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1 Introduction

This section introduces the reader to the background and problem as well as the purpose and related research questions used in the study. The chapter will be concluded with a brief presentation of the literature search.

1.1 Background

There is a general assumption that insider trading is something that must be prohibited in order to protect the general public's confidence in the stock market (Hetzler, 2001). The subject has arisen lately due the recent insider trading scandal where a number of individuals traded on insider information to earn enormous profits. The whole incident, as well as illegal insider trading in general, has been negatively portrayed in mass media, where for example, the editorial in Dagens Industri (2007-04-18) writes that insider trading is a misuse of trust and that persons using insider information take advantage of other's ignorance making them buy or sell at the wrong price. The negative aspects are also emphasized by attorneys who argue that use of inside information can be considered a form of fraud towards the stock holders (Eklund, 2003).

Economists on the other hand advocate the argument of market efficiency (Eklund, 2003). For example, there have been difficulties in presenting hard evidence that insider activities actually cause any significant damage to the stock market or impair public confidence (Manne, 1992). Some economists in fact claim that the market can actually benefit from insider trading as it potentially can make the information reach the market faster, thus contributing to the market efficiency (Manne, 1966). However, the general tendency during the last decades has been in line with the attorneys'; a strengthening of the legislation. Sweden for instance imposed tighter restrictions with the insider law (2000:1086) (now insider law (2005:377)) which made some penalties more severe and shortened the time period to report insider trades to the Swedish Financial Supervisory Authority (Finansinspektionen) from fourteen to five days (Bengtsson, 2001).

Since data of illegal insider trading is obviously not readily available and the very nature with illegal insider trading makes it difficult to test for, it is very hard to appraise the level of illegal trading on the stock market. Those few reported and/or prosecuted cases might only constitute a fraction of the total number. Thus, there is a need for a method that can measure the extent of non reported insider trading on the stock market in general before one can study its implications. Such a method can be based on the efficient market hypothesis which assumes that all available information is incorporated in (stock) prices (Fama, 1970).

The efficient market hypothesis divides market efficiency, or inefficiency, into three different categories or forms; the weak form, the semi-strong form and the strong form (Bodie, Kane & Marcus, 2005). For the strong form of efficiency to hold true the market must incorporate all available information including monopolistic information. Therefore illegal insider trading is a violation of the strong form of efficiency since it is based on non-public information. As a result, studying insider trading has been a common method for testing the strong form of the efficient market hypothesis. Usually these tests involve a buy and hold strategy based on the announced insider trades. Many of these tests (Eckbo & Smith, 1998) have indicated that using such a strategy can generate abnormal returns i.e. a violation of the strong form of the hypothesis. However one can take the opposite approach and study insider trading using the efficient market hypothesis as oppose to test market efficiency using insider trading.

1.2 Problem

Under the efficient market hypothesis, as put forward by Fama (1970), we would expect stock prices to immediately react to information that is new to the market. This implies that we would not observe any risk adjusted excess returns during the period immediately following an event when new information is passed on to the market, as in case of, for instance, an earnings release. In line with the same reasoning, we would not observe any abnormal movements in the stock price prior to an earnings release since the new information has not yet reached the actors on the market[1]. Abnormal stock price movements prior to or after a specified event, like for instance an earnings release, is usually referred to as price drifts. Price drift occurring after the specified event is explained with market inefficiency i.e. the market is not able to instantly incorporate the new information, and is called post-announcement drift. Drift prior to an event, pre-announcement drift, on the other hand is not due to prices not immediately reflecting new information but can instead partly be explained with information leakage or possibly insider trading (Damodaran, 2002) since no other actors should have access to this information. Thus, by testing for the existence of pre-announcement drift, one has a method for studying insider trading. However, since earnings announcement dates are known on beforehand, speculation about price movements is inevitable and this makes quarterly earnings unsuitable to serve as an event when studying insider trading. One must therefore find an event where the influence of speculation can be filtered out. Such an event is a profit warning since it is close to impossible for the market to predict such an announcement. Thus any stock price moving prior to the profit warning date is most likely caused by the use of monopolistic information or with others words, illegal insider trading activity.

1.3 Purpose

The purpose of this thesis is to investigate if it exists non reported insider activity prior to profit warnings on the Stockholm Stock Exchange.

1.4 Research questions

Considering the issues that have been raised in the previous sections, the following research questions emerged:

- Does it exist statistically significant evidence of non reported insider trading on the Stockholm Stock Exchange prior to profit warnings?
- If so, what are the characteristics of the illegal trading in terms of pattern and timeframe?
- How can the findings be related to the current debate regarding insider trading legislation?

1.5 Delimitations

The primary limitation made in the thesis is the chosen time frame of only the last four years, 2004-2007. A longer time period would yield stronger statistical evidence. However,

[1] If we assume that the market is efficient in the strong form, i.e. no information leakage occurs

approximately thirty observations have been found rendering it possible to assume the central limit theorem (Aczel, 2002) which makes the generalizations statistically valid. In addition, the authors wanted to avoid including the turbulent and speculative period of 1999 to 2001 since this period, characterized by extraordinary stock movements, might skew the inferences drawn from the sample.

Due to the limited number of profit warning observations, the authors have decided to group the entire sample into only one portfolio instead of separating the companies into different portfolios according to their market capitalization or business field.

1.6 Literature search

In order to fully understand and correctly utilize the theories used in this paper, extensive and careful studying of previous research related to the concept of price drift, market equilibrium and the efficient market hypothesis have been conducted. The main source of empirical research were articles found in academic journals such as Journal of Finance and Journal of Financial Economics. These articles among others include Henry G. Manne's research on insider trading and market efficiency and Eugene F. Fama's discussion on the *Efficient Market Hypothesis*.

These articles were found using academic databases such as JSTORE and Libris and through the reference lists and suggested readings sections of various course text books. The necessary data for the statistical tests and regressions were found using the databases of OMX, Affärsvärlden and Affärsdata.

2 Frame of reference

This section defines important concepts and present the most relevant theories in order to facilitate the reader's understanding of the thesis's findings.

2.1 Insider trading

Insider trading can both be legal and illegal. The latter includes trades based on the use of *inside information* (the concept will be presented in more depth in the next section). Legal insider trading occurs when an *insider* (defined below) at an organization, following certain requirements mentioned below, makes a trade with securities of the company with whom he or she is associated with (Finansinspektionen, 2007-04-16). The requirements that need to be fulfilled in order to make the trade legal is not using information that is not yet known to the public, report the trade to the Financial Supervision and hold the shares for at least three months (Insider law 2000:1087). Insiders are considered to be persons who through their position, employment or responsibilities possess inside information (Finansinspektionen, 2007-04-16). Such positions are according to the insider law (2000:1087):

- A member or a deputy member of the board in either the company or its parent company
- A managing director or a deputy managing director of the company or its parent company
- An accountant or a deputy accountant for the company or its parent company
- A person who holds a managerial position in the company or its parent company and therefore possess information that could be influential on the future stock price
- Anyone who owns more than 10% of the total holdings or voting rights.

Employees that do not have managerial responsibilities or are owning 10% of the shares are thus not subject to the obligation of reporting trades. Apart from the kind of insider described above, shareholders and recipients of insider information also fall under the category of being insiders. The legal difference is that these are not obligated to report their trades. Naturally, the recipient of insider information cannot make any trades at all on the security for which he or she possess inside information as it by definition is illegal.

2.1.1 Illegal insider trading

Illegal insider trading occurs when an individual uses inside information to make a security trade. Such a trade is punishable with prison up to two years (Insider law, 2005:377).

Inside information is defined as all information that not yet been made public and that, when released, could have a significant impact on the value of the security (Insider law, 2005:377). Such information includes:

- Future company restructurings
- Share issueing
- Lowering of the nominal value of the company's share
- Contents of a quarterly earnings report
- Profit warnings

Information is considered to have been made public when it has been published on a market place or been mentioned in mass media (Bengtsson, 2001). Consequently, information that has been spread within a closed group such as a private stock club is not sufficient. If the information is not obtainable though public channels such as media and public statements it is not made public.

Henceforth, the concept insider trading will only be used referring to illegal insider trading and the use of the word must never be interpreted as including legal insider trading.

2.1.2 Controversy surrounding insider trading

The legislation against insider trading has, over the last twenty years, become all the more strict (Eklund, 2003). It was primarily trough the European Union directive, The European Community Insider Trading Directive in 1989, that legislation forbidding insider trading was established in Sweden (Bengtsson, 2001). This law was revised and made stricter in 2001 when the law was divided into two laws, one dealing with the penalty aspects and the other with administrative issues such as the reporting obligation. Some of the penalties also became more severe for some insider crimes and the time period to report an insider trade was shortened from fourteen days to five.

It is obvious through the new legislation that the view on insider trading has become more rigorous. The primary arguments for the harsher legislation are marketing fairness which deals with the notion that it is not fair that some people can make abnormal profits only because they possess information others do not, and to protect the public's confidence in the stock market (Eklund, 2003). Leland (1992) lists the primary cons with insider trading which are in line with those of Eklund (2003) as he points to the "fairness" aspect which argues that outside investors will be less prone to invest due to the unfair market. As a result there will be less investments which in turn lead to lower and less real investments (Leland, 1992). Apart from the market "fairness" argument it is generally believed that the public's confidence in the stock market will be damaged due to insider trading (Hetzler, 2001).

However, there are numerous arguments in favor of insider trading. Manne (1966) argues that insider trading can have positive aspects. Among these is that insider trading can make the market more efficient since information can reach the market more rapidly and thus contribute to the efficiency of the market. Rundfelt (1989) also discusses some of the potential benefits for market efficiency. He writes that since those in company boards and in top management are best informed they should be allowed to make trades in the shares of their respective companies, since their knowledge would be transformed into more just pricing of the stock(s). Eklund (2003) argues that regulations against insider trading may prevent information from ever reaching the market. In addition, the costs of maintaining the legislation are of significant magnitude and put in relation to the effectiveness of the law, it can be difficult to justify its existence. Experiences from U.S and Europe show that the chance of being detected when conducting insider trading is minimal. Moreover, the implementation of the stricter legislation has failed in significantly decreasing insider trading (Eklund, 2003).

2.2 Efficient market hypothesis

A market where prices reflect all available information is fundamental for allocating resources and investments to the best available alternatives. Such a market, where prices "fully reflect" all available information, is referred to as an *efficient market* (Fama, 1970). Since prices of real assets are assumed to be set by the prices of financial assets, a capital market that inefficiently prices financial assets will also cause real assets to be priced out of equilibrium. Hence, an efficient financial market is fundamental for the economy to not suffer from social loss due to security miss pricing leading to improper real investments (Bodie, et al. 2005).

In the fifties, economist and statistician Maurice Kendall started analyzing stock price movements in his now classical *The Analysis of Economic Time Series* (Kendall, 1953). Theorists believed that they were to find a pattern of periodic up and down movements doing such a study. Finding such a pattern would allow the users to predict price appreciations or depreciations and thus generate abnormal returns (Bodie et al. 2005). Unfortunately, Kendall (1953) was unable to discover such a pattern but instead found little correlation within the series and that it was impossible to predict stock price movements using historical prices. Stock prices were as likely to go up as down regardless of past performance and they were thus assumed to move randomly since the fluctuations were independent of each other and had the same probability distribution.

During this time some economists claimed that random fluctuations were due to investors behaving irrational but the lack of predictable pattern could later be explained (Bodie et al. 2005). If one would be able to predict stock price movements everyone would take advantage of this by buying stocks that were predicted to rise (and shorting stocks that were predicted to fall). Unfortunately no one would agree to sell these stocks for a price lower than what they were expected to rise to. Therefore the stock price would immediately reach the predicted level as a result of the good news. Since the stock price at that moment would acknowledge all available information, further price fluctuations could only be a result of new information. Since this new information must be unpredictable (otherwise it would be a part of the identified information), stock price movements should thus also be unpredictable and must as such follow a *random walk*[2] (Bodie et al. 2005).

Bodie et al. (2005) refer to the assumption that stock prices reflect all available information, as the Efficient Market Hypothesis (EMH). The efficient market hypothesis was principally developed by Eugene Fama and presented in the article *Efficient Capital Markets* (1970).

2.2.1 Assumptions of the EMH

According to Fama (1970) the following three conditions are sufficient for a market to be efficient:

- There are no transaction costs in trading securities
- All participants have access to all available information
- All participants agree on the implications of the available information for the security

[2] However, referring to stock price changes as random is not entirely corrects since prices can be positive not only as a result of the time value of money but also due to systematic risk compensation (Bodie et al. 2005)

Since these conditions do not hold true in reality as there for instance are transaction costs in trading, it is important to stress that these conditions are sufficient but not necessary for market efficiency. If investors take all available information into consideration when trading securities, high transaction costs (that might reduce the number of trades) will not in themselves inhibit prices from "fully reflecting" all information once the security is traded. In addition the market may be efficient as long as a "sufficient number" of investors have access to the available information (Fama, 1970).

Damodaran (2002) argues that market do not become efficient automatically and provides the following conditions for market inefficiencies to be eliminated:

- The market actors must be profit maximizing investors in the sense that they can discover the potential for abnormal returns and be able to employ the procedures that earn these returns until they cease to exist
- The asset(s) that are the source of the inefficiency must be traded and the return of doing this must be higher than the transaction costs for the trades

Some supporters of the EMH question the usefulness of extensive analysis since the hypothesis claims that prices incorporate all available news and as such are accurate at that point in time. Therefore it is important to emphasize that the market does not become efficient on its own but only through investors trying to discover under and over valued stocks. In addition skeptics must believe that the market will correct its errors at some point in time in order for them to be able to take advantage of the miss pricing they have found. If the market was to be perfectly efficient at all times, investors would stop searching for and exploiting miss perfections which would in turn make the market inefficient again. One must therefore accept the market as a self-correcting mechanism which, at times, is in fact inefficient (Damodaran, 2002).

Despite the common idea that stock prices always reflect the true value, prices can in fact deviate from their so called true values in an efficient market. The only rule is that these deviations must be random. In addition, investors will be able to beat the market at times. In fact, nearly 50% of the investors will beat the market in a given year[3]. The EMH also argues that no investor will beat the market persistently in the long run but due to probability theory and the large number of investors, several investors will be able to beat the market during longer periods. However, according to theory, this is due to pure luck and not because of any superior investment strategy (Damodaran, 2002).

2.2.2 Forms of efficiency

The hypothesis constitutes of three different forms, or levels, of efficiency. These are the *weak form*, the *semi-strong form* and finally the *strong form*. The difference between the three are the amount of information incorporated in the price, the more information the more efficient the market (Bodie et al. 2005). All of the three different forms are inclusive, meaning that a higher form of efficiency also requires the assumptions of a lower level to hold true.

[3] Before transaction costs.

2.2.2.1 Weak form efficiency

The weak form of the hypothesis holds that all historical information is reflected in the stock price. This means that any investment strategy trying to take advantage of historic information such as historical prices or trading volume i.e. technical analysis would be useless. On the other hand, fundamental analysis could still be valuable in finding price errors; hence the weak form of efficiency (Fama, 1970).

The weak form efficiency can be described mathematically as:

Equation 2-1 Weak form efficiency

$$P_t = P_{t-1} + \text{Expected return} + \text{Random error}_t$$

The equation states that the price today is equal to the last price plus the expected return for the security plus a random component occurring over the period (Ross, Westerfield & Jordan, 2003). The random component of the equation is the information about the stock which can be either positive of negative and has an expectation of zero. The random component i.e. the information is unrelated to the random component for any other period, hence it is not predictable from past prices. If the weak form of the hypothesis holds true the stock is thus following the random walk described earlier. Testing the hypothesis is usually done by examining the predicative power of technical analysis.

2.2.2.2 Semi-strong form efficiency

The essence of the semi-strong form version is that prices not only incorporate historical trading data as in the weak form but all additional public information. Examples of such information are annual and quarterly earning reports and balance sheet composition. This form of efficiency implies that also fundamental analysis is useless (Bodie et al. 2005). Fama, Fischer, Jensen & Roll (1969) confirmed the semi-strong hypothesis by testing if the information about a stock split was, at the time of the split, fully reflected in the price. The result was supported by Ball and Brown (1968) who found similar evidence using annual earnings announcements.

2.2.2.3 Strong form efficiency

The strongest form of the hypothesis implies that prices incorporate *all* information, including non public information i.e. information that certain investors have monopolistic access to (Fama, 1970). If the strong form hypothesis was completely valid, no one would be able to make abnormal profits from non public information. One can therefore consider illegal insider trading as an immediate confirmation of at least some monopolistic access and thus inefficiency in terms of the strong form of the hypothesis. It is thus more important to examine how wide spread this monopolistic information is.

Niederhoffer and Osborne (1966) found evidence that those professional traders with access to non firm specific information can make abnormal profits, when they examined NYSE specialists using information about unfilled limit orders in their trading. Jensen (1968) had a broader perspective than Niederhoffer and Osborne in his study of the performance of mutual funds between 1945 and 1964. Jensen analyzed whether fund managers were able to earn monopolistic profits using their experience and connections but did not find any evidence of such monopolistic gains. Even though fund managers as a whole did not seem to hold monopolistic information, a few could consistently be able to make larger profits than expected but if this was the case these few were able to remain undisco-

vered in Jensen's study. However, as Damodaran (2002) highlights, some managers should in fact be able to make abnormal earnings during longer periods due to the law of probability and the numerous funds.

2.3 Price drift

As mentioned, one of the most elementary characteristics of an efficient market is that stock prices react immediately when new information is made available to the market. Should this not be the case i.e. the reaction does not occur at all or the market fails to incorporate the new information immediately, we encounter a sign of inefficiency known as a (price) drift. Drifts are usually identified adopting an event study approach which is described in detail in the *Event study* section of this paper. Whether the event is an earnings release or the death of a CEO we would, on an efficient market, expect prices to jump or fall instantaneously with the news release on the announcement day. Price drift occurs when stock prices move before or after the announcement or event and is usually depicted in a similar manner as in the graph below.

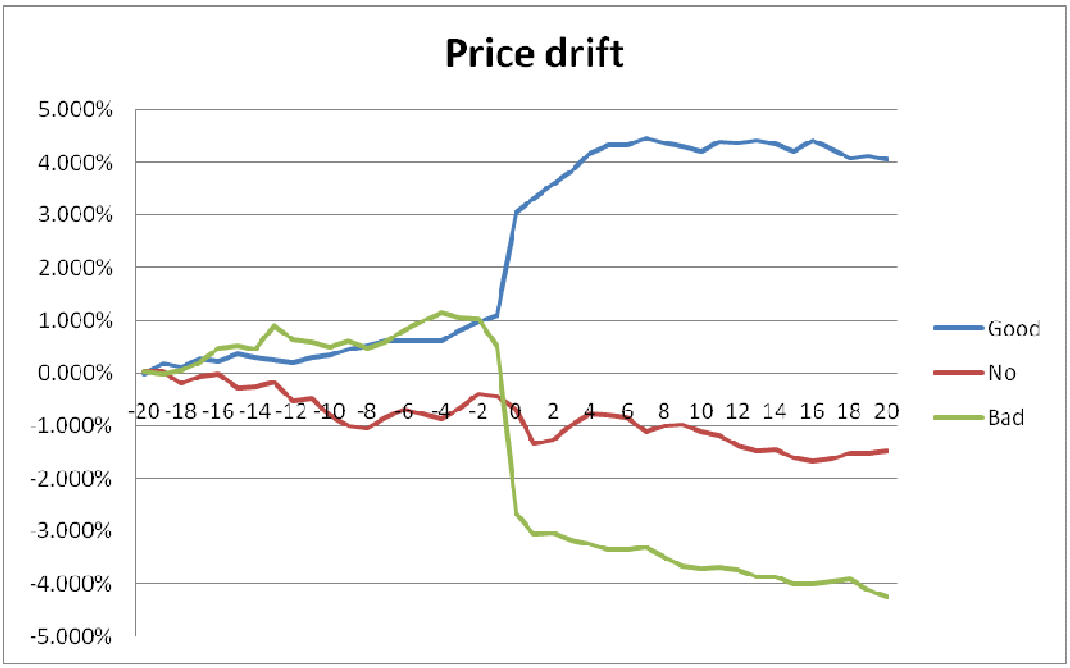


Figure 2-1 Example of price drift. Adopted from Höijer et al. (2006)

When examining drift, one is usually concerned with drift in abnormal returns so that changes resulting from general market movements are removed (Bodie et al. 2005). One of the major weaknesses in drift studies thus lie in the definition and problematic estimation of abnormal returns. Ball (1978) summarizes misspecification of asset pricing models as one of the competing models for explaining systematic drifts. On the other hand, Beaver and Landsman (1981) points to that the security market can exhibit abnormal returns over shorter periods but in the long run appear to not exhibit any abnormal behavior. In essence, it would seem like any attempt to explore price drifts must be done with an understanding of the limitations of the used method. On the other hand, it is hardly possible to carry out financial research without the use of deterministic models.

One of the most influential pieces of research on price drift is carried out by Foster, Olsen, Shelvin (1984). By using a sample including some 56000 observations ranging from 1974 to 1981 they investigated and proposed explanations of security post drift around unexpectedly high or low earnings announcement. The study found signs of price drift, positive for the firms with positive earning surprises and negative for firms with negative earnings surprises, not only on the day of the announcement but also during the period after the announcement. Investors could thus have earned abnormal returns by buying stocks with a positive earnings surprise on the day of the announcement since the market adjust to the earnings information slowly.

Even though most research on market efficiency has been carried out on the US market, there are some studies carried out on the Swedish market. One of the more extensive studies is a doctoral thesis written by Kerstin Claesson (1987) at Stockholm School of Economics. She performed six tests using a sample with the longest ranging from January 1978 to may 1985. The strongest indication against market efficiency in the study was the turn of the year effect which exhibited basically all criteria for market inefficiency. For the other of the tests, the results were either mixed or less significant.

A small study of price drift on the Stockholm Stock Exchange was conducted by Höijer, Lejdelin and Lindén (2006). The study used an approach similar to Foster et al. (1984) and found indications of a price drift for firms with both negative forecast error as well as positive. For firms with a positive error, statistically significant positive price drift was found for both the pre- and post period. As for the firms with earnings below analyst's mean estimates, negative pre-announcement drift was statistically supported.

However, even though the above mentioned studies suggest that the market is inefficient, one has to bear in mind that the choice of model has a significant impact on the outcome of the results. Depending on the model chosen, the result may be that the market is indeed inefficient but it might also be the other way around. For example, looking closer at the study by Foster et al. (1984) the evidence of both pre- and post announcement drift is only significant when using a time series approach when constructing earning forecasts. On the other hand, when an earnings forecasting model based on security returns are used, the result is quite striking; price drift is limited. Thus, it is evident that depending on how the models are constructed the outcomes can vary.

2.4 Profit warnings

Profit warnings are negative adjustments of previously publicly announced expected quarterly or annual earnings as well as other result associated factors. Profit warnings tend to be released in a random manner not necessarily in relation to any earnings report. Such adjustment must not necessarily be negative since positive adjustments for expected earnings is existent and also of interest to the market since it has influence on stock prices. Positive adjustments are referred to as positive or reversed profit warnings. Due to the random probability that warnings will occur there should be no possibility for the market to anticipate such an announcement. Thus it serves as an excellent event when one wishes to study use of monopolistic information.

Reporting profit warnings is not obligated by law in Sweden (Finansinspektion, personal communication, 2007-04-24) but in other countries, for instance Finland, companies are required, as a part of their continuous information sharing obligation, to also report profit warnings. In Sweden, although not enforced by law, the administration of the stock ex-

change, the OMX Group, requires profit warnings as a part of the listing agreement (OMX Group, 2007).

2.5 Event study

In order to familiarize the reader with the theory of event studies, a brief overview of the concept will follow. The focus in this overview is financial event studies but event studies can also be carried out in other areas such as law. An event study as such is a powerful tool when trying to isolate the effect of an event on the value of a firm. Concerning financial event studies such as the one used in this particular paper, the power in an event study is derived from the fact that in an efficient market, the effect of an event on stock prices should be instant (MacKinlay, 1997).

The first published event study was conducted by James Dolley (1933) who investigated the nominal effects on stock split. Early research like Dolley's however, did suffer from some drawbacks that where refined in later research. Most notably, the effect of general stock movements was removed using asset pricing models. This is crucial since the very reason for an event study is to measure the impact of a certain event and not overall market movements. The procedure that is used today was essentially presented during the 60's and 70's by Ball and Brown (1968) and Fama among others (MacKinlay, 1997). Over the years there has been a large creativity when it comes to defining the event, where one of the more unusual event studies is a study done on price reactions to sudden CEO deaths (Johnson, Magee, Nagarajan & Newman, 1984).

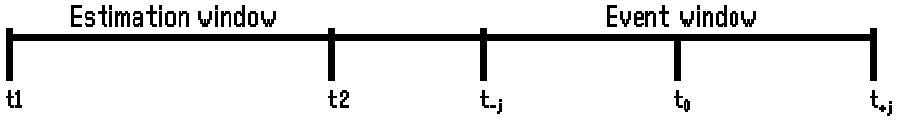
2.5.1 Steps in an event study

According to MacKinlay (1997) an event study constitutes of seven steps and this framework will also be used in this paper.

1. Event definition

An event study is initiated by defining the event which is to be studied. The event can for instance be an earnings release or the announcement of a stock split. Damodaran (2002) stresses the importance of pinpointing the announcement of the event since financial markets often react to the information about the event rather than the event itself. If one for example were to study the effects of a CEO change, selecting the very day of the CEO change will be of little value since the financial market will have valued the change already on the announcement day. As a result the announcement of the CEO change must be used as the event in order to find the true effect of it.

In order to examine the effect of the event it must be extended to create an *event window* during which the effects are studied. An event window usually covers a period both before as well as after the actual event but the study can be focused on only the pre- or post period.



Where:
t1 to t2 = estimation window
t_{-j} to t_{+j} = event window

t_0 = the event

2. Selection criteria

The next step is usually to set the criteria for the selection of firms to be included in the sample, the criteria is usually restricted by factors such as firm size but the sample could also be gathered according to industry or be based on a specific stock exchange.

3. Normal and abnormal returns

The impact of the event is measured by the abnormal return over the time of the event window which is usually computed as the actual return minus the expected return for the period. Abnormal and expected returns will be discussed more thoroughly in the *Expected return estimation* section.

4. Estimation procedures

There are two classes of models estimating required return, statistical and economic models. In short, statistical models only consider statistical characteristics in returns to yield a measure of required return of that asset. An example of such a model is the market model. Economic models, apart from including statistical assumptions, also take economic factors such as investor behavior into consideration and are thus sometimes favored over a purely statistical approach. Common economic models for expected return are the capital asset pricing model, CAPM, and the arbitrage pricing theory. These models will be discussed more thoroughly in the *Expected return estimation* section. In order to estimate the expected return the researcher must also define the estimation window on which the return estimations will be based. Most often the period immediately prior to the event window is used and it is advisable that the two periods does not overlap.

5. Testing procedure

In order to verify or reject the significance of the effects statistical tests must be conducted and usually the data on individual assets are aggregated before any such tests can be carried out. Typically these tests involve determining whether the returns are different from zero using t-tests and appropriate hypotheses but the statistical process can also include testing whether the effects are different from each other using a parametric test such as an F-test or nonparametric test such a rank sum test (Damodaran, 2002). However the last tests are more frequently used in *portfolio studies* which on the other hand often are combined with event studies.

6. Empirical results

After the significance of the expected effects are either confirmed or rejected the results should be presented. For small samples one or a few firms may influence the entire sample and this might be important to keep in mind when evaluating the importance of the results.

7. Interpretation and conclusions

Finally interpretations and conclusions of the results should be made to gain insight of the effects and their causes. In order to draw conclusions for a wider population than the sample, the selection process during stage 2 must be careful in order to limit any potential biases.

2.6 Expected return estimation

As has been described in the *Event study* section, one has to calculate the expected return for the asset in question in order to clear out the general market movements to better isolate the event (MacKinlay, 1997). MacKinlay presents in his paper, *Event studies in economics and finance*, a number of models for measuring the expected return. These are the *Constant mean return model* and the *Market model*, which are categorized as statistical methods, and the *Capital asset pricing model, CAPM,* and the *Arbitrage pricing model, APM*, which are economic models. The former method, the statistical method, is based on statistical assumptions on historical returns and do not, as such, rely on any economic arguments. Economic models can be cast as restrictions on the statistical methods to achieve more constrained expected return models. Economic models, although still largely reliant on statistical assumptions, also consider the behavior of investors. The statistical models measure the realized returns as oppose to CAPM which calculates expected returns (MacKinlay, 1997).

2.6.1 Economic models

Since CAPM is the model chosen for calculating expected returns in this particular event study, the authors have chosen to present a more thorough discussion of the model. The reasoning behind this is that the reader should be aware of the assumptions of CAPM, which in this study has a major influence on the results, in order to understand the limitations of the inferences drawn from the study as a whole.

2.6.1.1 Capital asset pricing model

The Capital Asset Pricing Model, CAPM, is a model for estimating the required rate of return on a financial asset. CAPM has, apart from assuming market equilibrium, a number of additional underlying assumptions, listed below:

- It assumes that there are no transaction costs for trading
- Investors pay no taxes on returns
- All assets are traded
- All assets are infinitely divisible (you can buy any fraction of an asset)
- All investors have the same information which renders it impossible to find under- or over valued assets

Under these conditions, the investors can diversify their portfolios with no additional costs which result in that every rational investor would keep diversifying until he or she owns every asset traded on the market, with each asset weighted for their respective market value. This portfolio is called the *market portfolio* since it contains all the tradable assets on the market and is a logical result of not having any transaction costs as the diversifiable risk will approach zero the more assets an investor holds (Damodaran, 2002).

As mentioned earlier, the firm specific risk is assumed to be diversified away when using CAPM. Hence only the systematic risk is considered which is an individual asset's risk measured relative to the market portfolio. It is thus the risk an asset contributes to the market portfolio. In order to estimate systematic risk, which is denoted with the Greek letter β (Beta), the covariance of any given asset with the market portfolio is divided with the variance of the market portfolio (Damodaran, 2002):

Equation 2-2 Beta estimation

$$\frac{\sigma_{i,m}}{\sigma_m^2}$$

Where:

$\sigma_{i,m}$ = covariance of asset i with market portfolio

σ^2_m = variance of market portfolio.

The beta of the market portfolio is always 1 since the covariance of the market portfolio with itself is its variance. A security beta that is higher than 1 implies that the asset is riskier than the market and hence more susceptible to economic factors than the market in general. Consequently, an asset with a beta lower than 1 will be less risky than the market (Damodaran, 2002). The estimation of beta can be demonstrated graphically as below.

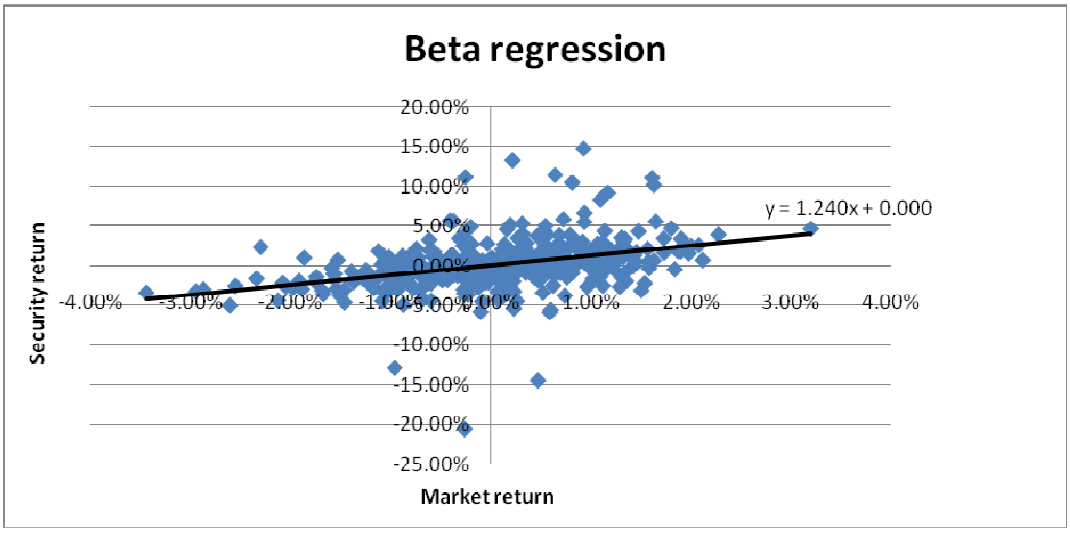


Figure 2-2 Example of beta regression

The mix of risk free assets and the market portfolio that all investors hold results in the conclusion that the required return for any asset is positively linearly related to the risk (beta) of the asset and can be written as a function of the risk free rate and the beta of the asset - the CAPM formula (Damodaran, 2002).

Equation 2-3 Capital Asset Pricing Model, CAPM

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f]$$

Where:

$E(R_i)$ = Expected (required) return on asset i

R_f = Risk free rate

$E(R_m)$ = Expected return on market portfolio

β_i = Beta of asset i

The required return provided by CAPM helps the investor to determine whether or not to invest as it produces a return requirement that adequately compensates the investor for the risk involvement. To invest in assets that yield a return less than the required would be irrational behavior. Cases where the actual return outcome is higher than the required is regarded as abnormal and is an indication of market inefficiency.

Unfortunately most of the assumptions seldom or never hold in reality. Example of such problematic factors are that the market portfolio is unobservable and transaction cost and taxes do exist. Despite these obvious drawbacks the model is still widely used since the additional accuracy gained from other, more advanced, asset pricing models are often limited (Bodie et al. 2005).

2.6.1.2 Alternatives to CAPM

There are alternatives to CAPM for estimating the required return. The most common is the Arbitrage Pricing Model, APM (Damodaran 2002). The main difference between CAPM and APM is where the former captures the entire market risk in one measure, beta, APM allows for multiple sources of market wide risk and measures the sensitivity of the asset against all these factors. The sensitivity is measured by a factor beta which is similar to the beta in CAPM. However, the factors are not identified in economic terms but rather a set of common factors are used which are measured by their respective betas to gauge the risk impact for each factor on the investment (Damodaran, 2002)

2.6.2 Statistical models

As mentioned above, there are primarily two statistical models, the constant mean return model and the market model. The former of the two is defined as:

Equation 2-4 Constant mean return model

$$R_{it} = \mu_i + \zeta_{it}$$

Where:

R_{it} = Return on asset i for period t

μ_i = Average return for asset i

ζ_{it} = Time period t disturbance term for security i[4]

As apparent in the model the return of the asset are held to be constant and is based on an historical average. The market model is considerably more complex and is defined as:

Equation 2-5 Market model

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

Where:

[4] Expectation of zero and variance $\sigma^2_{\zeta_i}$

R_{it} = Return on security i for period t

R_{mt} = Return on market portfolio m for period t

ε_{it} = Zero mean disturbance term

α_i = Security return not explained by the market return (compare with the risk free rate in CAPM)

β_i = Market influence on security

The return yielded by the market model is estimated by applying regression analysis to excess rates of return. The Beta parameter in the model is the markets influence on the security, i.e. the systematic risk and alpha is the return on the security that is not explained by the return of the market. The two parameters are appraised by a regression based on historical data of security prices and index fluctuations. The slope of the regression line is represented by beta and alpha is the intercept (Bodie et al, 2005). The model relates the return of any given security to the return of the market portfolio, using beta, which most often is substituted with a broad index such as S&P 500. The advantage with the market model over the more simple constant mean return is that the variance in abnormal return is reduced since the part of the variation that is caused by market return fluctuations are removed. This is the result when the expected return for the asset is put in relation to the expected return of the market. The result is that the effect on the event can become more easily detected (MacKinlay, 1997).

The beta for the market model is principally the same as the beta in CAPM, with the important difference that CAPM requires the theoretical market portfolio (that all shares on the stock exchange are included), whereas the market model measures beta against a well-specified observable market index. Thus, the market model in essence does not rely on the assumption that one must relate the systematic risk against the market portfolio, as CAPM does, but on any well-specified index. However, even though CAPM assumes the market portfolio which is almost impossible to appraise other than in theory, CAPM is nonetheless widely used in the financial community, which is the primary reason for it being used in this thesis (Bodie et al. 2006).

3 Method

This section describes the chosen methods and discusses possible drawbacks with each of these.

3.1 Quantitative vs. qualitative approach

Depending on the purpose of the thesis, different methods, in terms of number of observations, are appropriate (Jankowicz, 1991). The primary two methods to choose from are qualitative and quantitative. The former is characterized by a few, but thoroughly processed, numbers of observations which usually take the shape of in depth interviews. A qualitative study is inductive in nature as general theories are constructed from a small number of observations (Darmer & Freytag, 1995). A typical drawback associated with a study conducted using a qualitative approach is that the inferences drawn based on the empirical findings are subject to subjective interpretation of the researcher as well as the interviewee. Hence the conclusions can be colored due to the personal characteristics, such as previous experience and knowledge of the researcher. The same can be said about the interviewees, which have different perspectives that can cause different interpretations of the questions (Ghauri & Grønhaug, 2005). A possible implication of a qualitative study can thus be that depending on who is conducting the research, different conclusions might be made i.e. the reliability of the study might be compromised.

A quantitative study on the other hand, is based on a large(r) number of observations with the objective to draw inferences applicable to a wider population (Bryman, 2004). Thus, it is necessary that the sample both consists of a sufficient number of observations as well as covering all facets of the population in order to adequately represent the population as a whole. Due to the many observations, a quantitative sampling procedure is analyzed by using statistical measurements. In contrast to a qualitative approach, which is often inductive in nature, a quantitative is usually deductive in the sense that large samples are used to verify or reject a specific theory (Darmer & Freytag, 1995).

As far as this study is concerned, a quantitative approach is most appropriate considering the purpose of this thesis:

"…to investigate if there exist non reported insider activity prior to profit warnings on the Stockholm Stock Exchange".

Since the objective of the thesis is to draw conclusions that can be applied to a wider group than the chosen observations, the sample must be both large and representative enough to reflect the Stockholm Stock Exchange as a whole. In addition, the authors are of the belief that due to the sensitive nature of the subject this thesis aims to investigate, interviews might both be difficult to arrange since potential interviewees may be reluctant to participate and should an in interview take place, personal emotions regarding insider trading might for example either cause an exaggeration of the insider activity or the complete opposite, a complete denial. It seems probable that one in favor of insider trading (and perhaps engages in such activity him/herself) might tend to deny its existence in order steer off attention and vice versa. Furthermore, even though the interviewees might be credible by virtue of their profession or position in a company, the authors feel that the delicate nature of investigated area needs to be supported by legal documents in order to strengthen the trustworthiness of the information obtained during the interview. As a documented support of the accusations of insider trading discussed with an interviewee might be difficult to obtain, the authors feel the need to circumvent this obstacle. With the, by the au-

thors', perceived complications of personal interviews in mind, the purpose of the thesis can best be fulfilled by a quantitative approach with which statistical models are used to measure insider trading activity on the Stockholm Stock Exchange, thus avoiding the problems associated with personal interviews.

3.2 Conducting our study

The following section aims at in detail explaining how the study will be executed and provides the reader with considerations that were made. It will start off with how the data was gathered and then continue with the event study specifications including abnormal return estimations. Finally some critic and concerns of the chosen method will be discussed.

3.2.1 Event study specification

This paper aims at studying the extent of insider trading on the Stockholm Stock Exchange rather than effect of profit warnings per se. However in order to do an event must found where insider trading can be isolated i.e. an event where the release date is unknown to the public. For example using earnings announcement and finding pre-announcement drift might indicate insider trading activity (Damodaran, 2002) but, since the date of the earnings announcement is known on beforehand, potential pre-announcement drift can not be explained simply with insider trading. This is due to that investors might be speculating on the outcome on the announcement day. As a result, profit warnings serves as an appropriate event since these *should* be unknown before they are announced to the market. This study will thus use profit warnings to find insider trading prior to them by testing for pre-announcement drift. However, using this method where the population is defined as all profit warnings ever to occur and the approximately 30 observations included in the study constitute the sample, limits the ability to generalize the findings to profit warnings. Thus, should any statistical evidence support the existence of abnormal negative returns which in turn indicates insider trading, those inferences can only be said to hold true in relation to profit warnings. Nevertheless the authors find it reasonable to assume that, if insider trading exist prior to profit warnings it might just as likely occur prior to any other stock price moving information announcement, such as an quarterly report. This notion will be discussed in more depth in the *Discussion* section.

In order to measure the effects of the event, the profit warning it must be extended into an event window. Since the aim of this paper is to study insider trading by examining pre-announcement drift there is no need to include any days subsequent to the event in the event window and the test period. In order to find the whole effect of the potential insider trading the authors have decided to use a window of 30 days preceding the event. There are two reasons for this length. First of all, insiders, as defined earlier, are not allowed to trade shares in their respective companies later than 30 days before earnings announcements (Insider law 2000:1087) and second, using a thirty day long event window allows for running statistical tests on the entire period for an individual company since the period includes 30 observations. Even though the data itself may not be strictly normally distributed, the sample size of 30 observations is sufficient enough to assume that the sample parameters are normally distributed under the central limit theorem approach (Azcel, 2002).

Incorporating the event and the estimation period into the model it will look like figure 3-1 below:

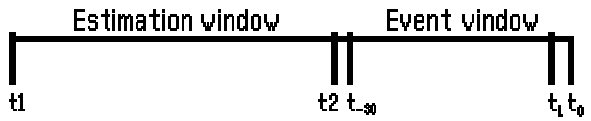


Figure 3-1 Our event window

Where:

t1 to t2 = the two year period during which beta is estimated

t_{-30} to t_{-1} the thirty day period during which the abnormal returns are estimated

t_0 = the profit warning day

3.2.2 Data gathering

When conducting the data gathering approximately 40 warnings were found for the specified period, 2004-2006. Unfortunately due to the inadequacy of the databases from which stock prices were obtained, less than thirty of the observations remained for statistical testing. The effect of this forced an extension of the initial time frame to also include 2003. However only the missing two observations that were required to construct a total sample of thirty were taken from this year. As a result year 2003 is not fully represented in the sample.

The sample do not allow for tests that take into account characteristics such as company size, business field or time period. Unfortunately an involuntary partial division of the observations occurred as exactly 50% of the companies are from the large cap. list while the remaining 50% are spread between the mid- and small cap. lists. Large cap. companies are thus somewhat overrepresented in the sample but no special attention will be paid to this fact though. The uneven distribution of company size however, is not so much due to that larger companies in general tend to adjust forecasts but rather a result of that profit warnings for which data were unavailable, and thus had to be abandoned, were almost entirely from small cap. companies. A detailed description of companies included can be found in *Appendix 1* and the data and test can be found in *Appendix 2*.

The sources that are used to gather the relevant data are summarized in the table below.

Table 3-1 Data sources

Data	**Source**
Historical stock prices	OMX Group
Historical index prices	OMX Group
Treasury note return (Risk free rate)	Affärsvärlden
Profit warnings	Affärsdata & press releases at respective company web sites

3.2.3 Beta and abnormal return estimations

Since the objective with an event study is to isolate the effect of the event, profit warnings, effects of general stock movements must be removed. In order to achieve this, CAPM will be used to estimate the expected return which is then subtracted from the actual return – leaving the *abnormal* return.

In order to estimate the expected return, betas for every stock in the sample are needed. The market term in CAPM is in fact an imaginary creation of *all* stocks but usually a major stock index is used as a proxy. Thus, in this case, *OMXSPI*, the all share index of the Stockholm Stock Exchange, is used as a proxy for the overall market return.

To obtain the beta for each stock a number of regressions, using daily returns, will be run. A common procedure (Damodaran, 2002), that will also be used in this study, is to use two years of daily trailing returns to estimate the beta values from the following regression:

$$R_i = a_i + \beta_i(R_m) + \varepsilon_i$$

Where:

R_i = Return on stock i

α_i = Alpha value stock i

β_i = Beta value stock i

R_m = Return on OMXSPI

ε_i = Random term stock i

Since it is important to separate the estimation period from the event and the event window, the last observation in the time series used to estimate beta, is the last trading day preceding the event window i.e. the 30 trading days leading up to the profit warning. As a result, beta for a firm making a profit warning on 1st September will be estimated using two years of daily returns up until the last trading day before the 30 trading days period prior to 1st September.

After finding betas for all firms in the sample the abnormal returns can be estimated. When performing the estimations, the proxy used for the risk free rate is the twelve month Swedish treasury note. The yearly rate for each day was collected and subsequently adjusted to a daily return. A fixed income instrument is more desirable than longer duration bonds to use as proxy for the risk free rate (Damodaran, 2002). The return for the market portfolio is estimated using the OMXSPI index. All abnormal returns are calculated for each of the 30 trading days preceding the event. Thus, the return will be calculated on a daily basis, using the twelve month treasury note adjusted to daily returns, daily return of the stock and the market portfolio and finally the corresponding beta for that particular firm.

Abnormal return can thus be defined as follows:

Equation 3-1 Abnormal return

$$\alpha_{i,t} = R_{i,t} - E(R_{i,t})$$

Where:

$\alpha_{i,t}$ = Abnormal return on stock i at time t

$R_{i,t}$ = Actual return on stock i at time t

$E(R_{i,t})$ = Required return stock i at time t

And as derived from the CAPM:

Equation 3-2 Abnormal return derived from CAPM

$$E(R_{i,t}) = R_{f,t} + \beta_i (R_{m,t} - R_{f,t})$$

Where:

$R_{f,t}$ = Daily risk free return at time t

β_i = Beta value stock i at quarter q[5]

$R_{m,t}$ = Daily return on market portfolio at time t

3.2.3.1 Estimating cumulative abnormal returns

The event window in this study extends 30 trading days prior to the warning. Thus, in order to investigate the impact on returns prior to the event, daily abnormal returns for any given stock must be summed for the entire period. In general, cumulative abnormal returns are calculated in the following way:

Equation 3-3 Cumulative abnormal return

$$CAR_{i,m} = \sum_{t=j}^{m} \alpha_{i,t}$$

Where:

$CAR_{i,m}$ = Cumulative abnormal return for stock i during the [j,m] time period

However, only looking at whether one specific company's returns are abnormal does not say if the same negative price fluctuation occurs in relation to profit warnings in general. Therefore it is necessary to include at least thirty warning observations in the study. In addition, only testing for one company's returns do not circumvent firm specific aspects, such as other price driving news. It can thus be difficult to explain the negative drift exclusively with insider trading as it can have been caused by other factors. Insider activity is still though, the most plausible explanation. Over a large sample, firm specific price moving news, good and bad, cancel each other out – leaving insider trading as the only possible explanation for the significant negative abnormal return. The authors nevertheless argue that examining drift on an individual company level could be of interest since if indications of insider trading exist, one has an incentive to conduct further research on the company in question, for example looking at the short interest and/or press releases. However due to

[5] See the beta estimation part for details on quarterly betas

the limited sample the value of such a test would, in this context, be low and therefore such a test will not be conducted.

To identify any price drift for the sample as a whole, one looks at cumulative abnormal returns on a portfolio level. Since this study is only concerned with profit warnings and not so called reversed profit warnings (announcing *higher* than expected earnings) and that no division of the announcements according to magnitude will be made, there is no need of dividing the firms into more than one portfolio. If the study aimed at studying negative (profit warnings) as well as positive earning forecast adjustments (reversed profit warnings), dividing them into two portfolios, one negative and one positive, would be necessary in order for the results not to offset each other in a statistical test.

The cumulative abnormal return for the portfolio can be calculated using the formula below:

Equation 3-4 Cumulative average abnormal return

$$\hat{CAR}_{p,m} = \frac{1}{n}\sum_{i=1}^{n}\sum_{t=j}^{m}\alpha_{i,t}$$

Where:

$\hat{CAR}_{p,m}$ = Cumulative average abnormal return for portfolio p during the [j,m] time period

n = Number of stocks included in portfolio p

3.2.4 Statistical testing

To be able to draw a valid inference about a population from a sample, it is important that the sample is created in a random manner, otherwise the sample will not be a true representation of the population and any inference drawn can thus be distorted (Azcel, 2002). As mentioned above, the population in this study is defined as all profit warnings. Thus the observed warnings included in the sample must be randomly selected among profit warnings in general. The selection of observations i.e. the sampling was however not done randomly since the sample constitutes entirely of profit warnings from a limited period with conditions that may differ from those prevailing historically.

T-tests will be used to accept or reject the hypothesis whether the abnormal return are significantly different from zero and thus ascertain that the abnormal returns are in fact abnormal. Since the very nature of trading on profit warning information requires either shortening or selling company shares in order to make a profit, the hypothesis is that the abnormal return is significantly *less* than zero. Considering the purpose of the study, studying insider trading prior to profit warnings, statistically significant positive deviations from zero are of no value since such deviations could not be derived from insider trading but rather from the ordinary random walk characterizing an efficient stock market. Based on this reasoning there is no need to use a *two-tailed test* where both positive and negative deviations are tested for significance but instead a *one-tailed test* where only lower t-statistic can reject the hypothesis stated below.

When testing on the portfolio level the hypothesis are:

$$H_0 : C\hat{A}R_{p,m} \geq 0$$

$$H_1 : C\hat{A}R_{p,m} < 0$$

The test will be carried out on an 95% significance level and with n-1, in this test, 29 degrees of freedom, the critical value equals 1.6991 for a one-tailed test. In order to reject the null hypothesis the t-statistic must thus be below the negative of this value.

3.3 Validity and reliability

The concepts of reliability and validity must be taken into consideration by any researcher who wants to make one's results credible (Ghauri & Grønhaug, 2005). Therefore, a brief discussion on how this thesis encompasses these important concepts will follow.

3.3.1 Validity

Validity measures how well the findings conform to what the researcher intends (Ghauri & Grønhaug, 2005). This means that the observed measure should equal the true measure. Issues that can lower the validity are for example misinterpretations of questions by a respondent in questionnaire. This particular issue is not a concern for this paper as it solely relies on secondary data. Although, problems that might create validity issues as far as this study is concerned can be minor errors when collecting data due to the considerable amount of different information needed. Possible errors include dates for each profit warning, historical stock prices or index prices. Thus, the collection of these must be conducted with care. Other aspects that can lower the validity of the findings in this paper is that the approach of using an event study to measure insider activity might not be one hundred percent certain. However, considering that the method has been applied for a similar study before (Engert, 2005) and through the reasoning that since profit warnings are completely random events, abnormal returns prior to such a release can only be caused by insider trading or news leakage (Damodaran, 2002). However, these two cannot actually be separated since news leakage, if used without being publicly known, automatically becomes insider trading. Considering these explanations for abnormal return prior to profit warnings the potential validity implications caused by choosing an event study, is by the authors deemed to be entirely non existent. A third aspect to consider concerning potential negative validity implications is the model used for calculating the excepted return. CAPM for example, does not capture all the underlying factors that affect the expected return. On the other hand, the use of credible sources for obtaining the data which includes OMX Group and Affärsdata, contributes to an increased validity.

3.3.2 Reliability

The concept of reliability is concerned with the stability of the measures. It means that, regardless of who is conducting the study, the same results should be found provided that the exact same method is used (Ghauri & Grønhaug, 2005).

This thesis, as it is based on secondary data that are readily available to anyone, analyzed by standardized statistical models, can be considered to generate reliable results in the sense that anyone hosting the necessary skills could duplicate the results. However, one must use the exact same procedures, including the same model for estimating expected returns to reach the same conclusions. By employing other models for expected as well as abnormal

return calculations, like for instance the market model or the APM instead of CAPM, will generate results that will differ from those found in this thesis where CAPM is used.

3.4 Criticism of sources and method

Financial event studies in general are sensitive to the models chosen, especially concerning the expected return and in turn abnormal return estimations. Therefore regardless of the method chosen, the research will always be exposed to the inherent imperfections of the model used. The model chosen for the expected return estimations in this paper is heavily reliant upon CAPM's ability to accurately determine the expected return which unfortunately might cause some distortions in the inferences drawn from the results. CAPM has as its main drawback that certain aspects might not be fully reflected when using it to determine the expected return since, for instance, studies have shown that small firms have been somewhat undervalued with CAPM (Smith & Smith, 2004). In addition, the rather stringent assumptions of CAPM seldom hold true in reality. Nevertheless, it is the most widely used model to value companies (Smith & Smith, 2004) which provides some insights to the model's superiority and accuracy despite its critique. Thus the authors feel confident that the results are both valid and reliable regardless of the mentioned problems associated with CAPM.

4 Empirical results and analysis

In this section the empirical results as well as the analysis is presented. The empirical findings will be primarily presented through extensive use of graphs. The analysis of the findings also includes a discussion on the findings applications regarding the legislative debate.

4.1 Initial remarks

Because of the nature of the empirical findings, being in form of statistical data and presented as graphs and tables, the authors are of the opinion that it would be inconvenient to separate the analyzing comments on the data from the data itself. Thus the empirical result and the analysis section have been merged.

The empirical results and analysis section will start off with a descriptive graph that provides an visual overview of the result but whose pattern, at this point, is not statistically supported. The statistical tests will be covered in the following section where the core findings will be analyzed. The findings will also be analyzed and discussed in the light of current debate regarding insider trading in a concluding section – *Insider trading law effectiveness.*

4.2 Descriptive results and analysis

In order to visualize the collected data for the thirty day event window, a graph, using the average abnormal returns for all thirty companies for each day, was constructed. It is important to clarify that this graph is not the result of the cumulative average abnormal return formula, presented in the *Estimating the cumulative abnormal return* section, where the average thirty day CAR for each company is used but instead *all* company abnormal returns are averaged for each day. The implication of this is that it is not possible to draw any statistically verifiable inferences from the graph. However the graph nonetheless does serve an important purpose, namely that it shows an indication of not only a potential existence of drift but also the magnitude as well as sign of it.

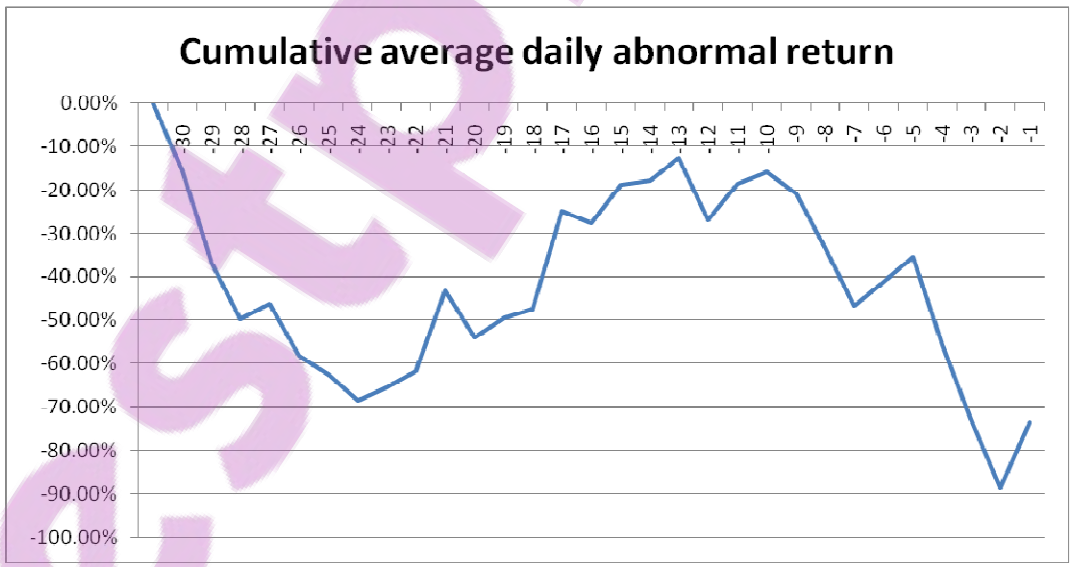


Figure 4-1 Cumulative average daily abnormal return

The graph clearly indicates a negative drift or abnormal returns prior to the profit warning. During the first twenty days the graph exhibits no pattern that can be related to the event since the initial negative drift is offset by the drastic positive returns during the middle of the event window. The situation is different the ten days immediately preceding the event where the abnormal returns are consistently negative for the entire period save for the very last day when returns are positive. However, scrutinizing the sample return data for all companies for the last day before the announcement day, only three of the thirty companies have drastic positive abnormal returns. These returns are of such magnitude that they skew the results for the entire sample. Thus one can, to some extent, disregard the upward movement of the line the day before the warning as it is due to firms specifics rather than a pattern that reflects the sample as a whole. The ten days of consistent negative returns, although not statistically tested, strongly indicates a pre-announcement drift or insider trading. Based on the graph above it is highly interesting performing statistical tests on the last ten day period rather than focusing only on the entire period. Intuitively, the thirty day period might distort statistical testing since the high deviation among abnormal returns for the period as a whole are likely to offset potential drift. Thus, by isolating the last ten day period the drastic fluctuations during the beginning are circumvented. In addition, the authors are of the opinion that should insider trading exist it is more likely to occur closer to the announcement since information that could be used for such insider trading is probably not known too long before the announcement.

4.3 Statistical testing

Based on the indicative pattern in figure 4-1 there is an obvious interest in testing the -10 to -1 day period for significance apart from the initial chosen time frame, -30 to -1. For the entire event window of thirty days statistical testing cannot reject the null hypothesis, that the abnormal returns differ from zero, thus there is no statistical evidence occurring for the this particular period. Looking at the -10 to -1 period the t-statistic is lower than the critical value implying a significant difference from zero. This results in the conclusion that for firms announcing a profit warning, on average, insider trading activity occurs during the ten days immediately preceding the announcement. One must though, be somewhat cautious when extending the results to time periods not included in the study, i.e. years other than 2003-2007, since the period tested can be different from other time periods. Such differences can for instance be the state of the economy, the current legislation and perhaps even the moral of individuals.

The t-statistics for the two tests can be found in table 4-1. Significant t-statistics are denoted in bold. Even though the t-statistic for the -30 to -1 day period may seemingly be high it is not sufficient for making the cumulative average abnormal return statistically significant.

Table 4-1 t-statistics for -30 to -1 and -10 to -1 period

Test period	**t-statistic**
-30 to -1	-1.5678
-10 to -1	**-1.7363**

At 95% confidence level and n-1 (29) degrees of freedom, critical value = 1.6991 for a one-tailed test

Even though a statistically negative abnormal return, which can be explained with insider trading, is confirmed for the ten day period before the profit warning, it is still of academic value testing for a significant difference on individual days. Since the authors are of the belief that if insider trading exist it is more likely to take place towards the end of the event window rather than during the beginning, it is interesting to examine if the daily abnormal returns are significantly negatively different from zero and if so where, within the event window, these days are located. It is nevertheless important to stress the difference between the previous statistical test and test on individual days. Remember that the former test tested cumulative returns whereas the latter tests whether the average abnormal return among the thirty companies for a single day is different from zero. Thus the findings can be generalized to that one can pinpoint the day(s) on which negative returns are different from zero i.e. the days when insider trading before profit warnings tend to occur.

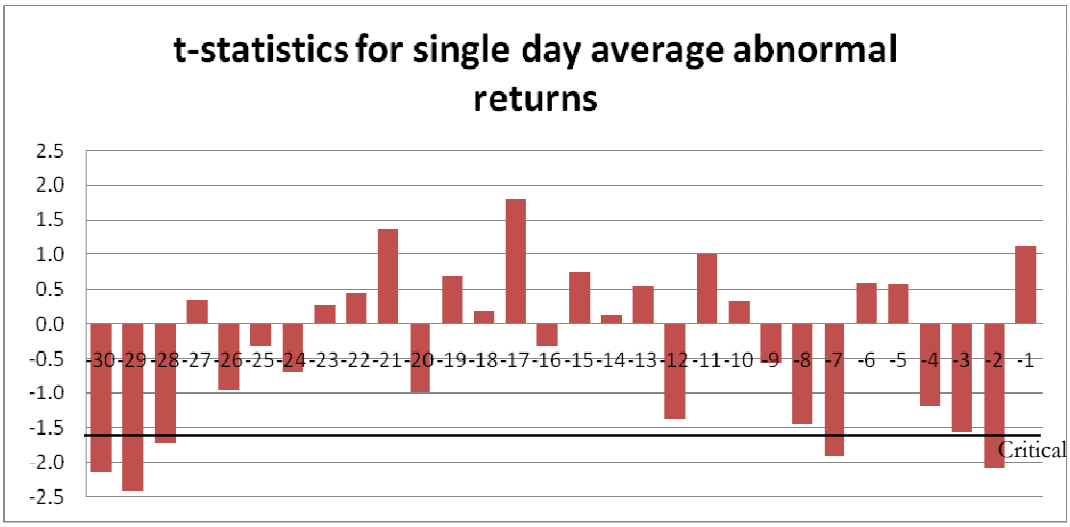


Figure 4-2 t-statistics for single day average abnormal returns

Figure 4-2 above shows the t-statistics for the individual days. All values lower than the critical value of 1.6991, in the graph represented by the black line, are significantly different from zero. According to the test there are six days where the returns can be confirmed as different from zero, however only two of these are located in the -10 to -1 day period. This might seem contradictory to the other test where the cumulative abnormal return for the entire 10 day period were significant. One must remember though, that also non significantly different days add to a significantly different *cumulative* return as long as they are negative.

As far as the three initial days of the event window are concerned, one can believe that since there are three consecutive days of significant abnormal returns there is a pattern of insider trading. The authors find it hard to believe though, that information regarding a future profit warning would be known at this point in time. Also, it would be questionable that company management, realizing that a profit adjustment must be made, chooses to prolong making the information public, especially since harsh penalties can be imposed. Therefore these days are more likely the result of a limited sample of merely thirty observa-

tions where drastic firm specific fluctuations are not entirely filtered out and resulting in a sample bias as a consequence.

4.4 Insider trading law effectiveness

The purpose of this study is not to take a stand in the discussion whether insider trading contributes to a more efficient market or should be prohibited due to moral aspects but rather this study can be used as a *basis* for decisions. The study verifies the existence of insider trading during the 10 day period before profit warnings but whether the findings should be used as a motive for having an insider legislation or the opposition's idea of a complete abandonment of the law, whether it concerns market efficiency or the cost of upholding the law, is a matter of politics.

Should one be of the supportive side of the law the results presented in the thesis ought to generate a will to strengthening the law. However, the penalties connected to breaking the law can be argued to be of such severity that it should be sufficient to deter individuals from such activity. Thus it seems that it is rather a matter of strengthening the apparatus enforcing the law. Such enforcements could include increased information obligation or increased resources for agencies monitoring market activity. On the other hand, viewed from the opposing perspective the results can be used as a basis for arguing that the law's effectiveness is at best limited which in turn can lead to a questioning of the benefit vis-à-vis the cost of maintaining the law. As a matter of fact, studies show that the cost associated with the law are high (Eklund, 2003).

As is obvious from the above discussion the findings can be used by both sides and the authors are hoping that the findings can be a refreshing injection that can take the highly interesting and important debate to a higher level and spur further research on the subject of insider trading.

5 Conclusion

This section concludes the findings and also discusses some issues with them. To clarify the conclusions the research questions are included.

The purpose of this study was to investigate the existence of insider trading on the Stockholm Stock Exchange prior to profit warnings. It was achieved through conducting an event study measuring the cumulative abnormal return, CAR, for a sample of thirty profit warnings between the years 2003 and 2007 during a period of thirty days prior to the warnings.

Does it exist statistically significant evidence of non reported insider trading on the Stockholm Stock Exchange prior to profit warnings?

Testing at 95% significance level using a one-tailed test, a significant abnormal return was not found for the entire period of thirty days but for the last ten day period immediately prior to the announcement, significance was found. These results imply that in general, for companies making a profit warning, insider trading occurs during the ten days before the announcement. Since the sample constitutes such a large proportion of the profit warnings for the chosen timeframe, the authors feel confident in the reliability of the test performed concerning the cumulative average abnormal return. However it is import to bear in mind the limited ability to generalize the findings to a period other than the one tested as well as to events other than profit warnings. It thus follows that for the period tested insider trading has occurred but as far as any other time period is concerned one must be cautious in making claims of insider trading. As far as other events are concerned, profit warnings may be unique in the sense that profit warnings may give rise to a particular type of insider trading focusing on selling one's capital and thus protecting oneself from making a loss rather than simply trade for profit. Thus insider trading based on negatively price driving information might be higher than that of positive as insiders that otherwise would not engage in such activity waives his/her moral beliefs in order to protect one's wealth.

If so, what are the characteristics of the illegal trading in terms of pattern and timeframe?

Additional research questions included researching average abnormal returns on individual days prior to profit warnings. This gave rise to a test where the average return among the thirty companies was tested for significance every single day. The test found a significant abnormal return for six of the thirty days prior to the announcement. Since three of these days occurred during the first three days in the event window they were considered to be caused by sample issues, despite them being consecutive. The reasoning behind this decision was based on the presumed improbability that insider information would be known such a long time in advance and, in addition, that it would be unlikely for management to withhold such information almost thirty days before making the profit warning announcement. Abnormal returns was also found for two days within the ten day period for which a significant CAR was found which might suggest that on average insider trading is most frequent during these days.

How can the findings be related to the current debate regarding insider trading legislation?

Concerning the current debate on insider trading this study's findings can be used as an argument for both sides. The results can be interpreted as a reason to strengthen the law, either in terms of more severe penalties or by committing more resources to uphold it, or the results can be seen as sign of an ineffectiveness of the law. If so, decision makers should weigh any potential benefit with the law against its cost and implications on market efficiency.

6 Discussion

This section raises some issues of concern that the authors feel the need to properly address as well provides some recommendations for further research. It also includes an analysis of the impact of profit warnings on stock prices.

6.1 Profit warning impact on stock prices

Although not necessary to fulfill the purpose of the thesis and as such not necessarily needed in this thesis, the authors nevertheless deem it to be interesting to show and test the impact of a profit warning on the stock prices.

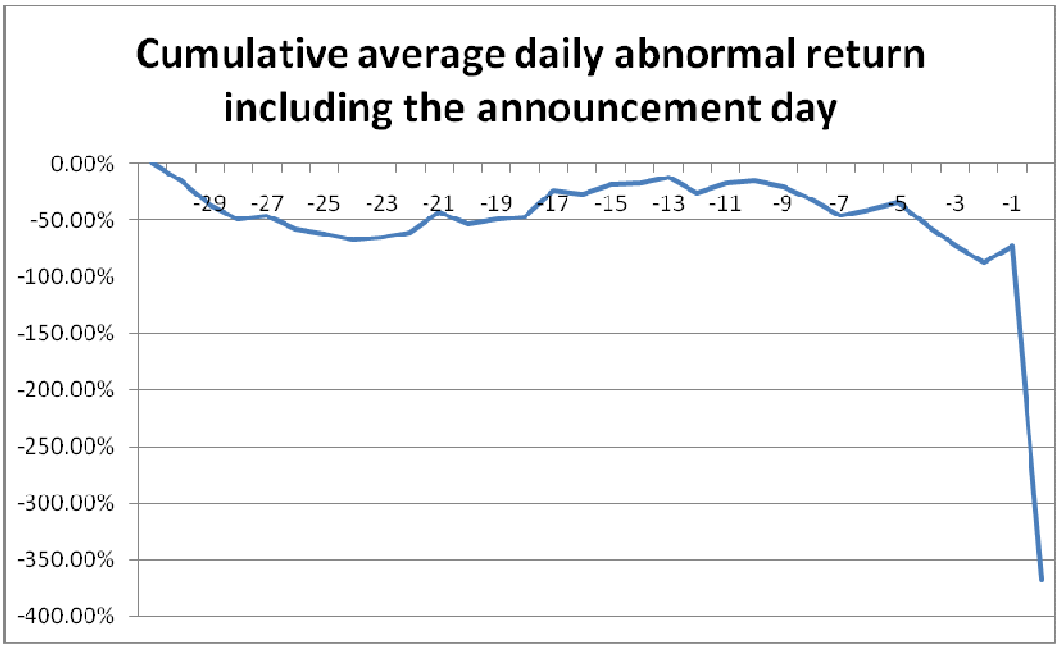


Figure 6-1 Cumulative average daily abnormal return including the announcement day

Not surprising the average return on the announcement day is negative. What is interesting though is the extreme magnitude of the stock price drop. On average the stock drops approximately 10% on the day of the profit warning.. Event though the abnormal return seem beyond any reasonable doubt significantly different from zero it is interesting calculating the t-statistic to confirm it. When performing a one-tailed test on a 95% significance level the test resulted in a t-statistic of -8.31 which is far higher than the critical value of -1.6991. From an efficient market perspective such a high price adjustment might be interpreted as an instant reflection of the new price driving information. However this study is unable to verify market efficiency (surrounding profit warnings) since the market might be lagging in incorporating the new information in the stock price which would be revealed by testing for a post-announcement drift. In order to do so the event window would have to be extended to include a number of days after the event. Once again this is not the concern of this particular study but from the author's perspective, and hopefully others', this would be of general interest.

The t-statistic for the test can be found in table 4-1. Significant t-statistics are denoted in bold.

Table 6-1 t-statistics for the announcement day

Test period	**t-statistic**
Announcement day	**-8.31**
At 95% confidence level and n-1 (29) degrees of freedom, critical value = 1.6991 for a one-tailed test	

6.2 Insider trading pattern and possible differences

Although rather thoroughly discussed in the concluding section the authors feel the need to highlight the possibility that different types of information give rise to different types of insider trading, or more likely *insider traders*. The authors believe that depending on the whether the price driving information are positive or negative, the insider trading activity will differ. It seems probable that negative news would make traders with otherwise solid moral beliefs inclined to act on such information. Imagine a substantial share holder that has a large proportion of his/her wealth allocated in this particular company knows a couple of days in advance that the share will plummet upon the release on the upcoming earnings adjustment or release. Does it not seem more likely that such a person would make an insider trade than increasing his/her investment in the company due to positive insider information?

To summarize, due to individuals' propensity to protect their wealth rather than act upon greed, insider trading activity seems likely to be more extensive in connection to negative information.

6.3 Recommendations for further research

Since only four years are covered and neither business field nor company size are taken into consideration in the study, the authors find it interesting to extend the sample so that these factors can be included. Such a study would require a much larger sample in order for a normal distribution for every factor to be assumed. It would first and foremost be highly interesting to research differences between larger and smaller companies since the extent of insider trading might differ between the two sizes as trade volume and information availability tend to be higher for larger companies. To see whether insider trading differ between business field and/or time periods is another possible avenue of research.

Since this study only research insider trading connected to profit warnings it provides limited insights to the extent of insider trading on the Stockholm Stock Exchange as a whole. Thus complementing these findings with event studies using other events such as mergers and acquisitions or reversed profit warnings would not only provide insights concerning those events but also reveal insider trading patterns on positive information. This study only covered negative price driving information which suggests that trades based on the information will only be sell- or possibly short transactions. As mentioned in the previous section the extent of such insider activity might very well be different from that based on positive news. Thus it would be of great interest to research whether this hypothesis holds true in reality.

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Additional internet sources

Finansinspektionen http://www.fi.se

Affärsdata http://www.afv.se

Appendix 1 – Company information

	Company	Date	List	Change [%] on day 0	Beta
1	ABB	2005-06-30	SSE Large Cap	-6.88%	1.240
2	Axfood	2005-09-14	SSE Large Cap	-2.81%	0.100
3	Electrolux	2004-09-23	SSE Large Cap	-8.07%	1.088
4	Elekta	2006-02-28	SSE Large Cap	-15.22%	0.615
5	Eniro	2003-09-08	SSE Large Cap	-8.39%	0.847
6	Getinge	2004-10-11	SSE Large Cap	-6.63%	0.441
7	Lundin Petroleum	2006-08-04	SSE Large Cap	-6.87%	1.399
8	Nokia	2004-04-06	SSE Large Cap	-17.13%	1.460
9	Nokia	2003-07-17	SSE Large Cap	-14.63%	1.585
10	Oriflame	2006-09-19	SSE Large Cap	-6.13%	1.175
11	SAS	2004-06-23	SSE Large Cap	-8.59%	0.876
12	Stora Enso	2004-01-20	SSE Large Cap	-6.86%	0.907
13	Tieto Enator	2006-04-13	SSE Large Cap	-9.72%	1.038
14	Tieto Enator	2007-01-18	SSE Large Cap	-14.22%	0.831
15	Trelleborg	2006-06-26	SSE Large Cap	-6.62%	1.168
16	Billerud	2005-01-07	SSE Mid Cap	-4.39%	0.638
17	Gunnebo	2005-06-15	SSE Mid Cap	-7.94%	0.902
18	Lindex	2004-06-14	SSE Mid Cap	-2.75%	0.548
19	Micronic	2006-12-21	SSE Mid Cap	-4.59%	1.492
20	Micronic	2006-06-16	SSE Mid Cap	-38.22%	1.378
21	Nolato	2007-03-29	SSE Mid Cap	-8.31%	0.708
22	Orc Software	2006-02-24	SSE Mid Cap	-16.91%	0.456
23	Scanmining	2007-02-02	SSE Mid Cap	-9.15%	1.673
24	Studsvik	2007-01-17	SSE Mid Cap	-9.42%	0.502
25	Boss Media	2006-10-02	SSE Small Cap	-18.67%	0.918
26	Rottneros	2005-10-14	SSE Small Cap	-5.67%	0.629
27	Sardus	2006-01-16	SSE Small Cap	-4.43%	0.220
28	Sardus	2004-12-09	SSE Small Cap	-6.10%	0.195
29	Switchcore	2005-12-22	SSE Small Cap	-11.11%	1.556
30	Teligent	2006-07-03	SSE Small Cap	-9.48%	1.014

Appendix 2 – Data and statistical tests

	Company	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
	ABB	-7.15%	0.96%	0.12%	-0.72%	1.67%	0.76%	0.55%	-0.82%	-0.02%	0.31%	-0.46%
	Axfood	-2.86%	-1.26%	-1.49%	1.93%	-1.47%	5.20%	0.74%	-0.57%	-1.06%	1.02%	0.41%
	Electrolux	-7.62%	-0.10%	0.51%	-0.47%	-0.18%	1.09%	-1.20%	-0.80%	0.21%	-1.35%	1.19%
	Elekta	-14.04%	4.20%	-0.47%	-2.68%	-1.40%	0.66%	-1.31%	-1.48%	0.25%	2.96%	0.52%
	Eniro	-8.64%	2.00%	-2.09%	1.41%	-0.43%	-0.12%	0.96%	-1.64%	-0.63%	0.15%	-1.22%
	Getinge	-6.64%	-1.04%	0.81%	-0.96%	-2.51%	1.14%	-0.36%	0.18%	2.63%	-1.50%	-0.05%
	Lundin	-7.75%	-2.30%	2.51%	3.79%	-0.25%	1.15%	-1.36%	-0.55%	2.44%	-3.56%	2.14%
	Nokia 2004-04-06	-16.54%	-0.77%	1.09%	-1.13%	0.80%	-0.92%	-0.72%	-1.21%	-0.06%	1.98%	-1.93%
	Nokia 2003-03-17	-13.70%	0.66%	-1.10%	-1.04%	-2.22%	2.41%	5.35%	1.16%	1.38%	-1.57%	-2.38%
	Oriflame	-5.61%	-1.20%	0.96%	3.41%	-2.64%	0.11%	1.31%	-1.86%	-1.36%	-0.67%	3.52%
	SAS	-9.97%	-0.81%	-0.66%	-3.08%	0.28%	0.39%	-3.33%	3.55%	0.23%	1.62%	-2.13%
	Stora Enso	-6.26%	0.42%	0.12%	0.01%	1.20%	-2.01%	1.34%	-1.31%	-2.48%	-0.65%	0.93%
	13	-9.95%	0.43%	-0.30%	-0.80%	0.09%	0.51%	-0.76%	-1.39%	-4.44%	0.93%	-0.54%
	18	-14.08%	-0.28%	0.07%	0.29%	-1.94%	-1.41%	-0.36%	1.10%	1.48%	0.08%	-2.22%
	Trelleborg	-6.73%	0.58%	-0.90%	-2.63%	2.27%	-0.64%	1.59%	-1.73%	0.30%	-1.10%	-1.09%
	Billerud	-4.66%	1.03%	-2.19%	-2.96%	-0.58%	-0.03%	-1.08%	0.84%	-0.47%	0.79%	0.14%
	Gunnebo	-7.58%	0.95%	-3.12%	-0.91%	-15.87%	-2.23%	0.10%	1.29%	-0.26%	0.01%	1.43%
	Lindex	-2.16%	0.92%	-0.19%	-2.17%	-0.16%	-0.58%	-2.32%	-0.05%	-0.92%	0.25%	0.80%
	Micronic 2006-06-19	-35.97%	10.18%	-2.51%	-2.34%	-0.70%	-1.83%	2.13%	0.76%	-1.49%	-4.19%	3.61%
	Micronic 2006-12-21	-5.13%	0.75%	-2.09%	-1.78%	0.47%	-0.86%	-0.70%	-1.02%	-1.36%	2.06%	-0.56%
	Nolato	-9.06%	1.99%	-0.39%	1.64%	0.74%	0.27%	0.86%	-2.13%	-1.24%	-1.90%	1.33%
	Orc Software	-17.26%	-0.36%	-1.38%	0.83%	-0.16%	-0.03%	-0.93%	-1.16%	-0.74%	0.68%	0.03%
	Scanmining	-8.86%	-2.97%	1.62%	-3.52%	-0.23%	0.01%	0.49%	0.58%	1.35%	0.93%	-1.38%
	Studsvik	-9.60%	-1.17%	1.43%	3.22%	2.39%	5.89%	3.24%	-0.37%	-1.16%	-1.52%	1.44%
	Boss Media	-19.01%	-0.64%	-0.54%	-0.72%	-0.16%	-0.85%	0.89%	-1.38%	-3.26%	-0.16%	1.08%
	Rottneros	-5.75%	0.04%	-0.11%	-0.10%	0.42%	0.03%	-0.69%	-0.34%	0.84%	-1.92%	-0.37%
	Sardus 2006-01-16	-4.51%	0.16%	-0.08%	-0.89%	0.31%	0.26%	1.19%	0.94%	-1.33%	1.43%	-0.14%
	Sardus 2004-12-09	-5.91%	-0.82%	-0.63%	0.07%	0.65%	0.36%	0.32%	-1.34%	0.86%	-0.92%	0.78%
	Switchcore	-11.59%	4.45%	-1.61%	-0.89%	-1.34%	0.28%	-0.68%	-0.39%	-0.36%	2.05%	-1.59%
	Teligent	-9.73%	-1.07%	-3.17%	-3.82%	0.57%	-3.13%	0.15%	-2.25%	-1.55%	-1.27%	-0.65%
	CAR	-294.32%	14.94%	-15.78%	-17.02%	-20.38%	5.87%	5.38%	-13.40%	-12.24%	-5.04%	2.65%
	CAAR	-367.81%	-73.48%	-88.43%	-72.65%	-55.63%	-35.25%	-41.12%	-46.51%	-33.10%	-20.87%	-15.82%
STD DEV		0.064677	0.024242	0.013869	0.020021	0.031332	0.018491	0.01662	0.012846	0.015362	0.016603	0.015339
MEDIAN		-8.20%	0.10%	-0.43%	-0.84%	-0.16%	0.07%	0.12%	-0.68%	-0.42%	0.05%	-0.01%
Mean		-9.81%	0.50%	-0.53%	-0.57%	-0.68%	0.20%	0.18%	-0.45%	-0.41%	-0.17%	0.09%
MEAN												
H_0	0%											
n	30											
t statistic	`	-8.31	1.13	-2.08	-1.55	-1.19	0.58	0.59	-1.90	-1.45	-0.55	0.32

Appendix 2 – Data and statistical tests

Company	-11	-12	-13	-14	-15	-16	-17	-18	-19	-20
ABB	-2.32%	3.00%	-0.33%	-1.25%	3.12%	1.11%	-0.49%	0.32%	2.14%	-0.46%
Axfood	-0.25%	1.27%	-0.48%	-0.42%	0.11%	-0.19%	0.51%	0.46%	-0.27%	1.66%
Electrolux	0.24%	0.88%	1.03%	0.30%	0.19%	-0.76%	0.16%	0.62%	-2.03%	1.09%
Elekta	-2.08%	1.55%	0.42%	-0.89%	3.09%	2.01%	-0.72%	-1.21%	0.27%	-0.26%
Eniro	0.17%	1.33%	-1.35%	-0.24%	-0.65%	-1.74%	3.14%	-3.22%	1.61%	-1.52%
Getinge	-1.08%	-0.66%	2.85%	0.50%	-0.20%	-0.37%	2.08%	1.44%	-0.50%	-0.04%
Lundin	0.97%	-4.71%	-0.27%	-1.25%	1.48%	2.71%	1.82%	-1.59%	2.26%	-0.32%
Nokia 2004-04-06	-0.11%	-0.84%	-1.79%	0.57%	0.77%	-1.98%	-0.16%	0.68%	-0.48%	-0.98%
Nokia 2003-03-17	-0.11%	1.28%	-2.94%	-2.27%	0.38%	0.05%	1.48%	-0.73%	2.77%	0.29%
Oriflame	-1.33%	-0.79%	0.08%	0.57%	1.14%	0.65%	-0.13%	-0.90%	0.52%	0.41%
SAS	2.79%	-0.54%	-1.40%	-0.84%	-1.07%	0.79%	2.04%	1.99%	-1.46%	1.49%
Stora Enso	2.66%	-0.87%	-0.79%	1.49%	0.01%	-1.04%	-1.48%	-1.52%	-0.41%	-1.54%
13	3.39%	-0.05%	-0.47%	-2.59%	-0.65%	0.04%	0.53%	2.80%	0.12%	0.27%
18	-1.17%	-2.43%	1.83%	0.85%	1.20%	-0.69%	-0.54%	1.57%	-0.63%	-0.04%
Trelleborg	-0.20%	-0.69%	0.67%	-1.37%	0.18%	-0.86%	-0.17%	-1.33%	0.82%	-1.14%
Billerud	1.25%	-0.06%	-0.20%	-1.56%	-0.84%	2.92%	-0.34%	0.23%	0.39%	0.78%
Gunnebo	-0.57%	0.15%	0.81%	2.29%	0.69%	0.51%	0.04%	0.75%	1.62%	-0.51%
Lindex	-0.49%	0.80%	-0.29%	0.70%	1.26%	-0.95%	-0.38%	0.55%	-0.90%	0.83%
Micronic 2006-06-19	3.26%	2.57%	0.69%	0.51%	-5.08%	2.57%	6.53%	-6.34%	2.27%	-0.20%
Micronic 2006-12-21	1.98%	-3.02%	-0.97%	1.26%	7.18%	-2.31%	-0.88%	0.54%	1.02%	-0.84%
Nolato	-0.02%	1.17%	0.52%	1.98%	1.42%	-0.35%	0.81%	4.27%	-2.00%	-1.73%
Orc Software	-0.53%	-0.11%	-0.56%	-1.94%	0.33%	-0.32%	3.97%	-1.34%	-0.85%	-1.78%
Scanmining	-0.32%	-4.03%	-1.00%	2.52%	-1.34%	-1.48%	0.53%	1.71%	0.14%	-2.21%
Studsvik	-1.72%	0.01%	-0.04%	3.71%	-2.94%	-1.37%	-0.08%	-2.80%	-0.41%	-8.52%
Boss Media	1.90%	-2.19%	7.09%	-1.65%	0.54%	-3.25%	-0.71%	0.38%	-0.34%	0.00%
Rottneros	0.69%	-1.24%	-0.10%	1.27%	0.58%	-2.26%	-0.82%	-0.69%	-0.13%	0.48%
Sardus 2006-01-16	0.34%	1.20%	0.38%	-0.61%	-0.69%	-0.02%	-0.82%	0.61%	-0.50%	0.38%
Sardus 2004-12-09	0.95%	-1.02%	0.11%	1.11%	-0.92%	0.71%	-2.68%	2.80%	-0.15%	0.35%
Switchcore	-1.66%	-2.90%	0.17%	-3.15%	-2.39%	1.11%	0.89%	-0.27%	-0.45%	-0.91%
Teligent	1.83%	-3.37%	1.42%	1.57%	1.74%	1.96%	8.51%	2.22%	0.12%	4.12%
CAR	8.45%	-14.32%	5.11%	1.16%	8.64%	-2.80%	22.62%	1.99%	4.57%	-10.86%
CAAR	-18.47%	-26.92%	-12.61%	-17.72%	-18.88%	-27.52%	-24.73%	-47.34%	-49.33%	-53.90%
STD DEV	0.015577	0.018959	0.017167	0.016463	0.020994	0.015598	0.022987	0.020612	0.01217	0.01983
MEDIAN	-0.07%	-0.32%	-0.07%	0.40%	0.26%	-0.25%	-0.02%	0.42%	-0.14%	-0.12%
Mean	0.28%	-0.48%	0.17%	0.04%	0.29%	-0.09%	0.75%	0.07%	0.15%	-0.36%
MEAN										
H_0										
n										
t statistic	0.99	-1.38	0.54	0.13	0.75	-0.33	1.80	0.18	0.69	-1.00

Appendix 2 – Data and statistical tests

Company	-21	-22	-23	-24	-25	-26	-27	-28	-29	-30			CAR	1-5	1-10
ABB	-0.62%	1.94%	0.39%	0.56%	0.24%	1.46%	-1.44%	-1.58%	-0.52%	0.77%			8.35%	2.78%	2.34%
Axfood	-0.27%	0.81%	-0.25%	-0.49%	0.43%	-0.04%	0.26%	-0.24%	-0.48%	-2.36%			3.22%	2.91%	3.45%
Electrolux	0.70%	0.98%	0.21%	0.25%	-1.33%	-0.79%	0.28%	0.54%	0.27%	0.52%			2.26%	0.85%	-1.11%
Elekta	2.38%	1.14%	5.47%	0.36%	-2.26%	-2.65%	1.97%	0.81%	-1.34%	-0.98%			8.35%	0.31%	1.25%
Eniro	-0.35%	1.79%	0.84%	1.06%	2.36%	-1.28%	-0.79%	0.21%	2.62%	-2.01%			0.37%	0.77%	-1.60%
Getinge	0.34%	-1.44%	-0.20%	-0.52%	-0.32%	0.41%	-0.37%	1.64%	-1.56%	-0.19%			0.14%	-2.57%	-1.66%
Lundin	0.57%	-2.38%	3.96%	-2.96%	-1.14%	2.33%	2.55%	1.71%	-0.33%	-1.24%			8.20%	4.91%	4.01%
Nokia 2004-04-06	0.55%	0.50%	2.18%	-0.52%	0.85%	-0.90%	-0.58%	0.11%	-0.37%	-0.45%			-5.84%	-0.92%	-2.86%
Nokia 2003-03-17	-0.98%	0.43%	0.05%	-3.61%	-1.49%	-2.47%	0.14%	-2.62%	-2.20%	0.23%			-9.66%	-1.29%	2.65%
Oriflame	-0.22%	-0.51%	-0.81%	-1.26%	-3.49%	-0.06%	2.81%	-1.47%	-4.06%	0.29%			-6.96%	0.64%	1.58%
SAS	0.35%	-2.65%	0.05%	-1.76%	0.13%	0.14%	-0.70%	-1.15%	-1.58%	0.46%			-6.85%	-3.88%	-3.93%
Stora Enso	0.98%	-1.63%	-1.26%	0.24%	1.39%	1.84%	-1.00%	-0.68%	0.89%	-1.94%			-7.11%	-0.26%	-2.45%
13	-0.64%	1.18%	-0.70%	0.34%	-1.57%	0.13%	0.61%	0.60%	-1.68%	-1.75%			-6.35%	-0.07%	-6.28%
18	2.66%	2.37%	-0.26%	1.63%	0.39%	0.47%	0.59%	-0.44%	0.78%	-2.52%			2.44%	-3.27%	-3.20%
Trelleborg	1.53%	1.45%	-2.66%	0.43%	1.42%	-0.82%	0.77%	-0.35%	-2.12%	0.48%			-7.33%	-1.31%	-3.35%
Billerud	1.56%	1.05%	-1.21%	1.29%	0.60%	-1.10%	-0.85%	1.30%	-0.84%	-0.27%			-0.43%	-4.73%	-4.52%
Gunnebo	-0.30%	-0.13%	-2.07%	0.95%	-2.34%	-1.30%	2.92%	-1.20%	-1.37%	-1.75%			-19.44%	-21.18%	-18.61%
Lindex	2.43%	-0.48%	-0.60%	-0.39%	1.39%	0.14%	-0.87%	0.18%	0.47%	0.14%			-0.88%	-2.18%	-4.42%
Micronic 2006-06-19	-1.66%	-2.66%	3.41%	-3.43%	-0.12%	-2.57%	-1.47%	1.51%	3.31%	-2.95%			3.78%	2.81%	3.63%
Micronic 2006-12-21	2.34%	-1.57%	0.14%	-2.22%	-0.74%	0.19%	5.44%	1.62%	1.18%	-1.30%			3.92%	-3.50%	-5.08%
Nolato	2.09%	-1.34%	0.55%	-1.04%	-0.46%	-0.16%	-0.45%	0.24%	-1.13%	1.62%			7.13%	4.25%	1.16%
Orc Software	-3.66%	4.17%	0.20%	-0.40%	0.79%	3.19%	-0.33%	-0.96%	0.11%	-2.73%			-5.95%	-1.10%	-3.22%
Scanmining	-0.22%	-0.32%	-2.89%	3.00%	10.26%	-4.47%	-0.44%	-1.23%	-3.42%	-0.25%			-8.56%	-5.09%	-3.12%
Studsvik	11.29%	0.98%	0.30%	2.60%	-0.44%	0.18%	0.04%	-0.45%	-0.79%	0.30%			13.22%	11.75%	13.37%
Boss Media	-1.80%	-0.53%	-1.25%	0.62%	-1.06%	3.55%	-3.43%	-1.97%	-0.49%	1.73%			-8.58%	-2.91%	-5.73%
Rottneros	0.24%	0.37%	4.29%	0.72%	-0.55%	0.92%	1.95%	-1.07%	-2.40%	-0.09%			-0.04%	0.28%	-2.19%
Sardus 2006-01-16	-0.33%	0.59%	0.23%	-0.39%	-1.62%	2.51%	0.12%	-0.15%	-0.34%	-0.39%			2.34%	-0.25%	1.84%
Sardus 2004-12-09	0.38%	0.95%	-1.01%	-0.12%	-0.86%	-0.09%	0.67%	-1.17%	0.51%	-1.04%			-1.21%	-0.37%	-0.67%
Switchcore	1.48%	-1.48%	-2.02%	-1.42%	-0.58%	-2.80%	-0.32%	-3.33%	-3.24%	1.85%			-21.52%	0.88%	-0.09%
Teligent	-2.28%	0.22%	-2.11%	0.56%	-4.25%	-7.88%	-4.65%	-3.08%	-1.31%	0.35%			-20.53%	-10.63%	-16.20%
CAR	18.54%	3.80%	2.97%	-5.93%	-4.37%	-11.92%	3.44%	-12.68%	-21.45%	-15.45%	0.00%				
CAAR	-43.05%	-61.59%	-65.39%	-68.36%	-62.43%	-58.06%	-46.14%	-49.58%	-36.90%	-15.45%	0.00%				
STD DEV	0.024972	0.015714	0.02009	0.015593	0.02442	0.022966	0.018936	0.013531	0.016249	0.013203		TOT CAR	**-73.48%**	**-32.36%**	**-55.01%**
MEDIAN	0.34%	0.40%	-0.08%	0.06%	-0.45%	-0.05%	-0.14%	-0.40%	-0.65%	-0.26%		STD DEV	0.0856	0.0540	0.0578
Mean	0.62%	0.13%	0.10%	-0.20%	-0.15%	-0.40%	0.11%	-0.42%	-0.71%	-0.52%		MEAN	-2.45%	-1.08%	-1.83%
MEAN												MEDIAN	-0.65%	-0.31%	-1.93%
H_0												H_0	0	0	0
n												n	30	30	30
t statistic	1.36	0.44	0.27	-0.69	-0.33	-0.95	0.33	-1.71	-2.41	-2.14		t-stat	-1.5678	-1.0941	-1.7363