Interpreting the Repurchase Signal

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May 2018

Master's Programme in Accounting and Finance

Abstract

Title	Interpreting the Repurchase Signal
Seminar date	2018-06-01
Course	BUSN79, Business Administration; Degree Project in Accounting and Finance, Graduate level, 15 ECTS.
Authors	Adam Kindstrand & Alexander Truedsson
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Key words	Information asymmetry, Insider trading, Share repurchases, Undervaluation, Abnormal returns, Signaling.
Purpose	The purpose of this study is to examine the potential of improving the interpretation of signals of undervaluation inherent to share repurchases, by accounting for insider trading, level of insider and cash holdings. The goal is to contribute to decreased information asymmetry and increased efficiency in capital markets.
Methodology	The study performs a long-horizon event study, applying buy-and-hold abnormal return as primary measure. In order to assess abnormal returns three years post-event, with the primary event of interest being share repurchases concurrent with insider trading.
Theoretical perspectives	The study is based on previous research regarding share repurchases, insider trading and the combination of the two in terms of signaling.
Empirical foundation	The sample of the study consists of 231 observations. These observations consist of firms listed on the Stockholm Stock Exchange, and have performed material share repurchases in any quarter during the period ranging from year 2000 to year 2014. The data were gathered from Datastream, Eikon, Holdings, Finansinspektionen and Nasdaq.
Conclusions	The study concludes that; Firms with insider buying concurrent to share repurchases obtain higher abnormal returns than non-buying repurchasing firms, CEO insider buying concurrent with share repurchases obtain higher abnormal returns than other insider buying concurrent with share repurchases, Repurchasing firms with lower levels of cash obtain higher abnormal returns than repurchasing firms with higher levels of cash.

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1. Introduction

1.1 Background

One important part of an efficient capital market is corporate disclosures (Healy & Krishna, 2001). The credibility of different disclosures is increased by regulations, auditors and other intermediaries in the capital market (Healy & Krishna, 2001). However, some disclosures could contain mixed signals, for example if a firm is repurchasing shares while an insider is selling shares (Bonaimé & Ryngaert, 2013). In order for corporate disclosures to decrease information asymmetry and create a more efficient capital market, market participants need to correctly interpret the signals of these disclosures (Bonaimé & Ryngaert, 2013).

One such signal, according to Ikenberry, Lakonishok and Vermaelen (1995), is share repurchases. Their findings are in line with Dittmar's (2000) conclusion that firms carry out repurchases when they seem to be undervalued. Repurchases as a method of distributing capital to shareholders have increased in the US during the 1980s and 1990s (Grullon & Michaely, 2002). According to Floyd, Li and Skinner (2015) repurchases have exceeded cash dividends as payout method during most of the recent years for industrial firms in the US. This increase in repurchases as payout method entails an increase in the availability of signals inherent to those specific events, which might be used to identify undervalued firms and decrease information asymmetry.

Another type of event which grants the possibility of decreasing information asymmetry is insider trading. The inherent signals might convey information regarding mispricing, where insider buying may suggest undervaluation and insider selling may suggest overvaluation (Rozeff & Zaman, 1988). This is also in line with findings by Ke, Huddart and Petroni (2003) who conclude that insiders trade on knowledge of future economically significant accounting disclosures. Thus, insider trading can be used as a signal to identify mispricing.

The debate regarding both insider trading and share repurchases is constantly relevant, since rules and regulations are frequently being changed. In July 2016 a new decree from the European

Union, Market Abuse Regulation (MAR), was implemented in Sweden. This decree affects both insider trading and share repurchases. MAR demand that insiders, trading in capital insurance depot, must report their transactions (Wahlin, 2016), and MAR also regulates the reporting requirements of share repurchases.

The primary focus of this study is the combined signaling effect inherent to insider trading concurrent with share repurchases, which has the ability to convey information beyond that of the two separate signals. According to Bonaimé and Ryngaert (2013) the signals of insider trading have the ability to either validate or mitigate the signals of undervaluation inherent to repurchases. They conclude that insider buying strengthens repurchases as a signal of undervaluation, while insider selling weakens repurchases as a signal of undervaluation. Chan, Ikenberry, Lee & Wang (2012) draw a similar conclusion, although limited to "value firms" i.e. firms with lower than average price-to-book ratio. Bonaimé and Ryngaert (2013) also found that insider trading by top executives have a stronger ability to validate or mitigate the repurchasing signal of undervaluation, compared to other insiders.

Another variable that could be useful when interpreting the undervaluation signal inherent to share repurchases is the firm's cash holdings. Andriosopoulos and Lasfer (2015) found that, when announcing a share repurchase program, firms with low cash holdings obtained a higher abnormal return compared to firms with high cash holdings. The authors draw the conclusion that share repurchases are more commonly motivated by undervaluation than a mean of reducing agency conflicts, by distributing excess cash. Ruei-Shian (2012) obtain similar results. He found that when firms announced a share repurchase program, the market reacted more favorable to firms with low cash-to-total assets ratios than to firms with high cash-to-total assets ratios. However, not all researchers draw the same conclusion regarding cash holdings' impact on the signal from share repurchases. Bonaimé (2012) found that when announcing a share repurchase program firms with high cash holdings obtained a higher abnormal return compared to firms with low cash holdings. She motivates this finding based of the agency cost related to retaining cash. Based on this lack of consensus regarding cash holdings' impact on the undervaluation signal inherent to share repurchases, this study will also focus on whether cash holdings affect the undervaluation signal inherent to share repurchases, or not.

Healy and Palepu (2001) argue that high levels of corporate disclosures enable investors to trade stocks at a "fair price". Further, Frankel and Li (2004) claim that information asymmetry is reduced by disclosure of relevant information. The authors also state that asymmetric information between managers and shareholders is a central problem for both investors and other market participants. To decrease the unfair information gap has for a long time been a goal in the United States (Frankel & Li, 2004). This study aims to, by the use of insider trading and cash holdings, improve the ability to interpret information inherent with share repurchases. By being able to better determine the information inherent with share repurchases, information asymmetry should decrease and market participants should be able to make more informed decisions.

Studying the occurrence of insider selling concurrent with repurchases might also add to the ability to evaluate the actions of insiders, who might be acting in their own best interest instead of the shareholders'. Insiders who are selling when the firm is repurchasing could both be trying to use repurchasing as a misguided signal of undervaluation, as well as personally trying to capitalize on increased demand of shares due to the repurchase (Bonaimé & Ryngaert, 2013; Chan, Ikenberry, Lee & Wang, 2010).

Most of the previous studies regarding share repurchases and insider trading, as signals of mispricing, have been researching the two variables separately. For example, Vermaelen (1981) argues that share repurchases are a signal of undervaluation. Similar findings are also presented regarding insider trading. Rozeff & Zaman (1988), find that insiders have the ability to time the market, thus insider trading entails a signaling effect.

Previous studies on the relationship between insider trading and repurchases have primarily been conducted on samples consisting of firms traded on the US stock market focusing on announced repurchase programs rather than actual performed repurchase transactions. (e.g. Chan et al. (2010), Jategaonkar (2013) and Chen, Chen, Huang & Schatzberg (2014)). US regulatory standards only require firms to disclose actual repurchase transactions in the following quarterly report (Atkins, 2013), which limits the availability of relevant data on actual repurchase transactions. Open market repurchases, which according to Bonaimé (2012) are the most common form of repurchases, are not binding commitments. As a consequence of this, not all announced repurchase programs are carried out. According to Stephens and Weisbach (2002) an

estimated 74 to 82 percent of announced repurchase programs are fully carried out within three years of the announcement being made. This is problematic since market participants do not consider the actual share repurchases when they are acting on the announcement of share repurchase programs (Wang & Johnson, 2008). Jagannathan, Stephens and Weisbach (2000) argue that the announcement of share repurchase programs only is a declaration of a firm's plan to repurchase shares and not a binding commitment. Further, Chan et al. (2010) state that some managers might announce repurchase programs without the intention of going through with the actual repurchase transactions, as a means of boosting share price through false signaling. This reasoning is supported by Stephens and Weisbach (2000), who suggest that management use the announcement of share repurchase programs to increase the share price of the firm.

Another problem with the announcement of share repurchases as a signal, compared to actual share repurchases, is that long-run abnormal stock returns are only correlated with actual share repurchases and not the announcement of share repurchase programs (Wang & Johnson, 2008). Wang and Johnson (2008) argue that it is difficult for market participants to assess the impact of the announcement of share repurchase programs. They argue that, because of this, the impact of the announcement of share repurchase programs is not immediately incorporated at the announcement date, but rather gradually reflected in the long-run abnormal stock returns. Wang and Johnson (2008) show that market participants tend to overreact within the short horizon following a repurchase announcement, typical to event studies. While they state that the opposite can be observed regarding the long horizon following a share repurchase announcement, where market participants tend to underreact when the repurchase transaction is carried out and as such, the full extent of the share repurchase is known. Because of this, they argue that a short-horizon event study is inappropriate when studying the relationship between share repurchases and stock returns.

Due to these problems with studying announcements of share repurchase programs, this study focuses on actual repurchase transactions, which could contribute to existing research by examining the additional information of actual share repurchase transactions. Bonaimé and Ryngaert (2013) also argue about the problems related to announced repurchase programs. Their long-horizon event study of the US market examined a proxy for actual repurchase transactions

by trying to estimate the size and time of the repurchases. By studying the Swedish stock market, where firms must disclose information regarding share repurchase transactions within seven days (Nasdaq, 2018), this study partly aims to improve the current literature regarding share repurchases by using a more reliable variable for actual share repurchases. Due to the implications of the full extent of the information inherent to share repurchases is being gradually reflected in firm value during a time-period of up to three years (Wang & Johnson, 2008), the chosen research design of this study is based on a long-horizon event study.

1.2 Purpose and Research Questions

The aim of this study is to, using insider trading and cash holdings, improve the ability to interpret information inherent with share repurchases. By contributing to a more solid understanding of how to interpret signals of firm value related to share repurchases, information asymmetry will decrease as market participants are able to make more informed decisions. Further, regulators might gain support in constructing regulatory frameworks that decrease information asymmetry, which is a fundamental step toward more efficient capital markets. This leads to the following research questions;

- Do insiders and their firms trade in the same direction during quarters with substantial share repurchases?

- Is there a relationship between share repurchases concurrent with insider trading and abnormal returns? Further, do insider trades made by CEOs have a stronger implication on the repurchasing signal of undervaluation, compared to trades made by other insiders?

- Is there a negative relationship between the firm's cash-to-total assets and the strength of the undervaluation signal of a share repurchase?

1.3 Delimitations

This study is limited to firms traded on the Stockholm Stock Exchange. Due to share repurchases initially being allowed in Sweden during the year 2000, and this study examining abnormal

returns during three years post-event, the research period ranges from year 2000 until 2014. Further, one industry is excluded entirely from this study, namely the financial sector. This sector is excluded due to extensive regulatory standards explicitly governing the financial industry. These regulations primarily limit firms in the financial sector by imposing certain requirements regarding capital coverage, thus limiting their ability to carry out share repurchases (SFS 2004:297 & SFS 2006:1371).

1.4 Thesis Outline

The remainder of this study is outlined in the following way:

- *Regulatory Framework*: This section introduces the reader to relevant rules and regulations regarding insider trading and share repurchases.
- *Theoretical Background*: This section gives the reader an understanding of relevant theories as well as presenting the hypotheses.
- *Methodology*: This section presents and discusses the method used in the study.
- *Results*: In this section the empirical findings are presented and briefly commented.
- *Analysis*: In this section the results and hypotheses are analyzed.
- *Concluding Discussion*: This section concludes the findings of the study, presents practical implications and proposes future research topics.

2. Regulatory Framework

2.1 Rules and Regulations – Insider Trading

The rules and regulations regarding insider trading is a subject under constant change and during the sample period of this study, these rules and regulations have changed several times. On the 3d of July 2016 the decree regarding market abuse, MAR, from the European Union was implemented in Sweden. Article 19 in MAR regulates when insiders are allowed to trade shares in their own firm. According to this article it is forbidden for insiders to trade during a 30-day period prior to the firm's quarterly report. Before MAR was implemented, the time-period regarding prohibited insider trading was regulated through SFS 2000:1087 and 2005:377. The implementation of MAR did not change the prohibited period of insider trading (Finansinspektionen, 2016).

Another important regulatory change that MAR implemented was the reporting requirements regarding insider trading and capital insurance depots. Before MAR was implemented insiders could trade shares without reporting the transaction if the transaction was performed within a capital insurance depot, however when MAR was implemented insiders became required to report these kind of transactions (Finansinspektionen, 2016).

During the time-period examined in this study SFS 2000:1087 was regulating the timeframe within which insider trades are to be reported. According to this law, insider transactions had to be reported within five days after the transaction took place. This changed with the implementation of MAR. According to MAR insider transactions are to be reported within three business days after the transaction took place. This differs from reporting requirements imposed on firms that are active in the US, where insider transactions are to be reported within two business days (SEC, 2013).

2.2 Rules and Regulations – Share Repurchases

In Sweden there are three primary regulatory frameworks affecting share repurchases. These are; the Swedish law, the regulatory standards of Finansinspektionen and Nasdaq's regulatory

framework. SFS 205:551 state that the decision regarding share repurchases must be made at the annual general meeting. Further, SFS 205:551 also state that a firm is not allowed to acquire more than ten percent of the firm's own shares. This differs significantly from how a share repurchase decision is made in the US. In the US a repurchase decision only needs to be authorized and approved by the firm's board (Atkins, 2013).

FFFS 2007:17 regulated, up until the 3d of July 2016, how firms were to report their share repurchases. According to this regulation, the firm had to report their repurchase transactions at least 30 minutes before the stock market opened the following business day. This reporting requirement was ceased by FFFS 2016:19 and the reporting requirements are now regulated by Nasdaq's regulatory framework and MAR.

According to Nasdaq's regulatory framework, Swedish firms must report their share repurchase transactions within seven days of the transaction taking place (Nasdaq, 2018). The report is required to include the date of the transaction, number of shares repurchased, price, current holding of the firm's own shares and the firm's total number of shares (Nasdaq, 2018). This reporting requirement differs from what firms in the US are required to report regarding their share repurchases. In the US, firms must disclose information before they start to repurchase their own shares (Atkins, 2013). This disclosure should be made with enough time for the market to take in the information before the repurchasing program commences (Atkins, 2013). This has implications when compared to Sweden. Due to this, disclosures of information regarding share repurchases and the actual repurchases could be months apart for firms who have their legal residence in the US. Further, there are no requirements to disclose information right before the actual repurchase transactions. US firms do not have to disclose information regarding repurchase transactions within seven days, unlike their Swedish counterparts. Instead they are required to include this information in their following quarterly report (Atkins, 2013).

In Sweden, Nasdaq´s regulatory framework state that firms are to report the resolution made during the annual general meeting, regarding share repurchases, without delay (Nasdaq, 2018). The firms are to report during which time-period the share repurchases will be utilized, the current holding of existing shares, maximum number of shares that the firm intend to repurchase, the price range and the purpose of the repurchase (Nasdaq, 2018).

3. Theoretical Background

3.1 Information Asymmetry

Information asymmetry is defined as an event where one party is in possession of more information than the other party. As a result of insiders' possibility to constantly monitor their firm's development, while outsiders only have access to a collection of information at specific times, all corporate decisions create information asymmetries (Aboody & Lev, 2002). According to Frankel & Li (2004), the asymmetric information between managers and shareholders is a central problem for both investors and other market participants. The authors claim that the advantages and costs related to collecting and communicating information is the cause for variation in information asymmetry.

Information asymmetry can, at least partly, explain the occurrence of both insider trading and share repurchases. According to Dittmar (2010), the information asymmetry between insiders and shareholders can lead to firms being misvalued. She uses this reasoning to argue that insiders use their information advantage to repurchase shares when the firm is undervalued. Furthermore, she also argues that the information asymmetry is larger for firms that repurchase shares compared to firms that do not repurchase shares.

Huddart (2010) state that, even though there can be other reasons for insider trading, one part that drives insider trading is insider's information advantage compared to other market participants. He also argues that, since insiders are able to achieve abnormal returns, the current disclosures are not enough to bridge the information gap between insiders and outsiders. Kahle (2000) supports the argument that insider trading is driven by asymmetric information, she finds that insider selling increases and insider buying decreases before issuance of new securities.

3.2 The Signaling Hypothesis

The Signaling hypothesis stems from the information asymmetry between a firm's management and other market participants (Ikenberry, Lakonishok & Vermaelen, 1995). If the firm is undervalued according to the firm's management, they can choose to repurchase shares.

According to Ikenberry, Lakonishok and Vermaelen (1995), such an announcement is a signal to the less informed market participants. Thus, share repurchases are a mean for the management to signal that their firm is undervalued. This approach to the signal of share repurchases is supported by Bonaimé and Ryngaert (2013). The authors claim that share repurchases have, for a long time, been considered a way for the firm's management to convey that their firm is undervalued. However, according to Wang and Johnson (2008), it is not the signal from the announcement of a share repurchase program that decrease information asymmetry, but rather signal from the actual share repurchase.

In a market with an efficient response, the share price should adjust at once to a new equilibrium, which would be based on the new information of the repurchase announcement (Ikenberry, Lakonishok & Vermaelen, 1995). Vermaelen (1981) also support the view of share repurchases as a signal. He concludes that the signals inherent to share repurchases increases market efficiency by allowing firms to adjust mispricing of their shares. However, there are researchers who question the signaling hypothesis regarding share repurchases (e.g. Fried, 2001 and Brockman, Khurana and Martin (2008)). Fried (2001) claims that the signaling hypothesis is questionable because it takes for granted that managers intentionally sacrifice their wealth in order to increase the wealth of the shareholders. He also argues that, if the firm is undervalued, signaling through share repurchases would limit manager's ability to buy shares for themselves at the most favorable price.

Another type of signal with the possibility to improve market efficiency, are the signals inherent to insider trading. Prentice and Donelson (2010) states that interpreting signals from insider trading can increase the capital market's efficiency. Previous studies show that insiders are able to make abnormal returns on their insider trades (e.g. Jaffe (1974) and Seyhun (1992)). This implies that insider trading contains a signal that could be useful for other market participants. This reasoning is supported by Bettis, Vickrey and Vickrey (1997). The authors conclude that, by following insider trades, outsiders are able to earn abnormal returns. Etebari, Tourani-Rad and Gilbert (2004) also argue that signals from insider trading are important for market efficiency. Further, the authors found that insiders that delay the disclosure of their insider transactions are more likely to earn an abnormal return compared to insiders that disclose the information

immediately. Firth, Leung and Rui (2010) also support the view of insider transactions as signals. The authors state that, according to the signaling hypothesis, a firm's management could trade the firm's shares in order to carry out a signal, where an insider buying is a signal of undervaluation and a sell is a signal of overvaluation.

3.3 The Managerial-opportunism Theory

Another theory that explains why firms carry out share repurchases is the managerial-opportunism theory (Fried, 2001). Fried (2001) argues that, according to the managerial-opportunism theory, there are two different scenarios for managers to initiate share repurchase programs. He states that the first scenario is when the firm's shares are undervalued, then managers use share repurchases to buy back shares at a discount. However, he argues that managers do not do this to signal undervaluation, but instead managers perform the share repurchase to transfer wealth from the selling shareholders to the firm. Further, he states that to maximize the wealth transfer, managers attempt to hide that the firm's shares are undervalued.

The second scenario is when managers want to sell shares and therefore they announce a share repurchase (Fried, 2001). Fried (2001) states that the announcement of share repurchases is likely to increase the share price and therefore managers use the announcement to increase the share price before they sell their own shares. He argues that in the second scenario the firm does not need to actually repurchase any shares, managers are able to profit from simply announcing a share repurchase.

3.4 The Pecking Order Theory

According to the pecking order theory firms prefer internal financing and if internal financing is not available they prefer issuance of debt over issuance equity (Myers, 1984). Myers (1984) argue that this preferred order is partly due to the information asymmetry between the firm and the other market participants. Further, he argues that firms want to avoid having the need to issue risky securities when the firms face a project with a positive net present value. According to the pecking order theory, firms would accumulate cash until they have an excessive amount of cash

holdings as a buffer (Opler, Pinkowitz, Stulz & Williams, 1999). Based on the pecking order theory firms prefer to hold large cash holdings, thus if the reason for a share repurchase would be that the firm is undervalued, a firm with low cash holdings that carry out a share repurchase is more likely to be undervalued than a firm with large cash holdings that carry out a share repurchase. This is due to the motive behind the share repurchase simply being a way of distributing excess cash being less likely.

3.5 Motivations of Share Repurchases

As mentioned previously in this study, one of the reasons for a firm to motivate share repurchases is that the firm's management believes that the firm is undervalued. This is in line with what Dittmar (2000) concluded, namely that firms commonly use share repurchases to exploit possible undervaluation. If repurchases were exclusively motivated by management's belief of undervaluation, repurchases would be a clear signal of potential undervaluation. However, Dittmar (2000) also find that firms use repurchases to allocate excess capital, adjust their leverage, decrease dilution due to stock options being exercised and as a takeover defense. Some firms may prefer share repurchases over dividends as means of allocating excess cash, primarily due to the stickiness of dividends (Dittmar, 2000). Further, Fried (2001) argue that managers may use share repurchases to protect the value of their stock options. Not all these reasons for performing share repurchases imply undervaluation, which creates an urge for market participants to interpret the signals inherent to share repurchases correctly, in order to identify mispricing and decrease information asymmetry.

3.6 Hypothesis Development

All the following hypotheses are tested with 1-tailed t-tests, due to the assumption that negative abnormal returns are unlikely results of this study. Thus, the hypotheses are all formulated with an expressed direction in mind, enabling the use of 1-tailed testing.

3.6.1 Repurchases

According to Ikenberry, Lakonishok and Vermaelen (1995) share repurchases are a signal of undervaluation. Their findings are in line with research by Dittmar (2000), she claims that one of the reasons for share repurchases is undervaluation. If that is the case, one would expect that repurchasing firms obtain abnormal returns (Stephens & Weisbach, 1998). Based on the previously presented research, the following hypothesis is formulated:

$H_0(a)$: Firms performing repurchases do not obtain abnormal returns.

$H_1(a)$: Firms performing repurchases obtain abnormal returns.

3.6.2 Repurchases and Insider Trading

According to Bonaimé and Ryngaert (2013) the undervaluation signals inherent to share repurchases can be either strengthened or weakened with the use of insider trading. They find that insider buying strengthens the repurchasing signal of undervaluation, while insider selling weakens the repurchasing signal of undervaluation. If insider buying strengthens the signal of undervaluation one would expect that firms with insider buying concurrent with share repurchases obtain higher abnormal return compared to firms with only share repurchases, while the opposite could be expected for firms with insider selling. Based on this line of reasoning as well as the findings by Bonaimé and Ryngaert (2013) the two following hypotheses are formulated:

$H_0(b)$: Firms with insider buying during the same quarter as share repurchases do not obtain a higher abnormal return than firms with no insider buying during the same quarter as share repurchases.

$H_1(b)$: Firms with insider buying during the same quarter as share repurchases obtain a higher abnormal return than firms with no insider buying during the same quarter as share repurchases.

H₀(c): Firms with insider selling during the same quarter as share repurchases do not obtain a lower abnormal return than firms with no insider selling during the same quarter as share repurchases.

H₁(c): Firms with insider selling during the same quarter as share repurchases obtain a lower abnormal return than firms with no insider selling during the same quarter as share repurchases.

3.6.3 Repurchases and CEO Insider Trading

Bonaimé and Ryngaert (2013) find that insider trading made by different levels of insiders has an implication when interpreting the signal of a share repurchase. They found that signals from insider transactions made by top executives have a stronger ability to strengthen or weaken the repurchasing signal of undervaluation. If the insider buying of top executives is a stronger predictor of undervaluation than the insider buying of other insiders, one would expect firms with the former to obtain higher abnormal returns. As such, firms with top executive selling would be expected to obtain lower abnormal returns compared to firms with insider selling made by other insiders. Based on this line of reasoning as well as the findings by Bonaimé and Ryngaert (2013) the two following hypotheses are formulated:

H₀(d): Firms with CEO insider buying during the same quarter as share repurchases do not obtain higher abnormal returns than firms with other levels of insider buying during the same quarter as share repurchases.

H₁(d): Firms with CEO insider buying during the same quarter as share repurchases obtain higher abnormal returns than firms with other levels of insider buying during the same quarter as share repurchases.

H₀(e): Firms with CEO insider selling during the same quarter as share repurchases do not obtain lower abnormal returns than firms with other levels of insider selling during the same quarter as share repurchases.

H$_1$(e): Firms with CEO insider selling during the same quarter as share repurchases do obtain lower abnormal returns than firms with other levels of insider selling during the same quarter as share repurchases.

3.6.4 Repurchases and Cash

As previously mentioned, in accordance with the pecking order theory, firms generally prefer to have large cash holdings (Opler et al. 1999). With this in mind and Dittmar's (2000) findings that the primary reasons for carrying out share repurchases are; the firm being undervalued and distribution of excess cash. Thus, it could be argued that firms with lower cash holdings, while carrying out share repurchases, could be more likely to have undervaluation as the primary motive. As compared to as simply being a means of distributing excess cash. This implies that firms with lower cash holdings, carrying out share repurchases, would obtain higher abnormal returns compared to firms with higher cash holdings, carrying out share repurchases. Both Andriosopoulos and Lasfer (2015) and Ruei-Shian (2012) found that, when carrying out share repurchases, firms with low cash holdings obtain higher abnormal returns compared to firms with high cash holding. Based on this line of reasoning as well as the findings by Andriosopoulos and Lasfer (2015) and Ruei-Shian (2012) the following hypothesis is formulated:

H$_0$(f): Firms with lower levels of cash-to-total assets during the same quarter as share repurchases do not obtain a higher abnormal return than firms with higher levels of cash-to-total assets during the same quarter as share repurchases.

H$_1$(f): Firms with lower levels of cash-to-total assets during the same quarter as share repurchases obtain a higher abnormal return than firms with higher levels of cash-to-total assets during the same quarter as share repurchases.

4. Methodology

4.1 Research Approach

This study is based on a long-horizon event study framework, primarily motivated by Fama (1991) recommending long-horizon event studies when studying efficiency of capital markets. It is further motivated by the findings of Wang and Johnson (2008) that there is a long-term gradual incorporation of information inherent to share repurchases. In order to perform an event study, four different steps are usually employed. These steps are the following; defining the event and the event window, calculating abnormal returns, defining the estimation window and statistical analysis of the abnormal returns (MacKinlay, 1997). However, instead of using an estimation window this study applied characteristic-based matching of portfolios, which is described in further detail in section 4.3.2. The use of such portfolios instead of an estimation window is in line with previous research regarding share repurchases and insider trading performed by Bonaimé and Ryngaert (2013). Further, Kothari and Warner (2006) state that historical risk estimates, such as the use of pre-event estimation windows, could lead to large errors in long-horizon event studies.

This study has three events of interest. These events of interest are quarters with; share repurchase transactions, share repurchase transactions concurrent with insider buying and share repurchase transactions concurrent with insider selling. These events of interest are described in further detail in section 4.2.1. The event windows for which abnormal returns were calculated are; the quarter when the events are taking place [*Quarter during*], one quarter post-event [*Quarter after*] and three separate years post-event [*Year 1*, *Year 2* and *Year 3*]. A similar set of event windows were applied by Bonaimé and Ryngaert (2013) when they conducted a similar study.
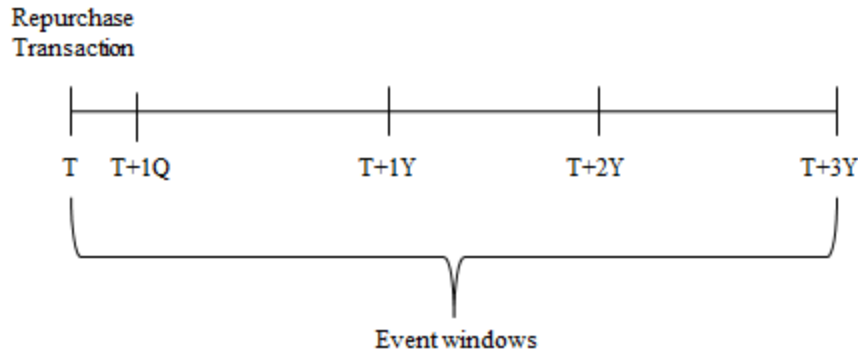
Figure 1. Event windows

4.2 Data

4.2.1 Construction of Sample

The first step when collecting data was to identify firms that were traded on Nasdaq Stockholm and had performed repurchases of common stock during any given quarter of the examined time-period ranging from year 2000 to 2014. In order for these repurchases to entail a significant signal of undervaluation, i.e. consisting of non-trivial amounts, the aggregate amount during the quarter had to exceed a threshold value of 1 percent of the firm's total market capitalization. Applying this threshold is in line with previous research conducted by Bonaimé and Ryngaert (2013). They state that by applying this threshold trivial amounts are excluded, leading to stronger results. Further support for this threshold is given by Banyi, Dyl and Kahle (2008) who state that the use of a 1 percent threshold of the firm's total market capitalization improves the ability to use share repurchases as a measurement when conducting research.

Once the firms with significant repurchases had been compiled, the insider trades that were made concurrent with quarters containing repurchases were identified. In order for the insider trades to be significantly large, they had to be above a threshold of 0.01 percent of the firm's total market capitalization and/or exceed an amount of 100,000 SEK. The same threshold was applied for insider buying as well as insider selling, and the threshold value was inflation adjusted with a starting point in year 2014. This adjustment accounts for changes in purchasing power. The insider trades that did not exceed 0.01 percent of the firm's total market capitalization and/or the

amount of 100,000 SEK were classified as neutral insider trading, this also applied for firms with no insider trading. The method of classifying insider trading by putting it in relation to the firm's total market capitalization as well as the value of the transactions in real terms is in line with previous research within the same subject performed by Bonaimé and Ryngaert (2013).

To evaluate a potential relationship that the two variables CEO insider trading and cash holdings might have to share repurchases and abnormal returns, subsamples were constructed. The samples used when evaluating whether repurchasing firms with CEO insider trading yield higher or lower abnormal returns, depending on insider buying or selling, were constructed by sorting the observations into two groups depending on the presence of CEO insider trading. The samples used to compare the abnormal returns between repurchasing firms with higher and lower levels of cash were constructed by separating the primary sample into two halves based on the firms' respective cash-to-total assets.

Beyond the delimitation regarding firms in the financial industry some other exclusions were made. After identifying all firms with share repurchases, the observations with a negative price-to-book value were excluded. These observations were excluded since control portfolios, with the chosen method, could not be created to calculate their normal return. Further, Bonaimé and Ryngaert (2013) state that firms with negative price-to-book value could have covenants that restricts these firms from carrying out share repurchases. In total seven observations were excluded due to negative price-to-book value, all these observations were repurchases made by the same firm, namely Swedish Match. That all these observations stem from one single firm indicates that Swedish Match could be excluded as an outlier. Since it is not a group of different firms, where one might suspect a distinguishable pattern, the impact of this exclusion is deemed to be negligible. Further, one foreign firm was excluded from the sample. This firm was excluded since foreign firms are not required to report insider transactions. To exclude firms in the financial industry, firms with a negative price-to-book value and foreign firms are in line with a similar study conducted by Bonaimé and Ryngaert (2013). The last type of exclusion was the exclusion of firms which market capitalizations were too large to find comparable firms. Due to this, one observation was excluded, the firm excluded due to this was Volvo. The insider trading of this particular observation was classified as neutral. As the variables of this

observation did not show any extreme values, it can be assumed that this particular exclusion did not have a material impact on the results of this study. The method of constructing control portfolios could have been altered but was not. By deviating too far from the primary method, the matching characteristics would no longer be a suitable proxy for the normal return of the firm (Kothari & Warner, 2006).

4.2.2 Time-period Subsamples

The entire period ranging from year 2000 to 2014, was divided into different subsamples accounting for different time-periods. The sample regarding only repurchases and the samples regarding both repurchases concurrent with insider buying and selling were all divided into three different subsamples. The first subsample ranged from year 2000 to 2007, the second subsample ranged from year 2008 to 2014 and the last subsample ranged from year 2006 to 2008. There are two reasons why this study used the subsample ranging from year 2006 to 2008. The first is due to the financial crisis taking place during those years, thus by examining this time-period separately, this study may be able to examine if the results differ during times of financial distress. The second reason is due to an overrepresentation of observations during this time-period. Thus, it may be interesting to examine if this has any implications on the results. The sample sizes are presented in section 4.2.3.

4.2.3 Sample

The applied method of constructing the sample lead to a total number of 240 observations, where firms carried out significantly large share repurchases during the period of year 2000 to 2014. As previously mentioned in section 4.2.1, some of the observations were excluded for various reasons, which led to the final number of observations in the sample being 231, consisting of repurchases carried out by 65 individual firms. These exclusions were deemed to have a negligible impact on the study, due to the relatively small number of firms being excluded. In addition to the exclusion of certain firms that has been mentioned. Aside from exclusions, one source of data loss is presented in section 4.5.3.

In Table 1, the various sample sizes are presented for different time-periods and combinations of repurchases with other variables; direction of insider trading, CEO insider trading and level of cash holdings.

Table 1. Sample

	Observation period			
	2000-2014	2000-2007	2008-2014	2006-2008
Repurchases				
Share repurchases	231	132	99	76
Repurchases concurrent with insider buying				
Insider buying	102	56	46	36
Other insider directions	129	76	53	40
Repurchases concurrent with insider selling				
Insider selling	39	21	18	13
Other insider directions	192	111	81	63
Repurchases concurrent with CEO buying				
CEO buying	14	-	-	-
Other insider directions	88	-	-	-
Repurchases concurrent with CEO selling				
CEO selling	9	-	-	-
Other insider directions	31	-	-	-
Repurchases and cash holdings				
Low cash to total assets	116	-	-	-
High cash to total assets	115	-	-	-

4.2.4 Sources of Data

All the data that were used in this study were secondary data. The data regarding insider trading, which consists of selling, buying and level of insider, were gathered from the database Holdings, supplied by Modular Finance. Data regarding share repurchases were supplied by Nasdaq. Other data, such as market capitalization [MVC], total returns [RI] and price-to-book value [PTBV] were collected from Datastream, supplied by Thomson Reuter. Data regarding cash holdings and total assets were gathered from Eikon, supplied by Thomson Reuter. Historical Swedish 10-year government bond yields were collected from FRED - Economic data, supplied by the Federal Reserve Bank of St. Louis.

Table 2. Data sources

Holdings	Nasdaq	Datastream	Eikon	FRED
Insider trading and level of insider	Share repurchases	Market capitalization, total returns and price-to-book value	Cash holdings and total assets	10-year government bond yields

4.3 Abnormal Return

4.3.1 Buy-and-hold Abnormal Return

The measurement that was applied when calculating abnormal returns was the so called buy-and-hold abnormal return, denoted as [BHAR]. Which is a method that, according to Barber and Lyon (1997), closely mimics the returns that an investor would obtain. Other measurements, such as Cumulative Abnormal Returns, typically applies periodic rebalancing of the portfolio (Kothari and Warner, 2006). They state that these types of measurements do not resemble the behavior of investors as closely as BHAR. Buy-and-hold abnormal return is defined as the difference between actual- and normal return:

$$BHAR_{i,t} = \prod_{t=1}^{T}\left(1 + R_{i,t}\right) - \prod_{t=1}^{T}\left(1 + R_{j,t}\right) - 1$$

(I)

The actual returns were calculated as the quarterly change in indexed total return for each of the observations within the sample and event windows. This includes reinvestment of dividends, which is in line with the concept of buy-and-hold abnormal return. Normal returns were estimated with the use of characteristic-based matching of control portfolios of non-event firms, which is described in further detail in section 4.3.2.

4.3.2 Normal Return

To estimate the normal returns of the sample firms of this study, characteristic-based matched control portfolios were constructed by identifying non-repurchasing comparable firms by two

criteria. The criteria that were used in the creation of said control portfolios were to include the firms with market capitalizations and price-to-book values that as closely as possibly matched that of the observed firm. According to Barber & Lyon (1997) this form of control portfolios, with total market capitalization and price-to-book value as parameters, yields the most accurate result when examining abnormal returns. The use of these parameters when constructing control portfolios is also in line with previous research conducted by Bonaimé and Ryngaert (2013) when researching a subject similar to this study. By including price-to-book values and market capitalization when calculating the abnormal return, an element of control is added when it comes to the implication that these variables might have on the abnormal return. Fama and French (1992) find that size and book-to-market value helps capture cross-sectional variation in stock returns. Thus, the inclusion of market capitalization and price-to-book value when constructing the characteristic-based portfolios is a contributing adjustment when examining the relationship between repurchases, insider trading and abnormal return in a multivariate context.

To construct the control portfolios that were used, the firms which total market capitalization did not differ by more than 20 percent from that of the observed firm were compiled. Out of these firms the five firms which price-to-book values were the closest to the observed firm were chosen to make up the equally weighted portfolio. This procedure was repeated for all the 231 observations where significantly large share repurchases were identified. For those firms where a deviation of a maximum of 20 percent in market capitalization generated fewer than five control firms, the threshold was raised by five percentage points until five control firms had been identified. If the threshold reached a 30 percent deviation from the observed firm and five control firms had not been identified, fewer than five firms were allowed to comprise the control portfolio. In this study the number of such smaller control portfolios were used in 8 out of the 231 observations. This deviation from the primary method is deemed to have had a negligible impact on the result of the study due to the relatively small number of control portfolios deviating from the primary method. Another modification of the primary method was made when the observed firm had an ownership stake in any of the firms that qualified for the control portfolio. In such cases, that specific control firm was exchanged for the next comparable firm. If this adjustment had not been made the cross-ownership would have included a dependency bias when calculating the abnormal returns.

4.4 Econometric Method

4.4.1 Distribution and Testing of Data

The dependent variable of this study, buy-and-hold abnormal return, was deemed to be approximately normally distributed. This was determined primarily by conducting Shapiro-Wilk tests for all the subsamples and different event windows, i.e. the BHAR for the respective investment horizons. As a test of robustness, the approximately normal distribution was also supported by Jarque-Bera scores ranging from 0 to 60, as well as through ocular inspection of histograms and QQ-plots. The Shapiro-Wilk test was chosen above the Kolmogorov-Smirnov test. This is in accordance with Conover (1999) stating that the Shapiro-Wilk test is more flexible in that it allows for the use of smaller sample sizes, while the Kolmogorov-Smirnov test is less appropriate for sample sizes of n ≤ 50. In this study the sample sizes ranged from 13 to 231, which motivated the choice of Shapiro-Wilk as the primary test for normality. Due to the dependent variables being continuous and approximately normally distributed a parametric test could be applied when testing the hypotheses, which is preferred due to parametric tests generally having stronger statistical power compared to non-parametric options (Conover, 1999). For all the samples that were included in this study, a 90% winsorization was applied to mitigate the impact of outliers, as such were observed when inspecting box plots of the data.

When testing the significance of the abnormal returns for all repurchasing firms, a one sample t-test was carried out in Eviews, where the abnormal returns were tested to determine if they were above zero. When significance testing the difference in abnormal returns when adding measurements of insider trading, level of insider and cash holdings, independent sample t-tests were carried out in SPSS. Levene's test for equal variances were conducted to test the assumption of equal mean variance, which showed that the assumption did not hold. Due to this, Welch's t-test *(II)* with Satterthwaite correction for unequal variances *(III)* was used to test the statistical significance of the difference in abnormal returns between the different subsamples:

Welch's t-test:

$$t \quad = \quad \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}} \qquad\qquad (II)$$

Welch–Satterthwaite equation, included in Welch's t-test:

$$\nu \quad \approx \quad \frac{\left(\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2} \right)^2}{\frac{s_1^4}{N_1^2 \nu_1} + \frac{s_2^4}{N_2^2 \nu_2}} \qquad\qquad (III)$$

4.4.2 Cross-sectional Regression

Cross-sectional regression analyses were conducted to test the hypotheses of the study in a multivariate context. The regression method that was used was ordinary least squares with a Huber-White-Hinkley correction for heteroskedasticity-consistent standard errors and covariance.

4.4.2.1 Dependent Variables

The dependent variables used in the regressions were the buy-and-hold abnormal returns for each of the event windows, ranging from BHAR during the quarter of the event to BHAR during the third year post-event.

4.4.2.2 Explanatory Variables

Buy

Insider buying was the positive net insider trading after adjusting for the threshold of significantly large insider trading, which entails amounts above 0.01 percent of market capitalization and/or above 100,000 SEK. Insider buying was transformed into a dummy variable, to better represent the polarized classification of net insider buyers and sellers:

1 = Insider buying

0 = Insider selling and Neutral insider trading

Sell

Insider selling was the negative net insider trading after adjusting for the threshold of significantly large insider trading, above 0.01 percent of market capitalization and/or above 100,000 SEK. Insider selling was also transformed into a dummy variable for the same reason that was previously mentioned for insider buying:

1 = Insider selling

0 = Insider buying and Neutral insider trading

Having two separate dummies for insider buying and insider selling was necessary, since there is a spread between the two, neutral insider trading. This necessitates running the regression with two variations of the primary specification, since the result e.g. the dummy for insider buying could not be used to infer interpretations, a contrario, regarding insider selling. This is due to neutral insider trading being included in the reference dummy.

Repurchase

Share repurchases were included as the total amount of share repurchases performed during one quarter, expressed as a fraction of market capitalization for normalization purposes.

Cash

Cash-to-total assets was the total amount of cash and cash equivalents expressed as a fraction of total assets for normalization purposes.

CEO

CEO insider trading was the net amount of insider trading performed by a CEO, expressed as a fraction of total net insider trading.

4.4.2.3 Control Variables

The control variable that was explicitly included in the regression specification is the historical yield of Swedish 10-year government bonds, denoted as Bonds. It is included to impose a

measure of control for macroeconomic factors. According to Alam and Uddin (2009) there is a significant negative relationship between interest rates and stock prices, thus the inclusion is deemed to be appropriate.

According to Abarbanell and Bushee (1998), size and book-to-market are important determinants of stock returns. These factors are not included as explicit control variables, since they are already present in the dependent variable. This is due to the method of using characteristic-matched portfolios when calculating abnormal returns, which were based on market capitalization and price-to-book value.

The second set of regression specifications included firm-specific dummy variables. One for each of the 65 individual firms that were included in the study. This was done in order to control for firm-specific characteristics.

4.4.2.4 Regression Specification

As previously mentioned, two similar specifications were necessary due to the need to apply different combinations of reference dummies for the Buy and Sell variables, e.g. Buy can not be interpreted as simply the opposite of Sell, as there is a Neutral component included in the reference dummy. This, combined with the set of chosen dependent-, explanatory- and control variables lead to the following specifications being formulated:

$$BHAR_i = \alpha_o + \beta_1 Buy + \beta_2 Repurchase + \beta_3 Cash + \beta_4 CEO + \beta_5 Bonds + \varepsilon_i \qquad (IV)$$

$$BHAR_i = \alpha_o + \beta_1 Sell + \beta_2 Repurchase + \beta_3 Cash + \beta_4 CEO + \beta_5 Bonds + \varepsilon_i$$

$$BHAR_i = \alpha_o + \beta_1 Buy + \beta_2 Repurchase + \beta_3 Cash + \beta_4 CEO + \beta_5 Bonds + \beta_6 Firm_1 + \ldots + \beta_{71} Firm_{65} + \varepsilon_i \qquad (V)$$

$$BHAR_i = \alpha_o + \beta_1 Sell + \beta_2 Repurchase + \beta_3 Cash + \beta_4 CEO + \beta_5 Bonds + \beta_6 Firm_1 + \ldots + \beta_{71} Firm_{65} + \varepsilon_i$$

4.4.2.5 Diagnosis of Regression Data

The residuals were tested for heteroskedasticity by running a Breusch-Pagan-Godfrey test, which showed presence of heteroskedasticity. Thus, leading to the decision of including the Huber-White-Hinkley correction. As MacKinlay (1997) states heteroskedasticity and multicollinearity as typical risk factors of an event study, the explanatory- and control variables were also tested

for multicollinearity by examining a correlation matrix. None of the explanatory variables showed any material correlation, which would have been the case if they showed a correlation above 0.8 (Gujarati & Porter, 2009). The output of this test is presented in the appendix (A).

The residuals were tested for normality by inspecting histograms and Jarque-Bera statistics, the residuals were deemed to be approximately normally distributed with Jarque-Bera statistics ranging from 2 to 60, typically below 30. Further, no signs of material autocorrelation were found, as the regression outputs were checked to make sure that the Durbin-Watson statistic did not deviate too far from 2. The values for this statistic were typically within a range of 1.9 and 2.1 and without any extreme outliers.

4.4.3 Robustness

A robustness test that was conducted, was to use an alternative threshold when identifying significantly large insider trades. Instead of applying 0.01 percent of market capitalization and/or an amount in excess of 100,000 SEK, 0.01 percent of market capitalization was used exclusively. Due to this modification, the number of observations, regarding share repurchases concurrent with insider buying and share repurchases concurrent with insider selling, decreased. Due to this decrease, this robustness test was only conducted for share repurchases concurrent with insider buying and share repurchases concurrent with insider selling, during the entire time-period, ranging from year 2000 to 2014. To test the statistical significance of the difference in abnormal returns, an independent sample t-test was carried out in SPSS. Levene's test for equal variances was conducted to test the assumption of equal mean variance, which showed that the assumption did not hold. Due to this, Welch's t-test with Satterthwaite correction for unequal variances was used. The results of this robustness test did not show any substantial deviations when compared to the results of the primary sample. The output of this test is presented in the appendix (B).

One important issue of this study is that a number of firms were observed multiple times. In order to grasp the impact of this, another robustness test was conducted. This test was carried out by only using the first event of interest for each firm in the sample. For example; the firm Wallenstam carried out share repurchases concurrent with insider buying during both the first

quarter year 2004 and the first quarter year 2006. Thus, for this robustness test, only the observation during the year 2004 was used. Due to this modification, the number of observations decreased. Because of this decrease, this robustness test was only conducted for share repurchases concurrent with insider buying and share repurchases concurrent with insider selling, during the entire time-period, ranging from year 2000 to 2014. To test the statistical significance of the difference in abnormal returns, an independent sample t-test was carried out in SPSS. Levene's test for equal variances was conducted to test the assumption of equal mean variance, which showed that the assumption did not hold. Due to this, Welch's t-test with Satterthwaite correction for unequal variances was used. The results of this robustness test did not show any substantial deviations when compared to the results of the primary sample. The output of this test is presented in the appendix (C).

4.5 Method Discussion

4.5.1 Long-horizon Event Study

There are several difficulties when performing long-horizon event studies. Kothari and Warner (2006) state that whether abnormal returns observed in long-horizon event studies are due to actual mispricing or measurement problems is an unresolved debate among financial researchers.

The primary issue of long-horizon event studies is related to the event study-approach of examining the incremental impact that pre-specified events might have on firm value (Kothari & Warner, 2006). There is a conceptual clash between event studies in general and the application of longer term event windows, where long-horizon event studies are predisposed toward yielding noisy results. Consequently, any inferences made from such results should be made with care. It would be inappropriate to make claims regarding causal relationships due to the issue of omitted explanatory variables increasing with longer return horizons (Bernard, 1987).

The ability to pinpoint the exact event date is important when designing a successful event study (MacKinlay, 1997). Although it might be argued that it has a weaker implication for long-horizon event studies, compared to the more common short-horizon event studies. With longer

event windows, the immediate effect of an event could be expected to have a, relatively speaking, smaller impact on the total long-horizon abnormal return. The implication of this is that this study might miss out on some of the impact on firm value post-event, due to defining the events of the study as the quarterly aggregated share repurchases as well as insider trades, thus not capturing an exact event date. The choice of applying this type of event date was primarily to facilitate a comparison to previous research conducted by Bonaimé and Ryngaert (2013), who applied such an event date. The choice of using quarterly event dates was also made in order to identify events where the firms carried out repurchase transactions that were large enough to entail a significant signal of undervaluation. Further, two out of three events of interest, described in section 4.2.1, comprise of two concurrent actions related to the firm. These two events of interest are; share repurchases concurrent with insider buying and share repurchases concurrent with insider selling. Observing repurchase transactions that are large enough, and also take place during the same event date as significantly large insider buying or selling necessitates the use of quarterly event dates. Shorter event dates would yield too small samples to be able to statistically evaluate the results.

Another issue typical to long-horizon event studies, is that buy-and-hold returns tend to be skewed toward the upper end of the normal distribution. This is due to the fact that abnormal returns have a lower limit of -100 percent, while the upside is unlimited (Kothari & Warner, 2006). The results of this study show a consistent skewness toward the upper end, although it is deemed to have had a negligible impact on the study due to the skewness being small, reflected in the Jarque-Bera statistics as previously mentioned in section 4.4.1, indicating an approximately normal distribution of abnormal returns among the observations sampled in this study. No transformations of the abnormal returns have been made to adjust for the observed skewness. The skewness statistic for the abnormal returns of this study place well within the range of -2 and +2 for skewness and kurtosis, proposed by George and Mallery (2010) as acceptable to prove normal distribution. Due to this, no adjustment was made to handle the skewness, as the tradeoff between improving the distribution and modifying the data was not deemed to be justifiable.

The overlapping of event windows when comparing the different subsamples, combined with the inclusion of multiple observations per firm within the same samples, lead to cross-sectional dependence within the data. When firm-specific dummies, 65 of them in total, were included in the regression specification *(V)*, firm-specific characteristics not covered by the explanatory variables seem to carry a lot of explanatory power. As an example, roughly half of the firm dummies showed statistical significance, at the 10 percent level, when running the regression for insider buying during the entire time-period, ranging from year 2000 to 2014. The r-squared and adjusted r-squared were 42 and 17 percent respectively for the *Year 1* event window, which can be put in relation to the r-squared generally ranging from roughly 2 to 4 percent for the regression specification when run without firm-specific dummies. Firm-specific dummies could not be included for any of the subsamples, due to there being too few observations to allow for the inclusion of as many variables. The regression output including firm-specific dummies *(V)*, for insider selling and buying during the entire time-period, and for each of the five event windows, is presented in appendix (D). In order to test the robustness of the results of the study, in terms of cross-dependence inherent to having multiple observations for most of the firms in the sample, a subsample consisting of only the first observation for each firm was created and tested. This process was previously described in section 4.4.3, and the outputs of the test are presented in the appendix (C). The results of this robustness test did not show any substantial deviations when compared to the results of the primary sample.

4.5.2 Alternative Approaches to Measuring Abnormal Return

An alternative method for measuring abnormal returns would have been to calculate cumulative abnormal returns, CAR. A method which means that abnormal returns are calculated on a daily interval and then aggregated to represent the entirety of the measured period (Barber & Lyon, 1997). CAR as a measurement of abnormal returns is applied by several researchers conducting studies similar to this one (e.g. Ikenberry, Lakonishok and Vermaelen (1995)). According to Barber and Lyon (1997) CAR is a poor reflection of an assets actual abnormal return due to it not reflecting the actual abnormal returns made by an investor. They also state that CAR can lead to faulty conclusions both when applied on a shorter time horizon as well as on a longer time horizon as a result of measurement bias. Further, they mean that CAR as a measure of abnormal

returns is the most appropriate when measuring how a separate event affects share price but is inappropriate when studying abnormal returns of investments. With this in mind, BHAR was chosen as the method to calculate abnormal returns, which in turn lead to the method of calculating actual returns being buy-and-hold.

Alternatives to applying characteristic-based matching could have been to calculate the normal returns in accordance with the Market Model, the Capital Asset Pricing Model, or other similar theoretical models. Mullins (1982) present several difficulties related to applying CAPM, which contributed to the choice of using actual observations instead of applying a theoretical model. With the primary issue being, as previously mentioned when motivating the applied method, that the theoretical models are weaker when it comes to making the risk-adjusted estimations of normal return, which according to Kothari and Warner (2006) is an especially critical step when conducting long-horizon event studies, where potential errors might increase in magnitude over a long-term event window.

Another alternative to using characteristic-based matching of portfolios when calculating the abnormal returns would have been to make use of the so called Jensen-alpha approach, also known as the calendar-time approach. The primary characteristic of this approach is to make use of calendar-time portfolios, which entails creating and rebalancing portfolios for each calendar month (Kothari & Warner, 2006). According to Loughran and Ritter (2000) this method is predisposed toward results that are in line with capital markets being efficient. They state that due to the method applying equal weightings for time-periods, at the exclusion of equal firm weightings, it does not capture the market timing dimension of share repurchases in a satisfying manner. With this particular reasoning the Jensen-alpha approach was not applied in this study, since market timing has fundamental implications when examining signaling effects.

4.5.3 Data Loss
Some data were lost due to historical market capitalization not being available for all the firms that had performed share repurchases during the observed time-period. Thus, the relative size of those repurchases could not be calculated. Due to the inability to calculate the relative size of

these repurchases, it is not possible to estimate the implication that this type of data loss had on the study. It is not known how many of these firms that would have reached the threshold of one percent of market capitalization, and thus have qualified for the sample. The reason for the market capitalization not being available is that those firms had been delisted some time during the observed time-period. The firms were delisted either due to them being acquired, or forcibly delisted due to issues such as bankruptcy.

The data loss following the forced delisting is assumed to lead to a survivorship bias within the samples, since some of the underperforming firms have been excluded. This could lead to a higher average return within the sample, and thus strengthening of the observed abnormal returns. The assumption that firms that have been forcibly delisted are underperforming on average is supported by Macey, O'Hara and Pompilio (2008) who state that the firm value on average decreases by more than 50 percent in conjunction with forced delisting. The directional effect of losing data due to acquisitions is not as clear, since acquisitions target both under- and over-performing firms. According to Berk and DeMarzo (2017), acquisitions are primarily motivated by the acquirer's prospects of synergies.

The total number of firms that could not be included in the sample due to delisting was 31, as previously mentioned, it is not clear which of these firms that would have reached the repurchase threshold, and thus being included in the sample of this study. Roughly 20 percent of repurchasing firms made repurchases large enough to qualify. This gives an indication of how large the data loss due to delisting could be. Based on this, the effect on this study due to this type of data loss is deemed to be negligible.

4.5.4 Capital Insurance Depots

As previously mentioned in section 2.1, insiders could, until MAR was implemented, trade shares in a capital insurance depot without reporting the transactions. This means that insiders, during the entire observed period, were able to hide their insider transactions. However, according to Wahlin (2016) capital insurance depots were used to a limited extent before year 2007. He states that during the year 2007 it became more common to use capital insurance

depots, due to online stockbrokers introducing free capital insurance depots. The possibility of insiders to hide their insider transactions has an important implication on this study. It is reasonable to expect that insiders, because of the reporting requirement and the tax differences, have used capital insurance depots during the observed period. Thus, it is probable that this study does not capture all insider transactions. However, it is impossible to know how many transactions, since there were no reporting requirements during the observed period.

4.5.5 Threshold Values for Insider Trading and Share Repurchases

As previously mentioned in section 4.2.1, this study applied threshold values to ensure that the repurchases and insider transactions entailed a significant signal, i.e. consisted of non-trivial amounts. This study used a threshold value of 1 percent of the firm's total market capitalization for repurchases and a threshold of 0.01 percent of the firm's total market capitalization and/or an amount exceeding 100,000 SEK for insider transactions. If the threshold would have been higher this would most likely entail a stronger signal, however it would also lead to a smaller sample. If the threshold would have been lower this would most likely entail a weaker signal, however the sample would have been larger. The threshold of 100,000 SEK for insider transactions is used in order mitigate the risk of the sample being skewed toward smaller firms.

The motives behind insider sales were not presented in the data, thus redemption of stock options was not taken into account in this study. Stock options also have the possibility to influence share repurchases, since some firms choose to repurchase shares instead of diluting current shareholders. However, with the threshold value of one percent of the firm's total market capitalization, share repurchases due to stock options should have a fairly low impact on this study.

4.5.6 Validity and Reliability

The primary objective of this study is the identification of potential relationships between certain specified events and abnormal returns. Thus, appropriate definitions of the classifications and thresholds that were used are paramount to obtaining results that can make valid contributions to

the current body of research on the subject. This is especially true since, as previously mentioned in section 4.5.2 regarding the estimation of risk-adjusted normal returns, inaccurate classifications and estimations will have a larger impact on results when observing abnormal returns over a longer time-period, where initial errors might increase in magnitude over time.

The various classifications and thresholds applied in this study have all been used in previous studies, conducted by researchers who have made successful publications on the subject of interpreting signals regarding firm value inherent to share repurchases under various conditions (e.g., Bonaimé & Ryngaert (2013), Chan et al. (2010)). Thus, the measures of the study can be deemed as fitting and having face validity, as presented by Bryman and Bell (2011).

One weakness of the study, which has a negative implication on the internal validity of the study, is that any inferences made on the basis of buy-and-hold abnormal return relies heavily on the assumption that the event firms do not differ from the non-event firms, in aspects other than experiencing the specified event. The characteristics used when matching control portfolios are, implicitly, assumed to be a perfect proxy for normal returns. Due to this, one observation was excluded where an inclusion would have required a substantial deviation from the matching-criteria, which would have risked contaminating the BHAR measurement.

The application of threshold values when classifying share repurchases and insider trading is deemed to increase the validity of the study, as it is reasonable to assume that transactions deemed as trivial do not carry a material signal regarding firm value. It is important to keep in mind that this kind of classification is a tradeoff, due to a degree of subjectivity when determining where to draw the line between trivial and non-trivial amounts. Although, the threshold values of this study seem to be generally accepted by other researchers conducting research on similar subjects. Further, the robustness of the criteria used to define an event was, in part, tested by creating a sample based on modified sampling-criteria. The results of this test did not show any substantial deviations when compared to the results of the primary samples, which supports the internal validity of that particular threshold value. This robustness test is described further in section 4.4.3 and the output is presented in the appendix (B).

The inclusion of control variables strengthens the internal validity of the study. Three different control measures were included in an attempt to mitigate some of the noise contaminating the BHAR, thus improving the internal validity of the study. Government bond yields were explicitly included in the regression specifications, intended as an implicit proxy for macroeconomic factors. Both Market capitalization and price-to-book value are implicitly controlled for, due to being used as matching-characteristics when estimating the normal return.

As previously mentioned in section 4.5.1, the event date is not defined as an exact point in time, but rather a period of time where an aggregate event takes place. The risk of missing part of the initial effect of the event window lowers the internal validity. As previously mentioned in 4.5.1, this issue is slightly mitigated due to the long-term perspective of the study.

The external validity of the study is low. There are several reasons for this, the first one being that extrapolation of the results onto other markets or time-periods is inappropriate due to differences in regulatory standards as well as differences in economic environment. The results of the regression analyses do not support the findings to such an extent that causality can be claimed, thus making inferences outside of the examined samples inappropriate. This issue is enhanced due to the samples not being randomly collected. The issue of examining a non-random sample could have been mitigated through bootstrapping, but this was not possible due to the examined sample consisting of all firms, on the Stockholm Stock Exchange, that experienced the events of interest during the examined period, with an exception for firms that have been delisted. Thus, inferences regarding the entire population, as in all firms listed on the Stockholm Stock Exchange, would be made with a substantial degree of uncertainty. This is primarily due to the estimated loss of observations, previously mentioned in section 4.5.3, amounting to 20 percent of the potential observations.

That the study relies exclusively on secondary data introduces an uncertainty regarding the precision of the data included. That the sources could be argued as being trustworthy and widely used does not guarantee the integrity of the data. To mitigate this uncertainty, random cross-checking of the data was done, primarily by comparing the supplied data to data available through other sources, such as; annual reports, Finansinspektionen and Avanza. In accordance

with Saunders, Lewis and Thornhill (2009), such cross-checking strengthens the reliability of the study in terms of data accuracy.

Data were to a large extent handled manually, consequentially there could be faulty data due to human error. In order to mitigate this risk, thus strengthening the reliability of the data, the handling of data was done in a consistent and standardized manner, e.g. by preparing templates for most of the calculations that were carried out in Excel.

The primary reference articles that were used are all deemed to be of relevance. The study performed by Ikenberry, Lakonishok and Vermaelen (1995) could be argued as old enough to risk being outdated, although it is still actively cited which supports relevance. The other two primary articles, Bonaimé and Ryngaert (2013) and Chan, Ikenberry, Lee & Wang (2012), are both well cited and relatively modern publications. There is no apparent issue regarding the validity of the literary foundation of the study.

4.6 Concepts and Definitions

This section summarizes some of the different concepts and definitions that are used in this study. However, note that all these concepts and definitions are previously described in more detail.

4.6.1 Share Repurchases

In this study, firms are labeled as carrying out share repurchases if the firm, during one quarter, carry out share repurchases comprising of at least 1 percent of the firm's market capitalization.

4.6.2 Insider Trading

For all firms with significant share repurchases the insider trading during the same quarter as the share repurchase were identified. In this study, insider trading is defined as the aggregated amount of insider buying during one quarter, less the aggregated amount of insider selling during

the same quarter. A positive net amount entails insider buying, while a negative entails insider selling. Further, the net amount must make up at least 0.01 percent of the firm's market capitalization or exceed an amount of 100,000 SEK to be deemed significant. All net insider trading that does not meet this threshold was classified as neutral insider trading.

4.6.3 Events of Interest

This study has three events of interest. These events of interest are quarters with; share repurchase transactions, share repurchase transactions concurrent with insider buying and share repurchase transactions concurrent with insider selling.

4.6.4 Event Windows

The event windows used in this study are; the quarter when the event is taking place [*Quarter during*], one quarter post-event [*Quarter after*] and three separate years post-event [*Year 1*, *Year 2* and *Year 3*].

5. Results

5.1 Direction of Insider Trades

During the examined period, from year 2000 until 2014, 240 observations of significantly large share repurchases were made. These observations were classified depending on the different direction of insider transactions concurrent with the share repurchases. The distribution is presented in Table 3 below. The distribution in the table clearly shows that buying was the most common form of insider transaction during quarters of repurchases, this direction represented 44.75 percent of all observations. The least observed form of insider trading was selling, which only represented 17.5 percent. Neutral insider trading made up the rest of the distribution, 38.75 percent.

Table 3. Direction of insider trading

Direction of insider trading	Observations	Distribution
Net selling	42	17.50%
Neutral	93	38.75%
Net Buying	105	43.75%
Column total	240	100%

5.2 Frequency of Insider Trading

Figure 1 below shows the observations grouped by year and the direction of insider trading. As presented below, the number of insider trades varied a lot from year to year. Year 2000, which was the year with the fewest observations, had 1 observation, while year 2001, which was the year with the most observations, had 31 observations. The direction of insider trades also varied during the observed period. For example, insider buying varied from 1 observation in year 2000 to 15 observations in year 2007. Insider selling also varied, during two of the years there were no observations and in year 2007 there were 6 observations of insider sales. Out of the total 105 observations of insider buying, 36 of them were observed during the year 2006 to 2008. Of all the 240 insider transactions, 76 of them were observed during the same time-period.
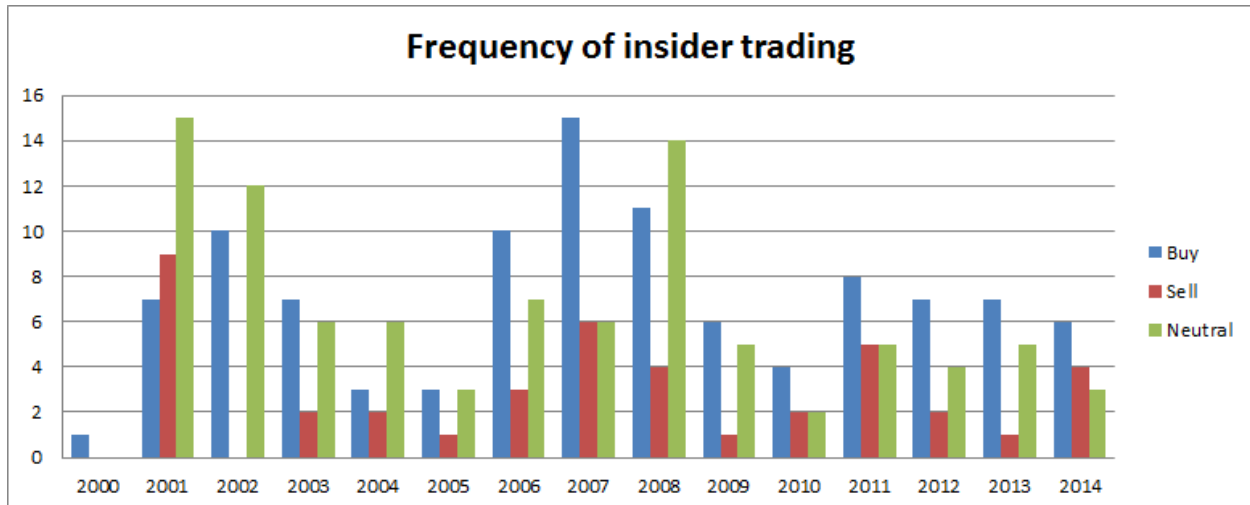
Figure 2. Frequency of insider trading

5.3 Abnormal Return

In the tables following in this chapter, the average BHAR is presented for each of the different event windows. The quarter during which the repurchase transaction took place is denoted as *Quarter during*, and *Quarter after* denotes the quarter following the event. The year following the event is denoted as *Year 1*, *Year 2* denotes the second year following the event and *Year 3* denotes the third year following the event. The tables also display the corresponding p-values and significance level. The one, two and three stars represent statistically significant results at the ten, five and one percent level respectively.

5.3.1 Repurchases

In table 4 below, the results for the entire time-period are presented, as well as the results for the time-period ranging from year 2000 to 2007, the time-period ranging from year 2008 to 2014 and the time-period ranging from year 2006 to 2008. The table displays if the abnormal returns for firms with share repurchases were significantly higher than zero. For the entire time-period, firms with repurchases all had a positive abnormal return. All the abnormal returns for these firms obtained statistical significance. For the time-period ranging from year 2000 to 2007, firms with repurchases all had a positive abnormal return. However, only the event windows *Year 1* and *Year 2* obtained statistically significant returns. For the time-period ranging from year 2008

to 2014, firms with repurchases all had a positive abnormal return. All event windows obtained statistically significant returns. For the time-period from year 2006 to year 2008, firms with repurchases all had a positive abnormal return. The abnormal return for these firms obtained statistical significance for the event windows *Year 1*, *Year 2* and *Year 3*.

Table 4. Share repurchases

	BHAR 2000-2014	P-Value	Sig.	BHAR 2000-2007	P-Value	Sig.	BHAR 2008-2014	P-Value	Sig.	BHAR 2006-2008	P-Value	Sig.
Quarter during	1.87%	0.0263	**	1.29%	0.1670	-	2.55%	0.0360	**	1.72%	0.1520	-
Quarter after	1.89%	0.0266	**	1.00%	0.1930	-	3.07%	0.0350	**	1.39%	0.1745	-
Year 1	5.29%	0.0120	**	5.35%	0.0340	**	5.16%	0.0955	*	7.63%	0.0130	**
Year 2	5.36%	0.0146	**	0.28%	0.4630	-	12.49%	0.0015	***	11.55%	0.0030	***
Year 3	10.53%	0.0001	***	7.10%	0.0195	**	15.17%	0.0000	***	19.94%	0.0000	***
n =	231			132			99			76		

5.3.2 Repurchases and Insider Trading, 2000 – 2014

In table 5 below, the results for the entire time-period are presented. The table displays if firms with insider buying concurrent with share repurchases had a significantly higher abnormal return compared to firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider selling. The abnormal return for insider buying concurrent with share repurchases was higher than the return for firms with only repurchases and the other insider directions for all the examined time-periods, except for the time-period during the repurchases. However, the results are only statistically significant for the *Quarter after* the event and *Year 3*.

Table 5. Repurchases and insider buying

	Insider buy	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	102	1.19%	-0.63%	0.3540	-
	0	129	1.82%			
Quarter after	1	102	2.80%	2.62%	0.0595	*
	0	129	0.18%			
Year 1	1	102	6.88%	3.10%	0.2225	-
	0	129	3.78%			
Year 2	1	102	7.41%	3.08%	0.2420	-
	0	129	4.32%			
Year 3	1	102	13.03%	5.66%	0.0990	*
	0	129	7.37%			

In table 6 below, the results for the entire time-period are presented. The table displays if firms with insider selling concurrent with share repurchases had a significantly lower abnormal return compared to firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider buying. The abnormal return for insider selling concurrent with share repurchases was lower than the return for firms with only repurchases and the other insider directions for the event windows *Year 2* and *Year 3*. For the other event windows, the abnormal return was higher for the firms with insider selling concurrent with share repurchases. However, only one event window obtained statistically significant higher abnormal returns, namely *Year 1*.

Table 6. Repurchases and insider selling

	Insider sell	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	39	3.47%	2.37%	0.1355	-
	0	192	1.09%			
Quarter after	1	39	3.15%	2.07%	0.1595	-
	0	192	1.08%			
Year 1	1	39	11.26%	7.68%	0.0295	**
	0	192	3.58%			
Year 2	1	39	1.51%	-4.95%	0.1670	-
	0	192	6.46%			
Year 3	1	39	8.09%	-3.02%	0.2665	-
	0	192	11.11%			

5.3.3 Repurchases and Insider Trading, 2000 – 2007

In table 7 below, the results for the time-period ranging from year 2000 to 2007 are presented. The table displays if firms with insider buying concurrent with share repurchases had a significantly higher abnormal return than firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider selling. The abnormal return for insider buying concurrent with share repurchases was higher than the abnormal return for firms with only repurchases and the other insider directions for all the examined time-periods. However, these returns are only statistically significant for *Year 1* and *Year 3*.

Table 7. Repurchases and insider buying, 2000 – 2007

	Insider buy	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	56	0.40%	-0.89%	0.3540	-
	0	76	1.29%			
Quarter after	1	56	2.44%	2.72%	0.1080	-
	0	76	-0.28%			
Year 1	1	56	11.96%	11.91%	0.0110	**
	0	76	0.05%			
Year 2	1	56	3.98%	5.61%	0.1365	-
	0	76	-1.64%			
Year 3	1	56	13.32%	10.32%	0.0460	**
	0	76	2.99%			

In table 8 below, the results for the time-period ranging from year 2000 to 2007 are presented. The table displays if firms with insider selling concurrent with share repurchases had a significantly lower abnormal return than firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider buying. The abnormal return for insider selling concurrent with share repurchases was lower than the return for firms with only repurchases and the other insider directions for *Year 2* and *Year 3*. For the other event windows, the abnormal return was higher for the firms with insider selling concurrent with share repurchases. However, none of these results were statistically significant.

Table 8. Repurchases and insider selling, 2000 – 2007

	Insider sell	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	21	3.22%	2.72%	0.2055	-
	0	111	0.50%			
Quarter after	1	21	2.40%	1.67%	0.2580	-
	0	111	0.72%			
Year 1	1	21	9.47%	5.18%	0.1705	-
	0	111	4.29%			
Year 2	1	21	-8.02%	-9.99%	0.1030	-
	0	111	1.97%			
Year 3	1	21	7.10%	-0.22%	0.4865	-
	0	111	7.32%			

5.3.4 Repurchases and Insider Trading, 2008 – 2014

In table 9 below, the results for the time-period ranging from year 2008 to 2014 are presented. The table displays if firms with insider buying concurrent with share repurchases had a significantly higher abnormal return than firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider selling. The abnormal return for insider buying concurrent with share repurchases was higher than the return for firms with only repurchases and the other insider directions for one event window, the *Quarter after* the event. However, none of these results were statistically significant.

Table 9. Repurchases and insider buying, 2008 – 2014

	Insider buy	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	46	2.08%	-0.49%	0.4140	-
	0	53	2.57%			
Quarter after	1	46	4.16%	2.26%	0.2350	-
	0	53	1.90%			
Year 1	1	46	1.06%	-7.96%	0.1110	-
	0	53	9.02%			
Year 2	1	46	12.48%	-1.56%	0.4145	-
	0	53	14.04%			
Year 3	1	46	13.37%	-2.35%	0.3670	-
	0	53	15.71%			

In table 10 below, the results for the time-period ranging from year 2008 to 2014 are presented. The table displays if firms with insider selling concurrent with share repurchases had a significantly lower abnormal return than firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider buying. The abnormal return for insider selling concurrent with share repurchases was lower than the return for firms with only repurchases and the other insider directions for only the event window *Year 3*. For the other event windows, the abnormal return was higher for the firms with insider selling concurrent with share repurchases. However, only the results for *Year 1* were statistically significant.

Table 10. Repurchases and insider selling, 2008 – 2014

	Insider sell	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	18	4.26%	2.53%	0.2105	-
	0	81	1.73%			
Quarter after	1	18	5.82%	4.27%	0.1740	-
	0	81	1.56%			
Year 1	1	18	15.23%	12.61%	0.0535	*
	0	81	2.63%			
Year 2	1	18	13.71%	0.64%	0.4680	-
	0	81	13.07%			
Year 3	1	18	4.30%	-11.79%	0.1105	-
	0	81	16.10%			

5.3.5 Repurchases and Insider Trading, 2006 – 2008

In table 11 below, the results for the time-period ranging from year 2006 to 2008 are presented. The table displays if firms with insider buying concurrent with share repurchases had a significantly higher abnormal return than firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider selling. The abnormal return for insider buying concurrent with share repurchases was higher than the return for firms with only repurchases and the other insider directions, for all event windows, except for the *Quarter during* the event. However, none of these results were statistically significant.

Table 11. Repurchases and insider buying, 2006 – 2008

	Insider buy	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	36	-0.48%	-3.44%	0.1025	-
	0	40	2.96%			
Quarter after	1	36	1.65%	1.13%	0.3285	-
	0	40	0.52%			
Year 1	1	36	11.75%	6.82%	0.1190	-
	0	40	4.93%			
Year 2	1	36	12.10%	1.53%	0.4065	-
	0	40	10.58%			
Year 3	1	36	23.83%	9.12%	0.1245	-
	0	40	14.71%			

In table 12 below, the results for the time-period ranging from year 2006 to 2008 are presented. The table displays if firms with insider selling concurrent with share repurchases had a significantly lower abnormal return than firms with only repurchases and the other insider directions, i.e. neutral insider trading and insider buying. The abnormal return for insider selling concurrent with share repurchases was lower than the return for firms with only repurchases and the other insider directions, for all event windows, except for the *Quarter after* the event and *Year 1*. For the other event windows, the abnormal return was higher for the firms with insider selling concurrent with share repurchases. However, only the abnormal return for *Year 2* was statistically significant.

Table 12. Repurchases and insider selling, 2006 – 2008

	Insider sell	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	13	-1.38%	-3.14%	0.2090	-
	0	63	1.75%			
Quarter after	1	13	3.29%	2.80%	0.2080	-
	0	63	0.49%			
Year 1	1	13	8.03%	0.36%	0.4825	-
	0	63	7.67%			
Year 2	1	13	-1.27%	-15.47%	0.0355	**
	0	63	14.21%			
Year 3	1	13	14.86%	-5.42%	0.2725	-
	0	63	20.28%			

5.3.6 Repurchases and CEO Insider Trading

In table 14 below, the results for the entire time-period are presented. The table displays if firms with CEO buying concurrent with share repurchases had a significantly higher abnormal return than firms with insider buying concurrent with share repurchases, excluding CEO buying. The return for CEO buying concurrent with share repurchases was higher than the return for firms with insider buying repurchases for the *Quarter during* the event, the *Quarter after* the event and *Year 1*. However, the results were only statistically significant for *Year 1* and the *Quarter after* the event.

Table 14. Repurchases and CEO buying

	CEO Buy	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	14	1,75%	0,73%	0,4180	-
	0	88	1,02%			
Quarter after	1	14	7,88%	6,02%	0,0625	*
	0	88	1,86%			
Year 1	1	14	24,34%	20,38%	0,0030	***
	0	88	3,96%			
Year 2	1	14	2,03%	-6,06%	0,1625	-
	0	88	8,09%			
Year 3	1	14	9,99%	-3,51%	0,3270	-
	0	88	13,50%			

In table 15 below, the results for the entire time-period are presented. The table displays if firms with CEO selling concurrent with share repurchases had a significantly lower abnormal return than firms with insider selling concurrent with share repurchases, excluding CEO selling. The abnormal return for CEO selling concurrent with share repurchases was lower than the return for firms with insider selling repurchases, for all event windows, except for the *Quarter after* the event and *Year 3*. However, none of these results were statistically significant.

Table 15. Repurchases and CEO selling

	CEO Sell	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	9	3.55%	-0.86%	0.4485	-
	0	31	4.42%			
Quarter after	1	9	4.53%	1.06%	0.3975	-
	0	31	3.47%			
Year 1	1	9	5.31%	-8.84%	0.1590	-
	0	31	14.15%			
Year 2	1	9	0.35%	-4.32%	0.4030	-
	0	31	4.67%			
Year 3	1	9	8.19%	2.00%	0.4390	-
	0	31	6.19%			

5.3.7 Repurchases and Cash

In table 16 below, the results for the entire time-period are presented. The table displays if firms with low levels of cash-to-total assets, during the time of the share repurchases, had a significantly higher abnormal return than firms with high levels of cash-to-total assets, during the time of the repurchases. The return for the firms with low levels of cash-to-total assets was higher for the *Quarter after* the event, *Year 2* and *Year 3*. However, these results were only statistically significant for *Year 3*.

Table 16. Repurchases and cash holdings

	Low Cash	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	116	1.48%	-0.25%	0.4405	-
	0	115	1.73%			
Quarter after	1	116	2.43%	2.01%	0.1080	-
	0	115	0.42%			
Year 1	1	116	4.06%	-2.00%	0.3065	-
	0	115	6.06%			
Year 2	1	116	7.74%	4.36%	0.1570	-
	0	115	3.38%			
Year 3	1	116	14.67%	8.85%	0.0290	**
	0	115	5.82%			

5.3.8 Regression Output

In table 17 below, the results for the first regression specification *(IV)* are presented for all the different event windows. As previously mentioned, the abnormal returns for each of the different event windows were used as the dependent variables. Thus, the regression was performed five different times, with the different abnormal returns as the dependent variable. The regressions cover the entire time-period, ranging from year 2000 to 2014. The first regression specification includes the previously described buy dummy. For all the event windows, the buy dummy had a positive coefficient, but it did not obtain any statistically significant results. Only one of the variables for one of the event windows obtained a statistically significant result, namely cash-to-total assets for *Year 3*. This variable had a negative coefficient. The R-squared was low for all of the event windows, ranging from 0.80 to 4.16 percent.

Table 17 - Insider buying

Variable	Quarter during			Quarter after			Year 1		
	Coefficient	Std. Error	P-value	Coefficient	Std. Error	P-value	Coefficient	Std. Error	P-value
C	-0.0078	0.0324	0.8110	-0.0302	0.0397	0.4478	-0.0988	0.0954	0.3016
Buy Dummy	0.0024	0.0204	0.9056	0.0270	0.0204	0.1859	0.0369	0.0492	0.4549
Repurchase	-0.2376	0.3993	0.5524	0.5134	0.4610	0.2667	2.0369	1.3453	0.1314
Cash to total assets	0.1070	0.0790	0.1769	0.1536	0.1103	0.1654	0.2238	0.2017	0.2685
CEO insider trading	-0.0050	0.0147	0.7352	-0.0121	0.0185	0.5122	-0.0102	0.0400	0.8000
10 year government bonds	0.0052	0.0077	0.4996	0.0023	0.0090	0.8021	0.0168	0.0223	0.4529
R-squared	0.0080			0.0294			0.0239		
Adj. R-squared	-0.0140			0.0078			0.0022		
F-statistic	0.3632			1.3616			1.1035		
Prob (F-statistic)	0.8734			0.2398			0.3594		

Variable	Year 2			Year 3		
	Coefficient	Std. Error	P-value	Coefficient	Std. Error	P-value
C	0.1661	0.0879	0.0600	0.2325	0.0919	0.0120
Buy Dummy	0.0342	0.0495	0.4899	0.0508	0.0521	0.3301
Repurchase	-0.3802	1.5819	0.8103	1.1278	1.6279	0.4892
Cash to total assets	-0.0844	0.1861	0.6504	-0.4191	0.2157	0.0533
CEO insider trading	-0.0387	0.0453	0.4954	-0.0592	0.0553	0.2853
10 year government bonds	-0.0283	0.0211	0.1818	-0.0347	0.0216	0.1090
R-squared	0.0416			0.0318		
Adj. R-squared	0.0203			0.0103		
F-statistic	1.9532			1.4788		
Prob (F-statistic)	0.0866			0.1977		

In table 18 below, the results for the second regression specification *(IV)* are presented, for all the different event windows. As previously mentioned, abnormal returns for each of the different event windows were used as the dependent variables. Thus, the regression was performed five different times, with the different abnormal returns as the dependent variable. The regressions cover the entire time-period, ranging from year 2000 to 2014. The second regression specification includes the previously described sell dummy. For the following event windows; *Quarter during*, *Quarter after* and *Year 1*, the sell dummy had a positive coefficient. For *Year 1*, the sell dummy obtained a statistically significant result. For the other event windows, the coefficient for the sell dummy was negative. Only one other variable obtained a statistically significant result, namely cash-to-total assets for *Year 3*. This variable had a negative coefficient. The R-squared was low for all the event windows, ranging from 1.38 to 4.24 percent.

Table 18 - Insider selling

Variable	Quarter during			Quarter after			Year 1		
	Coefficient	Std. Error	P-value	Coefficient	Std. Error	P-value	Coefficient	Std. Error	P-value
C	-0.0143	0.0288	0.6198	-0.0209	0.0332	0.5301	-0.1059	0.0837	0.2074
Sell Dummy	0.0301	0.0247	0.2236	0.0334	0.0277	0.2295	0.1180	0.0583	0.0443
Repurchase	-0.2650	0.4096	0.5182	0.5035	0.4728	0.2880	1.9525	1.4204	0.1706
Cash to total assets	0.1203	0.0788	0.1284	0.1639	0.1128	0.1476	0.2709	0.1967	0.1698
CEO insider trading	-0.0046	0.0132	0.7263	-0.0078	0.0172	0.6523	-0.0043	0.0359	0.9057
10 year government bonds	0.0057	0.0075	0.4500	0.0012	0.0086	0.8898	0.0168	0.0211	0.4254
R-squared	0.0138			0.0285			0.0367		
Adj. R-squared	-0.0081			0.0069			0.0153		
F-statistic	0.6319			1.3189			1.7130		
Prob (F-statistic)	0.6756			0.2569			0.1326		

Variable	Year 2			Year 3		
	Coefficient	Std. Error	P-value	Coefficient	Std. Error	P-value
C	0.2037	0.0862	0.0190	0.2838	0.0817	0.0006
Sell Dummy	-0.0526	0.0611	0.3906	-0.0612	0.0674	0.3642
Repurchase	-0.2997	1.5690	0.8487	1.2310	1.6206	0.4483
Cash to total assets	-0.1147	0.1904	0.5477	-0.4563	0.2182	0.0376
CEO insider trading	-0.0351	0.0436	0.4534	-0.0509	0.0516	0.3252
10 year government bonds	-0.0316	0.0214	0.1410	-0.0393	0.0212	0.0646
R-squared	0.0424			0.0312		
Adj. R-squared	0.0211			0.0097		
F-statistic	1.9900			1.4487		
Prob (F-statistic)	0.0811			0.2078		

6. Analysis

6.1 Analysis of the Hypotheses

6.1.1 Repurchases

This study's first hypothesis was regarding share repurchases and whether they entail a signal of undervaluation or not. In table 4, the abnormal return for firms with share repurchases clearly show that these firms outperform the expected return. For the entire time-period as well as the time-period ranging from year 2008 to year 2014, all event windows are statistically significant. For the time-period of ranging from year 2000 to 2007 only two event windows obtain statistically significant returns. For the time-period ranging from year 2006 to year 2008, the event windows for *Year 1*, *Year 2* and *Year 3* obtained statistically significant returns. Based on the statistically significant abnormal returns, this study can confirm that firms with share repurchases obtained abnormal returns during the observed period, hence the null hypothesis *(a)* is rejected.

> $H_0(a)$: *Firms performing repurchases do not obtain abnormal returns.*
>
> $H_1(a)$: *Firms performing repurchases obtain abnormal returns.*

For the entire time-period, the event window the *Quarter after* the event, firms with share repurchases obtained an abnormal return of roughly 1.9 percent. For *Year 1* and *Year 2*, the firms obtained an abnormal return of roughly 5.3 percent and for *Year 3* they obtained an abnormal return of roughly 10.5 percent. These findings support previous research regarding share repurchases as a signal of undervaluation (e.g. Vermaelen (1981) and Ikenberry, Lakonishok and Vermaelen (1995)). When comparing the abnormal return for firms with share repurchases in this study with the abnormal return observed by Ikenberry, Lakonishok and Vermaelen (1995), it clearly shows that this study observes a higher abnormal return for all three years after the share repurchases. Ikenberry, Lakonishok and Vermaelen (1995) observed an abnormal return of 2.04 percent for the first year, 2.31 percent for the second year and 4.59 percent for the third year.

However, there is one important difference between this study and the one performed by Ikenberry, Lakonishok and Vermaelen (1995). Their study examined the announcement of share repurchase programs, while this study examines actual share repurchases. That this study obtains a higher abnormal return could therefore imply that actual share repurchases are a stronger signal of undervaluation than the announcement of share repurchase programs. However, due to the different time-periods, rules and regulations as well as general market conditions, it is not possible to determine if actual share repurchases are a stronger signal.

An interesting pattern that can be observed when examining the abnormal return of repurchasing firms, is that the abnormal return, almost exclusively, for all of the time-periods show a continuous increase between *Year 1, Year 2* and finally peaking for *Year 3*. When comparing this result to those of Ikenberry, Lakonishok and Vermaelen (1995), a similar pattern is observed. This could be explained by the findings of Wang and Johnson (2008), who state that the informational content of repurchasing signals is gradually reflected in long-run abnormal stock returns. They explain this by referring to market participants having difficulties interpreting the actual impact of share repurchase announcements. They initially tend to overreact to repurchase announcements, hence resulting in lowered abnormal returns during the more immediate period following the announcement. As the full extent of the repurchase program is gradually conveyed through the signals of actual repurchase transactions being carried out, market participants correct their expectations downwards. Wang and Johnson (2008) state that market participants tend to underreact to the actual repurchase transactions, which would explain the continuous increase in abnormal returns during the years following the announcement. The pattern observed in this study seems to support the statements made by Wang and Johnson (2008). One possible implication of this pattern in abnormal returns, speaks for actual repurchase transactions conveying more information through signaling, compared to the signal inherent to announcements of share repurchase programs. Another implication of the findings of this study, supported by the findings of both Wang and Johnson (2008) and Ikenberry, Lakonishok and Vermaelen (1995), is that conventional short-horizon event studies on share repurchases might be missing out on the full reaction due to the share repurchases.

6.1.2 Repurchases and Insider Trading

This study's second and third hypotheses were whether insider trading could either validate or mitigate the undervaluation signal inherent to share repurchases. The first of these hypotheses was if firms with insider buying concurrent with share repurchases obtain higher abnormal returns compared to firms that carry out repurchases and do not have insider buying. Thus, indicating that insider buying strengthens the repurchasing signal of undervaluation. As presented in the results, this study found that for the entire period, firms with insider buying concurrent with share repurchases obtained a higher abnormal return for all event windows, except for the *Quarter during* the event. However, the returns were only statistically significant for the *Quarter after* the event and *Year 3*. The findings for the entire time-period are consistent with the findings regarding the earlier time-period, ranging from year 2000 to year 2007. For this time-period, firms with insider buying concurrent with share repurchases obtained higher abnormal returns compared to firms that carry out repurchases and do not have insider buying, for all event windows except for the *Quarter during* the event. However, only *Year 1*, and *Year 3* obtained statistically significant returns.

For the later time-period, ranging from year 2008 to 2014, the return for insider buying concurrent with share repurchases differ, compared to the earlier time-period ranging from year 2000 to 2007. For the later time-period, the *Quarter after* the event was the only event window that obtained higher abnormal returns compared to firms that carried out repurchases and did not have insider buying. However, none of the returns for this time-period are statistically significant. The time-period, ranging from year 2006 to 2008, showed similar results as the entire time-period and the time-period ranging from year 2000 to 2007. All event windows, except for the *Quarter during* the event, obtained a higher abnormal return for the time-period ranging from year 2006 to 2008. However, none of the event windows obtained statistically significant returns. Due to the only statistically significant abnormal returns being higher for firms with insider buying concurrent with repurchases, the null hypothesis *(b)* is rejected. That is, no event window obtained statistically significant lower abnormal returns, which would have supported the null hypothesis.

H$_0$(b): Firms with insider buying during the same quarter as share repurchases do not obtain a higher abnormal return than firms with no insider buying during the same quarter as share repurchases.

H$_1$(b): Firms with insider buying during the same quarter as share repurchases obtain a higher abnormal return than firms with no insider buying during the same quarter as share repurchases.

These findings are in line with those of Bonaimé and Ryngaert (2013), stating that insider buying strengthens the undervaluation signal inherent to share repurchases. Thus, yielding higher abnormal returns. This implies that insider buying adds valuable information to the repurchasing signal of undervaluation, thus repurchases concurrent with insider buying provides further guidance in enabling market participants to identify true firm value. This also implies that the information asymmetry is more extensive regarding repurchasing firms with insider buying, compared to repurchasing firms. Consequentially, this lends support to viewing insider buying as a proxy for information asymmetry when it coincides with share repurchases.

The third hypothesis was about insider selling's possibility to weaken the use of share repurchases as a signal of undervaluation. Firms that carried out share repurchases concurrent with insider selling obtained lower abnormal returns compared to firms that carried out share repurchases and did not have insider selling, this was during the entire period, for the event windows *Year 2* and *Year 3*. For the remaining event windows, the *Quarter during* the event, the *Quarter after* the event and *Year 1*, insider selling concurrent with share repurchases obtained a higher abnormal return. Interestingly, the only event window with a statistically significant mean difference in abnormal return was *Year 1*, which had a 7.7 percent higher abnormal return. For the earlier time-period ranging from year 2000 to 2007 the results are similar to the results for the entire time-period. The same event windows obtained lower abnormal returns, although none of these showed a statistically significant mean difference.

For the time-period ranging from year 2008 to 2014 the results differ. For all the event windows, except *Year 3*, the firms with insider selling concurrent with share repurchases obtained a higher

abnormal return. Interestingly, the only event window that showed a statistically significant mean difference was *Year 1*, which also had a statistically significant positive mean difference for the entire time-period. The last examined time-period, ranging from year 2006 to 2008 showed similar results as both the entire time-period and the time-period ranging from year 2000 to 2007. For this time-period all event windows, except the *Quarter after* and *Year 1*, obtained lower abnormal returns. However, only *Year 2* obtained a statistically significant negative mean difference. Due to both negative and positive statistically significant mean differences, this study can not reject the null hypothesis *(c)*. Hence, this study can not show that insider selling has the ability to weaken the use of share repurchases as a signal of undervaluation.

> *H$_0$(c): Firms with insider selling during the same quarter as share repurchases do not obtain a lower abnormal return than firms with no insider selling during the same quarter as share repurchases.*

> *H$_1$(c): Firms with insider selling during the same quarter as share repurchases obtain a lower abnormal return than firms with no insider selling during the same quarter as share repurchases.*

Accepting the null hypothesis *(c)* is not in line with the findings presented by Bonaimé and Ryngaert (2013), who state that insider selling weakens the undervaluation signal inherent to share repurchases. The ambiguous results of this study, being the opposing statistically significant mean differences, could be due to insider sales being motivated by other reasons than overvaluation. Such a reason could be that insiders need financing in order to be able to exercise their stock options or other personal reasons. The results of this study imply that insider selling can not provide further guidance in enabling market participants to identify true firm value, as opposed to the results regarding insider buying.

6.1.3 Repurchases and CEO Insider Trading

This study's fourth and fifth hypotheses question if CEOs' insider trading have a stronger signaling effect than regular insider trading. The first of these hypotheses was if firms with CEO insider buying during the same quarter as share repurchases obtain higher abnormal returns than firms with other levels of insider buying. Thus, indicating that CEOs' insider buying have a stronger strengthening effect on share repurchases as a signal, compared to other insiders' buying. For the entire examined period, CEO buying concurrent with share repurchases obtained a higher abnormal return for the *Quarter during, Quarter after* and *Year 1*. However, only the *Quarter after* and *Year 1* obtained a statistically significant positive mean difference. Due to the statistically significant positive mean difference for the *Quarter after* and *Year 1*, this study can reject the null hypothesis *(d)*. Thus, it appears that CEO insider buying has a stronger strengthening effect on repurchases as a signal of undervaluation, compared to other insider's buying.

> *H_0(d): Firms with CEO insider buying during the same quarter as share repurchases do not obtain higher abnormal returns than firms with other levels of insider buying during the same quarter as share repurchases.*

> *H_1(d): Firms with CEO insider buying during the same quarter as share repurchases obtain higher abnormal returns than firms with other levels of insider buying during the same quarter as share repurchases.*

Rejection of the null hypothesis *(d)* supports the findings of Bonaimé and Ryngaert (2013), who found that the insider buying of top executives have a stronger ability to strengthen the repurchasing signal of undervaluation, thus yielding higher abnormal returns than repurchases with other insiders' buying. This result is not surprising, since it is reasonable to assume that CEO have an information advantage compared to other insiders.

The fifth hypothesis was if firms with CEO insider selling during the same quarter as share repurchases obtain lower abnormal returns than firms with other levels of insider selling. Thus,

indicating that CEOs' insider selling have a stronger weakening effect on share repurchases as a signal, compared to other insiders' selling. For the entire examined period, CEO insider selling concurrent with share repurchases obtained a lower abnormal return, compared to other insiders' selling, for the following event windows; the *Quarter during*, *Year 1*, *Year 2*. However, none of these event windows obtained a statistically significant negative mean difference. Due to this lack of statistically significant results, this study can not reject the null hypothesis *(e)*. Thus, this study can not show that CEO insider selling has a stronger weakening effect on repurchases as a signal of undervaluation, compared to other insider's selling.

> *$H_0(e)$: Firms with CEO insider selling during the same quarter as share repurchases do not obtain lower abnormal returns than firms with other levels of insider selling during the same quarter as share repurchases.*

> *$H_1(e)$: Firms with CEO insider selling during the same quarter as share repurchases do obtain lower abnormal returns than firms with other levels of insider selling during the same quarter as share repurchases.*

Accepting the null hypothesis *(e)* is not in line with the findings presented by Bonaimé and Ryngaert (2013), namely that CEO insider selling has a stronger weakening effect on the repurchase signal of undervaluation, compared to other insiders' selling. The ambiguous results of this study, although not statistically significant, implies that there is no substantial difference between CEOs and other insiders' selling regarding the implication the repurchase signal of undervaluation. As mentioned previously, the reason for these unclear results could be referred to CEOs selling shares for other reasons than the firm being overvalued.

With what has been presented so far regarding insider trading concurrent with share repurchases, it seems that insider selling might have a weaker relationship to abnormal returns, compared to insider buying. The reason for this, to put it simply, could be that there are several reasons for selling shares, but only one reason to buy. In this study, several reasons for selling have been

presented in earlier sections, one of them being the exercising of stock options. While insider buying seems to be motivated by one dominating reason, to make financial gains.

6.1.4 Repurchases and Cash

The sixth hypothesis was regarding lower levels of cash strengthening the signal of undervaluation inherent to share repurchases. For the entire examined period, firms with lower levels of cash-to-total assets concurrent with share repurchases obtain a higher abnormal return for the *Quarter after*, *Year 2*, and *Year 3*. However, the only statistically significant positive mean difference was during *Year 3*. Based on this, the null hypothesis *(f)* can be rejected. Thus, it appears that lower levels of cash-to-total assets can strengthen the undervaluation signal inherent to share repurchases.

> *H_0(f): Firms with lower levels of cash-to-total assets during the same quarter as share repurchases do not obtain a higher abnormal return than firms with higher levels of cash-to-total assets during the same quarter as share repurchases.*

> *H_1(f): Firms with lower levels of cash-to-total assets during the same quarter as share repurchases obtain a higher abnormal return than firms with higher levels of cash-to-total assets during the same quarter as share repurchases.*

In congruence with Andriosopoulos and Lasfer (2015) and Ruei-Shian (2012) this study finds that when carrying out share repurchases, firms with lower cash holdings obtain higher abnormal returns compared to firms with higher cash holdings. Thus, this study's findings support the current literature regarding the use of firms' cash holdings as a mean to further interpret the undervaluation signal inherent to share repurchases. As previously mentioned, Andriosopoulos and Lasfer (2015) draw the conclusion that share repurchases are more commonly motivated by undervaluation than a mean of reducing agency conflicts, by distributing excess cash. They draw this conclusion due to firms with higher cash holdings obtaining lower returns compared to firms with lower cash holdings. The same conclusion could be made regarding the sample of this study, the market seems to put a higher value on potential undervaluation than the reduction of

agency conflicts. The findings of this study are also in line with the pecking order theory, which implies that repurchasing firms with lower levels of cash holdings are more likely to be undervalued, since firms in general prefer large cash holdings as a buffer.

6.2 Analysis of the Direction of Insider Trades

The first research question of this study is regarding the direction of insider trading during share repurchases. As presented in the results, insiders most frequently trade in the same direction as the firm, thus it is more likely that insiders are buying shares in their own firm during the same quarter as the firm is repurchasing shares. It is also interesting to note that for all years, except 2001, insider buying occurred more frequently than insider selling, during quarters of share repurchases. If the firm is repurchasing shares due to the firm being undervalued, this result is expected, since rational insiders are likely take advantage of this undervaluation. That this study finds that insider buying concurrent with share repurchases is the most common type of insider transaction should strengthen the previous studies concluding that firms primarily repurchase shares because they are undervalued (e.g. Ikenberry, Lakonishok and Vermaelen (1995)).

However, it is interesting to note that Bonaimé and Ryngaert (2013) arrived at the opposite result when they studied the direction of insider trading during share repurchases on the US market. They found that during the same quarter as firms were repurchasing shares, insiders were more likely to sell shares than buy shares. During the examined period they found that during quarter of repurchases, 38.72 percent of insiders were selling shares and only 13.83 percent of insiders were buying shares in the own firm. One possible reason for insiders in the US to primarily trade against the firm, while insiders in Sweden mostly trade in the same direction, is the difference in regulations between the two countries. As previously mentioned, in section 2.2, share repurchases in Sweden are to be reported within seven days of the repurchase transaction, while there are no immediate disclosure requirements in US legislation. This difference in disclosure requirements makes it easier for insiders in the US to trade against the firm without the public knowing about it, which could be assumed to increase information asymmetry due to the market having access to fewer signals inherent to disclosures. This could at least partly explain the difference. If the management motivates the share repurchase by arguing that the firm's shares

are undervalued, while selling shares privately, this is something that probably would not be appreciated by neither shareholders nor the public in general. This use of share repurchases is in line with the reasoning by Bonaimé and Ryngaert (2013), who argue that insiders could use share repurchases as misguided signals of undervaluation, as well as personally trying to capitalize on increased demand of shares due to the repurchase. Further, this use of share repurchases is in line with the theory about managerial-opportunism. According to this theory, one reason for share repurchases is to increase the share price so that insiders are able to sell at a more favorable price. Thus, it seems that insiders in Sweden, compared to insiders in the US, are more likely to act in the best interest of the shareholders instead of in their own best interest. At least regarding not to trade against their own firm. One possible explanation for this difference, is the aforementioned difference in legislation regarding the reporting requirements for share repurchases.

6.3 Regulatory Framework

As previously mentioned in section 2, regulations regarding both insider trading and share repurchases are constantly changing. The regulatory framework that was current during the beginning of the examined period is not the same as the one that was current during the ending of the examined period. Further, the regulatory framework that was current during the end of the examined period has kept on changing. For example, up until the 3d of July 2016, firms were required to report their share repurchase transactions at least 30 minutes before the opening of the stock market on the following business day, however after the 3d of July 2016, firms are required to report share repurchases within seven days after the transaction taking place.

The ongoing change of rules and regulations is something that at least partly could explain the differing results when comparing the different time-periods that are examined. For the examined period ranging from year 2000 to 2007, insider buying concurrent with share repurchases obtained abnormal returns for all event windows following the event date, i.e. quarter. For the examined period ranging from year 2008 to 2014, only the *Quarter after* the event obtained abnormal return. However, it is important to note that all event windows for the examined time-period ranging from 2008 to 2014, lacked statistically significant returns. Nevertheless, the

ongoing changes regarding rules and regulations could in part explain why these time-periods show differing results. It is reasonable to assume that a tougher regulatory framework regarding insider trading would lead to fewer insider transactions. Thus, resulting in fewer observations to include in the study, which might have affected the results of the later time-period, ranging from year 2008 to 2014.

Another possible reason for the differing results when comparing the period ranging from year 2000 to 2007 with the period ranging from year 2008 to 2014, could be due to insiders using capital insurance depots for their insider trading. As previously mentioned, capital insurance depots became increasingly common during the year 2007. This could lead to a more extensive use of capital insurance depots among insiders, during the examined period ranging from year 2008 to 2014. As mentioned earlier, insider trades performed in a capital insurance depot did not need to be reported until MAR was implemented in July 2016. The implication of this could be a decrease in number of observable insider transactions, thus resulting in fewer observations to include in the study. Due to the lack of reporting requirements, it is possible that some opportunistic insiders performed their most profitable trades in capital insurance depots, which could be one of the reasons why the event windows for the time-period ranging from year 2008 to 2014 obtained lower abnormal returns compared to the abnormal returns during the time-period ranging from year 2000 to 2007.

An implication on this study, due to changes made to regulatory standards, could be that share repurchases, as previously mentioned in section 1.3, were first allowed during the first year of the examined period, i.e. year 2000. This change could be another possible reason behind the differing abnormal returns of the two time-periods ranging from year 2000 to 2007 and year 2008 to 2014, for repurchasing firms. Where the later period showed higher abnormal returns, for all event windows except *Year 1*. This could be due to Swedish firms not being used to having the ability to time the market and repurchase shares if they deem themselves to be undervalued. The lower abnormal returns for repurchasing firms during earlier time-period could be due to inexperience regarding market timing, thus leading to lower abnormal returns. One could reason that it could also be due to firms potentially viewing share repurchases, primarily,

as a method of distributing excess cash, thus leading to fewer repurchases being motivated by undervaluation.

6.4 Analysis of the Regressions

To test the hypotheses in a multivariate context, cross-sectional regression analyses were conducted. As previously mentioned in section 4.4.2, the two primary regression specifications *(IV)* were formulated to enable analysis of both insider buying and insider selling as dummy variables, with one of the two combined with neutral insider selling as a reference dummy. These two specifications are presented in section 5.3.8. These two regressions, presented in section 4.4.2, were run with the entire examined period as sample, due to the smaller subsamples having too few observations to yield any usable results.

Both the primary specifications seem to fit the data quite badly. The R-squared statistics ranging from 0.8 to 4.24 percent show that the explanatory power of the models are weak. Running the two models for the five different event windows, resulting in a total of ten regression outputs consisting of five independent variables, yielded a total of three statistically significant coefficients;

The regression specified for testing insider buying resulted in one statistically significant coefficient:

- When *Year 3* BHAR was used as the dependent variable, cash-to-total assets showed a coefficient of -0.4191 (*). This coefficient supports the rejection of the null hypothesis *(f)* in section 6.1.4, since the expectation was that lower levels of cash holdings and abnormal returns should be negatively correlated.

The regression specified for testing insider selling resulted in two statistically significant coefficients:

- When *Year 1* BHAR was used as the dependent variable, the sell dummy showed a coefficient of 0.1180 (**). This coefficient supports the accepting of the null hypothesis

(c) in section 6.1.2, since the expectation was that insider selling and abnormal return should be negatively correlated.

- When *Year 3* BHAR was used as the dependent variable, cash-to-total assets showed a coefficient of -0.4563 (**). This coefficient supports the rejection of the null hypothesis *(f)* in section 6.1.4, since the expectation was that lower levels of cash holdings and abnormal returns should be negatively correlated.

Several issues are observed, which might explain the bad fit of the two primary regression models. As previously mentioned in section 4.5.1, the research design being a long-horizon event study introduces a lot of noise due to the issue of omitted explanatory variables increasing with the length of the event windows. This demands strong control variables in order for the model to be of good fit, which proved to be very challenging due to the countless number of variables that can impact the abnormal returns of a firm. The control variables that are used are described in section 4.4.2, and it can be stated that they were insufficient in controlling for omitted explanatory variables.

Another critical issue that partly explains the bad fit of the models, is the issue of cross-sectional dependence, due to the inclusion of multiple observations per firm within the examined sample. In order to assess the magnitude of this problem, a robustness test was performed, where only the first event of interest per firm was included in the sample. The results of this test of robustness did not show any severe deviations when t-tested against the full sample, this is further described in section 4.4.3 and the output of the test is presented in the appendix (C).

In an attempt to account for firm-specific effects, the second set of regression specifications *(V)* was formulated. The two additional regression specifications mirror the first set of specifications *(IV)*, but also include firm-specific dummy variables for each of the 65 firms in the sample, presented in section 4.4.2. These additional models were run with the entire examined period as sample due to the smaller samples not having enough observations to accommodate the degrees of freedom, the output of these additional models *(V)* is presented in the appendix (D). Both the modified regression models show an increased fit to the data when compared to the primary

regression models, i.e. an increase in adjusted R-squared which should be the appropriate statistic when including a large number of variables. Thus, firm-specific characteristics seem to carry substantial explanatory power, which is what could be expected regarding abnormal returns. This is further supported by roughly half of the firm-specific dummy variables yielding statistically significant coefficients (*) The relevant outputs are presented below:

The regression model including the dummy variable for insider buying showed an adjusted R-squared of 5.2 and 16.89 percent respectively for the two event windows that yielded three statistically significant coefficients, *Quarter after* and *Year 1*:

- When the *Quarter after*-BHAR was used as the dependent variable, repurchase showed a coefficient of 1.2295 (**). This coefficient supports the rejection of the null hypothesis *(a)* in section 6.1.1, since the expectation was that larger repurchases and abnormal returns should be positively correlated.

- When the *Quarter after*-BHAR was used as the dependent variable, the dummy variable for insider buying showed a coefficient of 0.0372 (*). This coefficient supports the rejection of the null hypothesis *(b)* in section 6.1.2, since the expectation was that the presence of insider buying, and abnormal returns should be positively correlated.

- When the *Year 1*-BHAR was used as the dependent variable, repurchase showed a coefficient of 4.1726 (***). This coefficient supports the rejection of the null hypothesis *(a)* in section 6.1.1, since the expectation was that larger repurchases and abnormal returns should be positively correlated.

The regression model including the dummy variable for insider selling showed an adjusted R-squared of 18.46 percent for the single event window that yielded two statistically significant coefficients, *Year 1*:

- When *Year 1* BHAR was used as the dependent variable, repurchase showed a coefficient of 3.9009 (**). This coefficient supports the rejection of the null hypothesis *(a)* in section

6.1.1, since the expectation was that larger repurchases and abnormal returns should be positively correlated.

When *Year 1* BHAR was used as the dependent variable, the dummy variable for insider selling showed a coefficient of 0.1283 (*). This coefficient supports the accepting of the null hypothesis *(c)* in section 6.1.2, since the expectation was that insider selling and abnormal returns should be negatively correlated.

7. Concluding Discussion

7.1 Research Questions and Purpose

The purpose of this thesis was to improve the ability to interpret information inherent with share repurchases. This was done by analyzing insider trading concurrent with share repurchases and by accounting for cash holdings during quarters of share repurchases. By doing this, it is possible to conclude that firms with insider buying concurrent with share repurchases obtain a higher abnormal return than firms with share repurchases and no insider buying. Thus, it is reasonable to assume that insider buying has the ability to strengthen the undervaluation signal inherent to share repurchases. Further, this study can conclude that firms with CEO insider buying during the same quarter as share repurchases obtain higher abnormal returns than firms with other levels of insider buying concurrent with share repurchases. Hence, it is reasonable to assume that CEO insider buying has a stronger strengthening effect on the repurchase signal of undervaluation compared to other insider's buying. This study can also draw the conclusion that firms with lower levels of cash-to-total assets during the same quarter as share repurchases obtain a higher abnormal return than firms with higher levels of cash-to-total assets. Based on this finding it appears that lower levels of cash-to-total assets can strengthen the undervaluation signal inherent to share repurchases.

However, this study can not conclude that insider selling weakens the undervaluation signal inherent to share repurchases. Further, this study can not conclude that CEO insider selling has a stronger weakening effect on repurchases as a signal of undervaluation, compared to other insider's selling. The pattern of drawing conclusions related to insider buying, while not being able to make conclusions regarding insider selling, can be conservatively interpreted as an indication that insider selling does not carry as much information as insider buying.

This study also had the objective to determine if insiders trade in the same direction as their firm during quarters of share repurchases. This study found that insiders are more likely to buy shares than they are to sell shares, during quarters of share repurchases. This result is not unexpected, especially since this study also found that firms that carry out share repurchases obtain abnormal returns. However, Bonaimé and Ryngaert (2013) arrived at the opposite result when they studied

the direction of insider trading during share repurchases on the US market, namely that insiders are more likely to sell shares than they are to buy shares, during quarters of share repurchases. As previously described in section 6.2, the opposing results might be due to the differing regulatory frameworks of the US and Sweden.

Finally, this study has partly succeeded in fulfilling the stated purpose. The conclusions that are mentioned and were made by rejecting the pre-defined hypotheses, stated in section 3.6, can be seen as contributions to how signals regarding firm value can be interpreted when firms carry out share repurchases. Consequentially, it can be stated that a slight contribution has been made regarding knowledge that can be valuable when working toward reduced information asymmetry and increased efficiency in capital markets. Contributions have also been made by producing empirical results that can be of assistance when designing regulatory frameworks with the goal of increased efficiency in capital markets.

7.2 Practical Implications

Definitive inferences of the results are only reliable if made on firms that are included in the sample of this study. The sample of the study consists of most firms that are listed on the Stockholm Stock Exchange and performed share repurchases during the time-period of year 2000 up to and including year 2014. The entire population targeted by this study would be all repurchasing firms listed on the Stockholm Stock Exchange, but as previously mentioned, an estimated 20 percent of said population were not included in the sample due to the firms being delisted at some point during the examined time-period. Inferences could be made on this population if one is ready to accept a degree of uncertainty.

It is important that it is explicitly stated that this study does not attempt to make conclusions regarding causal relationships between the variables that have been examined, but rather observe potential correlation between certain characteristics and the information carried in share repurchases. This is especially accentuated by the regression analyses of the study yielding weak results, thus not controlling for externalities. The empirical results that have been presented are recommended to be conservatively interpreted as indications, not definitive.

One practical implication of the results of this study, is that it is recommended that regulators strive toward creating regulatory frameworks that encourage frequent and swift disclosure of major firm actions, as this study has illustrated the additive power of signaling inherent to firm actions.

A more specific policy recommendation is to either prohibit insider selling during ongoing repurchase programs or create stricter regulatory frameworks surrounding such actions. This is due to insider selling concurrent to share repurchase programs being deemed as a likely case of insiders exploiting their information advantage over other market participants and their own shareholders.

The relatively strict regulatory framework surrounding share repurchases in Sweden is deemed to be a plausible explanation for the difference in direction of insider trading in relation to the own firm, when comparing with the US. This could be viewed as either a recommendation or guidance for regulators who wish to decrease managerial opportunism. As the comparison indicates that stricter reporting requirements might decrease managers taking advantage of their own shareholders.

7.3 Future Research

As previously mentioned, there are two types of signals inherent to share repurchases. The first signal is when firms announce share repurchase programs and the second is when the firms report actual share repurchase transactions. This study only focused on the signal related to actual share repurchases. However, it would be interesting to conduct future research that focuses on both signals. By doing so, the future study would ensure that it does not miss any important information related to share repurchase signals of firm value. A recommendation on this point would be to apply both a short- and long-horizon event study, as short-horizon studies are appropriate to capture the more immediate announcement effect but long-horizon studies are necessary to capture the long-term gradual reaction of market participants.

Another proposal for future research would be to examine a larger population. For example, instead of only studying Stockholm Stock Exchange, the future research could look at the entire Nordic stock market. A larger sample would be advisable, since it could facilitate statistically significant results compared to this study. Further, a larger population could also make it possible to make inferences on the entire population if samples are chosen randomly and simulations such as bootstrapping could be conducted.

This study only analyzed one firm-specific variable regarding its effect on share repurchases as a signal of undervaluation, namely cash holdings. It would be interesting if future research expanded this and examined other variables as well. Such variables could be; leverage, price-to-book ratio and changes in cash flow.

Another interesting research proposal would be to examine the negative signal of insider selling concurrent with issuance of equity, which essentially would be a way of studying the reversed concept of insider buying concurrent with share repurchases.

8. References

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9. Appendices

Appendix A. Correlation Matrix

Included observations: 231

Correlation	CASH	CEO	BUY	SELL	REPURCHASE	BONDS
CASH	1.000000					
CEO	0.027006	1.000000				
BUY	0.019392	0.100653	1.000000			
SELL	-0.123108	-0.194002	-0.262719	1.000000		
REPURCHASE	0.133094	-0.010893	0.040476	0.001620	1.000000	
BONDS	-0.202246	-0.067061	-0.143217	-0.091237	0.187543	1.000000

Appendix B. Robustness Test, Thresholds

Insider buying

	Insider buy	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	75	3.34%	2.23%	0.1545	-
	0	156	1.10%			
Quarter after	1	75	4.38%	3.69%	0.0505	*
	0	156	0.69%			
Year 1	1	75	10.18%	7.27%	0.0955	*
	0	156	2.91%			
Year 2	1	75	9.25%	5.54%	0.1610	-
	0	156	3.71%			
Year 3	1	75	18.35%	11.53%	0.0175	**
	0	156	6.82%			

Insider selling

	Insider sell	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	29	4.10%	2.60%	0.1760	-
	0	202	1.50%			
Quarter after	1	29	5.61%	4.25%	0.1115	-
	0	202	1.36%			
Year 1	1	29	15.14%	11.29%	0.0730	*
	0	202	3.85%			
Year 2	1	29	5.02%	-0.56%	0.4695	-
	0	202	5.58%			
Year 3	1	29	5.29%	-6.03%	0.2250	-
	0	202	11.32%			

Appendix C. Robustness Test, First Observation

Insider buying

	Insider buy	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	20	2.21%	-0.17%	0.4820	-
	0	44	2.37%			
Quarter after	1	20	6.49%	5.11%	0.0740	*
	0	44	1.38%			
Year 1	1	20	11.00%	6.63%	0.2420	-
	0	44	4.38%			
Year 2	1	20	1.71%	4.55%	0.2990	-
	0	44	-2.84%			
Year 3	1	20	3.49%	2.33%	0.4190	-
	0	44	1.15%			

Insider selling

	Insider sell	N	Mean	Mean Difference	P-value	Significance
Quarter during	1	12	4.10%	2.02%	0.3035	-
	0	52	2.08%			
Quarter after	1	12	3.42%	0.22%	0.4765	-
	0	52	3.20%			
Year 1	1	12	8.33%	2.97%	0.3625	-
	0	52	5.37%			
Year 2	1	12	-11.73%	-12.38%	0.1030	-
	0	52	0.65%			
Year 3	1	12	-5.88%	-9.83%	0.1695	-
	0	52	3.95%			

Appendix D. Regression Output, Firm-specific Dummies

Buy dummy

Variable	Quarter during Coefficient	P-value	Quarter after Coefficient	P-value	Year 1 Coefficient	P-value	Year 2 Coefficient	P-value	Year 3 Coefficient	P-value
C	0.0232	0.7672	0.0218	0.7886	-0.3705	0.0821	-0.8011	0.0000	0.1592	0.3129
REPURCHASE	-0.3573	0.5844	1.2295	0.0389	4.1726	0.0058	-1.4055	0.4756	0.1132	0.9431
BUY_DUMMY	-0.0059	0.8253	0.0372	0.0653	-0.0179	0.7573	-0.0310	0.5705	-0.0247	0.6903
VDPROCENT	-0.0044	0.8226	-0.0576	0.1291	-0.0542	0.1227	-0.0453	0.1297	-0.0469	0.2853
CASH_TO_TA	0.0064	0.9623	0.0588	0.2397	0.6405	0.1327	-0.0355	0.9329	-0.4957	0.2268
_10Y_GVNMT_BONDS	0.0115	0.4460	-0.0177	0.3452	-0.0353	0.4107	-0.0143	0.6186	-0.0247	0.4360
ACANDO	-0.0056	0.9102	0.0557	0.4968	0.5502	0.0001	0.9823	0.0000	-0.2755	0.1644
ADDNODE	0.0176	0.6171	0.1222	0.0000	0.7754	0.0000	0.5887	0.0000	-0.0438	0.6182
ADDTECH	-0.0425	0.4586	-0.0071	0.9020	0.5500	0.0000	1.0548	0.0000	0.1871	0.0522
AF_AB	0.0217	0.6353	0.0302	0.5438	0.4424	0.0007	0.7848	0.0000	-0.2436	0.0094
ALFA_LAVAL	0.0785	0.2733	0.1263	0.0346	0.6427	0.0000	0.7649	0.0000	-0.1518	0.2403
ATLAS_COPCO	-0.1616	0.0000	-0.0362	0.2025	0.1968	0.0682	0.9407	0.0000	0.1962	0.0454
AXFOOD	-0.1295	0.2681	0.0335	0.8115	1.0083	0.0160	1.1113	0.0000	-0.0509	0.7148
BILIA	-0.0829	0.1932	-0.0688	0.1559	0.4148	0.0014	1.0914	0.0000	0.1600	0.2713
BILLERUD	-0.1514	0.0410	-0.0130	0.8242	0.1955	0.2917	0.5383	0.0000	-0.3949	0.0087
BIOTAGE	0.0210	0.7521	-0.1173	0.0233	0.1744	0.4648	1.2022	0.0000	0.5788	0.0022
BOLIDEN	-0.2550	0.0157	0.0257	0.3327	-0.0208	0.8004	1.1119	0.0000	0.4418	0.1331
BURE_EQUITY	0.0192	0.7636	-0.1831	0.0033	0.1665	0.5211	1.1746	0.0000	0.1776	0.3810
CLAS_OHLSON	-0.0223	0.8553	0.1072	0.5732	0.4990	0.0002	0.6033	0.0000	0.0621	0.7589
CONCENTRIC	-0.1004	0.2459	-0.1497	0.0638	0.2362	0.1847	0.6893	0.0000	0.1198	0.3760
COREM_PROPERTY_GROUP	-0.0221	0.6935	0.0944	0.1336	0.3026	0.0541	0.8243	0.0000	0.3656	0.0011
DIOS_FASTIGHETER	0.0156	0.7477	0.1082	0.4024	0.6766	0.0000	0.9219	0.0000	0.2194	0.0082
EAST_CAPITAL_EXPLORER_EASTNINE_	-0.0387	0.5257	-0.0603	0.2481	-0.1247	0.4979	0.7098	0.0025	-0.1635	0.3143
ELECTROLUX	-0.0570	0.3140	-0.0465	0.4764	0.3746	0.0226	0.8186	0.0000	0.0993	0.6050
ELEKTA	-0.0600	0.4560	0.0958	0.0042	0.8378	0.0000	0.8791	0.0000	0.5598	0.0000
ENEA	-0.0870	0.2010	-0.0808	0.5894	0.1320	0.7054	1.1161	0.0000	0.3642	0.1144
ENIRO	-0.0426	0.3581	-0.0596	0.1290	-0.3138	0.0054	0.6790	0.0000	-0.4489	0.0000
FABEGE	-0.0819	0.2024	-0.0215	0.7134	0.2678	0.0003	0.9153	0.0000	0.2569	0.0963
FAGERHULT	-0.0581	0.2112	0.1420	0.0009	0.0686	0.5772	0.3692	0.0040	0.1061	0.3939
FASTIGHETS_AB_BALDER	-0.0386	0.6934	0.0942	0.1616	0.4820	0.0000	1.7041	0.0000	0.7151	0.0000
FASTPARTNER	-0.0600	0.3740	0.0273	0.5817	0.4290	0.0001	1.2215	0.0000	0.5799	0.0000
HUFVUDSTADEN	-0.0060	0.8771	-0.0032	0.9272	0.1403	0.0906	1.0602	0.0000	-0.3629	0.0002
INTELLECTA_ICTA_	0.2364	0.1145	-0.0350	0.7772	0.5348	0.0000	0.7886	0.0249	0.0611	0.7190
INTRUM_JUSTITIA	-0.0385	0.6120	-0.0384	0.5461	0.2306	0.1569	0.8442	0.0000	-0.1138	0.3920
JM	-0.0725	0.2150	-0.1116	0.0498	0.1706	0.3029	0.9341	0.0000	-0.0094	0.9596
KLOVERN	-0.0240	0.7083	0.0635	0.4897	0.6602	0.0000	0.4320	0.3420	0.0426	0.7891
KNOWIT	0.1144	0.0011	0.0279	0.3597	0.6665	0.0000	0.9191	0.0000	0.7162	0.0000
LAGERCRANTZ	-0.0737	0.3164	-0.0734	0.2638	0.3150	0.0211	0.7842	0.0000	0.0705	0.6629
LATOUR	-0.0745	0.0826	0.0401	0.5080	0.4654	0.0002	0.6608	0.0000	-0.1817	0.1384
LINDAB	-0.2355	0.0000	-0.1328	0.0000	0.0903	0.2982	0.6756	0.0000	-0.4941	0.0000
LUNDBERGFORETAGEN	-0.0872	0.2844	0.0322	0.6622	0.5085	0.0000	1.2406	0.0000	-0.2000	0.1350
MALMBERGS	0.3153	0.0000	-0.0585	0.1716	0.6432	0.0000	1.0789	0.0000	-0.5590	0.0000
MTG	0.0271	0.5568	0.0168	0.6657	0.2232	0.0422	1.1406	0.0000	0.0920	0.4212
NCC	-0.2207	0.0000	-0.0096	0.8186	0.3261	0.0023	0.6634	0.0000	0.7340	0.0000
NOBIA	-0.1396	0.0055	-0.1110	0.0913	0.2281	0.0037	1.2628	0.0003	0.1417	0.5962
NOVESTRA_STRAX_	-0.0335	0.4619	-0.2396	0.0000	0.0584	0.6338	0.8279	0.0000	-0.1286	0.1604
OEM	-0.1062	0.1873	0.0510	0.4352	0.2631	0.2496	0.7835	0.0000	-0.0454	0.8428
OREXO	0.4109	0.0000	0.2535	0.0015	0.7137	0.0043	1.5201	0.0000	-0.5505	0.0143
ORIFLAME	-0.1650	0.0029	-0.1435	0.0066	-0.2788	0.0688	0.0936	0.4044	-0.2485	0.0372
PEAB	-0.0538	0.3860	0.1595	0.0555	0.7803	0.0000	0.7317	0.0000	0.1252	0.3991
POOLIA	0.0907	0.4924	-0.0822	0.0694	0.4735	0.0928	1.0124	0.0000	-0.1246	0.3581
PROACT	0.0377	0.6275	0.0129	0.8557	0.7348	0.0000	1.3751	0.0000	0.1994	0.3757
PROBI	-0.0192	0.8423	-0.0189	0.9495	0.4888	0.1266	0.6559	0.0214	0.1342	0.6389
PROFFICE	0.0962	0.0490	0.1903	0.0000	0.7998	0.0000	0.6895	0.0000	-0.0258	0.8262
REZIDOR	-0.0659	0.1505	-0.2378	0.0000	-0.0168	0.8792	1.8397	0.0000	0.1481	0.1802
ROTTNEROS	-0.0250	0.8360	0.0239	0.8822	0.4182	0.2664	0.5659	0.0008	-0.2719	0.1456
SAAB	-0.0442	0.6939	-0.1088	0.3039	0.2118	0.3200	1.1928	0.0000	-0.2767	0.1869
SANDVIK	-0.0536	0.4380	0.0704	0.1236	0.5900	0.0000	0.9280	0.0000	0.2438	0.1229
SKANSKA	0.0263	0.5558	0.0288	0.4863	-0.0450	0.6717	0.8407	0.0000	0.0331	0.7726
SSAB	0.2094	0.0000	0.1712	0.0001	0.9780	0.0000	1.2366	0.0000	-0.3669	0.0015
SWECO	0.1476	0.0005	-0.0387	0.2653	0.1798	0.1061	1.4731	0.0000	-0.2448	0.0264
SWEDISH_MATCH	-0.0528	0.3426	-0.0869	0.0546	0.3272	0.0143	1.0068	0.0000	-0.0218	0.8543
TELIA	-0.0035	0.9061	-0.2420	0.0000	0.2507	0.0038	0.8667	0.0000	-0.0428	0.4899
TRACTION	-0.0840	0.4149	-0.1000	0.0594	0.2931	0.2118	0.5982	0.0004	0.3882	0.0418
TRELLEBORG	-0.0543	0.4379	-0.0219	0.6574	0.5818	0.0000	0.9276	0.0000	0.2778	0.2623
UNIFLEX	-0.0898	0.0135	-0.0308	0.2990	-0.0337	0.7146	1.3401	0.0000	1.3127	0.0000
VITROLIFE	-0.0371	0.4279	0.3013	0.0000	0.5717	0.0000	0.9079	0.0000	-0.5050	0.0000
VOLVO	-0.0006	0.9907	0.0099	0.8005	0.1242	0.2654	1.2129	0.0000	0.4583	0.0000
WALLENSTAM	-0.0238	0.6558	0.0610	0.1790	0.7234	0.0000	1.2695	0.0000	0.3153	0.0082
WIHLBORGS_FASTIGHETER	0.0212	0.6969	0.2131	0.0358	0.6617	0.0000	1.1158	0.0000	0.2893	0.0015
R-squared	0.2821		0.3364		0.4182		0.5545		0.5030	
Adjusted R-squared	-0.0256		0.0520		0.1689		0.3636		0.2900	

Sell dummy

Variable	Quarter during Coefficient	P-value	Quarter after Coefficient	P-value	Year 1 Coefficient	P-value	Year 2 Coefficient	P-value	Year 3 Coefficient	P-value
C	0.0145	0.9285	0.0585	0.7121	-0.4132	0.2384	-0.8317	0.0110	0.1275	0.7230
REPURCHASE	-0.3812	0.6002	1.1564	0.1075	3.9009	0.0143	-1.3416	0.3594	0.0707	0.9653
SELL_DUMMY	0.0136	0.6794	0.0114	0.7245	0.1283	0.0744	-0.0111	0.8672	0.0321	0.6632
CEO	-0.0054	0.8255	-0.0249	0.3020	-0.0594	0.2654	-0.0569	0.2963	-0.0507	0.3550
CASH_TO_TA	0.0126	0.9303	0.3992	0.2176	0.4567	0.1932	-0.0195	0.9464	-0.4748	0.1408
_10Y_GVNMT_BONDS	0.0125	0.3555	-0.0165	0.2139	-0.0260	0.3746	-0.0154	0.5715	-0.0226	0.4531
ACANDO	-0.0097	0.9544	0.0222	0.8937	0.4844	0.1875	1.0114	0.0033	-0.2775	0.4619
ADDNODE	0.0227	0.9141	0.0858	0.6782	0.7869	0.0859	0.6193	0.1439	-0.0215	0.9634
ADDTECH	-0.0429	0.7853	-0.0193	0.9007	0.5357	0.1181	1.0654	0.0009	0.1892	0.5901
AF_AB	0.0231	0.9137	0.0307	0.8839	0.4547	0.3268	0.7846	0.0688	-0.2402	0.6140
ALFA_LAVAL	0.0765	0.6795	0.0806	0.6586	0.5845	0.1473	0.8042	0.0320	-0.1452	0.7254
ATLAS_COPCO	-0.1629	0.4431	-0.0340	0.8707	0.1881	0.6831	0.9392	0.0289	0.1924	0.6845
AXFOOD	-0.1265	0.4672	0.0061	0.9714	1.0094	0.0082	1.1344	0.0014	-0.0364	0.9253
BILIA	-0.0823	0.6012	-0.0848	0.5840	0.4057	0.2361	1.1052	0.0006	0.1656	0.6374
BILLERUD	-0.1487	0.3531	-0.0536	0.7335	0.1828	0.5985	0.5727	0.0763	-0.3776	0.2909
BIOTAGE	0.0225	0.8899	-0.1331	0.4066	0.1728	0.6250	1.2158	0.0003	0.5866	0.1078
BOLIDEN	-0.2596	0.1355	-0.0013	0.9943	-0.0849	0.8318	1.1355	0.0025	0.4369	0.2883
BURE_EQUITY	0.0214	0.8963	-0.1962	0.2260	0.1740	0.6257	1.1858	0.0004	0.1866	0.6108
CLAS_OHLSON	-0.0232	0.9001	0.0638	0.7262	0.4522	0.2611	0.6406	0.0865	0.0708	0.8639
CONCENTRIC	-0.0991	0.5784	-0.1479	0.3998	0.2485	0.5210	0.6879	0.0564	0.1225	0.7582
COREM_PROPERTY_GROUP	-0.0198	0.9265	0.0949	0.6542	0.3222	0.4905	0.8240	0.0582	0.3712	0.4399
DIOS_FASTIGHETER	0.0190	0.9177	0.0854	0.6365	0.6851	0.0871	0.9412	0.0116	0.2338	0.5686
EAST_CAPITAL_EXPLORER_EASTNINE_	-0.0391	0.8218	-0.0566	0.7405	-0.1252	0.7397	0.7070	0.0441	-0.1656	0.6692
ELECTROLUX	-0.0579	0.7207	-0.0659	0.6796	0.3489	0.3219	0.8354	0.0111	0.1018	0.7783
ELEKTA	-0.0652	0.7261	0.0690	0.7063	0.7691	0.0582	0.9026	0.0168	0.5534	0.1838
ENEA	-0.0888	0.6271	-0.1045	0.5615	0.0947	0.8113	1.1367	0.0023	0.3654	0.3709
ENIRO	-0.0368	0.8622	-0.0982	0.6376	-0.2984	0.5167	0.7115	0.0963	-0.4242	0.3702
FABEGE	-0.0828	0.6217	-0.0456	0.7824	0.2377	0.5143	0.9361	0.0061	0.2606	0.4869
FAGERHULT	-0.0546	0.7976	0.1033	0.6223	0.0638	0.8902	0.4020	0.3484	0.1248	0.7928
FASTIGHETS_AB_BALDER	-0.0332	0.8568	0.0539	0.7662	0.4925	0.2186	1.7380	0.0000	0.7392	0.0733
FASTPARTNER	-0.0557	0.7627	-0.0141	0.9381	0.4287	0.2853	1.2564	0.0009	0.6013	0.1455
HUFVUDSTADEN	-0.0011	0.9960	-0.0431	0.8351	0.1475	0.7470	1.0939	0.0106	-0.3399	0.4699
INTELLECTA_ICTA_	0.2297	0.1925	-0.0696	0.6876	0.4460	0.2436	0.8189	0.0216	0.0528	0.8931
INTRUM_JUSTITIA	-0.0378	0.8219	-0.0725	0.6608	0.2063	0.5712	0.8734	0.0104	-0.1033	0.7828
JM	-0.0706	0.6602	-0.1346	0.3953	0.1661	0.6339	0.9537	0.0036	0.0012	0.9972
KLOVERN	-0.0215	0.9067	0.0422	0.8155	0.6625	0.0978	0.4502	0.2237	0.0544	0.8944
KNOWIT	0.1126	0.5965	0.0269	0.8976	0.6508	0.1599	0.9203	0.0326	0.7120	0.1350
LAGERCRANTZ	-0.0739	0.6451	-0.0791	0.6168	0.3079	0.3774	0.7893	0.0154	0.0713	0.8422
LATOUR	-0.0786	0.6437	0.0029	0.9862	0.3963	0.2832	0.6931	0.0437	-0.1828	0.6297
LINDAB	-0.2433	0.2534	-0.1822	0.3844	-0.0214	0.9629	0.7186	0.0942	-0.5015	0.2914
LUNDBERGFORETAGEN	-0.0830	0.6340	-0.0090	0.9583	0.5082	0.1802	1.2754	0.0004	-0.1787	0.6459
MALMBERGS	0.3067	0.1556	-0.1133	0.5932	0.5200	0.2668	1.1265	0.0100	-0.5670	0.2391
MTG	0.0318	0.8810	-0.0227	0.9137	0.2283	0.6207	1.1739	0.0066	0.1141	0.8099
NCC	-0.2171	0.3062	-0.0492	0.8133	0.3223	0.4837	0.6969	0.1032	0.7535	0.1124
NOBIA	-0.1443	0.4352	-0.1381	0.4480	0.1625	0.6854	1.2865	0.0007	0.1364	0.7410
NOVESTRA_STRAX_	-0.0322	0.8800	-0.2404	0.2532	0.0686	0.8822	0.8288	0.0548	-0.1251	0.7927
OEM	-0.1059	0.5157	0.0227	0.8873	0.2404	0.4968	0.8077	0.0145	-0.0374	0.9180
OREXO	0.4107	0.0696	0.2653	0.2324	0.7216	0.1412	1.5105	0.0010	-0.5542	0.2711
ORIFLAME	-0.1581	0.4587	-0.1781	0.3964	-0.2497	0.5896	0.1226	0.7749	-0.2219	0.6411
PEAB	-0.0558	0.7326	0.1329	0.4087	0.7392	0.0383	0.7547	0.0226	0.1269	0.7279
POOLIA	0.0956	0.6052	-0.1166	0.5218	0.4848	0.2279	1.0413	0.0056	-0.1034	0.8021
PROACT	0.0365	0.8183	0.0085	0.9564	0.7206	0.0378	1.3795	0.0000	0.1974	0.5776
PROBI	-0.0193	0.9255	-0.0274	0.8926	0.4806	0.2836	0.6634	0.1109	0.1362	0.7672
PROFFICE	0.0878	0.6838	0.1412	0.5060	0.6831	0.1458	0.7323	0.0927	-0.0349	0.9422
REZIDOR	-0.0608	0.7745	-0.2766	0.1864	-0.0070	0.9879	1.8724	0.0000	0.1712	0.7177
ROTTNEROS	-0.0247	0.8817	-0.0075	0.9634	0.3930	0.2756	0.5928	0.0768	-0.2631	0.4773
SAAB	-0.0400	0.8189	-0.1346	0.4336	0.2254	0.5521	1.2145	0.0007	0.2941	0.4507
SANDVIK	-0.0594	0.7296	0.0213	0.8999	0.4953	0.1856	0.9705	0.0055	0.2413	0.5296
SKANSKA	0.0303	0.8865	-0.0111	0.9576	-0.0468	0.9191	0.8745	0.0417	0.0533	0.9103
SSAB	0.2137	0.3145	0.1299	0.5342	0.9781	0.0349	1.2715	0.0033	-0.3454	0.4661
SWECO	0.1382	0.5203	-0.0878	0.6778	0.0540	0.9079	1.5160	0.0006	-0.2565	0.5928
SWEDISH_MATCH	-0.0527	0.7352	-0.1098	0.4747	0.3072	0.3646	1.0264	0.0013	-0.0158	0.9637
TELIA	-0.0025	0.9904	-0.2404	0.2470	0.2603	0.5692	0.8655	0.0423	-0.0408	0.9308
TRACTION	-0.0805	0.6292	-0.1291	0.4316	0.2983	0.4101	0.6228	0.0645	0.4049	0.2773
TRELLEBORG	-0.0517	0.7646	-0.0492	0.7725	0.5793	0.1238	0.9507	0.0068	0.2912	0.4506
UNIFLEX	-0.0838	0.6905	-0.0634	0.7593	-0.0105	0.9816	1.3675	0.0015	1.3373	0.0049
VITROLIFE	-0.0320	0.8803	0.2622	0.2107	0.5811	0.2085	0.9408	0.0287	-0.4819	0.3100
VOLVO	-0.0083	0.9693	-0.0321	0.8795	0.0192	0.9672	1.2497	0.0044	0.4491	0.3510
WALLENSTAM	-0.0232	0.8826	0.0475	0.7581	0.7165	0.0365	1.2811	0.0001	0.3203	0.3608
WIHLBORGS_FASTIGHETER	0.0173	0.9250	0.1869	0.3025	0.6040	0.1315	1.1388	0.0024	0.2858	0.4865
R-squared	0.2826		0.3272		0.4292		0.5535		0.5030	
Adjusted R-squared	-0.0249		0.0389		0.1846		0.3622		0.2900	

Appendix E. Sample Firms

Sample firms	
Acando	Lindab
Addnode	Lundbergföretagen
Addtech	Malmbergs
Alfa Laval	MTG
Atlas Copco	NCC
Axfood	Nobia
Bilia	Novestra (Strax)
Billerud	OEM
Biotage	Orexo
Boliden	Oriflame
Bure Equity	Peab
Clas Ohlson	Poolia
Concentric	Proact
Corem Property Group	Probi
Diös Fastigheter	Proffice
East capital Explorer (Eastnine)	Rezidor
Electrolux	Rottneros
Elekta	SAAB
Enea	Sandvik
Eniro	Skanska
Fabege	SSAB
Fagerhult	Sweco
Fastighets AB Balder	Swedish Match
FastPartner	Telia
Hufvudstaden	Traction
Intellecta (ICTA)	Trelleborg
Intrum Justitia	Uniflex
JM	Wallenstam
Klövern	Vitrolife
KnowIT	Volvo
Lagercrantz	Xano Industri
Latour	ÅF AB