore dismisses this information initially.

\textsuperscript{28} Test statistics are presented in Appendix B.
In contrast to previous research, we find the signaling effect of insider purchases and insider sales to be similar, suggesting that both types of transactions bear a rather equal informative value. This contradicts the notion stated by previous research that insider purchases are more informative than insider sales since there can be many reasons for an insider to sell shares but only one reason to buy shares, which is to earn a return on investment.

Further, we find the signaling effect to be stronger for smaller firms than for larger firms. This does however only apply for insider purchases and not for insider sales. Still, this finding indicates that firm size does have a certain influence on the signaling effect of insider trading. This can be explained by a larger information asymmetry in smaller firms which makes insider transactions within smaller firms more revealing about the firm's future prospects compared to larger firms.

Overall, this paper presents further evidence that the market deems insider trading to be valuable information and that it sends signals about the future prospects of firms’ to outside investors. However, this study does suffer from some limitations where the most noteworthy is the size of our sample. As a result of our rather limited sample size, we are not able to form the distinct portfolios that would allow for a more detailed study of the impact firm size has on the signaling effect. Another limitation is that the PDMR transactions register does not include information about the price for which the insiders purchased or sold their shares until July 2016. This makes us unable to calculate the size of the majority of transactions in our sample which in turn restricts us from studying the effect transaction size has on the signaling effect. In addition, not having access to transaction size also prevents us from adjusting for it when studying the other variables in this paper and thereby better isolate the effect they have on the signaling effect.

Lastly, it is possible that Regulation (EU) No 596/2014 taking effect on 3rd of July 2016 have had an impact on our CAR estimates as well. Due to the size of our sample, we are not able to study how much of an impact it has on our CAR estimates which in turn increases the risk that our results are biased due to legal changes as well.

Given the limitations of this paper, we see a possibility for research to further investigate the signaling effect of insider trading on the Swedish market by using a significantly larger sample.
size and also including transaction size as a variable. Further, the effect of recent regulatory changes on the informational value seen in insider trading might also be of interest for future research. By taking into account and making up for the limitations of this study, it is possible to make a more thorough and detailed study on insider trading which certainly will make valuable contributions to existing literature on insider trading.
References


Appendices

Appendix A. This table shows the abnormal returns (AR), $t$-statistics and cumulative average abnormal returns (CAR) for purchases and sales for each trading day in the event window.

| Day | Purchases (n=86) | | | Sales (n=61) | | |
|-----|-----------------|-----------------|-----------------|-----------------|-----------------|
|     | AR (%) | $t$-statistic | CAR (%) | AR (%) | $t$-statistic | CAR (%) |
| -10 | -0.208 | -0.846 | -0.208 | 0.391 | 1.142 | 0.391 |
| -9  | -0.339 | -1.377 | -0.547 | 0.305 | 0.892 | 0.696 |
| -8  | 0.620  | 2.520  | 0.073  | -0.026 | -0.075 | 0.670 |
| -7  | -0.374 | -1.519 | -0.301 | 0.061 | 0.177 | 0.731 |
| -6  | 0.086  | 0.349  | -0.215 | 0.287 | 0.837 | 1.017 |
| -5  | -0.590 | -2.399 | -0.805 | 0.014 | 0.040 | 1.031 |
| -4  | -0.148 | -0.602 | -0.953 | 0.082 | 0.241 | 1.113 |
| -3  | 0.176  | 0.717  | -0.777 | -0.527 | -1.541 | 0.586 |
| -2  | -0.031 | -0.126 | -0.808 | 0.182 | 0.531 | 0.768 |
| -1  | 0.200  | 0.811  | -0.608 | -0.040 | -0.117 | 0.728 |
| 0   | 0.935  | 3.800  | 0.327  | -0.306 | -0.893 | 0.422 |
| 1   | 0.334  | 1.358  | 0.661  | -0.724 | -2.117 | -0.302 |
| 2   | 0.311  | 1.263  | 0.971  | -0.321 | -0.938 | -0.623 |
| 3   | 0.100  | 0.407  | 1.072  | 0.304  | 0.887  | -0.319 |
| 4   | 0.312  | 1.268  | 1.384  | 0.491  | 1.436  | 0.172 |
| 5   | 0.063  | 0.256  | 1.447  | -0.240 | -0.703 | -0.069 |
| 6   | 0.096  | 0.389  | 1.542  | 0.436  | 1.274  | 0.367 |
| 7   | 0.150  | 0.610  | 1.692  | -0.182 | -0.533 | 0.185 |
| 8   | 0.179  | 0.728  | 1.871  | 0.604  | 1.765  | 0.789 |
| 9   | -0.678 | -2.754 | 1.194  | -0.480 | -1.402 | 0.310 |
| 10  | -0.042 | -0.171 | 1.152  | 0.042  | 0.124  | 0.352 |
Appendix B. Hypothesis testing on CAR differences between purchases and sales (hypothesis 3) and between smaller and larger firms (hypothesis 4). Results from independent samples tests (parametric) and from Wilcoxon rank sum tests (non parametric). ** indicates significance at the 5% level.

<table>
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<th>Hypothesis</th>
<th>Mean Difference (%)</th>
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<th>P-value Wilcoxon</th>
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<td>3</td>
<td>Purchases</td>
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</tr>
<tr>
<td></td>
<td>0.24</td>
<td>1.26**</td>
<td>1.12</td>
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<tr>
<td></td>
<td>0.609</td>
<td>0.018</td>
<td>0.171</td>
</tr>
<tr>
<td></td>
<td>0.768</td>
<td>0.024</td>
<td>0.028</td>
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</tbody>
</table>

Appendix C. Results from one-sample Wilcoxon signed rank test for CAR (0;1).

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Larger firms</td>
</tr>
<tr>
<td>P-value</td>
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</table>

Appendix D. Graphical illustration of CAR development in the event window for insider purchases.

Appendix E. Graphical illustration of CAR development in the event window for insider sales.