

Informativeness of Reported Insider Trades: Evidence from the Swedish Stock Market

Eugeniu Guzun *

Marcus Gurfeldt †

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Department of Accounting

Stockholm School of Economics

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Abstract

This paper examines the informativeness of reported insider trades on the Stockholm Stock Exchange for abnormal returns over the period of 2004 to 2017. The paper evaluates whether outside investors can earn long-term abnormal returns by investing in firms with net insider buying. We find that a portfolio investing in firms with monthly net insider buying and holding them for 24 months earns an abnormal return of 1.36 percent per annum, though transaction costs may reduce the return to an insignificant amount. In addition, we find that the trades of chief executive officers signal higher abnormal returns than the trades of other insiders, and that the very largest insider purchases signal significant negative abnormal returns, as these purchases are usually motivated by control motives. Firm size does not affect abnormal returns. Using a three-month holding period, a strategy that ignores firms with the most intense insider buying and invests in firms with net buying earns an annual return of 21.56 percent and an abnormal return of 5.49 percent per annum.

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Supervisor: Mattias Hamberg‡

*41095@student.hhs.se

†41114@student.hhs.se

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1. Introduction

If knowledge is indeed power, inside knowledge should be even more powerful. Corporate insiders such as senior executives and lower-ranked employees are believed to enjoy an informational advantage over external shareholders, investors, sell-side analysts, and other external stakeholders (e.g. Fama, 1970; Jaffe, 1974; Myers & Majluf, 1984). After all, corporate insiders are running the day-to-day affairs of their firms and should, therefore, be more informed about corporate actions and events affecting firm prospects.

At first glance, insider trading, defined as the buying or selling of a security by someone with access to material non-public information about the security, is cheating and ought to be illegal. However, corporate insiders are allowed to trade own-firm securities as long as they trade on information generally available to the public. Regardless of whether insiders trade on legal or illegal inside information, they are required to report their trades to relevant securities regulators such as the Securities and Exchange Commission in the United States or the Finansinspektionen in Sweden.

In addition to being reported with securities regulators, insider trades often create a lot of fuzz within the investment community and serve as a basis for investment recommendations targeted towards individual investors. Furthermore, mimicking corporate insiders has long been a well-known strategy employed by professional investors. The idea of making money by piggybacking corporate insiders raises a few questions: Are some insider trades more informative than others? Can outside investors actually profit from mimicking insiders? And should trading strategies imitating insider behavior offer high returns, are those returns truly the result of mimicking insiders or do the returns stem from indirect exposure to stock characteristics such as low price-to-book ratio? This string of questions has practical implications for investors seeking to design trading strategies imitating insider behavior, and scientific implications for the study of market efficiency.

Most academic studies uniformly conclude that corporate insiders earn abnormal returns when buying and selling shares of their respective firms (e.g. Jaffe, 1974; Seyhun, 1986; Lin & Howe, 1990; Jeng, Metrick, & Zeckhauser, 2003; Ke, Huddart, & Petroni, 2003; Huddart & Ke, 2007; Kallunki, Nilsson, & Hellström, 2009; Skaife, Veenman, & Wangerin, 2013). However, evidence on whether outside investors can profit from piggybacking reported insider trades is less conclusive. Some researchers (e.g. Bettis, Vickrey, & Vickrey, 1997; Lakonishok & Lee, 2001) find that investors can earn abnormal returns by mimicking

insiders, although such returns are often limited to certain types of insider trades and specific holding periods. Other researchers (e.g. Rozeff & Zaman, 1988) find that outside investors cannot earn abnormal returns as excess returns disappear once insider trades are announced and transaction costs accounted for. On the Swedish stock market, some studies such as Greilich and Härtel (2014) find that abnormal returns can be earned by mimicking insiders.

Our study relates to a research area exploring the ability of outside investors to profit by following the insider trading activity at firms listed on the Stockholm Stock Exchange. Using data on reported insider trades from 2002 to 2017, our study examines whether outside investors can generate long-term abnormal returns by investing in companies with monthly net insider buying, defined as the difference between the number of shares purchased by a firm's corporate insiders in a given month and the number of shares sold. We construct calendar-time portfolios that invest in all firms with net insider buying and hold these investments for a period of 24 months. Portfolio returns are evaluated using the characteristic-selectivity approach developed by Daniel, Grinblatt, Titman, and Werners (1997), which compares each firm's monthly returns with the returns of a matching portfolio containing firms with similar firm characteristics. The resulting abnormal-return estimates average across all firms, not trades, and are conceptually different from the returns earned by corporate insiders themselves. That said, the main purpose of this study is to investigate whether outside investors can earn abnormal returns by buying into companies with net insider buying.

Next, we examine if abnormal returns differ depending on the intensity of insider buying, firm size, and insider position. The disintegrated analysis enables us to identify differences in the informativeness of reported insider trades across various dimensions. Based on the breakdown, we identify the most informative trades for future abnormal returns and select an appropriate holding period to design a profit-making trading strategy piggybacking the trading of corporate insiders at Swedish public firms. We also approximate the transaction costs associated with the implementation of this strategy.

This paper begins with the literature review section, which establishes the foundation of our research by reviewing previously-published papers on the subject. Section 3 provides a detailed explanation of the method employed in the study and displays descriptive statistics to summarize the insider trading data. Following this section, we present and discuss our results and answer the hypotheses formulated prior to conducting the study. The last section concludes the paper and discusses the limitations of our study.

2. Theoretical framework and hypotheses

2.1. Information asymmetry and utility maximizing individuals

Prior research and common-sense point to the existence of an information asymmetry between corporate insiders and outside investors. Corporate insiders are thought to enjoy an informational advantage over outside investors (e.g. Fama, 1970; Jaffe, 1974; Myers & Majluf, 1984). These insiders are closely involved in the business activities of their companies and should, reasonably, be more informed about events affecting firm prospects. The information asymmetry raises questions whether insiders attempt to exploit such an informational advantage by engaging in insider trading.

Microeconomic theory assumes utility-maximizing individuals (e.g. Mas-Colell, Whinston, & Green, 1995). Given the information asymmetry between insiders and outsiders, microeconomic theory suggests insiders act in a utility-maximizing way with respect to the informational advantage they enjoy. Utility refers to the amount of perceived satisfaction an individual receives from an economic act, which is determined by his or her preferences. Even though economists disagree on how to measure utility, most agree that individuals choose between different acts based on expected utility. Although preferences vary among individuals, it seems reasonable to believe that a monetary gain has a positive utility impact for most individuals, including insiders. As a result, insiders might be motivated to engage in insider trading as a way of exploiting their informational advantage.

Drawing on the idea that insiders exploit their informational advantage, Kyle (1985) puts forth a model for informed insider trading that predicts a positive relation between information asymmetry and abnormal returns. In other words, if insiders actually exploit their informational advantage by engaging in insider trading, positive abnormal returns should follow insider purchases and negative abnormal returns should follow insider sales. Further, insiders with the greatest informational advantage should earn the highest abnormal returns. Indeed, many empirical studies conclude that insiders earn abnormal returns from their trades (e.g. Jaffe, 1974; Seyhun, 1986; Lin & Howe, 1990; Jeng et al., 2003; Ke et al., 2003; Huddart & Ke, 2007; Marin & Olivier, 2008; Kallunki et al., 2009; Skaife et al., 2013). Consistent with the aforementioned model's predictions, Seyhun (1986) also finds that senior executives, generally viewed as more informed insiders, earn higher abnormal returns than lower-ranked employees.

Returning to microeconomics theory, one should note that maximizing utility does not necessarily equal maximizing abnormal returns from insider trading. Corporate insiders exploiting private information also face reputational and legal risks (Brochet, 2010; Veenman, 2012; Badertscher, Hribar & Jenkins, 2011; Cohen, Malloy, & Pomorski, 2012), which should, to some extent, discourage them from trading on private information. Put differently, the utility derived from insider trading is positively affected by expected abnormal returns and negatively affected by reputational and legal risks associated with exploiting private information.

To avoid or limit reputational and legal risks, one would expect that corporate insiders avoid trading on a short-lived informational advantage (e.g. buying shares in anticipation of better-than-expected quarterly results). The idea is supported by Seyhun (1992), who studies U.S. insider transactions around quarterly earnings announcements and concludes that the tendency of insiders to trade before these announcements decreased over time as penalties for illicit insider trading progressively increased in severity. Moreover, Kallunki et al. (2009) reject the hypothesis that insiders at Swedish public firms purchase shares before positive earnings announcements and sell shares before negative announcements, indicating that insiders do avoid trading on a short-lived informational advantage.

Instead of trading on a short-lived informational advantage, insiders might be motivated to trade on a long-lived informational advantage. After all, if an insider trades on private information that will be revealed to the public far into the future, it seems unlikely that the insider will be heavily scrutinized by investors, the media, and regulators. The link between the insider's trade and the private information is more ambiguous with time. Consistently, previous research suggests that insiders trade on private information well in advance to the information being revealed to the public. For instance, Ke et al. (2003) study the relation between insider trading and future company earnings on the U.S. market between 1989 and 1999. They provide evidence that insiders trade on accounting foreknowledge up to two years prior to the information being disclosed to the public, indicating that insiders indeed trade on a long-lived informational advantage.

In addition to exploiting private information, insiders have other motives to engage in insider trading (e.g. Ke et al., 2003; Huddart & Ke, 2007; Kallunki et al. 2009). For example, Kallunki et al. (2009) conclude that diversification objectives, tax considerations, and behavioral biases (e.g. reluctance to realize losses) play important roles in insider trading decisions. Such motives primarily relate to insider sales decisions, suggesting that insider

sales are less driven by the exploitation of private information than insider purchases. The idea is consistent with findings showing that insider purchases are followed by abnormal returns, whereas insider sales are not (Jeng et al., 2003).

To summarize, corporate insiders seem to exploit their informational advantage by engaging in insider trading to earn abnormal returns. However, reputational and legal risks associated with exploiting private information should discourage insiders from trading on a short-lived informational advantage. Instead, we expect insiders to predominantly trade on a long-lived informational advantage, often ignoring short-term prospects.

2.2. Insider trading and stock market efficiency

The ability of corporate insiders to earn abnormal returns by purchasing securities of their own firms serves as evidence against the strong-form of market efficiency introduced by Fama (1970), which states that all information, both public and private, is fully reflected in stock prices. Nonetheless, profitable trading on the part of corporate insiders has not been considered a serious anomaly, mainly because of the common belief that insiders enjoy an informational advantage over other market participants. Surprisingly though, a branch of the insider trading literature suggests that outside investors can earn abnormal returns by mimicking the reported trades of corporate insiders (e.g. Bettis et al., 1997). The ability of outsiders to earn abnormal returns by mimicking insiders represents a violation of the semi-strong form of market efficiency, which states that that all publicly available information is fully reflected in stock prices (Fama, 1970). According to the semi-strong form, stock markets should efficiently incorporate the information conveyed in insider transactions once they are announced to the public.

Past research provides mixed evidence on whether outside investors can earn abnormal returns by using publicly available data on insider trading after adjusting for transactions costs. Bettis et al. (1997) is one of the earliest studies documenting that outsiders can earn significant abnormal returns by mimicking large-volume trades conducted by high-ranked insiders. More specifically, the study finds that outside investors earn abnormal returns by mimicking insider transactions of at least 10,000 shares conducted by corporate insiders at firms listed on the New York Stock Exchange and the American Stock Exchange. In addition, the results imply that outside investors can earn cumulative average size-adjusted abnormal returns (transaction-cost-adjusted) of 2.95 percent after 26 weeks to 6.96 percent after 52 weeks for purchases and 2.05 percent after 26 weeks to 4.86 percent after 52 weeks

for sales. This conclusion is consistent with a body of empirical literature suggesting equity markets are not efficient in the semi-strong form.

Relying on the premise that corporate insiders are long-term-oriented contrarian investors, Lakonishok and Lee (2001) study whether insider trades predict abnormal returns over long investment horizons. Without accounting for size and book-to-market characteristics, Lakonishok and Lee (2001) find that firms with extensive insider purchases during the previous six months outperform companies with extensive insider sales by 7.8 percentage points in the first 12 months, with the spread in returns dropping to 2.3 percentage points in the second year. After adjusting for book-to-market and size characteristics, the spread in returns declines to 4.8 percentage points in the first year.

In contrast to the two aforementioned studies, Rozeff and Zaman (1988) determine that outside investors cannot earn significant abnormal returns by mimicking corporate insiders after accounting for firm size and earnings-to-price ratio effects, as well as incorporating transaction costs. Using insider trading data covering the period of 1973 to 1982, Rozeff and Zaman (1998) conclude that the ability of outside investors to earn abnormal returns by using publicly available insider trading data is largely a manifestation of size and earning-to-price ratio effects. Their results provide support for the semi-strong form of market efficiency.

Gębka, Korczak, Korczak, and Traczykowski (2017) use a large cross-country data set of reported insider transactions in 18 European countries to examine whether portfolios that closely mimic reported purchase and sale transactions of corporate insiders generate abnormal returns. The data set includes countries with data on insider transactions covering at least five years, with all data series running until the end of 2012. The researchers find that portfolios mimicking insider purchases earn statistically significant risk-adjusted abnormal returns in only a few European countries, whereas portfolios mimicking sale transactions are broadly unprofitable. Gębka et al. (2017) also conclude that there are no sub-samples of firms with specific characteristics such as firm size, analyst coverage, industry classification, or ownership structure that offer significant returns.

2.3. Underreaction to reported insider trades and quarterly capitalism

A series of studies such as Dickgiesser and Kaserer (2010) suggest that market participants underreact to reported insider transactions, implying that markets do not

efficiently react to the release of new information. In addition to concluding that insider transactions predict abnormal returns, Lakonishok and Lee (2001) conclude that market participants tend to ignore insider transactions when reported, as well as ignore the information conveyed in these transactions. As a result, market participants underreact to reported insider transactions, pointing out that insider transactions are informative for longer investment horizons. These conclusions are in line with other studies documenting instances of market underreaction to managerial signals (e.g. Ikenberry, Lakonishok, & Vermaelen, 1995).

Should market participants indeed underreact to reported insider transactions, theories related to short-term capitalism, also known as quarterly capitalism, can explain why the information conveyed in reported insider transactions is not fully incorporated into stock prices. Economists, journalists, academicians, and others are increasingly calling attention to an observable trend toward short-termism in financial markets. For example, Graham, Harvey, and Rajgopal (2005) find that 80 percent of managers prefer meeting an earnings target at the expense of building long-term shareholder value by decreasing discretionary spending on research and development, advertising, and maintenance. Additionally, Black and Fraser (2000) find conclusive evidence of short-termism in financial markets, concluding that stock market investors are short-term-oriented and place too much weight on current and near-term cash flows when assessing stock market valuations. Barton (2011) urges shareholders such as pension funds, insurance companies, mutual funds, and sovereign wealth funds to “break free from the tyranny of short-termism” and transition from quarterly capitalism to long-term-oriented capitalism.

The so-called mania over quarterly earnings and the short-termism in financial markets in particular seem to corroborate Lakonishok and Lee (2001)’s conclusion that market participants underreact to reported insider transactions. After all, insider transactions should convey long-term information, mainly because of the relatively long investment horizons of corporate insiders instigated by the short-swing rule, and risks associated with trading on a short-lived informational advantage. Although not all corporate insiders can be ascribed to the group of long-term-oriented investors, the just mentioned short-swing rule imposed by stock market regulators are expanding the investment horizons of corporate insiders. Corporate insiders at U.S.-listed companies, for instance, are restricted from making opposing trades within a period of six months. At the same time, corporate insiders are likely to avoid trading on a short-lived informational advantage, as transactions based on soon-to-be

revealed material non-public information are increasingly likely to get the attention of stock market regulators and the media. Therefore, insider transactions are expected to convey information about future price-relevant events rather than near-term developments.

Since insider transactions tend to convey long-term information, the notion of quarterly capitalism seems to explain why market participants underreact to reported insider transactions. In other words, market participants focus on short-term information such as quarterly earnings, for example, instead of paying attention to the long-term information conveyed in insider transactions. That said, the main purpose of this study is to investigate whether the market is right in ignoring reported insider transactions and whether the long-term information conveyed in these transactions offers potential benefits for investors with longer investment horizons.

Main hypothesis: Outside investors can earn long-term abnormal returns by investing in Swedish public companies with monthly net insider buying.

Previous research suggests corporate insiders exploit their informational advantage by engaging in insider trading to earn abnormal returns (e.g. Jeng et al., 2003). Legal and reputational risks associated with insider trading should discourage insiders to trade on a short-lived informational advantage (c.f. Brochet, 2010; Kallunki et al., 2009). Instead, we expect insiders to predominantly trade on a long-lived informational advantage. Increased short-termism in financial markets documented by academicians (e.g. Graham et al., 2005) may explain why markets tend to underreact to insider trading announcements. Hence, we anticipate this tendency to offer opportunities for outside investors with longer investment horizons to earn abnormal returns by investing in companies with net insider buying.

2.4. Informativeness of different types of insider trades

2.4.1. Insider buying intensity

On an individual basis, corporate insiders predominantly purchase own-firm shares for two reasons: either because they have private information about future price-relevant events or they identify valuation errors made by outside market participants (Kallunki et al., 2009). That said, there are logical reasons to believe higher-volume purchases indicate that corporate insiders possess better information on prospective price-relevant events or, similarly, show that insiders are more confident in their beliefs about valuation errors. Prior research documents a positive relation between the volume of transactions and abnormal

returns (Seyhun, 1986; Jeng et al., 2003). By decomposing insider purchase transactions into low-volume, medium-volume, and high-volume categories, Jeng et al. (2003) find that high-volume purchases exhibit higher abnormal returns than low-volume purchases.

Although our study focuses on net insider buying rather than individual trades, we anticipate a positive relation between the intensity of insider buying and the abnormal returns outside investors can earn by investing in companies with net insider buying. Prior studies such as Seyhun (1998) and Lakonishok and Lee (2001) conclude that aggregate insider trading predicts market movements, with the former study showing that stocks with higher intensity of insider buying tend to outperform stocks with lower intensity of buying. That said, our study seeks to examine the relation between the intensity of net insider buying and the abnormal returns outside investors can earn by investing in companies with net insider buying. Put differently, we seek to determine whether insider portfolios containing companies with higher intensity of insider buying signal greater abnormal returns.

Hypothesis: Outside investors can earn greater abnormal returns by investing in Swedish public firms with higher insider buying intensity than firms with lower intensity.

2.4.2. Firm size

In line with the empirical findings of Lakonishok and Lee (2001), we expect corporate insiders at small firms to earn higher abnormal returns than insiders at larger firms. According to Lakonishok and Lee (2001), insider trading activity represents a stronger indicator of future performance in small-cap stocks, which, as a group, represent a less efficient segment of the market. Gregory, Matatko, Tonks, and Purkis (1994) argue that abnormal returns are more prevalent in small firms because their corporate insiders are more knowledgeable about their prospects. Indeed, because smaller firms are usually associated with looser, informal organizations and more free-flowing information, more corporate insiders at these firms are likely to have access to price-relevant information.

Additionally, Hillier and Marshall (2003) suggest that corporate insiders at small firms hold a greater informational advantage over outside market participants because small firms receive significantly less analyst coverage than large firms. The information asymmetry between corporate insiders and outside market participants should, expectedly, be greater at smaller companies because they receive less analyst and media coverage, as well as exhibit lower institutional ownership. We further expect insiders at small companies to experience greater opportunities to exploit their private information compared to insiders at larger

companies. Characteristics often associated with small companies, including higher stock price volatility, less analyst coverage, and less media attention, could increase the likelihood of these stocks deviating from their intrinsic worth, creating opportunities for attentive insiders to exploit their informational advantage. Given our discussion of quarterly capitalism, we also expect market participants to underreact to the announcements of insider purchases, creating opportunities for outside investors to earn abnormal returns as well.

Hypothesis: Outside investors can earn greater abnormal returns by investing in small companies with net insider buying rather than large companies.

2.4.3. Insider position

A series of studies of insider trading conclude that higher-ranked corporate insiders such as chairmen of the boards of directors and chief executive officers, who expectedly have more knowledge and insight concerning the state of their companies and possible future firm-developments, are more successful predictors of future abnormal returns. For instance, Seyhun (1986) puts forward the information hierarchy hypothesis, according to which insiders who are more familiar with the overall operations of their firms trade on more valuable information. Similarly, Cicero and Wintoki (2015) conclude that abnormal returns are more pronounced following trades by members of the executive team. They also suggest that even if most corporate insiders have access to short-lived information, only senior executives normally possess pieces of information that take a longer window of time to be revealed (e.g. changes in strategic direction or an imminent loss of major customers).

However, there is no general consensus among researchers on whether higher-ranked corporate insiders earn significantly higher abnormal returns when purchasing own-firm securities. For instance, Jeng et al. (2003) find evidence that top executives do not earn higher abnormal returns than other insiders, concluding that the scrutiny these executives receive from the market forces them to trade more cautiously. This study suggests higher-ranked executives tend to limit trading on a short-lived informational advantage. Given that only senior executives are expected to possess longer-term information such as changes in strategic direction or possible loss of a major customer, we expect the insider buying conducted by chief executive officers at Swedish public firms to signal higher abnormal returns.

Hypothesis: The insider buying conducted by chief executive officers of Swedish public firms signal higher abnormal returns than other insiders.

3. Methods

3.1. Research design and data sources

We use a quantitative research design to investigate whether outside investors can earn abnormal returns by investing in firms with net insider buying and whether abnormal returns differ among different types of insider trades. Further, we employ a deductive approach based on theories of market efficiency, information asymmetry, and quarterly capitalism to test the hypotheses. The tests are carried out on firms listed on the Stockholm Stock Exchange using univariate analysis.

Insider trading data is obtained directly from the Finansinspektionen, the Swedish Financial Supervisory Authority. The data set includes all reported insider transaction between January 2002 and December 2017. Monthly total stock returns (i.e. combining both capital performance and income reinvested at the closing price on the ex-dividend date), market capitalizations, and price-to-book ratios for firms listed on the Stockholm Stock Exchange are collected from Thomson Reuters Eikon. The data set also includes delisted firms.

3.2. Corporate insider definition and insider trading regulations

Management executives and other corporate insiders possess an informational advantage over outside investors, which may undermine the confidence of market participants in the fairness and integrity of security markets. Therefore, prohibitions against trading on material inside information, defined as private information not generally known to the public that is likely to significantly affect the price of financial instruments, are typically stipulated in law and corporate policy.

The Regulation (EU) No. 596/2014 of the European Parliament and of the Council on market abuse (MAR) entered into force and became directly applicable in Swedish law in July 2016. Legally referred to as a person discharging managerial responsibilities, a corporate insider is a member of the administrative, management, or supervisory body of a firm or other senior executive who has regular access to inside information and has power to take managerial decisions affecting the firm's future developments and business prospects. Older definitions stipulated in the Swedish legislation on insider trading were slightly broader, as they also classified auditors and major shareholders as corporate insiders. Our definition of a

corporate insider is aligned with the new definition of a person discharging managerial responsibilities.

Insider trading in Sweden is regulated by the Swedish equivalent of the Securities and Exchange Commission in the United States, the Finansinspektionen. Corporate insiders at U.S. companies report their insider transactions with the SEC by submitting Form 4 filings. Similarly, insiders at Swedish companies are required to report their insider holdings and insider transactions to the Finansinspektionen within five working days from the transaction date, according to the Act Concerning Reporting Obligations for Certain Holdings of Financial Instruments (SFS 2000:1087). Corporate insiders at Swedish companies have been subject to the five-day reporting obligation since the beginning of 1991, when the reporting obligation period was decreased from 14 calendar days to five trading days (SFS 2000:1086 and SFS 2000:1087). Since our data set includes insider transactions starting from 2002, the regulatory changes implemented in the early 1990s have no impact upon the design of our methodology.

3.3. Sample selection

The initial sample of insider trades contains 171,162 observations between January 2002 and December 2017. The data set contains information on the insider's name, the name of the insider's firm, the type of transaction (e.g. purchase, sale, option granted, gift), the type of security traded (e.g. common shares, options, preferred shares), the insider's association with the company (e.g. chief executive officer, director, large shareholder), the number of shares traded, the transaction date, and the announcement date. Similar to other insider trading studies (e.g. Ke et al., 2003; Kallunki et al., 2009), we only consider common shares bought and sold by chief executive officers, board members, and other corporate officers on the open market. Thus, transactions involving options or preference shares, for example, are excluded. Further, we exclude insider transactions for which the difference between the transaction date and the announcement date is greater than 30 days. As a result, 49,164 observations remain.

Next, we exclude transactions with shares not listed on the Stockholm Stock Exchange (e.g. shares listed on Nasdaq First North). Moreover, to ensure that trading strategies are practically implementable, firms with market capitalizations of less than SEK 200 million at the time of announcement are excluded. Finally, transactions in firms for which data on market capitalization or price-to-book ratio is missing at the beginning of the

year are ignored. The final sample includes 31,632 insider transactions. Table 1 provides more details on how the final sample is obtained.

Table 1: Sample selection of insider transactions

	Observations
Initial sample	171,162
Transactions not labeled as “purchase” or “sale”	-106,086
Transactions not concerning ordinary common shares	-10,321
Insider trades conducted by auditors, large shareholders, or firms themselves	-4,382
Insider trades with announcement delays of more than 30 days	-1,209
Insider trades in firms not listed on the Stockholm Stock Exchange	-12,411
Insider trades in firms with market capitalizations of less than SEK 200 million	-3,383
Insider trades in firms with missing data on firm size or price-to-book ratios	-1,738
Final sample	31,632

3.4. Abnormal returns

We estimate the abnormal returns that outside investors can earn by investing in firms with net insider buying as follows. First, all firms with net insider buying in a given month are added to a portfolio at the end of the month and kept for 24 months. There are 24 such portfolios at any given point in time starting from January 2004, which collectively form a fully-invested rolling portfolio. Second, we calculate equally-weighted monthly returns of the portfolios using the calendar-time portfolio approach. Third, we calculate monthly benchmark returns for each portfolio using the characteristic-selectivity approach, which compares each firm’s monthly return with the return of a matching portfolio containing only firms with similar firm characteristics. Finally, we calculate monthly abnormal returns as the difference between portfolio returns and benchmark returns, which are then averaged to get the mean abnormal return per month for the fully-invested rolling portfolio.

3.4.1. Portfolio construction and return calculations

We construct portfolios using the method of calendar-time portfolios, first developed by Jaffe (1974). Unlike the commonly used buy-and-hold abnormal return approach, which is essentially a “do no rebalance” strategy that assumes equal initial investments in each security, the calendar-time approach is based on the calculation of mean monthly returns of

each security. Fama (1998) strongly advocates the usage of the calendar-time approach over the buy-and-hold approach. He argues that the calendar-time approach solves some of the statistical problems inherent in the buy-and-hold approach, which become magnified in long-term event studies (e.g. cross-sectional correlation of event firms, non-normally distributed estimators). Moreover, Eckbo, Masulis, and Norli (2000) argue that the buy-and-hold approach does not resemble a practically implementable portfolio strategy because the required investable amounts are not known in advance.

The major drawback of the calendar-time approach is put forward by Loughran and Ritter (2000), who argue that this approach is biased towards finding results consistent with market efficiency by equally weighting each time period. With respect to insider trading, the calendar-time approach weights periods of high and low levels of aggregate insider trading equally, ignoring an insider's ability to time the market. In other words, the calendar-time portfolio methodology has low power to detect abnormal returns for events that occur as a result of behavioral timing. Since we are interested in the returns outside investors can earn from a fully-invested portfolio (i.e. cross-sectional returns), this major criticism of the calendar-time approach is not an issue. Given our long holding period, and the need for the trading strategy to be practically implementable, we find the calendar-time approach more suitable for our study.

On the last trading day of each month, firms with net insider buying during the respective month are added to a sub-portfolio that joins the fully-invested rolling portfolio. Companies with lower net insider buying (i.e. lower volume of net insider purchases) and companies with higher net insider buying (i.e. higher volume of net insider purchases) are weighted equally. The firms are then held for 24 months until disposed of. Consequently, the fully-invested rolling portfolio is made up of 24 sub-portfolios. On average, firms are added to sub-portfolios 15 days after the actual announcement day and 20 days after insider trades are conducted. Portfolio purchases and sales are made at prevailing market closing prices.

We calculate the fully-invested rolling portfolio's monthly return, $r_{p,t}$, as the weighted average monthly return of the 24 sub-portfolios,

$$r_{p,t} = \frac{1}{24} \sum_{j=1}^{24} r_{j,t} \quad (1)$$

And each sub-portfolio's monthly return, $r_{j,t}$, is calculated as,

$$r_{j,t} = \frac{1}{N} \sum_{i=1}^N r_{i,t} \quad (2)$$

Where $r_{i,t}$ is the monthly total return of firm i (i.e. reflecting both capital performance and income reinvested at the closing price on the ex-dividend date) and N is the number of firms in the sub-portfolio.

3.4.2. Benchmark returns

To assess whether an outside investor can earn abnormal returns by investing in companies with net insider buying, we need a model to estimate the expected returns of securities. One commonly used model is the capital asset pricing model developed by Sharpe (1964) and Lintner (1965). The capital asset pricing model assumes a constant and linear relation between a security's return in excess of the risk-free rate and the market's return in excess of the risk-free rate, which is captured by the security's market beta.

However, a wide range of previous academic studies such as Fama and French (1992) cast doubt on the relation between market betas and stock returns, concurrently casting doubt on the relevance of the capital asset pricing model in estimating expected returns. Specifically, Fama and French (1992) document that the cross-sectional returns for U.S. common stocks show little correlation to the betas specified in the model. Instead, the researchers find that firm size and book-to-market ratio are better correlated with stock returns. If securities are priced rationally, the researchers argue, the firm size and book-to-market ratio must proxy for risk factors in returns. In support of their findings, Kent and Sheridan (1997) conclude that after controlling for firm size and book-to-market ratio, a common stock with a low market beta has the same expected return as other common stocks with high market betas.

Although there is no clear consensus among researchers on the correct model for expected returns, we consider the characteristic-selectivity measure developed by Daniel et al. (1997) the most suitable for our study. Under the characteristic-selectivity approach, benchmark portfolios are constructed by matching firms with similar firm sizes and book-to-market ratios or price-to-book ratios. In addition to capturing the two major determinants of expected returns, the method also accounts for the tendency of corporate insiders to purchase securities in small firms with high book-to-market ratios (Seyhun, 1986; Rozeff & Zaman, 1988; Jeng et al., 2003). By matching a firm with net insider buying with a portfolio of firms

with similar firm characteristics, we estimate the abnormal return outside investors can earn by capitalizing on corporate insiders' special selection ability or their superior informational advantage rather than their tendency to purchase shares in small firms with low price-to-book ratios.

To measure abnormal returns under the characteristic-selectivity method, we employ a simplified version of the approach outlined by Daniel et al. (1997). First, instead of sorting the universe of firms listed on the Stockholm Stock Exchange into 125 groups based on firm size, book-to-market, and momentum (5 x 5 x 5), we sort firms into nine groups based on just firm size and price-to-book ratio (i.e. the inverse of the book-to-market ratio) (3 x 3). We sort firms into fewer groups to cope with the relatively small number of companies listed on the Stockholm Stock Exchange. Second, we use equally-weighted returns instead of value-weighted returns to ensure that the calculation of abnormal returns is consistent with our approach of constructing portfolios. Third, firms with market capitalizations of less than SEK 200 million at the end of each year are not considered to ensure consistency with the criteria put on the main net insider buying portfolio.

On the last day of each year, all firms listed on the Stockholm Stock Exchange at that point in time are placed into one of these nine groups based on tertiles of firm size and price-to-book ratio. Then each firm with net insider buying is assigned to a matching portfolio. Thus, the excess return earned by investing in a firm with net insider buying is calculated by subtracting the return of the matching portfolio from the firm's monthly return. The excess returns of all companies included in each of the 24 sub-portfolios forming the fully-invested rolling portfolio are multiplied by their weights in sub-portfolios to determine the benchmark-adjusted return for these sub-portfolios.

We calculate the monthly benchmark return of the fully-invested rolling portfolio, $r_{p,t}^*$, as the weighted average monthly return of the 24 sub-portfolios forming the portfolio,

$$r_{p,t}^* = \frac{1}{24} \sum_{j=1}^{24} r_{j,t}^* \quad (3)$$

And each sub-portfolio's monthly benchmark return, $r_{j,t}^*$, is calculated as,

$$r_{j,t}^* = \frac{1}{N} \sum_{i=1}^N r_{i,t}^* \quad (4)$$

Where $r_{i,t}^*$ represents the monthly return of the matching portfolio for firm i , and N is the number of firms included in the sub-portfolio. Finally, the abnormal return to the fully-invested rolling portfolio, $AR_{p,t}$, is calculated as the difference between the portfolio's monthly return and its matching benchmark return,

$$AR_{p,t} = r_{p,t} - r_{p,t}^* \quad (5)$$

3.5. Statistical tests

3.5.1. Main hypothesis: Main net insider buying portfolio

To start with, we test whether outside investors can earn significant abnormal returns by investing in all firms with monthly net insider buying, defined as the difference between the number of shares purchased by a firm's corporate insiders in a given month and the number of shares sold. All firms with net insider buying are added to a sub-portfolio on an equal basis and kept for 24 months. There are 24 such sub-portfolios at any given point in time starting from January 2004, which form a fully-invested rolling portfolio named the main net insider buying portfolio. The abnormal return for each of the 168 months between January 2004 and December 2017 is calculated using the characteristic-sensitivity method. Inference is based on a t-statistic derived from the time-series of the monthly abnormal returns earned by the fully-invested main net insider buying portfolio. In other words, a standard one-tailed t-test is used to determine if the mean abnormal return to the main net buying portfolio is significantly greater than zero.

3.5.2. Hypothesis: Insider buying intensity

We test whether abnormal returns differ depending on the intensity of insider buying. As argued in the theory section, we expect firms with more intense insider buying to yield higher abnormal returns than firms with less intense insider buying. We calculate the intensity of insider buying by dividing the quantity of net purchases for each firm by previous year's year-end number of shares outstanding. To illustrate, if a company with 100 million shares outstanding has net purchases amounting to 100,000 shares in a given month, then the estimate for the intensity of insider purchases equals 0.1 percent of shares outstanding.

Subsequently, all firms with net buying are sorted based on the proxy for insider buying intensity, calculated as monthly net purchases as a percentage of shares outstanding,

and divided them into three groups. To form the three groups, we create ten deciles based on the proxy for insider buying intensity. The firms in the top three deciles are included in the high-intensity portfolio, firms in the next four deciles are included in the medium-intensity portfolio, and firms in the bottom three deciles are included in the low-intensity portfolio. Inference is based on a t-statistic derived from the time-series of the difference in the monthly abnormal returns earned by the high-intensity and low-intensity portfolio. A standard one-tailed t-test is used to determine if the mean abnormal return to the high-intensity portfolio is significantly greater than the mean abnormal return to the low-intensity portfolio.

Our approach to estimate the intensity of insider buying offers several advantages over more simple classifications based on absolute measures such as the number of shares purchased or the monetary volume of shares purchased. First and foremost, the absolute measures, particularly the monetary volume of shares bought by corporate insiders, are highly correlated with firm size. For this reason, an analysis using absolute measures to estimate the intensity of insider buying would create a blurry line between firm size and trade-volume effects. In other words, insider transactions at larger firms would typically appear more sizeable than transactions at smaller firms. The approach of using net purchases as a percentage of shares outstanding mitigates this risk. Second, our approach also increases the likelihood of trades with a large market impact to be classified as high-volume. This enables us to identify certain companies with a very high volume of net purchases, which may be associated with corporate insiders trying to acquire corporate control.

3.5.3. Hypothesis: Firm size

We also test whether abnormal returns differ depending on firm size. As discussed previously, we expect small firms with net insider buying to yield higher abnormal returns than large firms with net buying. At the end of each year, all firms listed on the Stockholm Stock Exchange are sorted into ten deciles based on year-end market capitalizations. The firms in the top three deciles are classified as large firms, firms in the next four deciles as medium-sized firms, and firms in the bottom three deciles as small firms. At the end of each month, all firms with net insider buying in the respective month are placed in a portfolio based on its size category. Instead of placing all firms in sub-portfolios making up the main net insider buying portfolio, we create three size-based fully-invested rolling portfolios comprised of 24 sub-portfolios each starting from January 2004. A standard one-tailed t-test

is used to determine if the mean abnormal return to the small-firm net insider buying portfolio is significantly greater than the mean abnormal return to the large-firm portfolio.

3.5.4. Hypothesis: Insider position

Lastly, we test whether abnormal returns differ depending on the category of corporate insiders being mimicked. We expect the piggybacking of higher-ranked insiders to yield higher abnormal returns than mimicking lower-ranked insiders. The data set provided by the Finansinspektionen allows us to form three categories of corporate insiders: chief executive officers, directors, and other corporate insiders. Directors include chairmen of boards and lower-ranked board members, whereas other corporate insiders include chief financial officers and middle managers.

However, differences in the informational advantage possessed by directors and other corporate insiders are not clear. Therefore, we test whether outside investors can earn higher abnormal returns from mimicking CEOs than from mimicking all other insiders. We divide the main net insider buying portfolio into two portfolios based on insider position: the CEO net insider buying portfolio, which includes firms with net insider buying conducted solely by chief executive officers; and the lower-ranked net buying portfolio, which includes all other firms with net buying. A standard one-tailed t-test is used to determine if the mean abnormal return to the CEO portfolio is significantly greater than the mean abnormal return to the lower-ranked portfolio.

3.6. Descriptive statistics

Following the sample selection described earlier, Table 2 presents the summary statistics of our final sample of insider transactions. The table shows the number of purchases and sales conducted by corporate insiders at firms listed on the Stockholm Stock Exchange between January 2002 and December 2017. The table also displays the ratio of purchase-to-sale transactions for each respective year, calculated as the number of insider purchases divided by the number of insider sales. Finally, the table shows the percentage of firms with at least one insider transaction during the year.

Consistently over the past 16 years, the number of insider purchases exceeded the number of insider sales on the Stockholm Stock Exchange. Thus, the Swedish market differs from the U.S. market where the number of insider sales typically exceeds the number of insider purchases (e.g. Cicero & Wintoki, 2015). Goergen and Renneboog (2011) show that

stock options account for a significantly smaller portion of the compensation packages offered to executives in Sweden than to executives in countries such as the U.S., serving as an explanation as to why insider purchases exceed insider sales in Swedish firms. Interestingly, the purchase-to-sale ratio seems particularly high during years when the market performed poorly (2007, 2008, and 2011), serving as a small piece of evidence that insiders in aggregate are contrarian investors, as argued in previous research (e.g. Lakonishok & Lee, 2001).

Table 2: Summary statistics for insider transactions on an annual basis

Year	Purchases	Sales	Total	Purchase-to-sales ratio	Firms with insider trading (%)
2002	892	416	1,308	2.14	84.62
2003	737	494	1,231	1.49	83.37
2004	809	501	1,310	1.61	88.00
2005	998	750	1,748	1.33	86.68
2006	1,317	889	2,206	1.48	90.08
2007	1,838	692	2,530	2.66	86.78
2008	1,961	473	2,434	4.15	84.15
2009	1,165	510	1,675	2.88	84.76
2010	1,384	631	2,015	2.19	86.17
2011	1,414	573	1,987	2.47	84.30
2012	1,047	624	1,671	1.68	80.41
2013	1,115	748	1,863	1.49	82.35
2014	1,351	777	2,128	1.74	82.28
2015	1,475	1,171	2,646	1.26	84.77
2016	1,657	878	2,535	1.89	85.80
2017	1,603	742	2,345	2.16	79.16

This table shows summary statistics on an annual basis for the final sample of insider transactions announced between January 2002 and December 2017. The first four columns show the year, number of insider purchases, number of sales, and number of total trades in each year. The purchase-to-sales ratio is calculated as the number of purchases divided by the number of sales for each year. The final column shows the percentage of firms with insider trading, computed as the number of firms with at least one reported insider trade during the year by the total number of firms listed on the Stockholm Stock Exchange at the time.

Finally, Table 3 shows the number of firms with net insider buying for each of the portfolios tested, both the total number for the entire studied period and the monthly average.

In addition, the average number of portfolio components between January 2004 and December 2017 is presented. All tested portfolios are well diversified. The small-size portfolio, one of the most concentrated portfolios, adds eight different firms each month on average and has 55 portfolio components on average throughout the studied period.

Table 3: Descriptive statistics for different insider portfolios

	Total portfolio	CEO	Lower- ranked	High- intensity	Low- intensity	Large- size	Small- size
Firms with net insider buying	6,637	1,530	6,202	1,991	1,991	2,648	1,562
Firms with net insider buying per month	34.6	8.0	37.6	10.4	10.4	13.8	8.1
Average number of portfolio components	176	92	174	93	85	59	55

The table shows descriptive statistics for the seven different insider portfolios used to answer the hypotheses formulated prior to conducting the study. The first row shows the total number of firms with net insider buying (observations), calculated by adding the number of firms with a positive difference between insider purchases and insider sales over the studied 168 months. The second row shows the average number of firms with net insider buying per month, computed as the total number of firms with net buying divided by the number of months between January 2004 and December 2017. The last row shows the average number of firms each insider portfolio is invested in throughout the entire study period.

4. Empirical results

4.1. Main hypothesis

The following section addresses our main hypothesis, as we investigate whether outside investors can earn abnormal returns when buying into companies with net insider buying. We employ the characteristic-selectivity measure to evaluate the monthly returns earned by our main insider buying portfolio, a fully-invested rolling portfolio comprised of 24 sub-portfolios. Briefly referring back to our methodology section, all companies with net insider buying in any given month are placed in a sub-portfolio on the last day of the respective month and are held for exactly 24 months. Each sub-portfolio is rebalanced monthly to maintain the original level of allocation to each company. The main net buying portfolio comprises 24 such sub-portfolios at any point in time starting from January 2004. Table 4 summarizes the results.

Table 4: Performance statistics for main net insider buying portfolio

Portfolio	Mean (%)	Standard deviation (%)	Minimum (%)	Maximum (%)	Positive months (%)
Panel A: Monthly abnormal returns					
Main net insider buying portfolio	0.114** (0.052)	0.675	-1.872	3.494	54.17
Panel B: Monthly returns					
Main net insider buying portfolio	1.411	5.423	-19.282	30.840	63.69

This table presents raw returns, abnormal returns, minimum and maximum returns, and percentage of positive months for the main net insider buying portfolio. The main net insider buying portfolio is comprised of 24 sub-portfolios that include all firms with net insider buying at the end of each respective month and holds these firms for 24 months. These 24-sub-portfolios are rebalanced on a monthly basis to maintain the original level of allocation. The monthly returns of the main net buying portfolio are calculated as the weighted average monthly returns of the 24 sub-portfolios forming the portfolio. Abnormal returns are calculated using the characteristic-selectivity measure, which compares each firm's monthly return with the return of a matching portfolio containing only firms with similar firm characteristics such as firm size and price-to-book ratio. The symbols *, **, and *** indicate one-tail significance at the 10%, 5%, and 1% levels, respectively. The study period covers the period of January 1, 2004 to December 31, 2017.

For the entire study period, the main insider buying portfolio returns 1.41 percent per month on average. The mean abnormal return equals 0.114 percent per month, which is statistically significant at a significance level of 5 percent. In addition, the monthly abnormal returns for the main buying portfolio are positive in 54.2 percent of all months over the period of 2004 to 2017. Despite the statistical significance, the abnormal return to the main buying portfolio may appear economically insignificant. However, given that the portfolio is

invested in more than half of the firms listed on the Stockholm Stock Exchange at any point in time, we find this abnormal return economically significant.

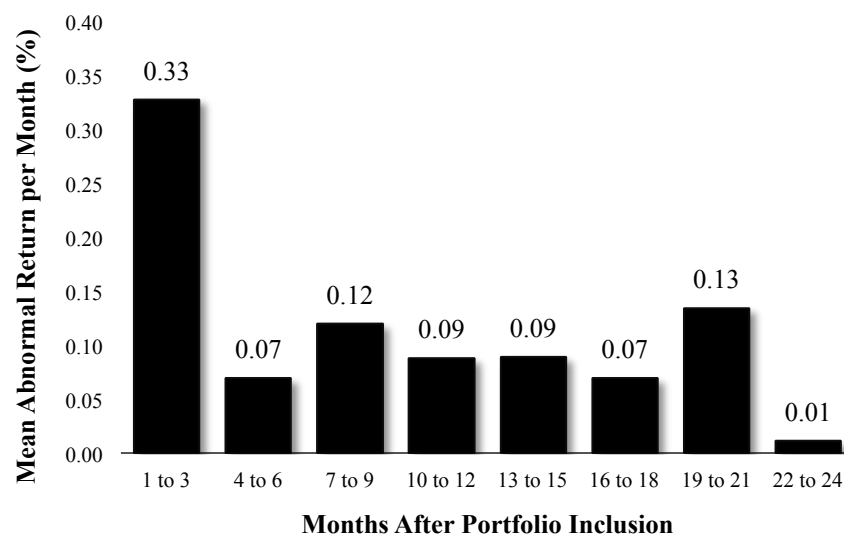
In contrast to a wide range of studies that appraise the impact of insider trading activities over a short period following insider trading announcements (e.g. Seyhun, 1986; Lakonishok & Lee, 2001), our study focuses on a much longer period of 24 months. The relatively long holding period is selected to account for the expectation that corporate insiders trade on a long-lived informational advantage. After having concluded that outside investors can earn abnormal returns by buying companies with net insider buying in any given month and holding these companies for 24 months, we then examine whether the largest share of these abnormal returns are generated in the period immediately after portfolio inclusion or whether the returns accrue during the entire 24-month period.

To understand whether a shorter investment horizon makes more economic sense, we deconstruct our main insider buying portfolio into portfolios that hold all companies with net insider buying for different subperiods during those 24 months. More specifically, we calculate the average abnormal returns of all companies included in the main buying portfolio for each of the eight quarters following portfolio inclusion. All companies with net insider buying are placed in the first portfolio, which holds the companies only for the first quarter following portfolio inclusion; then, at the end of the quarter, the same companies are placed in the second portfolio that holds the companies only for the second quarter following portfolio inclusion, and so on.

Figure 1 displays the average abnormal return per month to the main insider buying portfolio for each of the eight quarters following portfolio inclusion. As evident from the graph, abnormal returns are highest for the first three months following portfolio inclusion. The main buying portfolio earns an average abnormal return of 0.33 percent per month in the first quarter following portfolio inclusion, which equates to a cumulative abnormal return of 0.99 percent for the entire quarter. However, the abnormal returns that can be earned by outside investors buying into companies with net insider buying are not limited to the first quarter following portfolio inclusion. Instead, the abnormal returns to the main buying portfolio continue to accumulate during the remaining seven quarters, suggesting that outside investors can earn long-term abnormal returns when buying companies with net insider buying.

From the results presented in Table 4 and Figure 1, we draw three conclusions. First, the presence of abnormal returns implies that market participants underreact to reported insider purchases on the Stockholm Stock Exchange. The ability of outside investors to earn statistically significant abnormal returns by buying into companies with net insider buying represents a serious violation of the semi-strong form of market efficiency. Our study joins a series of studies such as Dickgiesser and Kaserer (2010), which claim that financial markets do not efficiently react to the release of new information. The results serve as evidence against the semi-strong form of market efficiency advocated by scholars like Fama (1970; 1998).

Figure 1: Mean abnormal return per month for the eight quarters after portfolio inclusion



This figure presents the mean abnormal return per month for each of the eight quarters after portfolio construction. The main buying portfolio is deconstructed into portfolios that hold all companies with net insider buying for different subperiods during the holding period of 24 months. More specifically, we calculate the average abnormal returns of all companies included in the main buying portfolio for each of the eight quarters following portfolio inclusion. All companies with net insider buying are placed in the first portfolio, which holds companies only for the first quarter following portfolio inclusion; then, at the end of the quarter, the same companies are placed in the second portfolio that holds the companies only for the second quarter following portfolio inclusion, and so on. The study period covers the period of January 1, 2004 to December 31, 2017.

Second, our results suggest that the marginal market participant is short-term-oriented, ignoring part of the long-term information conveyed in insider purchases. As discussed in the literature review, we expect insider transactions to convey long-term information owing to the legal and reputational risks associated with trading on a short-lived informational advantage. The continuous accumulation of abnormal returns throughout the 24-month holding period shows that market participants, at least to some extent, ignore the

long-term information conveyed in insider transactions. Had market participants reacted appropriately to insider trading announcements, abnormal returns should not have accrued throughout the entire holding period. This may serve as a small piece of evidence that market participants focus on shorter-term information instead of paying attention to the longer-term information conveyed in insider transactions. Similar to studies such as Black and Fraser (2000) and others, our results suggest that financial markets suffer from short-termism.

Finally, our results also serve as a piece of evidence that corporate insiders trade on a long-lived informational advantage. According to our findings, the abnormal returns that can be earned by outside investors buying into companies with net insider buying are not solely limited to the period immediately after portfolio inclusion. This conclusion supports the findings of Ke et al. (2003) that suggest corporate insiders trade on accounting foreknowledge up to two years prior to that information being disclosed to the public. The ability of outside investors to earn abnormal returns when buying into companies with net insider buying during the entire 24-month holding period following portfolio inclusion and the findings outlined by Ke et al. (2003) indicate that corporate insiders indeed trade on a long-lived informational advantage.

4.2. Abnormal returns for different types of insider trades

Our previous analysis is limited to the portfolio containing all companies with positive insider buying in any given month. In the following sections, we decompose the main insider buying portfolio along several dimensions: insider buying intensity, defined as the volume of monthly net purchases as a percentage of shares outstanding; firm size; and insider position. These respective portfolio decompositions enable us to answer the remaining hypotheses and provide insights into the possibility of designing an investment strategy that profits significantly from piggybacking the trading of corporate insiders.

4.2.1. Insider buying intensity

As discussed in the literature review section, previous research documents a positive relation between the intensity of insider buying and abnormal stock returns for corporate insiders and outside investors piggybacking insider trades. In the following subsection, we examine the relation between the monthly volume of net purchases for all Swedish companies included in our sample and the abnormal returns outside investors can earn by investing in companies with net insider buying.

Table 5. Performance statistics for insider buying intensity portfolios

Portfolio	Mean (%)	Standard deviation (%)	Minimum (%)	Maximum (%)	Positive months (%)
Panel A: Monthly abnormal returns					
High-intensity	-0.115 (0.102)	1.328	-3.447	8.570	44.64
Medium-intensity	0.242*** (0.076)	0.980	-2.263	5.593	58.93
Low-intensity	0.128** (0.065)	0.840	-4.198	2.494	56.55
Panel B: Monthly returns					
High-intensity	1.182	5.802	-21.667	27.481	59.52
Medium-intensity	1.530	5.634	-18.310	33.407	61.90
Low-intensity	1.425	5.184	-17.276	30.429	63.10
Panel C: Hypothesis testing					
Difference between high- and low-intensity	-0.243** (0.121)	1.574	-4.556	8.599	45.24

This table presents raw returns, abnormal returns, minimum and maximum returns, and percentage of positive months for the high-intensity, medium-intensity, and low-intensity net insider buying portfolios. To estimate the intensity of insider buying, we divide each firm's quantity of net purchases in any given month by the previous year-end number of shares outstanding. Firms in the bottom three deciles are included in the low-intensity portfolio, those in the next four deciles are included in the medium-intensity portfolio and firms in the largest three deciles are included in the high-intensity portfolio. Abnormal returns are calculated using the characteristic-selectivity measure, which compares each firm's monthly return with the return of a matching portfolio containing only firms with similar firm characteristics such as firm size and price-to-book ratio. Panel C displays the mean difference in the monthly abnormal returns of the high-intensity and low-intensity portfolio. The symbols *, **, and *** indicate one-tail significance at the 10%, 5%, and 1% levels, respectively. The study period covers the period of January 1, 2004 to December 31, 2017.

The results for the three buying-intensity portfolios are summarized in Table 5. Surprisingly, the mean abnormal return to the high-intensity portfolio is a negative 0.115 percent per month. Meanwhile, the medium and low-intensity portfolios earn abnormal returns of 0.242 and 0.128 percent per month, respectively, which are both statistically significantly greater than zero at the 5 percent significance level. In short, we do not find support for the hypothesis that the abnormal returns to outside investors are positively related to the intensity of insider buying. In fact, our results suggest the opposite. The high-intensity portfolio earns a statistically significantly lower abnormal return than the low-intensity portfolio, with a difference of 0.243 percent per month. However, as the medium-intensity portfolio earns a considerably higher abnormal return than the low-intensity portfolio, the relation between the intensity of insider buying and abnormal returns to a mimicking outside investor appears inconclusive.

To shed some light on the counterintuitive negative abnormal return for the high-intensity portfolio, we examine separately the performance of the tenth decile of firms with the highest intensity of insider buying. Since this decile includes companies with monthly net purchases of at least 0.25 percent of outstanding shares, we anticipate that the respective insider buying activity is more likely to be related to a quest for corporate control and may, therefore, not be related to expectations of future performance and returns. For instance, there are numerous companies with the volume of net purchases in a given month exceeding 5 percent, 10 percent, and even 50 percent of shares outstanding. Thus, the likelihood that such insider buying activity is related to a quest for corporate control or other reasons unrelated to expectations of future performance seems very high.

One example concerns consulting company Sigma AB, added to our high-intensity portfolio in April 2013, which was subject to a takeover offer in February 2013. On February 20, Danir AB, the largest shareholder in Sigma at the time of the public takeover offer, offered SEK 6.75 in cash for each share of Sigma. Eventually, Danir purchased a sizeable amount of Sigma shares at the beginning of April 2013, which triggered the inclusion of Sigma in our high-intensity portfolio. This insider buying activity was purely related to a quest for corporate control and one would not typically anticipate such activity to signal abnormal returns.

Interestingly, the control-buying portfolio containing the tenth decile of companies with the highest intensity of insider buying earns a negative abnormal return of 0.394 percent per month. This negative abnormal return is statistically significantly lower than zero at a significance level of 5 percent. Similar to conclusions outlined in past studies (e.g. Barclay & Holderness, 1989), one explanation for the observed negative abnormal return is that trades of large-percentage blocks of shares are typically priced at substantial premiums to exchange prices and also trigger substantial stock-price changes due to increased demand for shares.

In addition to the expected stream of dividends and other cash flows that accrue to all shareholders in proportion to their fractional ownership, large-block shareholders can also receive pecuniary private benefits such as higher salaries for individual blockholders or below-market transfer prices for corporate blockholders. Since our approach of constructing portfolios involves buying into companies with net insider buying only at the end of any given month, one would reasonably expect companies with large-percentage trades during a month to be associated with negative stock returns in the following months. Therefore, the substantial premium typically paid for large-percentage blocks and the associated stock-price

changes can explain the significant negative abnormal returns for the companies with the highest intensity of insider buying.

Table 6. Performance statistics for adjusted insider buying intensity portfolios

Portfolio	Mean (%)	Standard deviation (%)	Minimum (%)	Maximum (%)	Positive months (%)
Panel A: Monthly abnormal returns					
Control-buying portfolio	-0.394** (0.211)	2.740	-7.195	24.592	41.67
Adjusted high-intensity	0.149** (0.078)	1.016	-3.440	3.603	53.57
Adjusted medium-intensity	0.271*** (0.080)	1.037	-2.609	6.053	60.71
Low-intensity	0.128** (0.065)	0.840	-4.198	2.494	56.55
Panel B: Monthly returns					
Control-buying portfolio	0.866	6.424	-24.579	34.075	57.74
Adjusted high-intensity	1.438	5.590	-20.155	26.169	61.31
Adjusted medium-intensity	1.568	5.670	-17.532	33.817	62.50
Low-intensity	1.425	5.184	-17.276	30.429	63.10

This table presents raw returns, abnormal returns, minimum and maximum returns, and percentage of positive months for the control-buying portfolio containing the tenth decile of firms with the highest intensity of insider buying, the adjusted high-intensity, adjusted medium-intensity, and low-intensity net insider buying portfolios. To estimate the intensity of insider buying, we divide each firm's quantity of net purchases in any given month by the previous year-end number of shares outstanding. Firms in the bottom three deciles are included in the low-intensity portfolio, those in the next three deciles are included in the adjusted medium-intensity portfolio and firms in the largest three deciles except for the tenth decile are included in the adjusted high-intensity portfolio. Abnormal returns are calculated using the characteristic-selectivity measure, which compares each firm's monthly return with the return of a matching portfolio containing only firms with similar firm characteristics such as firm size and price-to-book ratio. The symbols *, **, and *** indicate one-tail significance at the 10%, 5%, and 1% levels, respectively. The study period covers the period of January 1, 2004 to December 31, 2017.

With a plausible explanation for why companies with the highest intensity of insider buying signal negative abnormal returns, we continue investigating whether companies with higher intensity of buying signal greater abnormal returns than firms with lower intensity of buying. For that reason, we exclude the tenth decile of firms with the highest intensity of insider buying. Instead, we form three new portfolios using nine of the ten decile portfolios created based on the intensity of insider buying: a portfolio containing the bottom three deciles, which is the same low-intensity net buying portfolio as above; the adjusted medium-intensity net buying portfolio containing the next three deciles, a smaller version of the

medium-intensity portfolio that excludes the seventh decile; and the adjusted high-intensity net buying portfolio containing the largest deciles except for the tenth decile. Table 6 summarizes the results for the control-buying portfolio and the newly-created three portfolios.

As shown in Table 6, the mean abnormal return to the adjusted high-intensity portfolio equals 0.149 percent per month, which is statistically significantly greater than zero at the 5 percent significance level. At the same time, the adjusted medium-intensity portfolio earns an economically large and statistically significant mean abnormal return of 0.271 percent per month. In contrast to our initial expectations, companies with higher insider buying intensity do not signal greater abnormal returns than companies with lower insider buying intensity. Although the low-intensity portfolio earns a slightly lower abnormal return of 0.128 percent per month, it is not statistically significantly lower the abnormal return to the adjusted high-intensity portfolio.

We find two main explanations as for why the adjusted high-intensity portfolio earns a lower abnormal return than the adjusted medium-intensity portfolio. First, higher-volume insider purchases likely receive greater attention from the media and the investor community, resulting in a greater and more immediate stock price response to these insider trading announcements. Since our approach to construct portfolios involves investing in companies with net insider buying only at the end of each month, we do not capture the stock performance between insider trading announcements and the end of each respective month. Second, as Cicero and Wintoki (2015) argue, corporate insiders trading during a short window of time tend to trade on a short-lived informational advantage, counteracting to our long investment horizon of two years. To check this idea, we examine the mean abnormal returns of each of the three portfolios for a short period immediately after portfolio formation.

Our analysis shows that the adjusted high-intensity portfolio earns a mean abnormal return of 0.612 percent per month for the first two months after portfolio formation, which compares favorably with the abnormal returns of 0.567 percent and 0.492 percent for the adjusted medium-intensity portfolio and the low-intensity portfolio, correspondingly. Similar to Cicero and Wintoki (2015), these results suggest that corporate insiders buying own-firm shares heavily during a short period of time are trading on a short-lived informational advantage.

4.2.2. Firm size

In the following section, we examine the relation between firm size and abnormal returns by decomposing the main net insider buying portfolio into three portfolios based on firm size. Past studies such as Lakonishok and Lee (2001) document that the insider buying at smaller firms signal higher abnormal returns than the buying activity at larger firms. We anticipate the information asymmetry between corporate insiders and outside market participants to be greater at smaller companies because they receive less analyst and media coverage and exhibit lower institutional ownership.

Table 7. Performance statistics for size-based insider portfolios

Portfolio	Mean (%)	Standard deviation (%)	Minimum (%)	Maximum (%)	Positive months (%)
Panel A: Monthly abnormal returns					
Large-firm portfolio	0.074 (0.061)	0.795	-1.972	4.850	54.17
Medium-firm portfolio	0.146* (0.099)	1.285	-2.693	4.947	54.17
Small-firm portfolio	0.066 (0.133)	1.727	-4.986	6.799	52.38
Panel B: Monthly returns					
Large-firm portfolio	1.370	5.277	-18.511	32.533	61.90
Medium-firm portfolio	1.439	6.203	-19.036	34.253	57.74
Small-firm portfolio	1.368	5.632	-21.556	19.437	64.29
Panel C: Hypothesis testing					
Difference between small-firm and large-firm portfolios	-0.007 (0.151)	1.960	-9.836	5.537	50.60

This table presents raw returns, abnormal returns, minimum and maximum returns, and percentage of positive months for the large-firm, medium-firm, and small-firm net insider buying portfolios. All firms listed on the Stockholm Stock Exchange are sorted into ten deciles based on their year-end market capitalization. Firms in the top three deciles are classified as large firms, firms in the next four deciles as medium-sized firms, and firms in the bottom three deciles as small firms. Abnormal returns are calculated using the characteristic-selectivity measure, which compares each firm's monthly return with the return of a matching portfolio containing only firms with similar firm characteristics such as firm size and price-to-book ratio. Panel C displays the mean difference in the monthly abnormal returns of the small-firm and high-firm net insider buying portfolio. The symbols *, **, and *** indicate one-tail significance at the 10%, 5%, and 1% levels, respectively. The study period covers the period of January 1, 2004 to December 31, 2017.

As mentioned on several occasions, our sample of firms is classified into three size groups on an annual basis. Each company with net insider buying in any given month is placed in a portfolio at the end of the respective month based on the size category assigned to at the beginning of the year. The holding stays in the same portfolio for the full 24 months

even though the firm falls in another size category the following year. We then evaluate the returns to the three newly-created portfolios using the same characteristic-selectivity approach used in the prior analysis. Table 7 summarizes the results.

Contrary to the findings in other studies (e.g. Lakonishok & Lee, 2001), the small-firm portfolio earns a lower abnormal return than the other two size-based portfolios. Specifically, the mean abnormal return to the small-firm portfolio is only 0.066 percent per month, compared to 0.074 percent and 0.146 percent to the large-firm and medium-firm portfolios, respectively. The low abnormal return to the small-firm portfolio is not attributable to our approach of calculating abnormal returns using matching bins. In fact, the mean return to the small-firm portfolio is 1.368 percent per month, which is also lower than the returns for the large-firm and medium-firm portfolios, correspondingly. In rejection of the hypothesis, we conclude that outside investors cannot earn higher abnormal returns by buying small firms with net insider buying than buying large firms with net insider buying. Although the medium-size portfolio earns the highest abnormal return, it is not statistically significantly higher than that of the other two size portfolios. Thus, we find no clear relation between firm size and abnormal returns available to outside investors.

One possible explanation to the unexpected results can be that our sample of firms is restricted to the firms listed on the Stockholm Stock Exchange. Companies listed on other Swedish exchanges, such as the Nasdaq First North, are typically smaller. Since the number of firms listed on the Stockholm Stock Exchange is relatively small compared to the number of firms listed on the significantly larger stock exchanges in the U.S. and since the companies listed on the Stockholm Stock Exchange contain predominantly Sweden's largest companies in terms of market capitalization, we believe the information asymmetry between corporate insiders and outside market participants in Sweden does not differ between smaller and larger companies.

Another possible explanation concerns the initial market reaction to insider trading announcements. Our approach to construct insider portfolios involves buying into companies with net purchases at the end of each month rather than mimicking each insider purchase transaction instantaneously following announcement. As a result, our approach leads to a lag between portfolio inclusion and insider trading announcements by two weeks on average. Thus, the difference in abnormal returns might be explained by differences in market reactions to reported insider trading in small and large firms. The stronger the market initial reaction to insider trading, the lower the available abnormal returns to our portfolios should

be. A stronger market reaction to insider purchases in small firms might therefore explain why the small-firm portfolio does not earn higher abnormal returns than the large-firm portfolio.

4.2.3. Insider position

In the following section, we examine the relation between an insider's position within the firm and abnormal returns. Since prior research suggests that only senior executives possess a long-lived informational advantage over outside market participants, we anticipate the insider buying conducted by chief executive officers at Swedish firms to signal higher abnormal returns than the buying of lower-ranked corporate insiders. To conduct the analysis, insider transactions conducted by CEOs are separated from the other insider transactions. Thus, the main net insider buying portfolio is divided into two portfolios: the CEO portfolio, which includes only transactions conducted by CEOs; and the lower-ranked portfolio, which includes all remaining transactions. Table 8 summarizes the results for the two portfolios.

Table 8. Performance statistics for insider position-based portfolios

Portfolio	Mean (%)	Standard deviation (%)	Minimum (%)	Maximum (%)	Positive months (%)
Panel A: Monthly abnormal returns					
CEO portfolio	0.200** (0.093)	1.208	-2.663	4.445	55.36
Lower-ranked portfolio	0.104** (0.054)	0.697	-1.927	3.936	56.55
Panel B: Monthly returns					
CEO portfolio	1.494	5.497	-19.880	25.922	61.31
Lower-ranked portfolio	1.402	5.429	-19.169	31.226	63.69
Panel C: Hypothesis testing					
Difference between CEO and lower-ranked portfolio	0.096 (0.085)	1.105	-5.410	3.417	49.40

This table presents raw returns, abnormal returns, minimum and maximum returns, and percentage of positive months for the CEO and lower-ranked net insider buying portfolios. Abnormal returns are calculated using the characteristic-selectivity measure, which compares each firm's monthly return with the return of a matching portfolio containing only firms with similar firm characteristics such as firm size and price-to-book ratio. Panel C displays the mean difference in the monthly abnormal returns of the CEO and lower-ranked net insider buying portfolio. The symbols *, **, and *** indicate one-tail significance at the 10%, 5%, and 1% levels, respectively. The study period covers the period of January 1, 2004 to December 31, 2017.

As shown in Table 8, the CEO portfolio earns a mean abnormal return of 0.200 percent per month, which is greater than the lower-ranked portfolio's abnormal return of

0.104 percent. The abnormal returns of both portfolios are statistically significantly greater than zero at a significance level of 5 percent. Even though the CEO portfolio's abnormal return appears economically larger than the abnormal return to the lower-ranked portfolio, the difference is not statistically significant. Despite a statistically insignificant difference, there is evidence that outside investors can earn higher abnormal returns by mimicking the insider buying activity conducted by top executives rather than piggybacking the transactions conducted by lower-ranked and less informed corporate insiders.

Just as Cicero and Wintoki (2015) conclude that abnormal returns are more pronounced following trades by members of the executive team, our results show that CEOs purchase own-firm shares opportunistically despite facing the most scrutiny from regulators. Given our results, we conclude that CEOs at Swedish public firms possess more knowledge about the state of their companies and price-relevant information than lower-ranked insiders. Hence, an investment strategy that tracks the insider buying conducted by these insiders would normally generate the highest abnormal returns. Since our approach to construct insider portfolios does not involve piggybacking the trades of CEOs instantaneously, we conclude that market participants underreact the most to the announced insider transactions conducted by these top executives.

More importantly, our results support the findings of Cicero and Wintoki (2015) suggesting that senior executives trade on a longer-lived informational advantage due to their privileged access to such information (e.g. changes in strategic direction, information related to particular research and development projects, etc.). For example, the CEO portfolio earns a mean abnormal return of 0.210 percent per month during the first six months after portfolio construction and a mean abnormal return of 0.262 percent during the subsequent six months. On the contrary, the lower-ranked portfolio earns a mean abnormal return of 0.221 percent during the first six months after portfolio construction and a mean abnormal return of 0.095 percent per month during the subsequent six months. When comparing these figures to the abovementioned abnormal returns, we conclude that that lower-ranked corporate insiders trade more intensely on a short-lived informational advantage compared to CEOs. Our results also confirm the conclusion outlined by Jeng et al. (2003) that top executives are forced to trade more cautiously due to higher scrutiny from market participants, the media, and regulators.

4.3. Investment strategy

Our analysis section shows that certain types of insider trades are more informative than others. For example, the trades of chief executive officers signal higher abnormal returns than the trades of lower-ranked insiders. We also find that the very largest insider purchases signal negative abnormal returns, as these trades are largely motivated by control motives. Contrary to original expectations, firm size does not significantly affect abnormal returns. Using these results and other important insights from the previous analysis, the following section discusses an investment strategy that profits significantly from piggybacking the most informative insider trades.

Perhaps the most important difference between the investment strategy and the main net insider buying portfolio relates to the holding period of investments. Although abnormal returns to the main insider portfolio accrue during the entire holding period of 24 months, our analysis shows that the highest abnormal returns come during the first three months following portfolio inclusion. Therefore, the proposed investment strategy would buy into companies with net insider buying at the end of each month and hold those companies only for three months. Similar to the main net buying portfolio, all investments are rebalanced monthly to maintain the original level of allocation to each company.

At the same time, the investment strategy would also ignore companies with the most intense insider buying. The reason for excluding these companies is that the portfolio containing the decile of companies with the most intense insider buying earns a negative abnormal return of 0.394 percent per month. This kind of insider buying activity most likely relates to a quest for corporate control on the part of insiders and does not relate to expectations of future performance. Hence, the strategy excludes companies with monthly net purchases of more than 0.25 percent of shares outstanding. The relatively short holding period of three months is also justified by our findings that all corporate insiders except for CEOs trade on a shorter-lived informational advantage and signal higher abnormal returns in the near-term rather than long-term.

Table 9 summarizes the results of the investment strategy. Our proposed investment strategy that buys Swedish public firms with net insider buying and holds those investments for three months would have earned a mean return of 1.797 percent per month over the period of 2004 to 2017. This return corresponds to an annual return of 21.558 percent. More importantly, such an investment strategy would have earned a mean abnormal return of 0.457

percent per month, which equates to an abnormal return of 5.486 percent per annum. In addition, the investment strategy portfolio has a market beta of 1.078, which suggests that the strategy is not associated with significantly greater volatility in returns compared to the broader market.

Table 9. Performance statistics for the investment strategy portfolio

Portfolio	Mean (%)	Standard deviation (%)	Minimum (%)	Maximum (%)	Positive months (%)
Panel A: Monthly abnormal returns					
Investment strategy portfolio	0.457*** (0.118)	1.532	-3.652	6.978	61.90
Panel B: Monthly returns					
Investment strategy portfolio	1.797	5.736	-21.509	27.792	66.67

This table presents raw returns, abnormal returns, minimum and maximum returns, and percentage of positive months for the investment strategy portfolio. Abnormal returns are calculated using the characteristic-selectivity measure, which compares each firm's monthly return with the return of a matching portfolio containing only firms with similar firm characteristics such as firm size and price-to-book ratio. The symbols *, **, and *** indicate one-tail significance at the 10%, 5%, and 1% levels, respectively. The study period covers the period of January 1, 2004 to December 31, 2017.

4.4. Transaction costs

As one would expect, our analysis has practical implications and creating implementable trading strategies mimicking reported insider trades means considering transaction costs. The cost of trading is not taken into account when estimating abnormal returns in our previous analysis. However, outside investors attempting to mimic reported insider trades would incur transaction costs such as brokerage commissions and bid-ask spreads. The following section examines whether the abnormal returns documented in our previous analysis are sufficient to allow a profitable trading strategy after accounting for transaction costs.

Under our approach of constructing portfolios, all firms with net insider buying in a given month are placed in sub-portfolio at the end of the respective month and are held for exactly 24 months. Given that each sub-portfolio is rebalanced monthly to maintain the original level of allocation, such an investment strategy would incur some transaction costs due to rebalancing. Previous studies employ advanced techniques to account for transaction costs, including the proportional cost models of Korajczyk and Sadka (2004). To approximate monthly transactions costs for our main net insider buying portfolio and the investment strategy portfolio, we multiply the mean monthly portfolio turnover of each of the

two portfolios by an estimate of round-trip transaction costs, generally defined as the total costs associated with buying and re-selling a security.

We employ the methodology developed by Barber and Odean (2000) to calculate monthly portfolio turnovers. Barber and Odean (2000) calculate a monthly portfolio turnover as the average of the buy and sell turnovers during a month, where the buy turnover for a month is defined as the monetary volume of all shares purchased during the month divided by the total beginning-of-month value of the entire portfolio. Similarly, the sell turnover is calculated as the monetary volume of all shares sold divided by the beginning-of-month portfolio value.

The main net insider buying portfolio has a mean portfolio turnover of 10.32 percent per month. Assuming a one percent round-trip transaction cost, an estimate used by previous studies such as Jeng et al. (2003), the main net buying portfolio would incur approximately 0.103 percent in transaction costs per month. Thus, the mean abnormal return of 0.114 percent per month earned by the main portfolio is not sufficient to allow a profitable trading strategy after transaction costs. Considering that the investment strategy proposed above buys into firms with net insider buying at the end of each month and holds these firms for three months, such a strategy would incur higher transaction costs than the main net buying portfolio due to a higher monthly portfolio turnover. The investment strategy portfolio has a mean portfolio turnover of 37.54 percent per month. Assuming a similar one percent round-trip transaction cost, the investment strategy portfolio would incur around 0.375 percent in transaction costs per month. In this case, the investment strategy portfolio's mean abnormal return of 0.457 percent per month is sufficient to allow a profitable trading strategy after transaction costs.

Indeed, further research can make an attempt at estimating transaction costs for our portfolios more accurately, but this section shows that the profitability of implementable trading strategies mimicking reported insider trades largely depends on transaction costs. Although transaction costs reduce returns, our study indicates that outside investors can still earn abnormal returns when investing in Swedish public firms with net insider buying even after accounting for transaction costs.

4.5. Robustness checks

In our main analysis, abnormal returns are calculated using the characteristic-selectivity approach, under which each firm's monthly returns are compared with the returns

of a matching portfolio consisting of firms with similar firm characteristics such as firm size and price-to-book ratio. In the following section, we check whether our results hold for an alternative method of measuring abnormal returns.

Most research studies of insider trading on the Stockholm Stock Exchange use broader market indices such as OMX Affärsvärldens Generalindex or OMX Stockholm Benchmark as benchmarks for computing abnormal returns. Since our study uses monthly total returns for each security instead of monthly price returns, the calculation of abnormal returns using market value-weighted price return indices would produce significantly overstated and inaccurate results. Considering there are no indices measuring the total return of the underlying OMX Affärsvärldens Generalindex with sufficient data history, we calculate a proxy index that reflects the equally-weighted monthly total returns of all firms listed on the Stockholm Stock Exchange. That said, instead of calculating abnormal returns as the difference between a firm's monthly total return and its matching bin's return, our alternative measure of measuring abnormal returns involves calculating the difference between the firm's total return and the equally-weighted total return of all firms listed on the Stockholm Stock Exchange.

Table 10: Performance statistics for main portfolio using alternative abnormal return measure

Portfolio	Mean (%)	Standard deviation (%)	Minimum (%)	Maximum (%)	Positive months (%)
Panel A: Monthly abnormal returns					
Main net insider buying portfolio	0.105* (0.072)	0.933	-4.343	5.049	52.98
Panel B: Monthly returns					
Main net insider buying portfolio	1.411	5.423	-19.282	30.840	63.69

This table presents raw returns, abnormal returns, minimum and maximum returns, and percentage of positive months for the main net insider buying portfolio using an alternative approach of calculating abnormal returns. The main net insider buying portfolio is comprised of 24 sub-portfolios that include all firms with net insider buying at the end of each respective month and holds these firms for 24 months. Instead of calculating abnormal returns as the difference between a firm's monthly total return and its matching bin's return, the alternative measure of measuring abnormal returns involves calculating the difference between the firm's total return and the equally-weighted total return of all firms listed on the Stockholm Stock Exchange. The symbols *, **, and *** indicate one-tail significance at the 10 percent, 5 percent, and 1 percent levels, respectively. The study period covers the period of January 1, 2004 to December 31, 2017.

As shown in Table 10, the mean abnormal return to the main net insider buying portfolio using the alternative method of measuring abnormal returns is 0.105 percent per month, which compares with the mean abnormal return of 0.114 percent per month calculated using the characteristic-selectivity approach. The difference between abnormal returns is

immaterial. One might argue that the main net insider buying portfolio warrants a higher return than the broader market because the portfolio exhibits greater volatility in monthly returns. However, our analysis shows that the main net buying portfolio has a market beta of only 1.043, which implies that the portfolio is not associated with greater volatility in returns. To sum up, our results are robust to alternative methodologies of measuring abnormal returns.

5. Conclusions

The whole research arena studies reported insider trading for three main reasons: testing market efficiency, designing profitable investment strategies piggybacking reported trades, and examining the effectiveness of insider-trading rules aimed at curbing market abuse. Our analysis focuses on the first two areas of insider trading research, namely market efficiency and investment strategies.

Our analysis starts from the premise that corporate insiders possess more knowledge and insight about the state of their firms and potential stock price-relevant events than most sell-side analysts and other outside market participants. Using the same line of thought, most insider trading research explores whether insiders attempt to exploit this informational advantage by engaging in legal insider trading. Based on the area of microeconomic theory that assumes utility-maximizing individuals, we anticipate an insider's utility from insider trading to be positively affected by expected returns and negatively affected by reputational and legal risks associated with exploiting private information. For that particular reason, we expect corporate insiders to avoid trading on a short-lived informational advantage and trade on a longer-lived informational advantage instead. Hence, our analysis starts off with the following central question: Can outside investors earn long-term abnormal returns by investing in Swedish public firms with monthly net insider buying?

We find a mean abnormal return of 0.114 percent per month to the main net insider buying portfolio investing in all Swedish firms with monthly net insider buying. This figure equates to a mean abnormal return of 1.368 percent per annum, which is statistically significant and economically large considering that the portfolio is invested in more than half of all firms listed on Stockholm Stock Exchange on average. Although the portfolio has a mean portfolio turnover of 10.32 percent per month, an assumed round-trip transaction cost of one percent would result in transaction costs of 0.103 percent per month. Further, the first three months following portfolio inclusion yield a mean abnormal return of 0.33 percent per month; however, the abnormal returns are not solely limited to this window of time after portfolio inclusion. Abnormal returns continue to accrue during the entire period of 24 months, though the magnitude of abnormal returns is lower after the first quarter following portfolio inclusion.

We draw four main conclusions from these results. First, market participants on the Stockholm Stock Exchange underreact to reported insider trading, serving as evidence that

the semi-strong form of market efficiency is violated. Indeed, the ability of outside investors to earn economically large and significant abnormal returns by investing in companies with net insider buying represents a serious exception to the efficient market hypothesis. Second, our results and previous studies incline us to believe that securities markets suffer from short-termism as market participants fail to incorporate accurately longer-term information conveyed in insider trades into stock prices. Third, corporate insiders trade on a long-lived informational advantage given the continuous accumulation of abnormal returns during the entire holding period of 24 months. This conclusion supports the findings Ke et al. (2003) that suggest insiders trade on accounting foreknowledge up to two years prior to that information being disclosed to the public. Lastly, the abnormal returns to the main net insider buying portfolio may not be sufficient to allow a profitable trading strategy after transaction costs.

When decomposing the main net insider buying portfolio across dimensions such as insider buying intensity, firm size, and job position, we identify more interesting insights about the behavior of corporate insiders and market reaction to reported insider trades. Whereas prior research such as Lakonishok and Lee (2001) documents a positive relation between the intensity of insider buying and abnormal returns, our results show that the decile of firms with the most intense insider buying earns a negative abnormal return of 0.394 percent per month. After examining several companies with intense insider buying, we find that the very largest insider purchases are predominantly motivated by control motives. But even after excluding the decile of firms with the most intense insider buying, we find no conclusive evidence that firms with higher insider buying intensity signal greater abnormal returns than companies with lower buying intensity. More interestingly, our results confirm the findings of Cicero and Wintoki (2015) that corporate insiders trading heavily during a short window of time are motivated by a short-lived informational advantage. Our analysis shows that the portfolio containing companies with high intensity insider buying earns a mean abnormal return of 0.612 percent per month for the first two months, which is greater than the mean abnormal returns of 0.567 percent and 0.492 percent for the medium-intensity and low-intensity net insider buying portfolios, correspondingly.

When examining the relation between firm size and the informativeness of insider trading for future returns, we find no conclusive evidence that net insider buying at small firms signal higher abnormal returns than the buying activity at larger companies. Despite being statistically insignificant, our results suggest that the insider buying conducted by chief

executive officers at Swedish public firms is more informative than the buying activity of lower-ranked corporate insiders. The portfolio of companies with net insider buying conducted by chief executive officers earns a mean abnormal return of 0.200 percent per month, compared to the mean abnormal return of 0.104 percent for the portfolio of companies with buying conducted by lower-ranked insiders. But more interestingly, our results suggest that chief executives trade on a longer-lived informational advantage than lower-ranked insiders, possibly reflecting their privileged access to long-term stock price-relevant information (e.g. change of strategic direction) and higher scrutiny from market participants and regulators. As a case in point, the CEO net insider buying portfolio earns a mean abnormal return of 0.210 percent per month during the first six months after portfolio construction and a mean abnormal return of 0.262 percent during the subsequent six months. On the contrary, the lower-ranked net buying portfolio earns a mean abnormal return of 0.221 percent per month during the first six months and only 0.095 percent during the subsequent six months. This serves as a small piece of evidence that lower-ranked corporate insiders trade more intensely on a short-lived informational advantage compared to chief executive officers.

What should outside investors think of these results? Indeed, corporate insiders at Swedish public firms possess valuable information and the current regulatory system cannot prevent them from trading profitably. Hence, outside investors can make use of our analysis to design a profit-making trading strategy piggybacking reported insider trading, on the condition that market participants on the Stockholm Stock Exchange continue to underreact to announced insider trades. Our analysis reveals that certain types of insider trades are more informative than others. For instance, the trades of chief executive officers signal higher abnormal returns than the trades of other insiders. In addition, firms with the most intense insider buying signal negative abnormal returns, as this buying activity is largely motivated by control motives. More importantly, since our main net insider buying portfolio earns the highest abnormal return per month during the first three months after portfolio construction, a trading strategy that holds firms with net insider buying for a period of three months only would earn significantly higher abnormal returns than our original portfolio.

After ignoring companies with the most intense insider buying, a trading strategy that had bought companies with net insider buying at the end of each month and held them for a period of three months would have earned a mean return of 1.797 percent and a mean abnormal return of 0.457 percent per month, respectively. This figure equates to a return of

21.558 percent and an abnormal return of 5.484 percent per annum, which is economically large for a well-diversified investment portfolio. The trading strategy has a mean portfolio turnover of 37.54 percent per month, with an assumed round-trip transaction cost of one percent resulting in transaction costs of 0.375 percent per month for the strategy. Hence, the strategy's abnormal return may be sufficient to allow a profitable trading strategy after transaction costs. All in all, the simple trading strategy outlined above serves as a piece of evidence that outside investors could have earned significant abnormal returns by piggybacking reported insider trades, though, there can be no assurance such a strategy would continue to earn significant abnormal returns going forward.

Although our study was not originally intended to evaluate the effectiveness of the insider-trading rules aimed at curbing market abuse on the Stockholm Stock Exchange, policymakers can use the results of the study to rectify potential weaknesses in the current regulatory system. The current regulatory system has two critical components, namely reporting requirements and the so-called blackout period. The former component, which may be viewed as a minor clerical imposition, assures that information on insider trading comes out in the market as quickly as possible and, hopefully, is incorporated timely and accurately into stock prices. Meanwhile, the blackout period implies that corporate insiders at Swedish public firms are restricted from buying or selling own-firm securities 30 days prior to the publication of earnings announcements. In mid-2005, this blackout period restriction replaced the short-swing rule under which corporate insiders were restricted from conducting round-trip transactions within a period of three months. Since the results of our analysis show that lower-ranked corporate insiders tend to trade on a short-lived informational advantage, the introduction of the short-swing rule that restricts corporate insiders from making round-trip transactions within a period of six months, for instance, might improve investor confidence in the fairness of securities markets.

Ideally, the study period would extend back to 1993 given the availability of an extensive data set on reported insider trades on the Stockholm Stock Exchange. Unfortunately, data on market capitalizations and price-to-book ratios was only attainable starting from 2004. A longer study period would certainly yield stronger statistical evidence for our findings. In addition, a more profound analysis of transaction costs would be necessary to understand whether the abnormal returns to our portfolios are sufficient to allow a profitable trading strategy net of transaction costs. Finally, we suggest future research employ the buy-and-hold abnormal return approach to calculate abnormal returns to outside

investors mimicking reported insider trading, as the approach measures investor experience more precisely. Since the buy-and-hold methodology should not be used for statistical inference in its traditional form, the bootstrapped skewness-adjusted t-statistic could be used to ensure well-specified test statistics. More importantly, we suggest future research thoroughly investigate some of the findings discussed in our paper. Specifically, future research can set out to study the following questions: Why do the firms with the most intense insider buying experience negative long-term abnormal returns? Are the largest-volume insider trades driven by control motives? Do higher-ranked insiders trade on a longer-lived informational advantage than lower-ranked insiders as suggested in this paper?

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