

INSIDER TRADING AND FIRM PERFORMANCE

**DOES INSIDER TRADING REFLECT FUTURE FIRM
PERFORMANCE ON THE SWEDISH MARKET AND HOW CAN
WE INTERPRET THEIR BEHAVIOR FROM A FINANCIAL AND
REGULATORY STANDPOINT?**

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Insider Trading and Firm Performance: Does insider trading reflect future firm performance on the Swedish market and how can we interpret their behavior from a financial and regulatory standpoint?

Abstract:

We investigate whether insider trading reflects future firm performance on the Swedish market as it can assist outsiders in revising firm evaluation. The results are compared with US data to understand insider legislation efficiencies. Our findings suggest that insider trading predicts future stock performance but not future change in return on assets. Relative firm valuation may be used to interpret the insider purchase ratio but not contemporaneous stock performance or contemporaneous change in return on assets. This implies that it is possible to implement insider behavior analysis during firm evaluation, which may enable improved stability in the market environment as it mitigates asymmetric information. However, as the results also indicate that insiders base trades on superior information, it could mean that the desired effects of EU regulations are not being met. Therefore, law and finance entities may cooperatively investigate to potentially improve regulations further.

Keywords:

Insider Trading, Signaling, Firm Performance, Insider Regulations, Asymmetric Information.

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1. Introduction

This paper investigates whether insider trading signals future firm performance on the Swedish market, and if it is possible to interpret insiders' behavior to enable outside investors to take advantage of that signaling value. Furthermore, our results illuminate the European Union's regulations' effects on insider trading. Understanding how and when insiders trade may assist in establishing a connection between insider trading activity and company performance, making it ex ante possible for outside investors to use insider trading activity to better evaluate a company's situation. The research hence addresses the asymmetric information issue as investors are at an information disadvantage compared to managers and other insiders. Also, comparing the regulatory frameworks in the US and Europe may assist regulators in obtaining an understanding of efficiencies and deficiencies in the law.

We investigate two major reasons for why insiders trade stock in the issuer: 1) insiders either buy or sell stock in the issuer due to the firm's contemporaneous performance, or 2) because they possess undisclosed information about future events. The former is documented by Rozeff & Zaman (1998), who find that insider purchase transactions are positively correlated to the book-to-market ratio and negatively correlated with stock performance. They further interpret this result as insiders taking advantage of market misvaluation. These findings are consistent with those of earlier studies, which find that insider purchases increase when the firm is undervalued (Fama & French, 1992; Lakonishok, Shleifer, Vishny, 1994). Furthermore, LaPorta, Lakonishok, Shleifer & Vishny (1997) show that undervalued companies tend to have higher future stock performance returns. The latter cause of insider trading is showed by Piotroski and Roulstone (2005), who report that insiders possess undisclosed information and use it as a basis for trading decisions. They also show results similar to aforementioned studies. Additionally, Piotroski & Roulstone find that projected future increases in both earnings and stock performance are viewed by insiders as positive and increase the fraction of insider trades conducted as purchases, while increases in contemporaneous earnings and stock performance decrease the relative purchase volume. These results are interpreted as insiders basing their trading decisions on anticipated stock price reversals, which would serve as an explanation as to why prior studies show an increased insider purchase ratio when the company is undervalued. Furthermore, Ke, B., Huddart, S., Petroni, K., (2003) support these findings as they document increases in insider sales three to nine quarters before earnings breaks.

Although coherent with one another, these studies have largely been centered around the US market, where regulations differ from the European and Swedish markets. As pointed out by Ventrone (2014), the EU system embraces the parity-of-information theory to provide equal access to information for all market participants, while the fundament for the US framework is a fiduciary duty-based approach. The US approach implies that an insider must breach a fiduciary duty to be convicted for illegal insider trading, a rule non-existent in the European Union. Furthermore, US regulations are in large parts based on judicial Court rulings, which adds complexity compared to the EU's clearer regulatory formulations. With these deviating theories at the foundation of the regulatory frameworks, the EU's system provides a broader scope for who can be found liable with illegal insider trading than the US system does. In the EU, anyone can be held accountable and face criminal charges for insider dealing, whereas a breach of fiduciary duty is a requisite for conviction in the US.

As a result, the regulatory differences between these countries could imply diverging insider behavior, making it inappropriate to assume the viability of findings from these studies to a Swedish (EU) setting. Prior research conducted on the US market shows a certain insider trading behavior and conclude that insider trading has signaling value for firm performance. However, as the regulatory framework in Sweden provides a broader scope for what constitutes illegal insider trading than the US system does, our hypothesis is that insider trades in Sweden will not signal future firm performance.

To study the relation between insider trades and signaling value, a trading behavior must be identified. We thus investigate what signals insiders may base their purchases on by conducting multiple regressions on the insider purchase ratio: a measurement calculated by scaling all insider purchases for a given year by all insider purchases and sales, which reflects the current insider sentiment. The regressions test contemporaneous and one-year ahead stock performance and change in return on assets, as well as book-to-market value, as explanatory variables, as these factors have shown to guide insider purchases in previous studies. To draw conclusions regarding the EU's regulation's impact on insider trading in Sweden, it is essential that we can compare our results with prior research on signaling value of insider trades in the US. Hence, we follow the methodology and study our results in relation to Piotroski and Roulstone (2005). We gather insider transaction data between 1992 and 2016 from the Swedish Financial Supervisory Authority's PDMM register (Finansinspektionens Insynsregister) and firm data from Refinitiv EIKON. We start by testing the contemporaneous and future stock performance and return on assets' individual impact on insider trading. We then control for relative book-to-market and relative stock performance to separate firm valuation effects from performance variables' impact on insider trading behavior. To be able to compare the variable's magnitudes against each other, they are subsequently standardized. Finally, we conduct robustness checks to investigate potential reverse cause-effect relationships.

Simple regressions on future stock performance and return on assets show that the insider purchase ratio is higher when the future performance is high. When testing for contemporaneous firm performance, results show that the insider purchase ratio is higher when the contemporaneous performance is low. These results concur with prior studies conducted by Piotroski and Roulstone (2005) and imply that insiders tend to purchase more stock, or sell less stock, in anticipation of positive future firm performance, and vice versa. Furthermore, insiders are unwilling to purchase stock when it is expensive, generated by positive stock and return on asset performance, which explains why the purchase ratio is low during positive contemporaneous performance.

When controlling for relative firm valuation and stock performance in multiple regression models, we find similar results. We see that high (low) relative firm valuation is linked to a lower (higher) insider purchase ratio, again suggesting that insiders do not want to invest in highly valued firms. Using standardized variables, we see that stock performance has the greatest impact among performance variables on the insider purchase ratio and has the highest explanatory value among the performance variables. In contrast, future and contemporaneous return on assets is shown to have a small impact on insider transaction decisions. Only future stock performance and relative firm valuation show conclusive evidence in influencing insider trading.

When studying for reverse-causality effects, we finally observe that insider behavior mainly predicts future stock performance. The insider purchase ratio is therefore both explained by, and explain, future stock performance. Contemporaneous and future return on assets both have high magnitudes and have statistically significant explanatory value on future stock return. These are however not explained by the insider purchase ratio.

Our research addresses the information asymmetry dilemma by allowing outsiders to revise firm evaluation accuracy by incorporating insider trading behavior in their analysis. Our findings imply that insider trading predicts future stock performance, and that relative firm valuation may be used to interpret the insider purchase ratio. Future and contemporaneous change in return on assets and contemporaneous stock performance may however not be used in the analysis. Our results may assist regulators in understanding the implications of insider trading legislations, which can lead to improvements to reach the desired regulatory effects. Moreover, our observations indicate that there may be flaws in the regulatory framework in the EU, as insiders show an ability to utilize superior information to make investment decisions. Comparison with US legislation may further aid in bringing the regions' legislations closer together. Furthermore, incorporation of insider trading in firm evaluations and an understanding of the outcome of legislation may improve fairness and stability in the market environment in the EU.

2. Literature Review

The main inspirations for this thesis, from which we draw parts of the methodology and research design, are Piotroski and Roulstone's (2005) as well as Seyhun's (1992) papers. Piotroski and Roulstone evaluate the sources on which insider trades are based and how these trades relate to company performance. However, their paper examines these relations on the US market, whereas our paper focuses on the Swedish market. For comparability purposes, the uses of different variables from Piotroski & Roulstone and Seyhun have largely been replicated and applied in our regression models. Some variables, however, depend on local factors which differ from Piotroski & Roulstone, such as using OMX Stockholm PI for relevant market adjustment when measuring market adjusted stock performance. Moreover, while the methodology is most similar to that used by Piotroski and Roulstone and Seyhun, the fundamental framework of this thesis builds from the works of Rozeff & Zaman (1998) and LaPorta, Lakonishok, Shleifer & Vishny (1997). Rozeff and Zaman lay out the hypothesis, and show, that insider trades are correlated to book-to-market value, thus sparking the idea that insiders trade based on market misvaluation, while LaPorta et al. incorporate future performance into their analysis and interpret the results as insiders trading based on superior information. Piotroski and Roulstone subsequently expand on this framework, as do we, although in a different manner; our research concerns the Swedish market, rather than the US market.

Although it has been shown in prior research that insider trading does signal firm performance in the US market, it may not be true in Sweden and Europe due to the different regulatory frameworks. Our paper thus contributes to the literature by generating an understanding of insider trading behavior in Sweden, which may reduce information asymmetries on the Swedish and European financial markets. As insiders have superior knowledge compared to outside investors, their trading behavior may help outsiders obtain a better understanding of a firm's true value, which generates more accurate firm valuations and therefore more stability on the financial markets. Additionally, studying and understanding insider trading behavior may also assist regulators in understanding efficiencies and deficiencies in the regulatory frameworks.

3. Comparing US and European Insider Trading Regulations

The current regulatory framework controlling insider trading in Sweden, which applies the European Union's framework, is the market abuse regulation (Mar 596/2014), implemented in Sweden in 2016. This replaced the older market abuse directive (MAD) (Swedish financial Supervisory Authority, 2016). In the US, no specific law prohibits or defines insider trading directly, instead insider trading prohibitions have been formed by judicial interpretation of the Securities Exchange Act of 1934. Today there are several regulations and acts which collectively constitute the insider trading regulations in the US (Greene & Schmid, 2013). The provisions most relevant to our research are section 10(b), section 16(b), and rule 10b5-1 of the Exchange Act of 1934, as we believe they highlight differences between the US's and the EU's regulatory frameworks.

The definition of an insider is largely similar under the EU's and the US's regulations. In Mar (596/2014), an insider is defined as someone who discharges managerial responsibilities and to them closely associated persons. This means officers, directors, and others discharging a managerial responsibility in the issuer. Up until 2016, major shareholders owning more than 10% of company stock were also considered insiders, this definition was, however, repealed with the new Mar (596/2014) regulation's coming into force (Swedish Financial Supervisory Authority, 2016). In the US, the SEC considers an insider an officer, director, 10% stockholder, or anyone else in possession of material non-disclosed information which springs from their relationship to the company (SEC's EDGAR Database, 2015, Ex. 99.4).¹ The difference is thus that 10% stockholders are considered insiders in the US, but not in Sweden.

More fundamental deviations between the systems can be found in the underlying theories that have formed the regulatory frameworks. Ventrone (2014) highlights the implications of these different theories and states that regulations have been formed in accordance with the equal access theory in the EU whilst the US system has its foundations in a fiduciary duty-based approach. The EU regulations thus imply that everyone, outsiders included, are either to refrain from trading or disclose private information if in possession of undisclosed material information, as it aims to uphold parity-of-information between insiders and the market, in line with the equal access theory. Furthermore, US law states that only insiders are prohibited from trading in the issuer when in possession of material non-disclosed information. Ventrone

¹ Information must be material to be illegal to base trading decisions on. There are two different definitions of what should be considered material. Information must be "substantially likely to be important to the reasonable investor in making an investment decision" or "substantially likely, in the eyes of a reasonable investor, to significantly alter the total mix of information available in the market" (Ventrone, 2014).

(2014) means that this distinction implicates differences in how the laws are interpreted, which has made the US system develop in a direction deviating from the European union's system. A telling illustration of this can be found in the *US v. Chiarella* trial in 1980, in which the Court ruled that the defendant, convicted for illegal insider trading under rule 10b-5, could not be found liable for his charges as no fiduciary duty had been breached (*US v. Chiarella*, 1980).² In the European Union it is sufficient that anyone trades on information that has not yet been made public and is material for a conviction to take place. The ruling in *US v. Chiarella* (1980) has thus, according to Ventoruzzo (2014), added complexity to the US system. The scope of who can be found liable with illegal insider trading would be smaller in the United States than in the European Union, as a breach of fiduciary duty must be proven to prosecute an individual in the United States.

This difference is further emphasized by U.S. District Judge Jed Rakoff of Southern District of New York City. In an interview with *Forbes* in 2017, he states that the "U.S. is falling behind Europe on insider-trading law because it hasn't figured out what the law is supposed to accomplish". Rakoff suggests that the laws build upon fundamentally different intentions and claims that the EU regulations are more focused on fostering fair markets whilst the US system focuses more on the ability to prosecute illegal insider trades. According to him, criminal prosecution of insider trading is rare in Europe. Rakoff states that the reason for the US system falling behind the European Union's is "judge-made law" being applied, as opposed to "a meaningful, straightforward ban on insider trading".

Moreover, other significant provisions, that separate the two regulations further, have been adopted in the US. One which stands unparalleled in the European system and could imply differing insider behavior is the short swing rule, under section 16(b) of the Exchange Act of 1934. Stating that any realized profits resulting from a purchase followed by a sale by an insider, or vice versa, is to be paid back to the company if the two transactions are within six months apart (SEC's EDGAR Database, 2015, Ex. 99.4), the rule could possibly affect the way insiders behave.

In summary, the major differences that might affect our results is that the US system is more complex and that the scope for who can be found liable for illegal insider trading is smaller than in the EU. Due to the seemingly different regulations between the EU and the US, results found in the US may not be viable in Sweden, thus making it inappropriate to assume that results from previous research reflect insiders' behavior in Sweden. We furthermore believe that the European system prohibits insiders from trading on inside information and that we will observe that insider trades have no signaling value for firm performance.

² The person owing a fiduciary duty to someone else, the principal, must act to further the principal's interests (Legal Information Institute, 2022). A fiduciary relationship arises, for instance, between a corporate officer and a stockholder.

4. Methodology

4.1. Model and variable timing

Our model utilizes the framework of Piotroski & Roulstone (2005), where both contemporaneous and future variables are evaluated. We investigate an insider purchase ratio ($IPR_{i,t}$) for a given firm at year t , which is seen as the base year in our model. This variable is then related to contemporaneous variables and future variables. The contemporaneous variables occur the same year as the insider purchase ratio, and are denoted with a t . These consist of the firm's relative equity valuation ($FV_{i,t}$), the earnings change ($\Delta ROA_{i,t}$) and the market adjusted stock performance ($SP_{i,t}$). The future variables are measured the year after the insider trades occur and are denoted with a $t+1$. These are assumed to reflect insiders' forecasts at year t and constitute the earnings change ($\Delta ROA_{i,t+1}$) and the market adjusted stock performance ($SP_{i,t+1}$).

Figure 1

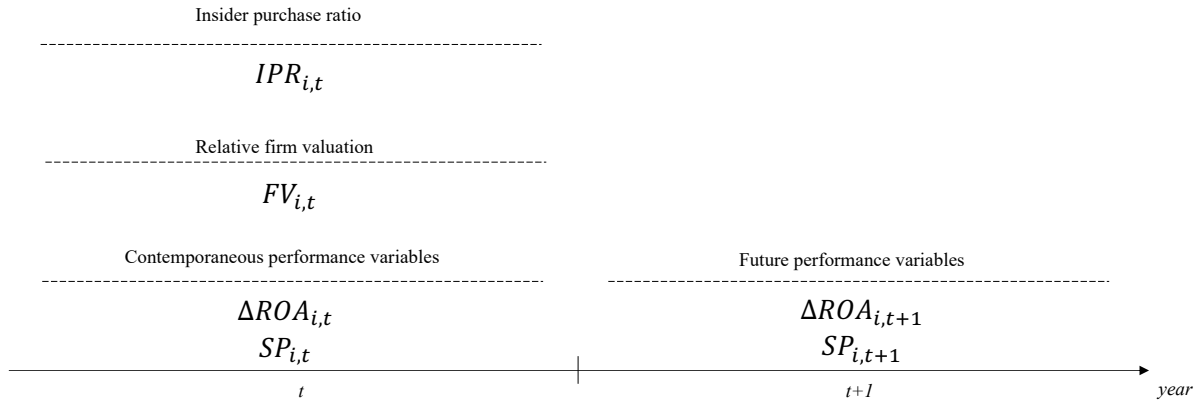


Fig. 1. Timeline of the model. The year of the insider purchases, $IPR_{i,t}$, is seen as the base year, denoted with a t . Each insider purchase ratio observation is linked to a certain year and company. Future and contemporaneous performance variables, as well as a contemporaneous relative valuation variable are matched for each insider purchase ratio observation. The contemporaneous variables $\Delta ROA_{i,t}$, $SP_{i,t}$, and $FV_{i,t}$ pertain to the base year. The future variables $\Delta ROA_{i,t+1}$ and $SP_{i,t+1}$ pertain to the subsequent year. The model derives from the model utilized by Piotroski & Roulstone (2005).

4.2. Insider purchase ratio

The insider behavior is studied through insiders' transactions in their own firm. An insider purchase ratio is calculated, and represents the aggregate volume of shares purchased by insiders divided by the total number of shares traded by insiders for a given firm i and year t ,

$$IPR_{i,t} = \frac{BUY_{i,t}}{BUY_{i,t} + SELL_{i,t}}$$

where $BUY_{i,t}$ ($SELL_{i,t}$) equals the number of shares purchased (sold). Looking at insiders' purchases as a ratio sheds light on the contemporary insider sentiment at a particular year, which proves useful as each purchase ratio is matched with performance variables of the corresponding firm and year.

4.3. Performance variables

We use return on assets and stock performance as a proxy for firm performance. Earnings affect companies' stock price as well as insiders' and investors' inclination to make transactions. As possessors of private information, insiders gain an advantage over other investors before such information is announced to the public. Following Piotroski and Roulstone (2005), we define the variable ΔROA_{t+1} for measuring earnings that occur the year after the insider purchases, year $t+1$. The change in ROA is calculated by subtracting the previous year's figure from the next year's figure.

$$\Delta ROA_{i,t+1} = ROA_{i,t+1} - ROA_{i,t}$$

Return on assets is interpreted as a proxy for changes in earnings which is a fundamental driving factor for stock price. Contemporaneous earnings ($\Delta ROA_{i,t}$) is calculated in the same way but one year prior.

Insiders' information advantage lays in having disclosed firm information before market participants. However, stock performance is affected by a multitude of factors beyond firm specific information, which may create a discrepancy between return on assets and stock performance. As investors aim to obtain profits, stock performance is the other performance variable our paper studies. Stock performance for year $t+1$ is defined as SP_{t+1} and is measured as the 12-month buy-and-hold return of a company's stock the year after the observed insider transactions. The return is then benchmarked against an appropriate market index—OMX Stockholm PI, comprising all Swedish listed companies—to gain insight on how the stock performs relative to the market portfolio. Contemporaneous market adjusted stock return (SP_t) is measured in the same way but using numbers from one year prior.

$$SP_{i,t+1} = \text{Stock performance}_{i,t+1} - r_{m,t+1}$$

4.4 Valuation variables

Prior literature has shown that insiders do not only trade on information regarding future performance, but also on market misvaluation (Piotroski & Roulstone, 2005) (Rozeff & Zaman, 1998). Thus, we control insider transactions for valuation effects. This will aid in observing the actual effect the performance variables have on the insider purchase ratio. We follow Piotroski and Roulstone (2005) and gather data on the relative equity valuation for each firm and year in which insider transactions have occurred. Relative equity valuation is measured as the book-to-market ratio, that is, book value of equity divided by market capitalization.

$$FV_{i,t} = \frac{\text{Book Value}_{i,t}}{\text{Market value}_{i,t}}$$

4.5. Variable treatment

Variables are treated differently in different regressions depending on the assumptions of how insiders make investment decisions. Firstly, they are treated either as continuous or discrete. Secondly, a discrete variable can either be absolute or relative, while a continuous variable can only be absolute. Discrete variables assume that insiders only care if the performance is positive or negative, hence disregarding the magnitude. All discrete variables therefore assume a value of 1 if a specific firm-year observation is in the interval it indicates, and 0 otherwise. If a

discrete variable is absolute, it is assumed that insiders care about the individual firm's absolute performance, without comparing the performance with other firms. The discrete absolute variables utilized are $PSP_{i,t}$, $PROA_{i,t}$, $PSP_{i,t+1}$ and $PROA_{i,t+1}$. $PSP_{i,t}$ and $PSP_{i,t+1}$ represent positive market adjusted stock return contemporaneously and one-year ahead, respectively, and $PROA_{i,t}$ and $PROA_{i,t+1}$ represent positive return on assets contemporaneously and one-year ahead, respectively.

Figure 2

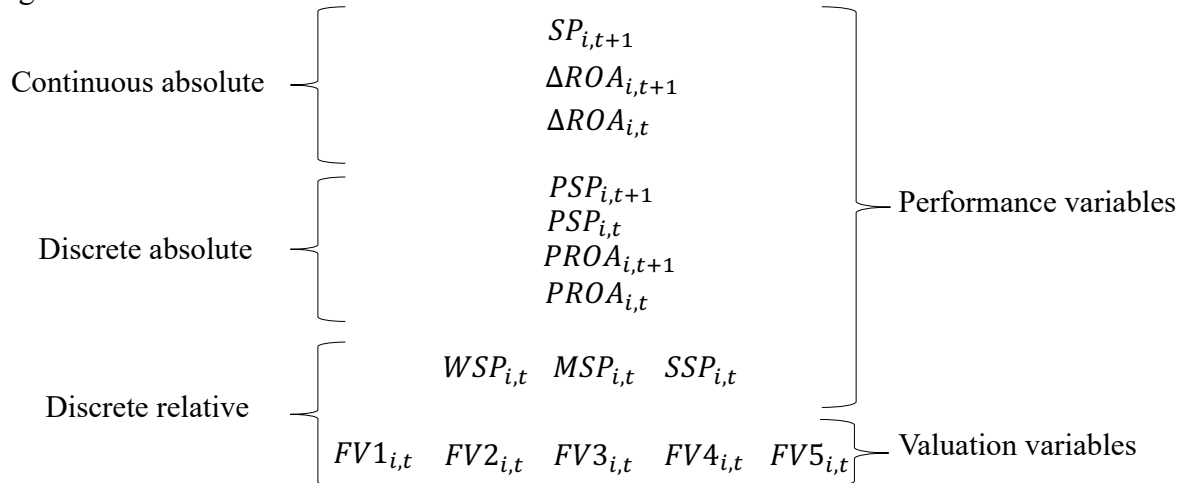


Fig. 2. Variable treatment. Variables are divided into different classifications: continuous absolute variables, discrete absolute variables, and discrete relative variables. The performance variables $SP_{i,t+1}$, $\Delta ROA_{i,t}$, and $\Delta ROA_{i,t+1}$ are continuous variables describing future stock performance, contemporaneous change in return on assets, and future change in return on assets, respectively. $PSP_{i,t+1}$, $PROA_{i,t}$, and $PROA_{i,t+1}$ are the discrete variable names for the same variables. $WSP_{i,t}$, $MSP_{i,t}$, and $SSP_{i,t}$ are discrete relative treatments of the discrete absolute variable $PSP_{i,t}$, describing contemporaneous stock performance. $FV1_{i,t}$, $FV2_{i,t}$, $FV3_{i,t}$, $FV4_{i,t}$, and $FV5_{i,t}$ are discrete relative variables describing the relative firm valuation.

If a discrete variable is relative, it is assumed that insiders compare the variable values between firms. These are therefore ranked and split into quantiles. The discrete relative variables are derived from $FV_{i,t}$ and SP_t . $FV1_{i,t}$, $FV2_{i,t}$, $FV3_{i,t}$, $FV4_{i,t}$, and $FV5_{i,t}$ are contemporaneous firm valuation variables representing different quintiles derived from firms' book-to-market ratios relative to other firms. $FV1_{i,t}$ corresponds to the book-to-market ratio in the bottom 20 percent, hence representing highly valued firms relative to other firms in the sample, whereas $FV5_{i,t}$ represents undervalued firms. Contemporaneous market adjusted stock performance SP_t is divided into terciles, using $WSP_{i,t}$, $MSP_{i,t}$, and $SSP_{i,t}$ for each 33-percentage point interval. Weak stock performance, $WSP_{i,t}$, therefore represent when a firm has weak contemporaneous stock performance relative to other firms in the sample, whilst $SSP_{i,t}$ represents a strong stock performance. Continuous variables are used when insiders are assumed to take the magnitude of a variable into account. These are always treated absolutely in the models and consist of $SP_{i,t+1}$, $\Delta ROA_{i,t+1}$ and $\Delta ROA_{i,t}$, meaning that they assume the value of the actual performance.

4.6. Sample characteristics

Table 1 describes the composition of the data sample. Insider transactions data was obtained from the Swedish Financial Supervisory Authority's (Finansinspektionen) PDMR transactions register; the financial data was gathered from Refinitiv EIKON's database. All data is winsorized at the 98% level. The sample consists of 1 408 firm-year observations, distributed among 175 companies. Panel A shows the distribution among firm-year observations between

positive and negative future stock returns, future change in return on assets and contemporaneous change in return on assets, in total and divided by relative firm valuation. Panel B describes descriptive statistics of key variables utilized in the sample.

Table 1
Descriptive Statistics

Panel A: Firm-year observation performance distribution							
		Glamour				Value	
	Observations	FV1	FV2	FV3	FV4	FV5	
Unconditional	1 408	292 (21%)	274 (20%)	277 (20%)	274 (19%)	291 (21%)	
<i>Conditional on future stock return</i>							
$SP_{i,t+1} > 0$	716 (51%)	129 (44%)	136 (50%)	143 (52%)	143 (52%)	165 (57%)	
$SP_{i,t+1} \leq 0$	692 (49%)	163 (56%)	138 (50%)	134 (48%)	131 (48%)	126 (43%)	
<i>Conditional on future return on assets</i>							
$\Delta ROA_{i,t+1} > 0$	720 (51%)	143 (49%)	134 (49%)	145 (52%)	150 (55%)	148 (51%)	
$\Delta ROA_{i,t+1} \leq 0$	688 (49%)	149 (51%)	140 (51%)	132 (48%)	124 (45%)	143 (49%)	
<i>Conditional on contemporaneous return on assets</i>							
$\Delta ROA_{i,t} > 0$	748 (53%)	147 (50%)	144 (53%)	151 (55%)	152 (55%)	154 (53%)	
$\Delta ROA_{i,t} \leq 0$	660 (47%)	145 (50%)	130 (47%)	126 (45%)	122 (45%)	137 (47%)	
Panel B: Descriptive Statistics							
	Mean	Std. Dev.	5th Pctl	25th Pctl	Median	75th Pctl	95th Pctl
IPRt	0.610	0.393	0.000	0.213	0.715	1.000	1.000
FVt	0.403	0.520	-0.170	0.070	0.232	0.629	1.477
SPt+1	0.043	0.325	-0.474	-0.182	0.006	0.228	0.792
ROAt+1	0.047	0.370	-0.192	0.010	0.063	0.115	0.268
$\Delta ROAt+1$	-0.002	0.106	-0.165	-0.034	0.001	0.031	0.142

Table 1 shows observation distribution and descriptive statistics of the key variables utilized in the paper, the observations originating from the Swedish market between 1992 and 2016.

Panel A indicates that the distribution between total firm-year observations having positive or negative performance variables is approximately even. There is however a minor skewness towards positive returns in all performance variables in the data, which contrasts Piotroski and Roulstone (2005) who observe that the majority of firms show poor future stock performance. When comparing the positive performances across the firm valuation quintiles, we see that the percentage of well performing firms increases from $FV1_{i,t}$ to $FV5_{i,t}$ for all variables, $FV5_{i,t}$ for the ROA variables being an exception. The opposite is true for negative performance. When comparing positive against negative performance in $FV5_{i,t}$, we observe that there are more firms performing well than poor for all variables. The opposite is true for the future variables in $FV1_{i,t}$, which is in line with findings of Piotroski and Roulstone (2005) and Fama and French (1992, 1995).

Panel B shows that the average insider purchase ratio in the sample is 61%, meaning that the majority of transactions conducted by insiders are purchases, which is the opposite of the findings of Piotroski and Roulstone (2005). The median of 0.715 tells us that half of the observed transactions consists of at least 71.5% purchases. Furthermore, we observe that approximately half of the firms have a negative change in return on assets (median is 0.1%), although the mean is negative. Market adjusted stock return has a mean of 4.3%, which can be considered a high number given that it beats index with this magnitude, however, with a median of 0.6%, only approximately half of the firms beat index.

5. Results

5.1. Relationship between insider trading and firm performance

Table 2 presents four simple linear regressions of insider purchase ratios and firm performance, derived from the following equation:

$$IPR_{i,t} = \beta_0 + \beta_1[INDEPENDENT VARIABLE] + \varepsilon_{i,t}$$

The four estimates are presented in the table, where [INDEPENDENT VARIABLE] is replaced with $PSP_{i,t}$, $PROA_{i,t}$, $PSP_{i,t+1}$ and $PROA_{i,t+1}$ respectively. The numbers in the table represent the insider purchase ratio during positive or negative variable performance.

Table 2

Insider purchase ratio explained by one binary performance variable in four simple linear regressions

Time Period	Contemporaneous		Future	
Dependent Variable	PSP_t	$PROA_t$	PSP_{t+1}	$PROA_{t+1}$
Estimate	(1)	(2)	(3)	(4)
Positive	0.604	0.601	0.64**	0.623
Negative	0.617***	0.621***	0.580***	0.597***
Difference (<i>t</i> -statistic)	-0.013	-0.019	0.060**	0.026

Table 2 incorporates four simple linear regressions based on the following model:

$$IPR_{i,t} = \beta_0 + \beta_1[INDEPENDENT VARIABLE] + \varepsilon_{i,t}$$

The independent variable is a discrete firm performance variable which assumes a value of 1 if the firm performance has been higher compared to the previous year ("Positive"), zero if it has been lower ("Negative"). "Negative" therefore represents β_0 and $\varepsilon_{i,t}$, whilst "Difference" represents β_1 . The independent variables measure market-adjusted stock performance and return on assets during a contemporaneous or future time perspective. One, two and three stars (*) represent significance at the 5%, 1% and 0.1% level, respectively. The regressions are based on 1408 firm-year observations between 1992-2016 in Sweden.

Estimate (1) and (2) show results that are in line with prior research conducted by Piotroski and Roulstone (2005) and Seyhun (1992). The insider purchase ratio is higher during negative contemporaneous firm performance than when contemporaneous performance is positive. The difference is somewhat higher when tested against ROA than stock return. The inverse correlation is true and in line with prior research when testing for future firm performance. In this case, the difference between positive and negative performance is significantly higher for

future stock performance than for future return on assets. All regressions' intercepts show significance at the 0.1 percent level as well as the future stock performance variable from a two-tailed two sample *t*-test of means.

5.2. Relationship between insider trading, firm valuation and firm performance

Firm valuation is another factor which may affect insider trading, as insiders may purchase (sell) stock based on beliefs of under- or overvaluation, a factor the preceding test did not incorporate. To test for these, we apply the methodology utilized by Piotroski and Roulstone (2005) and Seyhun (1992) and estimate coefficients by conducting a cross-sectional multiple regression. Using this methodology is vital because it allows us to compare our results with prior research to draw conclusions regarding the different regulations in the US and Sweden.

The following multiple regression model acts as a basis for the regressions in Table 3 Panel A and intends to test the relationship between insider purchase ratios, firm performance, and firm valuation, when insiders are assumed not to consider the magnitude of the performance:

$$IPR_{i,t} = \beta_0 + \beta_1 PSP_{i,t+1} + \beta_2 PROA_{i,t+1} + \beta_3 PROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

In Panel B of Table 3, the discrete absolute performance variables are instead treated as continuous variables. The model hence assumes that insiders base their purchase decisions on the magnitude of the performance indicators instead of focusing on if the performance was just positive or negative. The base model is derived from the following equation:

$$IPR_{i,t} = \beta_0 + \beta_1 SP_{i,t+1} + \beta_2 \Delta ROA_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

From the equations, five different multiple regression estimates are generated for each panel, as presented in Table 3. Estimate (1) measures relative firm valuation and relative stock performance impact on insider trading. It hence assumes that insiders only study their firm's relative valuation and relative contemporaneous stock performance when making transaction decisions. Estimate (2)-(4) build on the previous model but add firm performance variables' individual impact on insider trading. They therefore add the assumption that insiders base the purchase decision on how the firm performs with respect to each performance variable individually. Estimate (5) incorporates the full model and all variables, therefore assuming insiders take future stock performance, future return on assets, contemporaneous return on assets, relative firm valuation, and relative stock performance into consideration when making a transaction.

Table 3

Insider purchase ratio explained by relative book-to-market quintiles, relative stock return terciles and performance variables in ten cross-sectional regression estimates

Panel A: Performance variables are discrete absolute						
Estimate		(1)	(2)	(3)	(4)	(5)
Discrete Absolute Variables	Discrete Relative Variables					
	Intercept	0.685***	0.655***	0.672***	0.693***	0.658***
	FV1 _t	-0.116***	-0.109***	-0.115***	-0.117***	-0.109***
	FV2 _t	-0.110***	-0.105**	-0.109**	-0.111***	-0.105**
	FV3 _t	-0.082*	-0.078*	-0.082*	-0.082*	-0.079*
	FV4 _t	-0.082*	-0.079*	-0.083*	-0.082*	-0.079*
	SSP _t	-0.002	-0.008	-0.004	0.004	-0.004
	MSP _t	0.012	0.010	0.011	0.014	0.011
	PSP _{t+1}	-	0.055**	-	-	0.053*
	PROA _{t+1}	-	-	0.026	-	0.014
PROA _t	-	-	-	-0.020	-0.019	
Average adj. R^2		0.008	0.012	0.008	0.007	0.011
p -value		0.011	0.001	0.011	0.014	0.003
Panel B: Performance variables are continuous						
Estimate		(1)	(2)	(3)	(4)	(5)
Continuous Variables	Discrete Relative Variables					
	Intercept	0.685***	0.678***	0.686***	0.683***	0.676***
	FV1 _t	-0.116***	-0.108***	-0.117***	-0.115***	-0.108***
	FV2 _t	-0.110***	-0.110***	-0.110***	-0.110***	-0.110***
	FV3 _t	-0.082*	-0.081*	-0.083*	-0.081*	-0.081*
	FV4 _t	-0.082*	-0.080*	-0.083*	-0.082*	-0.081*
	SSP _t	-0.002	-0.005	-0.002	0.003	0.000
	MSP _t	0.012	0.013	0.011	0.014	0.014
	SP _{t+1}	-	0.084***	-	-	0.084**
	Δ ROA _{t+1}	-	-	0.089	-	0.006
Δ ROA _t	-	-	-	-0.110	-0.109	
Average adj. R^2		0.008	0.015	0.007	0.008	0.014
p -value		0.011	0.000	0.015	0.012	0.001

Panel A: Presents coefficients from 5 individual cross-sectional regressions utilizing the following model:

$$IPR_{i,t} = \beta_0 + \beta_1 PSP_{i,t+1} + \beta_2 PROA_{i,t+1} + \beta_3 PROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

Estimate (1) solely tests the discrete relative variables, Estimate (2)-(4) separately test the discrete absolute performance variables $PSP_{i,t+1}$, $PROA_{i,t+1}$ and $PROA_{i,t}$, respectively, and Estimate (5) utilizes the full regression model.

Panel B: Presents coefficients from 5 individual cross-sectional regressions utilizing the following model:

$$IPR_{i,t} = \beta_0 + \beta_1 SP_{i,t+1} + \beta_2 \Delta ROA_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

Estimate (1) solely tests the discrete relative variables, Estimate (2)-(4) separately test the continuous performance variables $SP_{i,t+1}$, $\Delta ROA_{i,t+1}$ and $\Delta ROA_{i,t}$, respectively, and Estimate (5) utilizes the full regression model.

One, two and three stars (*) represent significance at the 5%, 1% and 0.1% level, respectively. The regressions are based on 1408 firm-year observations between 1992-2016 in Sweden, winsorizing the data at the 98% level.

Overall, the results in Table 3 show that the mean insider purchase ratio is around 67% for firms having a low relative firm valuation and weak relative stock performance, as seen in the intercept. This is around 6 percentage points higher than the sample mean insider purchase ratio observed in Table 1 Panel B. An observation consistent in all results is that when a firm is classified in another valuation quintile than $FV5_{i,t}$, i.e. becomes more highly valued, the insider purchase ratio decreases. This is in line with previous studies. However, the results produced by Piotroski and Roulstone (2005) show that the relative firm valuation has a stronger negative impact on the insider purchase ratio than does our data. Another conflicting general observation is that when a firm has moderate relative stock performance, the purchase ratio is the highest relative to the other terciles in our results. The precedent study observes that weak relative stock performance relates to the highest purchase ratio among the terciles.

Results from Panel A Estimate (2) and (3) imply that there is a positive effect on insider purchases when future firm performance is positive. The insider purchase ratio increases with 5.5 and 2.6 percentage points, respectively, when a firm has positive future stock performance or future return on assets. However, Estimate (4) shows that when a firm has positive contemporaneous return on assets, the insider purchase ratio decreases with 2.0 percentage points, indicating that strong operative performance this year decreases insiders' inclination to purchase company stock. Estimate (5) largely concurs with these results, only showing a significant deviation in magnitude for future return on assets which approximately decreases with 50% compared to Estimate (4).

From Panel B in Table 3 the results mostly show similar patterns. A one percentage point increase in future stock performance increases the insider purchase ratio with 0.084 percentage points in both Estimate (2) and (5). Future return on assets also shows a positive relationship with the insider purchase ratio, however, the magnitude greatly differs between Estimate (3) and (5), showing that an increase in one percentage point raises the insider purchase ratio with 0.089 and 0.006 percentage points, respectively. Lastly, the contemporaneous return on assets is suggested to have a negative impact, the purchase ratio decreasing with 0.110 and 0.109 percentage units for each percentage unit increase in Estimate (4) and (5), respectively.

Finally, all regression estimates show a significance level around 1%. Studying the individual variables, the relative firm valuation shows significance levels between 5% and 0.1% but the relative stock performance shows no significance. Among the performance variables, only future stock performance show significance at the 5% and 1% levels in Panel A, and at the 1% and 0.1% levels in Panel B. In terms of explanatory power, all regressions explain around 1% of insider purchase ratios.

5.3. Relationship between insider trading, firm performance and firm valuation using standardized variables

To compare the impact of stock performance and return on assets on the insider purchase ratio with each other, we standardize the regression model from table 3 Panel B by log-transforming the data values using natural logarithms. Thus, the same multiple regression model as is used in Table 3 Panel B constitutes the basis for the regressions in Table 4:

$$IPR_{i,t} = \beta_0 + \beta_1 SP_{i,t+1} + \beta_2 \Delta ROA_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

The estimates in table 4 portray the same scenarios as table 3: Estimate (1) incorporates only the firm valuation and contemporaneous stock performance, Estimate (2)-(4) regress the performance variables' individual impact, and Estimate (5) utilizes the full model.

Table 4

Insider purchase ratio explained by standardized relative book-to-market quintiles, relative stock return terciles and continuous performance variables in five cross-sectional regression

	Estimate	(1)	(2)	(3)	(4)	(5)
Discrete Relative Variables	Intercept	0.685***	0.686***	0.687***	0.682***	0.684***
	FV1 _t	-0.116***	-0.107***	-0.117***	-0.115***	-0.107**
	FV2 _t	-0.110***	-0.108**	-0.111***	-0.110***	-0.109**
	FV3 _t	-0.082*	-0.081*	-0.083*	-0.082*	-0.081*
	FV4 _t	-0.082*	-0.081*	-0.083*	-0.082*	-0.081*
	SSP _t	-0.002	-0.008	-0.003	0.003	-0.004
	MSP _t	0.012	0.009	0.011	0.014	0.011
Continuous Variables	SP _{t+1}	-	0.091**	-	-	0.089**
	ΔROA _{t+1}	-	-	0.106	-	0.024
	ΔROA _t	-	-	-	-0.093	-0.085
	Average adj. R Square	0.008	0.014	0.008	0.008	0.014
	<i>p-value</i>	0.011	0.000	0.012	0.014	0.001

Table 4 tests insider purchase ratio using log-transformed variables, based on the following cross-sectional multiple regression model:

$$IPR_{i,t} = \beta_0 + \beta_1 SP_{i,t+1} + \beta_2 \Delta ROA_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

Estimate (1) solely tests the discrete relative variables, Estimate (2)-(4) separately test the continuous firm performance variables $SP_{i,t+1}$, $\Delta ROA_{i,t+1}$ and $\Delta ROA_{i,t}$, respectively, and Estimate (5) utilizes the full regression model. One, two and three stars (*) represent significance at the 5%, 1% and 0.1% level, respectively. The regressions are based on 1408 firm-year observations between 1992-2016 in Sweden, winsorizing the data at the 98% level and standardizing it utilizing the natural logarithm.

Table 4 shows results similar to Table 3, with a mean insider purchase ratio around 67% for firms having a low relative firm valuation and weak relative stock performance. Firm overvaluation is also suggested to affect the insider purchase ratio negatively; if classified in another valuation quintile than FV5_t, the insider purchase ratio decreases. Firms with moderate relative stock performance generate the highest purchase ratio relative to the other terciles. Significance levels for the regressions and variables, and explanatory power of the models are also largely similar to Table 3.

A comparison between the performance variables shows that future return on assets has the largest impact among the individual performance regressions (Estimate (2)-(4)). A one percentage point increase in future return on assets corresponds to 0.106 percentage point increase in the insider purchase ratio. In the full regression model, Estimate (5), the future stock performance has the largest impact among the performance variables, with a coefficient of 0.089. Contemporaneous return on assets has a negative impact on the insider purchase ratio.

6. Robustness Tests

6.1. Firm performance variables explained by net insider purchases

We perform two robustness tests, exchanging the dependent variable with performance variables to check for any reverse cause and effect relationships between the insider purchase ratio and the independent variables. The two tests were conducted both in the regular data sample and the standardized data sample. These are displayed in Table 5 Panel A and Panel B, respectively.

The first test investigates stock performance as the dependent variable. Previous models have assumed that insiders base their investment decisions on the firm's stock performance. However, the stock performance may be triggered by insiders themselves, the rationale being that outside investors could base their trades on insiders' investment behavior. This trading behavior could therefore put pressure on the stock price. This test thus assumes that future stock performance is affected by the insider purchase ratio, future and contemporaneous return on assets, relative contemporaneous firm valuation, and contemporaneous relative stock performance. The following regression model constitutes the fundament for the output figures in Table 5 Estimate (1) and (2):

$$SP_{i,t+1} = \beta_0 + \beta_1 IPR_{i,t} + \beta_2 \Delta ROA_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

The second test investigates if insider transactions have an impact on the future return on assets. The test may show if insiders' beliefs in the company can generate higher return on assets. We thus examine if future return on assets could be explained by contemporaneous insider purchases, contemporaneous return on assets, relative contemporaneous firm valuation, and relative contemporaneous stock performance. The coefficients in Table 5 Estimate (3) and (4) are derived from the following underlying model:

$$\Delta ROA_{i,t+1} = \beta_0 + \beta_1 IPR_{i,t} + \beta_2 SP_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

Estimate (1) and (3) test for the insider purchase ratios individual impact on the respective future performance variable after controlling for relative firm valuation and relative stock performance. The second estimate of each test, Estimate (2) and (4), then utilizes the full multiple regression model.

Table 5

Alternative dependent variables explained by insider purchase ratio, relative book-to-market quintiles, relative stock return terciles and continuous performance indicators in eight cross-sectional regression estimates

Panel A: Variables are regular						
Dependent Variable		SP _{t+1}		ΔROA _{t+1}		
Estimate		(1)	(2)	(3)	(4)	
Continuous Variables	Discrete Relative Variables	Intercept	0.013	0.028	-0.019*	-0.022**
		FV1 _t	-0.079*	-0.087**	0.010	0.015'
		FV2 _t	0.009	0.005	0.008	0.006
		FV3 _t	0.004	-0.004	0.012	0.011
		FV4 _t	-0.013	-0.019	0.010	0.009
		SSP _t	0.033	0.020	0.007	0.017*
		MSP _t	-0.011	-0.019	0.007	0.012
		IPR _t	0.092***	0.089**	0.007	0.000
		SP _{t+1}	-	-	-	0.044***
		ΔROA _{t+1}	-	0.696***	-	-
		ΔROA _t	-	0.185'	-	-0.248***
		Average adj. <i>R</i> ²	0.012	0.041	-0.002	0.090
		<i>p-value</i>	0.001	0.000	0.737	0.000
	Panel B: Variables are standardized					
Dependent Variable		SP _{t+1}		ΔROA _{t+1}		
Estimate		(1)	(2)	(3)	(4)	
Continuous Variables	Discrete Relative Variables	Intercept	-0.073*	-0.049	-0.029**	-0.030***
		FV1 _t	-0.084**	-0.093**	0.011	0.017*
		FV2 _t	-0.004	-0.009	0.010	0.008
		FV3 _t	-0.004	-0.013	0.012	0.012
		FV4 _t	-0.005	-0.013	0.012	0.011
		SSP _t	0.065**	0.049*	0.010	0.019**
		MSP _t	0.026	0.014	0.011	0.015*
		IPR _t	0.084**	0.080**	0.008	0.002
		SP _{t+1}	-	-	-	0.057***
		ΔROA _{t+1}	-	0.713***	-	-
		ΔROA _t	-	0.176'	-	-0.258***
		Average adj. <i>R</i> ²	0.016	0.055	0.000	0.103
		<i>p-value</i>	0.000	0.000	0.472	0.000

Table 5 presents coefficients from cross-sectional multiple regressions. The first two estimates are derived from the following model:

$$SP_{i,t+1} = \beta_0 + \beta_1 IPR_{i,t} + \beta_2 \Delta ROA_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

The second two estimates are derived from the following model:

$$\Delta ROA_{i,t+1} = \beta_0 + \beta_1 IPR_{i,t} + \beta_2 SP_{i,t+1} + \beta_3 \Delta ROA_{i,t} + \beta_4 FV1_{i,t} + \beta_5 FV2_{i,t} + \beta_6 FV3_{i,t} + \beta_7 FV4_{i,t} + \beta_8 SSP_{i,t} + \beta_9 MSP_{i,t} + \varepsilon_{i,t}$$

Estimate (1) and (3) solely tests the insiders purchase individual impact on the firm performance variable, and Estimate (2) and (4) utilize the full model. One, two and three stars (*) represent significance at the 5%, 1% and 0.1% level, respectively, a dot (.) represents significance at the 10% level. The regressions are based on 1408 firm-year observations between 1992-2016 in Sweden, winsorizing the data at the 98% level.

In Panel A, the insider purchase ratio is shown to have a positive effect on the future stock performance when tested alone in Estimate (1) and with the other performance variables in Estimate (2), displaying coefficients of 0.092 and 0.089, respectively. These results are significant at the 0.1% and 1% level and indicate that the insider purchase ratio does signal future stock performance. Furthermore, high overvaluation—being classified in FV1—is shown to be negative with regards to future stock performance, a result that also concurs with previously conducted tests. Future return on assets is suggested to have a positive correlation to the future stock performance. These observations remain true when looking at Panel B, where the future return on assets is shown to have the strongest impact on future stock performance. Comparing coefficients in Panel B with coefficients in Table 4, we see that insider purchase ratio's impact on future stock performance is approximately equal to future stock performance's impact on contemporaneous insider purchases. Estimate (1) and (2) in both Panel A and B show strong significance at more than 0.1%.

For Estimates (3) and (4) in Panel A and B, the insider purchase ratio is shown to have no or little effect on future change in return on assets. Contemporaneous change in return on assets and future stock performance are, furthermore, shown to have a strong explanatory value for $\Delta ROA_{i,t+1}$, increasing with 0.044 and decreasing with 0.248 percentage points per percentage point increase for the variables, respectively, in Estimate (4) Panel A. Moreover, contemporaneous return on assets is suggested to have the strongest impact on future return on assets; when contemporaneous earnings increase, future earnings tend to decrease.

7. Discussion

7.1. *Insiders signaling future stock performance*

Our findings show that insiders signal future stock performance, suggesting that insiders do possess, and trade based on, superior information about the firm, which contradicts our hypothesis. These results indicate that there may be flaws in the EU regulatory framework as parity of information is not upheld. The shortcoming might for instance lie in poor enforcement of applicable regulations. The findings may therefore be further investigated by legislators to understand the legal efficiency of the insider trading regulations.

Another feasible explanation of the results may be that the insider purchase ratio reflects trades which are based on collective superior hunches about the firm. It can be assumed that insiders mostly possess undisclosed information about their own department and not the whole firm, information which they refrain from trading on because of the regulations. However, they may have hunches about what is happening in the other departments. Due to their expertise of the business and involvement in the firm, these hunches may be more accurate compared to outsiders' beliefs. Given that insiders in this case have not officially received any private information which would be likely to have a significant effect on the stock price if announced, trading based on these superior hunches would be considered legal. One hunch may be faulty, but collectively, these insider trades could generate a view of the company which is superior to outsiders' beliefs. The same applies when insiders base their trades on hunches about future events within their department, but which they have no confidential information about. These theories are not, however, tested in the thesis but could be studied in future research.

When comparing our results in Table 3 with what is observed by Piotroski and Roulstone (2005), we see that future continuous stock performance in Sweden, with a coefficient of 0.084, has a significantly higher impact on the insider purchase ratio compared to in the US, which shows a coefficient value of 0.027, in Estimate (5) Panel B. With the variables being significant at the 1% and 5% levels, respectively, we can say with confidence that the difference is substantial. This illuminates the different practical implications of the regulatory environments, as the data suggests that insiders rely more heavily on superior information in Sweden than in the US. The finding goes against our initial beliefs of the EU system being more stringent than the US system. As stated by Supreme Court Justice Jed Rakoff in a Forbes magazine interview, the EU has a low number of prosecutions (Fisher, 2017). As our results indicate that insiders do possess and trade on inside information, the low number of prosecutions might be explained by ineffective ways to practically enforce the law. A feasible explanation may therefore be that the EU regulatory system is poorly enforced in practice. This is not tested in our paper, hence leaving an opportunity for legislators to conduct future research on the topic. Understanding the differences between the practical implications of the frameworks would allow legislators to take actions to harmonize regulations, which could contribute to more equal and uniform global markets.

7.2. Insiders signaling future change in return on assets

We do not find conclusive evidence that future change in return on assets is linked to insiders' trading behavior. This leaves room for several explanations. Firstly, it can be explained by the regulations in place, which suggests that insiders are not allowed to trade stock based on future change in return on assets as it is considered inside information. As we see in Table 5, change in future return on assets has a statistically significant high explanatory value on future stock performance, hence it is likely that it has a significant effect on the stock price. Insiders would therefore refrain from making a transaction if they would know what the future change in return on assets would be before the market as it is considered illegal. Trading based on future change in return on assets would hence not generate any definite profits as the market would incorporate it in the stock price, making insiders never base their trades on the metric. Hence, we do not observe any connections between insider purchases and change in future return on assets. Change in future return on assets' true impact on stock performance is however not the investigated topic in this paper.

Secondly, an economically based explanation may be that changes in return on assets is a poor measurement of firm performance. A firm may for instance take on projects with a positive net present value, which should improve the firm's performance, and make insiders prone to purchase stock. However, the process requires capital, which decreases return on assets by inflating the asset side of the ratio, making the change negative. Our models will then observe that insiders purchase stock despite the change in return on assets going down, which therefore generates a low prediction value.

Furthermore, we observe that future return on assets have a substantially stronger impact on the insider purchase ratio when comparing our results to those of Piotroski and Roulstone (2005). They find a coefficient value of 0.160 while our regression shows only 0.006 in Table 3 Panel B Estimate (5). As return on assets measures the profitability of the underlying business, it may be used for estimating firm profitability in the longer run, as compared to the stock price which is more volatile and sensitive to market news. Investors who mean to hold stock for a longer period might thus be interested in the underlying operational profitability. Our results show that insiders look to the actual stock performance, indicating that they

potentially seek short term profits. However, in the US, insiders are subject to a rule under section 16(b) in the Exchange Act of 1934, commonly called the short-swing rule, stipulating that any investment position taken by insiders in the issuer must be held for at least six months. Failure to act accordingly will result in the proceeds from the investment being given back to the company (SEC's EDGAR Database, 2015, Ex. 99.4). This means insiders in the US have an additional incentive to trade for long term gains and explains the results from prior studies, while insiders in Sweden may trade for short term profits, which is what we observe.

7.3. Contemporaneous performance explaining insider purchase ratio

Our results imply that insider purchases are high when the contemporaneous relative stock performance is low, which could be interpreted as insiders seeking to purchase stock when it is cheap. We also observe that the insider purchase ratio is low when firm valuation is high, which can be understood as insiders not being interested in purchasing stock in overvalued firms. Instead, they want to purchase low valued firms, a result we also observe from the regressions. These conclusions are consistent with what Piotroski and Roulstone (2005) state. However, relative contemporaneous stock performance does not show a conclusive impact on the insider purchase ratio, but relative contemporaneous firm performance does. Using the relative firm valuation, investors can evaluate whether a price is feasible or if they should invest in another company. Relative stock performance does not reflect this and may be misleading because it may not be connected to the firm's fundamental value.

Positive contemporaneous return on assets also seems to have a negative impact on the insider purchase ratio. Given that the future change in return on assets correlates strongly with future stock performance, the contemporaneous variables should as well. Hence, the negative impact can be understood as insiders not wanting to purchase expensive stock. However, the contemporaneous return on assets neither has explanatory value on the insider purchase ratio, and plausible explanations might correspond with those discussed for changes in future return on assets. In comparison, Piotroski and Roulstone (2005) neither find that change in return on assets have explanatory value on insider purchases.

7.4. Practical application

Applying the results practically, it may be possible for outsiders to utilize insider purchase ratios to predict firms' stock performance. This is possible by comparing the contemporaneous insider purchase ratio and compare it to the company's historical mean purchase ratio. Our results also imply that relative firm valuation effects must be considered during the comparison. The contemporaneous purchase ratio must therefore be adjusted based on its contemporaneous relative firm valuation in comparison with its historical relative valuation. For instance, if a firm has a historical relative firm valuation matching FV2, but the relative firm valuation of today is FV5, the insider purchase ratio should be adjusted down as it is possible that insiders base their purchases merely on the attractive firm valuation, and not on future stock performance. Understanding this adjustment is vital as the insider purchase ratio otherwise may be interpreted wrongly and generate a faulty belief of future firm stock performance.

This understanding addresses the information asymmetry dilemma and may generate more accurate firm valuations. Markets will be more stabilized as participants will have another metric on which to assess firms' valuation, which is based on the individuals who possess the best knowledge about the firm. An issue that might arise if this way of analysis becomes widely established is however that insiders start trading to manipulate outsiders. This is a problem to be addressed in the future through additional analysis.

6.5. Limitations and further research

The chosen time span of our paper imposes limitations in the conclusions we can make. Our paper observe data over a large time span, 1992-2016, which may generate different insider behaviors because of changing regulations. Furthermore, our sample size should ideally be larger to obtain more reliable results and maybe higher significance. Moreover, because the data does not include the last five years, in which the Mar (596/2014) framework has been implemented, one could potentially obtain different results if conducting the same tests for a period closer to the present. A similar problem arises as Piotroski and Roulstone (2005) studied data between only 1992 and 1999. Therefore, regulation differences' impact on insider transaction behavior between the US and the EU may be disparate today. This leaves room for future investigations.

Furthermore, the lack of research investigating insider transactions in the US also limits our paper's ability to compare our results with multiple sources. We measure our findings solely with those of Piotroski and Roulstone (2005), which increases the risk of mistakes in the papers not being discovered and adjusted for, leading to the comparison not generating an accurate representation of reality.

Moreover, the choice of using return on assets as a proxy for firm performance is another limitation we observe. A more valid proxy for firm performance ought to be more closely connected to stock performance. Examples would be growth (in for instance revenues or EBIT), cost development, M&A transactions or similar. Another interesting variable could be tied to material information, such as order books, operating cash flows, project procurement or similar. By incorporating variables such as these in the model, future research models may show higher explanatory value and provide improved understanding of insider trading behavior, which further diminishes asymmetric information.

Low explanatory value consistent in all regressions is another limitation our paper faces. This means that there are other variables which explain insider purchases that we do not investigate. Future research may therefore try to investigate alternative factors to improve the understanding of what drives insider purchases and generate a better prediction value of future firm performance.

A proposal for an extension within the topic is to compare insider trading's signaling value with knowledgeable outside investors. Examples of this may be investment entities such as bank analytics or funds. The results may provide interesting understanding of which actor that contributes with the best proxy for firm outlooks, which might be especially interesting for retail investors looking to make investments.

8. Conclusion

Our research discovers that insider trading does signal future firm performance on the Swedish market by predicting future firm stock performance during the year following insider trades. Furthermore, we learn that to interpret the insider behavior correctly, it is important to adjust for the contemporaneous relative firm valuation. Our paper does not find any conclusive evidence that insiders can predict future change in return on assets or use relative contemporaneous stock performance to understand insider behavior. Neither contemporaneous change in return on assets has explanatory value on insider purchases. The implications of these findings are that outsiders should be able to utilize insider trading when evaluating a firm's future stock performance but that it is important to control for variables which impact insider trading behavior. Implementation of these methods may mitigate asymmetric information issues, which improves stability in the market environment as outsiders' firm evaluation accuracy is revised. The results disprove our hypothesis, suggesting that insiders are able to trade based on superior information despite the tight EU regulations in place. We therefore make the interpretation that insider regulations in the EU are not stricter than in the US in practice, which may indicate that the effects of the regulations are not as desired. Because of this interpretation, it may be of interest for regulators to further investigate the regulations efficiency and compare it to other regions. Law and finance entities could cooperatively investigate regulations and test against practical implementation to discover and improve legislative weaknesses. Until then, an understanding of insider trading behavior from a financial standpoint may mitigate regulatory issues as insiders' information advantage diminishes.

Appendix A.

Table 6
Variable Description

Variable	Description
SP_t	= Contemporaneous Market Adjusted Stock Performance.
SP_{t+1}	= One Year Ahead Market Adjusted Stock Performance.
ROA_t	= Contemporaneous Return on Assets.
ROA_{t+1}	= One Year Ahead Return on Assets.
ΔROA_t	= Contemporaneous Change in Return on Assets, compared to previous year.
ΔROA_{t+1}	= One Year Ahead Change in Return on Assets.
PSP_{t+1}	= Positive Stock Performance, assumes a value of 1 if one year ahead stock return is positive, 0 otherwise.
$PROA_{t+1}$	= Positive Return on Assets, assumes a value of 1 if one year ahead change in return on assets is positive, 0 otherwise.
$PROA_t$	= Positive Return on Assets, assumes a value of 1 if contemporaneous change in return on assets is positive, 0 otherwise.
SSP_t	= Strong Stock Performance tercile, contemporaneous stock performance is in the top tercile relative to other companies in the sample.
MSP_t	= Moderate Stock Performance tercile, contemporaneous stock performance is in the middle tercile relative to other companies in the sample.
WSP_t	= Weak Stock Performance tercile, contemporaneous stock performance is in the bottom tercile relative to other companies in the sample.
FV_t	= Firm Valuation, Measured by contemporaneous Book-to-Market ratio.
$FV1_t$	= First (Highest) Firm Valuation quintile, based on contemporaneous Book-to-Market ratio relative to the other companies in the sample.
$FV2_t$	= Second Firm Valuation quintile, based on contemporaneous Book-to-Market ratio relative to the other companies in the sample.
$FV3_t$	= Third Firm Valuation quintile, based on contemporaneous Book-to-Market ratio relative to the other companies in the sample.
$FV4_t$	= Fourth Firm Valuation quintile, based on contemporaneous Book-to-Market ratio relative to the other companies in the sample.
$FV5_t$	= Fifth (Lowest) Firm Valuation quintile, based on contemporaneous Book-to-Market ratio relative to the other companies in the sample.
IPR_t	= Insider Purchase Ratio, calculated by dividing annual aggregated purchase volume by annual aggregated transaction volume.

All data has been gathered from Refinitiv EIKON and Swedish Financial Supervisory Authority's (Finansinspektionen) PDMR transactions register.

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