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INSIDERS' VIEWS AS A PREDICTOR OF STOCK PERFORMANCE

Can insider trading be used to predict stock performance on the United States stock market?

Master´s Thesis
in Accounting and Finance

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13.11.2013
Turku

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1   INTRODUCTION

1.1   Stock valuation through the ages

Shares are an important means of raising capital for companies and have existed for a long period. The origins of modern stock can be traced at least to the founding of the Dutch East India Company in 1602 (Petram & Petram 2011) but equity-type securities have existed since the roman republic (Malmendier 2009).

Valuation of equity instruments is important in order for capital to be allocated efficiently to different ventures. Incorrect valuation makes the equity seem either too expensive to attract the optimal amount of capital or so cheap that it is flooded with more capital than it should get. Apart from the societal dimension, correct valuation is also important for individual investors. Valuing stock incorrectly will quickly result in losses for the investor.

Value of shares is based on the expected present value of future cash flows from the shares. Estimating this is very difficult due to numerous uncertain variables involved in the calculation. These variables also change constantly making any estimation inherently volatile. The share price on the secondary stock market can be seen as the closest observable estimation of the correct value.

The share price on secondary market is formed through a supply-demand process. A simplified example of this process is that investors buy shares they estimate to be undervalued and sell shares they estimate to be overvalued. The supply-demand equilibrium corresponds to the market's weighed average valuation of the shares.

The secondary market serves an important function for primary markets as an indicator of proper valuation. Even if the shares to be traded on primary market are not traded on secondary market, other similar shares offer indications on the correct levels of some of the variables affecting the valuation.

The correctness of valuations found in the secondary market is the source of lively academic debate. Efficient markets hypothesis, first introduced by Fama (1970), suggests that the valuation found in the markets is the best estimation of the correct valuation given publicly available information. The reasoning behind this notion is that if the valuation in the market would be incorrect anyone could buy (sell) undervalued (overvalued) shares and make risk-free profits. This activity would increase demand (supply) and quickly force the valuation to the correct level.

Since 1980s this hypothesis has been challenged at ever increasing strength by the theories of behavioural finance (see overview in Barberis & Thaler 2002). They state that systematic misvaluations are found in the markets because psychological factors of individual people and investors as a group cause irrational behaviour. The misvaluations

can be maintained for extended periods and are identifiable by investors. Thus valuing shares correctly would require taking the behavioural factors into account in the valuation process.

This debate is explored in more depth in chapter 3.1. For now it is sufficient to recognise that over time there have been very different ideas about correct valuation of shares, and that the methods for valuations vary a lot. Investors generally choose valuation methods that make most sense to them. The methods differ a lot on what information they use, how they combine the pieces of information, and how they present the forecast[1]. The common denominator for these methods is that they combine some pieces of information to create a forecast of the present value of future cash flows associated with the shares.

While the valuation methods differ the stock performance can be uniformly measured ex-post. As this thesis studies forecasting stock performance it is prudent to define exactly how stock performance is measured. This will be done in the following chapter. Additionally the basics of price formation process for stocks are presented.

1.2   Definition of stock performance

As mentioned above the value of a company is the present value of all future cash flows from the company. These cash flows can be either dividends or capital repayments. These cash flows cannot be known with certainty as they all happen in the future. Nevertheless, investors try to estimate them along with the probability distributions associated with them.

These estimations are used to deduce the value of the company, and how much the investor is willing to pay for the shares[2]. The market price for a company is formed through the supply and demand resulting from individual investor's trading decisions and the number of shares available. Investors reach their trading decisions by comparing their estimate of the value of the company to the current market price of the company's shares.

Investors naturally use all available information when making decisions. This means that any information viewed as important to the value of the company by any investor affects the stock value through the equilibrium of supply and demand. The equilibrium is not affected by the number of investors but by the amount of capital they are willing,

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[1] For example the forecast can be implicit or explicit, or absolute or relative to other shares.

[2] Some market participants may create explicit estimations of cash flows while others resort to key figures in estimating the value of the company. Some may even base their estimation on gut feeling alone.

or able, to invest to back up their view. The price discovery process and how information is transmitted to the price is explained more thoroughly in chapter 3 below. This chapter will finish by further elaborating the definition of stock performance in practice.

Stock performance over a defined time period is comprised of the change in the company value and any cash flows from the company during the period. As mentioned above the value of the company is the present value of all cash flows, and it translates to the market price of shares. This leads to change in company value being measured as the difference between the sale and purchase price of shares. This difference is referred to as a capital gain. Cash flows usually refer to dividends as corporations are in principle designed to exist forever and rarely conduct capital repayments[3].

This thesis focuses on how information related to insiders' transactions can be used to forecast stock performance. The fundamentals of the relationship between this information and the stock performance are presented in the next chapter.

1.3   Association between stock performance and insider trading

In order to trade on shares insiders must also value the shares. When compared to other investors they have access to more information while valuing shares of the companies in which they are insiders. But who exactly are the insiders, and what extra information do they have?

The widest definition of insiders comes from section 20A of the Securities Exchange Act of 1934[4], where any person in possession of material, non-public information about a company is considered an insider. Mostly this refers to people employed by the company but can also include others who have received information about the company.

The abovementioned definition of insiders is, however, very wide. Section 12 of the Securities Exchange Act states another, more restrictive, class of insiders who have to report all their trades to the Securities and Exchange Commission[5]. This reporting requirement is not extended to the earlier, more widely defined group of insiders who only have to refrain from trading before the information they possess is publicised.

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[3] Companies can of course go bankrupt or they can be dismantled if the business no longer offers reasons for the company's existence. These situations may result in significant cash flows. These are, however, decisions taken due to environment change and not due to specific maturity date for the company's existence.

[4] Hereafter referred to as the Securities Exchange Act.

[5] Hereafter referred to as SEC.

The persons who need to report their trades are classified as insiders because their position or ownership in the company is considered to supply them with material, non-public information continuously. This class of insiders consists of all officers or directors of the company and all shareholders of the company who directly or indirectly own at least ten per cent of any class of any equity security.

While the definitions above are used in insider trading regulation in United States (U.S.), insiders can be defined in different ways. For example, insiders can be defined as the officers of a company for the purposes of studying the impacts of insider trading in agency theory. The most suitable definition for this thesis is the latter of the above-mentioned regulatory definitions for two reasons. Firstly, these people are interesting for studying information content of insiders' trades as they conceivably hold value-relevant information. Secondly, the required data is available for persons fitting this definition of insiders.

Hence for the rest of the thesis, the term 'insiders' refers to persons who have to report their trades according to the Securities Exchange Act (officers, directors and large shareholders) unless stated otherwise. Additionally all references to insiders' trading activities or transactions refer to trading in the shares of the companies in which they are insiders.

These insiders are running the daily operations of companies and make the decisions which dictate the success of a company. This makes them the best experts on the company. They know all the information that is published by the company and, additionally, they know information that is not published for some reason. The unpublished information could for example be small, perhaps intangible, signals on the status of the company. These signals do not need to be publicised to the general public but could, on their own or combined with other bits of information, provide valuable insight into the future potential of the company.

Insiders of companies also follow the industry in which their company operates very closely. They can easily get signals on the general direction of the industry through formal (e.g. trade journals) or informal channels (e.g. discussions with suppliers, customers or peer companies). All this ensures insiders have detailed information on the industry providing additional inputs for valuation.

Securities markets are based on voluntary transactions meaning that insiders only execute trades they see as beneficial. Insiders can view trades as beneficial for reasons varying from displaying confidence in their own company to attempting to benefit from future stock price changes financially. Trades which are based on insiders' views on the future stock performance are most interesting for forecasting stock performance. These trades can be seen to convey value-relevant information because insiders place part of their wealth to support their view on the stock performance, and they have more information about the company than an average investor.

As insiders possess more information about the company than an average investor they can be seen to possess an unfair advantage when compared to other investors. To limit this, their trading opportunities are restricted by regulation. U.S. was the first country to enact insider-trading laws in 1934 (Bhattacharya & Daouk 2002). The main purpose of the regulation is to protect investors engaged in securities transactions and guarantee public confidence in the integrity of the securities markets (Bainbridge 2001, 9). This is mainly achieved by ensuring that insiders cannot unfairly trade using information which is not yet publicised to other market participants. Thus insiders can legally trade only when they are not in possession of material, non-public information.

Even with the restrictions placed on insiders' trading activities they seem to be able to predict stock performance to some extent. This can be seen from several studies concluding that insiders are able to obtain abnormal profits from their investments (see Jaffe 1974; Givoly & Palmon 1985; Ke, Huddart & Petroni 2003; Bris 2005). Many market participants have also reached this conclusion and are actively following insiders' trades to try to obtain abnormal profits themselves. Information on the insiders' trades is readily available from numerous sources such as Wall Street Journal[6], Nasdaq OMX[7], dedicated websites[8] or SEC's Edgar service[9]. Some banks also follow insider trading actively and provide investment advice based on that information (e.g. FIM bank Ltd in Finland).

While some investors utilise insider trading as indicator of future stock performance, the scientific research has been more cautious around this topic. Although there are numerous studies dealing with insiders' ability to achieve abnormal profits, there are much fewer studies researching whether this information could be utilised to forecast stock performance. In addition to being fewer in number, these studies are also more dispersed in their conclusions (see Rozeff and Zaman (1998), and Gurgul and Majdosz (2007) for results indicating no possibility to forecast stock returns and Beny (2008), Stotz (2006), and Bajo and Petracci (2006) for results indicating a possibility to forecast stock returns). Many of the studies written about insider's abnormal profits state – based on the abnormal profits to insiders themselves – that it may be possible to forecast stock performance with the trades but have not researched the matter further.

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[6] http://online.wsj.com/mdc/public/page/2_3024-insider1.html

[7] http://www.nasdaq.com/quotes/sec-insider-form-4.aspx

[8] http://www.secform4.com/

[9] http://www.sec.gov/edgar/searchedgar/companysearch.html

Besides the scientific research a book written by Nejat Seyhun (1998) is familiar to large group of investors[10]. This book, which is partly based on research published in peer-reviewed journals, proposes that it is possible to achieve abnormal profits by following insiders' actions on the stock market.

Conversely to the articles in peer-reviewed journals, the book has taken an approach which provides a link between insiders' trades and forecasting stock returns. However, the statistical methods used in the book are not as rigorous as required by scientific research. While this book is missing the statistical rigour required by scientific research there are few scientific studies connecting insiders' transactions to subsequent stock performance.

Nevertheless, the studies done on the subject can be combined to form a coherent image of the connection. A more pressing issue is that many of the studies have become outdated because the regulatory and practical environment of reporting has changed due to the Sarbanes-Oxley Act.

Section 403 of the Sarbanes-Oxley Act made insider trading reports more readily available to the general public and reduced the reporting delay from previous maximum of approximately 40 days[11] to 3 days. These changes came to force on 30 June 2003 and have not been extensively studied so far. Brochet (2010) finds that this change has statistically significantly improved the information dissemination to the market but does not go on to explore the possible consequences.

This thesis aims to address this issue by further studying the possibility of forecasting stock performance using insiders' trades with data reported after the implementation of the Sarbanes-Oxley Act.

1.4   Objectives and limitations of the thesis

As seen in the previous chapter insider trading has already received considerable attention but there are still areas that have been examined less. In addition to the areas studied less, the regulatory environment has changed significantly since many of the earlier studies were made. This thesis aims to update the understanding on the topic by looking at insider trading in U.S. since the implementation of the Sarbanes-Oxley Act in 2003.

Furthermore, this thesis will investigate some facets of the issue that have been overlooked. The risk level of insiders' investments has not been explicitly investigated even

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[10] On 16 October 2011 the book had a sales rank of 116,308 at Amazon.com which indicates a wide readership among its limited target group.

[11] Before the change in legislation, reporting was due on the 10th day of the month following the trade.

though it could explain larger returns. This thesis will also study if the results remain static over time or if they could be explained by the specific data sample.

The primary objective of this thesis is to study the possibility of forecasting stock performance using public information on insider trading. This objective involves two sub-objectives. Firstly, it has to be ensured whether any forecasts are possible by finding out if insiders can still reach abnormal profits after the regulatory changes. Previous studies would suggest that the changes do not remove all of the insiders' profits (Jaffe 1974; Seyhun & Bradley 1997; Bhattacharya & Daouk 2002; Brochet 2010). Secondly, the thesis moves to study the possibility of forecasting stock performance. The forecasts are based on the premise that insiders hold value-relevant information and utilise it in their trading. The information is then extracted from the reported trades and used to create forecasts of stock performance ex-ante.

These research topics can be constructed as the following two research questions:

1. *Can insiders obtain abnormal risk-adjusted profits from their trades in securities of the companies in which they are insiders?*
2. *Can other market participants use insider's trading activities to forecast stock performance?*

The results on these research questions will be controlled for variables that have been found to affect stock performance in previous studies. One of the control variables, however, has not been examined widely in the previous studies concerning insider trading. This is the risk level of investments following insiders' trades which is somewhat puzzling as risk level is an important driver of returns. Hence this thesis will include risk level proxies as control variables.

Answers to the research questions will also provide insights into the question of how efficient the markets are. Fama (1970) formulated the Efficient Capital Markets Hypothesis from earlier theory and empirical results. In his seminal paper he presented three forms of market efficiency which all imply different results for the abovementioned research questions.

If the markets are efficient in the weak form or not efficient at all, the answer to both of the above questions should be positive. Under semi-strong market efficiency the first question should yield a positive answer, and in strong-form efficient markets neither of the questions should yield a positive answer. The theory of efficient markets is presented in more detail in chapter 3.1.1 and discussion on level of efficiency in capital markets in chapter 3.1.2.

There are also some notable limitations in the thesis. The returns during the reporting delay are not included in the calculations. This causes some inaccuracy in answering research question number two. The magnitude of this effect will be estimated with simplified methods.

Even though remuneration and private contracting of insiders are also closely tied to insider trading, these aspects are not included in this thesis. The effects of privately negotiated "closed windows" on insider trading will thus be left out of the thesis, and all insiders are assumed to follow only the legal requirements. Similarly, the results are not controlled for the remuneration policy of a specific insider or company even though the trading patterns of insiders can be influenced by the proportionate amount of securities they receive as remuneration.

Remuneration is also closely tied to the ongoing scientific debate about the appropriate amount of regulation for insider trading (Padilla 2002). While this debate is presented along with other issues affecting regulation, it is not studied in more detail in this thesis.

1.5   Research methodology and methods

Neilimo and Näsi (1980) divide research approaches into four types along two dimensions. One of the dimensions divides research types into those with either descriptive or normative objectives. Descriptive studies depict and explain the studied phenomenon. This type of research may also attempt to forecast the behaviour of the studied phenomenon. Normative studies on the other hand try to find out the best course of action in the studied situations. In a sense this type of research tries to establish recommendations, norms, or instructions.

The other dimension of the typology divides research into theoretical and empirical types according to the methods they use. Purely theoretical studies rely on previous research to reach their objectives; although they can also include empirical data from previous research. They create new information through synthesis and deduction based on previous research and not through analysis of new empirical data. In contrast, empirical studies analyse data collected for that particular study to create new information for the scientific community (Neilimo & Näsi 1980).

Neilimo and Näsi (1980) present this typology as a matrix with four different research approaches. These research approaches are conceptual, nomothetical, decision-oriented, and action-oriented. In addition to these four approaches, Kasanen, Lukka and Siitonen (1993) introduced the fifth, constructive, approach. All of the approaches are presented in figure 1 below.

	Theoretical	Empirical
Descriptive	Conceptual approach	Nomothetical approach
		Action-oriented approach
Normative	Decision-oriented approach	Constructive approach

Figure 1:   Typology of research approaches by Neilimo and Näsi (1980) as supplemented by Kasanen, Lukka and Siitonen (1993)

The research questions in this thesis aim to study one aspect of insider trading and link it to the price discovery process of securities. Whether insiders can identify the true stock price better than average investor is studied through empirical research setup using a large data sample collected for this purpose. Other aspects explaining insiders' trading decisions, which could be better studied with qualitative methods (see Morgan & Smircich 1980), are not included in this study.

These qualities place the thesis on the empirical end of the methodology dimension. On the objectives dimension this thesis is more in the descriptive end of the scale. While the thesis aims to create guidance on proper course of action for investors, it is not its main goal. The guidance is merely an outcome of the better understanding of the studied phenomenon. In the typology this type of research is called nomothetical.

Nomothetical research methodology is very closely related to positivism (Kasanen, Lukka & Siitonen 1993, 249). Positivist research attempts to create empirical laws from empirical observations (Lukka & Kasanen 1995, 74). Research of this type tries to find out what is the current situation and not contemplate how the situation should be. Originally the research approach was quite strict in creating "laws" but has moved towards recognising the fact that many issues in social sciences cannot be constructed into irrefutable "laws" due to the involved human factors (see Christenson 1983; Kasanen, Lukka & Siitonen 1993).

Deductive reasoning is used in this process to combine different theories together to reach a single result (Christenson 1983). However, an inductive feedback loop from the

results of the empirical tests is also included. With the results it is possible to confirm the initial set of theories, or potentially create new theories based on the findings[12] (see Christenson 1983; Salmi & Järvenpää 2000).

In addition to the abovementioned traits, nomothetical research is also categorised by the fact that the researcher cannot influence the studied phenomenon and that the research does not attempt to create norms or instructions. These traits belong to other types of research methodologies (Neilimo & Näsi 1980).

The approaches presented by Neilimo and Näsi (1980) are not mutually exclusive, and often more than one approach is used in any research. For example, studies conducted with one of the empirical approaches usually include a section which uses the conceptual approach as well. This approach describes research that attempts to create new information through reasoning and using existing studies as source material. This is important for many empirical studies because the current body of knowledge on the research topic needs to be established, and it needs to be explored how the research contributes new information to the topic. To achieve these goals, a conceptual part exists in this study, too. It consists of chapters 2 and 3.

Some characteristics of the constructive approach are also present in this thesis. As the goal is to create new, practical guidance for forecasting stock performance, it fulfils the description of constructive approach quite well (see Kasanen, Lukka & Siitonen 1993, 244). However, constructive approach only forms a portion of the thesis and should be viewed more as an outcome of research done using nomothetical approach.

The two remaining research approaches illustrated in figure 1 are not included in the thesis but will be described briefly. The action-oriented approach is a similar to the nomothetical approach but has a different approach to research. It attempts to create understanding of all the aspects of the topic and often brings along a human into analysis. This type of research often uses case studies to reach its objectives (Kasanen, Lukka & Siitonen 1993).

The remaining research type is the decision-oriented approach which is closer to the constructive approach. Both approaches include theoretical analysis and thinking in pivotal roles in creating the research setup. However, the decision-oriented approach does not include an empirical part and relies on deduction based on earlier studies to reach its results. Conversely, the constructive approach characteristically uses heuristics to create a practical solution (Kasanen, Lukka & Siitonen 1993).

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[12] Research whose main objective is to create new theories would fall under another research methodology according to Neilimo and Näsi (1980) but in positivism potential new theories should be seen more as an outcome of the descriptive research.

As mentioned above this thesis includes an empirical section and thus a closer look at the empirical methods is warranted. The data set should be as large as possible because valuing securities is very uncertain – even with superior information. The inherent uncertainty stems from complex interrelations between the different factors affecting pricing, impossibility to measure many of these factors, and the fact that all factors affecting prices cannot even be determined.

Additionally, superior information in this context does not mean perfect foresight but only more information than is available to other market participants. Thus insiders with superior knowledge are still wrong in large percentage of their trades. Large data set evens out the variations stemming from these uncertainties and allows reaching statistically significant results.

Even if one could be certain of the correct valuation[13] there is no guarantee that the price will move to this value, and no single investor can force the market price to move[14]. Over time the prices will tend to move toward the correct valuation as facts affecting the price become public. However, facts can remain unpublished for long periods. During this time the facts affecting the price may have changed, or the investor may have been forced to liquidate her holdings for some reason. Because of this it is important to have a sufficiently long period of data and a large sample of investors to minimise the effects of data remaining unpublished (Mauboussin 2002).

Given the large data set, the methods will have to be able handle the amount of data. For this reason, the potential methods are limited to statistical analysis techniques and more specifically regression analysis. Due to restrictions in computing power, the statistical analyses will be conducted on a 10 % sample of the entire data set. This creates a greater need to properly assess the reliability of the results. Simplified bootstrapping methods are used in addition to regression analysis to assess the reliability of the results.

The 10 % of the entire data set should provide sufficient data to address the above-mentioned issues. The data set also provides sufficiently long time horizon for analyses (although it would still be beneficial to have a longer time series). This data set will be described in more detail in the next chapter.

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[13] Correct valuation still does not infer perfect foresight but correct statistical calculation of the expected present value of the cash flows associated with the securities.

[14] This is true in deep, liquid markets. Given illiquid securities even individual investors with sufficient capital at their disposal can move the prices.

1.6   Data

The data set collected for this thesis consists of all insider trades done in companies which fall under jurisdiction of SEC between 1 July 2003 and 14 August 2009[15]. The selection of data was motivated by the implementation of the Sarbanes-Oxley Act which improved the reporting of insider trades considerably. As of 1 July 2003 all insider trades had to be reported in SEC's Edgar web portal[16], from which they can be easily viewed and downloaded by anyone. The change in reporting regime is very clear when examining the number of reports submitted to Edgar in figure 2.
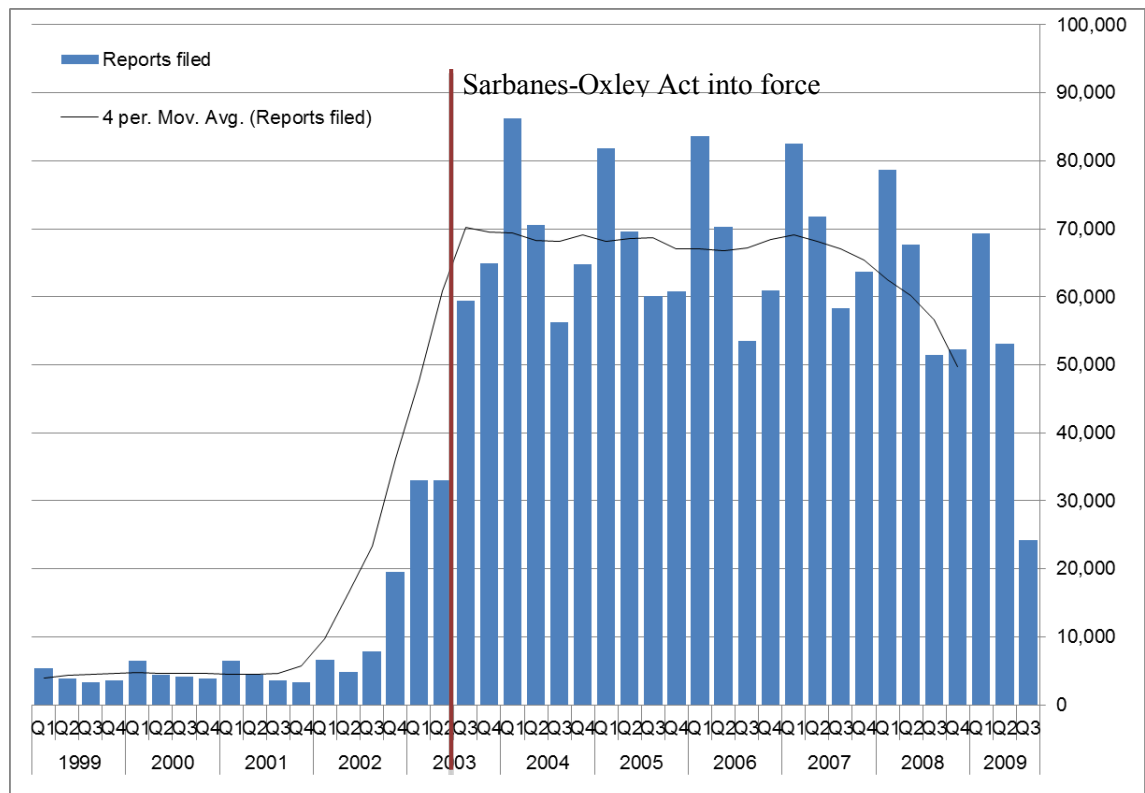
Figure 2:   Number of reports submitted to SEC's Edgar portal every quarter between 1 January 1999 and 17 August 2009

The figure clearly shows that the number of insider trading reports filed to SEC has jumped from around 32,000 reports per quarter in early 2003 to almost 70,000 reports per quarter (adjusted for seasonal variation) from third quarter of 2003 onwards. Even

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[15] As the latest data was downloaded from SEC on 17 August 2009, data between 15 August and 17 August is not complete due to the allowed three-day reporting delay. This indicates that 14 April 2009 is the last day for which complete information is available.

[16] Hereafter referred as Edgar.

the 32,000 reports in early 2003 is almost a tenfold increase when compared to the historical average of approximately 4,000 reports per quarter. This increase in reporting activity can be attributed to anticipation of the tighter regulation which came into force 1 July 2003 requiring all insider trades to be reported electronically and made available in Edgar.

In addition to the interesting change in regulation, the U.S. stock market[17] has other characteristics that make it an interesting target for research. The stock market in U.S. has existed for a long time and has well-established laws and regulations. The U.S. regulators ensure that the laws are followed and ensure that reporting is reliable and timely.

These characteristics enable fast information dispersal in the U.S. stock market. The U.S. markets also have large trading volumes, large number of financial service providers, and low taxes. These characteristics make it less likely that insiders' transactions contain information by creating better foundation for market efficiency and having a large number of analysts following companies. This eases possible generalisation of the findings.

Finally, the data on U.S. insider trades can be collected easily from one location. This makes data collection more straightforward than in many other countries and contributes to collecting a large, representative data set. Other data to supplement the analysis is also plentiful in U.S. as shown in chapter 4.1.

1.7   Structure of the thesis

The thesis is divided into four main segments which are introduction, theoretical basis for the study, empirical research, and conclusions. The first chapter presents the topic of the thesis, its objectives and limitations, the research methodology, methods and data and the structure of the thesis. The two research questions studied in the thesis are also presented in the chapter 1.4.

The theoretical basis of the study is divided into chapters 2 and 3. First of these chapters provides an overview of the conflicting interests of insiders and other investors. It also summarises the associated regulatory aspects. Chapter 3 discusses the price formation process for stocks and presents the theoretical basis for forecasting stock performance. Additionally the association between stock performance and insider trading is presented in chapter 3.

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[17] In this thesis U.S. stock market is considered as the New York Stock Exchange (NYSE), Nasdaq, Pink Sheets, and OTC Bulletin Board.

The thesis uses four hypotheses, two per research question, to investigate the research questions. The hypotheses are presented in chapters 3.2.2 and 3.2.3. The statistical analysis of the hypotheses is done in the empirical part of the thesis in chapter 4. Insiders' performance on the stock market is studied first. Based on that the possibility of mimicking their actions to forecast stock performance is researched. This chapter also contains the validation of the research findings.

The implications of the results are discussed in chapter 5. The discussion is separated to their own sub-chapters according to the research questions. Chapter 6 presents the conclusions of the study and the potential applications of the findings. At the end there is a summary which draws the contents of the entire thesis together.

2 INSIDER TRADING

In the current sense of the word insider trading always coexists with stock exchanges. This means that insider trading has been around for a long time. The first stock exchanges were established in 1611 in Netherlands, and in U.S. an early version of a stock exchange was formed a little later, in 1653 (Geisst 2004, 9-11). Even though, stock exchanges did not give birth to insider trading they are a prerequisite to it in the form discussed in this thesis as they anonymise counterparties in a transaction. Face-to-face (private) transactions follow a different logic because counterparties can identify that the other counterparty may hold non-public information. These circumstances require different regulation (Bainbridge 2001, 7-8).

While insider trading occurred before 20th century, there were no penalties, and it was even considered normal practice (Bainbridge 2001, 4-5). Notable insider trading cases of this era often included government officials such as in the cases of William Duer and Jay Gould. Duer used his position in Treasury to speculate in newly issued federal bonds, and Gould used his connections to president Ulysses Grant to gain information to speculate on gold (MacDonald & Hughes 2009, 15-33, 38-59). The discussion on the acceptability of insider trading began to gain momentum in the early 20th century, and the first regulations aimed at curbing it were introduced in U.S. (Bainbridge 2001).

The following chapters present the phenomena underlying the need to regulate insider trading. Academic discussion on the phenomena and the need for regulation is then tied to the development of regulation.

2.1 Information asymmetries in insider trading

2.1.1 What is information asymmetry?

As the term information asymmetry implies, it involves a situation where two parties have different amount of information. This was first described by Akerlof (1970) when he presented the issue using a market for used cars. This is an excellent example of agency issues created when two parties involved in a transaction have different amounts of information relevant to the transaction and their interests do not converge.

In the case described by Akerlof (1970) sellers know the true value of the car and buyers have no way to determine the true value of an individual car beforehand. Thus the buyers are only willing to pay the expected (average) value of the cars and rationally expect to get value for their money. However, as sellers are able to determine the true value, the best cars will not be offered for sale because they would fetch too low a price.

This leads to only the cars with price below the average[18] being offered for sale lowering the expected value for all cars.

Buyers can deduce this chain of events and will adjust the price they are willing to pay accordingly. Even fewer sellers are willing to sell their cars at this adjusted price and withdraw from the market. The iterative process leads to no cars being sold on the market because the best cars are always withdrawn from the market after the price decrease following the withdrawal of the best cars of the previous iteration round. This process stemming from asymmetric information is referred to as adverse selection and is further explored in chapter 2.2.2 (Akerlof 1970).

While the case described above is only a simple example it can easily be applied into more complex situations. The following chapters illustrate how this process behaves in the context of insider trading and extend the discussion to cover other relevant issues borne from information asymmetry. The first step is to analyse the information asymmetries in insider trading.

2.1.2   *Information superiority of insiders*

The entire discussion on insider trading is based on the information advantage that insiders have compared to other investors. The information can be anything that affects the value of the company's securities. According to sections 20 and 20A of the Securities Exchange Act any insider is prohibited to trade on the company's securities while in possession of material, non-public information.

Nevertheless, this definition does not cover all potentially value-relevant information. Materiality was only defined in 1976 through the case of TSC Industries, Inc. v. Northway, Inc. and it leaves some information out of the scope. Information was defined as material if a substantial likelihood exists that a reasonable investor would consider it important in making his or her investment decisions (Netter, Poulsen & Hersch 1998). The definition highlights that quite a lot of information falls outside its scope. First of all, requiring substantial likelihood means that the effects of the matter at hand have to be quite clear. Additionally the effects of the matter will also have to be significant enough to be worthy of consideration in an investment decision.

Information deemed as material is usually communicated through financial statements and other disclosures from companies to the public. All published information is collected through internal processes and at best contains the same amount of infor-

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[18] These cars that are offered for sale above their true value were referred as "lemons" in Akerlof's (1970) study.

mation that was produced internally when the information was prepared for publishing. Most often the information will be cleaned up to prevent revealing trade secrets and disclosing too much information which could cloud relevant facts. Insiders on the other hand would have access to all the information.

In addition to the information that remains within the company many smaller, or intangible issues, which may be published at some stage, would be considered immaterial for trading purposes. It would be very difficult to use matters such as atmosphere, innovativeness or good informal customer feedback in investment decisions without first-hand knowledge. Insiders are able to use this information in their investment decisions as they can observe it first-hand. While many of the pieces of information may not be relevant on their own, they could add up to a significant factor in the valuation of the company.

For this chapter it is important to observe that the level at which information is considered material cannot be very low. Otherwise insiders could not trade as they know about a wide variety of smaller, perhaps intangible, operational issues within a company at all times. If these pieces of information would be considered material we would witness a very low level of insider trading. This is clearly not the case as insider trading is abundant as seen from the statistics of the data sample presented in chapter 1.6.

Even though insiders can be allowed to trade in the company's securities while holding value-relevant information it does not guarantee that any insider is in possession of this type of information whilst trading. But given that insiders seem to be able to constantly outperform the market, it is a valid assumption that an average insider possesses more value-relevant information than an average outsider (see Jaffe 1974; Finnerty 1976; Jensen & Meckling 1976; Givoly & Palmon 1985; Rozeff & Zaman 1998; Ke, Huddart & Petroni 2003).

Yet, insiders are varied when it comes to what information they possess. Some insiders could merely hold some specific piece of material, non-public information and know nothing more about the company's future prospects. In the other extreme are the corporate officers who are actively involved in many of the company's activities and thus are acutely aware of a large percentage of the value-relevant information in the company (see Seyhun 1986, 206; Seyhun & Bradley 1997, 203).

For the purposes of this thesis, only those insiders who are required to file reports to SEC need to be taken into account. This leaves three categories of insiders to be considered: officers, directors, and large shareholders. Out of these insider categories, officers can be seen to possess most information because they run the daily operations of the company. Directors are one step removed from the active management of the company and should receive less information. Even creating and approving the corporate strategies that dictate the long-term performance of the company should not give directors an informational advantage over officers. Officers are most likely included in the

preparation of, and decisions in, these matters. At least they are informed about the issues promptly as they become relevant and only receive the information slightly later than directors (see Seyhun 1986, 206).

The last group, large shareholders[19], is once again further removed from the company than directors. They have no direct link to the functioning of the company and mostly cannot receive any material information prior to the general public[20]. Even if they received some information before it is published, they could not trade on it as it would most likely be material. They can, however, have information about the future supply and demand of the securities, as they are a major player in the market of the company's securities (Seyhun 1998, 70). Additionally the large shareholders have more incentives to investigate the company's potential and force the management to act in a way which is more consistent with the interests of shareholders.

All of the abovementioned groups are very well acquainted with the environment of the company. All of them have high incentives to follow the environment closely as they have large stakes in play. Nevertheless, this information should not create any informational advantage to insiders, because the U.S. markets are considered efficient in the semi-strong form (see Fama 1970; Fama 1991) barring abnormal profits from trading on publicly available information (Fama 1970, 383). In addition to knowing the public information insiders could know more about issues relevant to the development of the environment than the general public.

No matter what, insiders will always know at least as much as outsiders; most of the times they will know more than the outsiders. Even though the differences in the level of information may be relatively small, they can still add up to be value-relevant. The value-relevant information helps insiders define the true value of the company better.

The asymmetry in information possessed by insiders and outsiders is the source of many conflicts of interest between these groups. It is by no means the only source of conflict but it is most closely related to insider trading. Agency issues are another major source of conflicts. These problems are more thoroughly detail in the next chapters.

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[19] Large shareholders beneficially own at least 10% of any equity class of the company.

[20] It is possible that large shareholders are more closely involved in the management as is often the case in start-up companies. In these cases large shareholders are often formally either directors or executives and would also be categorised as such.

2.2 Agency problems stemming from information asymmetries

Information asymmetries and agency problems are closely linked. Although they were first formally connected in a situation involving sale and purchase of assets it can be applied to multitude of other situations. Agency problems themselves do not stem from information asymmetries alone but require a presence of differing incentives. This refers to conflicting interests which will be examined in this chapter.

The term "insiders" does not refer to large shareholders for the remainder of this chapter because their interests are more aligned with those of other shareholders. "Constructive insiders", who are trading in securities of a company that is not their employer using inside information[21] (Bainbridge 2005, 7), and conflicts of interest related to them will be presented separately due to the different nature of their involvement with the company. Furthermore it is useful to divide outsiders into two categories: existing shareholders and other market participants. Conflicts between these two groups and insiders are somewhat different, and they will be presented separately.

A situation where a principal delegates the responsibility of acting on his behalf to an agent is explained by agency theory (see e.g. Ross 1973; Eisenhardt 1989; Jensen & Meckling 1976). There are many applications for this theory but this thesis focuses on the views that are important for insider trading. On the one hand this refers to the conflicts between insiders and shareholders and on the other hand to constructive insiders and the company.

2.2.1 Control and agency issues

Generally insiders are not major owners of the companies they run. This is the main reason for the divergent interests between insiders and shareholders (Jensen & Meckling 1976, 312-313). In practice publicly traded companies usually require division of management and ownership because they are generally very large. Individual people are not likely able to take that much risk on one company (compare Fama & Jensen 1983, 322-323). For example the median market capitalisation of the companies covered in Russell 3000 index[22] is 1.034 billion U.S. dollars (Russel Investments 2012).

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[21] An example of a constructive insider is a lawyer, who is not employed by the company, handling merger proceedings for the company.

[22] Russell 3000 index contains the 3000 largest companies in U.S. and approximately 98% investable equity (Russel Investments 2012).

In fact one of the main advantages of corporation[23], which is the most common form of incorporation for publicly traded companies, is that it enables easy division of management and ownership. This potential for the division of responsibilities arises from the fact that a corporation is considered as its own legal entity, and the shareholders are only liable to lose their initial investment. The limited liability is also useful in limiting the risks shareholders have to carry. There is a third benefit as well: limited liability enables transferring shares freely to other investors, as shareholders cannot impose additional costs on other shareholders. One further, notable benefit of a corporation is that it can exist as long as the shareholders want it to exist. It does not have to be dissolved if some, or all, of the shareholders die or become ill (General Corporation Law of the State of Delaware)[24].

However, incorporating a company as a corporation has some drawbacks as well. The disadvantages mainly relate to increased regulatory and bureaucratic burden. Fulfilling all the requirements usually demands at least lawyers, consultants, and auditors; all of whom are costly. Also the employees of the company have to spend time doing tasks unrelated to the core business. In addition, shareowners of corporations can face double taxation because profits are taxed when they accrue to the corporation and again when profits are distributed to shareholders. Still, these disadvantages are outweighed by the benefits for any larger company because of considerable economies of scale in fulfilling them (General Corporation Law of the State of Delaware).

Due to the abovementioned reasons the corporation is an efficient way to organise commercial activities and collect financing from the general public. Although it is not necessary for a corporation to be publicly traded, many companies – especially larger ones – are enable buying and selling their shares easily and provide a possibility for shareholders to move their investments between companies (see Ekelund & Tollison 1980). Large number of shareholders who can change at any time is another reason why owners delegate responsibility of running the company to an external manager.

Even though managers are often owners, they generally only own a small percentage of the company and it is only a portion of their personal portfolio. This means that their personal wealth is driven more by their remuneration than capital gains or dividends. This leads to diverging interests between shareholders and managers. Management

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[23] Corporation refers to a U.S. legal entity whose owners are only liable for their investment, and their personal wealth cannot be used to pay company's debts. The rights and obligations of a corporation are regulated in different state laws. Similar entities can be found all over the world and for example in United Kingdom it is called "Limited company" and in Finland "Osakeyhtiö".

[24] The corporation law of the state of Delaware is used here as an example because over 50% of publicly traded companies in U.S. are incorporated there (Delaware Department of State 2012).

wants to pursue their own goals instead of maximising the utility of the shareholders, while shareholders cannot effectively observe and control the actions of the managers.

Insider trading raises concerns for two specific problems from agency theory: moral hazard and adverse selection. Allowing insider trading requires solving these problems (Padilla 2002). These problems are borne from the differing goals for principal and agent, and human traits of self-interest, rationality and risk aversion (Eisenhardt 1989).

Conflicts of interest between insiders and outsiders occur because these two groups have somewhat different objectives. Members of both groups attempt to maximise their own utility but the utility in one group is greater when the utility in the other group is smaller[25] (see Jensen & Meckling 1976, 312-313). Utility is often synonymous with money but this is not always the case. Especially for management of a company utility can refer also to status or influence. This is often referred to as empire building (Padilla 2002, 16).

Insider trading is a good example of agency problems in general as it can create very bizarre incentives for insiders. Insiders also endeavour to maximise their utility in their trading. Conflicting interests are normal in trading, but they become problematic in insider trading because insiders have more information than other market participants.

For example there is a moral hazard problem that insiders have incentives to sell the securities of the company short and then drive the company into bankruptcy (Easterbrook 1981, 319). They could most likely maximise their personal payoff through this scheme as it is easier to manage a company into failure than to success. But surely these types of actions are not desirable from a societal point of view.

These conflicts, also known as moral hazards, are in the heart of the agency theory, which attempts to identify them and devise methods for controlling their deleterious impact. The main method for mitigating agency problems is creating an incentive structure that aligns the incentives of the agent with those of the principal. Yet the questions of what the structure should be and how it should be implemented have no straightforward answers in many cases (see Carlton & Fischel 1983; Eisenhardt 1989, 58-59, 63).

It is worth pointing out that most managers do their job properly and do not attempt to misappropriate money from the shareholders. This is one reason why insider trading

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[25] This is somewhat inaccurate as this is not a zero-sum game (Padilla 2002, 11). For example, creating a better and costlier incentive structure for management decreases the utility of shareholders as it reduces their profit. However, if the incentive structure functions well and it drives the management to better results, it can also increase the utility of the shareholders. The statement above is only exactly accurate in a pareto-optimal situation. However the statement is a good approximation of reality as the utilities generally move against each other.

can be seen as something that should not be regulated even though it involves agency issues.

Regulation has often been viewed as proper response to control insider trading given the inherent difficulties for companies to monitor it[26]. This view has been challenged because there are other responses to dealing with agency issues (e.g. Manne 2005). One of these responses is board of directors, which is an organisational construct created to minimise agency problems between officers and owners by supervising officers on behalf of the shareholders (Jensen 1993, 862-863). Directors have the required access to information and sufficient knowledge to efficiently control that managers' actions are in the interests of shareholders. However, this solution creates new agency relationships between directors and officers as well as directors and owners.

Another way to reduce agency issues is private contracting to align the incentives of managers with those of shareholders. In the case of insider trading, private contracting is not really possible because regulation determines very closely all activities that are allowed. This is one of the main points for criticism of insider trading regulation. It is argued that insider trading acts as an efficient means for remuneration, and if this is not possible managers require more of traditional compensation (Manne 2005).

However, insider trading was not explicitly mentioned as part of private contracts prior to the regulations limiting insider trading. The compensatory aspect of insider trading exists without explicit mention of it. Limiting the allowed trading activities on the other hand would require explicitly mentioning the limitations. The fact that insider trading did not appear on private contracts indicates that it was not viewed as an important factor. Another reason might be the difficulty of enforcing restrictions on insider trading (Carlton & Fischel 1983, 864).

Nevertheless, trading by constructive insiders has been governed via private contracts and regulation has only been extended to these cases recently (United States v. O'Hagan 1997). Agency arguments similar to those for other insiders can be extended to constructive insiders who offer services to companies. In their case traditional insiders – i.e. managers – act as principals instead of owners. They are better equipped than the owners to actively monitor constructive insiders and create enforceable private contracts.

This does not change the agency issues but is relevant to the actions that can be taken to minimise them. Principals in this relationship have more complete knowledge of the

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[26] Shareholders have no methods with which they could observe trading by insiders because trading relationship is not divulged to third parties without the consent of the trader. The insiders could simply let shareholders know the allowed trades and conduct disallowed trading through a banking relationship that is not disclosed.

actions of the agent which reduces the need for regulation to restrict the actions of the agent. More complete knowledge does not mean perfect knowledge. The agent can still act against the interests of the principal while the principal limited information to control these actions.

This is not the only problem that different levels of information can cause. The other problem is referred to as adverse selection. It relates to the consequences of insiders' superior information to the markets. This problem is described in detail in the next chapter.

2.2.2   Adverse selection and its effects on the stock market

The logic of the market for used cars can also be applied to securities markets where insiders can be compared to sellers of used cars. However, this situation differs considerably from the ideal situation described by Akerlof (1970) because there are numerous sellers and buyers in securities markets and only a small portion of them possess an informational advantage. Consequently the adverse selection problems are not as severe as in the case of all sellers being better informed. However, the more informed traders – i.e. insiders – there are, the more severe the adverse selection problems are.

Securities markets are characterised by market makers who ensure that securities can be bought and sold at all times[27]. If there are people in the markets who know more about the true value of companies than the market makers, they can buy (sell) the securities at a lower (higher) price than their true value. They will only transact when prices are favourable to them leading to adverse selection of trades for the market makers.

Adverse selection creates uneven demand at times of pricing errors. When prices diverge from their correct value insiders can trade on the side that is favourable to them. This causes losses to market makers because offsetting trades do not materialise in the opposite direction. Naturally market makers adjust their prices when more demand appears on one side, but this process takes some time and during that time they can lose a significant amount of money.

Market makers quote a lower price for buying and a higher price for selling securities. This difference is called a spread and it depicts the uncertainty that the market

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[27] Not all publicly traded companies have market makers guaranteeing continuous liquidity but all of the larger companies listed in U.S. have them. All companies listed in New York Stock Exchange or Nasdaq have them as well as larger companies traded on the OTC market.

maker has about the value and volatility of the security[28]. The spread is often used to measure the efficiency of the markets because low spread indicates more accurate and rapid price discovery and lower transaction costs[29] (Bagnoli & Khanna 1992).

When insiders trade more using private information, the spreads are raised for two reasons. Firstly, it limits the occurrences of insiders being able to benefit from price deviations. Secondly, the increased spreads offset losses arising from trades with insiders by taking a larger share of all other transactions. Thus information asymmetries on securities markets do not immediately lead to breakdown of the markets as happens in the case of used cars described by Akerlof (1970). It only increases the costs in proportion to the number of informed traders. However, this increase in spreads has not been observed in practice yet (Dolgopolov 2004, 110-118, 149-174).

Of course the effects of insiders trading with superior information are not limited to theoretically higher spreads. Market makers also move the mid-price according to the added supply or demand from insiders. Increased demand (supply) from insiders shifts the mid-price higher (lower). Investors who are buying (selling) at the same time end up paying more (receiving less) than they would have paid (received) without the insiders. This is still lower (higher) price than the true value.

Thus the investors who traded against the insiders could say that they received too little (paid too much). While this may technically be true, they still traded at below (above) the true value. The investors who were trading in the same direction as insiders got a better deal than they would have gotten without the insiders, and all trades happened closer to the true value of the security. This more efficient price discovery can be seen as the socially beneficial side of insider trading (e.g. Leland 1992; Coff & Lee 2007; Padilla 2002). The debate on how much insiders should be allowed to trade is further explored in chapter 2.3.1.

As a consequence, if insiders would trade actively on private information other market participants could not be comfortable that they have similar opportunities to benefit from trades as their counterparties, who could be insiders. However, insiders only account for a small percentage of potential traders so they should not be trading against many outsiders. Additionally and trading by them helps keep the prices closer to their correct values.

Even different outsiders possess different levels of information. The difference in information levels between outsiders could usually be bridged with access to information portals and additional analysis. The important distinction information disparity between

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[28] This does not infer that market makers are certain that the true value is within the spread but that the supply-demand equilibrium is within the spread.

[29] Market efficiency is described in more detail in chapter 3.1.

insiders and outsiders is that insiders often have access to information that cannot be accessed by all market participants, even in theory. Thus the information asymmetry that cannot be bridged is important for the perceived fairness of marketplace.

Both fairness and efficiency are important for the proper functioning of capital markets. Because markets are supposed allocate resources in the economic system in the most efficient manner they require wide participation. This cannot be achieved without both fairness and efficiency. These properties are also interlinked. If markets are viewed as unfair they cannot attract a sufficient portion of capital from the economy to be allocated (Schotland 1967, 1450-1451). On the other hand, if the markets are not efficient they allocate capital in wrong ventures and can create a perception that the markets are not fair. Increased efficiency can also create a sense of unfairness as described above.

The design of the marketplace should ensure that these requirements are met. The implementation challenge and required trade-offs are explored in more detail in chapter 3.1.2. The regulatory environment for insider trading, which creates the boundaries for actions in the markets and tries to balance these properties, is presented in the next chapter.

2.3   Limiting problems related to insider trading through regulation

While the scientific community disagrees even on the fact whether there should be any regulation, in practice insider trading regulation has become more common and converged considerably around the world. Especially between 1990 and 2002 insider trading laws became much more common as 53 countries implemented them (Bhattacharya & Daouk 2002). In addition, to being implemented all over the globe the laws have also evolved to similar forms (Gevurtz 2002, 69-75).

In order to create an understanding on the aims of the current insider trading regulation around the globe this chapter first presents the scientific debate about the desirability of insider trading. Next the chapter moves to discussing how the regulation has evolved during the last century and presents the current state of the regulation. Finally, the challenges of enforcing insider-trading regulations are presented.

The focus is on U.S. regulation, because the empirical part of the study is based on U.S. data, but international aspect is presented as well. The international aspect is included to create a basis for comparison and possible generalisation of the results.

2.3.1   Debate on the proper amount of regulation

Regulators have similar views on how insider trading should be regulated (Gevurtz 2002, 69-75). But the discussion is still vivid in the scientific community. One school of thought agrees with the current regulatory stance and argues that insider trading is a fundamental problem in capital markets. As such it should be solved through regulation. This group contends that insider trading is detrimental to creating fair markets and that the ownership of inside information belongs to the company (e.g. Schotland 1967).

The other school of thought has three main arguments for deregulation of insider trading. Primarily this group argues that allowing insider trading would improve the efficiency of markets (e.g. Manne 1966)[30]. Efficiency is viewed as an important factor in modern capital markets. It implies more accurate security prices which reduce windfall profits to individual investors through smaller price fluctuations and fewer opportunities to benefit from mispricing. Accurate security prices also reduce investors' uncertainty about the companies, and about the performance of management (Carlton & Fischel 1983, 866-867; Bainbridge 2000, 777-778). After Manne (1966) presented this argument[31] it has sparked a heated debate on the issue, and many researchers have studied its potential. The results show both positive (see Finnerty 1976, 1146; Givoly & Palmon 1985, 85; Muelbroek 1992, 1696-1697) and negative (see Schotland 1967, 1443; Gilson & Kraakman 1984, 630-632) results for insider trading increasing market efficiency.

With these conflicting results the argument on increased efficiency remains undecided, but the theoretical basis for increased efficiency is convincing. Manne (1966, 114-115) proposes that the increased buying (selling) by insiders drives the price up (down) until all the information is incorporated into the price, or the information is disclosed and adopted into the market price.

This argument is countered by the fact that the overall amount of trading by insiders is too small to affect prices considerably (Schotland 1967, 1444). However, the counter-argument does not take into account the possible clustering of insiders' trades or the fact that trading patterns would likely be different if the current trading restrictions were loosened.

Manne (2005) has recently presented increased information transferral within a company as a further argument to support deregulation. Companies could actually monitor the stock price and insider trades to identify an event of interest and react to it faster.

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[30] See more detailed discussion on market efficiency in chapter 3.1.

[31] The argument was originally presented in 1966 in the book *Insider Trading and the Stock Market* and later adapted to a journal article.

This process utilises the concept of Hayekian markets and is described in more detail in Appendix I.

The second main argument for deregulation is not as strong as the argument for increased efficiency. It states that insider trading profits should be viewed more as remuneration to insiders and should be subject to private contracting. This argument relies on the fact that if insiders were allowed to trade freely they could accept a smaller salary as they could collect extra remuneration through insider trading. The argument continues to state that trading profits would act as a better incentive scheme than regular methods of remuneration (e.g. Manne 1966).

Even though insider trading can be viewed as effective compensation to stimulate entrepreneurial actions (Manne 1966, 117-119), its effectiveness has been questioned since it was first introduced. The main arguments against it are presented by Schotland (1967, 1455) and further developed by several scholars (Mendelson 1969, 486-490; Easterbrook 1981, 323-333).

These arguments revolve around four issues: (1) the wealth of an insider affects the payoff from insider trading more than the value of insider's contribution; (2) the value of trading profits is unknown beforehand; (3) insider trading may have nothing to do with the valuable contribution to the company; and (4) this enables insiders to profit from failed projects. Even Manne (2005, 168, 170-174), an avid proponent of deregulation, concedes that this argument has not faced scrutiny well but still argues that it is better than the alternatives.

Finally, the case for deregulation is argued through suggestion that there is no considerable harm done to long-term investors. Short-term investors (speculators) on the other hand would be harmed by unregulated insider trading. Manne (1966, 114-115) argues that this is not important because the capital markets are designed to serve the purposes of long-term investing.

This argument has later been countered most persuasively by demonstrating that market makers, who always trade against insiders, would take this into account by increasing the bid-ask spread (Bagnoli & Khanna 1992)[32]. While the increasing bid-ask spread has been heavily advocated in the literature (Dolgopolov (2004, 92-105) presents an extensive list) it does not seem to hold in practice. Dolgopolov (2004, 110-118, 149-174) reviews two questions: (1) how market makers themselves do not see disadvantages in insider trading, and (2) how the extensive empirical literature fails to reach a uniform conclusion. Thus he concludes that the counterargument does not hold in practice.

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[32] Detailed description of the market making process is included in chapter 2.2.2.

Another way how insider trading could harm long-term investors is increased volatility, which equates to higher risks. Du and Wei (2004) find that more insider trading is associated with higher volatility. This relationship has not received corroborative evidence from other studies yet. Furthermore, the reasons for increased volatility are still unresolved. Volatility could be driven by number of smaller adjustments instead of few larger ones. The true value of a company could also be more volatile than the perceived value meaning that increased efficiency is followed by higher volatility.

The case for regulation on the other hand is mainly driven through argument of fairness in the markets. Without a doubt it is important that markets are seen as fair because it ensures that a larger portion of the population can participate in them (Schotland 1967, 1450-1451). However, it is not clear that insider trading creates an unfair market. During the years prior to insider trading laws – and even after they were created but not effectively supervised – officers, directors, shareholders or other market participants did not voice concerns of insider trading creating an unfair market.

Although there is no direct evidence of extensive insider trading before effective regulation anecdotal evidence and experiences from countries which adopted regulations later suggest that it did exist[33]. If insider trading was viewed as harmful to the markets or to some market participant, someone would have voiced their concern, and it is not likely that no one would have noticed large-scale insider trading (Manne 2005, 174-177).

Additionally, Bainbridge (1995, 1207) has found that the main reason for the feeling of unfairness is envy of insiders' greater access to information. This means that insider trading is not seen unfair per se but the outsider wishes that she had access to similar information. When this is combined with the fact that there will always be investors with different levels of information and expertise (Netter, Poulsen & Hersch 1998, 2), it becomes clear that insider trading on its own does make the markets unfair and drive investors away.

Further arguments for regulation focus on the harms that insider trading causes to the company. Bainbridge (2000, 787-791) collates four potential problems that arise from insider trading: (1) delayed disclosure of information or corporate action; (2) compromised corporate plans; (3) stock price manipulation; and (4) damaged reputation of the company.

Delays can happen on many levels of the corporate ladder before information reaches the top management. When people take some time to trade before passing on the information even small time lags can multiply in the chain and delay the disclosure of information or delay the required actions (Schotland 1967, 1448-1449; Mendelson 1969,

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[33] Japan is an example of such a country (Carlton & Fischel 1983, 860).

476-477; Haft 1982, 1053-1060). Nevertheless, this argument does not seem to hold as no delays due to insider trading have been observed (Dooley 1980, 34). It is also quite easy for the employer to detect any delays (Bainbridge 2000, 787).

The compromised corporate plans might result from the incentives created when insiders try to maximise their trading profit. An example of this situation is merger negotiations after insiders have purchased shares. While the negotiations are underway insiders are exposed to market risks and cannot sell their shares as publication of the merger would increase the share price. Meanwhile other market movements could cause them losses and so it is in their interest that the price reaction would occur as swiftly as possible. This might encourage them to leak the information before it is in the best interests of the company (Schotland 1967, 1449; Mendelson 1969, 476-477; Bainbridge 2000, 788-790).

Easterbrook (1981, 332) also presents that insiders may be tempted to select riskier projects to introduce more volatility to the company's stock because they can then reach larger gains from trading on the biggest price moves. Carlton and Fischel (1983, 874-876) dispute this by stating that insiders work as a group and it would require participation from the entire group to change projects to gain better trading opportunities. All participating insiders would risk their reputation. Similarly to cartels, it would be beneficial for any of the participating insiders to break the silence and use the information for their own purposes.

The argument for incentives to manipulate stock prices has been presented by many authors starting from Schotland (1967, 1449-1450). Also Manne recognises the detrimental effect of stock manipulation. Still, he contends that the case he brought forward was not about allowing manipulation but about accepting that costs of creating perfect compliance were too high (Bainbridge 2000, 790).

There are numerous ways to manipulate stock prices and an overview of them can be found in Kose and Ranga (1997). Similarly to the case of compromised corporate actions, insiders will put their reputation on the line in a scheme such as this. Getting caught on stock price manipulation or compromising corporate actions would be very serious for any insider as a large portion of their (future) wealth is tied to their career success.

Last of the four harms collated by Bainbridge (2000, 787) is the potential damage to the company's reputation. He raises this issue because it is often discussed in the literature even though there is no reliable theory on what could cause reputational damage to the company. This question actually relates to the discussion on fairness of the markets as the reputational impact would be felt through insider trades perceived as unfair. The feeling on unfairness stems more from envy than rational channels of reputational impact towards the company (Bainbridge 2000, 790-791).

Lastly the debate on insider trading has focused on who owns the private information. The discussion revolves around issues which are similar to issues discussed regarding other intangible property rights such as patents and copyrights. For example, once patentable information is produced and used it can be used by anyone to compete with the original producer. This prevents the producer from gaining profits to cover the costs of producing that information. To ensure production of patentable information the producer gets a temporary monopoly to use the information (see Bainbridge 2000, 791-794). Society should find the proper balance between incentives to create new information and rights to use existing information. Coase (1960) discusses the choices in social arrangements and urges consideration of the total effect of different arrangements on the society.

In insider trading the question boils down to who gains most from the information while causing least costs to other parties (Carlton & Fischel 1983, 863). Current regulation has taken a clear stance on this question in the case of SEC v. Texas Gulf Sulphur [TGS] Co and placed the ownership of the information to the company (Dooley 1980, 1). Many scholars share this stance (Bainbridge 2000, 791-792) but the field is far from unanimous (see Manne 1966, 118; Carlton & Fischel 1983, 866). Advocates of companies owning the information agree that it is not optimal to place ownership to the company but that it is better than the alternative. This reasoning is based on the fact that the information remains neutral within the company. It does not increase or decrease he value of the company or move wealth between owners. Mostly allowing insider trading would not harm the company but only transfer wealth between insiders and outsiders (Bainbridge 2000, 793).

The problem with giving the ownership to insiders turns the discussion to insider trading as compensation. Consequently it is opposed with the same arguments that are used in the compensation discussion. A further argument against ownership rights of insiders is that if private contracts were formed it would be prohibitively expensive to enforce them (Easterbrook 1981, 334). Carlton and Fischel (1983, 864-865) argue that this is not a major issue as most insiders would adhere to the contracts and there are ways to control adherence. The control may not be perfect but it is possible. It is also worth remembering that companies did not report difficulties with insider trading before the current regulation came into force (Manne 2005, 174-177).

One point of view that has not been covered extensively in the literature is the question of who should be incentivised to create the information (see Bainbridge 2000, 794). The discussion has so far focused on who actually produces the information but it is equally relevant to consider who should be encouraged to create the information in the first place.

Current regulation and many scholars effectively argue that companies should be incentivised to create the information. However, information is always produced by the

people employed in the company, and the proponents of deregulation have argued that insider trading the best available compensation structure for entrepreneurial action within the company. Arguably that can be the case, as most employees do not strive to create innovations without proper incentives. Banning insider trading removes one way to compensate for innovation (Manne 1966, 118-119). For patents companies and employees are allowed to privately agree on the ownership of and compensation for potential innovations during employment.

To conclude, the question on appropriate regulation of insider trading remains unresolved by the scientific community. It is bound to continue as the opinions are varied and both sides of the debate have valid arguments. While the scientific community is divided on the issue, regulators around the world seem to agree that insider trading should be regulated using methods similar to those used in U.S. However, the regulators have not always been strongly opposed to insider trading. The regulators' views have developed over the last hundred years and this evolution is described in the next chapter.

2.3.2   *Development of the regulation on insider trading*

Prior to early 20th century insider trading remained practically unregulated in U.S. (Bainbridge 1995, 1199-1200). Internationally regulation on insider trading has been introduced even later than in U.S. (Bhattacharya & Daouk 2002, 81-84). Furthermore, it has not been mentioned that insider trading would have been restricted through private contracts before regulation was implemented (Manne 2005, 174).

Occasional cases involving insider trading were brought to court but the charges were based on other crimes than insider trading. This is also true for the two cases mentioned on page 15. The only reason why a person would have been convicted on insider trading was if they committed fraud towards the counterparty. The first case where insider trading was tried according to modern regulation was in 1903 in the case of Oliver v. Oliver, where Georgia Supreme Court decided that managers had a fiduciary duty to the shareholders and they could not use that information to trade against them (Bainbridge 1995, 1199-1200).

Several similar cases were brought to courts in the early 20th century but one other case is worth mentioning. In 1909 U.S. Supreme Court decided in the case of Strong v. Repide that under specific circumstances insiders must disclose material facts even though they do not generally owe that responsibility. The Court recognised two such conditions: concealed identity of the insider; and hidden facts that affect the stock price. After this ruling courts used mainly this "special circumstances" rule until the 1930's (Bainbridge 2001, 4-6).

However, these cases are quite far from the current insider regulation as their reach is very limited. First of all they only concern deals with current shareholders, not other outsiders. Secondly, they are only applicable to trades done outside stock exchanges as decided in the case of Goodwin v. Agassiz. This means that these precedents are only applicable to face-to-face transactions with intent to defraud (Bainbridge 2001, 6-9).

During the great depression there was a strong desire to prevent such depression from happening again by implementing a stronger regulatory regime. Part of this regulation was directed towards insider trading, and initial regulations were enacted in section 17 of the Securities Act of 1933[34]. A more thorough regulation restricting insider trading was passed the next year in the Securities Exchange Act (Bainbridge 2001, 9). After passing these laws it still took a long time before they were being enforced (Bhattacharya & Daouk 2002).

Before anyone was charged with breaking the insider trading laws SEC had to implement a more specific rule 10b-5 which banned insider trading on stock exchanges. Shortly after this SEC charged Cady, Roberts & Co in the first administrative decision under this rule. It took several years more before the insider trading regulation was tried in court (Bainbridge 2001, 12).

In 1960s U.S. was still the only country to have insider trading laws implemented. Even there no cases had been taken to court. Around the same time as France implemented insider trading regulation (1967) (Bhattacharya & Daouk 2002, 88) U.S. Supreme Court delivered the first verdict from on insider trading (1969) (Bainbridge 2005, 3). This first ruling on the case of SEC v. Texas Gulf Sulphur Co laid the groundwork for the future enforcement of insider trading as a battle against securities fraud (Bainbridge 2001, 15-16).

The next milestone in the development of insider trading regulation was reached in the case of Chiarella v. U.S. in 1980. This case was about the duty of people not employed by the company to abstain from using inside information when trading on the company's securities. Chiarella was an employee of a printing press which printed tender offers. He used the information from the tender offers to trade on the securities before it was publicised. Although he was convicted in lower courts the Supreme Court reversed the ruling because Chiarella did not owe fiduciary duty to the company (Bainbridge 2001, 16-18).

During the process a new theory on why Chiarella should be convicted was introduced but it was too late to affect this case. The misappropriation theory stated that Chiarella misappropriated (stole) information that was entrusted to him. While the theory did not affect this case it led SEC to create a new rule based on this theory. Soon it was

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[34] Hereafter referred to as the Securities Act.

enforced in court as well. In U.S. v. Newman the court upheld SEC's view that the defendants had misappropriated information which was given to them while providing advice to companies (Bainbridge 2008, 6-7).

The cases of Chiarella and Newman were among several high profile insider-trading cases of the 1980's. The case of Ivan Boesky, David Milken and Mark Levine was perhaps the most publicised of these cases (see Salinger 2005, 49-50). In addition to the enforcement actions the regulation was also developed. SEC introduced the misappropriation theory to insider trading rules and the Congress toughened insider-trading regulation after the cases of Chiarella and Dirks[35] with the Insider Trading Sanctions Act of 1984 (Netter, Poulsen & Hersch 1998). Congress once again toughened the regulations after the Boesky case with Insider Trading and Securities Fraud Enforcement Act of 1988.

Through these cases and laws the regulation started to resemble its current form. However, the misappropriation theory was still not tested in the Supreme Court. The first time misappropriation theory was tried in the Supreme Court in the case of Carpenter v. U.S. the verdict was undecided (Netter, Poulsen & Hersch 1998, 5). The final confirmation for the misappropriation theory came in 1997 in the case of U.S. v. O'Hagan. The Supreme Court decided that the defendants were guilty of insider trading by using "confidential information for securities trading purposes, in breach of a duty owed to the source of the information" (Bainbridge 2005, 5-6).

In the following years regulation surrounding the misappropriation theory was further clarified and made stricter. In 2000 SEC enacted rules 10b5-1 and 10b5-2, and regulation FD. Rules 10b5-1 and 10b5-2 set out the circumstances when a person is in possession of material non-public information and when a duty of trust is created respectively. Regulation FD clarifies the disclosure of information by issuers. The rules also define affirmative defences outlining the situations in which misappropriation theory will not be applied.

The next changes to regulation came in 2002 in the aftermath of the scandals in Enron and various other companies giving rise to the Sarbanes-Oxley Act. Although the bulk of the Sarbanes-Oxley Act deals with other issues than insider trading, the reporting requirements for insiders were tightened considerably. The Sarbanes-Oxley Act requires insiders to file their transactions electronically no later than two business days after the trades. Previously reporting was required prior to the tenth day of the month

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[35] Dirks v. U.S. was a case where Supreme Court ruled that in order for insider trading laws to be applicable, a tipper (a person relaying inside information to a third party) must receive personal gain from the tip (Bainbridge 2008, 5-6).

following the trades and could be delivered to SEC via paper submissions. The Sarbanes-Oxley Act also implemented restrictions on trading by insiders of pension funds.

Since the Sarbanes-Oxley Act insider trading regulation has not been significantly altered. However, one piece of legislation has been in the U.S. Congress several times but has not been passed into law. This regulation would prevent members and employees of congress from trading on information they receive in their privileged position in the government (H.R. 682--111th Congress: Stop Trading on Congressional Knowledge Act). Even though the regulation has not changed in the recent years, enforcement of insider trading crimes has been toughened. Several high-profile cases have been successfully tried in courts (U.S. Securities and Exchange Commission 2007, 3, 8, 92; Gorman 2007; U.S. Securities and Exchange Commission 2008, 2, 12, 32, 112; Burgess & Masters 2010; U.S. Securities and Exchange Commission 2011, 2, 14-15).

As seen above, the regulation on insider trading has been developed over a considerable time period. Most of the progress has concentrated to periods after certain key events such as court cases or major turbulence in markets. However, everyone does not agree that the development of insider trading regulation is progress. As shown in chapter 2.3.1 several researchers have argued that insider trading does not incur costs for investors, contributes to more efficient price discovery, and acts as an efficient remuneration scheme for insiders.

Regardless of these objections regulators and large number of researchers are of the opinion that insider trading is undesirable for the markets. They have also promoted their view extensively and received at least a silent approval from the general public (Manne 2005, 184). For the better part of the 20th and 21st centuries insider trading regulation has been tightened. With the recent market turmoil and several high-profile market abuse cases this tendency seems unlikely to be reversed.

However, the direction of development is uncertain as the debate on insider trading is still very vivid. It is possible that the proponents of deregulation are able to convince enough people to induce deregulation of insider trading in the future. Speculation on future of regulation will be left to this mentioning and the current regulation will be explained in detail in the following chapter.

2.3.3 Current regulation in the United States

Bulk of regulation concerning insider trading is contained in the Securities Exchange Act. The Securities Exchange Act has been modified numerous times after it was enacted. The modifications have introduced new requirements or modified existing ones. Other major sources of regulation are case law, rules enacted by SEC, and to a minor degree the Securities Act (Newkirk & Robertson 1998).

The Securities Exchange Act was enacted during the great depression to regulate the secondary market in securities. It was part of a larger reform of the financial markets along with the Securities Act which regulates primary markets in securities. While section 17 of the Securities Act contains provisions applicable to insider trading, lawsuits are mainly brought to courts based on the Securities Exchange Act. Thus this chapter will focus on the Securities Exchange Act[36].

The Securities Exchange Act contains both direct and indirect provisions regulating insider trading. Section 10 of the Act covers provisions against fraud in general but has been widely used to regulate insider trading. SEC has implemented rules 10b-5, 10b5-1, and 10b5-2 to extend and particularise how the section applies to insider trading. These rules, along with the case law, define insider trading on the basis of material non-public information fraudulent activity.

While the Securities Exchange Act does not clearly define what constitutes illegal insider trading, the case law has established it to mean wide variety activities. In the simplest form it includes corporate insiders[37] trading on the basis of material non-public information. Materiality has been defined in the case of TSC Industries, Inc. v. Northway, Inc. Although the case related to a merger, not insider trading, it defined materiality as it is used in all securities fraud cases. Materiality was defined to mean that there is a substantial likelihood that a reasonable shareholder would consider the fact as important in making investment decisions.

Trading "on the basis of" some information is defined to include all trading while in possession of that information unless affirmative defence can be established. In this context affirmative defence refers to a plan or contract to purchase or sell the securities in question. The plan or contract has to be established before the person receives the inside information (Rule 10b5-1: Trading "on the basis of" material nonpublic information in insider trading cases 2000).

Insider trading restrictions have further been extended to include constructive insiders, who receive material non-public information while providing services to the company or through some other relationship of trust between the person receiving the information and the source of that information (United States v. O'Hagan 1997; Rule 10b5-2: Duties of trust or confidence in misappropriation insider trading cases 2000). This extension has been accepted into the case law as misappropriation theory. The un-

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[36] This refers to the original Securities Exchange Act including all subsequent modifications. The modifying acts, such as Sarbanes-Oxley Act, have been mentioned in chapter 2.3.2.

[37] Corporate insiders are defined in section 16 of the Securities Exchange Act to include directors, officers and principal shareholders. Term "principal shareholders" refers to persons who own more than 10% of any class of security in the company.

derlying concept the theory is that the information belongs to the company or person from whom it was acquired (United States v. O'Hagan 1997).

Furthermore, insiders are forbidden from tipping the information to a third party who could use it to trade. If information would be passed to third parties, the tippees are also forbidden from trading on the basis of that information if they should reasonably be expected to know that the information is inside information and is supposed to be kept confidential (Dirks v. SEC 1983).

The securities in question do not have to be issued by the company from whom the information originates. They may as well be securities related to the information which is considered insider information. This has been established in the case of U.S. v. Carpenter (1987), in which a Wall Street Journal columnist communicated the contents of the column beforehand to a person who traded on the basis of this information. The information was deemed to be the property of Wall Street Journal, and the defendants were not allowed to use it[38].

All of the abovementioned restrictions can be extended to tender offers based on section 14 of the Securities Exchange Act and the corresponding SEC rule 14e-3. However, the regulations take services vital to tender offers, such as underwriting, into account by providing certain exemptions. Similar provisions can also be extended to primary market of securities through section 17 of the Securities Act. Combining this information means that insider trading regulation covers all securities transactions except certain exempted transactions.

These restrictions on insider trading have been derived from a more general ban of fraudulent activities in securities market. There are direct regulations on insider trading, too. The most prominent of them are the short-swing rule in section 16(b), and the ban on short sales in section 16(c) of the Securities Exchange Act.

The short-swing rule bans regular – but not constructive – insiders from receiving any profits from sales or purchases of the securities of the issuer in which they are insiders within a six-month time period. Any such profits can be recovered by the issuer or any owner of any of the issuer's securities if the issuer declines to press charges with-

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[38] The Supreme Court decision was a tie on the counts related to insider trading but the defendants were sentenced on other counts. The issue was finally resolved ten years later in U.S. v. O'Hagan, where the defendant was convicted from insider trading in similar case.

in 60 days of request. Certain types of transactions are exempted from this provision due to their nature[39].

The ban on short sales forbids insiders from selling securities they do not own or cannot promptly deliver to the buyer. This provision includes exemptions to allow brokerage activities and sale of securities, which will be issued or delivered to the insider at a later time (rules 16c-1, 16c-2 and 16c-3). Moreover, section 16(d) of the Securities Exchange Act exempts market makers from the two abovementioned requirements. Section 16(e) allows these restrictions to be broken in connection to international arbitrage transactions. Nevertheless, SEC has excluded officers and directors from the exemption of section 16(e) in rule 16e-1.

In addition to the restrictions on the trading of insiders, they must also report their trading activity to SEC. The regular insiders – i.e. directors, officers and principal shareholders – have to file reports on their transactions and holdings on non-exempted securities of the issuer in which they are insiders. Only securities that are required to be registered according to section 12(g) of the Securities Exchange Act are subject to the reporting requirements[40]. The reporting requirements do not apply to constructive insiders either.

Even if the transactions are exempt reporting requirements it does not mean that the trading restrictions covered earlier would not be applicable. SEC will still enforce those regulations but it is just more difficult to detect infractions. The reports that insiders file are aimed at distributing information to other market participants.

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[39] These transactions include certain trades approved by the regulators (rule 16b-1); certain non-discretionary transactions between an issuer and its officers or directors (rule 16b-3); bona fide gifts or inheritance (rule 16b-5); certain changes in securities ownership due to characteristics of derivatives, such as exercise of options, (rule 16b-6); qualified transactions in connection with a merger (rule 16b-7); and securities deposited to or withdrawn from a voting trust (rule 16b-8). Additionally, transactions exempted from the reporting requirements defined in section 16(a) are also exempted from section 16(b) except for small acquisitions (rule 16a-6 and rule 16a-10). The exempted transactions are transactions by odd-lot dealers (rule 16a-5); transactions in connection with distributing substantial block of securities (rule 16a-7); transactions resulting from stock splits, stock dividends, pro-rata rights (rule 16a-9), or dividend reinvestment plan (rule 16a-11); transactions pursuant to domestic relations orders (rule 16a-12); and changes in the form of ownership that do not affect the pecuniary interests (rule 16a-13).

[40] A security has to be registered if the issuer, which is conducting interstate business, has assets exceeding USD 1,000,000 and the security is held on record by at least 500 persons. This does not create an exhaustive list because for example securities registered on national securities exchange have to be registered according to different regulation. An exhaustive list of exemptions can be found in section 12(g)(2) of the Securities Exchange Act.

Market participants receive timely information on any changes in insiders' securities ownership as insiders report them within two business days of the transaction. Insiders also have to file a report when their reporting requirement begins. This could happen when a person becomes an insider or the company has to register one of its securities creating reporting requirement for all of the company's insiders. Additionally, insiders have to file a yearly report for any transactions that were exempted from the normal reporting cycle[41] unless the insiders have voluntarily reported these transactions earlier (Section 16 (a) of the Securities and Exchange Act).

Starting from 1 July 2003 all reports had to be delivered to SEC electronically. SEC then makes them available to the general public in electronic format. The reports also have to be displayed on the company website, if one exists, for at least 12 months (Section 16 (a) (4) of the Securities and Exchange Act; rule 16a-3). This ensures that investors can easily access all insider transactions for any company.

Naturally none of these provisions would have much of an effect if there were no sanctions for non-compliance. Sanctions for insider trading can be given through both civil and criminal proceedings (Newkirk & Robertson 1998). Civil and criminal actions are not mutually exclusive and both can be brought for the same offence (Sections 20A (e) and 21A (d) of the Securities and Exchange Act).

Civil actions have a considerably lower burden of proof than criminal actions and thus they are used in many cases. In a civil case plaintiffs only have to show by preponderance of evidence that the defendants are guilty. In some circumstances the burden of proof can also be shifted to the defendants (Newkirk & Robertson 1998). The range of potential sanctions in civil cases is considerable. In addition to anyone trading at the same time as the insider trading offence happened being able to claim their lost profits or excess costs (Section 20A (a) of the Securities and Exchange Act) SEC can seek a court to impose a penalty of up to three times the profit gained or loss avoided (Section 21A of the Securities and Exchange Act)

In criminal cases the defendants have to be shown to be guilty beyond reasonable doubt, which requires much more evidence than needed in a civil action (Newkirk & Robertson 1998). Imposing jail sentences requires criminal proceedings. Incarceration is a serious deterrent and consequently criminal cases are tried by SEC regularly. The maximum penalty without criminal history can lead to almost 25 years in prison depending on the amount of profits gained or losses avoided. While the maximum jail sentence is very long, the minimum sentences much shorter and first-time offenders can receive only probation (Federal Sentencing Guidelines Manual 2011, Chapters 2 and 5).

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[41] The exempted transactions are presented in footnote 39.

In cases where the information has been tipped to third parties for trading the informant is jointly and severally liable. This means they face the same penalties as the actual trader (Section 20A (c) of the Securities and Exchange Act). Controlling persons can also be held liable for the same offences as the person who actually committed the offences. The controlling persons are not liable if they can show that they did not recklessly disregard the fact that insider trading violations were likely and fail to take action, or they recklessly fail to set up and maintain policies to prevent violations (Section 21A of the Securities and Exchange Act).

Furthermore, failures to comply with the reporting requirements have their own, potentially stern consequences. They can go up to USD 5,000,000 fine and 20 years imprisonment for natural person and up to USD 25,000,000 fine for legal persons. These penalties emphasise that insider trading is seen as a serious offence in U.S. The following chapter will briefly present regulation and penalties in selected countries and compare them to the regulation and penalties in U.S.

2.3.4   Brief introduction to insider trading regulation globally

U.S. is in the forefront of developing insider trading regulation. For a long time it was the only country with any regulation on the subject. While U.S. enacted the first laws in 1934 the rest of the world mainly followed suit in the 1980's and 1990's. Canada was the first country outside U.S. to enact insider trading laws in 1966 with France following the next year. The fact that U.S. had had its first successful prosecution before most other countries had any regulation highlights the time lag between U.S. and the rest of the world (Bhattacharya & Daouk 2002, 81-84).

Given the long time U.S. has had to develop their insider trading regulation, many countries have chosen to create their regulation to encompass similar characteristics. However, relatively few countries have chosen to follow U.S. in the exact methods to bring these characteristics into effect. This can be seen as improving on U.S. regulators' work which is not always viewed as optimal (Steinberg 2002, 30-31).

Europe and Japan are the most active securities markets besides U.S. and their insider trading regulations are presented here on general level. The European regulation is based mainly on the European Community Directives 2003/6/EC and 2004/72/EC[42]. In

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[42] The securities regulation in Europe has been largely redrafted in the beginning of the third millennia. The original directive regulating insider trading (89/592/EEC) is no longer in force and was replaced by new directives in 2003 and 2004. These directives have also been amended afterwards to incorporate more uniform adoption and enforcement of the regulation (European Union 2011).

Japan insider trading is covered by the Financial Instruments and Exchange Act (Act No. 25 of 1948). Regulations in other countries are presented at certain points to highlight global tendencies in regulation.

When compared to U.S. or Japan, European Union (EU)[43] has chosen a different way to determine what type of information makes insider trading illegal. U.S. and Japan define this information to be something that is likely to affect a decision by a rational investor[44] (Steinberg 2002, 20). EU on the other hand has chosen to approach the same question from a slightly different angle. It has defined the information to be something that is likely to affect the market price of a security (Directive 2003/6/EC of the European Parliament and of the council). Australia has also opted for the same definition as EU (Steinberg 2002, 20). Both definitions of materiality attempt to reach the same result and are very close to each other.

The question of who are insiders is also resolved in similar manner in most countries. The main differences concern insiders who become aware of inside information through someone else (e.g. tippees or constructive insiders). U.S. and Japan are currently the only countries using a definition mentioning fiduciary duty or relationship of trust (Steinberg 2002, 21; Act No. 25 of 1948, Article 166 (3)). Many other countries, such as EU member states, have chosen an approach where a person becomes an insider by virtue of knowing a fact that is inside information and she ought to know that the piece of information is inside information (Directive 2003/6/EC of the European Parliament and of the council, Article 4). However, this distinction is not relevant in most insider trading cases as the relationship of trust can be formed implicitly in U.S. (rule 10b5-2[45]). Implicit relationship of trust means that overhearing insider information would be more or less the only situation left outside of the definition. Even with the definition used by EU these types of cases would be nearly impossible to enforce in practise. While the definitions related to insider trading vary slightly, insider trading is restricted in almost all countries with securities markets (Bhattacharya & Daouk 2002, 75; Beny 2004, 264).

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[43] European Community (EC) Directives mandate the member countries to adopt them into their own legislation. For this reason it is possible that the laws in different member states use different methods to reach the same goal (European Commission 2012).

[44] Japan has a list of specific corporate actions that are considered material and a general provision which covers all information that might influence a decision by investor (Act No. 25 of 1948, Article 166 (2)).

[45] This rule contrasts decisions made by courts, and in the past some SEC rules have been invalidated by courts (Steinberg 2002, 11-15). Then again, this rule has been in force since 2000 and used in several cases so it is unlikely that it would be invalidated anymore.

Even though the restrictions on insider trading are universal, penalties for offences vary. The EC directive does not mandate sanctioning but it is left to the member states, which results in considerable variation (Directive 2003/6/EC of the European Parliament and of the council, Article 14). Similarly to U.S., criminal proceeds can commonly be recovered from the offenders (Council of Europe 2012, Article 3) but the EU framework does not allow for other contemporaneous traders to file for compensation. Japan's system for recovering criminal proceeds is similar to EU but the method administrative penalties (Act No. 25 of 1948, Article 174).

Civil cases cannot be filed in EU and Japan and all insider trading offences have to be tried criminal cases[46]. For this chapter differences between the possible sentences are more important. Most EU member states, as well as Japan, have regulations that allow administrative penalties. Penalties in EU range from small sums to potentially unlimited amounts, but relatively few countries have adopted penalties proportionate to the profits gained (The Committee of European Securities Regulators 2008). Japan's administrative penalties are limited to the profits gained from trading (Act No. 25 of 1948, Article 174).

In criminal cases the maximum sentences in EU member states range from 1 to 15 years (The Committee of European Securities Regulators 2008, 3). In Japan the maximum sentence is 5 years (Act No. 25 of 1948, Article 197). Monetary penalties vary more than the prison sentences. The maximum fines in EU member states start from hundreds of thousands euro to unlimited fines in some member states (The Committee of European Securities Regulators 2008). Japan has a maximum fine of JPY 5,000,000 (Act No. 25 of 1948, Article 197). This shows that the potential penalties are considerably higher in U.S.

Finally, reporting requirements exist in EU and Japan but they are not as stringent as in U.S. While the report has to be submitted within two business days of trading in U.S., the deadline in Japan is on the fifteenth day of the month following trading (Act No. 25 of 1948, Article 163). EU is lacking uniform reporting requirements altogether. Article 6 of Directive 2003/6/EC only mandates that insiders notify the competent supervisor and that the information is disseminated to the public as soon as possible.

It can be concluded that the regulation of insider trading is very similar in the main securities markets, and the differences are mainly superficial. The regulation in U.S. is more stringent than elsewhere. There also seems to be a trend that more developed securities markets have stricter insider trading regulations (see Bhattacharya & Daouk 2002; Beny 2004, 287-293). But similar regulation does not ensure similar results. The en-

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[46] The main difference between civil and criminal cases is that prison sentences can only be decided in criminal cases. This is more of an enforcement issue and will be covered in chapter 2.3.5.

forcement of insider trading is very demanding, and the choices made in the form of regulation affect the choices of enforcers. The challenges enforcers meet will be reviewed in the next chapter and some solutions to common problems are presented.

2.3.5   *Challenges in enforcement of insider trading regulation*

Enforcement of insider trading regulations is challenging because the act of trading by insiders is perfectly legal. Only knowledge of material non-public information makes trading illegal[47]. In most cases it cannot be easily proven that an insider has known some fact, and it is not always clear that some fact is material. Whether the defendant is even an insider can be questioned in U.S. (see Thomsen 2006).

There is also a distinction between proving insider trading in criminal and civil proceedings because proving wrongdoings in criminal cases is more difficult. This is not a major issue in U.S. where supervisors can select between a civil and criminal case. This means that they can attempt to collect information for criminal proceedings but opt for a civil case if the proof is not solid enough for criminal conviction. In many other parts of the world the proof has to be sufficient to support a criminal case (see Thomsen 2006).

Guilt has to be proved beyond reasonable doubt in criminal cases. This spells trouble for supervisors because the evidence is often circumstantial. Proving a criminal case with circumstantial evidence alone is possible but challenging (Newkirk & Robertson 1998). It is not enough to find suspicious trading activity but it has to be proven that there are no other alternative explanations for the trading activity (Thomsen 2006). This is challenging when all one can use is meetings and communication logs prior to trading and the subsequent publication of information (Newkirk & Robertson 1998). It is also rather easy for traders to come up with alternative reasons to the trades.

Thus it is no surprise that criminal convictions often require confessions or some witnesses as seen in U.S. (Newkirk & Robertson 1998). Overall, enforcement has been more successful and going on for longer in U.S. than elsewhere in the world (Newkirk & Robertson 1998; Bhattacharya & Daouk 2002, 81-84). But the intensity and success of enforcement has been picking up around the world since the 1990s with ever increasing intensity and success in 2000s (Bhattacharya & Daouk 2002, 81-84; Thomsen 2006; Burgess & Masters 2010). U.S. is still in the forefront of enforcement. SEC staff

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[47] Challenges in enforcement are similar in all jurisdictions even though the definition of material non-public information might be slightly different. When there are differences that affect enforcement they are pointed out.

contributes some of this difference to the inability of many jurisdictions to impose civil cases (Newkirk & Robertson 1998).

Many insider trading cases are tried as civil actions in U.S., because the required evidence is less onerous to collect. For example, if SEC can show with preponderance of the evidence that insider trading violation has happened, the burden of proof can be shifted to the defendants (Newkirk & Robertson 1998).

Potential trading infractions need to be identified before civil or criminal cases can be investigated. Recognising them is difficult because billions of shares are traded in the markets on any given day[48]. This volume of trades cannot be investigated in detail (see Thomsen 2006). The reports which insiders submit to regulators cannot be trusted completely either as there are ways that the reporting requirements can be circumvented (e.g. Goldfarb & Rucker 2010).

It is also worth remembering that the reporting requirements do not cover all insiders. They only cover the regular insiders, i.e. officers, directors, and major owners of the companies. Third parties such as hedge funds do much of the illegal insider trading and the enforcement needs to be aimed at them accordingly.

To catch all these different types of insider trading the supervisors employ a large array of enforcement methods. SEC uses at least phone records, emails, instant messages, electronic footprints of internet protocol data, trading records, testimonies of witnesses, and bank and brokerage statements to collect sufficient evidence for trials (Thomsen 2006). Wiretaps have been used to investigate insider trading in Galleon, and they were ultimately allowed as evidence in addition to the abovementioned investigation methods (Pulliam & Bray 2011).

The tools used in insider trading investigations are to large extent same as in any other criminal investigation. It is tedious work and requires a lot of time and resources. Often supervisors have to just wait until price sensitive information is released and try to investigate if any suspicious trading has happened.

Defining price sensitive information ex-post is much easier than ex-ante because the price reaction can be observed in the market. However the price formation process is very complicated and the investigators must also prove that the information should have been known to be price sensitive ex-ante (Thomsen 2006). The research on possibilities for forecasting stock performance and details of the price discovery process will be explored in more detail in chapter 3 below.

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[48] In New York Stock Exchange alone there were 1,233,771,408 shares traded in 4,176,905 transactions on 9 August 2010 (New York Stock Exchange 2010).

3 FORECASTING STOCK PERFORMANCE

Keeping in mind the definition of stock performance from chapter 1.2 the price discovery process for a stock will be explored more deeply in this chapter. Additionally, the possibilities for forecasting stock performance are investigated, which means reviewing the current consensus on the efficiency of stock markets.

3.1 Can stock performance be predicted?

Foresight in stock markets is a heavily debated subject. In scientific literature it is described by the theory of market efficiency formulated by Fama (1970). The consensus on the efficiency of stock markets has varied over time. As anomalies have been witnessed in empirical studies new theories have been developed to better explain the reality. These new theories have moved the consensus away from a technical concept of markets towards a more dynamic model including the psychological aspects of human actions and interactions in the marketplace.

This development is described in the following chapters. The explanation attempts to provide a comprehensive picture of the current understanding of the functioning of securities markets and possibilities to forecast stock performance.

3.1.1 *Market efficiency and impossibility of predictions*

Prices are important in a market economy as they act as guidance for allocating resources across the economy (see Smith 1776; Hayek 1945). Prices transmit the value of different resources and contain all information needed by individual decision-makers. This enables distributed decision-making with incomplete information highlighting the importance of correct prices.

In securities markets the correctness of prices is studied as market efficiency. The efficient capital markets hypothesis was first comprehensively described by Fama in 1970 but the concept began to emerge earlier[49]. The hypothesis states that market prices fully reflect all available information at any time.

In a world where all information is costless and available to everyone this hypothesis is almost self-evident. It would be unthinkable that information known by all market

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[49] Gilson & Kraakman (1984, 550) provide a list of authors who contributed to the theory and its empirical basis before Fama defined it in its current form.

participants would not be incorporated into prices (Sharpe 1970). The efficient capital market hypothesis is relevant and worth studying in a world where these assumptions do not hold. It states that prices will act as if all information is known by all market participants even when information is not costless or available to everyone (Fama 1970; Gilson & Kraakman 1984).

Fama (1970) presented three levels of tests to measure how efficiently markets incorporate information into securities prices. The more extensively relevant information is incorporated into the price of a security the more difficult it is to forecast future price changes. These tests were created to better define the problem and assist in creating empirical tests for it.

The names of these tests are generally used to describe different levels of market efficiency. The first of them is weak form efficiency in which only the past price history is reflected in the current prices. The weak form efficiency mainly suggests that there is no possibility to forecast the future prices from the price history (Fama 1970, 383).

The second level, semi-strong efficiency, refers to a notion that prices always fully reflect all public information. This is mostly studied empirically through event studies investigating the pace at which markets adjust to newly published information. New information should be immediately incorporated in prices for markets to be efficient in the semi-strong form (Fama 1970, 383).

The third and last level, strong form efficiency, requires all public and private information to be incorporated in prices. This means that individuals could not take advantage of even monopolistic access to information and forecast future stock performance based on that non-public information. This is a radical proposition and there were few papers written on the subject at the time of publication of Fama's seminal article (1970, 409-410). Afterwards the strong form efficiency has received more focus and understanding of it has improved since. This thesis will also investigate how private information is incorporated into prices before and after its publication corresponding to strong and semi-strong form test respectively.

It is worth noting that weak, semi-strong and strong form of efficiency are not respectively inclusive. This means that semi-strong markets are not necessarily efficient in the weak form (Fama 1970; Gilson & Kraakman 1984). However, it is likely that markets that are efficient in the strong or semi-strong form are also efficient in the weak form due to the definitions of these categories. This was also hinted by Fama (1970, 388). Nevertheless, this has not been studied nor can it be directly derived from the definitions.

The studies since Fama's article (1970) have focused more testing how efficient markets are. The scientific community largely agrees that the markets cannot be completely efficient in the strong form as theoretically illustrated by Grossman and Stiglitz (1980). They argued that if markets were completely efficient there would be no incentive for

anyone to expend resources to uncover any information. Thus the information could not be incorporated into the market prices. This indicates that certain amount of inefficiency has to exists to create incentives to find information

Also Fama (1970, 414-415) originally noted that there is a difference between theory and reality. Given monopolistic access to information investors could attain monopolistic profits from securities markets using this information. Similar arguments can also be extended to semi-strong and weak forms of efficiency. In these cases the effect is much smaller as the resources required for uncovering this type of information are much smaller than in the case of strong form efficiency.

It takes some time for new information to be incorporated into prices as markets cannot always adjust immediately. These types of markets can still be considered efficient if there is no way to use the delay to achieve arbitrage profits (Fama 1970, 414-415). When Fama formulated the hypothesis he concluded that the evidence supports weak form efficient markets (1970, 414). Numerous studies also support the view that U.S. markets are generally efficient in the semi-strong form (e.g. Fama 1970; Epps 1979; Hillmer & Yu 1979; Patell & Wolfson 1984).

Studies have since emerged supporting possibilities to forecast stock performance based on historical prices only (Park & Irwin 2007). These results are also supported by the fact that many investors use technical analysis[50] even though it has not received widespread acceptance in the scientific community. The results on semi-strong efficiency are also being increasingly challenged. The empirical work is explored in more detail in chapters 3.1.2 and 3.1.3.

The theoretical foundation of the empirical findings challenging the efficient markets hypothesis is systematic biases. These are important for the hypothesis because it does not expect everyone to be right about the price of a security – quite the opposite actually. The hypothesis allows everyone to be wrong and the markets as a whole should still reach the correct price.

The hypothesis assumes that individual valuations do not differ from the correct value systematically. Systematic deviations would make predictions and arbitrage possible. The weak form the hypothesis predicts that pricing assets using historical information would produce results that are symmetrically divided around the correct value[51]. Similarly for the semi-strong and strong forms, the hypothesis stands that pricing assets us-

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[50] Technical analysis is a method of forecasting future stock performance from historical prices. It is often referred to as "charting" because it utilises charts to identify trends in prices.

[51] The true value refers to the correct price when the asset is priced using information for the mentioned efficiency level. The actual correct price could differ from this if more information is used.

ing public or private information respectively would produce results symmetrically divided around the true value.

For this thesis the important dimensions of the efficient markets hypothesis are the strong and semi-strong form tests. This is derived from the fact that no historical price information is used to forecast stock returns. The forecasts are created from information on insider trades. The results for the stock returns of insiders, who have monopolistic access to information, effectually act as a strong form test of market efficiency. Additionally, the speed of price adjustment to newly published information will be tested with the publication of insiders' trades.

Insider trading should increase strong form market efficiency because insiders transfer unpublished information into the prices. For semi-strong efficiency insider trading does not change much because insiders do not have informational advantage over other investors on public information. They will only contribute their capital to the price discovery process according to their interpretation of the information.

As mentioned earlier the price discovery process functions through supply and demand of securities. Investors value all securities constantly and buy undervalued securities and sell overvalued securities. Individual investors naturally focus on a subset of securities so they are not overwhelmed with information. With large number of investors all securities receive their fair share of investors who follow them actively.

When a piece of news is published the investors who are following the related securities estimate how the piece of news changes the value of the security. They then act accordingly and either buy or sell the securities; or leave their portfolio unadjusted. There is no guarantee that any individual investor actually estimated the effect on the value of the company correctly. But as all investors made a similar estimation, they all contribute to the price change. The new price will settle on a level where no one wants to invest capital to support a view that the security is overvalued or undervalued. At this point the supply and demand are in balance.

Because investors choose the amount of capital they are willing to invest they can express the certainty of their estimate with the amount of capital they invest. Thus, investors who believe they have more information will invest more capital to support that view (assuming their estimate leads to a situation in which they want to trade). Because of this investors with most information about the true value contribute most to the price.

In the end the price will be determined through the weighted average opinion of the investors and their confidence in that opinion. This results in a better estimate of the value than any individual investor could produce because groups are better at estimations than individuals (e.g. Manne 1966, 115-116). This implies that it is impossible to predict future performance of securities because individuals are unlikely to be better at estimations than groups.

An exception is individuals who have more information than other people. These investors can justifiably say that they can give better estimations because they know more than other market participants. However, investors know that they may not hold all information that is relevant to the value of the security and that someone else may know more. To mitigate this risk investors have to estimate how extensively they know all the value-relevant information in addition to estimating the value of the security. This confidence the in their information is a further variable investors have to take into account.

Investors who are aware that they may be missing some key information are quicker to re-evaluate their estimates and investment decisions. Corporate insiders naturally have access to most information and can be relatively certain that there are no major pieces of information unknown to them. Other investors are more likely to re-evaluate their decisions when they find out that insiders have a different view of the value.

The current regulation in U.S. mandates publishing of insiders' transactions. When they are published they become part of the pool of public, value-relevant information for the security. Through this channel the value of non-public information seeps into the public knowledge. However, the actual information is not published. This accentuates the price effect insiders have when they add their trades to either the supply or demand side of the market.

The insiders' contribution to the order flow is an important factor in the price discovery process. In principle, insiders should borrow and invest as long as the security is either under- or overvalued. This is only true in a situation of perfect foresight. In reality insiders have to take the inherent uncertainties of real world into account [52] and their personal limitations in taking risks. However, insiders only account for a small portion of the market so their influence on the order flow may not be large.

Additionally, the current regulation restricts insiders' investments heavily because they cannot trade on securities on which they hold material non-public information. Effectively this disrupts both of the abovementioned channels that transfer the value of non-public information to the market. It prevents insiders from contributing to the order flow and denies other market participants knowledge of how insiders estimate the value of the security. Of course insiders can still trade the securities of their companies but

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[52] This refers to the fact that even knowing all information, no one can be certain of the true value of a security. The cash flows affecting the value will only be realised in the future and are bound to a plethora of uncertain, interconnected, and to a degree random, events.

only at times when they should not possess an informational advantage[53]. At such time they would not contribute new information to the price.

Because no one is allowed to use non-public information, theoretically the markets cannot be efficient in the strong form. If they were, it would indicate that the regulations are circumvented, material information would leak to the market prior to its publication, and some investors would use the information to achieve arbitrage profits. The empirical results on the efficiency of U.S. markets are explored in the next chapter. Selected results from other main markets are also presented to create a foundation for generalisation of the results of the thesis.

3.1.2   *Are capital markets efficient?*

Empirical tests on the efficiency of capital markets were conducted before Fama (1970) formulated the hypothesis. The phenomenon has also received a lot of attention since and feeds an active debate on the level of efficiency. Earlier studies were almost unanimously supporting the efficient capital markets hypothesis but lately studies questioning the viability of the hypothesis have emerged.

This chapter will only skim the surface of the very extensive literature (see Fama 1991, 1575) on the topic of market efficiency. It is mostly based on the articles written by Fama (1970), Dimson and Mussavian (1998), Fama (1998), Barberis and Thaler (2002), Malkiel (2003), Park and Irwin (2007) and Yen and Lee (2008) summarising the empirical work. These articles provide a comprehensive overview of the empirical work conducted on the topic. They represent views of both the proponents as well as the opponents of the efficient capital markets hypothesis and present empirical results from all three levels of tests.

The results for the different level tests presented by Fama (1970, 383) naturally differ from each other. The empirical results on the efficiency of capital markets are presented according to these levels. First, results for weak form tests are presented as this category requires fewest assumptions and is most likely an accurate depiction of reality. Following these tests the results of semi-strong form tests and strong form tests are presented. They require more assumptions respectively.

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[53] Even though insiders should not possess informational advantage by holding specific information relevant to the value of the security, they do know numerous smaller details and other qualitative factors affecting the value of the security. Additionally they can be more certain of their valuation because there should be no unknown pieces of information.

Weak form tests have been conducted as early as 1900 when Louis Bachelier deduced that the expected profits for a speculator were zero. After the initial research, the field lagged until the age of computers introduced the ability to analyse larger data sets. Following computers in the 1950s and 1960s more research emerged. Initially the research lacked an economic rationale for efficiency. This changed with Samuelson (1965) and Mandelbrot (1966), who studied the issue more rigorously and introduced the rationale made famous by Fama (1970, 389-390).

When Fama's article was published the evidence was stacked heavily in favour of accepting the weak form efficiency. The only results contradicting the efficiency provided only weak evidence or could be explained by informational advantages and market structure (Fama 1970, 414-415). Since then more research has been conducted on the subject and dissenting opinions have been raised.

The research has moved from supporting results in the 1960s to challenging results in the 1990s as Yen and Lee (2008, 305) describe. The identified anomalies that are relevant to the weak form efficiency include momentum (e.g. De Bondt & Thaler 1985); seasonal effects (e.g. Lakonishok & Smidt 1988); and success of technical analysis (see review of studies in Park & Irwin 2007). However, these empirical findings can mostly be attributed to flawed sample selection, or sensitivities to either model selection for market return[54] or measurement methodologies (Fama 1998, 248-288). Additionally, Fama argues that that the research often lacks a supporting theoretical foundation which would provide an alternative to the efficient capital markets hypothesis (see also Malkiel 2003, 72).

Research aimed at challenging the semi-strong form efficiency more commonly contains an alternative theoretical foundation than research studying the weak form efficiency. The alternative theories for semi-strong form efficiency are based on behavioural premises instead of the rationality underlying the efficient capital markets hypothesis (Barberis & Thaler 2002).

All behavioural models have a common trait. They argue for deviations from the rationality due to certain biases that can be found in human behaviour. The full list of identified anomalies is long but some of the most prominent are: the size premium, anomalies based on price ratios, post-earnings announcement drift, anomalies surrounding dividend initiations and omissions, overperformance following stock repurchases; and underperformance after stock offerings (De Bondt & Thaler 1985; Barberis & Thaler 2002). The details of behavioural theories explaining these anomalies are presented in more detail in chapter 3.1.3.

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[54] Tests for market efficiency always test a pricing model as well because determining whether prices fully reflect all information requires defining a price which reflects all information.

The behavioural theories work well for the anomalies that they attempt to explain but fail to explain many other factors present in the markets. They are closely linked to the empirical work which they explain and several competing behavioural theories have spawned. These theories are not fully compatible with each other nor do they provide a comprehensive explanation for all empirical findings (Fama 1998, 188-192).

Even with these drawbacks the behavioural school has garnered increasing support in the scientific community. As of now it cannot be definitively said if the efficient capital markets hypothesis explains reality better than the behavioural models. Barberis and Thaler (2002, 1113) argue that there will most likely be better alternatives for both rational and behavioural theories because the current theories are not sufficient to explain the empirical findings.

Currently the efficient capital markets hypothesis is the prevailing theory for the majority of scientific community and still perhaps the most used underlying assumption in research in the area of finance or economics (see Yen & Lee 2008, 326). Also the practitioners seem to trust in the rational theories more; even though they see the behavioural theories as promising alternatives (see Shanken & Smith 1996, 100).

Lastly this chapter will present results from strong form tests of market efficiency in U.S. As mentioned in the previous chapter markets are not expected to be efficient in the strong form because of monopolistic access to information. Many people with access to non-public information can also control how it is publicised further deteriorating the possibilities of strong form efficiency in markets.

Furthermore, Grossman and Stiglitz (1980) pointed out that some inefficiency has to exist to incentivise market participants to spend resources on creating new information. In line with this Fama (1970, 415) found earlier that the few studies conducted in this area found that markets were not efficient in the strong form.

There have been more studies in this area later. Many of them have found inefficiencies relating to the use of non-public information. Especially insider trading has received a lot of focus in the recent decades. There have been numerous studies on whether insiders can use their information to outperform the markets. These studies have mostly found that insiders can outperform the markets indicating that markets are not efficient in strong form. The individual studies on insider trading are introduced in more detail in chapter 3.2.

Regardless of these findings many studies cannot (and actually do not even attempt to) show that external investors could use this knowledge to achieve arbitrage profits.

This indicates that the inefficiency is not large and does not 'leak'[55] to semi-strong form efficiency. However, there are also studies which find that external investors can utilise the information on insider trading activity to gain abnormal profits (Fama 1991, 1603-1604).

While studies disagree on the semi-strong form efficiency, they are unanimous about markets not being efficient in the strong form. Studies conducted on other market participants, such as market makers or security analysts, who hold non-public information support this notion. Often the research question is whether the studied investor group holds non-public information rather than if the markets are efficient in the strong form. This is true for studies on the performance of professional investors (Fama 1991, 1603-1607).

Based on the empirical evidence one can be quite confident that the U.S. capital markets are not efficient in the strong form. However, when it comes to weak and semi-strong form efficiency, the evidence is more scattered. Currently there is no consensus on the issue in the scientific community. The new behavioural theories challenge the efficient capital markets hypothesis. So far they have not been able to provide a better explanation of reality, but they have raised the need to conduct further research (Lo 2005, 1). Majority of the required research is aimed at the semi-strong form efficiency as most anomalies underlying the behavioural theories concern it. Some anomalies concerning the weak form efficiency exist but consistent evidence showing their existence over long periods of time has not been presented (Fama 1991, 1578-1581; Park & Irwin 2007, 817-818). Thus, the U.S. markets can be seen as efficient in the weak form.

The behavioural theories have received a larger role in the recent decades as seen above. For this reason it is necessary to present the basic characteristics of those theories in more detail. That will be done in the next chapter. Selected anomalies and the underlying biases are also covered in more detail as they will be taken into account in the empirical section of this thesis.

3.1.3 *Are stock markets driven by psychology?*

Behavioural theories have risen as contenders of efficient capital markets hypothesis and their main characteristics are presented in this chapter. The underlying concept in the behavioural theories is that humans do not always act rationally. The validity of the

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[55] Information on insider trades is published and becomes part of the pool of public information. If this information created arbitrage possibilities for external investors it would indicate that markets are not efficient in the semi-strong form.

assumption of rational investors[56] was questioned as early as 1950 when Alchian argued against it. His argument was that rationality fails to function under uncertainty and with lack of unique motivation for actors.

Rationality of investors was further scrutinised when Simon (1955) proposed that investors do not follow rationality but create simplifications in order to handle the amount of information and the required calculations. This article could be described as the beginning of behavioural finance[57] even though it did not present biases, which are in the centre of the behavioural finance literature. Systematic biases in human behaviour are the distinguishing factor of modern behavioural theories. These biases lead to situations where markets are not efficient and prices may not be correct for extended periods of time.

There are numerous behavioural theories to explain certain biases. The theories may not be mutually compatible. All theories do not even constitute a complete financial theory. Often they focus on explaining a specific, observed market anomaly, or bias unearthed in a psychological study (see Barberis & Thaler 2002, 1063, 1112). This lack of uniformity or agreement has been a common source of criticism towards the behavioural theories (Fama 1998).

Barberis and Thaler (2002) divide behavioural theories into two building blocks: limits to arbitrage and psychology. Arbitrage mechanisms should quickly restore prices to their correct values under efficient markets hypothesis. Limits to arbitrage building block includes theories describing how these arbitrage mechanisms do not function. Psychology building block on the other hand includes theories describing irrational behaviour of investors. These theories often use the extensive research done on biases in the field of cognitive psychology and apply those findings to the financial markets.

The two building blocks contain a large number of different theories, and it is beyond the scope of this thesis to review them all. This chapter will present the most prominent theories, and most notable biases and anomalies identified in the empirical research.

The theories which will be covered are: prospect theory, ambiguity aversion, belief and preference based models for average returns, theories of co-movement, and adaptive markets hypothesis. These theories all fall under the psychology building block.

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[56] It should again be noted that the efficient markets hypothesis does not require every investor to behave rationally at all times. It merely states that markets act as if investors acted rationally which is achieved when there are no systematic biases. In addition to this, the hypothesis has to be presented in a simplified form in research. This has to be taken into account when considering the real world implications. These issues were discussed more thoroughly in chapter 3.1.2.

[57] There are intermittent earlier works related to the subject – such as Le Bon (1896) and Selden (1912) – but they are separated from the more recent research.

Theories on limits to arbitrage building block will not be presented as they all describe different failures in arbitrage mechanisms. It is sufficient for this thesis to recognise that there are failures in arbitrage mechanisms. Biases are discussed when they are relevant to the presented theory. For a more complete list of different theories please refer to Camerer and Thaler (1995), Rabin (1998), Gilovich, Griffin and Kahneman (2002), and Lo (2005) on issues regarding psychology; for issues relating to limits to arbitrage please refer to Shleifer and Vishny (1997), and Gromb and Vayanos (2010).

Prospect theory is presented first as it is perhaps the most commonly known of the behavioural theories. Kahneman and Tversky proposed it in 1979 to replace expected utility theory, which the authors found unable to explain their findings. Daniel Bernoulli originally proposed the expected utility theory as early as 1738. Von Neumann and Morgenstern (1944) created formal axioms for the theory. Those axioms describe the main characteristics of rational investors.

The axioms state that a rational investor has preferences that fulfil four criteria: (1) they can be used to order all alternatives (completeness); (2) alternatives are ordered consistently (transitivity); (3) the order is not changed if the same outcome is added to all alternatives (independence); and (4) all alternatives can be placed on a continuous scale (continuity). If these axioms are fulfilled the preferences can be represented through a utility function. This theory was further extended by Savage in 1954 by adding a personal probability distribution (Savage 1954). This extended theory is called the subjective expected utility theory.

Kahneman and Tversky (1979) found that these axioms do not hold when people make decisions between gambles[58]. The main tenet of the prospect theory is that people are risk-seeking in the realm of losses and risk averse in the realm of gains. These characteristics of human behaviour are exhibited in figure 3 as convexity in the realm of losses and concavity in the realm of gains.

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[58] Gamble refers to any set of uncertain outcomes. The term prospect in the name of the theory is synonymous with the term gamble. Attitudes towards risk are often studied by asking which set of different payoffs with certain probabilities – i.e. which gamble – a person would choose.
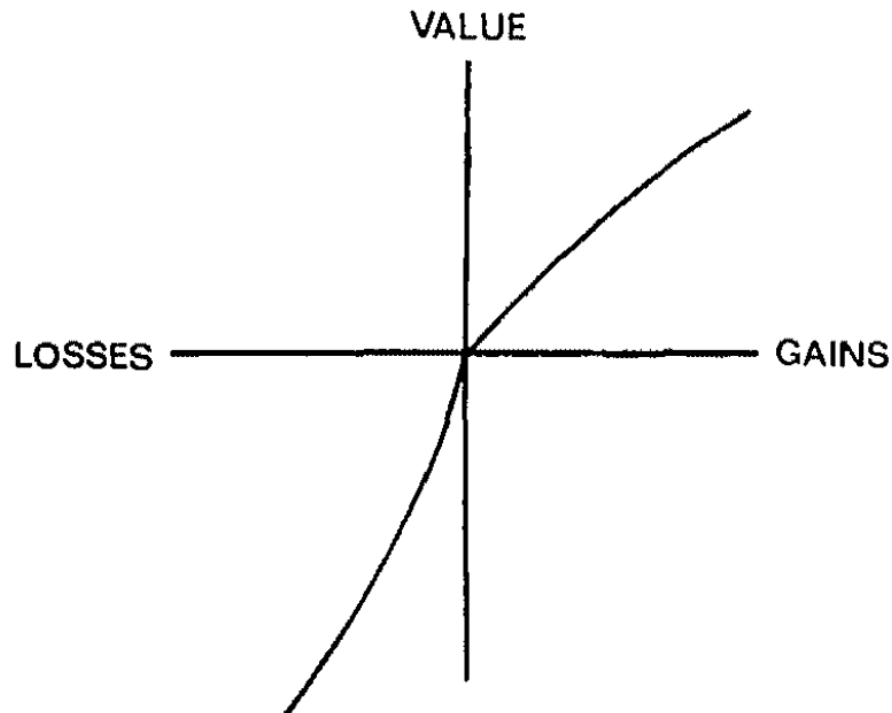
Figure 3:   Human perception of utility from gains and losses (Kahneman & Tversky 1979, 279)

Furthermore, people were observed to be loss averse. This means that their expected utility fell at a faster pace in the realm of losses than it rose in the realm of gains. Loss aversion is demonstrated as steeper slope of the curve in the realm of losses. Additionally the theory proposes that investors only consider the gains or losses without considering the final wealth position. This indicates that two gambles, which are presented differently but lead to the same outcome, can be judged differently (Barberis & Thaler 2002, 1069).

The prospect theory has one further aspect. It concerns the weight with which people take outcomes with different probabilities into consideration when deciding between gambles. This nonlinear probability transformation refers to a tendency to give too much (too little) weight to small (large) probabilities in decision-making process.

Tversky and Kahneman (1992) readjusted this part of the theory because the original version did not adhere to stochastic dominance in all cases. In the new version of the theory[59] cumulative probabilities are transformed instead of probabilities for individual outcomes. This is visually presented in Figure 4.

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[59] On occasion this theory is referred to as the cumulative prospect theory.
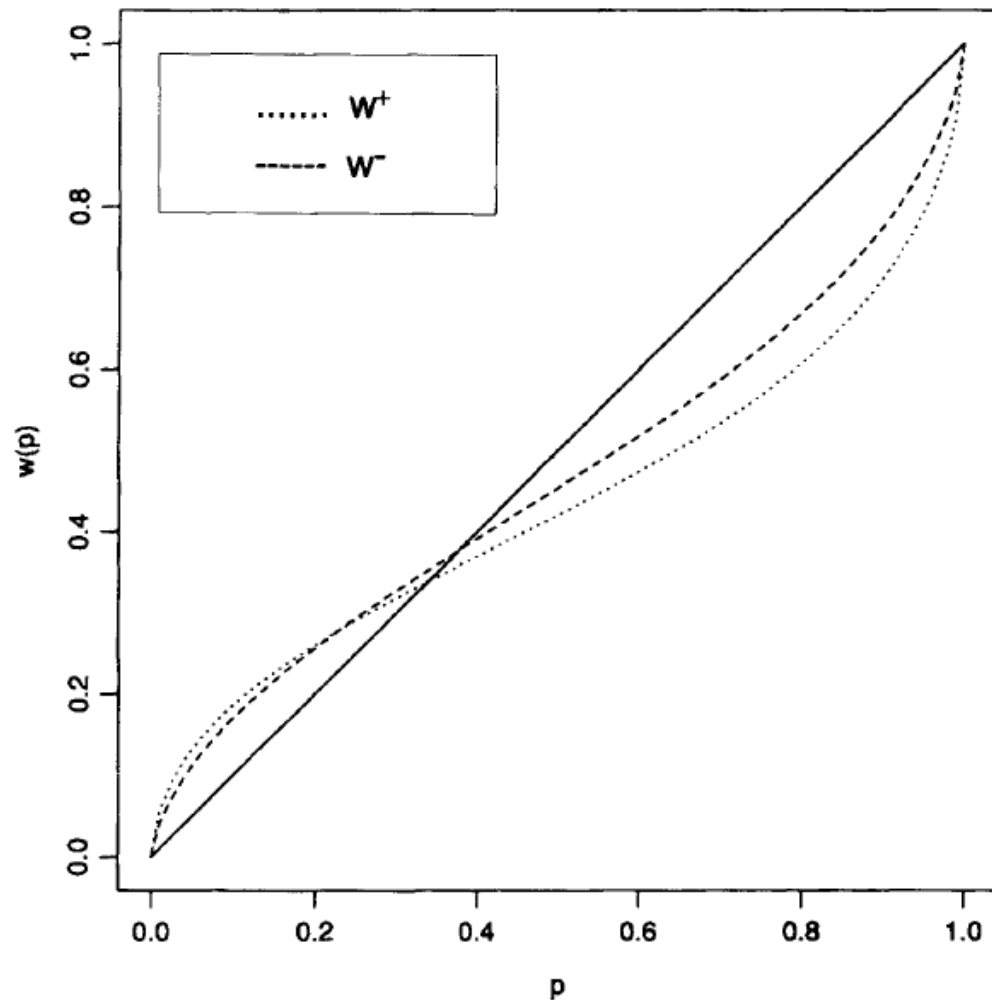
Figure 4:   Weights (w) people attribute to events when accepting gambles with dif-
              ferent probabilities (p) (Tversky & Kahneman 1992, 313)

The figure shows how people attribute weights to events with certain cumulative probabilities when they make decision on accepting gambles in the domain of gains (w^+) or losses (w^-). It can be clearly seen how people place proportionately smaller (larger) weight on large (small) probabilities (p). The effect is more pronounced for gains than it is for losses.

In addition to the abovementioned biases the prospect theory incorporates a few other biases. Mental accounting is one of these. It is closely related to the framing effect. People have a tendency to place gambles on a certain mental account, which they consider separate from other mental accounts. Given the shape of the utility function, this affects which gamble is selected. Thus, the prospect theory states that gains and losses are considered relative to a reference point determined by the used mental account.

Certainty effect is another bias included in the prospect theory. It refers to people's propensity to give more emphasis to certain outcomes as opposed to probable outcomes (Barberis & Thaler 2002, 1070). A closely related bias, pseudocertainty effect involves

conditional two stage gambles. It refers to people tending to choose an alternative with certain outcome in the second stage even though they would choose the riskier gamble if the gambles were presented as one-stage gambles[60] (Tversky & Kahneman 1986, 267-270).

Further biases linked to prospect theory are the status quo bias and endowment effect. Status quo bias means that people favour the current situation over changes. This bias is closely related to the endowment effect. The endowment effect means that people value property they already own more than they would be willing to pay if they were to buy it again. This can be observed for example when people decline to sell something for a larger sum than they would be willing to pay for it themselves. Another example is that people have been observed to decline to buy a service and conducting the service themselves even though they would not be willing to sell that service at the price they could have bought it. Naturally buy and sell prices should deviate a little to take transaction costs into account. The argument is that the observed difference is too large to be explained by transaction costs alone (Thaler 1980, 43-47; Kahneman, Knetsch & Thaler 1991).

The endowment effect has been observed in some studies (e.g. Kahneman, Knetsch & Thaler 1990) but it has also received criticism. Hanemann (1991, 635) argues that the difference in willingness to pay and willingness to accept can be explained by income effects or substitute products. Shogren, Shin, Hayes and Kliebenstein (1994, 255) argue that in addition to these effects there may have been lack of knowledge about the availability and price of objects. Their empirical tests show that there is no difference in willingness to accept and willingness to pay for perfectly substitutable objects with full knowledge of the price and availability of those objects. For imperfect substitutes the difference existed as Hanemann conjectured.

As seen above the prospect theory covers a large array of different biases. Ambiguity aversion, which is covered next, is also shortly mentioned in it as reducing decision weights but not integrated into the theory. Ambiguity refers to gambles whose probabilities are not known. In scientific literature this type of a problem surfaced in Ellsberg's article in 1961.

It has later been incorporated in to the literature on behavioural finance as one theory describing human decision-making. Simply put the theory states that people prefer to choose a gamble whose probabilities are known over a gamble whose probabilities are unknown. This leads impossible situations under the Savage axioms where all outcomes add up to a probability of less than 100 % (Barberis & Thaler 2002, 1072-1073). This

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[60] Comparing two-stage gambles to one-stage gambles is problematic, at least, because two-stage gambles involve path dependencies.

phenomenon is especially relevant for financial markets as they are inherently an ambiguous gamble.

Several possible justifications[61], all of which are not behavioural, have been presented for ambiguity aversion. From a behavioural standpoint the aversion towards ambiguous gambles relates to people's preference to familiar situations. This preference can also overcome the ambiguity aversion under specific circumstances. People can choose an ambiguous gamble over an unambiguous one if they are familiar with the situation. In situations where no familiarity is attached to either gamble, the one with unambiguous probabilities seems more familiar as more is known about it (Barberis & Thaler 2002, 1073).

Another justification is that people try to guard themselves from the worst outcomes, which is similar to loss aversion. Popular hypotheses on how people achieve this are maximising the minimum payoff and robustness controls (Barberis & Thaler 2002, 1080-1081). When maximising the minimum payoff, a person considers a range of possible distributions and selects the alternative with the best outcome in the worst-case situation[62] (Gilboa & Schmeidler 1989). Robustness controls mean that people stress test the assumed distribution and ensure that the outcome is acceptable even if the distribution is misspecified (Barberis & Thaler 2002, 1080-1081). This type of decision-making is consistent with real world experience, where playing a game with ambiguous probabilities against someone who controls the game is likely to lead to losses.

Lastly, ambiguity aversion has been explained through an enhancement of the expected utility theory. Choquet expected utility theory allows probabilities to be non-additive (Zhang 2002). However, this theory has not yet been widely applied.

The aforementioned theories focused on selection of desired alternative under uncertainty. The following theories try to explain how observed market anomalies such as size premium; long-term price reversals; momentum; predictive power of price ratios; earnings announcement drift; effects of dividends or stock repurchases on prices; anom-

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[61] One justification seems to be missing from the literature. It relates to the risk faced by the person entering into the gamble and the rational requirement to be compensated for the taken risks. In an unambiguous gamble the person knows the probabilities and thus the risks. In an ambiguous gamble the person faces an additional risk of not knowing the underlying probabilities. This does not add to the variance of a single game because the probability is locked once the game begins. However, over consecutive games the variance increases by the variance of the probabilities. This added risk, which does not show up when only single games are considered, has to be considered by the person accepting the gamble.

[62] Regret theory is close to this decision theory. It states that people choose the alternative which minimises the maximum regret. If regret is assumed to be a monotone function of the payoff, this is equal to maximising the minimum payoff.

alies following primary or secondary offerings; and unexplained co-movement of prices (Barberis & Thaler 2002, 1085-1088, 1097-1099). These observations are explained by many theories, which are not all compatible with each other, or explain all the anomalies. Barberis and Thaler (2002, 1082) address these as theories focusing on beliefs and focusing on preferences. Additionally, they discuss a theory for co-movement separately.

The belief-based theories use different human biases to explain some of the observed anomalies. The biases mostly focus on how people incorporate new information into existing information. The biases include conservatism (new information is not taken at full value), law of small numbers (short sequence of good results is assumed to be a reliable estimate of the population), new information bias (overweighing new information relative to prior information), and overconfidence (private information is assumed to be more valuable than public information). Some theories also introduce momentum traders who believe that price changes indicate private information diffusing to markets. They buy (sell) following price increases (decreases) and this can be used as an explanation for some anomalies (Barberis & Thaler 2002, 1090-1093).

Different theories use slightly different sets of biases to explain the empirical results. It is also argued that combining the biased human behaviour with institutional frictions is an efficient way to explain the anomalies. For example short-sale restrictions have garnered a lot of attention. Forming a short position in a share is more expensive than normal share transactions because of a lending fee and the risk of the loaned shares being recalled. Additionally, many institutions are not allowed to take short positions (Barberis & Thaler 2002, 1093-1095).

In contrast to the belief-based models, which try to explain the anomalies through the beliefs of investors, the preference-based models try to explain anomalies through the utility investors get from gains and losses. The model combines narrow framing with loss aversion to hypothesise that investors pay attention to losses from individual shares rather than looking at the entire portfolio. Investors then unjustly feel that the shares causing losses are more risky (Barberis & Huang 2001).

Lastly, co-movement of shares has been explained by two different theories (Barberis & Thaler 2002, 1097-1099). The first theory explains the phenomenon through noise traders, who are optimistic (pessimistic) about the potential of the market in general. These traders force their investment targets to rise above (fall below) their fundamental value. Investments in which these traders play a major role end up co-moving strongly regardless of fundamentals. This phenomenon is also observed in closed-end funds. The authors assume that there are a lot of noise traders in these funds which would explain the findings (Lee, Shleifer & Thaler 1991).

The second theory explaining co-movement is based on investors placing shares on certain mental account such as small-cap stocks. These mental accounts are used even if

the cash flows are not correlated. This creates high correlation between shares in the same mental account even if the correlation of the fundamental value is low (Barberis & Shleifer 2003). None of these theories, however, explain all of the anomalies listed above. Size and dividend announcement anomalies remain unexplained by all of them.

The explanations for the anomalies have not been widely accepted. It is also possible that these anomalies are not real. They could be sample-dependent and time-varying as Andrikopoulos, Daynes, Latimer and Pagas (2008) argue. The proponents of the efficient markets often use these arguments when discussing anomalies.

The last theory presented in this chapter attempts to reconcile the differences between behavioural and rational theories. The adaptive markets hypothesis presented by Lo (2004) argues that market participants are essentially rational but in a changing environment they are not able to adapt fast enough. The main tenet of the theory is that evolutionary forces are at play in the financial markets. This means that groups of market participants who cannot adapt to the prevailing market conditions exit the markets, i.e. go extinct. Alchian (1950) presented a similar idea earlier but it was formalised by Lo[63].

The adaptive markets hypothesis builds on the idea of bounded rationality presented by Simon (1955). Bounded rationality argues that humans are not able to do all the complicated calculations required by optimisation, and thus they engage in satisficing. Satisficing refers to finding an alternative which is satisfying but not necessarily optimal. The idea did not get approval in the scientific community because it could not be defined when satisficing ends.

Lo (2004, 22) suggest that an evolutionary approach solves this hurdle. An evolutionary approach explains that the satisfying alternative is determined through heuristics which have been developed through trial and error. Investors adopt heuristics as they notice that certain actions have positive outcomes. Investor's ability to create suitable heuristics determines how well they succeed in the market. Some investors are able to create better heuristics because they posses characteristics guiding them to the right direction. Investors not able to create good heuristics leave the market, and only investors with characteristics suitable to create heuristics which work in the prevailing conditions are left.

There is also another way for evolutionary processes to affect the investment heuristics. The coded behavioural patterns can also be passed on as memes. A meme acts as a unit for carrying cultural ideas, symbols or practices, which can be transmitted from one mind to another through writing, speech, gestures, rituals or other imitable phenomena (Dawkins 1976, 192). These propagate if they successfully capture attention and inspire

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[63] Lo (2004, 22) also notes that other authors, such as Niederhoffer and Bernstein, have presented the idea of Darwinian selection in financial markets earlier.

people to distribute them. In financial markets a successful meme would be connected to large gains in the prevailing market conditions.

Lo (2004) equates distinct groups of investors to species in biology. These groups can leave the market and take the characteristics creating certain heuristics with them. Alternatively the groups can adapt[64] and create new heuristics better suited to the prevailing environment. Only groups able to create suitable heuristics will remain in the market. Following a change in the environment there may be a period of inefficiency but the market will become efficient after the evolutionary forces have removed unsuccessful investors from markets.

Memes can go extinct without any group of investors changing or going extinct. Natural selection works in a similar way for memes as it does for genes (characteristics). If the heuristics created through a meme, do not produce adequate returns it will leave the market as it is no longer successful in capturing the attention of people.

Consequently, the adaptive markets hypothesis predicts that markets will be efficient most of the time because heuristics become efficient through natural selection in a static environment. It also predicts periods of inefficiency following changes in the environment. These short-lived inefficiencies could be captured by the behavioural theories and empirical findings of anomalies. This could explain the lack of unification in behavioural theories, and the sample-dependence or time-specific nature of many anomalies.

Taking all this into account the efficient markets hypothesis has not been cast aside but its limitations have been brought to light more. It is not common to argue for perfectly efficient markets, in which prices always reflect the best estimate of the intrinsic value. The argument has shifted more to the impossibility of consistently outperforming the markets with public information. The question of whether markets can be consistently outperformed with non-public information remains and this question is explored in the next chapter through insider trading.

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[64] Adaptation is not an accurate description of the process as it involves parts of the group's population leaving the market. The individuals leaving the market are those who are least fit to the prevailing environment. Individuals with characteristics suited to the new environment are favoured to enter or remain in the group. Gradually the population will consist of individuals who possess different, more suitable characteristics than the original population.

3.2 Previous research on using insiders' trading patterns in trading strategies

Evaluating trading strategies based on insiders' trading activity is approached in a step-wise manner. First step is to review evidence on the performance of insiders' investments. A prerequisite to creating profitable trading strategies is that insiders can outperform the market. Literature review also provides further evidence on the strong form market efficiency.

Second step is to evaluate the information contained in insiders' trading activity to determine the characteristics on which trading strategies can be founded. Then the literature on performance of potential mimicking trading strategies is reviewed.

This chapter will present four hypotheses based on the literature to study the research questions. The first two hypotheses will be used to investigate research question one and the latter two research question two. Before these hypotheses and the theoretical basis can be properly addressed it is essential to define how abnormal performance is measured.

3.2.1 How is abnormal performance measured?

Performance is usually measured by comparing returns to a benchmark. This method is the fundamental challenge in testing market efficiency. When returns are benchmarked against any model it is impossible to distinguish between testing the accuracy of the model and testing the normality of returns.

The benchmark model should depict normal returns of a security with certain risk level. Several benchmark models have been created for this purpose such as Capital Asset Pricing Model (CAPM) (Sharpe 1964; Lintner 1965a; Lintner 1965b; Mossin 1966), Arbitrage Pricing Theory (APT)[65] (Ross 1976) and Three-Factor Model[66] (Fama & French 1993). But there is no model which can do this perfectly, or even close to perfectly.

CAPM was widely used earlier (e.g. Jaffe 1974; Finnerty 1976) but serious drawbacks have later been identified from it when it is used as a benchmark model. Seyhun (1986, 193-194) draws attention to one of these. He highlights that CAPM has been found to have systematic deviations from expected returns between large and small companies. This can skew the results if the proportions of sales and purchases are not

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[65] APT is not actually a model for calculating normal returns but more of a method for the calculation.

[66] The Three-Factor Model can be considered as a special case of APT.

equal in large and small companies. CAPM has other shortcomings too. However, other models have their drawbacks as well. The main drawback of all models is that they cannot be guaranteed to capture all relevant risk factors. Clearest example of this flaw is shown in portfolio-based models. They only compare the returns to those of the benchmark portfolio – e.g. broad stock index – without regard to risk levels.

Furthermore, beta from CAPM has been found to be a poor measure of risk, and it is very sensitive to the selection of the benchmark portfolio. Fama and French (1993, 4-5) extended CAPM by including size and book-to-market value to the Three-Factor Model in addition to beta. This captures more risk factors than other models.

It is important that the risk is correctly taken into account because returns can always be improved by accepting more risk. Conceivably insiders could also be willing to take on more risk because they have a higher capacity for accepting risk. They are usually well off and have no immediate financial difficulties. This makes potential realisation of risks less serious for them indicating that the benchmark model has to accurately take the level of risk into account to get correct results. As a key factor risk will be revisited in the following presenting results from earlier literature.

3.2.2   Insiders' performance on the stock market

Insiders possess a lot of information on the performance and condition of their company as well as the sector in which it operates. This could enable them to achieve abnormal returns in capital markets. This question is interesting in many ways. It acts as an input to the debate on efficient capital markets hypothesis. It informs regulators on how the regulation is working and contributes information to the discussion on proper amount of regulation. Last but not least it provides information to the market practitioners. If the insiders' performance deviates from normal performance, there could be a way to infer trading strategies from the actions of insiders.

Given the many interesting aspects this question has also drawn a lot of attention from the scientific community. Most published articles, starting from the studies by Jaffe (1974), Finnerty (1976) and Seyhun (1986), find that insiders achieve abnormal profits. Over the years the regulation has become more stringent which could affect the insiders' ability to generate profits.

However, more recent studies have also concluded that insiders are able to outperform the market regardless of more stringent regulation, or easier and faster distribution of information. A study by Brochet (2010) finds that following the most recent tightening of regulations, the Sarbanes-Oxley Act, the returns to insiders were not affected. Only the rate at which the returns accrued changed. This can be expected from a faster reporting cycle. Similar returns are achieved as earlier in a shorter time period.

Nevertheless, there are studies which have not found abnormal profits. Generally there is a specific reason why the study found no abnormal profits. For example Lin and Howe (1990) found that insiders could not get abnormal profits from small companies traded on the Over-The-Counter (OTC) market because of prohibitive transaction costs. A more common reason for the lack of abnormal profits was insiders' position in the company.

As described in chapter 1.2 there are several different groups of insiders who are associated to the company in different ways. The closer the insider is to the daily operations the better the expected investment performance. Golec (2007) for example finds that the most distant group, large shareholders, cannot realise abnormal profits. Studies controlling for the insider group have achieved varied results. Some studies find that officers achieve the best results, with directors' returns close behind, and large shareholders' returns far behind the two other groups (Seyhun 1986; Baesel & Stein 1979, 568; Seyhun 1998). Other studies on the other hand find no difference in returns (Jeng, Metrick & Zeckhauser 2003, 468).

The returns that officers and directors achieve have generally been found to be in the range between 5 % and 10 % per annum before transaction costs[67]. Results from several studies are exhibited in figure 5 below. The annualised profits are calculated from the authors' estimates on how much abnormal profits insiders can get during the studied time period.

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[67] Ziobrowski, Cheng, Boyd and Ziobrowski (2011) find that U.S. house representatives achieve comparable annualised abnormal profits of 6%. However, these returns do not even compare to those of U.S. senators. Ziobrowski, Cheng, Boyd and Ziobrowski (2004) found that they are able to achieve 25% annualised abnormal returns. These returns arise from private information on upcoming legislation and connections to authorities.
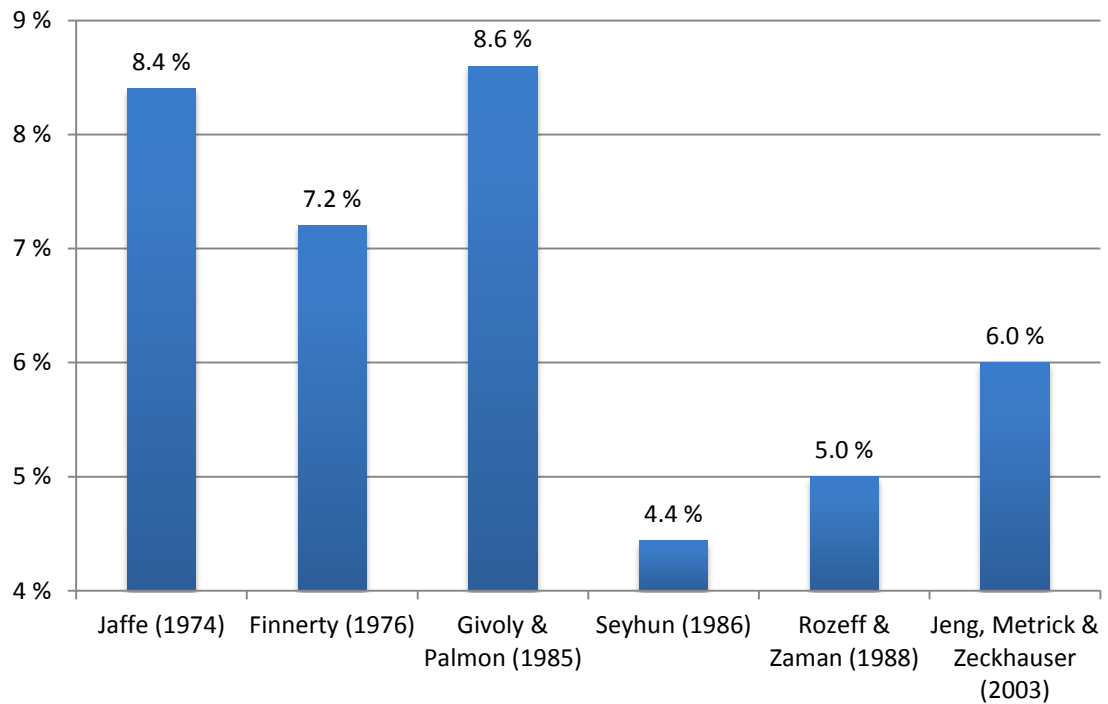
Figure 5:   Yearly abnormal profits (%) by insiders observed in different studies.

Figure 5 above presents studies which have found insiders to have achieved significant abnormal profits[68]. This thesis will also study the investment performance of insiders through hypothesis 1.

Hypothesis 1

> *H_0: Insiders' investment returns from their own companies are equal to the returns from an equivalent investment to a broad equity index*

If insiders earn different returns than can be expected from an equity index it is direct evidence that insiders' investment performance is somehow different. Even though risk level is not taken into account in this analysis it is likely not playing a major role in the results. Insiders in the sample are divided into a large number of companies with aggregate risk profiles close to the risk profile of the equity index.

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[68] Similar results have been obtained in studies which use data from other markets than the U.S. (Baesel & Stein 1979; Friederich, Gregory, Matatko & Tonks 2002; Stotz 2006; Zingg, Lang & Wyttenbach 2007; Del Brio & Perote 2007). There are also studies which have found no abnormal profits. However, there is no clear reason which would explain the results (Heinkel & Kraus 1987; Eckbo & Smith 1998; Kasanen 1999).

While the studies mentioned above do not directly measure the investment performance of insiders they do indicate that it has been good. This also seems to be the general consensus of the scientific community as the issue has not received widespread attention since the early studies.

Regardless of the fact that insiders have been observed to achieve abnormal profits earlier, the reasons for the investment performance are still unverified. Two main theories for the underlying reasons are that: (1) insiders are able to spot misvaluations by the market in general; and (2) that insiders possess more information[69] than has been incorporated into the security prices.

Apart from these hypotheses the results may be partially explained by incentive effects of share ownership. Share ownership aligns the incentives of owners and executives mitigating the agency problems (see Jensen & Murphy 1990, 149). When insiders sell (buy) shares, they simultaneously decrease (increase) their incentives to reach large stock returns.

While share ownership aligns executives' incentives with those of the owners, the relationship is not quite as straightforward when returns are considered. Empirical results on the topic vary considerably. Studies have concluded both that share ownership is related larger returns (e.g. Abowd 1990; Mehran 1995; Palia & Lichtenberg 1999; Cui & Mak 2002) and that it is not related (e.g. Loderer & Martin 1997; Himmelberg, Hubbard & Palia 1999). Tong (2008) argues that there is an optimal level of management share ownership and moving away from this level reduces returns.

With the conflicting findings it cannot be said with certainty that managerial ownership explains a portion of the abnormal returns from insider trading. The results do not rule out this possibility, but this question is not examined well enough in the insider trading literature. Earlier studies have also focused more on the information content of the insider trades than on the returns of insiders. Hypothesis 1 attempts to create a better estimation of the insiders' investment performance in their own companies.

Irrespective of which explanation is valid, the research results imply that the strong form of efficient capital markets hypothesis does not hold. The first explanation also implies that the semi-strong form efficiency does not hold. According to the strict interpretation of the hypothesis, adjustment to new information should be instantaneous. This type of result could be expected as economic theories are often not realised exactly as they are described.

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[69] Information referred to herein, is not specific, price-relevant information as trading while in possession of this type of information is illegal. The transactions generally studied are those that are reported according to the prevailing regulation and subject to the scrutiny of the SEC. This means that these trades are very unlikely to be directly against the regulation.

It is also worthwhile to remember that it is not straightforward to estimate insiders' investment performance. Most of their transactions are sales of stock they have received as remuneration, not bought from open market. Additionally, it is impossible to get reliable data on the holding periods of the shares traded by the insiders (Jeng, Metrick & Zeckhauser 2003, 453). When these issues are combined with the challenges in measuring abnormal returns, it should be stated that insiders' abnormal are just estimates providing an approximate range for the returns.

The results of this analysis, no matter what they are, do not provide a definitive answer to research question 1. Insiders generally hold considerable equity positions in their own companies and these mostly drive the returns. New trades do not contribute much to the overall returns but can offer non-trivial insights when viewed independently. Earlier studies have, thus, mainly approached the topic by studying individual transactions. Results from these studies are presented in more detail in chapter 3.2.3 along with description of how this thesis takes individual transactions into account.

3.2.3 Informational attributes in relation to insiders' transactions

The studies reviewed in the previous chapter showed that insiders can achieve abnormal profits from their investments. Arguably insiders achieve these profits through better knowledge of the company and the industry. This chapter evaluates if information[70] has been found to be transmitted to the public through the publication of the transactions.

Further investigation into the usefulness of insiders' trades on forecasting stock performance requires more advanced statistical techniques because the transactions are not fully described as sales and purchases. They have numerous other characteristics associated with them, and these could, and indeed have been found to, contain valuable information for forecasting.

It is important to extract as much information as possible because the available profits are slim; especially after accounting for transaction costs. The relevant informational attributes can be roughly divided into three categories: transaction attributes, insider attributes, and company attributes. The transaction attributes are for example the size of a single transaction or the clustering of several transactions. Insider attributes refer to characteristics of the insider conducting the transaction such as the position of the insider within the firm. The company attributes refer to the characteristics of the com-

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[70] Information refers to better knowledge of future returns for securities. Thus better information can be used interchangeably with abnormal returns.

pany, whose securities are traded, such as size and riskiness. Company attributes are often used to control the results. Additionally they can transmit information in connection with insiders' transactions if the transactional pattern differs over attribute values.

This chapter will first review the evidence on the information content of the transaction-specific attributes. While studies investigate different attributes at least one of these attributes is included in all studies. Buy and sell transactions have such different information content that they are always separated.

Insiders conduct more sell transactions than buy transactions in the open market (e.g. Seyhun 1986, 193; Jeng, Metrick & Zeckhauser 2003, 457; Aktas, De Bodt & Van Oppens 2008, 1384). The disproportion is caused by remuneration given as stock. Insiders sell the stock they get as remuneration when they need cash or need to rebalance their portfolio (e.g. Lakonishok & Lee 2001, 107; Jeng, Metrick & Zeckhauser 2003, 455; Aktas, De Bodt & Van Oppens 2008, 1384). This disproportion is significant as a large portion of the salary of officers and directors is given in some form of stock remuneration.

Consequently, studies have found that sell transactions do not convey much information. The returns subsequent to sales are slightly negative but they are not economically meaningful (e.g. Seyhun 1986, 198; Jeng, Metrick & Zeckhauser 2003, 459-460; Aktas, De Bodt & Van Oppens 2008, 1388). It is possible that some sell transactions convey valuable information, but they are veiled by the majority of sales motivated by liquidity or portfolio rebalancing. Buy transactions convey more information on average as they are not motivated by these factors (e.g. Seyhun 1986, 198; Jeng, Metrick & Zeckhauser 2003, 459-460; Aktas, De Bodt & Van Oppens 2008, 1388).

Given the fundamental nature of this distinction it is studied separately in this thesis via hypothesis 2. The results from this hypothesis form the foundation on which later analyses are built.

Hypothesis 2

H_0: Insiders' sales and purchases are followed by equal returns

If sales and purchases are followed by equal profits it tells that insiders are not able to time their purchases and sales to beneficial time. Rejection of the null hypothesis would rule out the possibility of insiders timing their trades, which is a major driver of abnormal risk-adjusted profits in research question 1.

Next to the buy or sell status of the transaction, the nominal amount of the traded securities is an important factor. Naturally, more significant investments indicate that the insider is more certain about their investment decision. Larger transactions have in fact been found to transmit more information than smaller transactions (e.g. Seyhun 1986, 203; Jeng, Metrick & Zeckhauser 2003, 462).

Transactions can also be viewed as groups which convey more information together than they would individually. Transactions are basically viewed together as one larger transaction. Grouped transactions should transmit more information for the same reasons as larger transactions transmit more information. Many studies have used this method to extract more meaningful information from insider transactions. It has been found that the grouping of transactions does have some informational content (Jaffe 1974; Seyhun 1986, 206).

However, Seyhun (1986, 206) states that the grouping seems to be a proxy factor for the proportion of the insiders' trading volume out of the entire trading volume of the company. This factor is correlated with the size of the transaction and contains similar information. For these reasons the size and the grouping of transactions are closely linked.

The transactions insiders report can be done directly or indirectly. Direct transactions are straightforward as insiders always bear the full responsibility in them. Indirect transactions on the other hand can be much more varied in nature. In some, insiders are just as invested as in direct transactions, but in other indirect transactions they may not have any active role. Most indirect transactions seem to be closer to the fully invested end of this spectrum. Thus both direct and indirect transactions have been used in many studies. Jeng, Metrick and Zeckhauser (2003, 467) discovered that the direct and indirect transactions do impart slightly different information, although this attribute does not produce statistically significant results.

The remaining, used transaction attributes are timing of the transactions and promptness of reporting. Many studies have investigated whether insider trading around specific events (earnings announcements, acquisitions, mergers, dividends, bankruptcies etc.) could inform the market about the true value of that event (e.g. Keown & Pinkerton 1981; Elliott , Morse & Richardson 1984; Kose & Mishra 1990; Sivakumar & Waymire 1994; Kolasinski & Li 2010). They have concluded that insider trading can be used to extract more information than could be extracted from the event itself.

For example Kolasinski and Li (2010) find that insiders identify market over- or underreactions to earnings announcements and trade to profit from those. This means that insiders' transactions can be informative even after the most up-to-date the most recent information has been provided to the market. It has not been studied whether the information content of insiders' transactions is greater or smaller following these events than it is otherwise. Elliot, Morse and Richardson (1984) conclude that the level of insider trading does not change around news events pointing towards the information content staying the same over time.

Having stated that, the world has changed considerably since the study by Elliot, Morse and Richardson (1984). For example companies are now using blackout periods extensively[71]. The blackout periods effectively change the timing of transactions as they tend to form clusters following the blackout period. This should lower their information content because transactions cannot be executed at optimal time. Postponing transactions also increases the likelihood of information leaking to the market via other channels. Additionally, grouping of transactions cannot be used as well to extract information because the blackout periods naturally create groups (Bettis, Coles & Lemmon 2000, 209).

However, Bettis, Cole and Lemmon (2000, 215-218) find that blackout periods actually lead to a slightly better investment performance. This might be explained by insiders feeling more secure when they have a corporate policy stating that they are allowed to trade. Additionally they find that trades during the blackout period[72] convey less information than those done outside the period. This is justified by the fact that when permission to trade during blackout period is given, the transaction must be motivated by liquidity reasons. Outside the blackout period insiders are free to trade as they wish.

One important factor about the timing of transactions still needs to be covered. As insiders are not allowed to make short-swing profits, any transactions where they realise such profits are irrational from pure profit maximisation rationale. This indicates that these transactions are done for other purposes. By studying aggregate trading Kolasinski and Li (2010, 40) find that insiders are more likely to buy (sell) securities if they have been buying (selling) them in the preceding six months indicating that they try to avoid short-swing gains.

Next to the timing of transactions, the timing of reporting of the transactions has been observed to convey information (e.g. Carter, Mansi & Reeb 2003, 65; Brochet 2010, 437-438). The importance of the reporting lag has diminished since the implementation of the Sarbanes-Oxley Act. This reduced the reporting lag to maximum of in three days instead of the previous maximum of approximately 40 days. This is good as the information in the transactions transmitted more swiftly to markets.

Longer reporting lag on sale transactions signalled worse news prior to the Sarbanes-Oxley Act. This behaviour is consistent with the human desire to communicate good news fast, while withholding bad news longer. It should hold even though the possibili-

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[71] 78% of companies have explicit blackout periods and 92% somehow restrict insider trading (Bettis, Coles & Lemmon 2000). This is a stark contrast to Seyhun (1992) who finds that only a quarter of companies had policies restricting insider trading.

[72] Trading during the blackout period could happen because of lack of enforcement or exemptions from the rules.

ties of postponing reporting are slimmer after the Sarbanes-Oxley Act (Brochet 2010, 444).

One transaction attribute has not been fully included in studies. Insiders have to report a variety of transaction types[73]. Open market transactions are used in studies because they include a conscious decision by the insiders. The other transaction types are more automatic in nature or at least much less controllable by the insiders themselves. However, these different types of transactions could conceivably be used to infer information from the transactions. Insiders could make some, perhaps implicit, decisions regarding them. Nevertheless this has not been studies so far and this attribute is only used as division to open market and other transactions.

The second group of attributes relevant to the informational content of the insiders' transactions is the insider attributes. These attributes are related to the characteristics of the insiders conducting the transactions. The most relevant of these is the position of the insider within the company. Previous studies have found that the information content of transactions varies considerably depending on the position. Generally the studies have found that transactions by insiders who are closer to the operational management of the company convey more information (e.g. Baesel & Stein 1979, 564-566; Seyhun 1986, 205-206; Lakonishok & Lee 2001, 93-94). This view is not unanimous as Jeng, Metrick and Zeckhauser (2003, 466) do not find evidence for differing investment performance.

As described in chapter 3.2.2 officers are closest to the daily operations of a company with directors behind and large shareholders furthest removed from the company. Generally, previous research has found that the top executives' transactions are most informative. Top executives refer to the most senior officers (CEO, CFO, etc.) and directors. Moreover, senior officers' transactions have been found to be more informative than directors' transactions (e.g. Seyhun 1986, 202; Jeng, Metrick & Zeckhauser 2003, 466). Large shareholders' transactions on the other hand do not convey much information (Lakonishok & Lee 2001, 93-94) and they are sometimes left outside the scope of the studies (Kolasinski & Li 2010, 32).

While insider's position most likely affects the information obtained by that individual, it is also related to the wealth of the individual. Wealthier individuals can carry more risk, and in return they are better compensated for carrying that risk. However, acquiring comprehensive data on the personal wealth of corporate executives is close to impossible and for this reason it has not been directly studied. It can be assumed that the more senior executives are wealthier and can carry more risk. But this aspect needs to be taken into account by other methods.

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[73] Full list of transactions types is provided in Appendix II.

Risk is more of a company attribute but there is one risk type that is better described as insider attribute: litigation risk. Litigation in this context refers to insider being prosecuted for breaking insider trading laws. The likelihood for this is composed of several variables. Some variables relate to whether the transaction is illegal, which may not always be straightforward to determine[74]. Rather than defining different variables driving the risk it is more interesting to look at how insiders see the litigation risk surrounding their company and the securities markets.

Brochet (2010, 438-439) has studied this and found that insiders are in fact more careful when litigation risk is perceived to be higher. He uses the recent insider trading lawsuits against a company as a proxy for litigation risk and finds that insiders in high litigation risk companies are more cautious when they sell securities. This highlights that insiders pay attention to the risk of litigation and adapt their trading accordingly. Consequence of this adaptation is lower returns.

While litigation risk was categorised as insider attribute it could have also been classified as company attribute as part of it is driven more by the characteristics of the company. It was placed in insider attributes because it conceptually matches that group better. Company attributes contain many attributes that are used as control variables because they have been found to forecast future returns in earlier studies[75]. Additionally there are attributes which signal a higher likelihood of insiders having value-relevant information. These attributes indicate that the companies have larger information asymmetries opening more opportunities for insiders to trade. They are referred to as information asymmetry proxy variables.

Several of the attributes can be seen as both a control variable as well as a proxy variable. Company size is perhaps the most prominent of these. It has been found to indicate the expected returns from the company (e.g. Banz 1981; Fama & French 1992; Fama & French 1993). Some studies have nevertheless used it as a proxy variable for

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[74] Even with full knowledge of the circumstances surrounding the transaction there is no clear way to determine when a transaction crosses the border and becomes illegal. This is caused by information being material or non-public to different degrees. Publicity of information can vary from only one insider knowing the information to everyone in the world knowing the information. Materiality on the other hand can vary from no price impact to being the decisive piece of information for the future of the company. Additionally it may be difficult to evaluate how the information was or should have been seen at the time of trading. This is even more difficult for regulators who have to base their judgement on incomplete information.

[75] Depending on the interpretation of the results this means either that the attribute conveys information about the true risk level of the security or exposes a market inefficiency. See chapter 3 for a more detailed discussion on market efficiency and pricing anomalies.

information asymmetry (e.g. Chari, Jagannathan & Ofer 1988). Fama and French (1993) for example used size in their three-factor model to explain a portion of the security's risk. It has also been argued that the size effect is an anomaly and does no convey information about the risk level. It has also been suggested that observed connection between size and returns is sample-dependent and neither conveys information about the risk level or proves a stock market anomaly (Andrikopoulos, Daynes, Latimer & Pagas 2008, 312).

Size is used as a proxy variable because larger companies are followed by a larger number of people leading to information about that company to become public faster (Chari, Jagannathan & Ofer 1988). This supposition contrasts the finding that the size effect is driven by microcap companies (Fama & French 2008). Microcap companies are close to each other in terms of size, which would indicate that the information asymmetry explanation would not hold. This topic remains unresolved and for this thesis it is sufficient to recognise that smaller companies have been observed to yield greater returns.

While it may be possible to distinguish between the different explanations for the size anomaly, such distinction is more difficult to make for the accrual anomaly identified by Sloan (1996). Sloan observed that accruals are negatively related to returns. Insiders have both information about the accruals and incentives to manage earnings[76]. Expectedly, insiders have been found to manage earnings down (up) when buying (selling) reinforcing the accrual anomaly (Beneish & Vargus 2002; Sawicki & Shrestha 2008).

The last dual purpose attribute is another factor from the three-factor model, Book-to-Market (B/M) ratio. While Fama and French (1992; 1993) find that companies with low B/M ratios contain more risk, managers of these companies also have more information than managers of high B/M ratio companies[77]. As most companies with low B/M ratios are growth companies with rapidly changing business logic they have larger information disparities. They provide ample opportunities for insiders to trade when they have more information. This means that both explanations can be true at the same time[78].

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[76] While earnings management in order to improve trading opportunities is illegal it is difficult to prove.

[77] Rosenberg, Reid and Lanstein (1985), and Chan, Hamao and Lakonishok (1991) also identify the phenomenon but argue that it is a market anomaly.

[78] While riskiness itself does not guarantee that insiders have more information than outsiders, such connection exists in certain companies. Part of the risk in these companies stems from the company seeming riskier to outside investors due to imperfect information.

The dual purpose variables are problematic because they can mask the true reason of any findings. For example Huddart and Ke (2007) faced this issue with B/M ratio. This can be alleviated by using variables which do not have dual purpose. When they have to be used they can be combined with another variable that explains the same variation without dual purpose.

Level of Research and Development (R&D) expenditure is such a variable for B/M ratio. R&D expenditure is often high in low B/M ratio companies with large amount of intangible assets. Huddart and Ke (2007, 207) confirm this assumption by observing a high correlation between the variables. R&D expenditure also explains why high B/M ratio companies can provide more insights to insiders: More R&D provides them with constant flow of new information, progress of R&D, which is not published constantly. Huddart and Ke (2007, 209) actually find that R&D expenditure acts as a better proxy variable than B/M ratio.

The value of R&D investments is not easily transmitted to the market due to several reasons (Aboody & Lev 2000, 2748-2749). Chan, Lakonishok and Sougiannis (2001), and Kothari, Laguerre and Leone (2002) have confirmed that high R&D expenditure is connected to high earnings variability in the future. Insiders, on the other hand, are continuously updated on the advances (or setbacks) in R&D. These updates do not necessarily constitute material information but contribute towards forming a complete picture of the potential rewards of the R&D activities. This assumption has also been confirmed in several studies, which have found that transactions by insiders in R&D-intensive firms convey more information (e.g. Aboody & Lev 2000; Brochet 2010, 436-437).

A number of other company attributes have been used as pure proxy variables for information asymmetries. Generally it has been found that larger information asymmetries for a company also mean that insiders' transactions are more informative. Different studies have, however, used different proxy variables to study information asymmetry. Several variables follow the same reasoning as company size that larger companies are more followed and information about them gets to markets faster. These are analyst following (Brennan & Subrahmanyam 1995; Huddart & Ke 2007), and number of news announcements (Dierkens 1991). They should only explain the variation in information asymmetry. However, Huddart and Ke (2007, 209) found that analyst following does not act as a good proxy variable for information asymmetry.

Similar explanatory attributes explaining information asymmetry are the total volume of transactions (Chari, Jagannathan & Ofer 1988), and the relative proportion of total market volume of shares traded (Dierkens 1991, 186-187). The reason why the former of these explains information asymmetry is essentially the same as for company size. It also faces the same problems because of high correlation. The latter is more independent of company size while containing similar information about the information asymmetry. The reasoning for using it as a proxy variable is that more active market for the

security means that information is included in the prices faster (Dierkens 1991, 186-187).

Information asymmetry has also been measured by how accurately markets predict the performance of companies. Dierkens (1991) used market-adjusted residual variance as a proxy variable for information asymmetry. This proxy variable measures the uncertainty connected to the company after correcting for uncertainty about the markets in general. She also used market-adjusted residual variance following news releases to act as a proxy variable to measure how different private information about the company is from the publicly available information[79]. Barclay and Smith (1995), and Krishnaswami, Spindt and Subramaniam (1999) have used another variable, future abnormal earnings, to measure the extent of private information.

Hayn (1995) suggests that results of loss-making firms are harder to forecast. Loss-making firms have higher variance of returns and higher forecast errors by analysts making it a suitable proxy variable. Huddart and Ke (2007, 209) also found that this variable measures the level of information asymmetry.

Finally, the ownership share of the insiders and institutional owners has been used as a proxy variable in several studies (e.g. Brennan & Subrahmanyam 1995; Huddart & Ke 2007). However, the results have not been as encouraging towards its use as they have been for many other variables. Huddart and Ke (2007, 209) for example find that it is not a suitable proxy variable for information asymmetry.

These information asymmetry proxies are relevant to better explain information content of insiders' transactions. However, other company attributes have to be considered to control that the information comes from the transactions and not from another source. These types of variables are included in practically all studies. Otherwise it could be argued that insiders are only following a previously discovered strategy and do not transfer new information to the market.

The studies, which included the results described above, take control factors into account but they use different variables. The variables are described here for completeness and as preparation for the empirical section of this thesis. Some of the variables were discussed above because they serve a dual purpose as both proxy and control variables.

Controlling for riskiness is the primary purpose of the control variables. However, many studies do not discuss risk level explicitly as pointed out by Finnerty (1976, 1141) and it has not improved much since. Controlling can be done in many ways. Traditionally riskiness is taken into account by adjusting the returns with theories such as Capital Asset Pricing Model (CAPM) (see review in Jensen 1972), Arbitrage Pricing Theory

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[79] Huddart and Ke (2007) also found a similar proxy variable around quarterly earnings announcement to be a valid proxy for information asymmetry.

(Ross 1976), the Three-Factor model (Fama & French 1993)[80], or simply a benchmark portfolio. Riskiness can also be accounted for by including risk metrics, such as volatility[81] or beta, into the statistical analysis. However, none of the known measures of risk is perfect. Numerous anomalies have been uncovered in the securities markets when these models have been tested. These anomalies form the second category of control variables.

They are attributes that have been observed to explain security returns without a link to riskiness. It is possible that risk has not been controlled properly in many of the studies (see Fama 1991, 1593). Regardless of whether the anomaly stems from unmeasured risk or inefficiencies in securities markets these attributes need to be controlled to ensure that the source of findings is not the anomaly but information insiders use in their trading activities.

Three of the anomalous attributes were presented above as dual purpose variables: company size, B/M ratio and accruals. In addition to these variables many more anomalies have been identified. Some of these will be briefly summarised below in no specific order.

Basu (1975; 1977; 1983) found that high (low) Price to Earnings (P/E) ratio forecasts low (high) returns while controlling for beta. Ball (1978) explains this finding with the risk proxy nature of the P/E ratio. He argues that a riskier company with same earnings will be evaluated as less valuable than a less risky company. However, there is no direct connection to riskiness of company and thus P/E ratio has been categorised as anomalous.

Another anomalous attribute is dividend yield. This anomaly has been around for a long time and states that higher dividend yields predict higher returns. It can be related to the observation that more profitable companies yield higher returns (Haugen & Baker 1996; Cohen, Gompers & Vuolteenaho 2002). A non-anomalous explanation for dividend yield has also been proposed but there is no clear evidence for this hypothesis. Some research has also cast doubt into the validity of the anomaly but it seems to hold so far (Fama & French 1988, 3-4; Robertson & Wright 2006, 91).

The last market anomaly described in this chapter relates to past return behaviour of the share. This is anomaly has been termed as momentum anomaly, because it states that positive (negative) past returns are followed by positive (negative) future returns (Jegadeesh & Titman 1993). In subsequent studies it has proved to be rather robust (Fama & French 2008). This anomaly is especially interesting for the current topic be-

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[80] See chapter 3.2.2 for a more thorough discussion of the models.

[81] Volatility is problematic as taking the diversification effects into account is difficult.

cause insiders have been demonstrated to be contrarian investors in several studies (e.g. Lakonishok & Lee 2001; Piotroski & Roulstone 2005; Seyhun 1992).

The contrarian behaviour has been hypothesised to stem from insiders' superior ability to spot mispricing and identify price reversals (see e.g. Piotroski & Roulstone 2005, 56). Contrarian strategy is the opposite of what is suggested by the momentum anomaly. Combining the information behind these could therefore yield better results than either piece of information could yield on its own.

As a conclusion it can be said that many different attributes have been found to transmit information to the markets. Most of these attributes will be combined into a regression model for the empirical part of this thesis to investigate the relationship between returns from a company and trading by the company's insiders. Hypothesis 3 was created as foundation for this regression.

Hypothesis 3

> *H_0: Trades by insiders of a company are independent of returns from the equity of the company*

The regression tests based on the hypothesis will reveal whether there is a statistically significant relationship between returns from a company and trading by its insiders. After this it is important to continue the investigation by establishing if the returns are sufficient to cover transaction costs, i.e. whether the findings are economically meaningful.

Besides trades by individual insiders the net aggregate insider trading has been studied and found to be positively correlated to subsequent index returns. Insiders' investment decisions being based partly on anticipation of activity in the entire economy is hypothesised to explain these findings. However, these returns were not found to be significant enough to base a trading strategy on (Seyhun 1988, 22-23). A recent study using more refined methods by Jiang and Zaman (2010) suggests that the relationship is stronger than previously thought. The relationship between aggregate insider trading and index returns will also be investigated in this thesis with a fresh data set through hypothesis 4.

Hypothesis 4

> *H_0: Returns from an equity index are independent of aggregate insider trading*

When evaluated together the results from analysing hypotheses 3 and 4 should provide sufficient information to formulate an answer for research question 2. There are still more facets to fully answer this research question. The next chapter explores some of them by reviewing the literature on how well pieces of information listed above can

be combined into trading strategies that can achieve abnormal profits after accounting for transactions costs.

3.2.4   *Performance of mimicking strategies*

The previous chapters indicate that insiders can achieve abnormal profits, and that potentially there is information content in the insiders' transactions. While this information may produce statistically significant abnormal returns, they are not necessarily economically meaningful. In order for the returns to be economically meaningful they have to cover all costs connected to utilising the information.

First concern is that the information is already old when an outside investor gets access to it. The delay for publishing insiders' transactions was dramatically reduced with the implementation of the Sarbanes-Oxley Act in 2003. Nevertheless, the delay can still be up to three days. During these three days, some of the information content of the transaction is already absorbed by the markets (see Brochet 2010, 434).

Moreover, active trading strategies, which are required to take advantage of the information, are exposed to three additional of costs when compared to passive strategies[82]. Commission and spread have to be paid for every transaction. Additionally active trading strategy forces payment of taxes faster than required by passive buy-and-hold strategies. Postponing tax payments allows an investor to earn returns on the tax liability. An active investor has to earn higher pre-tax returns to reach the same after-tax returns.

The difference in the required pre-tax returns to reach same after-tax returns depends on investment horizon, returns and tax rate. For example, in an environment with pre-tax returns of 6 % p.a. and a tax rate of 15 % passive strategy yields 5.4 % p.a. after-tax returns while an active strategy only yields 5.1 % p.a. after-tax returns[83].

The return difference stemming from taxes is not directly related to how active trading is because taxes are paid yearly based on the net capital gains. However, the two other types of trading cost, commission and spread, are driven by the number of transactions. They can thus vary considerably depending on the used trading strategy. Estimates on these costs vary considerably across studies. Some studies, such as Rozeff and

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[82] This leaves out costs which cannot be directly measured such as price impact of large transactions (see e.g. Chan & Lakonishok 1997) or research costs (see e.g. Stoll & Whaley 1983).

[83] This difference is exacerbated in the U.S. over longer investment horizons as the highest long-term capital gains tax rate in U.S. in 2012 is 15 % but short-term capital gains tax can be as high as 35 % for individuals. These rates are expected to rise to 20 % and 39.6 % respectively for 2013 (Fidelity 2012).

Zaman (1998, 43), use a very rough estimate of usually 2 % of the transacted amount. Other studies refer to Stoll and Whealey's (1983) study on transaction costs (e.g. Bettis, Vickrey & Vickrey 1997; Seyhun 1986)[84].

Stoll and Whealey (1983, 72-73) present transaction costs divided into spread and commission for 10 portfolios arranged by market value as percentage of the transacted nominal. The average transaction cost in this sample is 175 basis points. Since this study the transaction costs have been radically lowered due to, among other things, implementation of internet-based broker systems.

Stoll (1993) and French (2008) have studied the transaction costs subsequently and found them to be considerably lower than in 1979 when Stoll and Whealey's (1983) sample ends. The latest figures from French (2008) place transaction costs to 11 basis points of the transacted nominal[85]. Change of this magnitude affects the economic significance of any findings considerably.

However, studies that include transaction costs from outsiders' perspective are in the minority of all studies on the subject of insider trading. Generally studies settle for estimating the information content of insiders' transactions. While the studies generally find value-relevant information from the transactions as described in chapter 3.2.2, they leave two important points untouched: (1) They focus only on statistical significance; and (2) the value they uncover is only extractable by insiders because of their setup. The studies that estimate if outsiders can reach abnormal profits using mimicking strategies have mostly concluded that this is not possible (e.g. Rozeff & Zaman 1998; Seyhun 1986; Lakonishok & Lee 2001). The exception is the study by Bettis, Vickrey and Vickrey (1997) which shows that large volume transactions by insiders can be used by outsiders to reach abnormal profits. The authors explain the different results with a shorter reporting lag.

While the scientific evidence is heavily stacked against the possibility of creating profitable trading strategies from insiders' transactions, several investment advice services claim that it is possible (e.g. www.form4oracle.com, www.insidermonkey.com and www.secform4.com). Their claims are based on findings of information content from insiders' transactions without transaction costs. The idea is also logically appealing and has been advocated to investors by scholars (e.g. Seyhun 1998). Additionally

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[84] It is more common for studies to merely state that it does not seem likely that the amount of abnormal profits is sufficient to offset transaction costs. These studies do not explicitly assess how transaction costs affect the returns (e.g. Lin & Howe 1990, 1280; Lakonishok & Lee 2001, 109).

[85] Transaction costs in French (2008) are slightly lower than in Stoll (1993), or Stoll and Whealey (1983) for comparable time periods. However, the difference is not large enough to change the economic significance of the results.

anecdotal evidence on the profitability of these strategies is shown regularly in press (see for example Wall Street Journal's inside track columns).

Since these studies the Sarbanes-Oxley Act has been implemented reducing the reporting lag considerably. Brochet (2010) found that the change did not remove the informational content from transactions. Shorter reporting lag and easier access to data could actually improve the information content. This will be studied in detail in the next chapter. Initially the information content insiders' trading activity and statistical relationship between the trading and stock returns will be investigated according to the hypotheses listed above. After that it will be investigated if the informational content is sufficient for outsiders to achieve abnormal profits.

4 DATA AND RESULTS

4.1 Description of the data

The data is collected from SEC's web-based reporting portal called Edgar. Since the implementation of the Sarbanes-Oxley Act on 1st of July 2003, all insiders have to report all applicable transactions[86] electronically in Edgar. As seen in chapter 1.6 this requirement increased the number of filed reports considerably and created a single data source for all insider transactions.

These reports were collected from Edgar for the period of 1st July 2003 until 17th August 2009. There were a total of 1,616,071 reports filed during this time period as shown in table 1. These reports do not contain all insider transactions after 13th August, because the Sarbanes-Oxley Act allows reporting until the second business day after the transaction. In order for the analysis to focus on complete set of transactions, only data until 13th August 2009 is included.

Furthermore, only original reports are included in the data set. While submitted reports can be amended, the original report is the information initially available to market participants. This makes the original reports relevant for studying how to act when information on insider transactions is released. In addition, amendments are not linked to the original report making interpretations difficult.

Great care has been taken to clean the data from errors in the reports delivered to SEC[87] by comparing the information across different sources[88]. These efforts should ensure that the data is correct and complete, including merged and defaulted companies, to the greatest possible degree.

In order to study the possibility of forecasting stock performance based on insiders' trading activity, data on stock performance (i.e. price data) is included in the data set. Additionally more information on the companies is needed to control for other explanations of results as described in chapter 3.2.3. This data includes for example company size and P/E ratio. The company data has been collected from Thomson Reuters.

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[86] Applicable transactions refer to all transactions in the securities issued by the companies in which an insider relationship exists. The transactions include all changes in beneficial ownership and not only the transactions done directly by the insider.

[87] Typical problems were merged or defaulted companies whose information had to be found from historical databases. Another major issue was typographical errors in the report data.

[88] Cross-references were done to Bloomberg, company websites, finance services from Google, Yahoo and Microsoft, and news archives available in the internet.

In the end, some data was available for 9,184 companies and out of these prices were available for 9,068 companies. These 9,068 companies are included in the final data set which is used for studying the research questions. Most of insider trading happens in these companies as they account for 83 % of the reports delivered to SEC, 84 % of number of transactions, and 73 % of the notional volume of transactions. Table 1 presents how different steps to clean the data affect the amount of data.

Table 1:   Descriptive statistics of the data set

	Reports	Companies	Transactions			
	Count	Count	Open market	Remuneration	Other	Total
			Count	Count	Count	Count
Full data set	1,616,071	13,635	2,192,799	876,954	1,342,492	4,412,245
Relevant time period	1,589,530	13,597	2,180,386	858,303	1,330,908	4,369,597
Not an amendment	1,528,502	13,580	2,122,197	826,834	1,283,800	4,232,831
Company-specific data available	1,260,855	9,068	1,840,940	701,185	988,693	3,530,818

Each row in the table shows how a step in the data cleaning affects the amount of available data. The first row shows the full data set. Each row below that shows how an additional data cleaning step affects the amount of data available to study. The last row of the table show the final amount of data used in the thesis. The table also shows that the available data set is extensive and approximately half of the transactions are done on the open market. Open market transactions are most interesting because the returns from the shares constitute the only gains for insiders, and insiders are more likely to fully control the timing of these transactions[89].

Furthermore, the data is distributed evenly over the studied time span as seen in figure 2. In addition to data being evenly distributed over time, it is divided over a large number of insiders and companies. The distribution of open market transactions, which are most interesting for this study, is represented in figure 6.

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[89] The transactions, in which insiders receive securities as remuneration, may not convey much information, because insiders often cannot affect the details of the transactions at the time of trading.
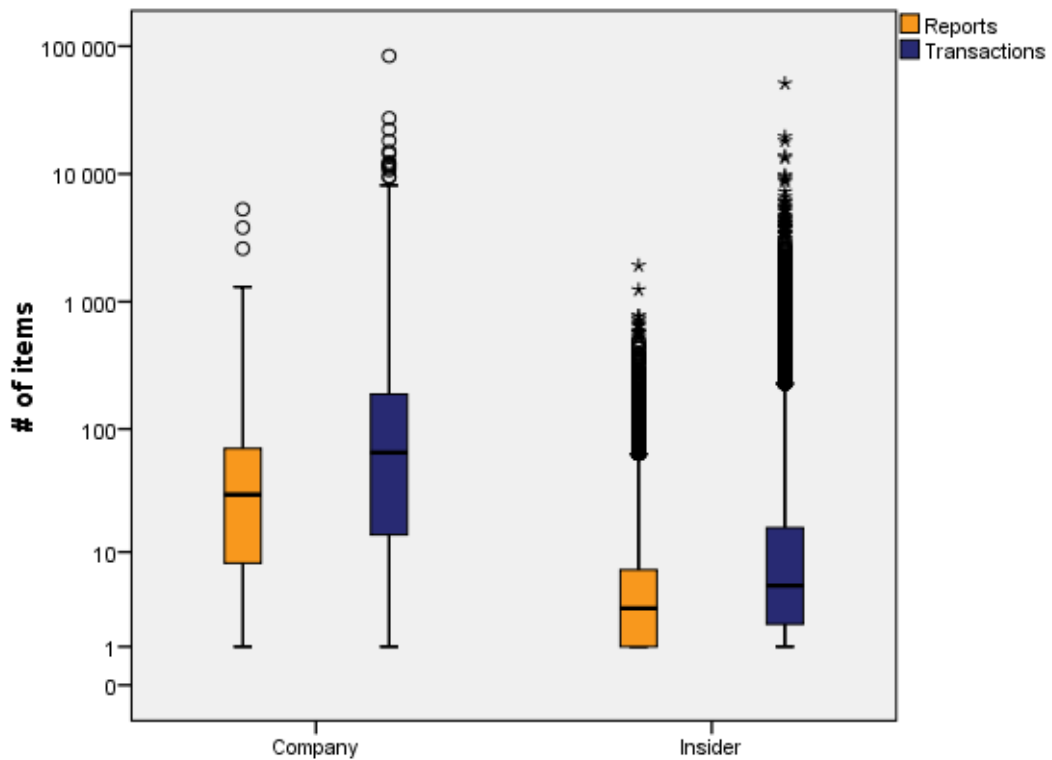
Figure 6:   Number of filed reports and number of reported open market transactions per company and insider

On average insiders filed 6.97 reports containing an average of 31.87 open market transactions. The median numbers of filed reports and transactions are only 3 and 5 respectively because the distribution is highly skewed. Most insiders have filed between 1 and 7 reports over the observed time period.

Officers and directors account for most reports with 49 % and 28 % respectively. The remainder of the reports has been submitted by large owners (20 %) and other insiders (4 %). Large owners report more and considerably larger open market transactions and thus account for 22 % of reported transactions and 49 % of the volume of transactions. Officers on the other hand report considerably smaller transactions and their share of the transacted nominal is only 25 %.

More important than the relatively low number of reports filed by individual insiders is the fact that the reports are distributed to various companies. Half of the companies have 30 or more reports and there are 1202 companies which have 100 or more reports containing open market transactions. This makes statistical analysis of the data shown in the following chapters more reliable as the data set is extensive and distributed to large number of companies.

4.2 Profitability of insiders' trading activities

This chapter presents the empirical finding for the first two hypotheses which are used to study research question 1. These hypotheses relate to how high trading profits insiders can achieve. Measuring insiders' trading profits fully is not possible because only a portion of insiders' transactions are published. Only transactions in securities of the companies in which an insider relationship exists can be observed. As a consequence insiders' positions or transactions in other shares are not known.

Even measuring the true profitability of the reported transactions can be challenging. Observations are collected from a limited time span only and the insider relationship can end making subsequent transactions not reportable. Additionally, the reporting quality is not sufficient to accurately track how an insider's ownership evolves over time.

It is impossible to definitely identify the security being traded. Insiders do not report an identifier[90] for securities but only a textual description[91]. This makes it is impossible to identify the true portfolio of insiders. When studying the possibility of using the transactions as indicators of future performance this does not pose as large problem. The reported information identifies whether the transaction corresponds to long or short position in the company. This information can easily be extended to provide indicators for equity securities.

However, this is challenging for studying insiders' investment performance as different securities behave very differently when the value of a company changes. For example, typical debt instrument's value changes at a slower rate than the value of an equity security. Furthermore, the value of an option changes at a faster pace than either of these instruments but the values of different options change at very different rates. Thus it is necessary to create simplifications in estimation of insiders' profits.

Based on a textual search of the descriptions provided by insiders, 84 % of the non-derivative transactions are done in common stocks or other instruments that behave as common stock[92]. This means that assuming that all of insiders' non-derivative transactions are done in common stock is a fair approximation.

Derivatives transactions are distributed to larger variety of different types of instruments which behave very differently when the price of the underlying changes. It is also impossible to determine how these instruments behave with the reported information.

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[90] Unique identifiers do not even exist for all securities.

[91] A stock ticker is reported for the company but this cannot be extended to individual transactions which can be done in another class of security.

[92] This is a lower bound for the estimate of the true proportion of trades in equity securities as only descriptions that could positively be mapped to equity security were included in the count.

For this reason, derivatives transactions will not be included in the evaluation of insiders' investment performance. This exclusion should not change the results significantly because derivatives transactions account for only 4 % of the total transaction volume.

Although the true profits cannot be accurately calculated they can be approximated for insiders' investments in their own companies as described above. The approximation can be approached in two different ways: by looking at individual transactions or by looking at insiders' full portfolio of investments in their own companies. The two methods are likely to produce different results as insiders tend own some shares of their own companies at all times.

Additionally, insiders are forbidden from entering into short positions. When sales are investigated as individual transactions, they seem to create short positions making subsequent stock price drops look profitable. When they are investigated in portfolio context, they only reduce the losses following the subsequent price drop. Profitability on portfolio level provides a more accurate picture on how much profit the insiders make. Profitability on a transaction-by-transaction basis, on the other hand, provides a better indication on how well insiders time their transactions. Thus both approaches are used in estimating the profitability of insiders' trading activity.

To examine insiders' trading profits their entire known portfolio needs to be examined. A time series of the total value of the insiders' known portfolio is created for this purpose. Creating this time series presents some challenges. Insiders receive a major portion of their stock as compensation or through exercise of derivative securities. Thus, comparing acquisition prices to disposition prices would not produce an accurate picture of insiders' profits.

In the following analysis this challenge has been overcome by disregarding the reported transaction price. New investments are calculated and added to the position every day at market price. Potential profits or losses stemming from off-market price transactions are left outside this study. This time series allows calculating the daily capital gains insiders receive. These gains are then compared to the Russell 3000 index to establish how insiders' returns compare to investors in general.

Insiders' results are slightly lower than returns on a broad equity index by 0.018 % per day. As seen in table 2 this difference is not statistically significant. Thus hypothesis 1 stating that insiders' investment returns from their own companies are equal to the returns from an equivalent investment to a broad equity index cannot be rejected.

Table 2:   Tests of statistical significance on difference between returns to insiders'
            known portfolio and returns broad index returns for hypothesis 1

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between Log. insider return and Log. index return equals 0.	Related-Samples Sign Test	.139	Retain the null hypothesis.
2	The median of differences between Log. insider return and Log. index return equals 0.	Related-Samples Wilcoxon Signed Rank Test	.087	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Regardless of the statistically insignificant return difference, the returns compound over the observed time period, and the difference can be clearly seen in figure 7. The change in the value of position is largely driven by capital gains as insiders as a group do not invest much new capital in the shares.
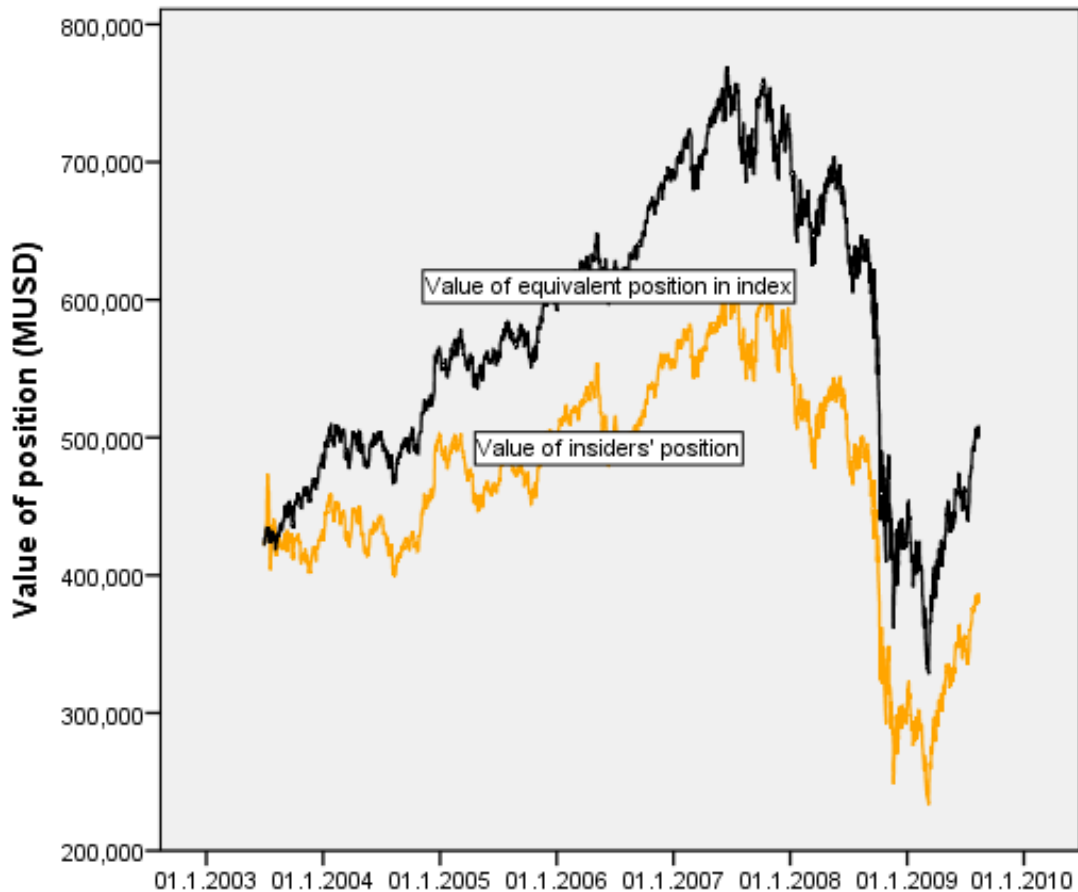
Figure 7:   Returns to aggregate insider portfolio and equal investment in Russell
             3000 index

Main contributor to the lack of new investments or significant dispositions is insiders' who hold very large positions. These insiders, such as Bill Gates and Warren Buf-

fet, do not generally react to changing future expectations. When the top fifth percentile of insiders (as measured on 1 July 2003) is removed from the analysis new investments become more significant contributor to the value of position. The development of the value of position with this restriction can be seen in figure 8.
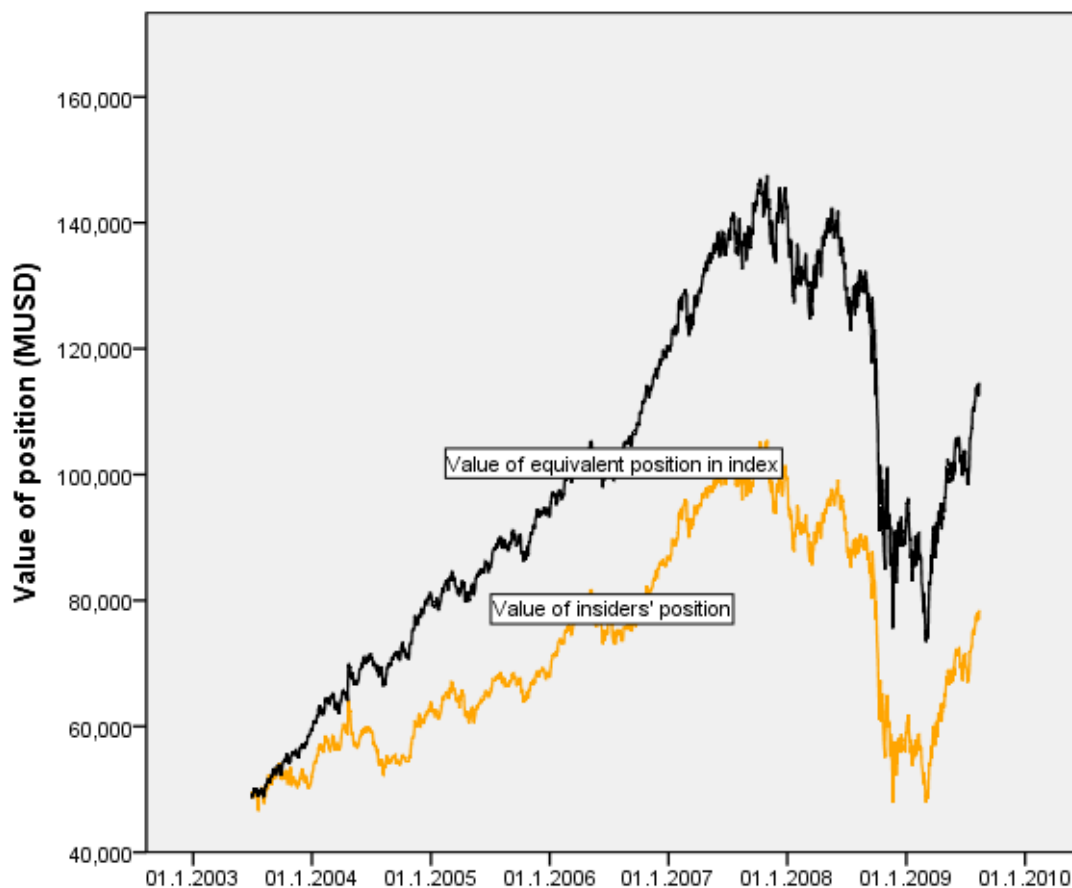
Figure 8:   Returns to aggregate insider portfolio and equal investment in Russell 3000 index without largest insiders

While there are proportionately more new investments without the top fifth percentile of insiders the return profile remains similar. Insiders tend to invest a relatively fixed amount to their companies so the cumulative new investments during the observation period tend to grow at a fixed rate. While this group makes larger new investments their capital gains are smaller than the gains for all insiders. They underperform the broad market index by 0.039 % per day. Even though this is a larger difference it is not clearly statistically significant. Wilcoxon signed rank test produces statistically significant results but related samples sign test does not produce statistically significant results. This supports the decision to accept hypothesis 1.

Next the stock returns following insiders' transactions will be studied. This provides evidence for estimating insiders' investment performance on transaction basis. For insiders' returns to differ from market returns, returns following sales and purchases need

to be different. The foundation for this analysis is hypothesis 2. All analyses on returns following insiders' transactions presented below are based on a 10 % sample of the full data set. This restriction is made because the available computational resources are limited and cannot process the full data set.

Comparing the returns following acquisitions and disposition by insiders' confirms that these differ. Table 3 shows that the returns following insiders' acquisitions are higher than returns following dispositions. However, acquisitions are not followed by larger returns over the every studied time horizon. After six months the returns following dispositions become higher than return following acquisitions.

Table 3:   Returns following insiders' sales and purchases to study hypothesis 2

Report

| | Transaction direction | | | | | |
| | Acquired | | Disposed | | Total | |
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Index-adjusted log. return (1D)	.0018	.04915	-.0001	.02993	.0006	.03831
Index-adjusted log. return (2D)	.0025	.05857	-.0004	.03867	.0007	.04716
Index-adjusted log. return (3D)	.0034	.06578	-.0006	.04621	.0009	.05443
Index-adjusted log. return (1W)	.0053	.09260	-.0018	.06609	.0009	.07720
Index-adjusted log. return (2W)	.0058	.11934	-.0033	.08965	.0001	.10192
Index-adjusted log. return (1M)	.0035	.16472	-.0051	.13095	-.0019	.14462
Index-adjusted log. return (3M)	-.0148	.28878	-.0159	.22853	-.0155	.25282
Index-adjusted log. return (6M)	-.0459	.40477	-.0426	.33471	-.0438	.36230
Index-adjusted log. return (9M)	-.0947	.52709	-.0664	.42059	-.0767	.46234
Index-adjusted log. return (1Y)	-.1429	.61223	-.0911	.49271	-.1095	.53874
Index-adjusted log. return (2Y)	-.2703	.91785	-.1729	.81147	-.2069	.85137

If the analysis shown above is run with median returns the observed difference is smaller, but the main findings remain same. With medians the acquisitions are followed by smaller returns at already three months. When these analyses are restricted to direct open market transactions all observations become more pronounced.

The averages in the analyses above are brought down by the transactions done in small companies quoted on the Pink sheets or Bulletin Board. Many of these stocks experience numerous reverse splits and capital issuances, in which insiders also participate. These features mean that many of these transactions are followed by negative returns. Limiting the analysis to only direct transactions in companies quoted in Nasdaq or New York Stock Exchange (NYSE) produces similar results with higher means as seen in table 4.

Table 4:   Return in stocks quoted in Nasdaq or NYSE following insiders' trans-
             actions to study hypothesis 2

Report

| | Transaction direction | | | | | |
| | Acquired | | Disposed | | Total | |
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Index-adjusted log. return (1D)	.0014	.03122	.0002	.02363	.0006	.02658
Index-adjusted log. return (2D)	.0018	.04050	.0000	.03128	.0006	.03485
Index-adjusted log. return (3D)	.0025	.04815	-.0002	.03713	.0007	.04141
Index-adjusted log. return (1W)	.0038	.06914	-.0013	.05401	.0005	.05988
Index-adjusted log. return (2W)	.0045	.09134	-.0018	.07425	.0004	.08080
Index-adjusted log. return (1M)	.0046	.12839	-.0033	.11106	-.0005	.11758
Index-adjusted log. return (3M)	-.0034	.22327	-.0108	.19988	-.0081	.20852
Index-adjusted log. return (6M)	-.0201	.32150	-.0339	.29238	-.0290	.30297
Index-adjusted log. return (9M)	-.0442	.38728	-.0519	.35997	-.0493	.36957
Index-adjusted log. return (1Y)	-.0700	.43666	-.0699	.41476	-.0699	.42223
Index-adjusted log. return (2Y)	-.1186	.59754	-.1125	.60080	-.1146	.59970

Regardless of the analysis, the differences shown above are significant at 1 % level for most of the observed time horizons[93]. The statistical significance was established through both independent samples median test and Kruskal-Wallis test because distribution of the returns is leptokurtic. The results of these tests are not shown here. As the tests show statistically significant difference of returns following insiders' acquisitions and dispositions, hypothesis 2 can be rejected indicating that insiders reach abnormal profits when measured on transaction level.

This indicates that there is a possibility to use information on insiders' trading activity to predict future share returns even though insiders' returns do not differ from the returns of a broad equity index. The above analysis does indicate that this is not achieved by strictly replicating an insider's portfolio but more advanced methods are required to create successful predictions. This possibility will be further studied in the next chapter.

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[93] The time horizons in which the difference is not statistically significant are those where the difference changes sign.

4.3   Forecasting stock performance with insider trading

As seen in the previous chapter insiders do not achieve larger profits than investors in general. This chapter will investigate whether their trading activity can be turned into valuable information for investors in spite of it. This will be examined in the following chapters with regression analyses analysing the third and fourth hypotheses. These analyses will provide an answer to research question 2. Due to the large amount of data and limited computing power the analyses were conducted on a 10 % sample of the full data set.

These analyses will mainly focus on open market transactions. Open market transactions are the centre of focus because they are presumed to convey most information due to their nature. They result from an active decision by the insiders whereas other transaction types are to a large extent mandated by outside factors. This supposition is also supported by the analysis conducted in chapter 4.2.

Firstly, the performance of individual companies following insiders' transactions is analysed. The analysis is performed through regression analysis on the connection between trading activity and subsequent returns. The single-company analyses are further expanded by introducing additional trading characteristics into the regression. This is done in order to identify all appropriate information for creation of trading strategies.

Secondly, regression tests are run to determine if the aggregate insider trading activity forecasts the overall stock market performance. This relationship is also further examined by introducing additional independent variables into the analysis.

4.3.1   Relationship between performance and individual companies insiders' transactions

The analysis studying the forecasting performance of insiders' trading activity is built around acquisitions and dispositions of shares. This separation is then further fine-tuned to take other variables listed in chapter 3.2.3 into account. The analysis is divided into three chapters which gradually build the final analysis. This approach is taken to investigate how different factors influence the analysis.

The method for statistical analysis in all three following chapters is regression analysis which is used to investigate hypothesis 3. The first step in this analysis is represented as regression equation (1). This regression is run on two subsets of data. One subset contains all acquisitions and the other all dispositions. The analysis needs to be run on separate subsets because the coefficients for some of the independent variables are expected to be different following acquisitions and dispositions.

$$
\begin{aligned}
\{y_t = \alpha_t &+ TransactionValue * \beta 1_t + OpenMarket * \beta 2_t + Direct * \beta 3_t \\
&+ ReportingDelay * \beta 4_t + BeforeResultPublication * \beta 5_t \\
&+ AfterResultPublication * \beta 6_t + Director * \beta 7_t \\
&+ TenPercentOwner * \beta 8_t + OtherInsider * \beta 9_t \}_{t_1}^{t_n}
\end{aligned}
\tag{1}
$$

The array in equation (1) signifies that the same equation is run for all studied time horizons from one day up to two years. The independent variables shown in the equation are defined in table 5. The justifications for using these variables were discussed earlier in chapter 3.2.3.

Table 5:   Definition of independent variables related to insiders' transactions

Variable	Explanation
TransactionValue	Logarithm of the nominal value of the transaction
OpenMarket	Dummy variable indicating that the transaction has been conducted on open market
Direct	Dummy variable signifying that the securities are owned directly by the insider and not indirectly via for example a family member or a trust
ReportingDelay	Number of days between the date of transaction and date when the report was filed
BeforeResultsPublication	Dummy variable indicating that the transaction has been conducted in the two weeks preceding a date on which financial results are published
AfterResultsPublication	Dummy variable indicating that the transaction has been conducted in the two weeks following a date on which financial results are published
Director	A dummy variable signifying that at least one reporting insiders is a director but none is an officer
TenPercentOwner	A dummy variable signifying that at least one reporting insiders is a large owner but none is an officer or director
OtherInsider	A dummy variable signifying that none of the reporting insiders is a director, an officer, or a large owner

The regression produces statistically significant associations but does not yield high R^2 statistics as expected. If any combination of variables would explain a large proportion of the variation in stock returns it would quickly be arbitraged away. Table 6 shows that regression model forecasts a positive (negative) average return for acquisitions (dispositions).

Table 6:   Residual statistics for regression model (1) in one-month time horizon

Residuals Statistics[a]

Acquisition		Minimum	Maximum	Mean	Std. Deviation	N
0	Predicted Value	-.0475	.0180	-.0043	.00694	150921
	Residual	-2.18694	1.78466	.00000	.12162	150921
	Std. Predicted Value	-6.225	3.217	.000	1.000	150921
	Std. Residual	-17.981	14.674	.000	1.000	150921
1	Predicted Value	-.0989	.0738	.0052	.01260	71316
	Residual	-3.68565	2.69505	.00000	.15094	71316
	Std. Predicted Value	-8.265	5.450	.000	1.000	71316
	Std. Residual	-24.417	17.855	.000	1.000	71316

a. Dependent Variable: Index-adjusted log. return (1M)

The results are similar over all time horizons even though the analysis results are only shown here for one of the studied time horizons. The observed differences in different time horizons are presented later. The regression coefficients for the analysis with the same one month time horizon are found in table 7. Both regression models have negative constants. This observation is in line with insiders' poorer than average investment performance. In fact the constant for the acquisition model is lower even though the predicted returns are on average a percentage point higher. This highlights that much of the information from acquisitions is in the independent variables.

Table 7:   Regression coefficients for regression model (1) in one-month time
             horizon

Coefficients[a]

Acquisition	Model		Unstandardised Co-efficients		Std. Coef-ficients	t	Sig.
			B	Std. Error	Beta		
0	1	(Constant)	-.010	.002		-4.418	.000
		Log. of transaction value	.001	.000	.020	7.835	.000
		Open market	-.001	.001	-.003	-1.242	.214
		Directly owned	-.004	.001	-.014	-5.491	.000
		Reporting delay	-1.43E-005	.000	-.004	-1.634	.102
		Traded before P/L reporting	-.013	.001	-.028	-10.588	.000
		Traded after P/L reporting	-.002	.001	-.006	-2.213	.027
		Director	-.001	.001	-.003	-.984	.325
		Ten per cent owner	-.020	.001	-.044	-16.657	.000
		Other insider	.004	.002	.004	1.614	.107
1	1	(Constant)	-.023	.003		-7.932	.000
		Log. of transaction value	.002	.000	.024	6.256	.000
		Open market	.026	.001	.083	19.309	.000
		Directly owned	.010	.001	.027	6.810	.000
		Reporting delay	-4.29E-005	.000	-.022	-5.850	.000
		Traded before P/L reporting	-.012	.002	-.022	-5.723	.000
		Traded after P/L reporting	-.003	.001	-.010	-2.585	.010
		Director	-.004	.001	-.012	-2.960	.003
		Ten per cent owner	-.011	.002	-.025	-5.441	.000
		Other insider	.002	.005	.002	.426	.670

a. Dependent Variable: Index-adjusted log. return (1M)

The regression model for acquisitions has more statistically significant variables and also produces predictions that are more widely distributed. This is a natural outcome of the fact that at least some of the dispositions are driven by the need to transform shares into cash and not by pure investment goals.

Transaction value also has the same sign for both models. The sign is expected for acquisitions where larger transactions signal larger subsequent returns. In the disposition model positive sign for the transaction value also forecasts larger subsequent stock returns which means that the returns are smaller following larger dispositions.

The first three dummy variables (direct ownership, open market transaction and reporting delay) all have coefficients with the expected sign predicting larger (smaller)

subsequent returns for acquisitions (dispositions). However, out of these variables only direct ownership is significant in conjunction with dispositions. Open market transaction is also the most striking difference between the models. For dispositions the variable does not convey information but for acquisitions it is the single most important variable.

The only significant reporting variable in the disposition model is trading before profit and loss (P/L) reporting. With a negative sign it states that sales before P/L reporting signal smaller subsequent returns. On acquisition side all reporting variables are statistically significant and have a negative sign. This means that insiders do not achieve as good returns in purchases around P/L reporting or when they are slow to report the transactions.

Insider type seems to have similar characteristics as transaction value and the reporting variables. Coefficients for both director and large shareholder dummy variables have a negative sign. Both acquisitions and dispositions by insiders who should possess most information forecast higher stock returns. While the coefficients are negative the coefficient for director is not statistically significant in the disposition model. The coefficients for other insiders are not statistically significant in either model.

This type of regression analysis cannot be used to estimate the statistical significance of differences in regression coefficients between acquisitions and dispositions. To study this aspect of the research question equation (1) is refined with interaction terms[94] to create equation (2).

$$
\begin{aligned}
\{y_t = \alpha_t &+ \text{acquisition} * \beta 1_t + TransactionValue * \beta 2_t + OpenMarket \\
&* \beta 3_t + Direct * \beta 4_t + ReportingDelay * \beta 5_t \\
&+ BeforeResultPublication * \beta 6_t \\
&+ AfterResultPublication * \beta 7_t + Director * \beta 8_t \\
&+ TenPercentOwner * \beta 9_t + OtherInsider * \beta 10_t \\
&+ \text{acquisition} \\
&* (TransactionValue * \beta 11_t + OpenMarket * \beta 12_t + Direct \\
&* \beta 13_t + ReportingDelay * \beta 14_t \\
&+ BeforeResultPublication * \beta 15_t \\
&+ AfterResultPublication * \beta 16_t + Director * \beta 17_t \\
&+ TenPercentOwner * \beta 18_t + OtherInsider * \beta 19_t)\}_{t_1}^{t_n}
\end{aligned}
\tag{2}
$$

The statistical significance of the interaction terms in equation (2) determines if the regression coefficients for acquisitions and dispositions are statistically significantly

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[94] All continuous variables in the regression equation have been centred as Aiken and West (1996, 37-38) propose for multiple regressions using interaction terms.

different. Table 8 presents how most interaction terms are statistically significant inferring that the differences between the two models shown above are significant.

Table 8:   Regression coefficients for regression model (2) in one-month time horizon

Coefficients[a]

Model	Unstandardised Coefficients		Std. Co-efficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Toler-ance	VIF
(Constant)	.010	.002		6.789	.000		
Acquisition	-.019	.002	-.079	-8.919	.000	.084	11.909
Log. of transaction value	.000	.000	.003	1.004	.315	.602	1.662
Open market	-.002	.001	-.008	-1.604	.109	.236	4.232
Directly owned	-.008	.001	-.029	-9.481	.000	.723	1.384
Reporting delay	-2.33E-06	.000	-.001	-.268	.789	.310	3.221
Traded before P/L reporting	-.012	.001	-.030	-9.361	.000	.639	1.564
Traded after P/L reporting	-.002	.001	-.008	-2.699	.007	.673	1.486
Director	-.002	.001	-.009	-2.775	.006	.612	1.633
Ten per cent owner	-.019	.001	-.045	-13.381	.000	.590	1.696
Other insider	-.001	.002	-.002	-.529	.597	.748	1.338
Acquisition*Log. of transaction value	5.69E-05	.000	.001	.194	.847	.584	1.714
Acquisition*Open market	.023	.002	.060	12.364	.000	.275	3.631
Acquisition*Direct	.015	.002	.059	9.191	.000	.161	6.224
Acquisition*Reporting delay	-3.97E-05	.000	-.017	-3.756	.000	.309	3.233
Acquisition*Trading before P/L reporting	.013	.002	.019	5.699	.000	.595	1.680
Acquisition*Trading after P/L reporting	.008	.001	.021	5.777	.000	.513	1.950
Acquisition*Director	.000	.001	-.001	-.179	.858	.438	2.282
Acquisition*Ten per cent owner	.039	.003	.059	15.377	.000	.449	2.226
Acquisition*Other Insider	.001	.005	.001	.231	.817	.737	1.357

a. Dependent Variable: Index-adjusted log. return (1M)

The interaction terms for transaction value, director, and other insider are not statistically significant. This is expected as their effects were of similar magnitude for both of the earlier regression models. Otherwise the results conform to the explanations above.

The same regression analyses are run for every time period t ranging. In equations (1) and (2) this is represented as a vector from t_1 to t_n. The results show how the regression coefficients behave over other time horizons. Generally the results for every time horizon are aligned on statistically significant variables but clear differences can still be found. The clearest difference seen in table 22 in Appendix III is a marked increase in R^2 for periods over 9 months.

While the acquisition dummy variable is statistically insignificant for short time horizons it does not signal that the difference between acquisitions and dispositions is insignificant. Most of the information for acquisition is loaded into the interaction terms. This also shows in the variance inflation factor which is for example 12 in the one-month analysis.

The interaction terms on the other hand are mostly statistically significant but not stationary over the observation horizons. The strength and even the sign of the interaction terms depend on the studied time horizon. A very good example of this is the coefficient for transaction value, which were almost the same value for both acquisition and disposition in one month stock returns. However, in time periods further away from one month the coefficients for acquisitions and dispositions become different as seen in figure 9[95].

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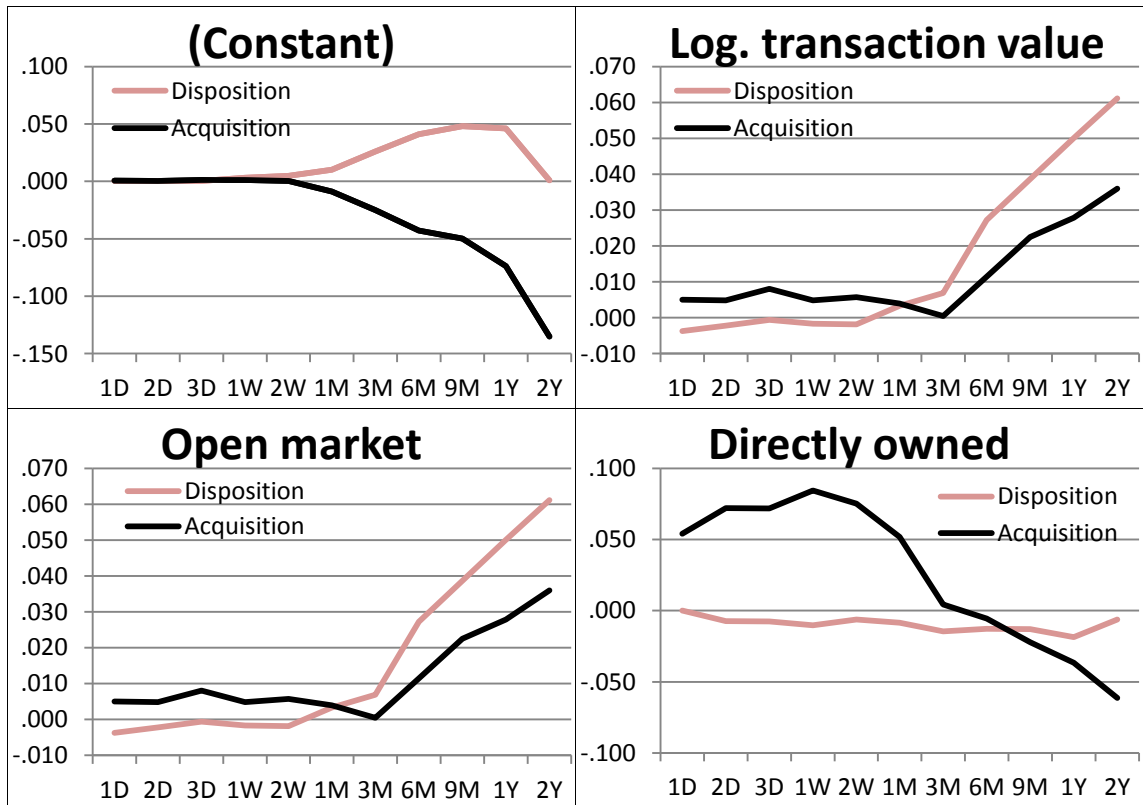
[95] The interaction terms are translated into lines describing the coefficient value for acquisitions and dispositions as it is easier to comprehend.
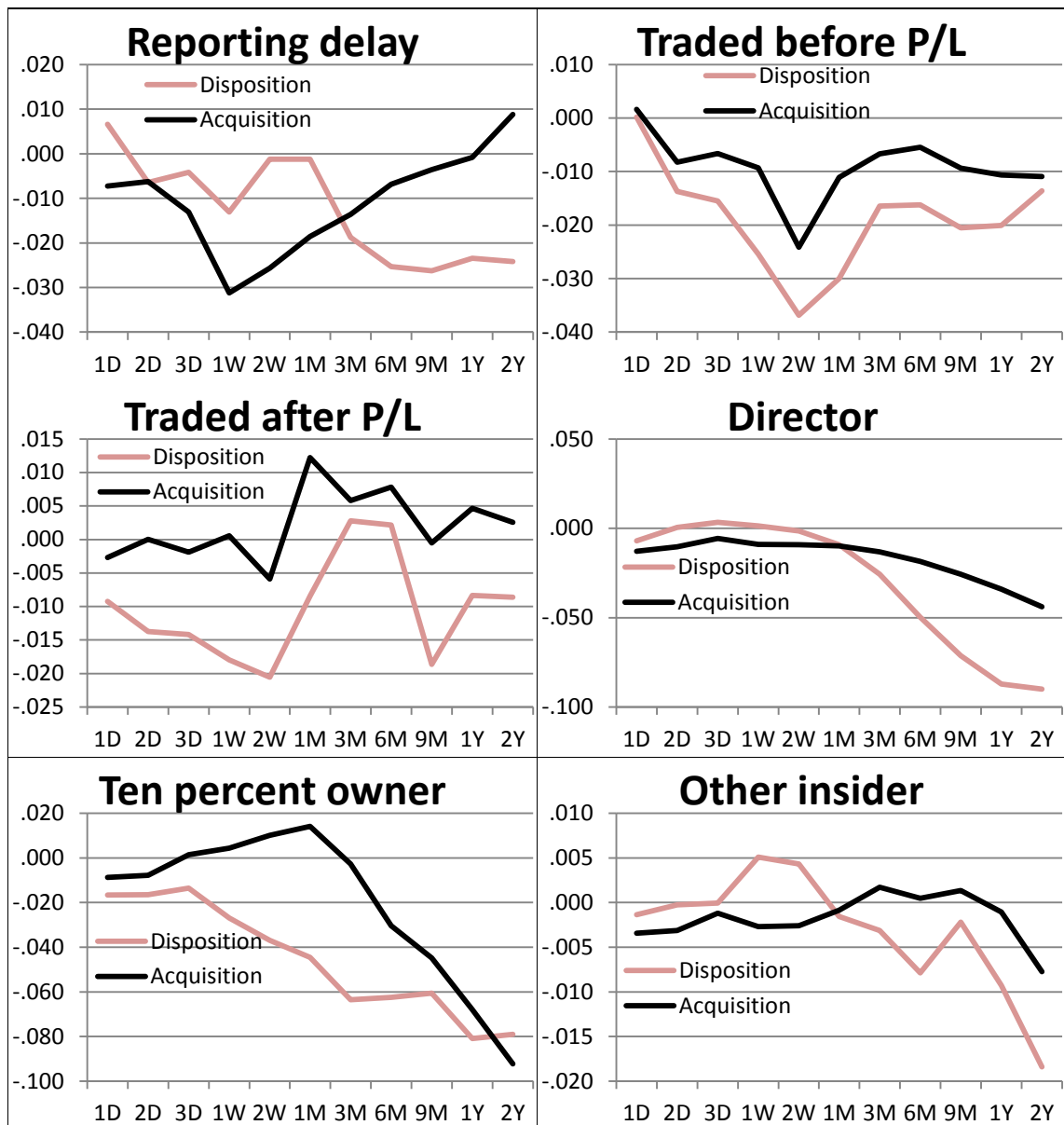
Figure 9: Standardised regression coefficients for equation (2) over different observation horizons

All coefficients presented in figure 9 exhibit significant changes when the observation period is changed. Almost all of the also show a change in the sign of difference between coefficient for acquisitions and coefficient for dispositions. As mentioned transaction value is a good example. In short time horizons acquisitions are followed by greater returns when larger transactions are made but this reverses for longer time horizons.

In addition to transaction value, coefficients for open market and direct dummy variables are larger for acquisitions in short time horizons and smaller in long time horizons. All these differences are also statistically significant as seen in table 22 in Appendix III. The signs of the differences are expected for the short time horizon but the

change in the sign of the difference is not expected. The phenomenon will be explored more in the discussion chapter 5.2.

The regression coefficients relating to the timing of insiders' transactions behave somewhat differently. Transactions that are done either before or after publishing financial results both signal higher returns following acquisitions. Reporting delay exhibits a similar change of sign as the first three variables that were discussed. However, the change happens in the opposite direction when compared to the other three variables. The variables related to reporting are considerably smaller than the other variables but they still remain mostly statistically significant in most time horizons as shown in table 22 in Appendix III.

Transactions by different types of insiders also have differing information content. The transactions by other insiders are mainly not statistically significant, and in any case the coefficients are around zero for all time horizons. The coefficients in figure 9 show the coefficient as compared to the base category of officers. They indicate that returns following officers' acquisitions are greater than those following directors' or large shareholders' acquisitions. The only exception is the one-month time period for large shareholders.

It is noteworthy that the coefficients for dispositions also have a negative sign. This states that sales by insiders are followed by larger returns than the sales by the other two insider groups. The difference in coefficients between sales and purchases of insiders in these groups is statistically significant for certain time horizons as shown in table 22 in Appendix III. For directors this is only true for longer time horizons when the coefficient for dispositions drops significantly. For large shareholders the medium time horizons have statistically significant difference in coefficients following acquisitions and dispositions.

Based on this analysis the insiders' trading activity can be used to forecast stock returns. However, the results need to be controlled for variables that have previously been identified to forecast stock returns to rule out the possibility that insiders' are only following previously identified trading strategies. This will be done in the next chapter.

4.3.2 *Controlling the results for previously identified predictors of stock returns*

While insiders' transactions are helpful in forecasting stock returns they may still not contribute new information. Insiders could utilise previously identified trading strategies to achieve abnormal without contributing any new information themselves. In this chapter the results presented above will be controlled for five financial indicators that have been found to have forecasting power for stock returns as described in chapter 3.2.3. The indicators – size, dividend yield, price-to-earnings (P/E) ratio, book-to-mar-

ket (B/M) ratio and momentum – were selected as controls because they are well documented phenomena. A description of these variables is presented in table 9.

Table 9:   Definition of independent variables related to insiders' transactions

Variable	Explanation
Size	Natural logarithm of the market capitalisation of the company at the end of the year
Dividend yield	Dividends paid during the year divided by the share price at the end of the year
P/E ratio	Share price at the end of the year divided by the most recent reported earnings per share
B/M ratio	Book value of assets at the most recently reported financial statements divided by the market capitalisation at the end of the year
Momentum	Logarithmic share returns in the six months preceding a transaction

These control variables are assigned to each transaction by using the most recent information available at the time of the transaction. For the four first variables it means that the control variables are calculated with information as of the last year-end. Momentum is calculated with information from the six months preceding the transaction.

Regression equation (3) is created by adding these variables into equation (2). This regression analysis will identify whether the variables related to insiders' transaction maintain their predictive power in the presence of the control variables. It also allows identifying if insiders' transactions can be used to improve the predictive power of these previously identified indicators.

$$\{y_t = \alpha_t + \text{Acquisition} * \beta1_t + TransactionValue * \beta2_t + OpenMarket$$
$$* \beta3_t + Direct * \beta4_t + ReportingDelay * \beta5_t$$
$$+ BeforeResultPublication * \beta6_t$$
$$+ AfterResultPublication * \beta7_t + Director * \beta8_t$$
$$+ TenPercentOwner * \beta9_t + OtherInsider * \beta10_t$$
$$+ \text{Acquisition}$$
$$* (TransactionValue * \beta11_t + OpenMarket * \beta12_t$$
$$+ Direct * \beta13_t + ReportingDelay * \beta14_t$$
$$+ BeforeResultPublication * \beta15_t$$
$$+ AfterResultPublication * \beta16_t + Director * \beta17_t$$
$$+ TenPercentOwner * \beta18_t + OtherInsider * \beta19_t)$$
$$+ MarketCap * \beta20_t + DividendYield * \beta21_t + PERatio$$
$$* \beta22_t + BMRatio * \beta23_t + DividendRatio * \beta24_t$$
$$+ \text{Acquisition}$$
$$* (MarketCap * \beta25_t + DividendYield * \beta26_t + PERatio$$
$$* \beta27_t + BMRatio * \beta28_t + DividendRatio * \beta29_t)\}_{t_1}^{t_n}$$

$$(3)$$

The results of the regression analysis for one-month time horizon are presented in table 10. Some coefficients change slightly from the results presented above. A few become statistically significant while a few others lose statistical significance. However this is somewhat illusory as the changes are better described by minor shifts in the coefficient profile over different time horizons. This leads to changes in statistical significance of individual time horizons.

Table 10:   Regression coefficients for the analysis including control factors

Coefficients[a]

	Model			
	1		2	
	Unstandardised	Standardised	Unstandardised	Standardised
(Constant)	.005***		-.002	
Acquisition	-.012***	-.044***	-.007***	-.025***
Log. of transaction value	.001***	.017***	-.001***	-.020***
Open market				
Directly owned	-.006***	-.018***	.001	.003
Reporting delay	.000***	-.012***	.000	.001
Traded before P/L reporting	-.013***	-.027***	-.012***	-.026***
Traded after P/L reporting	-.002*	-.006*	-.002*	-.006*
Director	-.001	-.002	.005***	.018***
Ten per cent owner	-.021***	-.046***	-.010***	-.023***
Other insider	.004	.004	.008***	.009***
Acquisition*Log. of transaction value	.001	.006	.002***	.022***
Acquisition*Open market	.025***	.064***	.030***	.077***
Acquisition*Direct	.015***	.052***	.010***	.035***
Acquisition*Reporting delay	.000	-.005	.000***	-.013***
Acquisition*Trading before P/L report-ing	.001	.001	.002	.002
Acquisition*Trading after P/L reporting	.000	-.001	.000	.001
Acquisition*Director	-.003*	-.007*	-.008***	-.019***
Acquisition*Ten per cent owner	.016***	.023***	.009***	.013***
Acquisition*Other Insider	.001	.001	.000	.000
Log. of market capitalisation			.007***	.120***
Dividend yield			-.001***	-.054***
P/E ratio			.000***	.070***
B/M ratio			-.002***	-.039***
Momentum			-.003***	-.008***
Acquisition*Log. of market capitalisa-tion			-.003***	-.034***
Acquisition*Dividend yield			-.001***	-.031***
Acquisition*P/E ratio			.000***	-.095***
Acquisition*B/M ratio			.001***	.015***
Acquisition*Momentum			.025***	.050***

a. Dependent Variable: Index-adjusted log. return (1M)

*** Significant at 1% level

* Significant at 5% level

The only clear changes in the coefficient profiles after the introduction of control variables happen to transaction value and open market dummy. These variables had large positive coefficients for both acquisitions and dispositions in long time horizons but after introduction of control variables they have negative coefficients. Introduction of control variables also removes the change in the sign of difference. Now acquisitions

are followed by larger returns in all time horizons. This change is clear when the inter-action charts in figure 9 and figure 10 are compared.

Direct transaction dummy variable is no longer statistically significant in most time horizons when control variables are introduced. The difference in the coefficient be-tween acquisitions and dispositions still remains significant over medium term. Other variables remain practically unchanged from the earlier analysis and are not opened here further. The detailed regression results are shown in table 10. The statistical significance of the interaction terms presented earlier also remains unchanged after the control vari-ables are introduced.

The control variables do not behave completely according to the expectations from previous studies. Returns following insiders' transactions grow with company size and P/E ratio and decline with dividend yield even though previous studies have found that these relationships have a different sign. The two remaining control variables – B/M ratio and momentum – behave as previous literature indicates.

The control variables can also be used to gauge more information from insiders' transactions. The difference in coefficients for size, P/E ratio and momentum are statis-tically significantly different between acquisitions and dispositions. Also the differences in the coefficients for B/M ratio and dividend yield are statistically significant but only for long time horizons as seen in table 23 in Appendix III.

The coefficients for dispositions are larger for most statistically significant time peri-ods in all control variables. P/E ratio over longer time horizons and momentum over very short time horizons are the exceptions with larger coefficients for acquisitions. The interaction terms shown in figure 10 display this difference in the regressions analyses of acquisitions and dispositions.
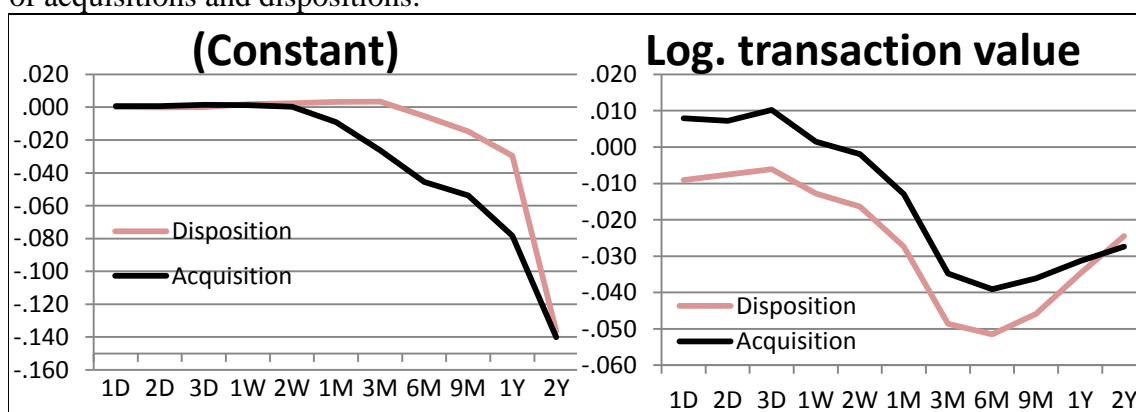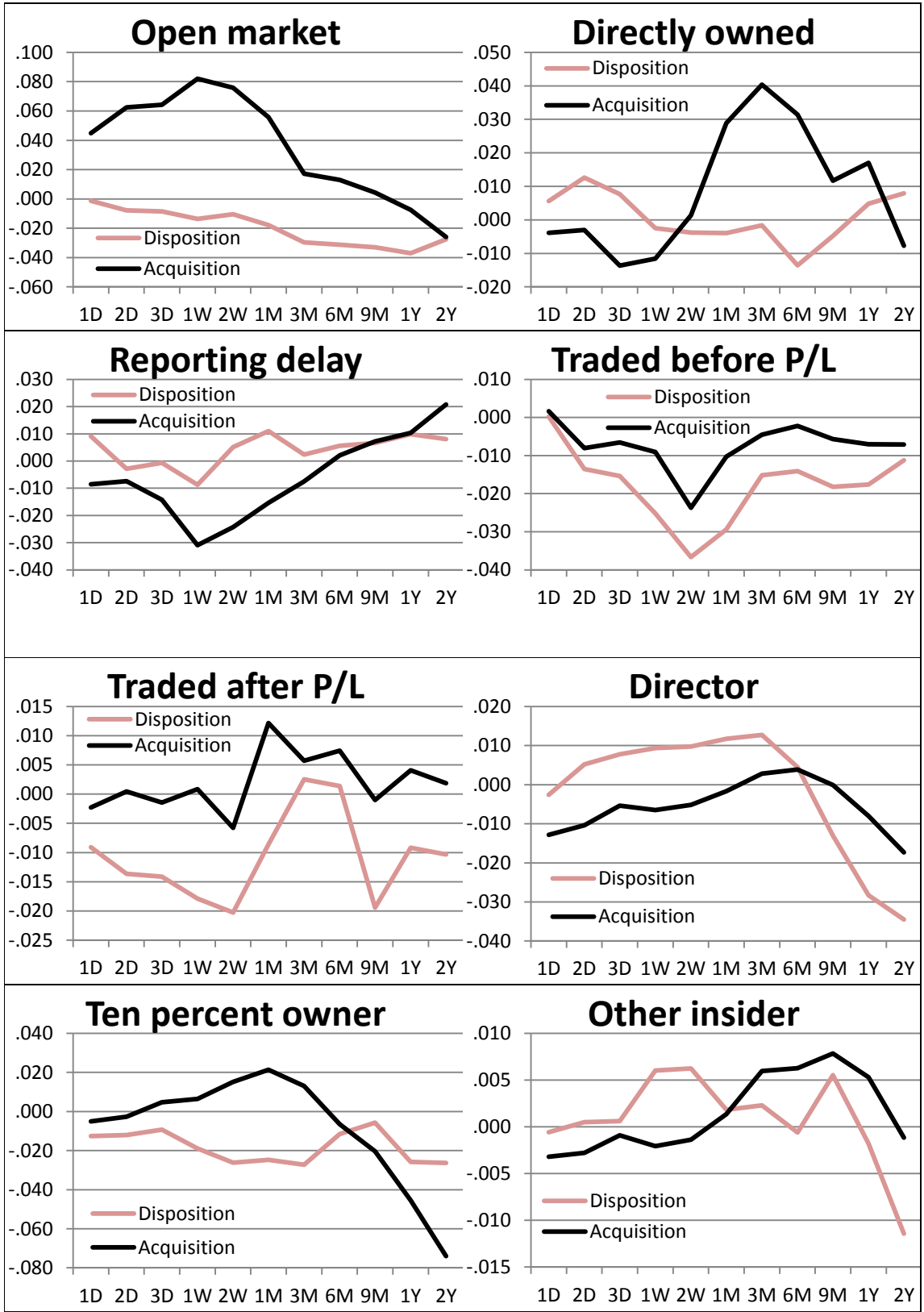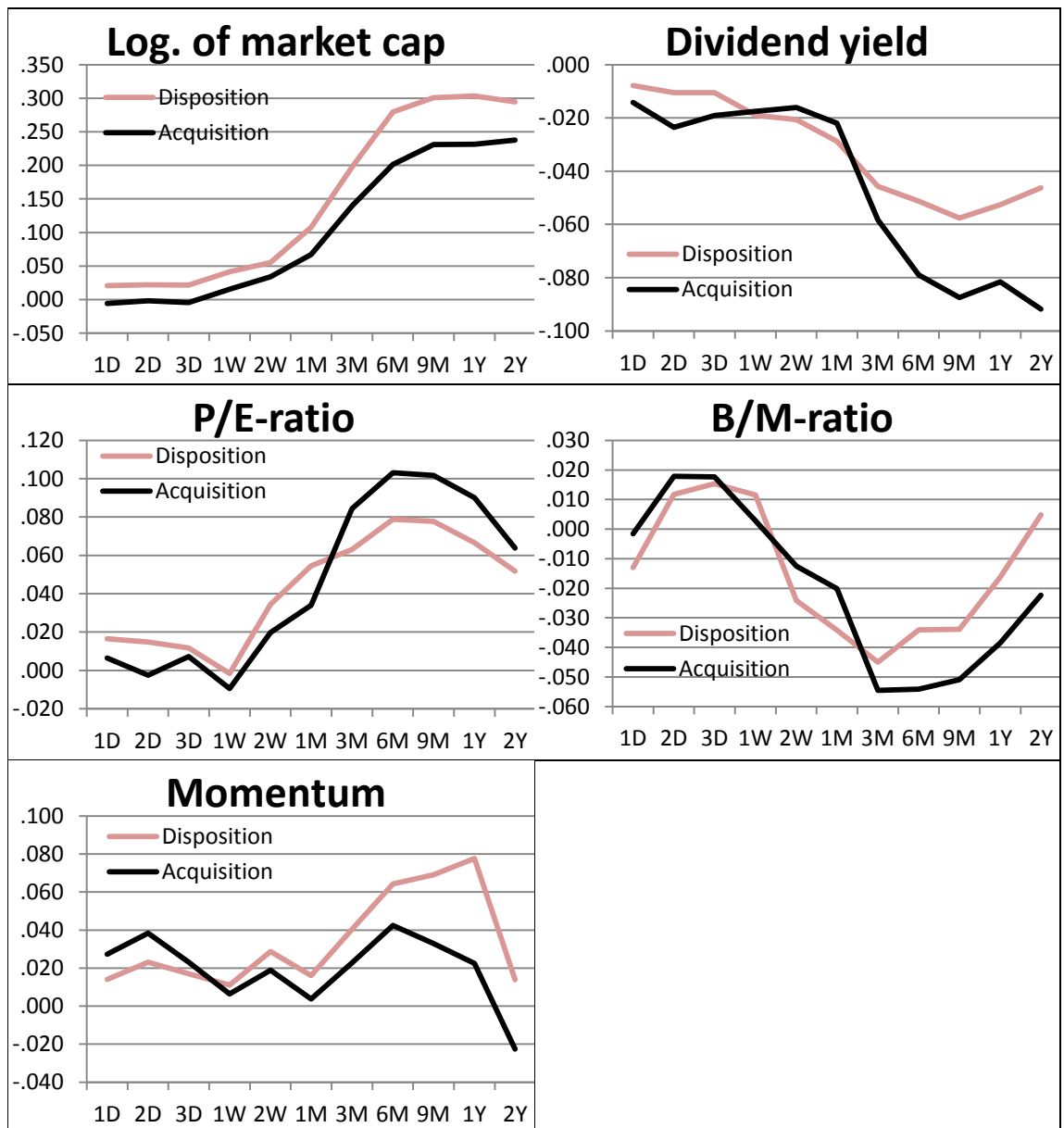
Figure 10: Standardised regression coefficients for equation (3) over different observation horizons

Size provides the clearest distinction between acquisitions and dispositions as it has the same sign at every time horizon. For acquisitions size predicts lower returns than for dispositions. Other interaction terms provide noisier signals. These variables will be further discussed in chapter 5.2. Now it is time move the focus to the last extension of the regression equation (2) introducing variables controlling the riskiness of the transactions.

4.3.3   *Effects of risk level on the predictive power of insiders' transactions*

One important factor missing from the analyses shown in the two previous chapters is the risk level of the investments. The risk factors considered in this thesis are beta and volatility. The calculation rules for these variables are listed in table 11. Size and B/M ratio can be considered as risk factors, too. Together with beta they complete the three factor model and should provide sufficient evidence on the riskiness of insiders' trading activity.

Table 11:   Definitions of risk factors related to insiders' transactions

Variable	Explanation
Beta	Covariance of company returns and Russell 3000 index returns divided by variance of Russell 3000 index returns. The returns used in the calculation are daily logarithmic returns. A single beta is calculated for a company over the entire observation horizon.
Variance	Variance of the daily logarithmic returns of a company. The variance is calculated for a company using returns from the entire observation horizon.

As seen from the above explanations the risk factors are calculated in a way that only creates one figure for each company. For this reason the results cannot be used as potential way to forecast returns as the risk factors cannot be observed beforehand. The regression equation (3) from chapter 4.3.2 is extended to create two new analyses by adding one of the risk metrics as an additional control variable. This is done to ensure that the forecasting power does not stem from taking on additional risk.

The regression equations are not shown here as they only add the risk factor and its interaction term to equation (3). The coefficients for both of the risk factors over all time horizons are shown below in figure 11. The interaction charts for all other variables are not shown here because the interaction charts in figure 11 remain essentially unchanged when either of the risk factors is included in the regression.
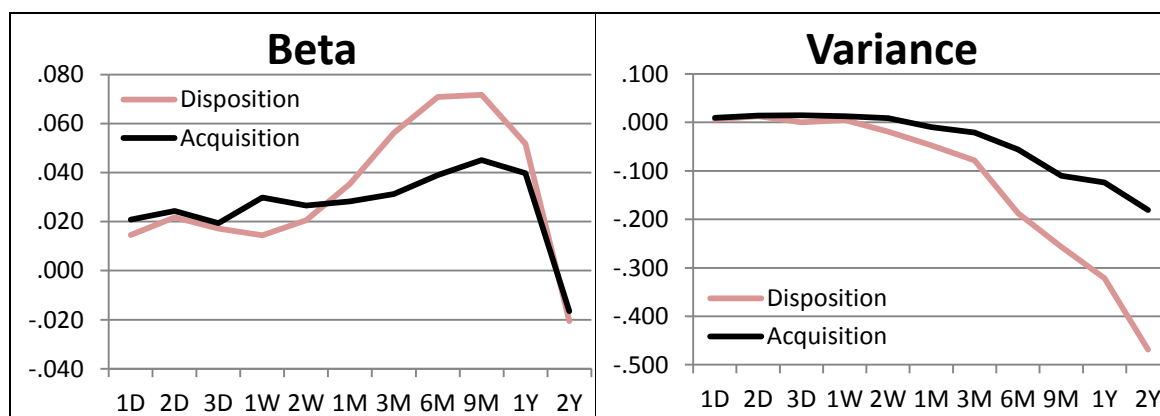
Figure 11:   Regression coefficients for risk factors over the observed time horizons

The most noticeable point about the regression coefficients is that coefficients the beta and variance have different signs. Higher beta is related to higher returns but higher variance is related to lower returns. Another noteworthy finding from the risk factors is that they are connected to different returns following acquisitions and dispositions.

The results confirm that the predictive power of insiders' transactions remains after controlling for risks indicating that the risk level is not an important factor in explaining insiders' investment returns. With the addition of risk factors the regression model now accounts for variables which have been identified to explain stock returns and risk factors. The variables on insiders' transactions remained statistically significant at all steps. With this information hypothesis 3 can be rejected.

With these results the focus can be moved to the last hypothesis on the predictive power of aggregate insider trading. The rejection of hypothesis 3 could indicate that also the aggregate insider trading is related to aggregate returns. This notion will be studied in the next chapter.

4.3.4   *Overall level of insider trading as predictor of market performance*

The data for this analysis on overall level of insider trading as predictor of market performance is created by aggregating insiders' open market transactions over time. The aggregate trading volume is divided to purchases and sales, and to trading by different groups of insiders. Then similar regression analyses are ran as in the previous chapters.

Running the regression models using total purchase and sale volumes reveals that there are no statistically significant independent variables[96]. Disaggregating the trading volume into trading by officers, directors, ten per cent owners and other insiders[97] does not change the results. Purchases by both officers and directors seem to explain the returns at certain time horizons but these variables are highly correlated. The effect of the correlation can be seen in the variance inflation factor of the regression analysis shown in table 12.

Table 12:   Regression coefficients for aggregate insider trading

Coefficients[a]

Model	Unstandardised Coefficients		Std. Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.021	.005		4.619	.000		
Volume purchased by officers	-3.96E-010	.000	-.257	-2.037	.042	.046	21.901
Volume sold by officers	-4.68E-012	.000	-.008	-.271	.786	.903	1.108
Volume purchased by directors	1.02E-010	.000	.261	2.066	.039	.046	21.902
1 Volume sold by directors	-6.40E-012	.000	-.019	-.618	.537	.755	1.324
Volume purchased by large owners	-8.43E-012	.000	-.025	-.923	.356	.998	1.002
Volume sold by large owners	-2.77E-012	.000	-.009	-.315	.753	.801	1.248
Volume purchased by other insiders	-2.90E-010	.000	-.029	-1.072	.284	.996	1.004
Volume sold by other insiders	-1.47E-011	.000	-.010	-.380	.704	.975	1.025

a. Dependent Variable: Log index return (6M)

The variance inflation factor indicates multicollinearity issues in the regression analysis which account for the explanatory power of the purchase volumes for certain time horizons. The purchases by officers and directors are statistically significant at only few

[96] Running the analysis with number of trades as independent variables instead of the trading volume produces similar results.

[97] A transaction is considered to be done by an officer if at least one of the reporters is an officer, by a director if at least one reporter is a director and no reporter is an officer, and by a ten per cent owner if the at least one reporter is a ten per cent owner and none of the reporters is an officer or a director. When only other insiders are reporters, the transaction is considered to be reported by other insider. Transactions are categorised in this manner because officers should hold most valuable information on the company. Directors and ten per cent owners should hold respectively less information.

time horizons. The shown 6-month time horizon in table 12 is an example of this phenomenon. When either of the correlated variables is removed the statistically significant results disappear.

The same regression analysis without director's purchase volume is shown in table 13. It shows that while the variance inflation factor is now low, the statistical significance of purchase volume of officers' has also disappeared. Similar results were found in untabulated analysis conducted for other time spans ranging from one day to two years.

Table 13:   Regression coefficients for aggregate insider trading while controlling
              multicollinearity issues

Coefficients[a]

Model		Unstandardised Coefficients		Std. Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.019	.004		4.272	.000		
	Volume purchased by officers	-3.67E-012	.000	-.002	-.086	.932	1.000	1.000
	Volume sold by officers	-5.59E-012	.000	-.009	-.325	.745	.903	1.107
	Volume sold by directors	-6.57E-012	.000	-.020	-.633	.527	.755	1.324
	Volume purchased by large owners	-8.10E-012	.000	-.024	-.886	.376	.998	1.002
	Volume sold by large owners	-2.93E-012	.000	-.010	-.333	.739	.801	1.248
	Volume purchased by other insiders	-2.54E-010	.000	-.025	-.940	.347	1.000	1.000
	Volume sold by other insiders	-1.32E-011	.000	-.009	-.342	.733	.976	1.025

a. Dependent Variable: Log index return (6M)

Only few variables were statistically significant in individual time horizons across the 11 analysed time horizons. These variables are not a sign of actual statistical significance but of random variation. The results clearly show that the aggregate trading volume by insiders is not related to the broad stock market returns and that hypothesis 4 is accepted.

While the aggregate trading does not forecast market movements, insiders' trading activity in individual companies still has forecasting power as seen in the previous chapter. This situation arises when insiders in companies performing poorly reduce their ownership and insiders in companies performing well increase their ownership.

The next chapters will evaluate and discuss the reliability and validity of these findings. It will verify that all statistical requirements are fulfilled and that the results are economically meaningful. It also presents evidence on how well the results can be generalised.

4.4   Evaluation of reliability and validity

4.4.1   Evaluation of statistic robustness

The results presented in the previous chapters fulfil the requirements for statistical significance. However, the dependent variables are leptokurtic and somewhat skewed as expected for stock returns. Combing kurtosis and skewness to the low R^2 of the regression analyses leads to non-normally distributed residuals which can be seen in table 14 below. The residuals have a leptokurtic distribution and contain some skewness as well.

Table 14:   Descriptive statistics of the complete regressions analyses over different time horizons

Descriptive Statistics

		Predicted return				Residual			
		Mean	Std. Deviation	Skew-ness	Kurtosis	Mean	Std. Deviation	Skew-ness	Kurtosis
Return period	1D	0.001	0.002	4.817	307.227	-3.22E-19	0.029	1.399	80.152
	2D	0.001	0.003	2.519	213.331	-6.69E-18	0.038	0.885	50.957
	3D	0.001	0.004	1.242	39.372	-3.05E-18	0.045	0.553	39.282
	1W	0.001	0.009	3.294	177.971	8.98E-18	0.066	-0.324	84.904
	2W	0.001	0.012	-0.805	232.102	-3.18E-17	0.089	0.168	55.274
	1M	-0.001	0.019	-3.595	306.552	-1.81E-17	0.127	-0.462	20.348
	3M	-0.011	0.045	-6.558	319.297	-7.07E-18	0.223	-0.664	12.435
	6M	-0.036	0.094	-8.427	374.461	-1.05E-17	0.319	-1.009	16.868
	9M	-0.063	0.132	-10.167	435.374	-1.63E-16	0.400	-1.542	19.685
	1Y	-0.095	0.160	-8.411	383.179	-4.49E-16	0.462	-1.534	12.948
	2Y	-0.200	0.346	-27.713	1650.151	-5.72E-16	0.751	-2.631	17.471

The non-normal residuals are a violation of the assumptions underlying linear regression. The returns used in the analysis were reduced to natural logarithm of the raw value as it is customary for statistical analysis of stock returns. This reduced kurtosis but did not remove it fully. Additionally, taking a logarithm does not address skewness.

The kurtosis and skewness could have been addressed with more aggressive transformations of the dependent variables but no transformation can address both issues simultaneously. This approach was not taken as because it would remove some of the signature characteristics of stock returns and complicates the interpretation of results. The distributions can be visually observed in figure 12 which shows that the distribution is not very extreme.
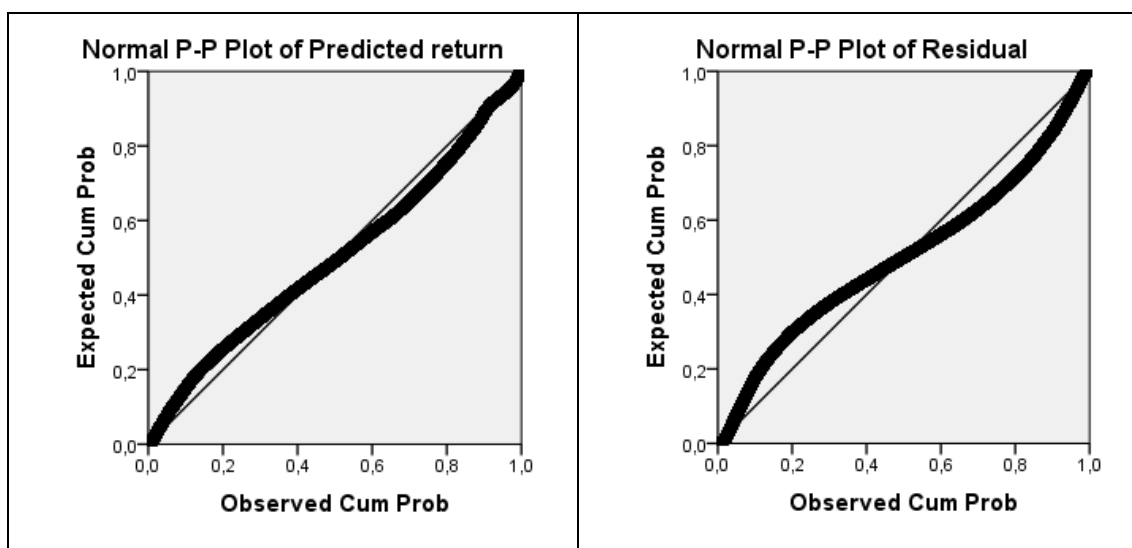
Figure 12:   P/P-plot of predicted returns and residuals for regression analysis for one month index-adjusted returns[98]

Linear regression is quite robust for non-normal residuals. They do not cause serious problems for linear regression if the cause of the non-normality is explainable as it is the case in this analysis. The dependent data is naturally leptokurtic and random leading to leptokurtic residuals. Other potential causes – non-linear relationship and erroneous data – for non-normal residuals have been taken into account[99].

The data has been cleaned of erroneous observations of dependent and independent variables. Care has also been taken to ensure that the linearity assumptions of the regression model are fulfilled. Some transformations of the data – including logarithm transformation of company size and stock returns – were done to achieve this. After the transformations the dependent and independent variables are linearly related. Finally, it can also be stated that it is standard practice to use regression analysis on leptokurtic dependent variables in studies on stock returns.

The two remaining assumptions underlying the linear regression are fulfilled. Auto-correlation issues are not relevant in this regression analysis because it does not involve time series or other series which could spawn autocorrelations. The time component of

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[98] These discussions on validity and robustness use analyses at one-month time horizon as an example. The results are equivalent when the analyses are run for time horizons ranging from one day to two years.

[99] It would have been beneficial to confirm the results through bootstrapping procedure but unfortunately the required software was not available. However, the results seen here remain stable when the analysis is run several times using new random samples of the underlying data (see discussion of using a sample in the analysis in chapters 4.2 and 4.3). This approach is useful to give further assurance that the results are statistically robust but it cannot be used to calculate statistical significance or confidence intervals.

the analysis is reduced to stationary model by the design of the analysis. The last assumption, homoscedasticity is also fulfilled. Figure 13 below shows how the residuals are homoscedastic across both time and predicted value.
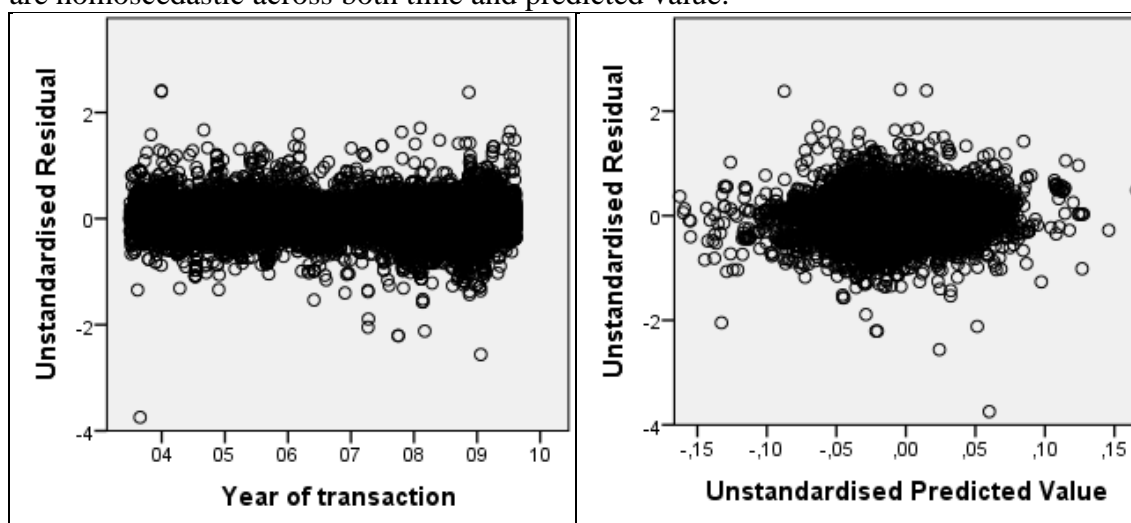
Figure 13:   Regression residuals across time and predicted value[100] for regression analysis with one month index-adjusted returns over time

While the figures above only show residuals for regression analysis for one-month time horizon, the results are identical for other time horizons. With this analysis the results presented in the previous chapters can be considered statistically reliable. Statistical reliability and significance does not guarantee that results are economically meaningful.

4.4.2   *Evaluation of economic significance*

In order to be economically meaningful the regression model has to predict outcomes that are sufficient to account for costs associated with acting on the predictions. Naturally the predicted outcomes also have to be realised so that the outcomes are greater than the associated costs. In the context of this analysis this means that the predicted returns need to be larger than transaction costs and tax effect of trading on the model.

The performance of the strategy after transaction costs is evaluated first. Tax effect will be calculated based on the performance of the entire strategy. This approach is taken because taxes are not directly related to individual transactions but only paid yearly based on netted income.

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[100] Chart is scaled to show the bulk of predicted values. There are individual observations beyond the scale shown here.

   Measuring transaction costs accurately is difficult because the realised costs are only visible to the counterparties in the transaction. This thesis approached the challenge with simplified means by considering commissions, bid-ask spread, and market impact. These components account for most transaction costs. More complex measures have been proposed (see Collins & Fabozzi 1991; Lesmond, Ogden & Trzcinka 1999), but they are not required for the purposes of this study. Mathematically this estimation can be expressed as the following equation (4).

$$TransactionCost = BidAsk + MarketImpact + 2 * Commission \qquad (4)$$

   Elkins/McSherry (Byrne 2010) has estimated that the average one-way equity trading cost including market impact in U.S. is 19.63 basis points. This study analysed trading costs faced by large investment managers and brokers. Generally small investors face additional broker commissions.

   Considering the trend towards lower transaction costs (compare Domowitz, Glen & Madhavan 2001, 227; Byrne 2010) the figure is in line with NYSE estimate from 2001 of 0.21 % (NYSE estimated Nasdaq trading costs at 0.37 % over the same period) (New York Stock Exchange 2001). NYSE estimate does not include market impact and is calculated for a roundtrip transaction.

   For the evaluation of economic significance transactions are assumed to be 1000$ round-trip transactions. Using this approach the lower limit of transaction costs for small investor can be estimated at 2*19.63 basis points plus 2*7 dollars[101]. This equates to transaction costs of 0.53 % of the transaction nominal (0.39 % for large investors).

   This limit is too low for some trading situations which are faced when trading on the predictions of this model. There are two common situations in which this estimate is too low: (1) trading on the OTC bulletin board or pink sheets, and (2) trading on predictions requiring short positions.

   Stocks traded on the bulletin board or pink sheets have considerably higher transaction costs due to smaller market and sparser trading. There are online brokers who offer access to bulletin board at similar commission levels as for the major markets (e.g. NobleTrading 2012). However, many brokers charge extra fees, which can run up to several per cent of nominal for shares on OTC market.

   Regardless of the potentially higher commissions the largest difference in trading costs arises from the bid-ask spread and market impact. These can vary wildly between individual stocks and fluctuate over time so they cannot be reliably estimated. No reliable estimate of the level of these costs was found but it was clear that they are of dif-

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[101] 7 dollars was the cheapest commission found at the time of writing this thesis (ScottTrade).

ferent magnitude than transaction costs for major markets. Thus, this thesis uses a naive estimate of 5 % of notional for bid-ask spread and market impact in OTC market.

The second major caveat in the initial estimate of the transaction costs is short selling. D'Avolio (2002, 286) found that the lending fees associated with short selling are generally quite small. The study found that 91 % of the shares in U.S. had an average lending fee of 17 basis points per annum. The remaining 9 % had average lending fee of 4.3 % per annum.

D'Avolio (2002, 273) also found that most shares in U.S. can be sold short. The shares which cannot be sold short were from tiny, illiquid companies. Small companies were also more likely to belong to the group with higher lending fees. These shares are mostly the same as those traded on the OTC market.

To confirm that the predictions from the model yield sufficient returns, predictions which exceed the estimated transaction costs are investigated further. The transaction costs for different time horizons calculated based on the discussion above are listed in table 15 below.

Table 15:   Transaction costs for different types of transactions

Transaction Costs					
		NYSE/Nasdaq		OTCBB/Pink sheets	
		Buy	(Short-)Sell	Buy	(Short-)Sell
Holding period	1D	0.53 %	0.53 %	4.88 %	4.89 %
	2D	0.53 %	0.53 %	4.88 %	4.91 %
	3D	0.53 %	0.53 %	4.88 %	4.93 %
	1W	0.53 %	0.53 %	4.88 %	4.96 %
	2W	0.53 %	0.54 %	4.88 %	5.03 %
	1M	0.53 %	0.54 %	4.88 %	5.21 %
	3M	0.53 %	0.57 %	4.88 %	5.88 %
	6M	0.53 %	0.61 %	4.88 %	6.88 %
	9M	0.53 %	0.66 %	4.88 %	7.89 %
	1Y	0.53 %	0.70 %	4.88 %	8.89 %
	2Y	0.53 %	0.87 %	4.88 %	12.91 %

It is clear that the predictions are large enough to account for these transaction costs when these they are compared to the predictions provided for index-adjusted monthly returns for shares in NYSE or Nasdaq shown below in figure 14. Conversely, the predicted returns for shares trading on bulletin board or pink sheets, shown on the right

side, mostly do not cover the expected trading costs even though the distribution of expected returns is wider[102].
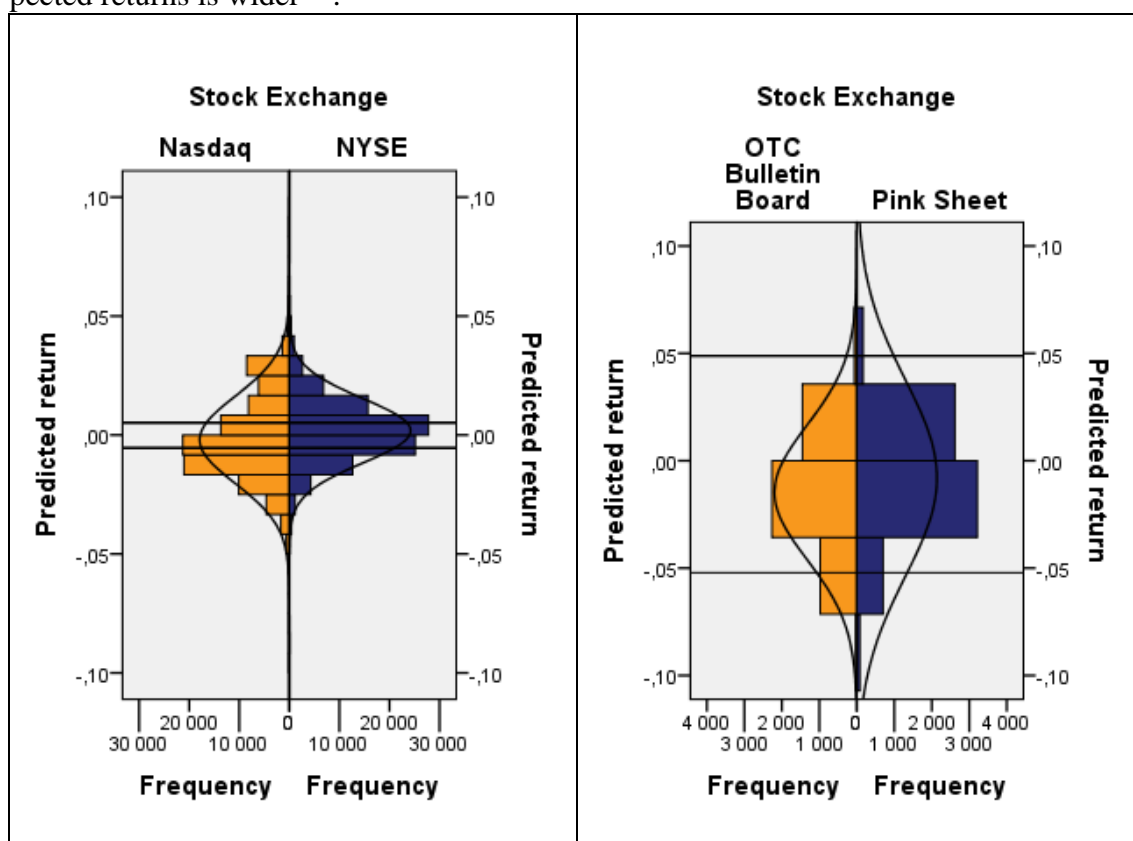
Figure 14:   Distribution of predicted monthly returns for shares trading in NYSE and Nasdaq, or in OTCBB and Pink sheets

While most potential transactions in shares traded on Bulletin board or Pink sheet do not exceed transaction costs, there are a number of transactions that still exceed these costs. Exploring only those transactions that exceed transaction costs reveals that they are followed by positive returns as expected. The effect can be seen in table 16 showing the average returns. The returns are statistically significantly positive for all exchanges. The returns are also statistically significantly higher than the assumed transaction costs for all exchanges except the OTC bulletin board.

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[102] Some of the predictions may be more useful than they seem from this figure because of the uncertainty in the trading costs for the bulletin board and pink sheet shares. For that reason it may be worthwhile to investigate how the actual trading costs for a specific share compare to the predicted stock return if this model will be used for trading or if it is further studied.

Table 16:   Descriptive statistics of transactions with predicted returns greater than transaction costs

Descriptive Statistics

				1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
								Return period						
Nasdaq	Buy	Valid N		4 693	10 358	12 595	21 238	25 787	28 707	22 442	19 981	17 062	15 805	12 003
		Mean		.0091	.0091	.0105	.0162	.0179	.0236	.0471	.0791	.0949	.1007	.2054
		95% Confidence Interval for Mean	Lower Bound	.0074	.0079	.0094	.0152	.0168	.0222	.0446	.0755	.0908	.0964	.1992
			Upper Bound	.0107	.0102	.0117	.0173	.0191	.0251	.0496	.0827	.0990	.1049	.2115
		5% Trimmed Mean		.0067	.0075	.0090	.0137	.0150	.0218	.0446	.0742	.0875	.1055	.2124
		Median		.0027	.0035	.0051	.0103	.0104	.0164	.0391	.0640	.0889	.1045	.2573
		Std. Deviation		.0587	.0579	.0660	.0780	.0944	.1237	.1909	.2584	.2720	.2743	.3448
		Skewness		3.6159	2.3487	1.4102	1.0752	.9840	.2322	.4911	1.1025	.6346	-.4505	-.5183
		Kurtosis		43.5071	39.9781	23.6322	18.9591	16.1333	15.2191	7.6369	9.4530	4.9791	3.2268	2.5822
	Sale	Valid N		46	238	388	17 434	31 270	46 320	66 153	72 779	75 077	74 183	56 117
		Mean		.0028	.0084	-.0001	.0062	.0088	.0146	.0341	.0724	.1026	.1309	.1920
		95% Confidence Interval for Mean	Lower Bound	-.0161	-.0025	-.0117	.0050	.0077	.0134	.0323	.0699	.0996	.1274	.1867
			Upper Bound	.0216	.0192	.0114	.0075	.0100	.0159	.0360	.0749	.1056	.1343	.1973
		5% Trimmed Mean		.0002	.0077	.0051	.0054	.0070	.0103	.0281	.0616	.0892	.1137	.1628
		Median		.0054	.0042	.0036	.0050	.0060	.0091	.0222	.0453	.0683	.0824	.1263
		Std. Deviation		.0635	.0848	.1160	.0813	.1015	.1421	.2422	.3440	.4155	.4740	.6423
		Skewness		1.0722	.1593	-1.2435	.4682	.6172	1.0326	.6266	.6580	.6413	.7014	.8771
		Kurtosis		4.3235	2.0468	6.5508	12.6522	10.6006	9.0718	4.4220	2.9218	2.6249	2.1328	2.7275

NYSE	Buy	Valid N		2 045	5 242	6 547	11 145	21 080	35 498	40 762	36 393	32 245	27 442	17 073
		Mean		.0040	.0057	.0072	.0115	.0102	.0099	.0240	.0402	.0397	.0448	.0177
		95% Confidence Interval for Mean	Lower Bound	.0015	.0042	.0057	.0102	.0092	.0090	.0225	.0380	.0372	.0415	.0111
			Upper Bound	.0065	.0071	.0086	.0129	.0113	.0109	.0255	.0423	.0423	.0480	.0242
		5% Trimmed Mean		.0038	.0051	.0067	.0100	.0089	.0094	.0218	.0359	.0380	.0488	.0448
		Median		.0022	.0036	.0048	.0060	.0057	.0065	.0170	.0332	.0288	.0338	.0478
		Std. Deviation		.0567	.0540	.0595	.0734	.0807	.0928	.1555	.2077	.2361	.2754	.4361
		Skewness		-.2006	.0154	.1879	.9902	.7571	.2885	.5341	.5744	-.6361	-1.5228	-2.1347
		Kurtosis		9.1549	17.9318	12.4020	17.3722	19.5098	12.2989	8.3485	7.7814	12.3760	15.8431	12.4002
	Sale	Valid N		2	123	180	7 544	18 612	26 141	42 057	53 884	57 860	61 593	52 092
		Mean		.0374	.0911	.0897	.0094	.0072	.0139	.0286	.0464	.0589	.0772	.0992
		95% Confidence Interval for Mean	Lower Bound	-.3487	.0593	.0609	.0077	.0060	.0125	.0267	.0440	.0557	.0737	.0938
			Upper Bound	.4235	.1229	.1185	.0111	.0084	.0153	.0305	.0489	.0622	.0807	.1047
		5% Trimmed Mean		.0000	.0791	.0744	.0050	.0049	.0099	.0203	.0311	.0327	.0488	.0531
		Median		.0374	.0031	.0074	.0030	.0039	.0084	.0136	.0174	.0109	.0162	.0116
		Std. Deviation		.0430	.1782	.1959	.0751	.0834	.1171	.2015	.2945	.3989	.4463	.6333
		Skewness		.0000	1.3391	2.0139	2.7258	2.0424	1.4048	1.0851	1.3207	2.1781	1.5427	1.6396
		Kurtosis		.0000	.8884	5.6221	21.1917	20.8614	13.5126	7.5326	6.5386	12.4448	5.7440	5.6352

				1	2	2	15	31	27	56	105	71	65	20
OTC Bulletin Board	Buy	Valid N		1	2	2	15	31	27	56	105	71	65	20
		Mean		#N/A	-.2303	-.2674	.0289	-.0008	-.0302	.2031	.0901	.1129	.2869	.9927
		95% Confidence Interval for Mean	Lower Bound	#N/A	-2.7106	-3.2010	-.0820	-.1131	-.2103	.0625	-.0208	-.0468	.1059	.5582
			Upper Bound	#N/A	2.2501	2.6663	.1398	.1116	.1498	.3437	.2009	.2725	.4679	1.4273
		5% Trimmed Mean		#N/A	.0000	.0000	.0325	.0072	-.0102	.1793	.0711	.1400	.3266	1.1010
		Median		#N/A	-.2303	-.2674	.0458	.0205	-.0104	.1284	.0473	.3109	.4636	1.2047
		Std. Deviation		#N/A	.2761	.3265	.2003	.3063	.4551	.5251	.5729	.6744	.7305	.9285
		Skewness		#N/A	.0000	.0000	-.6185	-.6014	-.8684	1.3260	.6569	-.8350	-.9771	-1.9267
		Kurtosis		#N/A	.0000	.0000	.4623	2.0713	.5815	6.7274	1.3045	.6554	1.5789	3.5066
	Sale	Valid N		#N/A	19	3	15	25	249	2 111	3 301	3 936	3 939	3 244
		Mean		#N/A	.0210	.0136	.0534	.1993	.1031	.1474	.2271	.3063	.3987	.7697
		95% Confidence Interval for Mean	Lower Bound	#N/A	-.0166	-.1357	-.2164	.0662	.0487	.1259	.2063	.2831	.3741	.7320
			Upper Bound	#N/A	.0586	.1629	.3231	.3324	.1575	.1688	.2479	.3294	.4232	.8074
		5% Trimmed Mean		#N/A	.0166	.0000	.1121	.2056	.1135	.1353	.2070	.2748	.3610	.6955
		Median		#N/A	.0122	-.0121	.0148	.0846	.0803	.1097	.1478	.1820	.2260	.4859
		Std. Deviation		#N/A	.0781	.0601	.4872	.3224	.4359	.5025	.6100	.7401	.7855	1.0962
		Skewness		#N/A	1.4508	1.5714	-2.2641	.1187	-.6662	1.6818	2.4685	3.0774	1.6721	1.2401
		Kurtosis		#N/A	2.9235	.0000	7.4161	-1.1236	7.0708	14.2423	33.1309	34.8090	11.5315	2.2955

Pink Sheet	Buy	Valid N		2	4	3	30	61	68	76	221	119	46	148
		Mean		-.0153	-.0957	-.0369	.0108	-.0679	-.1099	.0643	-.1851	-.2877	-.4451	-1.3014
		95% Confidence Interval for Mean	Lower Bound	-.4476	-.4951	-.2974	-.0833	-.1418	-.2182	-.0424	-.2686	-.4177	-.6599	-1.6884
			Upper Bound	.4171	.3037	.2235	.1049	.0060	-.0016	.1710	-.1016	-.1578	-.2302	-.9145
		5% Trimmed Mean		.0000	-.0834	.0000	-.0016	-.0541	-.1039	.0513	-.1636	-.2113	-.3786	-1.0885
		Median		-.0153	.0153	-.0125	.0105	-.0585	-.1228	.0572	-.0542	-.0468	-.1863	-.2537
		Std. Deviation		.0481	.2510	.1048	.2520	.2887	.4474	.4668	.6299	.7157	.7235	2.3818
		Skewness		.0000	-1.9422	-.9937	1.1566	-.7327	-.7424	1.3749	-.7231	-4.5626	-1.6165	-1.6338
		Kurtosis		.0000	3.8011	.0000	6.1170	2.2440	5.8137	8.5800	1.5290	31.4048	1.9686	1.2168
	Sale	Valid N		2	4	5	11	71	317	2 108	4 316	5 463	5 691	5 776
		Mean		.1247	.0465	.0454	-.0169	.0932	.1398	.2105	.3330	.4750	.6781	1.5772
		95% Confidence Interval for Mean	Lower Bound	-1.0275	-.1600	-.1963	-.2233	.0196	.1031	.1904	.3126	.4523	.6509	1.5278
			Upper Bound	1.2769	.2531	.2870	.1895	.1668	.1766	.2305	.3534	.4977	.7052	1.6266
		5% Trimmed Mean		.0000	.0456	.0517	-.0160	.0752	.1388	.1981	.2967	.4083	.5827	1.4311
		Median		.1247	.0383	.0307	.0125	.0060	.1062	.1468	.2238	.3041	.4490	.9678
		Std. Deviation		.1282	.1298	.1946	.3073	.3108	.3329	.4697	.6833	.8563	1.0446	1.9145
		Skewness		.0000	.3583	-.8826	-.2092	1.2759	.4019	.6815	1.5742	1.8957	1.8420	1.2990
		Kurtosis		.0000	.8828	.4865	3.1155	4.2959	4.5678	3.7310	8.6693	8.5376	5.6976	1.4464

Using transactions with predicted returns above the thresholds shown in table 15 would have led to abnormal returns during the observation period. This is shown as above 0 average returns in table 16. The annualised returns corrected with transaction costs from following this strategy are shown in table 17.

The returns are calculated by assuming a holding period equal to the prediction time horizon and adjusting the returns for transaction costs. The returns are also adjusted for index returns. Index adjustment infers that the trading strategy can be sanitised to exclude market movements by trading the index to the opposite direction to the predicted transaction.

Sanitised transactions offer a convenient way to estimate the tax effects of the active trading strategy. After sanitising the transactions only the returns shown in table 17 are left and they form the basis for tax calculations. Because the trading strategy is based on monthly holding periods the returns are subject to U.S. short-term capital gains tax. This varies from 10.0 % to 39.6 % whereas the long-term capital gains tax rate varies from 0 % to 20 %.

This means that the figures shown below need to be adjusted down by the relevant tax rate (from 10.0 % to 39.6 %). Meanwhile the comparison buy-and-hold strategy only pays a tax rate between 0 % and 20 %, and can also earn interest income on the deferred taxes. The exact calculations depend on the tax bracket of the investor and the investment horizon during which interest can be earned on the deferred taxes.

Calculations on the highest tax brackets and five year investment horizon show that the active trading strategy should outperform the passive strategy by approximately 35 % to be desirable. This is the largest difference caused by the taxes. The returns from the active strategy fulfil this requirement except in the case of NYSE-traded shares.

Table 17:   Annualised returns for transactions with predicted returns greater than transaction costs

Annualised Log. Returns

		Nasdaq	NYSE	OTCBB	Pink Sheet
Holding pe-riod	1D	93.52 %	-31.43 %	#N/A	147.19 %
	2D	47.24 %	29.39 %	-655.29 %	-926.55 %
	3D	41.45 %	34.22 %	-1242.16 %	-290.51 %
	1W	33.44 %	27.90 %	-41.75 %	-237.31 %
	2W	19.81 %	9.12 %	101.62 %	-80.27 %
	1M	15.26 %	7.53 %	45.94 %	53.03 %
	3M	12.73 %	8.34 %	36.11 %	58.76 %
	6M	13.58 %	7.62 %	30.92 %	47.98 %
	9M	12.65 %	6.13 %	29.93 %	50.73 %
	1Y	11.89 %	6.08 %	30.86 %	58.05 %
	2Y	9.31 %	3.56 %	32.12 %	68.91 %

Raising the filtering threshold to above transaction costs enables further improving the results following predictions. Returns calculated using two higher thresholds are shown in Appendix IV. The medium threshold is set at predicted logarithmic return of 0.025 for NYSE or Nasdaq, and 0.1 for Bulletin board or Pink sheets. The high threshold used for NYSE and Nasdaq is set at predicted logarithmic return of 0.05[103]. Those results confirm the monotonic relationship between predicted and realised returns.

However, increasing the threshold also increases the standard deviation making the strategy riskier. As the standard deviations are quite high, this strategy requires a sufficiently large number of transactions to be mimicked. The initial thresholds indicate that almost 100 transactions are required per day in NYSE or Nasdaq for the monthly strategy whose returns were shown above. This number corresponds to maintaining an average position of close to USD 3 million. In Bulletin board or Pink sheets these numbers are considerably smaller at 3 transactions and USD 15,000 respectively. These figures for the initial thresholds are shown for all time horizons below in table 18 and table 19.

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[103] High threshold is not determined for Bulletin board or Pink sheets as those models began to break down already with the medium thresholds due to lack of data points.

Table 18:   Average number of transactions with predicted returns greater than trans-
             action costs per day

Count of required trades per day

		Nasdaq	NYSE	OTCBB	Pink Sheet
Holding pe-riod	1D	6.14	2.65	0.00	0.01
	2D	13.73	6.95	0.03	0.01
	3D	16.82	8.72	0.01	0.01
	1W	50.10	24.21	0.04	0.05
	2W	73.92	51.42	0.07	0.17
	1M	97.20	79.86	0.36	0.50
	3M	114.78	107.30	2.81	2.83
	6M	120.17	116.96	4.41	5.88
	9M	119.37	116.73	5.19	7.23
	1Y	116.58	115.35	5.19	7.43
	2Y	88.25	89.61	4.23	7.67

Table 19:   Average position required to mimic transactions with predicted returns
             greater than transaction costs

Average position required by trades (kEUR)

		Nasdaq	NYSE	OTCBB	Pink Sheet
Holding pe-riod	1D	6	3	0	0
	2D	27	14	0	0
	3D	50	26	0	0
	1W	351	169	0	0
	2W	1 035	720	1	2
	1M	2 916	2 396	11	15
	3M	10 330	9 657	253	255
	6M	21 631	21 052	794	1 058
	9M	32 230	31 518	1 402	1 953
	1Y	42 553	42 102	1 893	2 713
	2Y	64 424	65 412	3 087	5 603

The tables above show that the number of transactions and required position may be too large for many purposes. Using higher thresholds helps with this issue and the corresponding tables are shown in Appendix IV. These strategies can produce annualised returns in hundreds of per cent. However, as all the analyses are done within the sample it is important to consider if the results remain static over time. This aspect will be investigated in the next chapter.

4.4.3   Are the results static over time?

The variation of monthly returns of mimicking strategy is large and the returns can be negative at times. This pattern can be seen in figure 15 for transactions with predicted returns which are greater than the transaction costs. Similar figures for the higher thresholds can be found in Appendix IV.
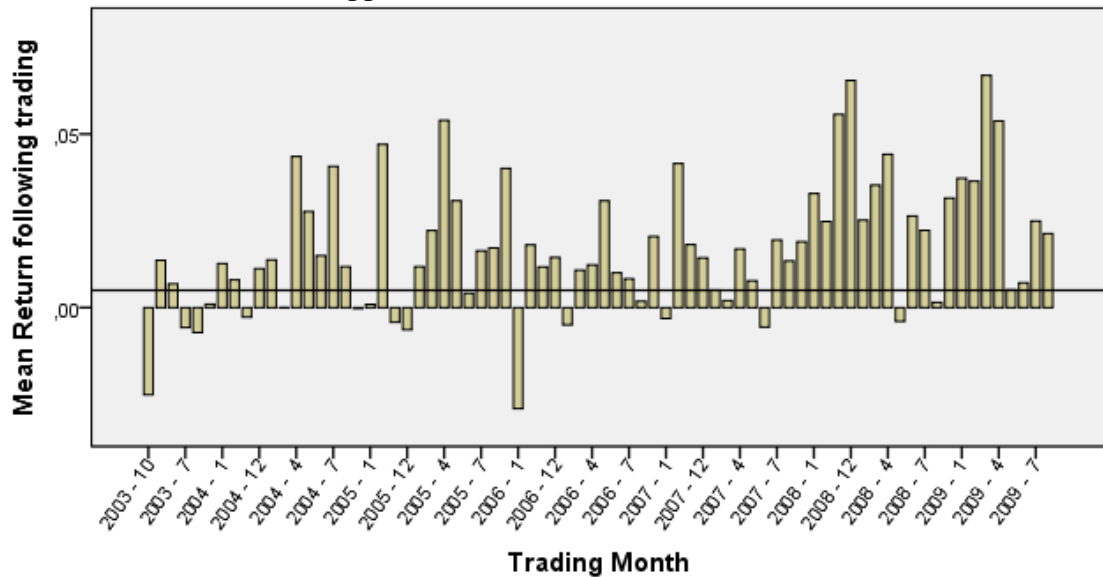
Figure 15:   Monthly realised returns achieved by mimicking transactions which exceed transaction costs

The returns exhibit consistently positive returns even though there is variation and occasional negative months. The returns also consistently exceed transaction costs which are shown in the chart as vertical line[104]. This implies that the predictive model remains static over the observation period. This is important because a non-static model is not usable for predictions.

However, this analysis is still conducted within the sample. In order to further investigate whether the results remain static over different periods a predictive model is created for non-overlapping sub-periods. The models for different sub-periods are then compared to evaluate if they produce similar results.

Table 20 shows the coefficients for these sub-period analyses and the results indicate that the model is not completely static over time. While the non-static nature of the model does not change the previous findings it makes the practical use of the findings more difficult. If the coefficients vary over time the model itself should also vary over

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[104] Transaction costs for NYSE and Nasdaq are shown in the chart because there are considerably more transactions in shares traded in one of these stock exchanges.

time. This means that it cannot be trusted that the findings are valid in the future and thus they cannot be so easily generalised to other time periods.

These issues could be somewhat mitigated by constantly updating the model to use most recent data but it may still not be representative of future. All this introduces additional model risk to practical applications. The additional model risk can be addressed to some degree by simplifying the model composition to consist of only stable predictors. This approach sacrifices some of the predictive capabilities of the model for robustness. More stable predictors can be identified from table 20. They are transaction value, open market dummy variable, director dummy variable, reporting delay, company size, dividend yield, P/E-ratio, and B/M-ratio.

These variables do not have the same sign in all sub-periods but they are relatively stable and maintain their sign in most time periods. Thus they qualify for the more restrictive regression model. The coefficients for this regression model are presented in table 21 below. The results highlight that this model proves to be more robust to different time periods.

As mentioned earlier this approach sacrifices some of the predictive power of the model. Regardless, the predictive power of the simple model remains relatively high between 0.012 and 0.043 as measured by R^2. These numbers compare well to the complete model, which has R^2 between 0.023 and 0.072.

Furthermore, the returns that could be achieved with the more restrictive model remain high. For low and medium thresholds described in table 17 above the returns are on the same level as for the complete model. For high threshold the returns are actually higher due to the more stable predictions over time. These returns are additionally achieved through fewer transactions. While the simple model remains more stable over the different sub-period some variation still remains.

The following chapters will reflect on the most important findings and compare the results to earlier literature. Furthermore, the analysis will be contextualised and the results generalised.

Table 20:   Standardised regression coefficients for sub-period analyses

Standardised coefficients

		Analysis Sub-period						
	2003	2004	2005	2006	2007	2008	2009	Total
(Constant)	.016***	-.002	.021***	-.009***	-.009***	-.007***	.019***	.003*
Acquisition	-.010	.002	-.095***	.018***	.030***	-.001	-.054***	-.050***
Log. of transaction value	.000	-.021***	-.033***	-.019***	-.036***	-.023***	-.025***	-.028***
Open market	-.062***	-.016***	-.007*	-.035***	.010***	-.027***	-.015***	-.017***
Directly owned	-.030***	.001	-.068***	.042***	.020***	-.001	-.049***	-.005
Reporting delay	-.017***	-.006	.025***	.024***	.014***	-.050***	.001	.013***
Traded before P/L reporting	.013***	-.029***	.014***	-.049***	-.029***	-.012***	-.059***	-.029***
Traded after P/L reporting	.035***	.009***	.018***	-.027***	-.024***	.006***	-.043***	-.009***
Director	.039***	.028***	-.045***	.051***	.013***	.022***	.022***	.011***
Ten percent owner	.057***	-.052***	-.071***	.023***	-.003	-.037***	.013***	-.023***
Other insider	-.004	.013***	.000	.005*	-.029***	.053***	.007	.001
Acquisition*Log. of transaction value	.002	.023***	.026***	.013***	.026***	.033***	.027***	.015***
Acquisition*Open market	.108***	.072***	.057***	.073***	.036***	.102***	.092***	.074***
Acquisition*Direct	-.005	-.003	.083***	-.041***	-.012***	.041***	.079***	.033***
Acquisition*Reporting delay	.030***	-.027***	-.027***	-.020***	-.022***	.029***	-.013***	-.028***
Acquisition*Trading before P/L reporting	-.034***	.022***	-.006*	.019***	.018***	-.033***	.029***	.019***
Acquisition*Trading after P/L reporting	-.001	.007***	.011***	.026***	.010***	-.043***	.055***	.021***
Acquisition*Director	-.052***	-.019***	.035***	-.028***	-.023***	-.011***	-.053***	-.013***
Acquisition*Ten percent owner	-.061***	.112***	.080***	-.008***	-.004*	-.026***	-.004	.044***
Acquisition*Other Insider	.001	-.001	-.006***	-.001	.015***	.000	.001	.000
Log. of market capitalisation	.006	.086***	.169***	.079***	.151***	.136***	.076***	.102***
Dividend yield	-.020***	.004	-.026***	-.032***	-.033***	-.073***	-.106***	-.030***
P/E-ratio	.311***	.242***	.028***	.047***	.082***	.107***	.159***	.054***

B/M-ratio	-.281***	-.201***	-.174***	-.050***	-.006***	-.046***	-.169***	-.036***
Momentum	-.055***	.070***	-.002	.126***	-.031***	-.060***	.061***	.018***
Acquisition*Log. of market capitalisation	-.049***	-.049***	-.071***	-.040***	-.043***	.034***	-.076***	-.046***
Acquisition*Dividend yield	-.001	-.015***	-.011***	.005*	-.018***	-.063***	-.006	.008*
Acquisition*P/E-ratio	-.242***	-.142***	.032***	-.016***	.066***	-.183***	.036***	-.020***
Acquisition*B/M-ratio	.233***	.107***	.168***	.042***	-.134***	.027***	.033***	.015***
Acquisition*Momentum	.008*	-.019***	.021***	-.048***	.033***	.153***	.133***	-.013***
Beta	.041***	.027***	.027***	.052***	-.010***	-.025***	-.021***	.035***
Acquisition*Beta	-.001	-.008***	.007***	-.017***	-.002	-.030***	.064***	-.007

*** Significant at 1% level
* Significant at 5% level

Table 21:   Standardised regression coefficients for a more restrictive model over different sub-periods

Standardised coefficients

	2003	2004	2005	2006	2007	2008	2009	Total
	\	\	\	Analysis Sub-period				
(Constant)	.011***	-.003***	.005***	-.002***	-.008***	-.009***	-.012***	-.003***
Acquisition	-.026***	.023***	-.006	-.009*	.031***	.007	.048***	.010*
Log. of transaction value	.013***	-.034***	-.044***	-.025***	-.034***	-.022***	-.030***	-.020***
Open market	-.044***	-.020***	-.011***	-.045***	.011***	-.022***	-.018***	-.019***
Reporting delay	-.013***	-.008*	.026***	.025***	.012***	-.053***	.006	-.001
Director	.034***	.037***	-.027***	.033***	.015***	.026***	.027***	.021***
Acquisition*Log. of transaction value	-.007	.037***	.036***	.017***	.023***	.024***	.028***	.021***
Acquisition*Open market	.086***	.114***	.079***	.088***	.035***	.086***	.145***	.081***
Acquisition*Reporting delay	.025***	-.023***	-.027***	-.022***	-.021***	.018***	-.016***	-.015***
Acquisition*Director	-.043***	-.043***	.016***	-.018***	-.022***	.010***	-.058***	-.018***
Log. of market capitalisation	-.013***	.106***	.202***	.072***	.148***	.144***	.066***	.123***
Dividend yield	-.030***	.008***	-.043***	-.008***	-.036***	-.079***	-.094***	-.057***
P/E-ratio	.347***	.225***	.029***	.039***	.084***	.140***	.159***	.071***
B/M-ratio	-.318***	-.183***	-.187***	-.043***	-.006***	-.063***	-.169***	-.039***
Acquisition*Log. of market capitalisation	-.039***	-.067***	-.090***	-.037***	-.043***	-.005*	-.098***	-.047***
Acquisition*Dividend yield	.001	-.013***	.002	-.011***	-.015***	-.067***	-.010	-.027***
Acquisition*P/E-ratio	-.248***	-.133***	.031***	-.012***	.056***	-.236***	.008*	-.100***
Acquisition*B/M-ratio	.240***	.097***	.180***	.036***	-.127***	.058***	.051***	.020***
Beta	.037***	.028***	.027***	.040***	-.006***	-.018***	-.014***	.005
Acquisition*Beta	.001	-.003	.010***	-.010***	-.004	-.015***	.118***	.009***

*** Significant at 1% level

* Significant at 5% level

5 DISCUSSION

5.1 Trading performance of insiders

The analyses in the previous chapter first studied whether insiders can achieve abnormal profits themselves. The methods with which insiders' profits were studied only provide a simplified picture. They only show investment performance of insiders' investments in their own company and do not, for example, take the ban on short-swing returns into account.

It is not surprising that the analysis results in acceptance of hypothesis 1 and concludes that insiders cannot achieve greater returns than investors in general. Insiders receive a large portion of their portfolio as compensation and sell investments to transform compensation into cash. Additionally, their investment decisions are limited by several restrictions preventing them from quickly reacting to market changes.

Moreover, insiders as a group always hold a considerable amount of their companies' securities in their portfolio as seen in the later analysis on predictive power of aggregate insider trading. Insiders' aggregate holding does not fluctuate a lot and mainly tells that insiders as a group do not react in advance of changes in the economic cycle.

This does not mean that insiders' trading activity cannot contain valuable information. Insiders mostly react to information in their company and positive and negative information evens out across all companies. Insiders' holdings of individual companies change in this environment but the aggregate value of shares held by insiders as a group may not change much.

To evaluate if individual transactions contain information it was studied if the acquisitions and dispositions by insiders were followed by different returns. They were found to be different prompting rejection of hypothesis 2 meaning that individual transactions do indeed contain valuable information. This is in line with the results from previous studies and also creates the foundation for subsequent analyses

It is interesting to note that the returns are negative after both acquisitions and dispositions for follow-up periods of three months or more. The time period which is included in the analysis is very interesting and could explain this finding. It includes both the steady bull market that went on for most of the 2000's as well as the beginning of the stock market crash in the end of the decade. The crash could explain the negative

returns but the analysis is conducted on index-adjusted returns so the poor overall market performance should even out[105].

The negative returns over longer time horizons could be explained by many things. They can result from the averaging process which weighs all transactions equally. A number of transactions ahead of long-term poor performance could dominate the transaction set. Insiders can conduct these transactions to show confidence in the company or to participate in capital injections to the company. Alternatively the results could indicate that insiders estimate the long-term performance of their company poorly.

Regardless of the reasons underlying the specific nature of the return patters, the most important finding was that the returns following acquisitions and returns following dispositions differed. This finding provides the groundwork for more detailed investigation on the information content of insiders' transactions. This more detailed analysis is discussed next.

5.2   Forecasting share performance using insiders' trading activity

As insiders' transactions were studied more closely they were in fact found to contain value-relevant information. Overall this meant that hypothesis 3 is rejected but there were more detailed findings in the individual statistical analyses. The findings related to the individual informational attributes are discussed and reflected against previous research next.

The transaction value and open market dummy variable have perhaps the clearest reason for transmitting information. They also changed most significantly with the introduction of control variables. However, they behave exactly as they were expected to behave. An open market purchase is followed by larger returns than an open market sale, and a larger purchase is followed by larger returns than a purchase with a smaller nominal. This is aligned with previous research and justifications why the returns should behave like this.

Insiders make most active decisions on open market transactions and thus they should increase the difference between sales and purchases. The explanation for transaction value is equally intuitive. Insiders stake more money on a larger transaction and have larger incentives on being correct. The simple reasoning probably contributed to the fact that these variables remained static over the entire observation period.

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[105] The average index return over the longer time periods is already negative in the sample so the returns following insiders' transactions are even more negative.

Direct transaction dummy variable should follow a similar train of thought as the open market dummy. Insiders have most active role in direct transactions and they should thus increase the difference between sales and purchases. This also seemed to be the case before control variables were introduced. After the control variables were included to the analysis only a specific period from one to nine months had this effect. Furthermore the results turned out to be volatile across sub-periods and led to the direct dummy variable not being included in the simplified model.

These results contradict earlier research which has found this variable to contain information. This difference could be explained by the variation between different sub-periods. The results may have seemed statistically significant but only for the specific time period. The variability on the other hand could be caused by too generous assumption on the differing incentives. Indirect transactions are often made by parties which could as well be equated to the insiders herself: e.g. her family members or the insider's own investment trust.

Timing of transactions provides noisier signals when compared to these three variables. The timing was studied in this thesis through promptness of reporting and through dummy variables signalling if the transaction happened close to release of financial statements. Trading close to the release of financial statements seemed promising in the initial analysis but proved non-static in the robustness checks. However, acquisitions before or after the release financial statements were followed by larger returns than sales. This difference also remained static over the studied sub-periods.

These findings can be explained by the information transfer happening at reporting the financial statements. The information mismatch between insiders and other investors is greatest before reporting. These circumstances provide an opportune situation for insiders to trade. However, this is also the time when transactions by insiders are most likely to draw scrutiny and also most limited by blackout periods. Conversely the information mismatch is the smallest after reporting financial results. But it is also the time when insiders can trade with least scrutiny and they are still likely to hold information not released to the market.

The reporting delay on the other hand produced noisier signals before the control variables were introduced to the regression. With control variables sales were consistently followed by higher returns the longer the reporting delay was. This consistency also followed relatively well through the different sub-periods. There is no clear explanation for this finding. It could be explained by insiders' being diligent in reporting the transactions that are timed best in a timely manner. The transactions that are reported later are those that are mostly done for other reasons than pure trading profit and do not draw excess interest.

The means with which these timing variables were studied were simple and they should be improved. This area of insiders' trading activity has not received much focus

in the earlier literature either. The results described above indicate that they are worth additional research.

The last group of variables in the regression analyses contained the type of insider. Officers were used as the base group to which other groups were compared because officers were assumed to have most information. Judging on the results this was not a completely unfounded assumption.

Other insiders do not seem to hold any valuable information. Large shareholders' acquisitions on the other hand are followed by larger returns than officers' acquisitions over short time horizons. This result can be conjectured to results from at least two causes: (1) large owners' transactions often change the supply and demand balance for the stock, and (2) when large owners stake their money in companies that are struggling they force them to produce better returns through large ownership stake[106]. However, these findings for large owners were not static over sub-periods.

Directors were the only group whose regression coefficients remained static over the sub-periods. The coefficients signal that their dispositions are followed by larger returns than sales but this is caused by the comparison to the base group of officers. The results state that officers' hold more information and time their transactions better. It is interesting to note that this order changes for long time horizons. This fits well with the board of directors' responsibility to plan long-term activities and strategies. These findings are in line with previous literature.

As these variables are statistically significant it indicates that insiders' trading activity contains different information than previously identified stock market anomalies. This is also aligned with previous studies conducted on insider trading. The control variables themselves exhibit some unusual characteristics.

Three of the five control variables have regression coefficients that do not agree with earlier research (size, P/E ratio, and dividend yield). These results were also robust over the sub-periods. This is not a clear contradiction as a random selection is not studied but the sample consists of the returns following insiders' transactions.

Higher predicted returns for larger companies are probably partially explained by insiders in small companies investing in their companies more when they are distressed. Additionally, smaller pieces of information are considered material for a smaller company meaning that insiders in small companies may need to be more careful when trading. Another explanation is that insiders in larger companies are better at evaluating the future. Smaller companies may not be able to invest much on exploring the market situation and focus more on their own internal functions trusting it pays off eventually.

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[106] Conversely, when large owners abandon a company it does not predict good times for the company.

For dividend yield the situation is most likely connected to changes in dividends. The statistically insignificant interaction term for short time horizons also supports this. When a dividend increase is close insiders are likely to be cautious in their activities. The observed values of P/E ratio on the other hand are more difficult to explain. The reason could be connected to how the P/E ratio evolves before and after insiders' transactions but this aspect was not studied in this thesis.

The remaining two control variables – momentum and B/M ratio – consistently predict the same sign as previous studies suggest. While B/M ratio behaves as predicted R&D expenditure could have been used to provide a better understanding of the findings. Unfortunately this was not possible with the data available for this thesis. The fact that momentum does not remain static over the sub-periods could be explained by the shortness of the sub-periods.

Final noticeable feature of the control variables is that the interaction terms signal that acquisitions are followed by smaller returns than dispositions. There are several reasons why this could happen. The relationship between momentum and returns should show these characteristics when insiders use contrarian investment strategies. Previous studies have established that insiders actually are contrarian investors.

Furthermore, insiders could be extra careful while trading and choose to trade at times when there is little risk of being accused of illegal insider trading. Trading restrictions could also have a similar effect. Additionally insiders could be exhibiting confidence in their company by buying at a time which does not precede best returns.

However, it is also possible that these variables could do not signal any information from insiders' behaviour. This could be justified argument because the variables seem to provide noisy signals on insiders' behaviour. This last justification does not hold well for size as the difference is very static for it.

Finally, incorporating the risk metrics into the analysis showed that the results were not driven by the risk level. Using both beta and variance provided similar results with very small changes in the regression coefficients of the other variables. The reason for negative coefficient for variance is not investigated further in this thesis but is most likely due to majority of variance being idiosyncratic, which has previously been found to predict lower stock returns (French, Schwert & Stambaugh 1987; Ang, Hodrick, Xing & Zhang 2006).

It may seem that the risk level could be used as part of the model because their interaction terms are statistically significant. It is also an appropriate argument that insiders would better identify when the risk metrics, especially variance, do not provide an accurate picture of the risk level. However, the design of the empirical approach in this thesis does not allow this. The risk metrics have been calculated over the entire observation period and do not present figures observable at trading time. It would be an interesting

topic for further research to change the research setup in a way which allows studying risk levels at the time of trading.

The results discussed here are statistically robust and economically meaningful for the specific time period and for the economic environment in U.S. The results can be generalised to different time periods and geographical areas to some extent. As discussed before it was studied how static the identified regression coefficients are across different sub-periods. The analysis provided assurance that the model has static elements which can be extended to other time periods.

The extension of course assumes that the economic and regulatory environment remains the same. This is also the key factor to extending the results to other geographical areas. As shown in chapter 2.3 the regulation is very similar in Europe, Japan and U.S. The economic environments in these countries are also very similar. Based on this the results should be extendable to these regions, too. There is one question, though. The data used in this thesis is collected from one source which contains all insider trading reports in U.S. This type of centralised repository offering insider trading reports from a long time period does not exist in Europe or Japan. Lack of a repository makes it more difficult to utilise the information and verify these findings.

 The last topic that was analysed in this thesis was the predictive power of aggregate insider trading. As seen in chapter 4.3.4 and discussed briefly in chapter 5.1 insiders' aggregate trading is not connected to index returns. This shows that insides as a group do not change their ownership in their companies in a way which correctly anticipates changes in economic cycles. This result was also indicated in chapter 4.2 which showed that insiders' returns do not differ from other investors.

Previous research had found evidence that insiders' as a group react weakly to upcoming changes in economic cycles. However, based on the analysis conducted in this thesis, this is not the case. The reason for the contradicting results between the predictive powers of individual and aggregate trading is that the changes in ownership by insiders mostly nets out when insiders are observed as a group.

6 CONCLUSIONS

This thesis investigated the trading patterns of insiders. The observation period began after the implementation of the Sarbanes-Oxley Act when insiders had to start reporting all their transactions electronically. Electronic filing changed the nature of insiders' transactions as all transactions are easily available to all interested parties.

Additionally, the Sarbanes-Oxley Act mandates that transactions have to be reported much faster than previously. These characteristics created an environment where information from insider transactions is transferred to markets faster and more fully. There have been earlier studies on the explanatory power of insiders' transactions but they have been done in a different environment prior to the implementation of the Sarbanes-Oxley Act.

This thesis contributes to the current body of knowledge by investigating the current state of the predictive power of insider trading. Additionally this thesis introduces new aspects to the scientific literature. Previously the risk level of insiders' investments has not been explicitly investigated even though it could explain larger returns. Furthermore, this thesis studied if the explanatory variables remain static over time. This has not been included in previous studies.

The results revealed that insiders do not achieve larger returns than markets overall achieve. This indicates that for the most part insiders do not use illegal information to achieve abnormal profits. The characteristics of insiders' transactions can, and were actually found, to explain subsequent returns regardless of this finding.

The most obvious reflection for investors is the possibility to use the findings to achieve larger returns than would be available otherwise. As seen in chapter 4.4 the potential returns are large but they are accompanied by significant risks as well. Not only do the returns vary considerably but there is also model risk associated with the strategy. Given these risks, the trading strategy should not be entered into lightly. Careful analysis should be done, and proper controls should be set up, before using information about insiders' transactions in trading. Using solely the model described in this thesis is relatively risky, and may be out of reach for many investors. However, the findings of the thesis can be used to improve the investor's normal investment process.

By incorporating the findings into the investment process investors can utilise the tacit information transferred to markets by insiders. This thesis finds that insiders are not engaged in large scale illegal trading activities meaning that they do not trade on material, non-public information. For the investors this assumption does not matter much as all information which can be used to correctly predict the future returns is useful. For regulators, though, the distinction is important. If the used information is specific in nature it is illegal to use it. Regulators should catch this type of trading and prevent it from happening. If insiders use tacit information, which is consequently trans-

ferred to markets through trading, security prices will reflect the true value more accurately and markets are more efficient.

More efficient markets are positive for investors and regulators alike as more accurate prices mean more efficient allocation of capital. Tacit information from insiders would not become public if it were not coming to markets via the trading activities. Thus, without the trading activities prices would not be at their optimal level. This makes insiders' trading a positive phenomenon even though it means that insiders have a distinct advantage in trading against other investors. The advantage is temporary because the trading activities are published quickly dissipating the informational advantage.

The data required to create these trading strategies is readily available. However, collecting the data requires development of proprietary software due to the complex nature and large amount of data. The software is needed to download the required individual reports from SECs FTP server and transform it into format which can be used in the analysis. This requires sophistication from the software and thus expertise from its creators. The data challenges could be alleviated by making, at least the core of, the data available in a more user-friendly format. This format could for example be a flat file or database compliant file. This approach would put the data into hands of a much wider audience who could then use the data while making investment decisions.

Nevertheless the challenges in accessing the data are not the biggest hurdles in comprehensive use of insider trading data. The real issue is connecting the data to market data and other data points in SECs database. SEC does not provide master data for the reporters and companies but relies on insiders reporting this data in every report.

Naturally this leads to some errors in mapping of companies to market data. Lack of master data has a similar effect as companies may merge or change tickers (the only reported connection to market data). These issues make it challenging to match SEC data to market data because the same SEC identifier can point to different stock tickers and the same stock ticker can point to several SEC identifiers.

While most data is correct there is considerable amount of data with problems described above. This type of data mandates stern quality assurance routines, which are out of reach for many investors. The problematic data is more prevalent in smaller companies but also occurs in larger companies. This means that while the problems can be mitigated by focusing on larger companies they cannot be completely avoided.

Alleviating these data issues the regulators could make the data more useful for larger number of investors. In addition to enabling faster transfer of information it would encourage new innovative ways of using the data. Enforcement of insider trading could also potentially be eased when the data can be easily read by all interested parties.

Additionally, simpler data retrieval and processing would help future research on the subject. Current research on insider trading still leaves many interesting topics open for

further studying. A direct extension to this thesis is further exploring the underlying reasons for the presented findings. Some possible explanations were presented along with the findings but their validity was not assessed in detail.

The thesis topic could also be extended by studying how static the predictions are which was only superficially examined in this thesis. Modern statistical methods are very powerful and can uncover relationships which are only present at certain periods. If the relationship does not remain static the conclusions made from the research could be incorrect when extended to another time period.

This perspective is very important for practical applications of the results and is disregarded in many studies. Out-samples and rolling forecasts should be employed in addition to investigating how static the predictions are in order to properly investigate the practical usefulness of the findings.

Furthermore, methods to strengthen the indicators could be a topic for further studies. One such method was studied by Seyhun in 1986 with unanimous actions by insiders. He found that if insiders act unanimously the indicators are also stronger. The analysis could also be extended to include other methods such as positive or negative news releases.

7   BIBLIOGRAPHY

Aboody, David − Lev, Baruch (2000) Information Asymmetry, R&D, and Insider Gains. *The Journal of Finance*, Vol. 55 (6), 2747-2766.

Abowd, John M. (1990) Does Performance-Based Managerial Compensation Affect Subsequent Corporate Performance? *Industrial & Labor Relations Review*, Vol. 43 (3), 52-73.

Act No. 25 of 1948 <http://www.fsa.go.jp/common/law/fie02.pdf>, retrieved 8.12.2007.

Aiken, Leona S. − West, Stephen G., (1996) *Multiple Regression: Testing and interpreting interactions.* 1st ed. Sage Publications, Inc, Thousand Oaks, California.

Akerlof, George A. (1970) The market for "lemons": Quality uncertainty and the market mechanism. *The quarterly journal of economics*, Vol. 84 (3), 488-500.

Aktas, Nihat − De Bodt, Eric − Van Oppens, Hervé (2008) Legal insider trading and market efficiency. *Journal of Banking and Finance*, Vol. 32 (7), 1379-1392.

Alchian, Armen A. (1950) Uncertainty, evolution, and economic theory. *The Journal of Political Economy*, Vol. 58 (3), 211-221.

Andrikopoulos, Panagiotis − Daynes, Arief − Latimer, David − Pagas, Paraskevas (2008) Size effect, methodological issues and 'risk-to-default': evidence from the UK stock market. *The European Journal of Finance*, Vol. 14 (4), 299-314.

Ang, Andrew − Hodrick, Robert J. − Xing, Yuhang − Zhang, Xiaoyan (2006) The Cross-Section of Volatility and Expected Returns. *The Journal of Finance*, Vol. 61 (1), 259-299.

Baesel, Jerome B. − Stein, Garry R. (1979) The Value of Information: Inferences from the Profitability of Insider Trading. *Journal of Financial and Quantitative Analysis*, Vol. 14 (3), 553-571.

Bagnoli, Mark − Khanna, Naveen (1992) Insider Trading in Financial Signaling Models. *The Journal of Finance*, Vol. 47 (5), 1905-1934.

Bainbridge, Stephen M. (1995) Incorporating state law fiduciary duties into the federal insider trading prohibition. *Washington and Lee Law Review*, Vol. 52 (4), 1189.

Bainbridge, Stephen M. (2000) Insider Trading: An Overview. *Working paper - University of California, Los Angeles*, 772-798.

Bainbridge, Stephen M. (2001) The Law and Economics of Insider Trading: A Comprehensive Primer. *Working paper - University of California, Los Angeles*.

Bainbridge, Stephen M. (2005) An Overview of US Insider Trading Law: Lessons for the EU? *Econ Research Paper - University of California Los Angeles School of Law* (05-5).

Bainbridge, Stephen M. (2008) The Iconic Insider Trading Cases. *Econ Research Paper - University of California Los Angeles School of Law*, Vol. 08-05

Bajo, Emanuele – Petracci, Barbara (2006) Do what insiders do: Abnormal performances after the release of insiders' relevant transactions. *Studies in Economics and Finance*, Vol. 23 (2), 94-118.

Ball, Ray (1978) Anomalies in relationships between securities' yields and yield-surrogates. *Journal of Financial Economics*, Vol. 6 (2-3), 103-126.

Banz, Rolf W. (1981) The relationship between return and market value of common stocks. *Journal of Financial Economics*, Vol. 9 (1), 3-18.

Barberis, Nicholas – Huang, Ming (2001) Mental accounting, loss aversion, and individual stock returns. *The Journal of Finance*, Vol. 56 (4), 1247-1292.

Barberis, Nicholas – Shleifer, Andrei (2003) Style investing. *Journal of Financial Economics*, Vol. 68 (2), 161-199.

Barberis, Nicholas – Thaler, Richard H., (2002) A Survey of Behavioral Finance. In: *Handbook of the Economics of Finance*, 1051-1121.

Barclay, Michael J. – Smith Jr., Clifford W. (1995) The Priority Structure of Corporate Liabilities. *The Journal of Finance*, Vol. 50 (3), 899-917.

Basu, Sanjoy (1975) The Information Content of Prices-Earnings Ratios. *Financial Management*, Vol. 4 (2), 53-64.

Basu, Sanjoy (1977) Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of The Efficient Market Hypothesis. *The Journal of Finance*, Vol. 32 (3), 663-682.

Basu, Sanjoy (1983) The relationship between earnings' yield, market value and return for NYSE common stocks: Further evidence. *Journal of Financial Economics*, Vol. 12 (1), 129-156.

Beneish, Messod D. – Vargus, Mark E. (2002) Insider Trading, Earnings Quality, and Accrual Mispricing. *The Accounting Review*, Vol. 77 (4), 755-791.

Beny, Laura Nyantung (2004) Insider Trading Laws and Stock Markets Around the World: An Empirical Contribution to the Theoretical Law and Economics Debate. *Research paper - University of Michigan Law School, Law and Economics* (04-004).

Beny, Laura Nyantung (2008) Do Investors in Controlled Firms Value Insider Trading Laws? International Evidence. *Journal of Law, Economics and Policy*, Vol. 4 (2), 267-310.

Bernoulli, Daniel (1954) Exposition of a new theory on the measurement of risk. *Econometrica: Journal of the Econometric Society*, Vol. 22 (1), 23-36. Translated from original article published in 1738 by Louise Sommer.

Bettis, Carr – Vickrey, Don – Vickrey, Donn W (1997) Mimickers of corporate insiders who make large-volume trades. *Financial Analysts Journal*, Vol. 53 (5), 57-66.

Bettis, J. C. – Coles, J. L. – Lemmon, M. L. (2000) Corporate policies restricting trading by insiders. *Journal of Financial Economics*, Vol. 57 (2), 191-220.

Bhattacharya, Utpal – Daouk, Hazem (2002) The World Price of Insider Trading. *The Journal of Finance*, Vol. 57 (1), 75-108.

Brennan, Michael J. – Subrahmanyam, Avanidhar (1995) Investment analysis and price formation in securities markets. *Journal of Financial Economics*, Vol. 38 (3), 361–381.

Bris, Arturo (2005) Do Insider Trading Laws Work? *European Financial Management*, Vol. 11 (3), 267-312.

Brochet, Francois (2010) Information content of insider trades: before and after the Sarbanes-Oxley Act. *The Accounting Review*, Vol. 85 (2), 419-446.

Burgess, Kate – Masters, Brooke (2010) Insider trading: A bigger bite. *Financial Times* (12 May 2010).

Byrne, John Aidan (2010) Elkins/McSherry - Global Transaction Costs Decline Despite High Frequency Trading. *Institutional Investor* 1.11.2010.

Camerer, Colin – Thaler, Richard H. (1995) Anomalies: Ultimatums, Dictators and Manners. *The Journal of Economic Perspectives*, Vol. 9 (2), 209-219.

Carlton, Dennis W. – Fischel, Daniel R. (1983) The Regulation of Insider Trading. *Stanford Law Review*, Vol. 35 (5), 857-895.

Carpenter v. United States, 484 U.S. 19 (U.S. Supreme court 1987)

Carter, Martha L. – Mansi, Sattar A. – Reeb, David M. (2003) Quasi-Private Information and Insider Trading. *Financial Analysts Journal*, Vol. 59 (3), 60-68.

Chan, Louis K. C. – Hamao, Yasushi – Lakonishok, Josef (1991) Fundamentals and Stock Returns in Japan. *The Journal of Finance*, Vol. 46 (5), 1739-1764.

Chan, Louis K. C. – Lakonishok, Josef (1997) Institutional equity trading costs: NYSE versus Nasdaq. *Journal of Finance*, Vol. 52 (2), 713-735.

Chan, Louis K. C. – Lakonishok, Josef – Sougiannis, Theodore (2001) The Stock Market Valuation of Research and Development Expenditures. *Journal of Finance*, Vol. 56 (6), 2431-2456.

Chari, V. V. – Jagannathan, Ravi – Ofer, Aharon R. (1988) Seasonalities in security returns: The case of earnings announcements. *Journal of Financial Economics*, Vol. 21 (1), 101-121.

Christenson, Charles (1983) The Methodology of Positive Accounting. *The Accounting Review*, Vol. 58 (1), 1-23.

Coase, R. H. (1960) The Problem of Social Cost. *Journal of Law and Economics*, Vol. 3, 1-44.

Coff, Russell W – Lee, Peggy M. (2007) Insider trading as a path to competitive advantage? *Strategic Organization*, Vol. 5 (1), 71-78.

Cohen, Randolph B. – Gompers, Paul A. – Vuolteenaho, Tuomo (2002) Who underreacts to cash-flow news? evidence from trading between individuals and institutions. *Journal of Financial Economics*, Vol. 66 (2-3), 409-462.

Collins, Bruce M. – Fabozzi, Frank J. (1991) A Methodology for Measuring Transaction Costs. *Financial Analysts Journal*, Vol. 47 (2), 27-36.

Commission Directive 2004/72/EC

Council of Europe (2012) Convention on Laundering, Search, Seizure and Confiscation of the Proceeds from Crime and on the Financing of Terrorism. *Council of Europe Treaty Series*, 1-31.

Cui, Huimin – Mak, Y. T. (2002) The relationship between managerial ownership and firm performance in high R&D firms. *Journal of Corporate Finance*, Vol. 8 (4), 313-336.

Dawkins, Richard, (1976) *The Selfish Gene*.

D'Avolio, Gene (2002) The market for borrowing stock. *Journal of Financial Economics*, Vol. 66 (2-3), 271–306.

De Bondt, Werner F. M. – Thaler, Richard H. (1985) Does the Stock Market Overreact? *The Journal of Finance*, Vol. 40 (3), 793-805.

Del Brio, Esther B. – Perote, Javier (2007) What Enhances Insider Trading Profitability? *Atlantic Economic Journal*, Vol. 35 (2), 173-188.

Delaware Department of State (2012) About Agency: Department of State: Division of Corporations. <http://www.corp.delaware.gov/aboutagency.shtml>, retrieved 28.10.2012.

Dierkens, Nathalie (1991) Information Asymmetry and Equity Issues. *The Journal of Financial and Quantitative Analysis*, Vol. 26 (2), 181-199.

Dimson, Elroy – Mussavian, Massoud (1998) A brief history of market efficiency. *European Financial Management*, Vol. 4 (1), 91-103.

Directive 2003/6/EC of the European Parliament and of the council

Dirks v. SEC, 463 U.S. 646 (U.S. Supreme Court 1983)

Dolgopolov, Stanislav (2004) Insider Trading and the Bid-Ask Spread: A Critical Evaluation of Adverse Selection in Market Making. *Capital University Law Review*, Vol. 33, 83-180.

Domowitz, Ian – Glen, Jack – Madhavan, Ananth (2001) Liquidity, Volatility and Equity Trading Costs Across Countries and Over Time. *International Finance*, Vol. 4 (2), 221-255.

Dooley, Michael P. (1980) Enforcement of Insider Trading Restrictions. *Virginia Law Review*, Vol. 66 (1), 1-83.

Du, Julan – Wei, Shang-Jin (2004) Does Insider Trading Raise Market Volatility? *The Economic Journal*, Vol. 114 (498), 916-942.

Easterbrook, Frank H. (1981) Insider Trading, Secret Agents, Evidentiary Privileges, and the Production of Information. *The Supreme Court Review*, 309-365.

Eckbo, Espen B. – Smith, David C. (1998) The Conditional Performance of Insider Trades. *The Journal of Finance*, Vol. 53 (2), 467-498.

Eisenhardt, Kathleen M. (1989) Agency Theory: An Assessment and Review. *The Academy of Management Review*, Vol. 14 (1), 57-74.

Ekelund, Robert B. Jr – Tollison, Robert D (1980) Mercantilist Origins of the Corporation. *The Bell Journal of Economics*, Vol. 11 (2), 715-720.

Elliott , John – Morse , Dale – Richardson , Gordon (1984) The Association between Insider Trading and Information Announcements. *The RAND Journal of Economics*, Vol. 15 (4), 521-536.

Ellsberg, Daniel (1961) Risk, ambiguity, and the Savage axioms. *The quarterly journal of economics*, Vol. 75 (4), 643-669.

Epps, Thomas W. (1979) Comovements in Stock Prices in the Very Short Run. *Journal of the American Statistical Association*, Vol. 74 (366), 291-298.

European Commission (2012) Application of EU Law. What are EU directives? <http://ec.europa.eu/eu_law/introduction/what_directive_en.htm>, retrieved 12.11.2012.

European Union (2011) Summaries of European Legislation. Market Abuse. <http://europa.eu/legislation_summaries/internal_market/single_market_services/financial_services_transactions_in_securities/l24035_en.htm>, retrieved 12.11.2012.

Fama, Eugene F. (1970) Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, Vol. 25 (2), 383-417.

Fama, Eugene F. (1991) Efficient capital markets: II. *Journal of Finance*, Vol. 46 (5), 1575-1617.

Fama, Eugene F. (1998) Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics*, Vol. 49 (3), 283-306.

Fama, Eugene F. – French, Kenneth R. (1988) Dividend yields and expected stock returns. *Journal of Financial Economics*, Vol. 22 (1), 3-25.

Fama, Eugene F. – French, Kenneth R. (1992) The Cross-Section of Expected Stock Returns. *Journal of Finance*, Vol. 47 (2), 427-465.

Fama, Eugene F. – French, Kenneth R. (1993) Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, Vol. 33 (1), 3-56.

Fama, Eugene F. – French, Kenneth R. (2008) Dissecting Anomalies. *Journal of Finance*, Vol. 63 (4), 1653-1678.

Fama, Eugene F. – Jensen, Michael C. (1983) Separation of Ownership and Control. *Journal of Law and Economics*, Vol. 26 (2), 301-325.

Federal Sentencing Guidelines Manual (2011)

Fidelity (2012) Active Trader News. Fidelity. <https://www.fidelity.com/viewpoints/active-trader/taxes-on-trades>, retrieved 16.10.2012.

Finnerty, Joseph E. (1976) Insiders and Market Efficiency. *The Journal of Finance*, Vol. 31 (4), 1141-1148.

French, Kenneth R. (2008) The Cost of Active Investing. *SSRN Working Paper Series* (Apr), 1-50.

French, Kenneth R. – Schwert, G. William – Stambaugh, Robert F. (1987) Expected stock returns and volatility. *Journal of Financial Economics*, Vol. 19 (1), 3-29.

Friederich, Sylvain – Gregory, Alan – Matatko, John – Tonks, Ian (2002) Short-run Returns around the Trades of Corporate Insiders on the London Stock Exchange. *European Financial Management*, Vol. 8 (1), 7-30.

Geisst, Charles R., (2004) *Wall Street: a history : from its beginnings to the fall of Enron*. Oxford University press, Oxford.

General Corporation Law of the State of Delaware <http://delcode.delaware.gov/title8/c001/index.shtml>, retrieved 16.3.2013.

Gevurtz, Franklin A (2002) The Globalization of Insider Trading Prohibitions. *The transnational lawyer*, Vol. 15, 63-97.

Gilboa, Itzhak – Schmeidler, David (1989) Maxmin expected utility with non-unique prior. *Journal of Mathematical Economics*, Vol. 18 (2), 141-153.

Gilovich, Thomas – Griffin, Dale – Kahneman, Daniel (eds.), (2002) *Heuristics and Biases - The Psychology of Intuitive Judgment*. Cambridge University Press, Cambridge, UK.

Gilson, Ronald J. – Kraakman, Reinier H. (1984) The Mechanisms of Market Efficiency. *Virginia Law Review*, Vol. 70 (4), 549-644.

Givoly, Dan – Palmon, Dan (1985) Insider Trading and the Exploitation of Inside Information: Some Empirical Evidence. *The Journal of Business*, Vol. 58 (1), 69-87.

Goldfarb, Zachary A. – Rucker, Philip (2010) SEC charges billionaire Texas brothers who donate to GOP with fraud. *The Washington Post* 30.7.2010.

Golec, Joseph (2007) Are the Insider Trades of a Large Institutional Investor Informed? *The Financial Review*, Vol. 42 (2), 161-190.

Gorman, Thomas O. (2007) Recent SEC an DOJ Insider Trading Cases. *Second Annual National Institute on Securities Fraud (ABA)*, 1-28.

Gromb, Denis – Vayanos, Dimitri (2010) Limits of arbitrage: The state of the theory. *Working paper - NBER*, Vol. Working paper series No 9 (Discussion paper No 650), 1-32.

Grossman, Sanford J. – Stiglitz, Joseph E. (1980) On the Impossibility of Informationally Efficient Markets. *The American Economic Review*, Vol. 70 (3), 393-408.

Gupta, Rakesh – Basu, Parikshit K. (2007) Weak Form Efficiency In Indian Stock Markets. *International Business & Economics Research Journal*, Vol. 6 (3)

Gurgul, Henryk – Majdosz, Pawel (2007) The informational content of insider trading disclosures: empirical results for the Polish stock market. *Central European Journal of Operations Research*, Vol. 15 (1), 1-18.

H.R. 682--111th Congress: Stop Trading on Congressional Knowledge Act <http://www.govtrack.us/congress/bills/111/hr682>, retrieved 23.2.2013.

Haft, Robert J. (1982) The effect of insider trading rules on the internal efficiency of the large corporation. *Michigan Law Review*, Vol. 80 (5), 1051-1071.

Hanemann, W. Michael (1991) Willingness to pay and willingness to accept: how much can they differ? *The American Economic Review*, Vol. 81 (3), 635-647.

Haugen, Robert A. – Baker, Nardin L. (1996) Commonality in the Determinants of Expected Stock Returns. *Journal of Financial Economics*, Vol. 41 (3), 401-439.

Hayek, Friedrich A. (1945) The Use of Knowledge in Society. *American Economic Review*, Vol. 35 (4), 519-531.

Hayn, Carla (1995) The information content of losses. *Journal of Accounting and Economics*, Vol. 20 (2), 125-153.

Heinkel , Robert – Kraus , Alan (1987) The Effect of Insider Trading on Average Rates of Return. *The Canadian Journal of Economics / Revue canadienne d'Economique*, Vol. 20 (3), 588-611.

Hillmer, S. C. – Yu, P. L. (1979) The market speed of adjustment to new information. *Journal of Financial Economics*, Vol. 7 (4), 321-345.

Himmelberg, Charles P. – Hubbard, R. Glenn – Palia, Darius (1999) Understanding the determinants of managerial ownership and the link between ownership and performance. *Journal of Financial Economics*, Vol. 53 (3), 353-384.

Huddart, Steven – Ke, Bin (2007) Information Asymmetry and Cross-sectional Variation in Insider Trading. *Contemporary Accounting Research*, Vol. 24 (1), 195-234.

Jaffe, Jeffrey F. (1974) The Effect of Regulation Changes on Insider Trading. *The Bell Journal of Economics and Management Science*, Vol. 5 (1), 93-121.

Jegadeesh, Narasimhan – Titman, Sheridan (1993) Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. *The Journal of Finance*, Vol. 48 (1), 65-91.

Jeng, Leslie A. – Metrick, Andrew – Zeckhauser, Richard (2003) Estimating the Returns to Insider Trading: A Performance-Evaluation Perspective. *The Review of Economics and Statistics*, Vol. 85 (2), 453-471.

Jensen, Michael C. (1972) Capital Markets: Theory and Evidence. *The Bell Journal of Economics and Management Science*, Vol. 3 (2), 357-398.

Jensen, Michael C. (1993) The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems. *The Journal of Finance*, Vol. 48 (3), 831-880.

Jensen, Michael C. – Meckling, William H. (1976) Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, Vol. 3 (4), 305-360.

Jensen, Michael C. – Murphy, Kevin J. (1990) CEO Incentives -- It's Not How Much You Pay, But How. *Harvard Business Review*, Vol. 68 (3), 138-149.

Jiang, Xiaoquan – Zaman, Mir A. (2010) Aggregate insider trading: Contrarian beliefs or superior information? *Journal of Banking & Finance*, Vol. 34 (6), 1225-1236.

Kahneman, Daniel – Knetsch, Jack L. – Thaler, Richard H. (1990) Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy*, Vol. 98 (6), 1325-1348.

Kahneman, Daniel – Knetsch, Jack L. – Thaler, Richard H. (1991) Anomalies: The endowment effect, loss aversion, and status quo bias. *The Journal of Economic Perspectives*, Vol. 5 (1), 193-206.

Kahneman, Daniel – Tversky, Amos (1979) Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, Vol. 47 (2), 263-291.

Kasanen, Eero – Lukka, Kari – Siitonen, Arto (1993) The constructive approach in management accounting research. *Journal of Management Accounting Research*, Vol. 5 (243), 243-264.

Kasanen, Juha Laurila (1999) Corporate insider trading and its regulation in Finland. *Bank of Finland Bulletin*, Vol. 73 (1), 27-32.

Ke, Bin – Huddart, Steven – Petroni, Kathy (2003) What insiders know about future earnings and how they use it: Evidence from insider trades. *Journal of Accounting and Economics*, Vol. 35 (3), 315-346.

Keown, Arthur J. – Pinkerton, John M. (1981) Merger Announcements and Insider Trading Activity: An Empirical Investigation. *The Journal of Finance*, Vol. 36 (4), 855-869.

Kolasinski, Adam – Li, Xu (2010) Are corporate managers savvy about their stock price? Evidence from insider trading after earnings announcements. *Journal of Accounting and Public Policy*, Vol. 29 (1), 27-44.

Kose, John – Mishra, Banikanta (1990) Information Content of Insider Trading Around Corporate Announcements: The Case of Capital Expenditures. *The Journal of Finance*, Vol. 45 (3), 835-855.

Kose, John – Ranga, Narayanan (1997) Market Manipulation and the Role of Insider Trading Regulations. *The Journal of Business*, Vol. 70 (2), 217-247.

Kothari, S. P. – Laguerre, Ted E. – Leone, Andrew J. (2002) Capitalization versus Expensing: Evidence on the Uncertainty of Future Earnings from Capital Expenditures versus R&D Outlays. *Review of Accounting Studies*, Vol. 7 (4), 355-382.

Krishnaswami, Sudha – Spindt, Paul A. – Subramaniam, Venkat (1999) Information asymmetry, monitoring, and the placement structure of corporate debt. *Journal of Financial Economics*, Vol. 51 (3), 407-434.

Lakonishok, Josef – Lee, Inmoo (2001) Are insider trades informative? *The Review of Financial Studies*, Vol. 14 (1), 79-111.

Lakonishok, Josef – Smidt, Seymour (1988) Are Seasonal Anomalies Real? A Ninety-Year Perspective. *The Review of Financial Studies*, Vol. 1 (4), 403-425.

Le Bon, Gustave, (1896) *The crowd: A study of the popular mind*. The Macmillan Co., New York.

Lee, Charles M. C. – Shleifer, Andrei – Thaler, Richard H. (1991) Investor sentiment and the closed-end fund puzzle. *Journal of Finance*, Vol. 46 (1), 75-109.

Leland, Hayne E. (1992) Insider trading: Should it be prohibited? *Journal of Political Economy*, Vol. 199 (4), 859-888.

Lesmond, David A. – Ogden, Joseph P. – Trzcinka, Charles A. (1999) A new estimate of transaction costs. *Review of Financial Studies*, Vol. 12 (5), 1113-1141.

Lin, Ji-Chan – Howe, John S. (1990) Insider Trading in the OTC Market. *The Journal of Finance*, Vol. 45 (4), 1273-1284.

Lintner, John (1965a) Security Prices, Risk, and Maximal Gains From Diversification. *Journal of Finance*, Vol. 20 (4), 587-615.

Lintner, John (1965b) The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The Review of Economics and Statistics*, Vol. 47 (1), 13-37.

Lo, Andrew W. (2004) The adaptive markets hypothesis: Market efficiency from an evolutionary perspective. *Journal of Portfolio Management*, Vol. 30 (September Anniversary Issue), 15-29.

Lo, Andrew W. (2005) Reconciling efficient markets with behavioral finance: the adaptive markets hypothesis. *The Journal of Investment Consulting*, Vol. 7 (2), 21-63.

Loderer, Claudio – Martin, Kenneth (1997) Executive stock ownership and performance tracking faint traces. *Journal of Financial Economics*, Vol. 45 (2), 223-255.

Lukka, Kari – Kasanen, Eero (1995) Methodological themes: The problem of generalizability: Anecdotes and evidence in accounting research. *Accounting, Auditing & Accountability Journal*, Vol. 8 (5), 71-92.

MacDonald, Scott B. – Hughes, Jane, (2009) *Separating Fools from Their Money: A History of American Financial Scandals*. Transaction publishers, New Brunswick.

Malkiel, Burton G. (2003) The efficient market hypothesis and its critics. *Journal of Economic Perspectives*, Vol. 17 (1), 59-82.

Malmendier, Ulrike (2009) Law and Finance "at the Origin". *Journal of economic literature*, Vol. 47 (4), 1076-1108.

Mandelbrot, Benoit (1966) Forecasts of Future Prices, Unbiased Markets, and "Martingale" Models. *The Journal of Business*, Vol. 39 (1), 245-255.

Manne, Henry G. (1966) In Defense of Insider Trading. *Harvard Business Review*, Vol. 44 (6), 113-122.

Manne, Henry G. (2005) Insider Trading: Hayek, Virtual Markets, and the Dog that Did Not Bark. *Journal of Corporation Law*, Vol. 31 (1), 167-185.

Manove, Michael (1989) The Harm From Insider Trading and Informed Speculation. *Quarterly Journal of Economics*, Vol. 104 (4), 823-845.

Mauboussin, Michael J. (2002) Revisiting Market Efficiency: The Stock Market as a Complex Adaptive System. *Journal of Applied Corporate Finance*, Vol. 14 (4), 47-55.

Mehran, Hamid (1995) Executive compensation structure, ownership, and firm performance. *Journal of Financial Economics*, Vol. 38 (2), 163-184.

Mendelson, Morris (1969) The Economics of Insider Trading Reconsidered. *University of Pennsylvania Law Review*, Vol. 117 (3), 470-492.

Morgan, Gareth – Smircich, Linda (1980) The Case for Qualitative Research. *Academy of Management Review*, Vol. 5 (4), 491-500.

Mossin, Jan (1966) Equilibrium in a Capital Asset Market. *Econometrica*, Vol. 34 (4), 768-783.

Muelbroek, Lisa K. (1992) An Empirical Analysis of Illegal Insider Trading. *The Journal of Finance*, Vol. 47 (5), 1661-1699.

Neilimo, Kari – Näsi, Juha (1980) Nomoteettinen tutkimusote ja suomalaisen yrityksen taloustiede: Tutkimus. *Tampereen yliopiston julkaisuja* (Sarja A 2:12).

Netter, Jeffry M. – Poulsen, Anette B. – Hersch, Philip L. (1998) Insider Trading: The Law, The Theory, The Evidence. *Contemporary Policy Issues*, Vol. 6 (3), 1-12.

New York Stock Exchange (2010) Investor Relations. Daily Market Summary. <http://www.nyse.com/financials/1108407157455.html>, retrieved 11.8.2010.

New York Stock Exchange (2001) Comparing Bid-Ask Spreads on the New York Stock Exchange and Nasdaq Immediately Following Nasdaq Decimalization. (July 26), 1-15.

Newkirk, Thomas C. – Robertson, Melissa A. (1998) Speech by SEC Staff: Insider Trading - A U.S. Perspective. <http://www.sec.gov/news/speech/speecharchive/1998/spch221.htm>, retrieved 20.9.2012.

NobleTrading (2012) NobleTrading. Direct Access OTCBB Trading. <http://www.nobletrading.com/direct-access-otcbb-trading.php>, retrieved 3.12.2012.

Padilla, Alexandre (2002) Can agency theory justify the regulation of insider trading? *Quarterly Journal of Austrian Economics*, Vol. 5 (1), 3-38.

Palia, Darius – Lichtenberg, Frank (1999) Managerial ownership and firm performance: A re-examination using productivity measurement. *Journal of Corporate Finance*, Vol. 5 (4), 323-339.

Park, Cheol-Ho – Irwin, Scott H. (2007) What do we know about the profitability of technical analysis? *Journal of Economic Surveys*, Vol. 21 (4), 786-826.

Patell, James M. – Wolfson, Mark A. (1984) The intraday speed of adjustment of stock prices to earnings and dividend announcements. *Journal of Financial Economics*, Vol. 13 (2), 223-252.

Petram, L. O. – Petram, Lodewijk Otto (2011) *The world's first stock exchange: how the Amsterdam market for Dutch East India Company shares became a modern securities market, 1602-1700.* Dissertation. University of Amsterdam, Amsterdam.

Piotroski, Joseph D. – Roulstone, Darren T. (2005) Do insider trades reflect both contrarian beliefs and superior knowledge about future cash flow realizations? *Journal of Accounting and Economics*, Vol. 39 (1), 55-81.

Pulliam, Susan – Bray, Chad (2011) Jury Hears Galleon Wiretaps. *The Wall Street Journal* 11.3.2011.

Rabin, Matthew (1998) Psychology and Economics. *Journal of Economic Literature*, Vol. 36 (1), 11-46.

Robertson, Donald – Wright, Stephen (2006) Dividends, Total Cash Flow to Shareholders, and Predictive Return Regressions. *The Review of Economics and Statistics*, Vol. 88 (1), 91-99.

Rosenberg, Barr – Reid, Kenneth – Lanstein, Ronald (1985) Persuasive Evidence of Market Inefficiency. *Journal of Portfolio Management*, Vol. 11 (3), 9-16.

Ross, Stephen A. (1973) The Economic Theory of Agency: The Principal's Problem. *The American Economic Review*, Vol. 63 (2), 134-139.

Ross, Stephen A. (1976) The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, Vol. 13 (3), 341-360.

Rozeff, Michael S. – Zaman, Mir A. (1998) Overreaction and Insider Trading: Evidence from Growth and Value Portfolios. *The Journal of Finance*, Vol. 53 (2), 701-716.

Rule 10b5-1: Trading "on the basis of" material nonpublic information in insider trading cases (2000)

Rule 10b5-2: Duties of trust or confidence in misappropriation insider trading cases (2000)

Russel Investments (2012) Russell 3000® Index Fact Sheet. <http://www.russell.com/Indexes/data/fact_sheets/us/Russell_3000_Index. asp>, retrieved 28.10.2012.

Salinger, Lawrence M., (2005) *Encyclopedia of white-collar and corporate crime*. Sage Publications, Inc, Thousand Oaks, California.

Salmi, Timo – Järvenpää, Marko (2000) Laskentatoimen case-tutkimus ja nomoteettinen tutkimusajattelu sulassa sovussa. *Liiketaloudellinen Aikakauskirja* (2), 263-275.

Samuelson, Paul A. (1965) Proof That Properly Anticipated Prices Fluctuate Randomly. *Industrial Management Review*, Vol. 6 (2), 41-49.

Sarbanes-Oxley Act of 2002

Savage, Leonard J., (1954) *The foundations of statistics.* Second Revised Edition of 1972. Dover Publications, Inc., New York.

Sawicki, Julia – Shrestha, Keshab (2008) Insider Trading and Earnings Management. *Journal of Business Finance & Accounting*, Vol. 35 (3-4), 331-346.

Schotland, Roy A. (1967) Unsafe at Any Price: A Reply to Manne, Insider Trading and the Stock Market. *Virginia Law Review*, Vol. 53 (7), 1425-1478.

Securities Act of 1933. As updated in 2004.

Securities Exchange Act of 1934. As updated in 2004.

Selden, G. C., (1912) *Psychology of the Stock Market*. Ticker Publishing Company, New York.

Seyhun, Nejat H. (1986) Insiders' profits, costs of trading, and market efficiency. *Journal of Financial Economics*, Vol. 16 (2), 189-212.

Seyhun, Nejat H. (1988) The Information Content of Aggregate Insider Trading. *The Journal of Business*, Vol. 61 (1), 1-24.

Seyhun, Nejat H. (1992) Why does aggregate insider trading predict future stock returns? *Quarterly Journal of Economics*, Vol. 107 (4), 1303-1301.

Seyhun, Nejat H., (1998) *Investment Intelligence from Insider Trading*. The MIT Press, Cambridge, Massachusetts.

Seyhun, Nejat H. – Bradley, Michael (1997) Corporate Bankruptcy and Insider Trading. *The Journal of Business*, Vol. 70 (2), 189-216.

Shanken, Jay – Smith, Clifford W. (1996) Implications of capital markets research for corporate finance. *Financial Management*, Vol. 25 (1), 98-104.

Sharpe, William F. (1964) Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *Journal of Finance*, Vol. 19 (3), 425-442.

Sharpe, William F. (1970) Efficient Capital Markets: A Review of Theory and Empirical Work: Discussion. *The Journal of Finance*, Vol. 25 (2), 28-30.

Shleifer, Andrei – Vishny, Robert W. (1997) The limits of arbitrage. *Journal of Finance*, Vol. 52 (1), 35-55.

Shogren, Jason F. – Shin, Seung Y. – Hayes, Dermot J. – Kliebenstein, James B. (1994) Resolving differences in willingness to pay and willingness to accept. *The American Economic Review*, Vol. 84 (1), 255-270.

Simon, Herbert A. (1955) A behavioral model of rational choice. *The quarterly journal of economics*, Vol. 69 (1), 99-118.

Sivakumar, Kumar – Waymire, Gragory (1994) Insider trading following material news events: Evidence from earnings. *Financial Management*, Vol. 23 (1), 23-32.

Sloan, Richard G. (1996) Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings? *The Accounting Review*, Vol. 71 (3), 289-315.

Smith, Adam, (1776) *The Wealth of Nations.* Bantam Classic Edition March/2003. Bantam Dell, New York, New York.

Steinberg, Marc I. (2002) Insider Trading - A Comparative Perspective. *Seminar on Current Developments in Monetary and Financial Law*, 1-32.

Stoll, Hans R. (1993) Equity Trading Cost in-the-Large. *Journal of Portfolio Management*, Vol. 19 (4), 41-50.

Stoll, Hans R. – Whaley, Robert E. (1983) Transaction costs and the small firm effect. *Journal of Financial Economics*, Vol. 12 (1), 57-79.

Stotz, Olaf (2006) Germany's New Insider Law: The Empirical Evidence after the First Year. *German Economic Review*, Vol. 7 (4), 449-462.

Thaler, Richard H. (1980) Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, Vol. 1 (1), 39-60.

The Committee of European Securities Regulators (2008) *CESR Executive summary to the report on administrative measures and sanctions as well as the criminal sanctions available in Member States under the Market Abuse Directive*. (February 28).

Thomsen, Linda Chatman (2006) *Testimony Concerning Insider Trading*. Testimony Before the U.S. Senate Committee on the Judiciary on September 26.

Tong, Zhenxu (2008) Deviations from optimal CEO ownership and firm value. *Journal of Banking and Finance*, Vol. 32 (11), 2462-2470.

TSC Industries, Inc. et al. v. Northway, Inc, 426 U.S. 438 (Supreme Court of United States 1976)

Tversky, Amos – Kahneman, Daniel (1986) Rational choice and the framing of decisions. *Journal of Business*, Vol. 59 (4), 251-278.

Tversky, Amos – Kahneman, Daniel (1992) Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty*, Vol. 5 (4), 297-323.

U.S. Securities and Exchange Commission (2007) *Performance and Accountability Report*. <http://www.sec.gov/about/secpar2007.shtml>, retrieved 30.1.2013.

U.S. Securities and Exchange Commission (2008) *Performance and Accountability Report*. <http://www.sec.gov/about/secpar2008.shtml>, retrieved 30.1.2013.

U.S. Securities and Exchange Commission (2011) *FY 2011 Performance and Accountability Report*. <http://www.sec.gov/about/secpar/secpar2011.pdf>, retrieved 17.3.2013.

United States v. O'Hagan, 521 U.S. 642 (U.S. Supreme Court 1997)

Von Neumann, John − Morgenstern, Oskar, (1944) *Theory of games and economic behavior*. 3rd ed. Princeton University Press, London. Reprint of 1953.

Worthington, Andrew C. − Higgs, Helen (2004) Random walks and market efficiency in European equity markets. *Global Journal of Finance and Economics*, Vol. 1 (1), 59-78.

Yen, Gili − Lee, Cheng-few (2008) Efficient market hypothesis (EMH): past, present and future. *Review of Pacific Basin Financial Markets and Policies*, Vol. 11 (2), 305-329.

Zhang, Jiankang (2002) Subjective ambiguity, expected utility and Choquet expected utility. *Economic Theory*, Vol. 20 (1), 159-181.

Zingg, Andreas − Lang, Sebastian − Wyttenbach, Daniela (2007) Insider Trading in the Swiss Stock Market. *Swiss Journal of Economics and Statistics*, Vol. 143 (3), 331-362.

Ziobrowski, Alan J. − Boyd, James W. − Cheng, Ping − Ziobrowski, Brigitte J. (2011) Abnormal Returns From the Common Stock Investments of Members of the U.S. House of Representatives. *Business and Politics*, Vol. 13 (1), 1-24.

Ziobrowski, Alan J. − Cheng, Ping − Boyd, James W. − Ziobrowski, Brigitte J. (2004) Abnormal Returns from the Common Stock Investments of the U.S. Senate. *Journal of Financial and Quantitative Analysis*, Vol. 39 (4), 661-676.

8 APPENDICES

Appendix I: Example of using Hayekian idea of markets to convey information through insider trading

Traditionally information asymmetry focused on problems between buyers and sellers as described in chapter 2. But another type of information asymmetry can be classified under the same name even though it has not been widely examined in the existing literature. It involves information asymmetries between different employees within a company. This refers to a common situation where an employee is more likely to know important facts before her manager. The manager, on the other hand, can put different pieces of information together to form a coherent and full picture of the situation.

This view is presented here because transfer of information within a company can be inefficient just as information transfer can be inefficient in the external securities markets. This creates information asymmetries within a company even though they are not traditionally described by the information asymmetry theory. Manne (2005) presents a way to utilise insider trading to transfer information within a company and alleviate problems related to information asymmetries.

He describes how Hayekian markets could be used to indicate important information for the company. This could be achieved through employees transmitting their views directly to the stock market in addition to the normal, more detailed information transmission of gradually passing the information forward in the organisation. Naturally the change in stock price would not tell what the information is but only the value of the information. A closer investigation can be initiated based on this information. So far no practical setup for creating a Hayekian market in this manner has been presented but a theoretical example is presented below.

This type of information transferral mechanism could mitigate the effects of information asymmetries in the external securities markets. When employees could trade on the information they receive, markets would be constantly closer to the true value of the company[107]. Besides these aspects, the process also includes a wealth transfer from outsiders to insiders because insiders can utilise their better valuation of the company in trading.

The wealth transfer would also happen without insiders' trading because the securities would move to their correct price once the information is published. In this case the wealth transfer would happen between outsiders who have the same access to infor-

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[107] The statement assumes that employees can value the company more accurately than outsiders, i.e. they have some additional value-relevant information that is not available to outsiders.

mation – at least in theory. These changes in wealth transfers could be negated with appropriate changes in remuneration. However, some agency issues would still have to be solved for this model to be usable.

Hayek (1945) originally described this problem in conjunction with entire economies when he described the problems faced by central planners in socialist system. In the article he argued that the optimal way to allocate the resources was to give power to make decisions to dispersed individuals who possessed the information on available resources and the values of different activities on which they can be spent.

Manne (1989, 178) extended this idea to an individual economic organisation, where a tiered organisation often raises similar problems. His conjecture is that most likely someone in the company knows any piece of information before corporate officers and directors receive it. Hayek (1945) argues that in an economy prices are the most efficient way of communicating information leading to effectually decentralised decision-making. Manne envisaged that organisations could utilise a concept similar to prices to transfer valuable information to managers.

Manne (1989, 182) suggests that companies would have internal, virtual markets for information in which the changes in the stock value would distribute the information. Markets should result in a more accurate picture than any individual could piece together on their own when people who are more confident about their views stake more of their own money. However, aligning incentives in virtual markets entail many difficulties and neither Manne nor anyone else has presented an example of these markets.

The following paragraphs describe one example of markets, which transfer information to managers within a company. The example is not strictly limited to using virtual markets but utilises a connection to real markets to bypass some of the challenges.

The starting point for the example is that all employees in the company are allowed to trade in the company stock in an internal marketplace. They would be allowed to invest their yearly bonuses – or other predetermined part of their compensation – without paying attention on insider trading regulations. This means that they can invest when they discover value-relevant information. The transactions in this internal market place would be executed at market price.

In effect the company would then be holding the shares of employees and pay them their market value when the bonuses are redeemed. The company could then hedge its position on the market. The company would define the amount of shares to hedge according to the number of own shares already owned by the company, and the desired ownership of own shares.

Management could deduce potential problems and receive feedback on current activities from the trades and positions of employees[108]. It is much more reliable to see people invest their own money to back their opinions rather than just stating their opinion.

This framework can also transfer valuable information to the markets. There are two mechanisms to achieve this. For one, the company transfers the demand or supply of shares to the markets through hedging. This happens whether or not the company decides to hedge their position because the net position held by the company changes according to the aggregate net position of the employees.

The other way this information is transferred to the markets is through publishing the positions and trades in real time. Thus investors could immediately see how the employees view the prospects of the company. The information shown externally would not have to be as detailed as shown internally. The entire process is presented in figure 16.
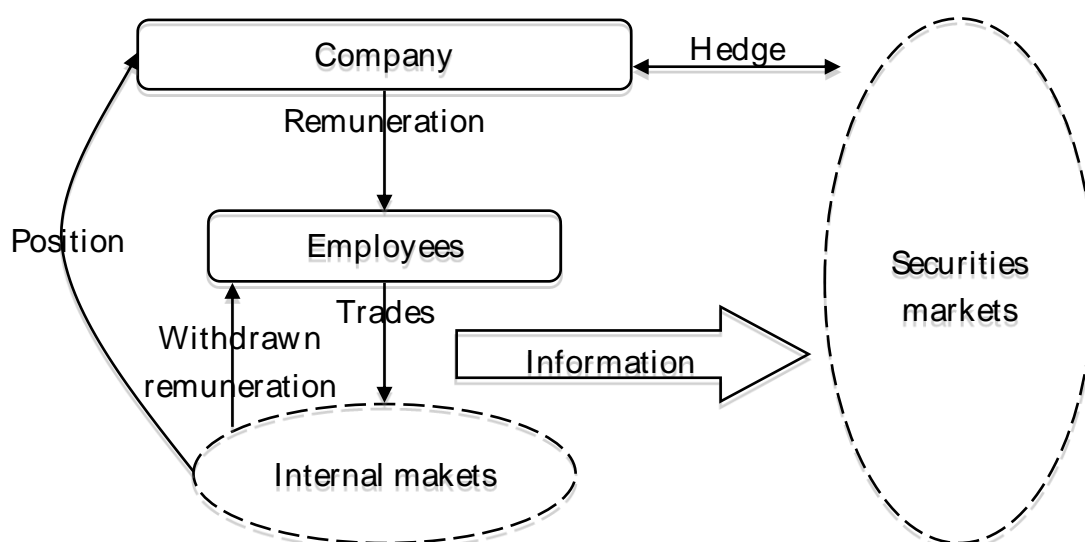
Figure 16:   Information and economic flows in the example market for information

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[108] Most likely some level of anonymity would be required to create trust and desirability.

Appendix II: Transaction codes for reporting transactions by insiders (SEC 2007)

General Transaction Codes
P   Open market or private purchase of securities
S   Open market or private sale of securities
V   Transaction voluntarily reported earlier than required

Rule 16b-3 Transaction Codes
A   Grant, award, or other acquisition
D   Sale (or disposition) back to the issuer of the securities
F   Payment of exercise price or tax liability by delivering or withholding securities
I   Discretionary transaction, which is an order to the broker to execute the transaction at the best possible price
M   Exercise of conversion of derivative security

Derivative Securities Codes
C   Conversion of derivative security (usually options)
E   Expiration of short derivative position (usually options)
H   Expiration (or cancellation) of long derivative position with value received (usually options)
O   Exercise of out-of-the-money derivative securities (usually options)
X   Exercise of in-the-money or at-the-money derivatives securities (usually options)

Other Sections 16b Exempt Transactions and Small Acquisition Codes
G   Bona fide gift
L   Small Acquisition
W   Acquisition or disposition by will or laws of descent and distribution
Z   Deposit into or withdrawal from voting trust

Other Transaction Codes
J   Other acquisition or disposition (transaction described in footnotes)
K   Transaction in equity swap or similar instrument
U   Disposition due to a tender of shares in a change of control transaction

Appendix III: Regression results over studied time horizons

Table 22:   Summary of regression model for equation (2) over different time horizons

Coefficients

		1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
	R Square	.003	.006	.007	.011	.011	.008	.005	.008	.011	.016	.024
	Durbin-Watson	1.336	1.287	1.261	1.257	1.209	1.137	1.098	1.067	1.034	1.052	1.077
(Constant)	B	.000	.000	.000	.003	.005	.010	.026	.041	.048	.046	.001
	Std. Error	.000	.000	.001	.001	.001	.002	.003	.004	.005	.006	.011
	Sig.	.329	.507	.453	.000	.000	.000	.000	.000	.000	.000	.935
Acquisition	B	.000	.000	.001	-.002	-.004	-.019	-.051	-.084	-.098	-.120	-.136
	Std. Error	.000	.001	.001	.001	.001	.002	.004	.006	.007	.009	.015
	Sig.	.614	.761	.186	.063	.003	.000	.000	.000	.000	.000	.000
Log. of transaction value	B	.000	.000	.000	.000	.000	.000	.001	.004	.007	.011	.023
	Std. Error	.000	.000	.000	.000	.000	.000	.000	.000	.001	.001	.001
	Sig.	.263	.498	.855	.615	.572	.315	.038	.000	.000	.000	.000
Open market	B	.000	-.001	-.001	-.001	-.001	-.002	-.007	-.008	-.011	-.019	-.011
	Std. Error	.000	.000	.000	.001	.001	.001	.002	.004	.004	.005	.009
	Sig.	.971	.169	.145	.052	.235	.109	.006	.016	.014	.000	.231
Directly owned	B	.000	.001	.000	-.002	-.003	-.008	-.022	-.054	-.064	-.067	-.110
	Std. Error	.000	.000	.000	.000	.001	.001	.001	.002	.003	.003	.006
	Sig.	.778	.010	.334	.000	.000	.000	.000	.000	.000	.000	.000

Reporting delay	B	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Std. Error	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Sig.	.151	.163	.364	.004	.789	.789	.000	.000	.000	.000	.000
Traded before P/L reporting	B	.000	-.002	-.002	-.005	-.010	-.012	-.012	-.018	-.028	-.033	-.040
	Std. Error	.000	.000	.000	.001	.001	.001	.002	.003	.004	.005	.009
	Sig.	.959	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Traded after P/L reporting	B	-.001	-.001	-.001	-.002	-.003	-.002	.001	.001	-.015	-.008	-.015
	Std. Error	.000	.000	.000	.000	.001	.001	.001	.002	.002	.003	.005
	Sig.	.003	.000	.000	.000	.000	.007	.369	.487	.000	.007	.005
Director	B	.000	.000	.000	.000	.000	-.002	-.012	-.033	-.060	-.089	-.163
	Std. Error	.000	.000	.000	.000	.001	.001	.002	.002	.003	.003	.006
	Sig.	.035	.862	.301	.690	.641	.006	.000	.000	.000	.000	.000
Ten per cent owner	B	-.002	-.002	-.002	-.006	-.011	-.019	-.049	-.070	-.085	-.137	-.238
	Std. Error	.000	.000	.000	.001	.001	.001	.003	.004	.005	.006	.010
	Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Other insider	B	.000	.000	.000	.002	.002	-.001	-.004	-.016	-.006	-.029	-.103
	Std. Error	.001	.001	.001	.001	.002	.002	.004	.006	.008	.009	.016
	Sig.	.646	.932	.980	.085	.143	.597	.292	.008	.459	.002	.000
Acquisition*Log. of transaction value	B	.000	.000	.000	.000	.000	.000	-.001	-.004	-.005	-.008	-.016
	Std. Error	.000	.000	.000	.000	.000	.000	.001	.001	.001	.001	.002
	Sig.	.010	.035	.010	.054	.023	.847	.058	.000	.000	.000	.000
Acquisition*Open market	B	.005	.009	.010	.019	.022	.023	.013	.007	-.012	-.028	-.150
	Std. Error	.000	.001	.001	.001	.001	.002	.003	.005	.006	.007	.013
	Sig.	.000	.000	.000	.000	.000	.000	.000	.141	.055	.000	.000
Acquisition*Direct	B	.000	-.001	-.001	.000	.003	.015	.040	.071	.071	.083	.100
	Std. Error	.000	.000	.001	.001	.001	.002	.003	.004	.005	.007	.012
	Sig.	.372	.050	.010	.733	.007	.000	.000	.000	.000	.000	.000

Acquisition*Reporting delay	B	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001
	Std. Error	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Sig.	.003	.968	.053	.000	.000	.000	.265	.000	.000	.000	.000
Acquisition*Trading before P/L reporting	B	.000	.001	.002	.006	.006	.013	.012	.020	.025	.026	.013
	Std. Error	.001	.001	.001	.001	.002	.002	.004	.006	.008	.009	.016
	Sig.	.657	.101	.008	.000	.000	.000	.003	.001	.001	.004	.418
Acquisition*Trading after P/L reporting	B	.001	.002	.002	.004	.004	.008	.002	.006	.023	.020	.031
	Std. Error	.000	.000	.000	.001	.001	.001	.003	.004	.005	.006	.010
	Sig.	.068	.000	.001	.000	.000	.000	.402	.115	.000	.000	.002
Acquisition*Director	B	.000	-.001	-.001	-.002	-.002	.000	.008	.030	.056	.079	.121
	Std. Error	.000	.000	.000	.001	.001	.001	.003	.004	.005	.006	.010
	Sig.	.132	.005	.021	.007	.046	.858	.001	.000	.000	.000	.000
Acquisition*Ten per cent owner	B	.001	.002	.003	.011	.021	.039	.072	.056	.035	.035	-.062
	Std. Error	.001	.001	.001	.001	.002	.003	.005	.007	.008	.010	.018
	Sig.	.040	.022	.000	.000	.000	.000	.000	.000	.000	.001	.000
Acquisition*Other Insider	B	-.001	-.001	-.001	-.006	-.008	.001	.014	.035	.019	.052	.120
	Std. Error	.001	.001	.002	.002	.003	.005	.009	.012	.016	.019	.033
	Sig.	.487	.336	.709	.009	.020	.817	.105	.005	.234	.006	.000

Table 23:   Simplified summary of regression model for equation (3) over different time horizons

Standardised coefficients

	1 Day	2 Days	3 Days	1 Week	2 Weeks	1 Month	3 Months	6 Months	9 Months	1 Year	2 Years
						Return period					
(Constant)	.000	.000	.000	.002*	.002*	.003*	.003	-.005	-.015***	-.030***	-.136***
Acquisition	.011	.009	.018*	-.004	-.013	-.050***	-.068***	-.063***	-.048***	-.050***	-.002
Log. of transaction value	-.009***	-.008*	-.006	-.013***	-.016***	-.027***	-.049***	-.052***	-.046***	-.035***	-.025***
Open market	-.001	-.008	-.009	-.014***	-.011*	-.018***	-.030***	-.031***	-.033***	-.037***	-.028***
Directly owned	.006	.013***	.008*	-.002	-.004	-.004	-.002	-.014***	-.005	.005	.008***
Reporting delay	.009*	-.003	-.001	-.009	.005	.011*	.002	.006	.007	.010*	.008
Traded before P/L reporting	.000	-.014***	-.015***	-.025***	-.037***	-.029***	-.015***	-.014***	-.018***	-.018***	-.011***
Traded after P/L reporting	-.009***	-.014***	-.014***	-.018***	-.020***	-.009***	.003	.001	-.019***	-.009***	-.010***
Director	-.003	.005	.008*	.009***	.010***	.012***	.013***	.004	-.013***	-.028***	-.035***
Ten percent owner	-.013***	-.012***	-.009***	-.019***	-.026***	-.025***	-.027***	-.012***	-.006	-.026***	-.026***
Other insider	-.001	.000	.001	.006*	.006*	.002	.002	-.001	.006	-.002	-.011***
Acquisition*Log. of transaction value	.017***	.015***	.016***	.014***	.014***	.014***	.014***	.012***	.010***	.003	-.003
Acquisition*Open market	.046***	.070***	.073***	.096***	.086***	.074***	.047***	.044***	.037***	.030***	.002
Acquisition*Direct	-.009	-.016*	-.021***	-.009	.005	.033***	.042***	.045***	.016***	.012	-.016*
Acquisition*Reporting delay	-.018***	-.005	-.013***	-.022***	-.029***	-.026***	-.010*	-.004	.001	.000	.013***
Acquisition*Trading before P/L reporting	.001	.006	.009***	.016***	.013***	.019***	.011***	.012***	.013***	.011***	.004
Acquisition*Trading after P/L reporting	.007	.014***	.013***	.019***	.015***	.021***	.003	.006	.018***	.013***	.012***
Acquisition*Director	-.010***	-.016***	-.013***	-.016***	-.015***	-.013***	-.010***	-.001	.013***	.020***	.017***
Acquisition*Ten percent owner	.007	.009*	.014***	.025***	.041***	.046***	.040***	.005	-.015***	-.020***	-.048***
Acquisition*Other Insider	-.003	-.003	-.002	-.008***	-.008*	.000	.004	.007*	.002	.007*	.010***
Log. of market capitalisation	.021***	.022***	.022***	.042***	.055***	.108***	.197***	.280***	.301***	.303***	.295***

Dividend yield	-.008*	-.010***	-.010***	-.019***	-.021***	-.029***	-.046***	-.051***	-.058***	-.053***	-.046***
P/E-ratio	.016***	.015***	.012***	-.002	.035***	.055***	.063***	.079***	.078***	.067***	.052***
B/M-ratio	-.013***	.012***	.015***	.012***	-.024***	-.034***	-.045***	-.034***	-.034***	-.016***	.005
Momentum	.014***	.023***	.017***	.011***	.029***	.016***	.040***	.064***	.069***	.078***	.014***
Acquisition*Log. of market capitalisation	-.026***	-.024***	-.026***	-.026***	-.021***	-.041***	-.058***	-.078***	-.070***	-.072***	-.057***
Acquisition*Dividend yield	-.006	-.013***	-.009*	.001	.005	.007	-.013***	-.028***	-.030***	-.029***	-.046***
Acquisition*P/E-ratio	-.010*	-.017***	-.004	-.008	-.015***	-.021***	.021***	.024***	.024***	.023***	.012***
Acquisition*B/M-ratio	.011*	.006	.002	-.009	.012*	.014***	-.010	-.020***	-.017***	-.022***	-.027***
Acquisition*Momentum	.013***	.015***	.006	-.005	-.010***	-.012***	-.018***	-.022***	-.036***	-.055***	-.037***

*** Significant at 1% level

* Significant at 5% level

Appendix IV: Performance of transactions with predicted returns exceeding medium and high selection threshold criteria

Table 24: Descriptive statistics of transactions with predicted returns greater than medium selection threshold criteria

Descriptive Statistics

					Return period									
				1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
Nasdaq	Buy	Valid N		1	23	22	2 124	4 212	10 584	14 469	16 008	14 894	14 148	11 410
		Mean		#N/A	.1769	.1532	.0458	.0439	.0414	.0593	.0940	.1039	.1134	.2187
		95% Confidence Interval for Mean	Lower Bound	#N/A	.0167	-.0221	.0397	.0391	.0389	.0564	.0902	.0997	.1091	.2126
			Upper Bound	#N/A	.3371	.3284	.0519	.0487	.0439	.0622	.0979	.1080	.1177	.2248
		5% Trimmed Mean		#N/A	.1493	.1353	.0403	.0389	.0375	.0543	.0876	.0949	.1164	.2252
		Median		#N/A	.0464	.0282	.0310	.0297	.0294	.0515	.0695	.0928	.1137	.2605
		Std. Deviation		#N/A	.3705	.3953	.1443	.1583	.1304	.1783	.2495	.2578	.2611	.3346
		Skewness		#N/A	1.6272	1.4801	.9855	.6224	.9903	.9094	1.4936	.7323	-.2954	-.4621
		Kurtosis		#N/A	1.0603	.8204	5.9816	8.4265	11.5797	8.0489	11.9886	4.9145	3.0897	2.6526
	Sale	Valid N		2	3	3	99	802	7 344	43 195	65 366	71 272	71 708	55 448
		Mean		-.0085	-.0046	-.0016	-.0171	.0457	.0446	.0492	.0828	.1099	.1360	.1930
		95% Confidence Interval for Mean	Lower Bound	-.1697	-.0319	-.0201	-.0584	.0325	.0401	.0468	.0801	.1068	.1325	.1877
			Upper Bound	.1527	.0227	.0169	.0242	.0589	.0491	.0516	.0855	.1129	.1395	.1984
		5% Trimmed Mean		.0000	.0000	.0000	-.0149	.0427	.0341	.0423	.0716	.0962	.1187	.1638
		Median		-.0085	-.0016	.0001	.0060	.0364	.0229	.0346	.0549	.0749	.0864	.1278
		Std. Deviation		.0179	.0110	.0075	.2071	.1905	.1968	.2547	.3482	.4180	.4757	.6436
		Skewness		.0000	-1.1565	-.9857	-.5402	.4898	1.1699	.6664	.6662	.6437	.7045	.8762
		Kurtosis		.0000	.0000	.0000	1.4868	2.9914	5.2197	4.5510	2.8491	2.5777	2.1272	2.7274

NYSE	Buy	Valid N		#N/A	2	2	1 169	2 485	4 296	19 431	26 376	25 451	22 198	15 001
		Mean		#N/A	.0838	-.0040	.0426	.0406	.0274	.0317	.0440	.0445	.0508	.0153
		95% Confidence Interval for Mean	Lower Bound	#N/A	-.3193	-.7167	.0340	.0345	.0227	.0295	.0416	.0418	.0471	.0083
			Upper Bound	#N/A	.4869	.7086	.0513	.0467	.0322	.0339	.0465	.0473	.0544	.0223
		5% Trimmed Mean		#N/A	.0000	.0000	.0396	.0355	.0240	.0270	.0380	.0409	.0545	.0422
		Median		#N/A	.0838	-.0040	.0383	.0256	.0144	.0217	.0347	.0325	.0413	.0427
		Std. Deviation		#N/A	.0449	.0793	.1511	.1550	.1591	.1558	.2042	.2274	.2759	.4393
		Skewness		#N/A	.0000	.0000	.6096	.8404	.5475	1.1895	.8283	-.8262	-1.7841	-2.1742
		Kurtosis		#N/A	.0000	.0000	3.7577	6.0844	6.9111	13.7677	9.8347	17.3206	19.1633	12.9725
	Sale	Valid N		#N/A	#N/A	2	50	259	1 918	18 325	42 047	50 799	56 276	50 004
		Mean		#N/A	#N/A	-.0116	.1878	.1738	.0598	.0452	.0617	.0728	.0885	.1044
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	-3.0688	.1123	.1416	.0506	.0420	.0588	.0692	.0847	.0988
			Upper Bound	#N/A	#N/A	3.0456	.2633	.2060	.0690	.0485	.0647	.0763	.0922	.1100
		5% Trimmed Mean		#N/A	#N/A	.0000	.1644	.1633	.0436	.0361	.0444	.0442	.0591	.0580
		Median		#N/A	#N/A	-.0116	.0496	.0432	.0281	.0255	.0277	.0179	.0230	.0168
		Std. Deviation		#N/A	#N/A	.3403	.2657	.2634	.2052	.2254	.3087	.4103	.4540	.6365
		Skewness		#N/A	#N/A	.0000	1.1765	.7989	1.9094	1.1160	1.3669	2.2176	1.5295	1.6268
		Kurtosis		#N/A	#N/A	.0000	1.2763	.1643	9.0433	7.6284	6.2873	12.2020	5.5029	5.5367

OTC Bulletin Board	Buy	Valid N		#N/A	#N/A	#N/A	6	7	8	7	62	62	53	19
		Mean		#N/A	#N/A	#N/A	.0069	.0338	-.0552	.0444	.1506	.1573	.4089	1.0562
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	#N/A	-.3049	-.2316	-.4187	-.3643	.0088	-.0051	.2450	.6184
			Upper Bound	#N/A	#N/A	#N/A	.3188	.2992	.3083	.4531	.2924	.3196	.5728	1.4940
		5% Trimmed Mean		#N/A	#N/A	#N/A	.0080	.0244	-.0501	.0269	.1337	.1692	.4552	1.1715
		Median		#N/A	#N/A	#N/A	.0823	-.0419	-.0423	.0331	.0685	.3109	.5109	1.2724
		Std. Deviation		#N/A	#N/A	#N/A	.2971	.2870	.4348	.4419	.5584	.6393	.5947	.9084
		Skewness		#N/A	#N/A	#N/A	-.3539	.9183	-.3751	.9317	.7904	-.5981	-1.2939	-2.2746
		Kurtosis		#N/A	#N/A	#N/A	-1.4212	1.1353	2.6561	1.0016	2.8196	-.1766	3.7367	5.2047
	Sale	Valid N		#N/A	#N/A	#N/A	11	13	19	1 003	2 480	3 580	3 892	3 257
		Mean		#N/A	#N/A	#N/A	.1926	.2550	.5456	.2159	.2661	.3256	.4018	.7698
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	#N/A	.0092	.0395	.2241	.1815	.2422	.3015	.3771	.7322
			Upper Bound	#N/A	#N/A	#N/A	.3760	.4704	.8671	.2502	.2900	.3497	.4264	.8074
		5% Trimmed Mean		#N/A	#N/A	#N/A	.1893	.2597	.5064	.1982	.2536	.2955	.3632	.6957
		Median		#N/A	#N/A	#N/A	.0148	.0846	.2444	.1694	.1987	.2000	.2271	.4867
		Std. Deviation		#N/A	#N/A	#N/A	.2730	.3565	.6670	.5549	.6070	.7342	.7848	1.0947
		Skewness		#N/A	#N/A	#N/A	.5244	.0129	.7894	1.5468	.6472	2.5989	1.7017	1.2400
		Kurtosis		#N/A	#N/A	#N/A	-1.9661	-1.9935	.1694	11.0673	4.7035	27.5593	11.6352	2.3027

Pink Sheet	Buy	Valid N		1	1	1	6	6	15	14	46	10	8	78
		Mean		#N/A	#N/A	#N/A	.0545	-.1209	.0575	-.0558	-.1073	-.9587	-1.0636	-1.9652
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	#N/A	-.4870	-.6622	-.1910	-.3608	-.3324	-1.3327	-1.9915	-2.5799
			Upper Bound	#N/A	#N/A	#N/A	.5961	.4205	.3060	.2493	.1178	-.5848	-.1357	-1.3505
		5% Trimmed Mean		#N/A	#N/A	#N/A	.0476	-.1083	.0407	-.0233	-.1226	-.9858	-1.0635	-1.8331
		Median		#N/A	#N/A	#N/A	-.0448	-.1540	.1566	.1368	.1896	-1.0259	-1.1487	-.7768
		Std. Deviation		#N/A	#N/A	#N/A	.5160	.5158	.4488	.5284	.7580	.5227	1.1099	2.7264
		Skewness		#N/A	#N/A	#N/A	.5067	-.6989	.5281	-.9889	.1690	1.5524	-.0172	-1.0606
		Kurtosis		#N/A	#N/A	#N/A	1.3128	1.0531	2.0521	.3241	-.5677	4.9539	-1.6329	-.5622
	Sale	Valid N		#N/A	#N/A	2	5	29	61	847	3 280	4 944	5 567	5 899
		Mean		#N/A	#N/A	-.0116	-.0550	.0724	.1442	.3389	.3550	.4931	.6840	1.5949
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	-3.0688	-.6538	-.0538	.0528	.3018	.3309	.4688	.6564	1.5457
			Upper Bound	#N/A	#N/A	3.0456	.5439	.1986	.2356	.3759	.3791	.5174	.7116	1.6440
		5% Trimmed Mean		#N/A	#N/A	.0000	-.0583	.0367	.1173	.3257	.3110	.4256	.5882	1.4505
		Median		#N/A	#N/A	-.0116	.0438	.0060	.0713	.2865	.2375	.3194	.4534	.9807
		Std. Deviation		#N/A	#N/A	.3403	.4823	.3318	.3570	.5492	.7045	.8714	1.0521	1.9256
		Skewness		#N/A	#N/A	.0000	.2110	2.7620	2.8202	.5125	1.7951	1.6742	1.8284	1.2715
		Kurtosis		#N/A	#N/A	.0000	.1908	9.0106	14.6038	2.1501	9.7002	5.8337	5.5962	1.3253

Table 25:   Descriptive statistics of transactions with predicted returns greater than high selection threshold criteria

Descriptive Statistics

				1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
									Return period					
Nasdaq	Buy	Valid N		#N/A	#N/A	#N/A	46	221	314	9 880	12 796	12 671	12 647	10 732
		Mean		#N/A	#N/A	#N/A	.2689	.1652	.1764	.0657	.1099	.1146	.1245	.2296
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	#N/A	.1707	.1253	.1448	.0626	.1058	.1104	.1201	.2234
			Upper Bound	#N/A	#N/A	#N/A	.3671	.2050	.2081	.0689	.1141	.1189	.1288	.2357
		5% Trimmed Mean		#N/A	#N/A	#N/A	.2579	.1572	.1688	.0591	.1019	.1053	.1262	.2352
		Median		#N/A	#N/A	#N/A	.2130	.1210	.1383	.0520	.0788	.0977	.1209	.2739
		Std. Deviation		#N/A	#N/A	#N/A	.3307	.3007	.2847	.1608	.2401	.2420	.2477	.3251
		Skewness		#N/A	#N/A	#N/A	.6500	.4416	.6572	1.0284	1.9768	.5572	-.1646	-.3566
		Kurtosis		#N/A	#N/A	#N/A	-.5156	1.8580	2.4990	4.8407	16.1624	2.6503	3.0600	2.5558
	Sale	Valid N		1	2	2	11	60	433	15 397	51 697	64 022	66 935	54 278
		Mean		#N/A	.0015	.0025	-.1985	-.1021	.1146	.0800	.1013	.1241	.1460	.1957
		95% Confidence Interval for Mean	Lower Bound	#N/A	-.0371	-.0275	-.3633	-.1767	.0895	.0753	.0982	.1208	.1424	.1903
			Upper Bound	#N/A	.0401	.0324	-.0336	-.0276	.1396	.0847	.1044	.1274	.1497	.2011
		5% Trimmed Mean		#N/A	.0000	.0000	-.2026	-.1111	.1045	.0705	.0900	.1104	.1288	.1663
		Median		#N/A	.0015	.0025	-.0546	-.0654	.0721	.0549	.0708	.0867	.0931	.1310
		Std. Deviation		#N/A	.0043	.0033	.2454	.2886	.2653	.2977	.3605	.4244	.4812	.6460
		Skewness		#N/A	.0000	.0000	-.0820	.2533	.7646	.7630	.6370	.6365	.6954	.8744
		Kurtosis		#N/A	.0000	.0000	-2.2217	-.4391	1.3836	4.2531	2.6568	2.4900	2.0645	2.7211

NYSE	Buy	Valid N		#N/A	#N/A	#N/A	26	199	312	4 183	15 715	18 127	17 053	12 532
		Mean		#N/A	#N/A	#N/A	.1961	.1544	.1463	.0410	.0584	.0564	.0641	.0154
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	#N/A	.0395	.1117	.1121	.0356	.0551	.0530	.0600	.0076
			Upper Bound	#N/A	#N/A	#N/A	.3526	.1971	.1805	.0464	.0617	.0597	.0682	.0231
		5% Trimmed Mean		#N/A	#N/A	#N/A	.1951	.1533	.1462	.0288	.0491	.0517	.0660	.0410
		Median		#N/A	#N/A	#N/A	.1898	.1552	.1373	.0279	.0425	.0454	.0519	.0311
		Std. Deviation		#N/A	#N/A	#N/A	.3876	.3054	.3068	.1779	.2084	.2290	.2736	.4442
		Skewness		#N/A	#N/A	#N/A	.0676	.0612	-.0648	2.5120	1.1246	-1.1641	-2.1162	-2.2397
		Kurtosis		#N/A	#N/A	#N/A	-.7185	1.3350	1.8206	21.0282	12.6828	23.1534	24.5727	13.8892
	Sale	Valid N		#N/A	#N/A	#N/A	1	32	181	4 339	26 456	40 021	47 819	46 132
		Mean		#N/A	#N/A	#N/A	#N/A	.3156	.3054	.0936	.0853	.0962	.1034	.1209
		95% Confidence Interval for Mean	Lower Bound	#N/A	#N/A	#N/A	#N/A	.1946	.2549	.0852	.0813	.0919	.0992	.1150
			Upper Bound	#N/A	#N/A	#N/A	#N/A	.4367	.3559	.1020	.0893	.1005	.1076	.1267
		5% Trimmed Mean		#N/A	#N/A	#N/A	#N/A	.3209	.2927	.0763	.0661	.0640	.0718	.0734
		Median		#N/A	#N/A	#N/A	#N/A	.3652	.2387	.0612	.0391	.0299	.0323	.0299
		Std. Deviation		#N/A	#N/A	#N/A	#N/A	.3357	.3444	.2828	.3353	.4367	.4668	.6445
		Skewness		#N/A	#N/A	#N/A	#N/A	-.2304	.3625	1.5537	1.3452	2.1998	1.5549	1.6220
		Kurtosis		#N/A	#N/A	#N/A	#N/A	-.3835	.8531	7.3520	5.5422	11.2137	5.3991	5.4303

Table 26:   Annualised returns from transactions with predicted returns greater than medium selection threshold criteria

Annualised Log. Returns

	Holding period										
	1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
Nasdaq	-231.73 %	1898.85 %	1086.10 %	196.09 %	101.08 %	44.85 %	18.44 %	15.81 %	13.67 %	12.56 %	9.47 %
NYSE	#N/A	989.21 %	-110.03 %	225.19 %	124.47 %	38.52 %	13.10 %	9.82 %	7.63 %	7.13 %	3.80 %
OTCBB	#N/A	#N/A	#N/A	404.57 %	332.24 %	379.76 %	62.37 %	38.99 %	32.58 %	31.35 %	32.14 %
Pink Sheet	#N/A	#N/A	-340.81 %	-230.81 %	-28.11 %	90.71 %	109.51 %	56.01 %	54.84 %	59.26 %	71.02 %

Table 27:   Annualised returns from transactions with predicted returns greater than high selection threshold criteria

Annualised Log. Returns

	Holding period										
	1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
Nasdaq	#N/A	-48.20 %	-23.84 %	901.63 %	267.27 %	162.24 %	27.56 %	19.41 %	15.49 %	13.59 %	9.66 %
NYSE	#N/A	#N/A	#N/A	955.25 %	445.71 %	239.24 %	24.92 %	13.89 %	10.35 %	8.66 %	4.52 %

Table 28:   Number of transactions with predicted returns greater than medium selection threshold criteria per day

Count of required trades per day

	Holding period										
	1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
Nasdaq	.00	.03	.03	2.88	6.50	23.23	74.71	105.42	111.63	111.23	86.62
NYSE	.00	.00	.01	1.58	3.55	8.05	48.91	88.64	98.78	101.67	84.22
OTCBB	.00	.00	.00	.02	.03	.03	1.31	3.29	4.72	5.11	4.24
Pink Sheet	.00	.00	.00	.01	.05	.10	1.12	4.31	6.42	7.22	7.74

Table 29:   Average positions required to mimic transactions with predicted returns greater than medium selection threshold criteria

Average position required by trades (kEUR)

	Holding period										
	1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
Nasdaq	0	0	0	20	91	697	6 724	18 976	30 140	40 599	63 231
NYSE	0	0	0	11	50	242	4 402	15 956	26 672	37 108	61 478
OTCBB	0	0	0	0	0	1	118	593	1 274	1 865	3 098
Pink Sheet	0	0	0	0	1	3	100	776	1 733	2 636	5 653

Table 30:   Number of transactions with predicted returns greater than high selection threshold criteria per day

Count of required trades per day

	Holding period										
	1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
Nasdaq	.00	.00	.00	.07	.36	.97	32.75	83.55	99.36	103.10	84.22
NYSE	.00	.00	.00	.03	.30	.64	11.04	54.63	75.33	84.04	76.00

Table 31:   Average positions required to mimic transactions with predicted returns greater than high selection threshold criteria

Average position required by trades (kEUR)

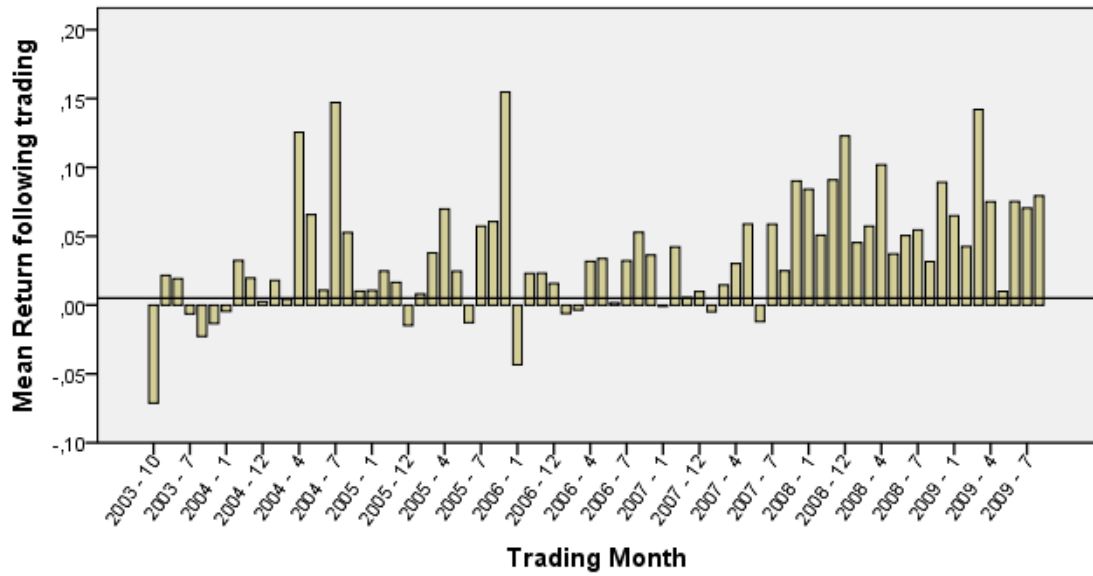|	Holding period										
	1D	2D	3D	1W	2W	1M	3M	6M	9M	1Y	2Y
Nasdaq	0	0	0	1	5	29	2 947	15 040	26 827	37 632	61 483
NYSE	0	0	0	0	4	19	994	9 834	20 340	30 676	55 481

Figure 17:   Monthly realised returns achieved by mimicking transactions which exceed medium selection threshold
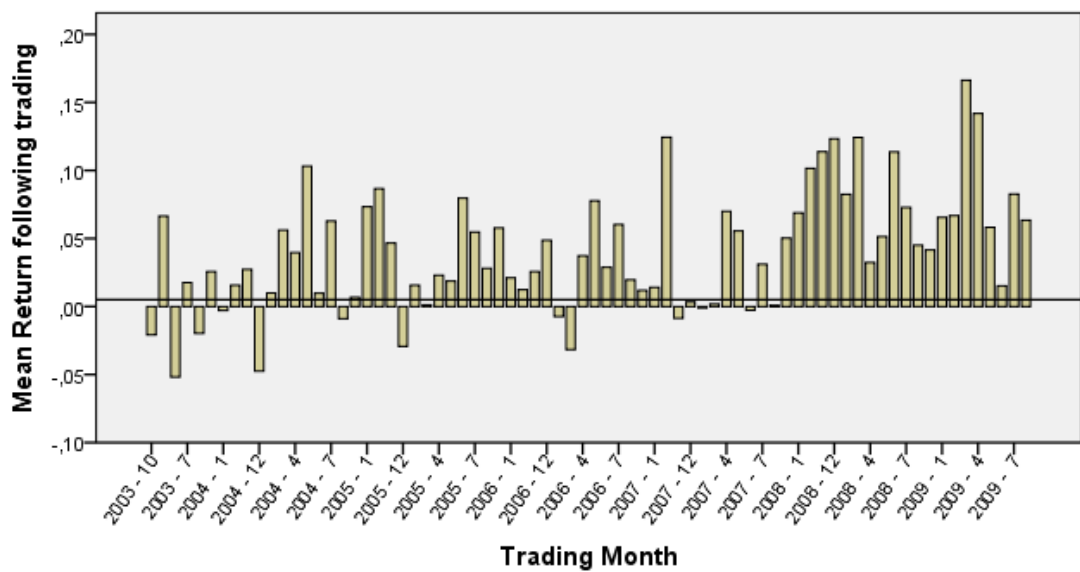

Figure 18:   Monthly realised returns achieved by mimicking transactions which exceed high selection threshold