

The Speed of Adjustment of Stock Prices to New Information

- An event study on the Swedish stock market

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Tutor: Gert Sandahl

Authors:	Year of Birth
Jonas Hartman	1987
Rasmus Rodestedt	1987

Abstract

The area of efficient markets has been of great interest to economists, scientists and frankly speaking the whole society for centuries. Ever since the days of Eugene Fama the Efficient Market Hypothesis has divided the financial community into sympathizers and opponents. A great variety of studies have either proved or disproved the theory. Our aim with this study was to join the discussion and test whether the semi-strong form of the EMH is applicable on the Swedish stock market. In other words we wanted to know what the speed of adjustment of stock prices to new information was and if there were any unusual patterns of trade surrounding the release of new information. Using the methodology of an event study and intraday data we found both evidence supporting the EMH and one quite interesting anomaly. As it turns out, when companies release a report that is above expectations the stock price increases more rapidly than it decreases subsequent to a bad report.

Keywords: EMH, Event Study, Anomaly, Stock Market, Interim Reports

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1. Introduction

1.1. Background

The number of trades during one day at the OMX was during 2009 on average 120 000 and the average turnover per day was approximately 13,6 billion Swedish kronor¹. It's not very hard to understand that this market is highly important to both corporations and investors and not to mention Sweden as whole. Here corporations seeking financing meet with investors seeking higher returns. This meeting between two very diverse parties is constantly controlled by a set of rules. Some rules are set by the government and the owners of the market while others exist because of market forces and the market itself. These self-fulfilling rules set by the market derive from every individuals wish to gain profit and they are often written down in theories, such as the Law of One Price. A similar theory is the Efficient Market Hypothesis (EMH)² which states that all available information is considered in the market price. This is very interesting to research closer because if the hypothesis is true there would be no need for investors to analyze firms and macro factors. A whole industry with funds and investors would then be completely unnecessary since a wide index portfolio would not be beaten over time on a risk-adjusted basis. One part of the efficient market hypothesis is the direct adjustment of market-prices to new information which is the interest of this study³.

There are two kinds of markets to which the EMH can be applied; the exchange market and the finance market. The finance market consists of the money market and the stock market; the stock market being the subject of research in this study. Further the stock market can be divided into a primary market⁴ where new issues are made and a secondary⁵ where trade between two parties occurs. It is at this secondary market that the price of the stock is determined. The price is set when participants at the market analyze both the financing and operating part of the company, discounting all future cash flows, giving the company a net present value. This net present value is then revised when new information is released,

¹¹ <http://www.redeye.se/aktieguiden/nyhet/bors-omsattning-sjonk-men-avslut-okade-2009-nasdaq-omx-vd> at 10/4-10, 11am

² Eugene F. Fama, Efficient Capital Markets: A Review of Theory and Empirical Work, The Journal of Finance, Vol. 25, No. 2

³ Ibid, Page 383

⁴ <http://www.businessdictionary.com/definition/stock-exchange.html>

⁵ Ibid

altering the future cash flows. In that way information is always incorporated in the price, making the market an efficient one.

Studies on the effects of new information to the value of a company have been done before and are generally known as event studies⁶. They can be applied to a large number of areas such as: annual reports, dividend reports, corporate financing or investments. Event studies can be based on financial theory and used to test that theory through statistical analysis⁷.

1.2. Problem analysis

The basis of the problem concerning efficient markets is determination of prices. Ever since man started trading with each other the price, regardless of currency or trade of objects, has been the main focus. The Efficient Market Hypothesis works in a way that it assumes that every individual participating in the market has rational expectations⁸. This means that when new information reaches the market, every single person evaluates that information, reassess their expectations and collectively they are on average right. This could very well mean that one-by-one they are all wrong, but through normal distribution the market as a whole is always right. In the long run this amounts to the fact that over time an investor cannot with reliability beat the return of the market⁹. If anyone were to find an anomaly in the market, it would have to be consistent and the returns would have to be substantial enough to compensate for transaction costs¹⁰. Otherwise one could still argue that the market is efficient. Even if all these factors are met and the market can be said to be inefficient, the arbitrage opportunities that would occur, would also soon disappear because of the self-regulating powers of an open market.

The aim of this study is not to research whether all markets are efficient or not, but rather to study the phenomena of efficient markets. More specific, we want to study the semi-strong form of the EMH, the presumption that the market reacts instantly to new information¹¹. If

⁶ Nonparametric Event Study Tests, Arnold R. Cowan, Review of Quantitative Finance and Accounting 2 (1992), p. 343-358

⁷ Ibid, Page 23

⁸ Eugene F. Fama, Efficient Capital Markets: A Review of Theory and Empirical Work, The Journal of Finance, Vol. 25, No. 2, Page 383

⁹ Human Behavior and the Efficiency of the Financial System, Robert J. Shiller

¹⁰ Thomas E. Copeland, J. Fred Weston, Kuldeep Shastri, Financial Theory and Corporate Policy, Published as Pearson Addison Wesley, 2005, Page 390

¹¹ Eugene F. Fama, Efficient Capital Markets: A Review of Theory and Empirical Work, The Journal of Finance, Vol. 25, No. 2, Page 383

this is true, we should be able to see an immediate reaction in the share price. However, in the real world, for a market or in this case a share price to change, people will actually have to react to information. This reaction consists of several moments: both seller and buyer have to recognize the information, value it and make the decision to buy or sell. With modern technology these moments should be almost instantaneous and the arbitrage opportunity should be lost, but we still have not found any study to tell us how fast this reaction is, at least not on the Swedish market. During our studies we have come across a number of studies which will tell you that the market is efficient, but few that actually use intraday data, allowing them to investigate down to the minute when the market has reached its new equilibrium price.

The main question that we want to answer is whether the Swedish stock market is efficient and adapts instantly when new information is released. We will try to answer this using one minute data, allowing us to say how fast the market reacts to new information. As an addition to this question we also want to know how fast a professional investor would have to trade to be able to gain abnormal returns. These two questions look very similar and it is easy to believe that one would answer the other, but that is not the case. When investigating the speed of adjustment to new prices we will use volatility to measure when the price is stable and when investigating the trade perspective of speed of adjustment we use cumulative returns. We do this because volatility does not tell us anything about the direction of the stock price only that it actually moves. Cumulative returns on the other hand should provide us with a graph that shows the time of increasing returns up until constant prices.

We chose the Swedish market for three reasons: the first being a purely selfish perspective. Living in Sweden, this is the market we face every day in news reports and the companies that catch most of our interest. It was also the only market where we could find intraday data. The third reason is that although our research was fairly limited, we could not find any other updated study asking the same questions that this thesis does. The Swedish stock market OMX has divided its companies into categories depending on their market capitalization¹². This provided us with a great opportunity to investigate whether any differences could be found in market behavior depending on the size of the company. The difference in size will surely affect the number of trades during a random day. Will it also affect the patterns of trade during the announcement day? By patterns of trade we mean the movements of both the

¹² <http://www.nasdaqomxnordic.com/aktier> , 20/5-10 at 1pm

volatility and the cumulative returns during the event window. The event window is defined as the time period of interest. Another categorization that we thought would be interesting was to look at the difference between companies that exceeded market expectations and companies that did not. Both these categorizations and comparisons are of most interest to traders who wish to find a strategy that regularly exceeds market returns.

Advances in technology and globalization are the two main factors which made us decide that this research would only deal with the most recent announcements. The interest here lies in trying to witness any changes in the efficiency of markets. When using data from a single period in time one also removes the disturbance factor of differing conjunctures. We also made the choice to only use interim reports since they are expected, they are preceded by estimates and because annual reports contain information which has already been released once.

1.3. Target audience

As already pointed out this study is of most interest to every participant in the market, but probably more interesting if you have the perspective of a regular trader. This is because if this study shows that the market is not efficient then there probably will be an arbitrage opportunity. It should also be of utmost interest to the owners of OMX to know that their market works in a satisfactory way. In our opinion this study should also attract some interest from the academic world, since it is a great follow up and an updated version of earlier studies in the area of efficient markets.

1.4. Research questions

- What is the speed of adjustment of stock prices to new information and does this mean that the market is efficient?
- Are there any differences in the patterns of trade between large and small companies surrounding the time of announcement of new information?
- Are there any differences in the patterns of trade between winners and losers surrounding the time of announcement of new information?

- At which point in time subsequent to an announcement will a trader lose the opportunity to gain abnormal returns?

1.5. Purpose

The purpose of this study is to be able to describe the trading patterns surrounding interim announcements on the Swedish stock market, patterns such as high volatility or peaking returns during certain periods. By doing this two measurements of speed of adjustment will be achieved. We also want to find out if there are any arbitrage opportunities surrounding the time of announcement of new information. If we are able to find such opportunities, it seems necessary to find out how fast an investor would have to act to gain returns higher than market average.

When conducting this study we decided to divide all companies into categories such as large, small, winners and losers and the purpose of doing this is to see differences between groups. Since the small companies attract much less attention from investors their event window is bound to have much fewer closures and therefore several minutes with the same value. This should affect both returns and volatility, but the interesting question is how much and in which way. The same goes for winners and losers, where one could argue that through risk aversion or other human behavioral the results should diverse. If we are able to answer all these questions in a satisfactory way it will give information about the Swedish stock market as a whole and hopefully also give privies to the market an insight to market efficiency and market forces.

The purpose of the theoretical framework is to create an understanding for the subject. A greater understanding will then help us find the most applicable method and form useable hypothesis.

1.6. Key terms

Abnormal return – Returns that are in excess of what is normal.

Anomaly – A deviation from the normal rules and standards of the market.

Arbitrage – A simultaneous buy and sell of securities to profit from unequal prices.

Benchmark population – A sample of prices or returns collected during days without any announcements.

Correlation – A statistical measure of how two series move in relation to each other.

Event – The exact time the interim report is released.

Event study – Is a methodology often used to evaluate how an event affects the value of a company. The aim of most event studies is to find the abnormal returns associated to the event¹³.

Event window – The time-period in which we measure one minute prices. For all stocks we start measuring 10 minutes before the news release till 60 minutes after it.

Heavy tails – In a normal distribution when the tails are not exponentially bounded, they are heavier than what is normal¹⁴.

Losers - Stocks that have a lower price one hour after announcement than ten minutes before.

NasdaqOMX – All the companies used in this study are listed at the Nordic market, either in large cap or in small cap. The OMX follow all the standard EU incentives and is a well known and respected financial market. Companies listed on the large cap all have market capitalizations exceeding one billion Euros and companies listed on the small cap fall below 150 million Euros¹⁵.

Short sell – Is used to make profits when the price of the stock is expected to fall. You sell assets that have been borrowed from a third party with the intention of buying them back when the price has dropped. In the end you return the stocks to the original owner and gain the price difference in returns.

SIX Edge – A computer software which allows the user to study the financial markets including intraday data from the OMX.

“SIX Generalindex” – Displays the average development of the Swedish stock market’s A and O-list¹⁶.

¹³ Nonparametric Event Study Tests, Arnold R. Cowan, Review of Quantitative Finance and Accounting 2 (1992), p. 343-358

¹⁴ A practical guide to heavy tails: statistical techniques for analyzing heavy tailed distributions, Robert Adler, Raisa Feldman, Murad Taqqu, 1997, p. 2

¹⁵ <http://www.nasdaqomxnordic.com/aktier> , 20/5-10 at 1pm

¹⁶ <http://www.fondbolagen.se/Index/SIXGX.aspx>, 20/5-10 at 1pm

Spread – The difference between bid and ask prices for a stock or other securities.

SPSS – A statistical analysis program with a great variety of statistical test, including the Wilcoxon used in this study.

Transaction costs – A small fee that the owners of the market charge investors at each trade.

Winners – Stocks that have a higher price one hour after announcement than ten minutes before.

2. Theoretical Framework

2.1. The Random Walk and Efficient Market Hypothesis

The whole idea of efficient markets was first expressed by the French mathematician Louis Bachelieres in the year 1900. In his dissertation “Theorie de la Speculacion” he uses the law of probability to establish that price changes are consistent with the market at that instant. In the opening segment Bachelieres states that:

“...past, present and even discounted future events are reflected in market price.¹⁷”

This is the very essence of informational efficiency and the backbone of this thesis. The purpose or object of Bacheliere’s study is to:

“Research for a formula which expresses the likelihood of a market fluctuation...¹⁸”

This is done by applying mathematic models of probability to different buy and sells strategies of options and futures. The conclusion of the study is that for example commodity prices fluctuate randomly and that

“...the market, unwittingly, obey a law which governs it, the law of probability.¹⁹”

The next person to contribute to and extend the theory was Kendall in 1953 when he followed up on Karl Pearson’s (1905) Random Walk²⁰. Through an extensive analysis of economic time-series during the period of 1929-1938 he investigated whether information about future stock prices were imbedded in old price information. His hypothesis states that:

¹⁷ The random character of stock market prices, Paul H Cootner, The M.I.T. Press 1964, Page 17

¹⁸ Ibid, Page 17

¹⁹ Ibid, Page 75

²⁰ Karl Pearson appealed to the readers of scientific magazine *Nature* to help him find a solution to the problem of where to start searching for a drunk man left in a field. Or more scientifically “A man starts from a point O and walks l yards in a straight line; he then turns through any angle whatever and walks another l yards in a second straight line. He repeats this process n times. I require the probability that after these n stretches he is at a distance between r and $r + \delta r$ from his starting point, O.”. One of the answers came from Lord Rayleigh who proposed that through the calculus of probability you are most likely to find him closer to where he had been left than to any other point.

“The series looks like a "wandering" one, almost as if once a week the Demon of Chance drew a random number from a symmetrical population of fixed dispersion and added it to the current price to determine the next week's price.²¹”.

This has become a very famous citation and it is clear that Kendall is a great supporter of the Random Walk Theory and that he believes that it is impossible to earn excess returns by studying past stock prices. When the correlation test is done all intervals and tests support his hypothesis except the serial correlation between averaged series. According to Kendall this is very disturbing because if this is a general correlation it would be hard for economists to draw any conclusions about averaging series. Despite this he summarizes his work in a rather presumptuous way, saying that:

“...it is unlikely that anything I say or demonstrate will destroy the illusion that the outside investor can make money by playing the markets, so let us leave him to his own devices.²²”.

Following up on Kendall's study, Eugene Fama presented his paper “The behavior of stock market prices” in 1965²³. In this paper he investigates whether the random walk is applicable by using data from the Dow Jones Industrial Average during the period of 1957 to 1962. The main hypothesis is that if history repeats itself in any way reading charts could give excess returns, which means that the efficient market hypothesis would not hold. The hypothesis is broken down into two different questions: Are successive price changes independent and do price changes conform to some kind of probability distribution? The first question could lead to some implications according to Fama. The independence of price changes depends on the independence of every individual investor, which is not always the case. In reality it is probably a few institutions that lead the opinion and affect other smaller investors in their process of decision making. There could also be a problem when assuming that new information is independent, since for example good news is more likely to be followed by more good news. Both these problems can according to Fama be solved by the fact that investors act sophisticated. Sophisticated investors will short-sell a stock that is overvalued and consequently offset the opinion-leader effect. The same thing will happen with the independent information problem when investors learn that this relationship exists. The second question of whether price changes can be conformed to a probability distribution is

²¹The Analysis of Economic Time-Series-Part I: Prices, M. G. Kendall and A. Bradford Hill, Journal of the Royal Statistical Society. Series A (General), Vol. 116, No. 1 (1953), Page 13

²² Ibid, Page 20

²³The Behavior of Stock-Market Prices, Eugene F. Fama, The Journal of Business, Vol. 38, No. 1 (Jan., 1965), pp. 34-105

much more difficult to answer. Both Kendall in 1926 and More in 1941 tried to approximate price changes to a normal distribution function, but both came to the conclusion that when doing so the tails were too heavy. When conducting his own study Fama came to the same conclusion as previous researchers.

In his paper Fama tests the Random Walk Theory by using serial correlation coefficients and different time periods. He finds no significance in either the short or the long run and after all the tests are done he concludes that no investor can gain excess returns by studying information imbedded in old prices. This is strong evidence that the market is efficient and that chart readers have yet to bring up good empirical facts to support their beliefs.

One of the earliest and most cited event-studies of market reactions to new information was presented by Fama, Jensen, Fisher and Roll in their paper “The adjustment of stock prices to new information” (1969)²⁴. Here they examine market reactions to the information of a stock split, but first they conclude that a stock split is often conducted in times when the company experiences higher than average market returns and that a split is often followed by increased dividends. This information is very important since it tells us that the market considers the information of a future split to be something positive and reacts appropriately. This is what the authors mean by “implicit” in the introduction to the paper:

“The prime concern of this paper is to examine the process by which common stock prices adjust to the information (if any) that is implicit in a stock split.”²⁵

The authors give rise to two significant questions that are most important to this paper:

“...is the adjustment so rapid that splits can in no way be used to increase trading profits?”²⁶

The answer is quite clear and it is shown through empirical evidence that trading profits cannot be made unless you are able to foresee which split is going to have higher dividend payouts in the future. And if you do find these higher trading profits it is not because of the split itself but because of superior analytical talent. The second question is also very much in parity with our thesis:

²⁴The Adjustment of Stock Prices to New Information, Eugene F. Fama, Lawrence Fisher, Michael C. Jensen, Richard Roll, *International Economic Review*, Vol. 10, No. 1 (Feb., 1969), pp. 1-21

²⁵ *Ibid*, Page 1

²⁶ *Ibid*, Page 17

“...consider the policy of buying splitting securities as soon as information concerning the possibility of a split becomes available.²⁷”.

To answer this, the authors analyzed two different sample sets, one that was drawn from a paper presented by Bellemore and Blucher (1956) and one from their own paper. The conclusion is consistent for the two samples and suggests that

“...the policy of buying splitting securities as soon as a split is formally announced does not lead to increased expected returns.²⁸”.

The conclusion of the whole paper then states that

“...the evidence indicates that on the average the market's judgments concerning the information implications of a split are fully reflected in the price of a share at least by the end of the split month but most probably almost immediately after the announcement date. Thus the results of the study lend considerable support to the conclusion that the stock market is "efficient" in the sense that stock prices adjust very rapidly to new information.²⁹”.

Even though this paper was presented in the 60's when the speed of trade was much slower the findings and conclusions are very much significant and in time with our paper.

The next paper to be introduced by Eugene Fama was published in 1970³⁰ in The Journal of Finance and it is one of the first to properly introduce and investigate the subject of market efficiency and more specifically the Efficient Market Hypothesis. The reason this is such an important paper is because it somewhat summarizes all the work done in the area of efficient markets up until that date. It provides a very important framework for future research and does not only answer a lot of questions but also poses a few to consider.

Market efficiency can be categorized into three different levels: The Weak form efficiency, The Semi-strong form efficiency and The Strong form efficiency. These different levels are the basis for the paper published by Fama and much of the additional research done in the subject. Therefore we believe it is of relevance to our paper to distinguish the differences between these levels. The reader should keep in mind that the general notion of market

²⁷ The Adjustment of Stock Prices to New Information, Eugene F. Fama, Lawrence Fisher, Michael C. Jensen, Richard Roll, International Economic Review, Vol. 10, No. 1 (Feb., 1969), pp. 1-21, Page 18

²⁸ Ibid, Page 18

²⁹ Ibid, Page 20

³⁰ Efficient Capital Markets: A Review of Theory and Empirical Work, Eugene F. Fama, The Journal of Finance, Vol. 25, No. 2, 1970

efficiency is that “all prices fully reflect all relevant information” and that these levels only define what is understood to be relevant. One should also know that in the original efficient market theory, the market conditions are assumed to be perfect which according to Fama means:

“(i) there are no transactions costs in trading securities, (ii) all available information is costlessly available to all market participants, and (iii) all agree on the implications of current information for the current price and distributions future prices of each security.³¹”.

Even though most markets exist without perfect conditions you cannot rule out the possibility of market efficiency, which Fama and other papers have proved through empirical studies.

The weak form efficiency: “No investor can earn excess returns by developing trading rules based on historical price or return information. In other words, the information in past prices or returns is not useful or relevant in achieving excess returns.³²”.

This is the area that generated most of the empirical studies up until the 70`s and through those studies one very important model was created: “The Fair-Game” model. The “fair-game” relies on the fact that the market equilibrium for prices is found through expected returns and that it can be divided into the special cases of “The Random Walk” and “The Submartingale”. However these cases will not be further investigated since the subject has already been discussed. The conclusion made by Fama after studying most of the work done in the weak form efficiency-area is that the market is fully efficient and that no investor can gain abnormal returns.

The semi-strong efficiency: “No investor can earn excess returns from trading rules based on any publicly available information.³³”.

This is the kind of efficiency that we will be dealing with in our thesis and the very essence of it is that when new information is released the impact of that information is instantaneously reflected in the price. Most if the work done in this area: Fama, Jensen, Fisher and Roll (1969,

³¹ Efficient Capital Markets: A Review of Theory and Empirical Work, Eugene F. Fama, The Journal of Finance, Vol. 25, No. 2, 1970, Page 387

³² Financial Theory and Corporate Policy, Thomas E. Copeland, J. Fred Weston, Kuldeep Shastri, Pearson Addison Wesley, 2005, Page 355

³³ Ibid, Page 355

Ball and Brown (1969)³⁴ and Patell (1984)³⁵ is consistent with the fact that it is impossible to earn excess returns and that the market is efficient.

The strong form efficiency: “No investor can earn excess returns using any information, whether publicly available or not.”³⁶.

The work done in this area is very ambiguous and studies have shown that there are market imperfections. Phenomenon such as insider trading, momentum strategies, small firm effect and the January effect all show that it is possible to earn abnormal returns when in possession of monopolistic information³⁷.

2.2. Anomalies in the stock market

In the recent year we have seen the effects of a global financial crisis caused by the sub-prime loans. In the year 2000 some stocks at the Swedish market were valued at P/e 100, e.g. Ericsson, the largest company in Sweden which dropped more than 90% when the bubble burst. Is this rational behavior from investors? In 2002 Daniel Kahneman was awarded the Nobel Prize in economics for his work in behavior economics. Kahneman believes that decision making is not only based on cost-benefit analyses, but rather on emotions, guesses and rule of thumb. One significant human factor that can be observed is over confidence, for example: entrepreneurs believe that they have 80-100% chance of success; in reality one third has gone bankrupt in five years time. Another interesting human behavior is that the feeling of a loss is more intense than that from a gain, which leads to a loss aversion³⁸. If Kahneman is right in his predictions, the market will behave irrationally due to human psychology. There are large quantities of market imperfections that have been researched; two of them will be presented briefly.

³⁴ An Empirical Evaluation of Accounting Income Numbers, Ray Ball and Philip Brown, Journal of Accounting Research, Vol. 6, No. 2 (Autumn, 1968), pp. 159-178

³⁵ THE INTRADAY SPEED OF ADJUSTMENT OF STOCK PRICES TO EARNINGS AND DIVIDEND ANNOUNCEMENTS, James M. PATELL and Mark A. WOLFSON, Journal of Financial Economics 13 (1984) 223-252

³⁶ Financial Theory and Corporate Policy, Thomas E. Copeland, J. Fred Weston, Kuldeep Shastri, Pearson Addison Wesley, 2005, Page 355

³⁷ Efficient Capital Markets: A Review of Theory and Empirical Work, Eugene F. Fama, The Journal of Finance, Vol. 25, No. 2, 1970

³⁸ Finance & Development [0145-1707], Clift Jeremy, year: 2009 vol.:46 issue: 3 page: 4

2.2.1. The momentum effect

The momentum strategy is about buying stocks with the highest return in the preceding period short sell the ones with the lowest return and hold the portfolio for a given period of time. The logic behind this is that traders tend to overreact to information and that this non-rational behavior can be exploited. In a paper by Jenni Bettman, Thomas Maher and Stephen Sault³⁹ a test of the momentum strategy is done on the Australian stock market. In this test their rule of decision is to buy the winners in the preceding six months and short sell the losers. The portfolio is held for six months and then the procedure starts all over again. To make the test interesting from a trading perspective all transactions are made using the closing sell and buy prices. Their conclusion is that there do exist excess returns on the Australian market, at least during their test-period of 2001-2007. This is true even when considering transaction costs in comparison with their benchmark. A finding like this one is observed by Jegadeesh and Titman in 1993⁴⁰ and similar results have been shown by others⁴¹.

2.2.2. The January effect

On average January has had the highest return of all months, a phenomenon called the January effect. The most obvious effect of this can be seen in small firms that have reduced in value before January and then rocket during the month. This anomaly has two possible explanations: the first is that investors sell losers to reduce their tax payments and when they buy back the stock raises again. The second explanation is called window dressing which means that funds and capital investors want to show off an acceptable portfolio, a portfolio without small and insignificant companies, in the annual report. This also means that smaller firms are sold before January and then bought back, making the market rise quickly. Both these explanations and the existence of the January effect are discussed in “The evolution of the January effect” by Nicholas Moller and Shlomo Zilca⁴². The authors use data from 1927-2004 at the NYSE, AMEX and NASDAQ and find evidence that the January effect does exist.

³⁹ Momentum profits in the Australian equity market: A matched firm approach, Jenni L. Bettman, Thomas R.B. Maher, Stephen J. Sault, *Pacific-Basin Finance Journal* 17 (2009), 565–579

⁴⁰ Returns to buying winners and selling losers: implications for stock market efficiency, Jegadeesh and Titman, *The Journal of Finance* 48, 65–91.

⁴¹ Momentum Strategies, LOUIS K.C. CHAN, NARASIMHAN JEGADEESH and JOSEF LAKONISHO, *THE JOURNAL OF FINANCE* VOL. LI, NO 5, DECEMBER 1996

⁴² The evolution of the January effect, Nicholas Moller and Shlomo Zilca, *Journal of Banking & Finance* 32 (2008) 447–457

2.3. Speed of adjustment of securities to new information

Before examining the exact time it takes for the stock market to react to new information we need to know that it actually reacts. A study published by Ball and Brown in 1968⁴³ examines the significance of annual reports and income numbers. This is one of the first empirical interpretations of this specific problem and by using regression models and chi-square tests the authors found some very interesting results. One-half of all the information released from a company during one year can be found in the income numbers, but about 10-15% can be found only in the income numbers and not in, for example the interim reports. The effect of this is that the market is very efficient in anticipating differing income numbers early in the period preceding the annual report. This phenomenon is somewhat an indicator of strong-form efficiency, but more research is needed to actually conclude such a statement.

The speed of adjustment of stock prices to new information was thoroughly examined and published in 1983⁴⁴ by Patell and Wolfson in their paper “Intraday speed of stock price adjustment”. It is not only the speed of adjustment at the time of announcement that is tested, but also the average intraday returns, the variance surrounding the announcement day and the serial dependence of price changes. The data used in the study consists of 571 earnings and dividend disclosures released during 1976 and 1977. Much of the conclusions in this study are in line with other similar tests and show that trading profits largely disappear within five to ten minutes and that variance and serial correlation between prices may last several hours after the time of announcement. However the authors finish off by saying that:

“The influence of information arrival is one of the most challenging problems in modeling market behavior...⁴⁵”.

Although the paper published by Ederington and Lee⁴⁶ does not explore the short run price adjustments to new information in stock markets but instead focuses on the much more liquid interest rate and foreign exchange markets, it does provide important information regarding the patterns of speed of adjustment. The authors do not only answer how quickly new

⁴³ An Empirical Evaluation of Accounting Income Numbers, Ray Ball and Philip Brown, *Journal of Accounting Research*, Vol. 6, No. 2 (Autumn, 1968), pp. 159-178

⁴⁴ THE INTRADAY SPEED OF ADJUSTMENT OF STOCK PRICES TO EARNINGS AND DIVIDEND ANNOUNCEMENTS, James M. PATELL and Mark A. WOLFSON, *Journal of Financial Economics* 13 (1984) 223-252

⁴⁵ *Ibid*, Page 250-251

⁴⁶ The Short-Run Dynamics of the Price Adjustment to New Information, Louis H. Ederington and Jae Ha Lee, *The Journal of Financial and Quantitative Analysis*, Vol. 30, No. 1 (Mar., 1995), pp. 117 -134

information is incorporated in the market but also how long it takes for the volatility of the price to reach normal levels after new information has been released. This second part of Ederington and Lee's research is not of concern to this paper's research, but it comes with a very significant attendant question:

“Is the high volatility due to larger or more frequent price changes?⁴⁷”.

This is interesting because if the price changes after new information are large and few that would imply a more efficient market. The methodology for the research is serial-correlation using ten second intervals and Monte-Carlo simulations.

Ederington and Lee find that the price changes in the interest market occur in more frequent and smaller steps which indicates that trade is taking place at non equilibrium prices and that abnormal returns can be earned. The conclusion about price change patterns is very revealing and provides great information for further research. This is how the authors summarize their work:

“The market price begins adjusting almost immediately following a news release – generally within the first 10 seconds. The price adjusts in a series of small, but rapid price changes, so it is clear that some trades occur at nonequilibrium prices. However, the major adjustment to the initial release is basically complete within 40 seconds, certainly 50 seconds, of the release.⁴⁸”.

They also find evidence that the price continues to fluctuate after 40 seconds, perhaps due to overshooting, but that these price changes are independent of the first major change.

Many other studies have been made on the speed of adjustment of stock or other security prices to new information and most of them point towards the same conclusion; that the market is efficient and that information is incorporated in the price within the first minutes, see e.g. Pierluigi Balduzzi, Edwin J. Elton, and T. Clifton Green (2001)⁴⁹ and Jan Muntermann and Andre Guettler (2005)⁵⁰.

⁴⁷ The Short-Run Dynamics of the Price Adjustment to New Information, Louis H. Ederington and Jae Ha Lee, *The Journal of Financial and Quantitative Analysis*, Vol. 30, No. 1 (Mar., 1995), pp. 117 -134, Page 118

⁴⁸ *Ibid*, Page 130

⁴⁹ Economic News and Bond Prices: Evidence from the U.S. Treasury Market, Pierluigi Balduzzi, Edwin J. Elton, and T. Clifton Green, *Journal of Financial and Quantitative Analysis* Vol. 36, No. 4, December 2001

⁵⁰ Intraday stock price effects of ad hoc disclosures: the German case, Jan Muntermann and Andre Guettler, *Int. Fin. Markets, Inst. and Money* 17 (2007) 1–24

3. Hypothesis

3.1. Volatility

For each minute during the event window a separate test of significance will be performed. This test of each minute will then be replicated in order to test the Large Cap market, the Small Cap market and finally the market as a whole. When testing two matched samples in a non-parametric environment it is most common to use the Wilcoxon signed-rank test (0,05 level of significance), which will test if the two populations are significantly different. As previously stated, we will test each minute (t) with the Wilcoxon test:

H_0 : The volatility in population t is identical to the volatility in the benchmark population

H_1 : The volatility in population t is not identical to the volatility in the benchmark population

If H_0 is rejected we conclude that the minute t is not identical to the benchmark population and therefore experience higher or lower volatility, meaning that the adjustments of the stock prices are not completed.

The second test will tell us if the volatility is the same for companies with increased stock prices after the event and companies with decreased stock prices. Since this test uses the same kind of population we will still analyze it using the Wilcoxon test. Only this time the two different populations consist of average returns for all minutes, divided into winners and losers.

H_0 : The volatility in population winners is identical to the volatility in population losers

H_1 : The volatility in population winners is not identical to the volatility in population losers

If H_0 is rejected the two populations are not identical and further tests will have to be made in order to determine which has the highest volatility.

Finally we want to test if the volatility is the same for the large cap companies and the small cap companies. This is done with the exact same procedure as above, only a different categorization.

H_0 : The volatility in population Large Cap is identical to the volatility in population Small Cap

H_1 : The volatility in population Large Cap is not identical to the volatility in population Small Cap

The decision rule here is also the same as above.

3.2. Cumulative returns

The question we want to answer is: At which point is the cumulative returns the highest for winners and lowest for losers following an announcement? When plotting the returns we should be able to notice either a peak or a bottom and the corresponding time. This tells us that if you want to gain profit in the short run you will need to act before this corresponding time.

4. Methodology

4.1. Experienced problems

To do this study we need intraday data which is not so easy to get. First we thought that Reuters had all the data for all the companies, but soon we found out that it was just the biggest firms that were covered. This started a chase for the data and Swedish OMX, Reuters, Datastream, Six and so on were contacted. We found out that Six had intraday data for three weeks for all Swedish stocks, which was a big relief since the other sources to data were not satisfying. Earlier studies in the field of efficient markets use a great and differing variety of statistical methods. We needed to find a method that fitted our conditions in terms of data quality, time for the thesis and statistical skills. When dealing with intraday data the workload soon become overwhelming because of the huge amount of figures. Therefore some limitations had to be done.

4.2. Data collection and sample selection

To test the Swedish stock market we gathered information about stock prices around the time off the latest quarterly reports. The stock prices were collected using Six Edge which has one minute data stored for three weeks back in time. We collected the data the 10th and 11th of May, which means that all reports after the 19th of April qualified. Our sample consists of all companies that reported after the 19th of April and are listed on the OMX main lists Large Cap or Small Cap. Another limitation was that only used firms which announced their reports during the open hours of the stock markets. Since we wanted to know how the prices move ten minutes before the newsrelease and the stock market opens at 9 pm we needed the report to be released after 9.10 am local time. To find out when the firms released their reports we used www.avanza.se, company webpages and Six Edge. This gave us a total sample of 23 large and 61 small firms.

In other studies similar to ours it has been shown that the time it takes for the stock market to react and find a new equilibrium is shorter than one hour. To test that new information is released at the right time and that no systematic newsleakage occurs we analyze data 10

minutes before the official release time as well as 60 minutes after. This gives us an event window of 70 minutes where minute zero is referred to as the time of the release.

To be able to test for abnormal returns we need a reference or benchmark period that can be used to approximate normal returns; we chose this period to be nine days prior of the event. Due to the lack of intraday data in Six Edge and the fact that one minute data would be overwhelming we use day to day data for all stocks during the benchmark period. In order to calculate the abnormal returns we also need to know price changes for the market index. This daily data was collected from “Six Generalindex” for the same period.

4.3. Previous research

During the years there have been a lot of differing methods used by scientists in this field. One very common method is to measure the volatility surrounding the event and compare it to normal volatility. The obvious question when using a method like this is: what is normal volatility? Normal volatility can be kind of difficult to measure and all papers use different time periods for this. For example, some researchers used nine days before the event as their benchmark⁵¹ and at the same time some used 120 days⁵². It is easy to believe that it is always better to use the longer period because of the larger sample, but the effect of a longer period could also mean a greater risk for outside shocks such as reports and other new information that affect the company earnings.

It has been proven that the returns in the stock market do not follow a normal distribution⁵³ and therefore it is common to use non-parametric tests to avoid any assumptions about the distribution⁵⁴. These non-parametric methods appear in many papers and specifically the Wilcoxon signed-rank test which we will use. Results from earlier studies have showed that the time it takes for the market to stabilize subsequent to new information varies a lot. The

⁵¹ Intraday stock price effects of ad hoc disclosures: the German case, Jan Muntermann, Andre Guettler, *Int. Fin. Markets, Inst. and Money* 17 (2007) 1–24

⁵² Marknadseffektivitet - En fallstudie av aktiekursens rörelse efter ny information, Maja Johansson, Gabriella Kostic, Henrik Milton, Fredrik Wide, 2001.

⁵³ The Behavior of Stock-Market Prices, Eugene F. Fama, *The Journal of Business*, Vol. 38, No. 1 (Jan., 1965), pp. 34-105

⁵⁴ THE INTRADAY SPEED OF ADJUSTMENT OF STOCK PRICES TO EARNINGS AND DIVIDEND ANNOUNCEMENTS, James M. PATELL and Mark A. WOLFSON, *Journal of Financial Economics* 13 (1984) 223-252.

fastest normalization that has been measured was 40 seconds⁵⁵. If you compare this to the results achieved by the students from Lund which was about 4 hours⁵⁶ you will soon understand that the range of results is very wide. This can probably be explained by the sample and the method used to determine when the market is considered being normal again. The sample can vary in different geographical markets, in the chosen time period, in the underlying asset and in what kind of event that is of interest. The chosen method often has a huge impact on the answer, for example the students in Lund wanted the volatility and the accumulated return to be stable and have long measurable intervals. This meant that according to their specific decision rule no small companies behave normally until one hour after the event⁵⁷. What is important is to find a decision rule that corresponds well to the problem that is to be answered.

4.4. Methods used to analyze the data

The first test of our data will be a test of volatility based on average returns. This will give us information about stock market behavior surrounding the event. All stock returns (R_t) are calculated on a one minute basis. P_t is the price at time t and P_{t-1} is the price from the preceding period. This calculation is done using the equation:

$$R_t = (P_t - P_{t-1}) / P_{t-1} \quad (1)$$

This result in a huge table with 84 companies and 69 returns since the first minute do not have any earlier observation to be compared to. We copy and divide this table into two tables, one for the Large Cap firms⁵⁸ and one for the Small Cap⁵⁹ firms. The minute returns are either positive or negative and would easily cancel out each other when we sum all returns for a specific minute. Therefore we make all returns positive by summing them up in absolute returns for all minutes. The sum is then divided by the number of observations that each list contain. After this procedure we are left with average absolute returns for the entire time period.

⁵⁵ The Short-Run Dynamics of the Price Adjustment to New Information, Louis H. Ederington and Jae Ha Lee, The Journal of Financial and Quantitative Analysis, Vol. 30, No. 1 (Mar., 1995), pp. 117 -134

⁵⁶ Marknadseffektivitet - En fallstudie av aktiekursens rörelse efter ny information, Maja Johansson, Gabriella Kostic, Henrik Milton, Fredrik Wide, 2001.

⁵⁷ Ibid

⁵⁸ See appendix, Large Cap, changes per minute

⁵⁹ Ibid

At this point the exact method is to take all returns and subtract them with the one minute return for index. This is a very small, but extremely time consuming correction and in our case it would not even be an exact correction since we do not have minute returns for index. We would have to approximate returns using day by day data for the events and divide it into minutes. These approximated returns are very small and not accurate therefore we decided not to do this correction.

The numbers are all in absolute terms and therefore it would be easy to say that the returns are separated from zero, which should be the approximated normal return for one minute. This would probably give us significance for abnormal returns in all minutes. To calculate what a normal return of a stock is we use day by day data nine days before the event. These returns for the stocks (RSt) and index (RIIt) are calculated with the following formula:

$$RSt = (RSt - RSt - 1) / RSt-1 \quad (2)$$

$$RIIt = (RIIt - RIIt - 1) / RIIt-1 \quad (3)$$

Once again we receive one return less since day -9 does not have any earlier observations to relate to. We have to compensate the returns in the stocks with the index return for the same day to see how big the normal returns are. We still have the Small Cap and Large Cap separated and calculates the normal return with the formula:

$$\text{Normal Stock Return} = RSt - RIIt \quad (4)$$

These numbers are positive or negative and would be around zero when summed up since the stocks that make up the index must be equal over time. Therefore these results are converted to absolute numbers, just like we did with the stock returns on the minute data. Since we started with day to day data the average normal return is on a daily basis and needs to be recalculated to minutes to be comparable with the stock return around the time of the event. We treat the averages like a standard deviation when we move the figures in time. When the averages are taken from the figures and squared we divide it by the minutes in one stock market day. The stock market is open 9.00 am to 5.30 pm which is 8,5 hours a day. We calculate the square root to get the normal return in minutes. This number is what we will use as the benchmark since the figures are now in the same unit of time^{60 61}.

⁶⁰ See appendix, Large Cap adjusted with index

⁶¹ Ibid

To test which minute returns that are significant separated from the normal return we use the Wilcoxon signed-rank test. This test is non-parametric and therefore it fits our sample well. A second reason to use this test is that we have more than ten observations which is a requirement using the Wilcoxon sign-rank test. To analyze all the data we used SPSS which gave us all the results. As is standard in most statistical test of this kind we used a 5% level of significance.

The test described above will allow us to study the time it takes for the volatility to get back to normal. However it does not say that much about the returns that an investor would have got. Therefore we also calculate the cumulative returns for all events. The data is separated into winners and losers. A winner is defined as a stock with a higher close price minute sixty than the start price at minute -10 and a loser is the exact opposite. If any stock has the same opening price as close price they are excluded from the sample since they are neither winners nor losers. In the formula P_o is the price at time -10 and the cumulative returns (CRt) are calculated for all stocks with the formula:

$$CRt = (P_t - P_o) / P_o \quad (5)$$

To get a sample that is big enough Large Cap and Small Cap are sorted together as winners and losers. The samples are summed up for all minutes and the averages are used. This gives a good overview of how the stock market behaves in the event window.

4.5. Validity and reliability

In our thesis we will use a quantitative method to test our hypothesis. When using a quantitative method it is important that the collected data is representative. We have collected the data for 84 companies without any personal preferences; the only bias here is the sample period since we used all available events. This should only be a problem if the report period is unevenly distributed in any way. We found data for all firms that were of interest and no exclusion had to be done during the data collection. As said before we did not use minute data for the estimation of normal return which would have been preferred before day to day data. The face validity should therefore be quite good. To get a high validity a high reliability is needed since the validity never can be better than the reliability.

When collecting information there are always a few sources of error. The first thing is the date and time which has to correspond to the actual time of the event; otherwise information is gathered from the wrong period. A similar problem occurs when information about the price is collected and copied to Excel; it is possible that data from the wrong day or hour is copied. The raw data originally from Six Edge should be accurate and the only possible source of error in this part is the human factor. The study has required a lot of data handling, both during the collection and during the analysis. This is probably the biggest source of error and we cannot be sure that a mistake has not slipped through. We have tried to be careful when moving the data and looked out for strange results. Most results are calculated which generates a high inter-rater reliability⁶². In the analysis we have to be more subjective with support in the empirics. Using the methodology chapter and the rest of the thesis it should be easy for anyone who is interested in repeating the event study to do so.

⁶² <http://www.stat.purdue.edu/~bacraig/SCS/VALIDITY%20AND%20RELIABILITY.doc>25/5-10 at 8 pm

5. Empirical results and analysis

5.1. Volatility

In this part of the thesis we will present our results in order of hypothesis. Following the hypothesis and results we will present a short analysis. The first hypothesis considered was if the returns surrounding the event were more volatile than during the period preceding it.

H_0 : Population t is identical to the benchmark population

H_1 : Population t is not identical to the benchmark population

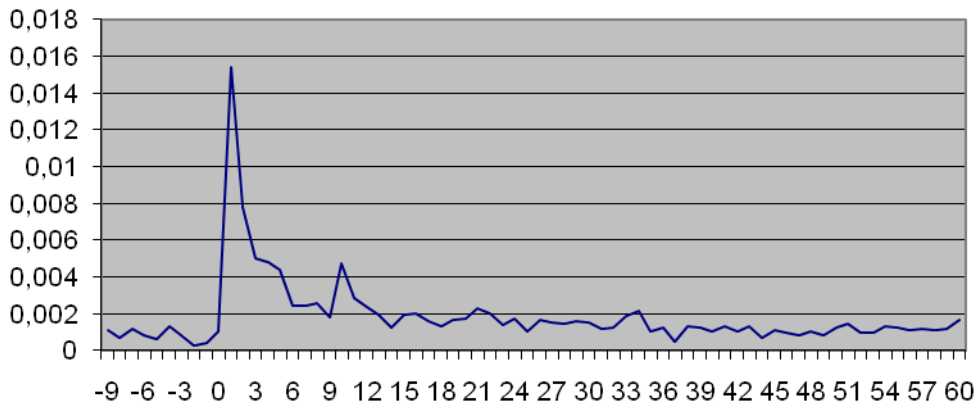
5.1.1. Graphical Presentation

The left column showing the event window is scaled in minutes. The Large Cap list consists of 23 companies listed on the Nordic OMX, the Small Cap consists of 61 companies and together they represent the entire market. All calculations were made using the Wilcoxon signed rank test for related samples and a 0,05 level of significance. The normal returns which were used in the test are: Large Cap - 0,000454961, Small Cap - 0,000715066 and Entire Market - 0,000648454. All minutes where we could reject the null hypothesis are marked with an asterix. If H_0 is rejected we conclude that the minute t is not identical to the benchmark population and therefore experience higher or lower volatility, meaning that the adjustments of the stock prices are not completed. All the numbers below except event window display the level of significance.

Event Window (min)	Large Cap	Small Cap	Entire Market
-9	0,127	0*	0*
-8	0,365	0*	0*
-7	0,075	0*	0*
-6	0,41	0*	0*
-5	0,986	0*	0*
-4	0,031*	0*	0*
-3	0,479	0*	0*
-2	0,008*	0*	0*
-1	0,094	0*	0*
0	0,471	0*	0,01*
1	0*	0,073	0*
2	0*	0,073	0*
3	0*	0,078	0,297
4	0*	0,304	0,073
5	0*	0,001*	0,768
6	0,009*	0,011*	0,549
7	0,005*	0,003*	0,741
8	0,001*	0,011*	0,582
9	0,004*	0,737	0,55
10	0*	0*	0,363
11	0*	0*	0,386

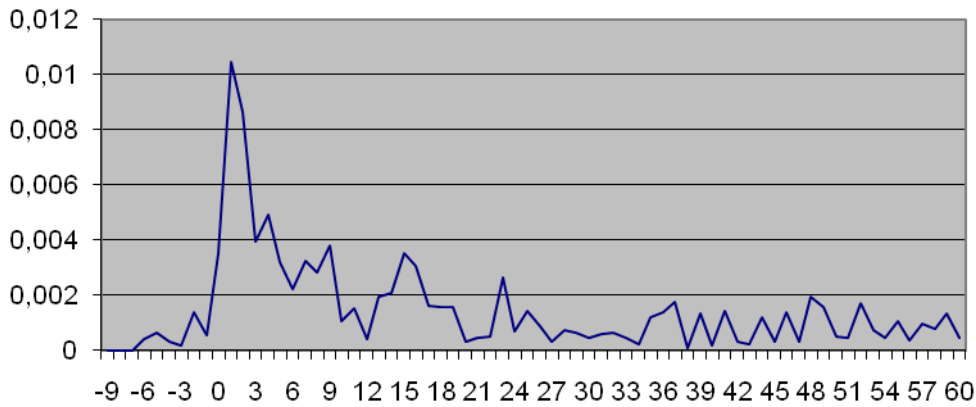
12	0,005*	0*	0,002*
13	0,001*	0*	0,083
14	0,052	0,003*	0,12
15	0,02*	0*	0,015*
16	0,02*	0,001*	0,038*
17	0,02*	0*	0,002*
18	0,026*	0*	0,002*
19	0,033*	0*	0,002*
20	0,012*	0*	0*
21	0,004*	0*	0*
22	0,002*	0*	0*
23	0,071	0*	0*
24	0,026*	0*	0,005*
25	0,349	0*	0*
26	0,127	0*	0*
27	0,005*	0*	0,005*
28	0,017*	0*	0,002*
29	0,024*	0*	0*
30	0,005*	0*	0,001*
31	0,657	0*	0*
32	0,026*	0*	0*
33	0,034*	0*	0*
34	0,034*	0*	0*
35	0,164	0*	0*
36	0,045*	0*	0*
37	0,257	0*	0*
38	0,56	0*	0*
39	0,174	0*	0*
40	0,076	0*	0*
41	0,061	0*	0*
42	0,316	0*	0*
43	0,013*	0*	0*
44	0,681	0*	0*
45	0,033*	0*	0*
46	0,331	0*	0*
47	0,331	0*	0*
48	0,333	0*	0*
49	0,555	0*	0*
50	0,033*	0*	0*
51	0,026*	0*	0*
52	0,846	0*	0*
53	0,316	0*	0*
54	0,136	0*	0*
55	0,681	0*	0*
56	0,076	0*	0*
57	0,066	0*	0*
58	0,127	0*	0*
59	0,08	0*	0*
60	0,075	0*	0*

Large Cap Average Absolute Returns



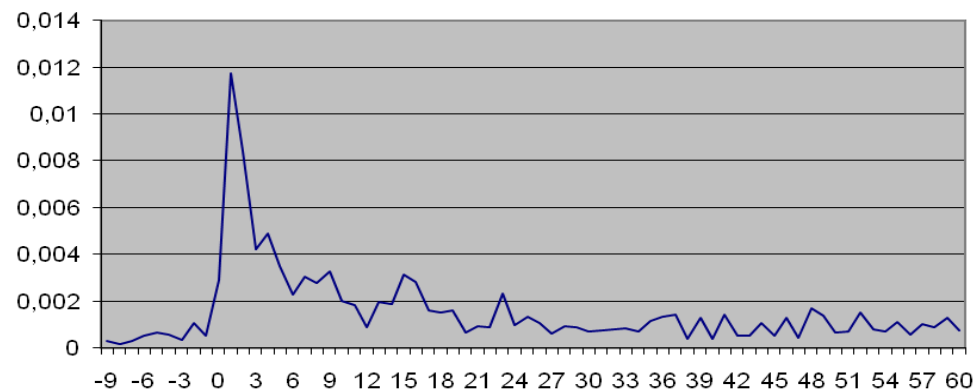
The x-axis shows the event window in minutes and the y-axis shows average absolute returns.

Small Cap Average Absolute Returns



The x-axis shows the event window in minutes and the y-axis shows average absolute returns.

Entire market



The x-axis shows the event window in minutes and the y-axis shows average absolute returns.

In the large cap column we see that ten minutes before the event the abnormal returns tend to be a bit overrepresented with two significant results. If this is due to chance or if the returns are higher before the announcement is hard to tell. Some guidance can be found by studying the graph and compare the average returns to the normal return. The answer will not be statistically significant but all minutes have higher than normal returns which indicate abnormally high returns. This comes as no surprise since the reports are expected and therefore create speculations prior to the release. Directly following the event we find observations with high significance up until the 13th minute. This means that the null hypothesis is rejected for all the thirteen minutes and that price changes are more volatile than not only the benchmark value but also the succeeding significance. The abnormal returns continue to appear all the way up to minute 36 although with some non-significant gaps. After this point there are only a few significant results and it is quite safe to say that the price has been stabilized. The observations made in the Large Cap column can easily be applied to the Large Cap graph even though it shows the average of each minute. As seen in the chart the volatility is very high in the first 15 minutes following the time of the report. This is consistent with the observations made in the table and the similarity does not stop there. The next 20 minutes continue to be more volatile than the benchmark, but at a stabilized level. During the last 25 minutes the volatility converges towards a more normal level.

When analyzing the Small Cap column one quickly realizes that there is something wrong. The results are exactly the opposite of the Large Cap and a lot of them ends up with a value of zero. This could be explained by the fact that poor liquidity affects the underlying returns used in the test. More specifically, when there are no new closures between two minutes the return becomes zero. When a zero is used in the Wilcoxon test it receives the lowest rank. When this happens to a majority of the companies the test interprets it as a difference in populations that is significant. We believe the reasons that there are so few transactions in these companies are because of the spread and the lack of interest. The spread is generally wider in small companies than in large and it tends to grow even wider in times of uncertainty, e.g. surrounding the report. This means that the buy and sell quotas often rise and fall, but without any closures they do not appear in our data. Because of the lack of depth in the market professional investors and swing traders are not able to buy and sell the preferred volume. They cannot do this because if they did they would probably have to buy or sell at all the available prices in the market, which would have a great impact on the share price. The thought of small companies being illiquid and inappropriate to use in this kind of test is

supported by theory⁶³. When it comes to the graph the pattern is very similar to the Large Cap. We think this is a better view of reality than the Wilcoxon test since the use of averages evens out the zero returns. This means that the zero returns does not have such a great impact on the overall result. The reason it is much more irregular than the Large Cap graph is because when dealing with very few closures their influence on one specific minute is substantial.

The column and graph showing the entire market bear much resemblance to the Small Cap analysis. The reason for that is the fact that there are 61 Small Cap companies and only 23 Large Cap and that the values are much more extreme in the case of the Small Cap. Therefore the analysis of the entire market's table and graph will experience the same problems as for the Small Cap and reach the same conclusion.

The final analysis of the efficiency of the market based on volatility will rely solely on the results obtained from the Large Cap test. We do this because as stated above the results from the Small Cap and Entire Market columns are misleading. The result derived from the first hypothesis is that the market has adjusted to the new information in 36 minutes. This does not mean that we are able to conclude if the market is efficient or not. The purpose of the test was just to measure the speed of adjustment.

Our second hypothesis was whether winners and losers behave the same. This is tested using the Wilcoxon rank test and average returns for the two groups. The hypothesis is:

H_0 : Population winners is identical to population losers

H_1 : Population winners is not identical to population losers

The test result shows a level of significance of 0,119 which means that we retain the null hypothesis. The fact that there is no difference between the two populations could be proof of investors behaving rationally and that the market is efficient. In the perspective of a day trader this is important information because it tells them that it does not matter if the report is positive or negative. The outcome would be the same. To be sure about this conclusion one would have to perform test on the stock market for a longer period since disturbance factors such as economic and political cycles exist.

⁶³ Thomas E. Copeland, J. Fred Weston, Kuldeep Shastri, Financial Theory and Corporate Policy, Published as Pearson Addison Wesley, 2005, Page 390

The third question that we want to answer is whether there are any differences between Large Cap and Small Cap firms.

H_0 : Population large cap is identical to population small cap

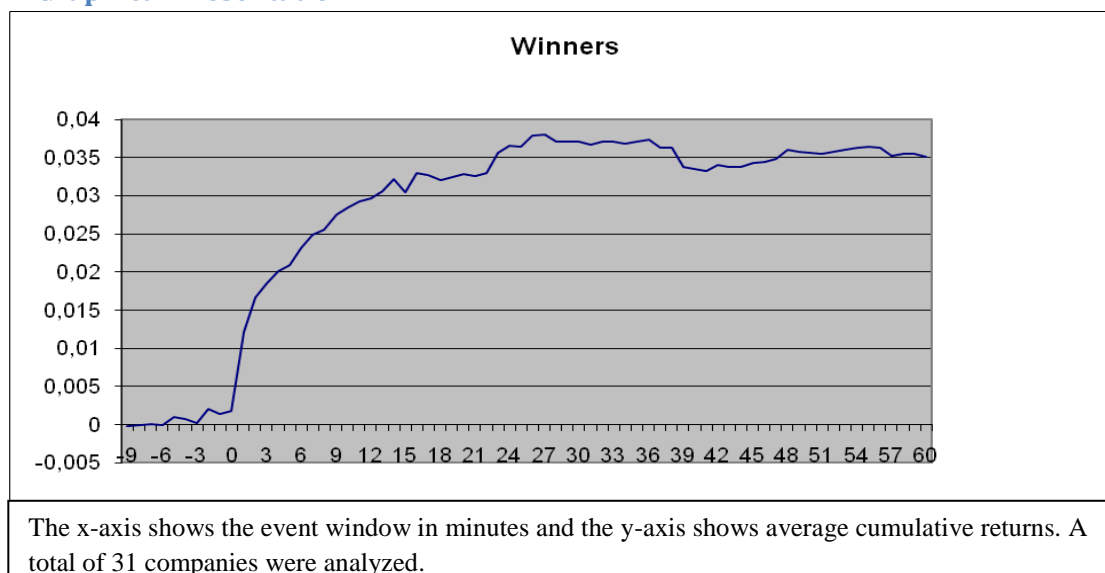
H_1 : Population large cap is not identical to population small cap

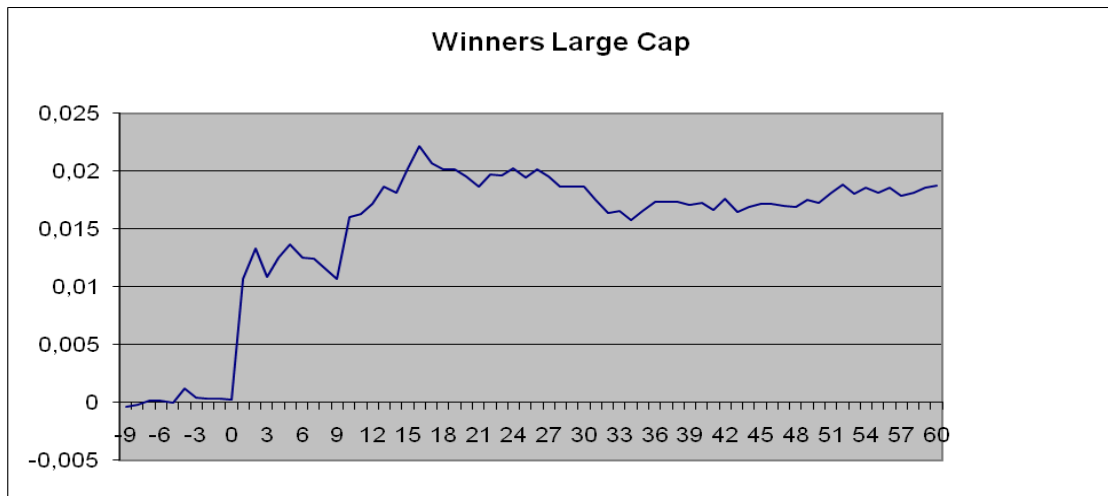
The test is based on average absolute returns and showed no difference between the two populations. The level of significance was 0,243 which mean that the null hypothesis cannot be rejected. In the first Wilcoxon test Large and Small Cap companies gave very differing answers, making this result a bit confusing. However, once again the reason for this is the use of averages which levels out the zero returns. For a trader this implies that no list is preferred to the other regarding average returns.

5.2. Cumulative returns

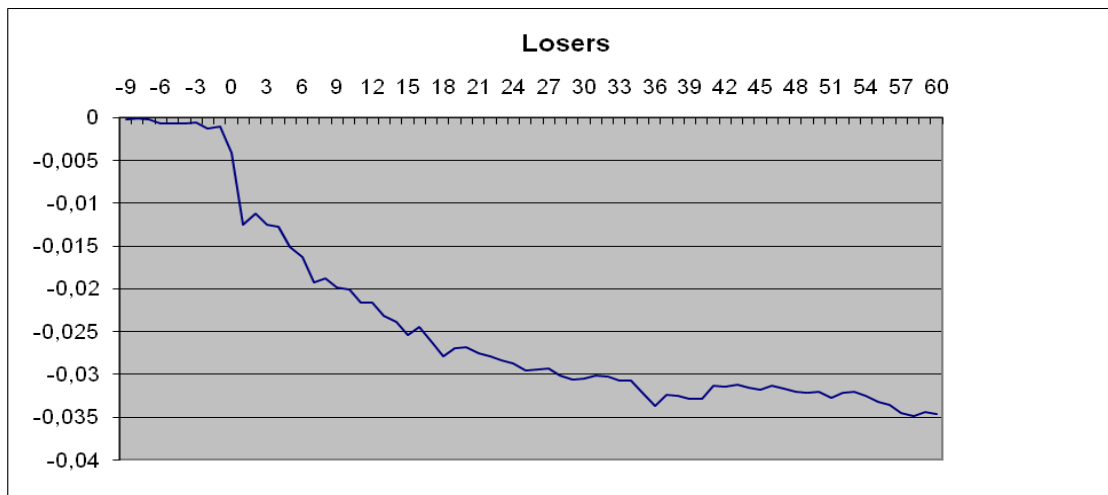
In a traders point of view it should be interesting to know how long it takes for the market price to adjust to the new information. It is at this point that the opportunity to gain abnormal returns is lost. It is not possible to test this using any hypothesis and statistical measures, but the graphical presentation below provides us with a good view of the stock price movements. As described earlier in the analysis the difference between the entire market and the Small Cap is negligible since the entire market consists of three quarters small companies. Therefore we decided to leave the Small Cap outside this analysis and instead focus on the entire market.

5.2.1. Graphical Presentation

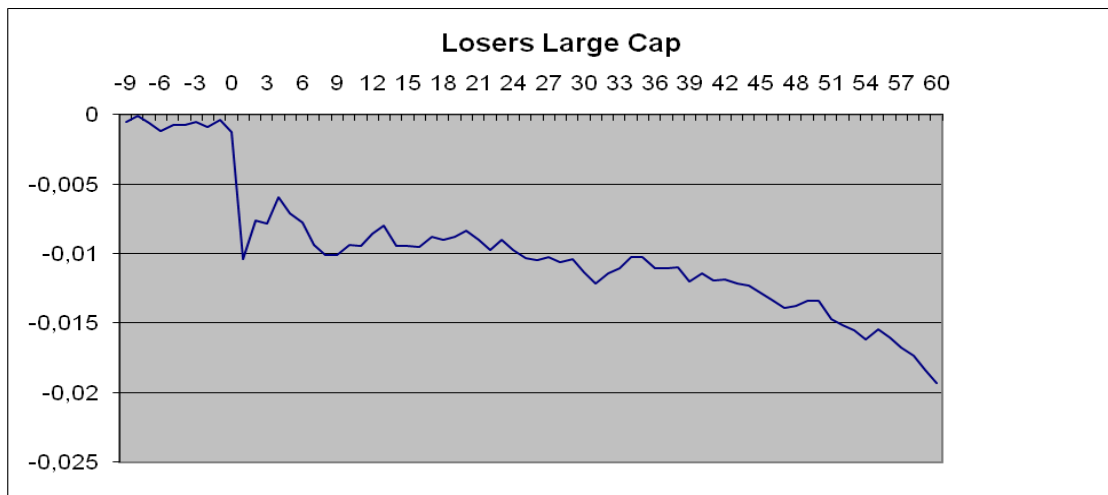




The x-axis shows the event window in minutes and the y-axis shows average cumulative returns. A total of 9 companies were analyzed.



The x-axis shows the event window in minutes and the y-axis shows average cumulative returns. A total of 45 companies were analyzed.



The x-axis shows the event window in minutes and the y-axis shows average cumulative returns. A total of 13 companies were analyzed.

When studying these graphs the first thing we noticed is that the minutes preceding the announcement show signs of which direction the stock price is moving. For example in the first chart with the winners from the entire market it is clear that at least from minute -3 to 0 the price increases. If we rule out the possibility of a miscalculation this is a very interesting observation. One possibility is that it is all just a coincident; otherwise it could be because of news leakage or insider trading. Our main objective when plotting cumulative returns was to find out at which point one would have to trade to be able to gain profits. The premise for this test of strategy was that the trader was sophisticated and knew how to analyze the report. He would then know which way the price of the stock would move. If the report is positive and he wants to trade on the entire market he would have to do that before minute 27 and if he only trades on the Large Cap market he would have to act before minute 16. The returns are much higher for the entire market because Small Cap firms experience more extreme price changes, probably due to lack of accurate estimates. It is our belief that the price stabilization is faster at the Large Cap market because of the high liquidity which makes it a more efficient market.

One of our most interesting observations was the returns displayed in the two loser charts. It seems that the returns keep decreasing through the entire event window. This would imply that an investor could gain profits up till an hour after the release of the report. We assume that it is equally time consuming to analyze a negative report as a positive one, which makes this phenomenon very remarkable. It is hard to explain this pattern, but perhaps the explanation can be found in behavioral finance and the psychology of the investor. Since we could not find any outliers in the underlying data, we find no other solution than to encourage further research. This could perhaps explain the pattern as an effect of coincidence or economic cycles. However, if no other solution is found we could only assume that a negative report challenges the EMH.

6. Conclusion

When we sum up our empirical results we find ourselves with a few conclusions. The first thing that has to be said is that an event study like this one is very hard to conduct when the sample of data is both small and inconsistent. On top of that, the time we had to write this thesis has been much shorter than previous researches on the subject. Despite all this we still feel that this study reveals important information about the Swedish stock market.

For the entire market the adjustment to new information measured in volatility peaks in the very first minute and more than half of the adjustment towards normality is done within the first three minutes. However, the final conclusion of the first hypothesis is that the adjustment is not fully completed until 35 minutes after the release of the report. For both test two and three, comparing winners and losers and large and small firms, the null hypothesis could not be rejected. Even though Large Cap and Small Cap firms showed no significant difference their reaction differs in strength. As seen in the cumulative returns graph the impact of Small Cap companies sends the values up with almost 100%. This means that the reaction from the market is twice as strong when a small company releases their interim report.

Another measure of speed of adjustment is the cumulative returns which gave us two very differing answers depending on whether we tested winners or losers. The adjustment-time for winners was 16 minutes and for losers the adjustment was not finished within the event window. This means that one of the two markets is not efficient and that investors could gain abnormal returns from this anomaly.

7. Further research

Now that this thesis is finished we would like to suggest a few additional research areas which we got to think about during the process:

When collecting the data we soon figured out that the liquidity in Small Cap companies was very bad, which meant that the one-minute returns often ended up being zero. This could probably be solved if one collected data with buy and sell quotas instead since they change more often. The results of such a study would probably generate a better comparison between large and small companies.

One of our most interesting results was that the winner market reacts much faster than the loser market. This could mean that the EMH is not true in this particular case and that arbitrage opportunities exist. If this truly is an anomaly or if it is just a coincidence could be solved by more extensive studies.

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9. Appendix

It is important to notice that these tables are only a small sample of our total data set and should only be used to understand the calculations.

9.1. Large Cap changes per minute

Large Cap, changes in % per minute						
	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Averages per minute
-9	0,002667	0,000943	0,004726	0,00122	0,000912	0,002093232
-8	0,001783	0,000942	0,00095	0,001221	0,000912	0,001161446
-7	0	0	0,001901	0,001222	0	0,000624727
-6	0,002669	0,000314	0	0,002442	0,001823	0,001449555
-5	0	0	0,000952	0,003672	0	0,00092487
-4	0,002676	0	0,003806	0,00122	0,000913	0,001722967
-3	0,001779	0	0	0	0,001825	0,000720835
-2	0,001783	0,000627	0	0	0	0,000481898
-1	0,002679	0,000314	0,000948	0	0	0,000788023
0	0,00089	0,000941	0	0	0,001821	0,00073054
1	0,019573	0,019146	0,025568	0,03663	0,027372	0,02565794
2	0,017241	0,002156	0,012004	0,024081	0,014071	0,013910664
3	0,017544	0,003395	0,000935	0,003713	0,00555	0,006227358
4	0,009074	0,002768	0,003742	0,003699	0,009302	0,005717213
5	0,004496	0,000613	0,006573	0,012376	0,002765	0,005364777
6	0,009033	0,000307	0,000945	0	0,008272	0,00371152
7	0,002735	0,000307	0,001889	0,003759	0,002735	0,002284855
8	0,001828	0,000307	0,001892	0	0,005484	0,001902302
9	0	0,000614	0,000948	0,001248	0,002757	0,001113469
10	0,006387	0,001535	0,003795	0,004988	0,007373	0,004815577

9.2. Large Cap changes per day adjusted with index

Firms & days	Stock % per day	Index % per day	Difference	Difference i absolut numbers
1, -8	0,008167	0,003299	0,004868	0,004868
1, -7	0,0018	0,000654	0,001146	0,001146
1, -6	0,010782	-0,00369	0,014472	0,014472

1, -5	-0,00089	-0,00785	0,00696	0,00696
1, -4	0,014235	0,012795	0,00144	0,00144
1, -3	-0,02018	-0,01209	-0,00809	0,00809
1, -2	-0,02686	-0,00505	-0,02181	0,02181
1, -1	0,00828	0,025001	-0,01672	0,016721
2, -8	-0,00523	-0,00785	0,00262	0,00262
2, -7	0,010517	0,012795	-0,00228	0,002278
2, -6	-0,00367	-0,01209	0,00842	0,00842
2, -5	-0,00307	-0,00505	0,00198	0,00198
2, -4	-0,0114	0,025001	-0,0364	0,036401
2, -3	0,005611	0,001561	0,00405	0,00405
2, -2	-0,02077	-0,02411	0,00334	0,00334
2, -1	-0,0038	-0,00433	0,00053	0,00053
			Averages	0,008445375
			Changes per minute	0,000373967