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Autoregressive behaviour in the stock market

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Abstract

This essay reveals relations between the autoregressive behavior in stocks and relative changes in volume, relative changes in dispersion and the release of earnings announcements. The purpose is to analyze what effect stock return, relative changes in volume, relative changes in dispersion and the release of earnings announcements have on the autoregressive behavior in stocks on the Stockholm Stock Exchange. To reveal these relations we test five hypotheses and use a total of six different regression models. In the regression models we test if the stock return in one week affects the return in the consecutive two weeks for different relative changes in volume and dispersion. We also test if the autoregressive behavior is affected by earnings announcements and if a possible effect from relative changes in volume on the autoregressive behavior is further affected by the release of earnings announcements. Our study also reveals if relative changes in volume have any affect on whether we get autoregressive behavior in form of momentum or reversal in consecutive weekly stock returns.

The data we use in our study are weekly closing prices for the ten stocks we study, weekly volume quotes for the ten stocks, closing data for OMX index that we will use to measure the dispersion and finally the dates for earnings announcements. We collected stock data for the period 1985 through 2004 and the study will be conducted on this period.

Our study in general shows that we have a weak efficient market since the stock prices or the stock prices in conjunction with volume or dispersion do not affect the return in consecutive weeks. However, earnings announcements in conjunction with return have a significant impact on the return in the latter week in 50 percent of the cases. Our conclusion is that the release of earnings announcements is a more important factor for the autoregressive behaviour in stocks than relative changes in volume or dispersion. Our study reveals no clear relations between relative volume/dispersion and whether stocks show autoregressive behaviour in the form of momentum or reversal in consecutive weekly stock returns.

Key words: autoregressive behavior, dispersion, earnings, volume, market efficiency

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1 Introduction

1.1 Background

Every investor likes to generate a return on his investment that is better than the return the average investor gets i.e. the return that the market as a whole generates. The fact that many prominent mathematicians and scientists have applied their considerable skills to forecasting financial securities prices to be able to "beat the market" is a testament to the fascination and the challenges of this problem. For an individual investor there are three ways to decide which companies to invest in. First he could try and analyze the company that he is interested in fundamentally. Secondly he could analyze the company by using technical analysis i.e. analyzing the historic movements in the stock. Finally the investor could just pick a stock without analyzing at all; to these investors investing is just like a game.

Many private investors find it difficult to analyze companies fundamentally and there are many reasons for this. One is that many private investors do not have the skills that are necessary to be able to perform an advanced analysis of a company that he is thinking of investing in. Another reason is that many private investors feel that they do not have access to all the relevant information that is needed to perform such an analysis. They also believe that the big institutional investors have more information about companies than they do themselves, i.e. they believe the institutional investors have access to inside information.

This might be one reason why many private investors think that it is easier for them to analyze companies technically by studying historic movements in the stocks. Technical analysts believe that price and volume data provide indicators of future price movements, and that by examining these data, information may be extracted on the fundamentals driving returns.[1] The historic movements are visual for everyone and therefore the private investors feel that in this way they are analyzing stocks on equal terms with the institutional investors.

Investors have always been interested in studying historic stock prices and see if it is possible to generate abnormal return on their investments. Most of the research in the area shows that it is not possible to generate abnormal return by analyzing historic stock prices i.e. the market has weak efficiency. Despite this many investors today claim that they are able to generate abnormal return by analyzing historic stock prices. Investors do this by studying the historic prices and from this they try to come up with forecasts for the prices in the future.

[1] Lawrence Blume, David Easley and Maureen O'Hara, Market Statistics and Technical Analysis: The Role of Volume (1994), p. 153

Investors who believe that an analysis like this is meaningful believe that movements in stock prices are not independent of each other i.e. the change in the stock price in one day is also in some way affecting the stock price in the upcoming days. The role of volume is also an issue that is being analyzed heavily. Many analysts believe that movements in stock prices that are accompanied by strong volume is a sign of a stronger and more secure movement in the stock than movements that are not accompanied by strong volume. According to Pring (1991) the normal relationship for volume is to expand on rallies and contract on declines. If volume becomes dampen when the price increases and enlarges on a decline, the prevailing trend may soon be reversed.[2]

An advantage with volume is that is a variable that is very easy to observe. Volume quotes are available for everyone in daily newspapers and investors do not need any advanced analytical programs to study volume. It is therefore important to study if it would be possible to generate abnormal return by paying close attention to changes in volume.

Dispersion is a measure that has been more and more analyzed in latter years and the results show that stocks tend to deviate from the market when they experience shocks in volume.

1.2 Problem discussion

Research in the past has showed that the relative changes in volume in a stock affect the autoregressive behavior of the stock. By this we mean that the relative volume affects to which degree the stock return in one week is dependent on the return in the prior week.

Connolly and Stivers (2003) found substantial momentum in consecutive weekly returns when the latter week had unexpectedly high turnover. If this is true, investors would be able to make a better prediction of the stock return in the upcoming weeks by studying the movements in volume. When a stock is experiencing a shock in relative volume it often also experiences a shock in relative dispersion i.e. relative volume and relative dispersion are usually positively correlated. If this is the case, it would be interesting to see if chocks in dispersion affect the return in the upcoming weeks in the same way as relative volume does.

[2] Martin J. Pring, Technical Analysis Explained (1991), p. 35

Why does the autoregressive behavior seem to change when taking relative volume and/or dispersion into consideration? According to Wang (1994)[3] the reason is that volume conveys important information about how assets are priced in the economy.

According to Wang (1994) the investors trade among themselves because they are different. Thus the behavior of trading volume is closely linked to the underlying heterogeneity among investors. By examining the dynamic relation between volume and prices, one can study how the nature of investor heterogeneity determines the behavior of asset prices. Wang shows that different heterogeneity among investors gives rise to different volume behavior and return-volume dynamics. This implies that trading volume conveys important information about how assets are priced in the market.

In Wang's framework (1994) the dynamic relation between volume and returns varies depending upon the motive for trading by so called "informed investors". A reversal in consecutive returns is likely if the primary motive for the informed investor's trading in the former period is changes in their outside investment opportunities. Prices move with turnover in the former period due to risk aversion and because the uninformed investors do not know whether trading is information based. Thus, the subsequent price movement in the latter period tends to exhibit some reversal from the former period's price movement.

Conversely, momentum in consecutive returns is likely if the primary motive for the trading in the former period is sufficient information about the stock's fundamentals. The partial incorporation of information in the former period tends to generate positive autocorrelation between the former and latter period returns.

In another paper Llorente, Michaely, Saar and Wang (2002) divides the trading into speculative trading and hedging trading. These two types of trades respectively result in different return dynamics. When subsets of investors sell a stock for hedging reasons the stock's price must decrease to attract other investors to buy. Since the expectation of future stock payoff remains the same the decrease in the price causes a low return in the current period and a high expected return for the next period. However when a subset of investors sells a stock for speculative reasons its price decreases, reflecting the negative private information about its future payoff. Since this information is usually only partially impounded into the price the low return in the current period will be followed by a low return in the next period when the negative private information is further reflected in the price. Due to this reason hedging trades generate negatively autocorrelated returns (reversals) and speculative trades generate positively autocorrelated returns (momentum).

Intensive trading volume is very helpful in trying to determine whether trades are of speculative or hedging character. This is according to Llorente, Michaely, Saar and Wang (2002) the reason why it is important to observe volume in the stock market.

[3] Jiang Wang, A model of competitive stock trading volume (1994), p. 128

Most investors and others that follow the financial markets closely have noticed that shocks in volume and dispersion often occur around earnings announcement. Do the shocks that occur in volume and dispersion around earnings announcements affect the autoregressive behavior in the same way as shocks that occur when there is no earnings announcement? This is a further question that we will try to answer in this study to see if investors should act differently when volume shocks occur around earnings announcements. We will also study the earnings announcements separately to see if they alone have any affect on the autoregressive behavior in the stocks.

1.3 Purpose

The purpose of this work is to analyze what effect stock return, relative changes in volume, relative changes in dispersion and the release of earnings announcements have on the autoregressive behavior in stocks on the Stockholm Stock Exchange.

1.4 Disposition

In chapter two we present which general theory and prior research we have used in our study. We present which econometrical theory we use in our study and how we have adjusted for econometrical disturbances in our regressions. In chapter three we describe how we have collected our data and present our hypotheses. We present the seven different regression models that we have used to conduct our study and we discuss how we will use the regressions to see how relative volume, relative dispersion and earnings announcements affect the autoregressive behavior in stocks.

In chapter four we present our empirical results and discuss the results from the different regressions. In chapter five we present our conclusions, both in the form of results to our hypothesis and as an empirical discussion. We finish the essay with some suggestions for further research.

1.5 Delimitations

We will limit our study to ten heavily traded stocks on the Stockholm exchange. No other exchanges or stocks than the ten chosen will be studied.

When we study relative volume and relative dispersion we will only study how volume and dispersion affect the autoregressive behavior in the stocks i.e. we study how changes in volume and dispersion in week t in conjunction with return in week t affect the return in week $t+1$ and week $t+2$. In this study we will therefore pay no attention to how changes in volume and dispersion in week t alone affects the return in week $t+1$ and week $t+2$.

In the same way as with volume and dispersion we will only study how earnings announcements affect the autoregressive behavior i.e. how the return in week *t+1* and week *t+2* is affected by earnings announcements and return in week *t*. This means that we will not study how earnings announcements affect the return in the week they are released. In the case with earnings announcements we will not separate earnings announcements that are positive from those that are negative i.e. we are only studying the fact that there was an earnings announcement in that week. We totally ignore the nature of the earnings announcements. We will further only study the autoregressive process in two lags i.e. we will not study how return, relative volume or dispersion in week *t* affect the return beyond week *t+2*.

2 General theory and prior research

The theories that we test are the autoregressive process and the random-walk theory. But many of the models we use cannot be found in main literature about financial theories. A lot of the models that we test are based on articles in financial journals. This chapter illustrates the main theories and then discusses prior research. Prior research is very essential for our study and the emphasis is on that part.

2.1 The efficient market hypothesis

A market with prices fully reflecting all available information is called efficient.[4] Researchers developed the random walks studies and the efficient market hypothesis was later found.

The efficient market hypothesis can be divided into three forms of market efficiency. There is weak-form efficiency, semistrong-form efficiency and strong-form efficiency.[5] In the weak-form efficient market it is impossible to make abnormal profits by using historical share prices or other financial data as only guidance. An example of this is studying charts like many Technical Analytics. In the semistrong-form efficient market it is impossible to make abnormal profits by studying publicly available information. An example of this is Fundamental Analytics. In the strong-form efficient market it is impossible to make profits from analyzing by using any information available, both private and public information. If this were true it would not be possible to earn an abnormal profit by using insider information.

2.1.1 Random Walk Theory

According to Fama (1965) the theory of random walk express that the future path of the price level of a security is no more predictable than the path of a series cumulated random numbers. Price changes are independent, identically distributed random variables.[6]

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[4] Eugene F. Fama, Efficient Capital Markets: A Review of Theory and Empirical Work (1970), p. 383
[5] Gordon J. Alexander, Jeffery V. Bailey and William F. Sharpe, Investments (1999), p. 93
[6] Eugene F. Fama, The Behavior of Stock-Market Prices (1965), p. 34

Malkiel (1999) describes the random walk as a walk "in which future steps or directions cannot be predicted on the basis of past actions."[7] The random walk theory says that stock price changes have the same distribution and are independent of each other i.e. there is no autoregressive behavior.

The corollary of this is that you cannot use past movements or trends of a stock price to predict its future changes.[8] It is impossible to outperform the market without taking on additional risk.[9] The theory of random walks in stock prices includes two hypotheses:

1. Price changes are independent
2. The price changes correspond to some probability distribution[10]

2.1.2 Ways to test the EMH

A useful way to organize the various versions of the random walk and martingale models is to consider the various kinds of dependence that can exist between an asset's returns r_t and r_{t+k} at two dates t and $t+k$. Under the weak form of the EMH the stock price P_t already incorporates all relevant historical information and the only reason for a price change is only the arrival of unexpected news and events.

2.1.2.1 Rational expectations

According to the rational expectations (RE):

$P_{t+1} = E_t (P_{t+1}) + \varepsilon_t$ **Equation 2-1**

Sine the events at time $t+1$ cannot be predicted at time t, the price changes are random and therefore the expected value of the forecast error based on the available information at time t is zero:

$E_t (\varepsilon_{t+1}) = (E_t(P_{t+1}-E_t(P_{t+1})) = 0$ **Equation 2-2**

…this implies that the expectation of P_{t+1} is unbiased. In other words the forecast error should be independent of any information available at time t (orthogonality condition) which implies that ε_t should be serially uncorrelated at all leads and lags. However, the RE puts no restrictions on the higher moments of the distribution of ε_t.

[7] Burton G. Malkiel, A Random Walk Down Wall Street (1999), p. 24
[8] http://www.investopedia.com/terms/r/randomwalktheory.asp, 22/06/2004
[9] http://www.investorwords.com/4029/random_walk_theory.html, 22/06/2004
[10] Eugene F. Fama, The Behavior of Stock-Market Prices (1965), p. 35

2.1.2.2 Martingale process

A martingale is a stochastic process (P_t), which satisfies the condition:[11]

$E_t(P_{t+1}) = P_t$ **Equation 2-3**

i.e. the best forecast of tomorrow's price is simply today's price.

This property implies that non-overlapping price changes are uncorrelated at all leads and lags. It follows that if P_t is a martingale process then $\varepsilon_{t+1} = P_{t+1}-P_t$ is a fair game, which means that the average return is zero, even if we use all available historical information.

2.1.2.3 The random walk hypothesis

The strongest version of the random walk hypothesis is the case where price changes are IID (independently and identically distributed). This is called the Random Walk 1 (RW1).[12]

This is given by:

$P_t = \mu + P_{t-1} + \varepsilon_t \quad \varepsilon_t – \text{IID}\ (0,\sigma^2)$ **Equation 2-4**

…where μ is the expected price change or drift in the returns. IID denotes that ε_t is independently and identically distributed with mean zero and variance σ^2. RW1 is much more restrictive than the martingale process since the returns are required to be independent and not only uncorrelated. A special case of RW1 is obtained by assuming that the innovations are normally distributed.

Despite the elegance and simplicity of RW1, the assumption of identically distributed increments is not plausible for financial asset prices over long time spans. The Random Walk 2 (RW2)[13] model relaxes the assumption of identically distributed returns:

$\varepsilon_t \sim \text{INID}\ (0,\sigma^2)$ **Equation 2-5**

…where INID denotes independent, not identically distributed. Hence, RW2 allows the distribution of the returns to change over time. If the assumption of independence is also relaxed so that the returns may be dependent but uncorrelated we obtain the Random Walk 3 (RW3)[14] model. This is the weakest form of the random walk hypothesis.

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[11] John Campbell, Andrew Lo and Craig Mackinlay, The Econometrics of Financial markets (1997), p. 28

[12] John Y. Campbell, Andrew W. Lo, A. Craig MacKinlay, The Econometrics of Financial Markets (1997), p. 31

[13] John Y. Campbell, Andrew W. Lo, A. Craig MacKinlay, The Econometrics of Financial Markets (1997), p. 32

[14] John Y. Campbell, Andrew W. Lo, A. Craig MacKinlay, The Econometrics of Financial Markets (1997), p. 33

2.2 Prior Research

The prior research reveals price and volume relationships, the effect from earnings announcements on prices and volume and price and dispersion relationships. The prior research is divided into five main topics that are described in more detail below.

2.2.1 Efficient markets

Janijigian (1997) presented evidence that investors can earn significant short-run profits from using stock recommendations based on fundamental analysis. But in the long run the recommendations do not beat the market. The data was taken from stock recommendations made from January 1980 to December 1994. The majority of the analyzed stocks were listed on the New York Stock Exchange.

Timmerman (2004) discovered that there is a big chance for short-lived gains to the first users of new financial prediction methods. But when the methods become more widely used, their information may get incorporated into prices and they will cease to be successful.[15]

2.2.2 Momentum and reversals

Connolly and Stivers (2003) have found substantial momentum in consecutive weekly returns when the latter week has unexpectedly high turnover. They have also found substantial reversals in consecutive weekly returns when the latter week has unexpectedly low turnover. "Turnover is defined as shares traded divided by shares outstanding."[16]

The results come from empirical studies of weekly returns of large- and small-firm portfolios, equity-index futures, individual firm returns, and in the U.S., Japanese, and U.K. stock markets. The first-order autoregressive coefficient increases around 0.80 as the turnover shock moves from its 5th to its 95th percentile.[17]

Lee and Swaminathan (2000) used data from all firms listed on the NYSE and AMEX from January 1965 to December 1995 for their empirical study.[18] Lee and Swaminathan discovered that the price momentum effect finally reverses and the timing is predictable based on past trading volume. The past trading volume predicts both the scale and the persistence of future price momentum.[19]

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[15] Allan Timmermann, Efficient market hypothesis and forecasting (2004), p. 26
[16] Robert Connolly and Chris Stivers, Momentum and Reversals in Equity-Index Returns During Periods of Abnormal Turnover and Return Dispersion (2003), p. 1527
[17] Robert Connolly and Chris Stivers, Momentum and Reversals in Equity-Index Returns During Periods of Abnormal Turnover and Return Dispersion (2003), p. 1550
[18] Charles M. C. Lee and Bhaskaran Swaminathan, Price Momentum and Trading Volume (2000), p. 2021
[19] Charles M. C. Lee and Bhaskaran Swaminathan, Price Momentum and Trading Volume (2000), p. 2018

Stocks that have gone up accompanied with high volume experience faster momentum and reversals than low volume losers. Prior research has shown that low volume firms earn higher future returns and high volume firms earn lower future returns. Lee and Swaminathan (2000) have discovered that this volume effect is long lived and is most obvious among the extreme winner and loser portfolios.

Bremer and Sweeney (1991) study how large negative 10-day rates of return reverse over the following days. They document that large negative 10-day rates of return tend to be followed by larger than expected positive rates of return over the following days. The price adjustment lasts approximately two days and is observed in a sample of firms that is largely devoid of methodological problems that might explain the reversal phenomenon. While perhaps not representing abnormal profit opportunities these reversals present a puzzle as to the length of the price adjustment period. Such a slow recovery is inconsistent with the notion that market prices quickly reflect relevant information.

Wang (1994) examines the link between the nature of heterogeneity among investors and the behavior of trading volume and its relation to price dynamics. Wang discovered that volume is positively correlated with absolute changes in prices and dividends. Wang shows that informational trading and non-informational trading lead to different dynamic relations between trading volume and stock returns.

According to Pring (1991) the normal relationship between volume and return is for volume to expand on rallies and contract on declines. If volume becomes dampen when price increases and enlarges on a decline the prevailing trend may soon be reversed.[20] Pring also says that volume should be measured on a relatively basis i.e. strong volume is only strong compared to the previous period's volume.[21]

Cooper (1999) discovered that high-growth-in-volume stocks tend to show weaker reversals and even positive autocorrelation, and low-growth-in-volume securities exhibit greater reversals. A security has a bigger chance to experience greater reversals if it has incurred two, instead of just one, consecutive weeks of losses or gains.[22] If reversals are interpreted as evidence of overreaction, then markets might overreact to a greater degree for stocks that have encountered relatively longer periods of losses and gains.[23] To do the study Cooper used weekly returns and weekly volume for the top 300 largest market capitalization NYSE and AMEX individual securities from July 2, 1962 to December 31, 1993.[24]

[20] Martin J. Pring, Technical Analysis Explained (1991), p. 35
[21] Martin J. Pring, Technical Analysis Explained (1991), p. 62
[22] Michael Cooper, Filter Rules Based on Price and Volume in Individual Security Overreaction (1999), p. 931
[23] Michael Cooper, Filter Rules Based on Price and Volume in Individual Security Overreaction (1999), p. 912
[24] Michael Cooper, Filter Rules Based on Price and Volume in Individual Security Overreaction (1999), p. 907

Stickel and Verrechia (1994) discovered that large stock price changes on days with weak trading volume tend to reverse the next day.[25] However, a large increase in price with strong volume support tends to be followed by another price increase the next day.[26] The analysis was made around quarterly earnings announcement days from 1982 to 1990 on stocks listed on Nasdaq. The same analysis was also made on stocks listed on the New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) from 1986 to 1990.[27]

2.2.3 Earnings announcements affect on prices and volume

Lee and Swaminathan (2000) discovered that higher future returns encountered by low volume stocks and lower future returns encountered by high volume stocks are linked to misperceptions about future earnings. Analysts present lower long-term earnings forecasts for low volume stocks and vice versa. Nevertheless, low volume firms experience considerably better future operating performance and high volume firms experience considerably worse future operating performance. Returns are short after the earnings announcement significantly more positive for low volume firms and significantly more negative for high volume firms. The same pattern is found for all stocks, both past winners and losers. The market is surprised with the lower future earnings of high volume firms and the higher future earnings of low volume firms.

Price changes reflect changes in market beliefs and trading volume demonstrates the sum of all investors' trades.[28] Bamber and Cheon (1995) have evidence that earnings announcements that generate a high trading volume reaction relative to price reaction are related with more divergent financial analyst's earnings forecasts; a large analyst following; higher random-walk-based unexpected earnings relative to analysts-based unexpected earnings; and price increases. The results show that the trading volume reaction is expected to be high (relative to price reaction) when an announcement generates differential belief revisions among individual investors. The authors have found that trading volume often behaves differently than stock prices.

[25] Scott E. Stickel and Robert E. Verrecchia, Evidence that trading volume sustains stock price changes (1994), p. 64
[26] Scott E. Stickel and Robert E. Verrecchia, Evidence that trading volume sustains stock price changes (1994), p. 66
[27] Scott E. Stickel and Robert E. Verrecchia, Evidence that trading volume sustains stock price changes (1994), p. 58
[28] Linda Smith Bamber and Youngsoon Susan Cheon, Differential Price and Volume Reactions to Accounting Earnings Announcements (1995), p. 419

Morse (1981) made an empirical investigation of price and volume changes and trading volume during the days surrounding the announcement of quarterly and annual earnings in the Wall Street Journal (WSJ). The data for price and volume data used came from 20 securities at NYSE, five securities at ASE and 25 securities traded over the counter (OTC) from 1973-1976.[29] Morse discovered that the most significant price changes and excess trading volume took place the day prior to and the day of the WSJ announcement. Morse has not found any activity related to the announcement on the day before the announcement. Several days after the announcement there seem to be adjusting in prices and portfolios, but the average security adjusted quickly in an unbiased style to the announcement.[30]

The average initial response to an earnings announcement is within fourteen minutes of an announcement according to a study made by Woodruff and Senchack (1988).[31] They also noticed that the price adjustment to unexpected earnings occurred within a few hours after the earnings announcement. Stocks with extremely favorable earnings surprises encountered a faster adjustment than those with extremely unfavorable unexpected earnings.

Companies with extreme earnings surprises had a small market capitalization, low institutional ownership and no tradable options compared to the stocks with no surprises.[32] The data in the study came from several hundred New York Stock Exchange companies.[33]

Scott, Stumpp and Xu (2003) argue that news about a company's earnings often creates volume and change in stock price. News creates greater volume and greater momentum for growth stocks. The data for the study was the largest 1500 publicly traded companies in the United States each quarter between 1981 and 1998.[34] When momentum is examined more in detail the authors find that the momentum effect becomes more distinct at higher levels of volume, mainly since negative momentum is exceptionally strong for stocks with high trading volumes.[35] Scott, Stumpp and Xu have found evidence that once the company's growth rate is controlled for, the momentum-volume effect is largely explained by news. The market is weak efficient since the momentum-volume effect should be considered a delayed reaction by investors to fundamental news, not technical trading based on volume or momentum.

[29] Dale Morse, Price and Trading Volume Reaction Surrounding Earnings Announcements: A Closer Examination (1981), p.376
[30] Dale Morse, Price and Trading Volume Reaction Surrounding Earnings Announcements: A Closer Examination (1981), p.382
[31] Catherine S. Woodruff and A.J. Senchack, Jr, Intradaily Price-Volume Adjustments of NYSE Stocks to Unexpected Earnings (1988), p. 468
[32] Catherine S. Woodruff and A.J. Senchack, Jr, Intradaily Price-Volume Adjustments of NYSE Stocks to Unexpected Earnings (1988), p. 487
[33] Catherine S. Woodruff and A.J. Senchack, Jr, Intradaily Price-Volume Adjustments of NYSE Stocks to Unexpected Earnings (1988), p. 471
[34] James Scott, Margaret Stumpp and Peter Xu, News, not trading volume, builds momentum (2003), p. 45
[35] James Scott, Margaret Stumpp and Peter Xu, News, not trading volume, builds momentum (2003), p. 47

Gosnell, Henson and Lamy (1995) discovered that portfolios composed of banks that announce improved earnings exhibit significant positive abnormal returns soon after the close of the accounting quarter while portfolios composed of banks that publicize poor profit performance show significant negative abnormal returns. The data used for the study include all banking stocks with fiscal years ending in December traded on the NYSE or AMEX for which quarterly earnings could be obtained during the time period from the first quarter 1980 to the third quarter 1987.

2.2.4 Other price and volume relationships

Gallant, Rossi and Tauchen's (1992) results from looking at large price movements associated with higher subsequent volume suggest that price changes lead to volume movements. Large price declines had almost the same impact on subsequent volume as large price increases, so the effect is fairly symmetric. The price index data was taken from the S&P composite and the volume data was the daily volume of shares traded on the NYSE, from the years 1928 to 1987.[36]

Blume, Easley and O'Hara (1994) show that volume captures the important information contained in the quality of traders' information signals. Volume is "defined as the number of shares of the risky asset that are traded".[37] The theory of rational expectations of that price seize all information is true, but the authors have shown that volume plays a role in the trading process and is just not a descriptive parameter. Further analysis discovers that technical analysis is valuable for all traders used in Blume's, Easley's and O'Hara's models. Traders make profit from studying prices, but they do better by analyzing prices and volume. Technical analysis is more useful if the past market statistic hold higher-quality information. If traders already know a lot about the asset or information in general, scrutinizing the market is not very helpful. The properties of technical analysis that have been discussed by the authors above imply that it may be particularly suitable for small, less widely followed stocks.[38]

It is expected that observations of instantaneous large volume and large price changes can be traced to information flows. In equity markets it is common that the volume related with a price increase usually exceeds the volume associated with an equal price decrease. According to Karpoff (1987) the reason for this phenomenon is that taking short sales is expensive and limit some investors' abilities to trade on new information.

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[36] A. Ronald Gallant, Peter E. Rossi and George Tauchen, Stock Prices and Volume (1992), p. 203
[37] Lawrence Blume, David Easley and Maureen O'Hara, Market Statistics and Technical Analysis: The Role of Volume (1994), p. 157
[38] Lawrence Blume, David Easley and Maureen O'Hara, Market Statistics and Technical Analysis: The Role of Volume (1994), p. 177

Campbell, Grossman and Wang (1993) discovered that the daily serial correlation of stock returns is lower on days with high volume than on low-volume days. The phenomenon shows even in very large stock returns and individual stock returns, so it is almost certain that it is not due to nonsynchronous stock trading. The data for the empirical study was taken from stocks traded New York Stock Exchange and American Stock Exchange from 3 July 1962 to 30 September 1987.[39]

Duffee (2001) implies that there is more news when the market rises than when it falls. Trading volume is higher when the market rises, since traders trade on news and they occur more often when the market rises.[40] The data in the survey are daily returns of securities on the NYSE, Amex and Nasdaq. The sample period is July 1962 through December 1999.[41]

2.2.5 Prices and dispersions relationships

Connolly and Stivers (2003) additionally discovered that the autocorrelation of index returns increases with the latter-week's dispersion shock across individual firm returns.[42] The first-order autoregressive coefficient increases around 0.50 as the dispersion shock moves from its 5th to its 95th percentile.[43]

Parsley's and Popper's (2002) empirical results show that there is a link between overall price increases and relative price dispersion in the equity markets. Aggregate price changes are positively linked to the dispersion in relative prices.[44] The data came from quarterly equity prices from the New York Stock Exchange (NYSE) and the National Association of Securities Dealers Automated Quotation (NASDAQ).[45]

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[39] John Y. Campbell, Sanford J. Grossman and Jiang Wang, Trading Volume and Serial Correlation in Stock Returns (1993), p. 907
[40] Gregory R. Duffee, Asymmetric cross-sectional dispersion in stock returns: Evidence and implications (2001), p. 20
[41] Gregory R. Duffee, Asymmetric cross-sectional dispersion in stock returns: Evidence and implications (2001), p. 3
[42] Robert Connolly and Chris Stivers, Momentum and Reversals in Equity-Index Returns During Periods of Abnormal Turnover and Return Dispersion (2003), p. 1521
[43] Robert Connolly and Chris Stivers, Momentum and Reversals in Equity-Index Returns During Periods of Abnormal Turnover and Return Dispersion (2003), p. 1550
[44] David C. Parsley and Helen A. Popper, Inflation and Price Dispersion in Equity Markets and in Goods and Services Markets (2002), p. 1
[45] David C. Parsley and Helen A. Popper, Inflation and Price Dispersion in Equity Markets and in Goods and Services Markets (2002), p. 2

2.3 Statistical theory

Below we will present the econometrical assumptions and the different test methods that we have used. They are divided into different sections.

2.3.1 T-value

The t-ratio solves the problem of significance. The t-ratio is also called the test statistic. We test if the β values are significant. The test statistic is derived from the following equation [46]:

$$\text{test statistic}=\frac{\beta_i}{SE(\beta_i)} \qquad \textbf{Equation 2-6}$$

…where $SE(\beta_i)$ is the standard error of β_i.

The null hypothesis is:

$H_0: \beta_i = 0$

and the alternative hypothesis is:

$H_1: \beta_i \neq 0$

We use a two-sided test that will test for both positive and negative values of the β-coefficient. If the coefficient that we test is negative the t-ratio will also be negative and vice versa. In a two-sided test with 10 % significance level we use a 90 % confidence interval. This means that 10 % of the total distribution will be in the rejection region, which means 5 % in each tail.[47] In a two-sided test the null hypothesis is rejected if the test statistic is bigger than or equal to the absolute value of the critical value. Microsoft Excel returns the two-sided critical value of the t-value. The t-distribution can be found in figure 2-1. The graph in figure 2-1 with the fattest tails is the t-distribution and the other graph in the same figure is the normal distribution.

[46] Chris Brooks, Introductory econometrics for finance (2003), p. 88
[47] Chris Brooks, Introductory econometrics for finance (2003), p. 75

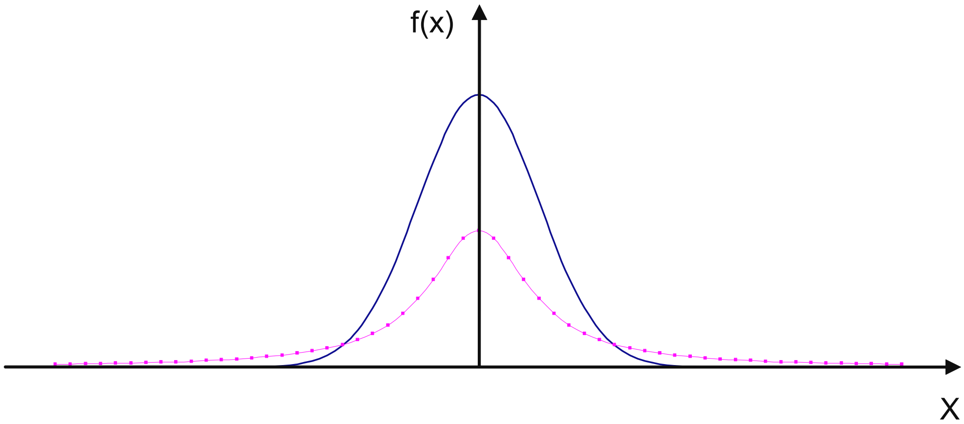


Figure 2-1

The t-values are adjusted for autocorrelation and heteroscedasticity with the Newey-West method in Eviews where it is necessary, i.e. where there is heteroscedasticity and/or autocorrelation. More about heteroscedasticity and autocorrelation follows in the text below.

2.3.2 P-value

The p-value is the probability of being wrong when the null hypothesis is rejected.[48] A p-value lies between 0 and 1. If the significance level is 10 % the null hypothesis is rejected if the p-value of the hypothesis test is smaller than 0.10. In our analysis we use 90 % confidence interval, which means 5 % significance level in each tail in a two-sided test.[49]

2.3.3 OLS

We have used ordinary least squares (OLS) estimation method in our study. Eviews has given us the data after we have chosen to do an OLS regression. But to draw conclusions in a study we have to know if the OLS assumptions are true for our regression. If they are not we have to know if the failure to meet the assumption does affect the result or if we can ignore it. If it affects the result we have to know how to deal with it. This is more specifically discussed below.

2.3.3.1 OLS assumptions

The white noise error term is u_t.

1. No Specification error: $E(u_t) = 0$
We do not think that our models are wrongly specified. Many of them are reconstructions of equations in earlier research.

[48] Chris Brooks, Introductory econometrics for finance (2003), p. 81
[49] William E. Griffiths, R. Carter Hill and George G. Judge, Undergraduate Econometrics (2001), p.105

2. Exogeneity: $E(u_t|x_t) = 0$
If this assumption is not true, there is endogeneity and the error term is dependent on the regressor, x_t. We have not tested for endogeneity, because we think that if there is endogeneity the general conclusions are robust to biases caused by endogeneity. Another reason is that we want to use the OLS.

3. No autocorrelation: $cov(u_i,u_j) = 0$ for $i \neq j$
There is more about autocorrelation and how to deal with it later in this section. We have tested for autocorrelation and we have adjusted for it where it has been found.

4. Homoscedasticity: $var(u_t) = \sigma^2$ (constant)
If this is wrong, there is heteroscedasticity. We have tested for heteroscedasticity and we have adjusted for it where it has been found. There is more about heteroscedasticity and how to adjust for it later in this chapter of our study.

5. No multicollinearity: $x_1 \ldots x_k$ linearly independent
If there is multicollinearity, the correlation between two variables is too high.[50] It leads to unreliable regression estimates. The use of too many dummy variables could be the cause of multicollinearity.[51] Near multicollinearity is when there is a non-neglible, but not perfect relationship between two or more explanatory variables.[52] We have not tested for multicollinearity, because we think that our models are adequate.

6. Normality: $u_t \sim N(0, \sigma^2)$ (normally distributed)
If there is non-normality the distribution could experience skewness and kurtosis. If non-normality is found it is not obvious what should be done. We have not tested for non-normality, since we think that non-normality in our samples does not affect the result notably and we want to use OLS.

2.3.4 Heteroscedasticity

If the variance of the errors is constant, $var(u_t) = \sigma^2$, then the errors are homoscedastic, but if the errors do not have a constant variance, they are heteroscedastic.[53] The diagonal elements of the covariance matrix are then not identical.[54] This could cause the OLS estimator to become biased or the standard errors could be based on the wrong expression. In our case we have to adjust the standard errors to allow for heteroscedasticity, since we do not want to change the specification of our model.

There are several statistical tests for heteroscedasticity. A popular one is White's general test for heteroscedasticity and it is also the test we use in our thesis.

[50] Marno Verbeek, A Guide to Modern Econometrics (2002), p. 38
[51] Marno Verbeek, A Guide to Modern Econometrics (2002), p. 39
[52] Chris Brooks, Introductory econometrics for finance (2003), p. 191
[53] Chris Brooks, Introductory econometrics for finance (2003), p. 147
[54] Marno Verbeek, A Guide to Modern Econometrics (2002), p. 74

2.3.4.1 White's test

To conduct the White's test we use Eviews. The program does everything that we need to do. The White's test in theory is described below.[55]

1. First you assume that the regression model is estimated of the standard linear form, e.g.

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + u_t \qquad \textbf{Equation 2-7}$$

To test $var(u_t) = \sigma^2$ you estimate the model above to get the residuals $\hat{u}_t$.

2. You then run the auxiliary regression below.

$$\hat{u}_t = \alpha_1 + \alpha_2 x_{2t} + \alpha_3 x_{3t} + \alpha_4 x_{2t}^2 + \alpha_5 x_{3t}^2 + \alpha_6 x_{2t} x_{3t} + v_t \qquad \textbf{Equation 2-8}$$

3. If there are many diagnostic tests, it is possible to use the Lagrange Multiplier (LM) test. It does not require an estimation of a second (restricted) regression. The R^2 value will be comparatively high for the $\hat{u}_t$ equation if one or more coefficients in $\hat{u}_t$ are statistically significant and the R^2 value will be very comparatively low if none of variables is significant. The LM test will multiply the R^2 from the auxiliary regression with the number of observations, T, which is shown below.

$$T\,R^2 \sim \chi^2\ (m) \qquad \textbf{Equation 2-9}$$

m is the number of regressors in the auxiliary regression (excluding the constant term).

4. It is a joint null hypothesis test. It examines if $\alpha^2 = 0$, $\alpha^3 = 0$, $\alpha^4 = 0$, $\alpha^5 = 0$ and $\alpha^6 = 0$.

If the chi-square-test statistic that is shown above is greater than the value from the statistical table then the null hypothesis that says that the errors are homoscedastic can be rejected.

If the p-values of the White's test are less than 0.05 there is heteroscedasticity and we have to adjust for that. We use the Newey-West method to adjust for heteroscedasticity.

[55] Chris Brooks, Introductory econometrics for finance (2003), p. 148-150

2.3.5 Autocorrelation

If the errors are uncorrelated with each other, $cov(u_i,u_j) = 0$ for $i \neq j$, then there is no autocorrelation.[56] But if the errors are correlated with each other there is autocorrelation. The covariance matrix is nondiagonal such that the different error terms are correlated.[57] If there is autocorrelation it could lead to biasedness or the standard errors could be based on the wrong expression. In our case we have to adjust the standard errors to allow for autocorrelation, because we do not want to change the specification of our model.

One way to test for first order autocorrelation is the Durbin-Watson test. It is one of the most common used tests in econometrics. The Durbin-Watson test statistic is given from the deviation below.[58]

$$dw = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2}$$ **Equation 2-10**

where e_t is the OLS residual and $0 \leq dw \leq 4$.

H_o: $\rho = 0$

H_1: $\rho \neq 0$

With the null hypothesis of no autocorrelation the Durbin-Watson distribution is symmetric around 2. So if dw is close to 2, the autocorrelation is close to zero. If dw is much smaller than 2 there is positive autocorrelation and if dw is much larger than 2 there is negative autocorrelation. The Durbin Watson test does not follow a standard statistical distribution. Dw has two critical values, an upper value (d_U) and a lower critical value (d_L).

[56] Chris Brooks, Introductory econometrics for finance (2003), p. 155
[57] Marno Verbeek, A Guide to Modern Econometrics (2002), p. 74
[58] Marno Verbeek, A Guide to Modern Econometrics (2002), p. 95-96

There is as well an inconclusive region between the critical values and 2, where the null hypothesis of no autocorrelation can be rejected or not rejected. In the number line below the rejection, non-rejection and inconclusive regions are shown.[59]

Reject H_0: positive autocorrelation	**Inconclusive**	**Do not reject H_0: No evidence of autocorrelation**	**Inconclusive**	**Reject H_0: negative autocorrelation**

0 — **d_L** — **d_U** — **2** — **4-d_U** — **4-d_L** — **4**

Figure 2-2

The critical values of the Durbin Watson test statistic can be found in tables. We have used Eviews to test for autocorrelation. In Eviews you get the Durbin-Watson test statistic by running an OLS regression. If there is autocorrelation we use the Newey-West method to adjust for it.

2.3.5.1 Newey-West

The Newey-West method can be found in Eviews. The Newey-West method adjusts both for heteroscedasticity and autocorrelation. The Newey-West estimator is given by [60]

$$\tilde{\sum}_{NW} = (X'X)^{-1}\,\tilde{\Omega}(X'X)^{-1}$$ **Equation 2-11**

where

$$\hat{\Omega} = \frac{T}{T-k}\left\{\sum_{t=1}^{T} u_t^2 x_t x_t' + \sum_{o=1}^{q}\left((1-v)/(q+1)\right)\sum_{t=o+1}^{T}\left(x_t u_t u_{t-o} x_{t-o}' + x_{t-o} u_{t-o} u_t x_t'\right)\right\}$$

Equation 2-12

In estimated Ω above, q, the truncation lag, is a parameter representing the number of autocorrelations used in estimating the dynamics of the OLS residuals u_t and the v is an arbitrary number. [61] When there is heteroscedasticity, autocorrelation or both you can use the Newey-West to adjust the OLS regression.

[59] Chris Brooks, Introductory econometrics for finance (2003), p. 163
[60] Eviews 3 Student Version Help System (2000)
[61] Whitney K. Newey and Kenneth D. West, A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix (1987), p. 704

2.3.6 Autoregressive processes

Autoregressive is "using historical data to predict future data". [62] An autoregressive model is a model where a variable, y, depends on past values of y and an error term.[63] AR(p) is an autoregressive model of order p:

$$y_t = \mu + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \ldots + \phi_p y_{t-p} + u_t$$ **Equation 2-13**

where u_t is the white noise disturbance term.

2.3.7 White noise process

A white noise process is a process with constant mean and variance, and zero autocovariances except at lag zero.[64] A zero-mean white noise process is defined as following:

$E(\varepsilon_t) = 0$ **Equation 2-14**

$var(\varepsilon_t) = \sigma^2$ **Equation 2-15**

$cov(\varepsilon_t \varepsilon_s) = 0, t \neq s$ **Equation 2-16**

[62] http://www.investorwords.com/344/autoregressive.html, 19/07/2004
[63] Chris Brooks, Introductory econometrics for finance (2003), p. 239
[64] Chris Brooks, Introductory econometrics for finance (2003), p. 232

3 Methodology

In this paper we will study autoregressive processes and the relation between return, relative volume and relative dispersion. It is therefore natural to use a quantitative approach since we will analyze historical stock prices and historical changes in volume and dispersion.

3.1 Data collection

In this paper we analyze 10 different stocks at the Stockholm Stock Exchange. The stocks we choose to analyze are:

- Ericsson B
- Atlas Copco A
- SKF B
- Electrolux B
- Hennes & Mauritz
- SCA B
- SEB A
- SHB A
- Sandvik
- Volvo B

When we selected these stocks we simply selected the 10 most heavily traded stocks at the Stockholm Stock Exchange since 1980. We excluded stocks that did not have data for the whole period 1980 through 2004. The reason for selecting the most traded stocks is that we believe that the processes we will study are easier analyzed in stocks that are heavily traded than in stocks that have lower volume.

The data that we need for our study are weekly closing prices for the ten stocks we study, weekly volume quotes for the ten stocks, closing data for OMX index that we will use to measure the dispersion and finally the dates for earnings announcements. We collected stock data for the period 1980 through 2004 but could not find data for earnings announcements further back than 1985. In our main study we therefore only conduct our analysis on the period 1985 through 2004. All our data we have used were found in the database Six Trust.

Our study will be based on weekly data. We therefore use the closing price for each stock every Friday during the period we analyze. The volume data that we use is the change in volume from one week to the next week. The same is true for dispersion. Since we study weekly data it is important that all weeks in our study have the same number of trading days.

We will therefore exclude weeks that have one or more holidays, i.e. all weeks that do not have five trading days are excluded from our study. Since we study relative changes in volume and dispersion we also exclude the first two weeks following a non five day trading week.

In the rest of the paper relative volume is the same as the change in volume from one week to another and relative dispersion is the same as the change in dispersion from one week to another. To measure dispersion we will use the Swedish OMX index as a benchmark. The further away the return in a stock is from the return in OMX-index the higher is the dispersion of the stock. We choose OMX-index as a benchmark for dispersion since it is a widely used index at the Stockholm Stock Exchange. An alternative would have been to choose an index for the stock's line of business as a benchmark for dispersion.

3.2 Key words

Dispersion: A measure of how much a stock's return deviates from an index i.e. the difference between the return in a stock and the return in an index

Momentum: When a stock shows autoregressive behavior in the form of momentum the stock's return in period t tends to continue in period $t+1$.

Reversal: When a stock shows autoregressive behavior in the form of reversal the stock's return in period t tends to reverse in period $t+1$.

Relative volume: The relative change in volume from one period to another. If the number of stocks traded increase/decrease from one period to another there is an increase/decrease in the stock's relative volume.

Relative dispersion: The relative change in dispersion from one period to another. If the dispersion increases/decreases from one period to another there is an increase/decrease in the stock's relative dispersion.

Relative volume in the 90^{th} percentile: The top largest increases in volume from one week to another. The weeks that are in the 90^{th} percentile are the weeks that have the largest relative increases in volume compared to the week before.

Relative dispersion in the 90^{th} percentile: The top largest increases in dispersion from one week to another. The weeks that are in the 90^{th} percentile are the weeks that have the largest relative increases in dispersion compared to the week before.

Relative volume in the 10^{th} percentile: The top largest decreases in volume from one week to another. The weeks that are in the 10^{th} percentile are the weeks that have the largest relative decreases in volume compared to the week before.

Relative dispersion in the 10^{th} percentile: The top largest decreases in dispersion from one week to another. The weeks that are in the 10^{th} percentile are the weeks that have the largest relative decreases in dispersion compared to the week before.

All the percentiles collectively: This expression is used when we study all the weeks in our study together, independent of their relative volume and relative dispersion.

3.3 Our hypothesis

In this paper we are working with the following hypothesis:

Hypothesis 1: Movements in stock prices are independent from one week to another i.e. there is no autoregressive behavior in stocks and the return in week *t* does not affect the return in week *t+1*.

Hypothesis 2: When considering relative volume there is autoregressive behavior in stocks i.e. the return and relative volume in week *t* affect the return in week *t+1*.

Hypothesis 3: When considering relative dispersion there is autoregressive behavior in stocks i.e. the return and relative dispersion in week *t* affect the return in week *t+1*.

Hypothesis 4: Earnings announcements are producing autoregressive behaviour in stocks i.e. the return in week *t* and an earnings announcement in week *t* affect the return in week *t+1*.

Hypothesis 5: Earnings announcements in conjunction with relative volume are increasing the autoregressive behavior in stocks i.e. the return and relative volume in week *t* in conjunction with an earnings announcement in week *t* affect the return in week *t+1*.

3.4 Empirical methodology

Below we will present the regressions we will use to be able to answer our hypotheses. Before this we make a brief presentation of the variables we will use in the regressions.

3.4.1 Brief outline

In order to be able to analyze the relation between return and relative volume/dispersion and test the five hypotheses mentioned in chapter two we use a total of six different regression models. Each model is explained in more detail below. In all regressions we use a 90 % confidence interval and we will test both ways i.e. we will test for both positive and negative relationships between the dependent and independent variables.

All our regressions will be made on three different parts of data. First we will study all the data we have collected for each stock i.e. we will study all the changes in volume and dispersion collectively. Secondly we will study the changes in volume/dispersion that is in the 90th percentile separately. We do this to see if the large positive shocks affect the return differently than other changes in volume/dispersion. Finally we will study the shocks that are in the 10th percentile separately i.e. the largest negative changes in volume/dispersion to see if they affect the return differently when they are analyzed separately. Due to very few weeks with earnings announcements in the 10th percentile we will exclude the 10th percentile from the regressions that include dummy variables for earnings announcements. In all the three studies (All data, 90th percentile and 10th percentile) we will study how the relative changes in volume and dispersion affect the return in the upcoming two weeks i.e. we study the first and second week after week *t* separately.

The return (the relative price change) for a stock in a week is defined as:

$$R_{t+1} = LN(\frac{P_{t+1}}{P_t})$$ **Equation 3-1**

…where P_{t+1} is the stock's price at week *t+1* and P_t is the stock's price at week *t*.

The relative volume for a stock is calculated by using the following equation:

$$X_{t+1} = LN(\frac{V_{t+1}}{V_t})$$ **Equation 3-2**

...where V_{t+1} is the stock's volume at week *t+1* and V_t is the stock's volume at week *t*.

To measure dispersion we used the following equation:

$$D_t = \left|R_{st} - R_{OMXt}\right|$$ **Equation 3-3**

….where R_{st} is the stock's return at week *t* and R_{OMXt} is the return of the OMX-index at week *t*.

We are only interested in the absolute dispersion, not if the dispersion is positive or negative.

The relative dispersion is defined in the same way as the relative volume:

$$Z_{t+1} = LN(\frac{D_{t+1}}{D_t}) \qquad \textbf{Equation 3-4}$$

…where D_{t+1} is the dispersion at week $t+1$ and D_t is the dispersion at week t.

For both relative volume and relative dispersion we then divide the data into percentiles. In the 90th percentile we put the weeks with the largest positive relative changes in volume or dispersion. In the 10th percentile we put the weeks with the largest negative changes in volume or dispersion. In the study where we will study all the percentiles collectively we simply put all the weeks, independent of their relative change in volume or dispersion. Next we will explain the seven different regression models that we use in our study to analyze the relationship between autoregressive behavior, relative volume, relative dispersion and earnings announcements:

3.4.2 Test for simple autoregressive behavior

$r_{t+1} = \alpha_0 + \beta_1 r_t$ **Equation 3-5**

$r_{t+2} = \alpha_0 + \beta_1 r_t$ **Equation 3-6**

where

r_{t+1} = Return in week $t+1$
r_{t+2} = Return in week $t+2$
r_t = Return in week t
α_0 = Intercept at the y-axis

This regression is made simply to find out if there is any autoregressive behavior in a stock's return when taking no consideration at all to volume and dispersion. We then test if β_1 is separated from zero:

H_0: $\beta_1=0$

H_1: $\beta_1\neq0$

If the null hypothesis is rejected β_1 is statistically separate from zero i.e. the p-value is < 0,05. This means that there is autoregressive behavior in the studied stock to some extent. If β_1 is positive this means that the autoregressive behavior is in the form of momentum i.e. the return in week t is positively related to the return in week $t+1$. If β_1 is negative the autoregressive behavior is in the form of reversal i.e. the return in week t is negatively related to the return in week $t+1$.

3.4.3 Does relative volume affect the autoregressive behavior?

In this regression we like to find out if changes in volume in one week affect the return in that particular stock in the upcoming two weeks. We do this by using the following regression models:

$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$ **Equation 3-7**

$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$ **Equation 3-8**

where

r_{t+1} = Return in week $t+1$
r_{t+2} = Return in week $t+2$
r_t = Return in week t
x_t = Relative volume in week t

This regression model reveals if the return in week $t+1$ or $t+2$ is affected by the return in week t and if the relative volume in week t in conjunction with return in week t affects the return in week $t+1$ and $t+2$ i.e. we like to find out if the autoregressive behavior is affected by relative changes in volume.

We then test if the result is significant by testing if β_1 and β_2 are separated from zero, using the same approach as above. If for β_1 the null hypothesis is rejected there is autoregressive behavior in the stock i.e. the return in week $t+1$ or $t+2$ is affected by the return in week t. If for β_2 the null hypothesis is rejected this means that there is autoregressive behavior in the stock when taking relative volume into consideration i.e. the return in week $t+1$ or $t+2$ is affected by the return times the relative volume in week t.

There are three ways in which we will reveal if volume affects the autoregressive behavior in stocks. First; by comparing the three different sets of percentiles that we have studied we will see if different changes in relative volume affect the autoregressive behavior differently. Secondly; by studying the β_2 coefficient in the regression we will see how the autoregressive behavior responds to different relative changes in volume. Thirdly; to discover if relative volume affects whether we get momentum or reversal in upcoming weeks we will compare the sign of the β_1 coefficient in the regression with equations 3-7 and 3-8 with the sign of the β_1 coefficient in the regression with equations 3-5 and 3-6.

This means that there are three ways in which we will study how the autoregressive behavior is affected by relative changes in volume. The three methods will be used together in our interpretations to reveal how relative volume affects the autoregressive behavior. The use of three methods will strengthen our interpretations.

3.4.4 Does relative dispersion affect the autoregressive behavior?

This regression reveals if changes in dispersion in one week affects the return in the upcoming weeks. We use exactly the same approach as above; we just replace volume with dispersion in the equations above:

$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$ **Equation 3-9**

$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$ **Equation 3-10**

where

r_{t+1} = Return in week $t+1$
r_{t+2} = Return in week $t+2$
r_t = Return in week t
z_t = Relative dispersion in week t

We then test if the result is significant by testing if β_1 and β_2 are separate from zero, using the same approach as above. If for β_1 the null hypothesis is rejected there is autoregressive behavior in the stock. If the null hypothesis is rejected for β_2 this means that when taking consideration to relative dispersion there is autoregressive behavior in the stock i.e. the return in week $t+1$ or $t+2$ is affected by relative dispersion and return in week t.

There are three ways in which we will reveal if dispersion affects the autoregressive behavior in stocks. First; by comparing the three different sets of percentiles that we have studied we will see if different changes in relative dispersion affect the autoregressive behavior differently. Secondly; by studying the β_2 coefficient in the regression we will see how the autoregressive behavior responds to different relative changes in dispersion. Thirdly; to discover if relative dispersion affects whether we get momentum or reversal in upcoming weeks we will compare the sign of the β_1 coefficient in the regression with equations 3-9 and 3-10 with the sign of the β_1 coefficient in the regression with equations 3-5 and 3-6.

This means that there are three ways in which we will study how the autoregressive behavior is affected by relative changes in dispersion. The three methods will be used together in our interpretations to reveal how relative dispersion affects the autoregressive behavior. The use of three methods will strengthen our interpretations.

3.4.5 Do earnings announcements affect the autoregressive behavior?

This regression reveals if earnings announcements affect the return in the two weeks following the announcement.

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 \qquad \textbf{Equation 3-11}$$

$$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 \qquad \textbf{Equation 3-12}$$

where

r_{t+1} = Return in week $t+1$
r_{t+2} = Return in week $t+2$
r_t = Return in week t
d_t^1 = Dummy variable for weeks with earnings announcement
d_t^2 = Dummy variable for weeks with no earnings announcement

We then test if the result is significant by testing if β_0, β_1 and β_2 are separated from zero (0), again by using the same approach as above. If the null hypothesis for β_0 is rejected this means that earnings announcements affect the return in week $t+1$ or $t+2$. By studying β_1 and β_2 we will find out if the autoregressive behavior in the stocks is affected by earnings announcements i.e. if the null hypothesis for β_1 is rejected this means that earnings announcements in conjunction with the return in week t affect the return in week $t+1$ or $t+2$. β_2 shows the same relation as β_1, but for weeks with no earnings announcements.

3.4.6 Earnings announcements in the same regression as relative volume

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t \qquad \textbf{Equation 3-13}$$

$$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t \qquad \textbf{Equation 3-14}$$

In this regression we add the relative volume to the regression above. When we have earnings announcements and relative volume in the same regression we will find out if adding relative volume will affect the β_1 and β_2 coefficients compared to equations 3-11 and 3-12. We will also by studying the β_0 coefficient see if the return in week $t+1$ and $t+2$ is affected by earnings announcements in week t alone. We then test for statistical significance the same way as above.

If β_0 is rejected this means that earnings announcements affect the return in week *t+1* and/or *t+2*. β_1 and β_2 will tell us if there is autoregressive behavior in the stock when taking earnings announcements into consideration i.e. if β_1 is rejected the return in week *t* in conjunction with earnings announcements affect the return in week *t+1* and *t+2*. If β_3 is rejected this means that the return in week *t* in conjunction with relative volume in week *t* affect the return in week *t+1* and *t+2* i.e. there is autoregressive behavior in the stock when considering both return and relative volume in week *t*.

3.4.7 Earnings announcements in conjunction with relative volume

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2 \qquad \textbf{Equation 3-15}$$

$$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2 \qquad \textbf{Equation 3-16}$$

In our final regression we put the dummy variable for earnings announcements and relative volume in conjunction. $\beta_{0,}$ β_1 and β_2 will be interpreted as above. β_3 and β_4 will tell us if the autoregressive behavior is affected by relative volume and earnings announcements in conjunction i.e. if β_3 is rejected return, relative volume and earnings announcements in week *t* in conjunction are affecting the return in week *t+1* or/and *t+2*. The coefficient β_4 does the same as β_3 but with weeks with no earnings announcements as dummy variable.

4 Empirical results

In this chapter we intend to present the results from our empirical analysis. We will present the results for each regression that we presented in the methodology chapter. The results that are significant are consequently marked in extra bold type.

4.1 Test for simple autoregressive behaviour

In the first regression we test if there is any autoregressive behavior in the ten stocks in our study. β_1 tells us how much the return in week t affects the return in week $t+1$ i.e. the strength of the autoregressive behavior. β_1 also tells us in what form the autoregressive behavior is expressed i.e. a positive β_1 indicates momentum and a negative β_1 indicates reversal. Table 4-1 shows the results from the regression with equation 3-5 and figure 4-1 shows the t-values for the β_1-coefficient in table 4-1 when we study all the percentiles collectively i.e. the β-values for the first column in table 4-1.

β_1	All perc	90 perc	10 perc
Atlas Copco A	-0.0451	0.1715	-0.1345
Electrolux B	0.0199	0.1043	0.1043
Ericsson B	0.0833	**0.2623**	0.1849
HM B	-0.0095	-0.0323	0.0698
Sandvik	0.0106	0.0646	0.0908
SCA B	0.0142	-0.0032	-0.1180
SEB A	-0.0425	0.1118	0.1712
SHB A	-0.0452	-0.1193	-0.0449
SKF B	-0.0124	0.0682	**0.3350**
Volvo B	0.0062	0.0313	-0.0150

Table 4-1, β_1 of R_{t+1}

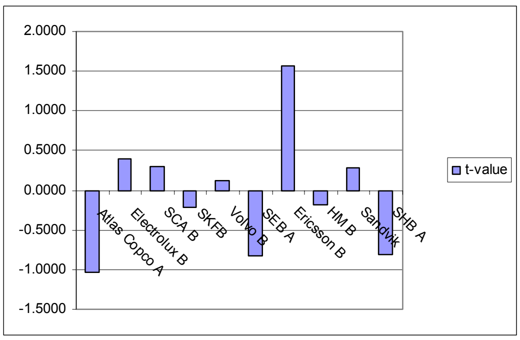


Figure 4-1, t-values for β_1 for all percentiles for R_{t+1}

When we study all the percentiles collectively there are no significant autoregressive behavior in any of the stocks i.e. the return in week *t* does not affect the return in week *t+1*. Half of the stocks show tendency towards momentum and half of the stocks show tendency towards reversal.

None of the stocks show any significant result but Ericsson is the stock where the autoregressive behavior is closest to significance. When we look exclusively at the 90th and 10th percentiles we find that most of the stocks show a larger tendency for autoregressive behavior than in all the percentiles collectively.

For Ericsson the autoregressive behavior in the 90th percentile is significant and for SKF the autoregressive behavior in the 10th percentile is significant. The autoregressive behavior is positive for both Ericsson and SKF i.e. the return in week *t* continues in week *t+1* (momentum). The conclusion is that the stocks in our study overall seem to become slightly more autoregressive in weeks with large relative changes in volume i.e. in the 90th or 10th percentile.

When we study the look of the autoregressive behavior in the 90th and 10th percentile the tendency is that more of the stocks experience momentum than reversals i.e. large changes in volume (either positive or negative) seem to produce more momentum than reversals in the 90th and 10th percentiles.

Table 4-2 shows the results for week *t+2* when we study all the percentiles collectively i.e. the regression with equation 3-6 where we study how the return in week *t* affects the return in week *t+2*. Figure 4-2 shows the t-values for the β_1-coefficient in table 4-2.

	β_1
Atlas Copco A	-0.0230
Electrolux B	0.0046
Ericsson B	0.0448
HM B	0.0016
Sandvik	0.0016
SCA B	-0.0276
SEB A	0.0759
SHB A	0.0878
SKF B	-0.0118
Volvo B	0.0453

Table 4-2, β_1 of R_{t+2}

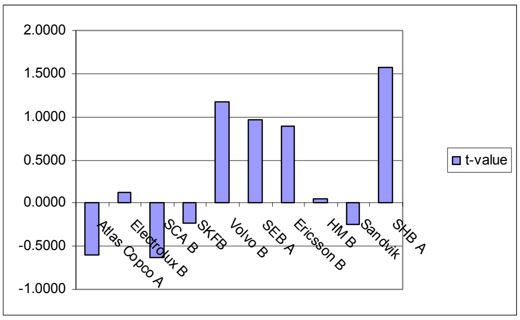


Figure 4-2, t-values for β_1 for R_{t+2}

The results look pretty much the same as in week *t+1*, which means that there are no signs of significant autoregressive behavior i.e. the return in week *t*, does not affect the return in week *t+2*. Figure 4-2 shows that SHB is the stock where the autoregressive behavior is closest to significance. In week *t+2* there are somewhat more stocks that show tendency for momentum than reversal.

In the 90th percentile[65] exclusively there are no stocks that show any significant autoregressive behavior. Ericsson showed significant momentum in week *t+1* and still shows a tendency for momentum in week *t+2* but the result is no longer significant. In the 10th percentile[66] Atlas Copco and Sandvik have significant autoregressive behavior (momentum) for week *t+2*.

4.2 Does relative volume affect the autoregressive behaviour?

Table 4-3 shows the results from the regression with equation 3-7 when we study all the percentiles collectively. β_1 tells us how much the return in week *t* affects the return in week *t+1* and β_2 tells us how the return in week *t* times the relative volume in week *t* affects the return in week *t+1*. Figure 4-3 shows the t-values for the β_2 coefficient in table 4-3.

	β_1	β_2
Atlas Copco A	-0.0495	0.0221
Electrolux B	-0.0225	**0.1325**
Ericsson B	0.0417	0.1462
HM B	-0.0071	-0.0075
Sandvik	0.0120	-0.0187
SCA B	0.0100	0.0179
SEB A	-0.0593	0.0578
SHB A	-0.0240	-0.0778
SKF B	-0.0219	0.0392
Volvo B	0.0138	-0.0490

Table 4-3, β_1 and β_2 of R_{t+1}

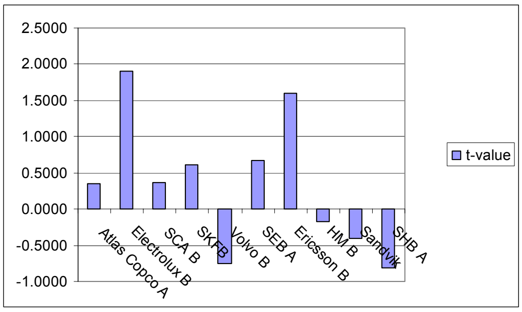


Figure 4-3, t-values for β_2 for R_{t+1}

Electrolux shows significant autoregressive behavior when we consider relative volume i.e. relative volume in week *t* times the return in week *t* does affect the return in week *t+1*. With the exception of Atlas Copco and SEB all the stocks in our study show a larger impact from the β_2 coefficient than the β_1 coefficient i.e. it is likely that relative volume increases the autoregressive behavior for the majority of the studied stocks. In addition to Electrolux also Ericsson has a strong tendency for autoregressive behavior but the result is not significant according to our criteria for significance presented in chapter 3.

The β_1 coefficient is not significant for any of the stocks i.e. for none of the stocks there is any sign of significant momentum or reversal in the stock's return when we study all the percentiles collectively.

[65] Tables for the 90th percentile can be found in Appendix A
[66] Tables for the 10th percentile can be found in Appendix A

In the 90th percentile the effect from relative volume on the autoregressive behavior becomes much stronger than when we study all the percentiles collectively. For the β_2 coefficient Electrolux is significant autoregressive and in addition also Atlas Copco and SEB show significant autoregressive behavior i.e. the return in week *t* times the relative volume in week *t* affects the return in week *t+1*. Table 4-4 shows the results for the β_1 and β_2 coefficients in the 90th percentile. The interpretation of the β-coefficients is the same as in table 4-3.

	β_1	β_2
Atlas Copco A	**0.8940**	**-0.6023**
Electrolux B	**-0.3624**	**0.4132**
Ericsson B	0.3839	-0.1323
HM B	0.3893	-0.2491
Sandvik	-0.2739	0.2364
SCA B	0.1715	-0.1387
SEB A	**0.7224**	**-0.5394**
SHB A	0.0492	-0.1357
SKF B	-0.0527	0.1066
Volvo B	-0.1003	0.1378

Table 4-4, β_1 and β_2 of R_{t+1} for the 90th percentile

The β_1 coefficient is overall much larger in the 90th percentile than when we studied all the percentiles collectively. Atlas Copco and SEB show significant momentum in week *t+1* in the 90th percentile and Electrolux shows significant reversal. This means that large positive shocks in relative volume in week *t* affect the return negatively in week *t+1* for Electrolux but positively for Atlas Copco and SEB. The results for these three stocks seem reliable since both the β_1 and β_2 coefficients are significant. It also worth to note that H&M is very close to significance with a t-value of 1.57 for the β_1 coefficient. This means that H&M shows a strong tendency for momentum in the 90th percentile.

In the 10th percentile Electrolux again shows significant autoregressive behavior when we take the relative volume in week *t* times return in week *t* (β_2). Table 4-5 shows the β_1 and β_2 coefficients for the 10th percentile. The interpretation of the β-coefficients is the same as in table 4-3.

	β_1	β_2
Atlas Copco A	-0.7223	-0.5552
Electrolux B	-0.6992	**-0.9007**
Ericsson B	-0.3932	-0.7141
HM B	**1.1609**	**0.5531**
Sandvik	0.0955	0.0034
SCA B	-0.1520	-0.0282
SEB A	0.1987	0.0294
SHB A	-0.0513	-0.0067
SKF B	0.2439	-0.0816
Volvo B	-0.1897	-0.1767

Table 4-5, β_1 and β_2 of R_{t+1} for the 10th percentile

However, the β_1 coefficient for Electrolux is not significant in the 10^{th} percentile but the tendency is still towards reversal, just as in the 90^{th} percentile. H&M shows significant autoregressive behavior in the 10^{th} percentile, both the β_1 and β_2 coefficients are significant. The β_1 coefficient is positive which indicates significant momentum in week *t+1* for H&M i.e. the return in week *t* seems to continue in week *t+1* in the 10^{th} percentile.

The general conclusion for week *t+1* is that the autoregressive behavior increases when we move to either the 10^{th} or the 90^{th} percentile in relative volume. However, if we get the autoregressive effect in the form of momentum or reversal in week *t+1* does not seem to depend on whether we move to the 90^{th} or 10^{th} percentile.

Table 4-6 shows the result for all the percentiles collectively from the regression with equation 3-8 i.e. the regression where we study how the return in week *t* and the relative volume in week *t* affect the return in week *t+2*. β_1 tells us how much the return in week *t* affects the return in week *t+2* and β_2 tells us how the return in week *t* times the relative volume in week *t* affects the return in week *t+2*. Figure 4-4 shows the t-values for the β_2 coefficient in table 4-6.

	β_1	β_2
Atlas Copco A	-0.0051	-0.0909
Electrolux B	-0.0330	**0.1175**
Ericsson B	0.0285	0.0574
HM B	0.0019	-0.0008
Sandvik	-0.0070	-0.0589
SCA B	-0.0556	**0.1188**
SEB A	**0.1299**	-0.1858
SHB A	**0.0945**	-0.0246
SKF B	-0.0216	0.0406
Volvo B	0.0404	0.0314

Table 4-6, β_1 and β_2 of R_{t+2}

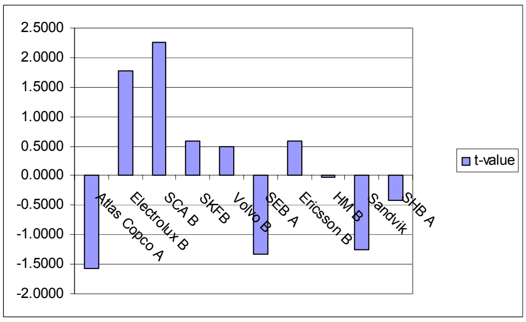


Figure 4-4, t-values for β_2 for R_{t+2}

In week *t+2* the autoregressive behavior (β_2) is still significant for Electrolux and also SCA shows significant autoregressive behavior. This significance is however not verified by the β_1 coefficient. This means that there is proof for autoregressive behavior when we multiply the return with relative volume but whether it is in the form of momentum or reversal cannot be verified by the β_1 coefficient.

Instead the two bank stocks SEB and SHB show significant autoregressive behavior in the form of momentum (β_1). For SEB and SHB the β_2 coefficient is not significant which can be interpreted as that the relative volume is not having any significant impact on the return in week *t+1* when we multiply it with the return in week *t* but the presence of relative volume in the regression increases the autoregressive behavior in the two stocks and therefore the β_1 coefficient becomes significant.

The results in the 90th percentile[67] differ quit a lot in week *t+2* compared to week *t+1*. In week *t+2* there is no sign at all of the strong increase in the autoregressive behavior that we saw in week *t+1* in the 90th percentile. SCA shows a strong tendency for reversal just as in the regression with all the percentiles collectively. but the other stocks show very small signs of any autoregressive behavior.

In the 10th percentile[68] Atlas Copco shows strong significant autoregressive behavior in the form of momentum. This is the opposite to the 90th percentile which means that large negative shocks in relative volume in week *t+2* are more likely to produce momentum in Atlas Copco than large positive shocks in relative volume. It is also the opposite of the results in week *t+1* where Atlas Copco showed strong significant momentum in the 90th percentile and a tendency for reversal in the 10th percentile. Also SKF shows the same tendency with results close to significance. SHB shows significant autoregressive behavior in the form of reversal. For SHB this result is the opposite of the result for all the percentiles collectively where the stock had significant momentum. Large negative shocks in relative volume therefore seem likely to reverse the trend in SHB, but not until week *t+2.*

4.3 Does relative dispersion affect the autoregressive behaviour?

Table 4-7 shows the results from the regression with equation 3-9 when we study all the percentiles collectively. β_1 tells us how much the return in week *t* affects the return in week *t+1* and β_2 tells us how the return in week *t* times the relative dispersion in week *t* affects the return in week *t+1*. Figure 4-5 shows the t-values for the β_2 coefficients in table 4-7.

	β_1	β_2
Atlas Copco A	-0.0219	-0.0426
Electrolux B	0.0239	-0.0067
Ericsson B	0.0801	0.0038
HM B	0.0320	-0.0415
Sandvik	0.0450	**-0.0637**
SCA B	0.0464	**-0.0555**
SEB A	-0.0302	-0.0134
SHB A	-0.0407	-0.0083
SKF B	-0.0287	0.0227
Volvo B	0.0390	-0.0451

Table 4-7, β_1 and β_2 of R_{t+1}

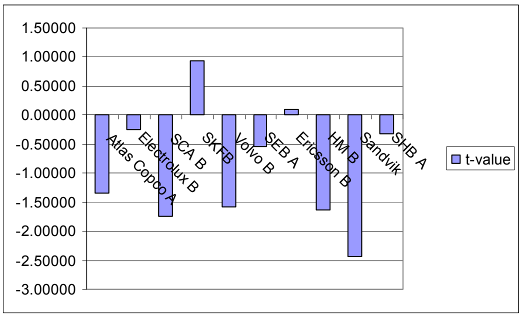


Figure 4-5, t-values for β_2 for R_{t+1}

[67] Tables for the 90th percentile can be found in Appendix A
[68] Tables for the 10th percentile can be found in Appendix A

There is proof of significant autoregressive behavior for two of the stocks in our study when we multiply the return in week *t* with relative dispersion in week *t*; Sandvik and SCA both show that the return in week *t* times relative dispersion in week *t* affects the autoregressive behavior when we make this study at all the percentiles collectively. There is however no significance for the β_1 coefficient which makes the result a little weaker. Because if this it is not either possible to tell if the autoregressive behavior is in the form of momentum or reversal. The size of the β_2 coefficient is overall smaller than when we studied relative volume in equation 4-7. This can be interpreted as that relative dispersion has a smaller affect on the autoregressive behavior than relative volume. Let us now look at what happens when we move to the 90th and 10th percentiles.

Table 4-8 shows the β_1 and β_2 coefficients for the 90th percentile and table 4-9 shows the β_1 and β_2 coefficients for the 10th percentile. The interpretation of the β-coefficients is the same as in table 4-7.

	β_1	β_2
Atlas Copco A	-0.4124	0.0715
Electrolux B	-0.2023	0.0727
Ericsson B	0.3203	-0.0786
HM B	-0.0004	0.0036
Sandvik	-0.1497	0.0145
SCA B	0.4681	**-0.1712**
SEB A	0.1293	-0.0768
SHB A	-0.4160	0.1171
SKF B	**0.6516**	-0.1730
Volvo B	0.1395	-0.0401

Table 4-8, β_1 and β_2 of R_{t+1} for the 90th percentile

	β_1	β_2
Atlas Copco A	-0.9298	-0.1719
Electrolux B	-1.1069	-0.4287
Ericsson B	-0.7261	-0.3187
HM B	**-1.4984**	**-0.7424**
Sandvik	-1.4984	-0.7424
SCA B	-0.1316	-0.1000
SEB A	1.8907	0.6633
SHB A	-0.1830	-0.0018
SKF B	**-0.5651**	-0.0914
Volvo B	-0.8188	-0.3655

Table 4-9, β_1 and β_2 of R_{t+1} for the 10th percentile

In the 90th percentile there is an overall tendency for the autoregressive behavior to increase. This is though only significant for SKF that shows significant momentum in the 90th percentile. Also in the 10th percentile SKF shows significant autoregressive behavior, but now in the form of reversal. The conclusion for SKF is that large positive shocks in relative dispersion in week *t* produce momentum in week *t+1* and large negative shocks in relative dispersion in week *t* produce reversals in week *t+1*. Small shocks, either positive or negative do not affect the autoregressive behavior in SKF.

In the 10th percentile also H&M shows significant autoregressive behavior in the form of reversal. It also worth to notate that nine of the ten stocks in the study show a tendency towards reversal in the 10th percentile. It therefore seems likely (although not significant) that large negative shocks in relative dispersion in week *t* (i.e. decreases in a stock's return relative the OMX-index) have a negative effect on the stock's return in week *t+1*.

Table 4-10 shows the results from the regression with equation 3-10 when we study all the percentiles collectively. β_1 tells us how much the return in week *t* affects the return in week *t+2* and β_2 tells us how the return in week *t* times the relative dispersion in week *t* affects the return in week *t+2*. Figure 4-6 shows the t-values for the β_2 coefficient in table 4-10.

	β_1	β_2
Atlas Copco A	0.0066	**-0.0543**
Electrolux B	0.0034	0.0020
Ericsson B	**0.0996**	-0.0563
HM B	-0.0124	0.0018
Sandvik	-0.0136	0.0042
SCA B	-0.0404	0.0221
SEB A	0.0539	0.0238
SHB A	**0.0868**	0.0017
SKF B	0.0208	-0.0455
Volvo B	**0.0798**	**-0.0475**

Table 4-10, β_1 and β_2 of R_{t+2}

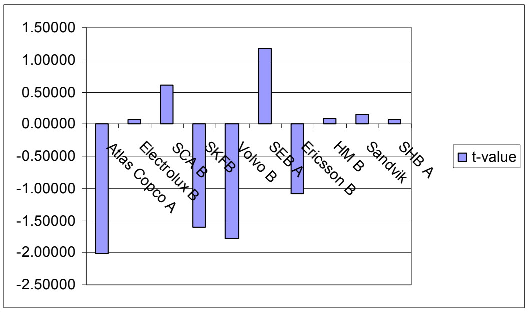


Figure 4-6, t-values for β_2 for R_{t+2}

In week *t+2* we for many stocks get a stronger autoregressive behavior than in week *t+1*. Ericsson, SHB and Volvo all show significant momentum in week *t+2* for the β_1 coefficient. It is just for Atlas Copco and Volvo that the results are significant for the β_2 coefficient. For Ericsson and SHB the β_2 coefficient is not significant which can be interpreted as that the relative volume is not having any significant impact on the return in week *t+1*, but the presence of relative volume in the regression increases the autoregressive behavior in the two stocks and therefore the β_1 coefficient becomes significant.

In the 90th percentile [69] Ericsson's β_1 coefficient is close to significant (momentum). In the 10th percentile[70] Ericsson's β_1 coefficient instead becomes negative i.e. there is almost significant autoregressive behavior in the form of reversal. It therefore seems in the case of Ericsson that positive shocks in relative dispersion produce momentum in week *t+2* but negative shocks produce reversals. This is the same tendency that Ericsson showed in week *t+1*; it is even somewhat stronger in week *t+2* than in week *t+1*.

In the 90th percentile there is also significant autoregressive behavior for SCA in the form of reversal and in the 10th percentile there is significant autoregressive behavior for Volvo (momentum) and SEB (reversal).

In our study with relative dispersion it seems overall that the same tendency in the results apply for week *t+2* as for week *t+1* i.e. it seem like the effect lasts longer in the regression with relative dispersion than in the regression with relative volume.

[69] Tables for the 90th percentile can be found in Appendix A
[70] Tables for the 10th percentile can be found in Appendix A

4.4 Do earnings announcements affect the autoregressive behaviour?

In the next regression we test if earnings announcements affect the autoregressive behavior according to equation 3-11. The β_0 coefficient shows how the dummy variable for an earnings announcement in week *t* affects the return in week *t+1*. The β_1 coefficient shows how the return in week *t* times the dummy variable for an earnings announcement in week *t* affects the return in week *t+1*. The β_2 coefficient shows how the return in week *t* times the dummy variable for no earnings announcements in week *t* affect the return in week *t+1*. The results for all the percentiles collectively are presented in table 4-11 and the t-values for the β_1 coefficient in table 4-11 are presented in figure 4-7.

	β_0	β_1	β_2
Atlas Copco A	0.0120	**-0.2415**	-0.0188
Electrolux B	-0.0017	-0.0011	0.0241
Ericsson B	0.0059	**0.3695**	0.0189
HM B	0.0016	**0.1482**	-0.0511
Sandvik	0.0038	-0.0859	0.0239
SCA B	-0.0078	0.2352	0.0005
SEB A	-0.0005	-0.1001	-0.0341
SHB A	0.0005	-0.0701	-0.0405
SKF B	-0.0013	**0.1922**	-0.0636
Volvo B	0.0012	**0.1815**	-0.0161

Table 4-11, β_1, β_2 and β_3 of R_{t+1}

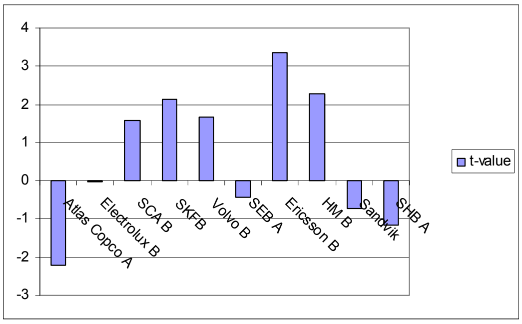


Figure 4-7, t-values for β_1 for R_{t+1}

Table 4-11 shows that there is much stronger autoregressive behavior in weeks with earnings announcements than in weeks with no earnings announcements. Five of the studied stocks show significant autoregressive behavior and the size of the β_1 coefficient is overall rather large which indicates that earnings announcements in week *t* in conjunction with the return in week *t* have a large impact on the return in week *t+1*. Ericsson, H&M, SKF and Volvo show significant momentum and Atlas Copco shows significant reversal. The β_0 coefficient is not significant for any stock which means that the earnings announcements them self do not affect the return in week *t+1*, the dummy variable for an earnings announcement only affect the return in week *t+1* in conjunction with the return in week *t* i.e. earnings announcements affect the autoregressive behavior and not stock return.

As seen in figure 4-7 there are only four stocks that do not show any tendency for autoregressive behavior when we consider earnings announcements. Four of the five significant stocks show their autoregressive behavior in the form of momentum and one in the form of reversal. It seems as the probability for momentum is higher than the probability for reversal when we consider earnings announcements i.e. the return in week *t+1* is more likely to be positively than negatively related to the return in week *t*.

In the 90th percentile[71] the results actually become less significant. Here only Ericsson shows significant autoregressive behavior (momentum). Instead Atlas Copco and Electrolux are significant (momentum) in weeks with no earnings announcements (β_2). The conclusion from this is that earnings announcements do not affect the autoregressive behavior as much when they are accompanied by large positive shocks in relative volume (90th percentile) as when they are accompanied by more moderate changes in relative volume.

Ericsson is the exception with a strong significant (momentum) result also in the 90th percentile. The β_1-coefficient is very large and the R-squared coefficient is 24 %, which clearly shows that a large amount of the return in Ericsson in week *t+1* is due to earnings announcements in week *t* and return in week *t*.

[71] Tables for the 90th percentile can be found in Appendix A

Table 4-12 shows the results for week *t+2* i.e. equation 3-12. The β_0 coefficient shows how the dummy variable for an earnings announcement in week *t* affects the return in week *t+2*. The β_1 coefficient shows how the return in week *t* in conjunction with an earnings announcement in week *t* affects the return in week *t+2*. The β_2 coefficient shows how the return in week *t* in conjunction with no earnings announcement in week *t* affects the return in week *t+2*. The t-values for the β_1 coefficient are presented in figure 4-8.

	β_0	β_1	β_2
Atlas Copco A	0.0035	-0.1291	-0.0085
Electrolux B	0.0064	-0.0885	0.0198
Ericsson B	0.0129	0.0062	0.0535
HM B	-0.0135	0.0544	0.0001
Sandvik	0.0070	-0.0580	-0.0026
SCA B	-0.0075	0.1270	-0.0365
SEB A	0.0073	-0.0465	0.0939
SHB A	0.0030	-0.0731	**0.1183**
SKF B	-0.0023	0.0304	-0.0240
Volvo B	-0.0044	**-0.2061**	**0.0769**

Table 4-12, β_1, β_2 and β_3 of R_{t+2}

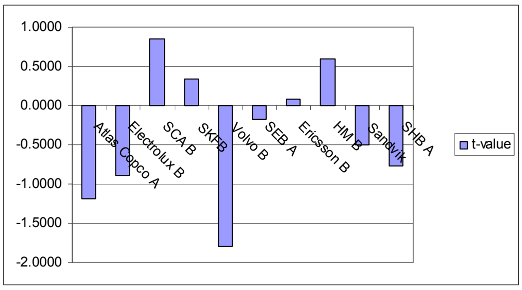


Figure 4-8, t-values for β_1 for R_{t+2}

In week *t+2* it seems like the autoregressive behavior is strongly reduced compared to week *t+1* i.e. almost all the effect from week *t+1* is gone and the *β* -coefficients are much smaller. The conclusion from this is that earnings announcements seem to have a large short-lived effect on the autoregressive behavior, even a very strong effect in week *t+1* as was the case for Ericsson disappears totally in week *t+2*. Volvo is the only stock where the effect from week *t+1* seems to last.

Volvo also in week *t+2* shows significant autoregressive behavior (reversal) but on the other hand Volvo shows autoregressive behavior (momentum) for weeks with no earnings announcements so there does not seem to be any distinction in the strength of the autoregressive behavior due to earnings announcements but whether we get momentum or reversal seems to be affected by earnings announcements in the case of Volvo.

In the 90th percentile[72] Electrolux still shows significance (momentum) for weeks with no earnings announcements (β_2) but overall the results in the 90th percentile in week *t+2* look pretty much the same as when we study all the percentiles collectively. Unlike Ericsson that showed significance in week *t+1* SEB shows significant autoregressive behavior (reversal) in week *t+2*.

4.5 Earnings announcements in the same regression as relative volume

In the next regression we add a β-coefficient for relative volume to the equation above and we then get equation 3-13. The β_0 coefficient shows how the dummy variable for an earnings announcement in week *t* affects the return in week *t+1*. The β_1 coefficient shows how the return in week *t* times the dummy variable for an earnings announcement in week *t* affects the return in week *t+1*. The β_2 coefficient shows how the return in week t times the dummy variable for no earnings announcements in week *t* affect the return in week *t+1*. The β_3 coefficient shows how the return in week *t* times the relative volume in week *t* affects the return in week *t+1*. The results for all the percentiles collectively are presented in table 4-13 and the t-values for the β_1 coefficient are presented in figure 4-9.

	β_0	β_1	β_2	β_3
Atlas Copco A	0.0117	**-0.2678**	-0.0250	0.0442
Electrolux B	-0.0014	-0.1100	-0.0131	**0.1504**
Ericsson B	0.0059	**0.3486**	0.0133	0.0298
HM B	0.0015	**0.1749**	-0.0464	-0.0289
Sandvik	0.0038	-0.0813	0.0244	-0.0125
SCA B	-0.0077	**0.2329**	-0.0041	0.0188
SEB A	-0.0003	-0.1370	-0.0506	0.0660
SHB A	-0.0002	-0.0135	-0.0254	-0.0797
SKF B	-0.0013	**0.1989**	-0.0618	-0.0117
Volvo B	-0.0003	0.2099	-0.0080	-0.0672

Table 4-13, β_0, β_1, β_2 and β_3 of R_{t+1}

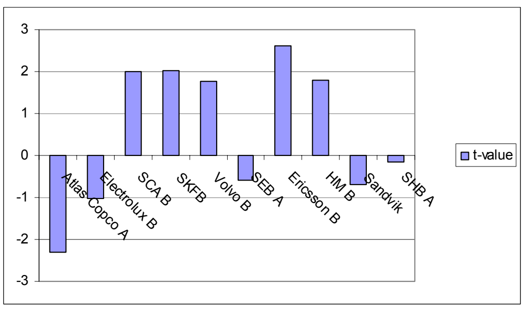


Figure 4-9, t-values for β_1 for R_{t+1}

[72] Tables for the 90th percentile can be found in Appendix A

The strength of the autoregressive behavior is overall stronger for β_1, the coefficient that considers earnings announcements. When we study all the percentiles collectively five stocks have a significant β_1 coefficient and four of those (Ericsson, SCA, H&M and SKF) show a positive autoregressive behavior i.e. momentum.

The β_1 coefficient is pretty large which means that earnings announcements in conjunction with return in week *t* usually have a large impact on the return in week *t+1*. For one stock, Electrolux, the β_3 coefficient is significant. In Electrolux the relative volume in week *t* times the return in week *t* has a larger impact on the return in week *t+1* than earnings announcements. This is also true for SHB but SHB:s result is not significant. When we compare the results in this regression with the ones from equation 3-11 the overall conclusion is that the results do not change much, which means that adding relative volume in the regression does not have any significant impact on the autoregressive behavior from earnings announcements. This gives further strength to our interpretations above that relative volume does not seem to affect the autoregressive behavior as much in weeks with earnings announcements as in weeks with no earnings announcements.

We now move on and see what happens when we make this regression on the 90th percentile exclusively. Table 4-14 shows the β-coefficients for the 90th percentile in week *t+1*. The different β-coefficients can be interpreted in the same way as in table 4-13.

	β_0	β_1	β_2	β_3
Atlas Copco A	0.0075	**0.5530**	**0.8673**	**-0.5110**
Electrolux B	0.0023	**-0.3742**	-0.3212	**0.3952**
Ericsson B	-0.0027	0.7131	0.2561	-0.2383
HM B	0.0026	0.3532	0.2194	-0.1888
Sandvik	0.0130	-0.2946	-0.2438	0.2211
SCA B	0.0017	0.3089	0.1628	-0.1345
SEB A	-0.0141	**0.9537**	**0.7045**	**-0.5725**
SHB A	0.0015	-0.0241	0.1040	-0.1294
SKF B	-0.0213	0.0419	-0.1285	0.1027
Volvo B	0.0073	0.1738	-0.1175	0.0972

Table 4-14, β_0, β_1, β_2 and β_3 of R_{t+1} for the 90th percentile

In the 90th percentile the results overall become stronger than when we study all the weeks collectively. Especially the β_3 coefficient that measures relative volume becomes larger in the 90th percentile and three stocks (Atlas Copco, Electrolux and SEB) have a significant β_3 coefficient in the 90th percentile i.e. in these three stocks large changes in volume have a significant effect on the return in week *t+1*. This result corresponds to the results in earlier regressions in this study that only large positive shocks in relative volume (90th percentile) seem to affect the autoregressive behavior and shocks in relative volume seem to have a larger impact in weeks with no earnings announcements than in weeks with earnings announcements.

Table 4-15 shows the results for week *t+2* i.e. regression 3-14. The β_0 coefficient shows how the dummy variable for an earnings announcement in week *t* affects the return in week *t+2*.The β_1 coefficient shows how the return in week *t* in conjunction with an earnings announcement in week *t* affects the return in week *t+2*. The β_2 coefficient shows how the return in week *t* in conjunction with no earnings announcement in week *t* affects the return in week *t+2*. The β_3 coefficient shows how the return in week *t* times relative volume in week *t* affects the return in week *t+2*. The t-values for the β_1 coefficient are presented in figure 4-10.

	β_0	β_1	β_2	β_3
Atlas Copco A	0.0039	-0.0794	0.0033	-0.0833
Electrolux B	0.0067	**-0.1972**	-0.0173	**0.1502**
Ericsson B	0.0129	-0.0570	0.0363	0.0901
HM B	-0.0135	0.0560	0.0004	-0.0017
Sandvik	0.0069	-0.0374	-0.0006	-0.0552
SCA B	-0.0068	0.1122	-0.0657	**0.1190**
SEB A	0.0067	0.0522	**0.1382**	-0.1763
SHB A	0.0031	-0.0786	**0.1168**	0.0077
SKF B	-0.0022	0.0127	-0.0288	0.0306
Volvo B	-0.0042	**-0.2295**	**0.0702**	0.0555

Table 4-15, β_0, β_1, β_2 and β_3 of R_{t+2}

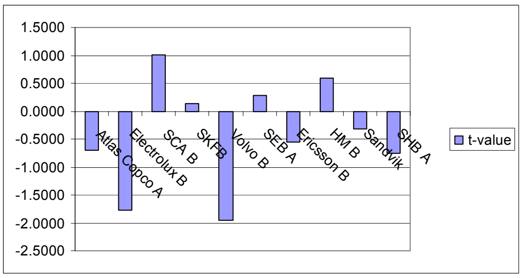


Figure 4-10, t-values for β_1 for R_{t+2}

When we look one week further ahead and study week *t+2* our study shows that the significant results for earnings announcements (β_1) in week *t+1* are no longer significant. Instead the β_1 coefficients for two of the other stocks (Electrolux and Volvo) are significant in week *t+2* (reversal). Overall the effect seems somewhat smaller than in week *t+1* which means that earnings announcements in conjunction with return in week *t* seem to have a smaller effect on the return in week *t+2* than in week *t+1* i.e. the autoregressive behavior decreases in week *t+2*. This result is even more visible when we study the 90th percentile exclusively.

In the 90th percentile[73] the autoregressive behavior from week *t+1* due to earnings announcements have decreased noticeable in week *t+2*. The β_3 coefficient on the other hand seems to affect the stock return to almost the same degree in week *t+2*. For Electrolux that showed significant autoregressive behavior for relative volume in week *t+1* this effect is still there in week *t+2* but it is not significant. The tendency is the same for the stocks that were not significant in week *t+1*.

[73] Tables for the 90th percentile can be found in Appendix A

When the 90th percentile is exclusively studied the results are the same, as with earnings announcements i.e. the significant autoregressive behavior in week *t+1* seems to disappear in week *t+2*. It seems that when we study the large positive changes in volume (those in the 90th percentile) the effect on return in week *t+1*, from both earnings announcements and relative volume become much smaller in week *t+2* i.e. the autoregressive behavior decreases when we consider earnings announcements or relative volume. When we study all the percentiles collectively on the other hand it seems like the autoregressive behavior does not decrease that much in week *t+2* compared to week *t+1* but it was not either as strong from the beginning (in week *t+1*) as it was in the 90th percentile. This result corresponds to our results in the regressions above.

4.6 Earnings announcements in conjunction with relative volume

In the final regression we put relative volume and the dummy variable for earnings announcements together and compare these β-coefficients with the ones without relative volume. This way it becomes easier to interpret the affect from relative volume in weeks with an earnings announcement. The β_0 coefficient shows how the dummy variable for an earnings announcement in week *t* affects the return in week *t+1*. The β_1 coefficient shows how the return in week *t* times the dummy variable for an earnings announcement in week *t* affects the return in week *t+1*. The β_2 coefficient shows how the return in week *t* times the dummy variable for no earnings announcements in week *t* affect the return in week *t+1*. The β_3 coefficient shows how the return in week *t* times the relative volume in week *t* times the dummy variable for an earnings announcement in week *t* affect the return in week *t+1*. The β_4 coefficient shows how the return in week *t* times the relative volume in week *t* times the dummy variable for no earnings announcements in week *t* affect the return in week *t+1*.

The results for all the percentiles collectively are presented in table 4-16. The t-values for the β_3 coefficient are presented in figure 4-11 and the t-values for the β_4 coefficient are presented in figure 4-12.

	β_0	β_1	β_2	β_3	β_4
Atlas Copco A	0.0127	-0.2005	-0.0276	-0.0687	0.0630
Electrolux B	-0.0014	-0.0315	-0.0156	0.0419	**0.1603**
Ericsson B	0.0060	0.2449	0.0185	0.1776	0.0022
HM B	0.0016	0.2277	-0.0471	-0.0858	-0.0246
Sandvik	0.0020	**-0.2434**	0.0251	**0.4221**	-0.0318
SCA B	-0.0076	**0.2258**	-0.0037	0.0755	0.0170
SEB A	-0.0001	-0.3663	-0.0371	0.4754	0.0120
SHB A	-0.0007	0.0480	-0.0289	**-0.1664**	-0.0608
SKF B	-0.0015	0.1585	-0.0604	0.0582	-0.0205
Volvo B	0.0010	0.0921	-0.0046	0.2111	-0.0960

Table 4-16, β_0, β_1, β_2, β_3 and β_4 of R_{t+1}

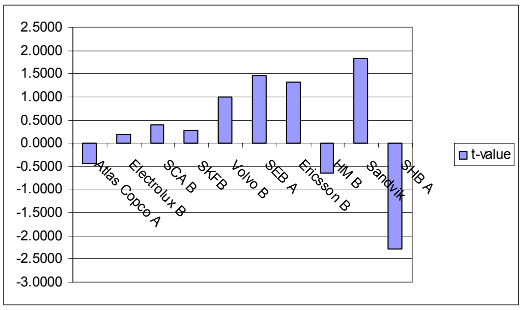


Figure 4-11, t-values for β_3 for R_{t+1}

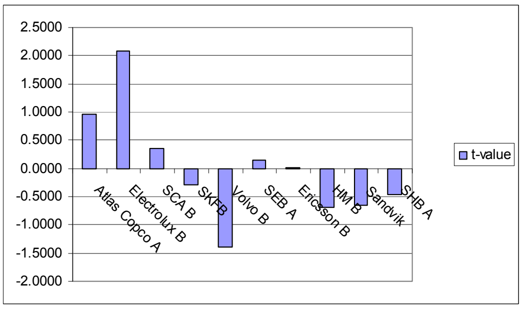


Figure 4-12, t-values for β_4 for R_{t+1}

First we can see that when we compare β_2 (no earnings announcement) with β_4 (relative volume times no earnings announcement) they differ only minimal from each other, with the exception of Electrolux that once again shows significant autoregressive behavior when relative volume is included. This can be interpreted as that for the majority of the stocks the autoregressive behavior is not affected by relative volume in weeks with no earnings announcements when we study all the percentiles collectively.

In the case of Sandvik (β_1) there is significant autoregressive behavior (reversal) and in the case of SCA (β_1) there is significant autoregressive behavior (momentum). These stocks showed no autoregressive behavior in the regression without relative volume (equation 4-11) i.e. it seems like relative volume in these two stocks increases the autoregressive behavior in weeks with earnings announcements.

Table 4-17 shows the results for the β-coefficients in the 90th percentile. The different β-coefficients can be interpreted the same way as in table 4-16.

	β_0	β_1	β_2	β_3	β_4
Atlas Copco A	0.0034	**1.6833**	**0.7662**	**-1.3622**	**-0.4234**
Electrolux B	0.0028	-0.5006	-0.2995	0.5218	**0.3774**
Ericsson B	0.0032	**1.5879**	-0.2075	**-1.1540**	0.2775
HM B	0.0055	0.5729	0.1833	-0.3648	-0.1713
Sandvik	-0.0004	-2.2923	-0.2229	1.8603	0.2068
SCA B	-0.0003	0.4653	0.1547	-0.2679	-0.1281
SEB A	-0.0059	-1.6824	**0.8222**	**1.6461**	**-0.6780**
SHB A	-0.0064	0.4369	0.0696	-0.4817	-0.1010
SKF B	-0.0242	**1.5134**	-0.3611	**-1.2288**	0.3069
Volvo B	0.0084	-0.0741	-0.0693	0.3377	0.0457

Table 4-17, β_0, β_1, β_2, β_3 and β_4 of R_{t+1} for the 90th percentile

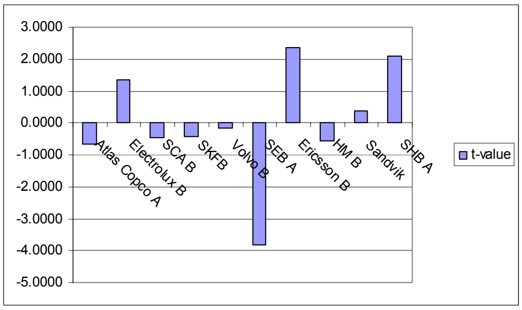
In the 90th percentile the effect is even stronger with three significant stocks (β_1) (Atlas Copco, Ericsson and SKF). The results for these three stocks are significant for both the β_1 and β_3 coefficient.

This means that earnings announcements in week *t* affect the return in week *t+1* and since it is the same three stocks that are significant for both the β_1 and β_3 coefficients it can be interpreted that relative volume does not increase the autoregressive behavior.

Table 4-18 shows the results for week *t+2* i.e. equation 3-16. The β_0 coefficient shows how the dummy variable for an earnings announcement in week *t* affects the return in week *t+2*. The β_1 coefficient shows how the return in week *t* times the dummy variable for an earnings announcement in week *t* affects the return in week *t+2*. The β_2 coefficient shows how the return in week *t* times the dummy variable for no earnings announcements in week *t* affect the return in week *t+2*. The β_3 coefficient shows how the return in week *t* times the relative volume in week *t* times the dummy variable for an earnings announcement in week *t* affect the return in week *t+2*. The β_4 coefficient shows how the return in week *t* times the relative volume in week *t* times the dummy variable for no earnings announcements in week *t* affect the return in week *t+2*. The results for all the percentiles collectively are presented in table 4-18, the t-values for the β_3 coefficient are presented in figure 4-13 and the t-values for the β_4 coefficient are presented in figure 4-14.

	β_0	β_1	β_2	β_3	β_4
Atlas Copco A	0.0040	-0.0674	0.0028	-0.1035	-0.0799
Electrolux B	0.0067	-0.3226	-0.0134	0.3234	**0.1344**
Ericsson B	0.0130	**-0.2290**	0.0450	**0.3351**	0.0443
HM B	-0.0134	0.1204	-0.0004	-0.0713	0.0035
Sandvik	0.0063	-0.0892	-0.0004	0.0836	-0.0614
SCA B	-0.0072	0.1363	-0.0672	-0.0744	**0.1251**
SEB A	0.0065	**0.4179**	**0.1166**	**-0.8293**	-0.0904
SHB A	0.0048	**-0.2851**	**0.1288**	**0.2986**	-0.0557
SKF B	-0.0021	0.0568	-0.0303	-0.0456	0.0402
Volvo B	-0.0042	-0.1921	**0.0691**	-0.0330	0.0646

Table 4-18, β_0, β_1, β_2, β_3 and β_4 of R_{t+2}



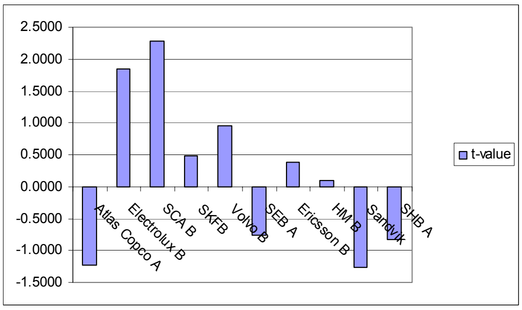


Figure 4-13, t-values for β_3 for R_{t+2}

Figure 4-14, t-values for β_4 for R_{t+2}

The result from week *t+1* for many stocks also holds for week *t+2*. SEB shows a very strong autoregressive behavior (momentum) when we consider relative volume and earnings announcements. In week *t+2* the other bank stock in our study (SHB) also shows a strong significant result (reversal) together with Ericsson (reversal). For the significant stocks the return in week *t+2* is the opposite of the return in week *t+1* i.e. it seems as the return between week *t+1* and *t+2* are negatively correlated. In the regression without relative volume (equation 4-12) SHB and SEB showed no significant result for earnings announcements. This can be interpreted as that relative volume increases the autoregressive behavior in weeks with an earnings announcement more than in weeks with no earnings announcements in week *t+2*.

In the 90th percentile[74] the results become less pronounced in week *t+2* and the β_1 and β_3 coefficients are overall smaller and fewer of the stocks show significant results compared to all the percentiles collectively. It seems once again as the effect from week *t+1* continues in week *t+2* when all the percentiles are collectively studied but when the 90th percentile is exclusively studied the strong results from week *t+1* decreases noticeable. The 90th percentile's relative volume seems to affect the return heavily in week *t+1* but then the effect disappears in week *t+2*. When all percentiles are collectively studied the effect on the other hand seems to be less in week *t+1* but instead it continues through week *t+2*.

[74] Tables for the 90th percentile can be found in Appendix A

5 Conclusions

We will below present the results of our hypothesis. After that follows a general discussion of our empirical findings. The general conclusion we can draw from our study is that the market is weak efficient i.e. all historical data is already being reflected in the stock prices.

5.1 Conclusion

Hypothesis 1: Movements in stock prices are independent from one week to another i.e. there is no autoregressive behaviour in stocks and the return in week t does not affect the return either in week $t+1$ or week $t+2$.

Result: Movements in stock prices are independent in all of the cases. Return in week t does not affect the return either in week $t+1$ or in week $t+2$. Our hypothesis is verified.

Hypothesis 2: When considering relative volume there is autoregressive behaviour in stocks i.e. the return and relative volume in week t affect the return in week $t+1$.

Result: The hypothesis could in general not be verified.

Hypothesis 3: When considering relative dispersion there is autoregressive behaviour in stocks i.e. the return and relative dispersion in week t affect the return in week $t+1$.

Result: The hypothesis could in general not be verified.

Hypothesis 4: Earnings announcements produce autoregressive behaviour in stocks i.e. the return in week t and an earnings announcement in week t affect the return in week $t+1$.

Result: Stock returns in the week after an earnings announcement show autoregressive behaviour. The return in a week with earnings announcements affects the return in the following week for half of the companies. There is a clear tendency for increasing autoregressive behaviour in weeks with earnings announcements. Our hypothesis is verified for 50 percent of the companies.

Hypothesis 5: Earnings announcements in conjunction with relative volume increase the autoregressive behaviour in stocks i.e. the return and relative volume in week *t* in conjunction with an earnings announcement in week *t* affect the return in week *t+1*.

Result: The hypothesis could in general not be verified.

5.2 Discussion of results

In general we have a weak efficient market since the stock prices or the stock prices in conjunction with volume do not affect the return in the latter week. However, earnings announcements in conjunction with return in 50 percent of the cases have a significant impact on the return in the latter week.

In the first part of our study we prove that movements in stock prices are independent from week *t* to week *t+1* and week *t+2* for all of the stocks when no consideration is taken to relative changes in volume or dispersion i.e. when all the percentiles are collectively studied none of the stocks show any significant autoregressive behaviour. The insignificant values are both positive and negative i.e. there are no clear tendency for either momentum or reversals. Our hypothesis is therefore true; last week's price does not affect today's price. The random-walk theory is true as described in the theory part of this thesis. Stock price changes are independent of each other from one week to another.

The second part of our study was to analyze if relative volume affects the autoregressive behaviour. Our study shows that large positive shocks in relative volume (90^{th} percentile) increase the autoregressive behaviour in week *t+1* but this result is only significant for a small number of the stocks. Also for large negative shocks (10^{th} percentile) the same results apply, but the result is only significant for one stock. There are no signs that large positive shocks affect the form of the autoregressive behaviour i.e. if there is momentum or reversal in the following week. The conclusion is therefore that large positive and negative shocks in relative volume make some of the stocks more autoregressive but in what form there is autoregressive behaviour cannot be concluded. Since these results are only significant for a small number of the stocks no general conclusions can be drawn from them.

Our conclusion corresponds to some extent to Connolly's and Stivers's. Connolly and Stivers found substantial momentum (reversals) in consecutive weekly returns when the latter week has unexpectedly high (low) turnover. In our study we find some proof for increasing autoregressive behaviour but no proof for any distinction between momentum and reversal due to positive or negative changes in relative volume.

There also seem to be a strong distinction between the autoregressive behaviour among different stocks and this distinction seems to be persistent over long periods. There are however too few stocks in our study to be able to make any guesses about the cause of this distinction.

The reason could be that stocks in different industries show different autoregressive behaviour or the reason could be different chart patterns in the stocks. The reason that we do not get more significant results can also be that trading on price and volume has a long history. If that is true then it is the same explanation as Timmerman found, that when methods become more widely used, their information may get incorporated into prices and they will cease to be successful.

For week *t+2* the results differ somewhat from the ones found for week *t+1*. The large positive shocks (90th percentile) produce less autoregressive behavior in the second week compared to the first week. The large negative shocks and the small shocks on the other hand seem to give the same result as for week *t+1*.

The third part of our study was to study how relative dispersion affects the autoregressive behaviour. It seems like the large positive shocks in relative dispersion (90th percentile) affect the autoregressive behaviour less than large positive shocks in relative volume. Only one stock shows significant autoregressive behaviour in the 90th percentile when we study relative dispersion compared to three stocks when we study relative volume. This is true for both week *t+1* and week *t+2*. The large negative shocks in relative dispersion (10th percentile) on the other hand seem to affect the autoregressive behaviour more than the large positive shocks. Nine of the ten stocks in week *t+1* show tendency for reversal in the 10th percentile and two of these are significant. The conclusion is therefore that negative shocks in relative dispersion in week *t* have a negative impact on the return in the following week.

This result corresponds to some extent to the findings of Parsley and Popper that discovered that price changes are positively linked to dispersion. Our study shows that negative changes in relative dispersion are linked to negative price changes in the following week.

The final part of our study was to study how an earnings announcement in week *t* affects the autoregressive behavior in latter weeks, both alone and in conjunction with relative volume. Our result shows that half of the companies in our study increase their autoregressive behavior in weeks with earnings announcements i.e. the return in week *t* is more likely to affect the return in week *t+1* if there is an earnings announcement in week *t*. When we compare the effect on the autoregressive behavior from an earnings announcement with relative changes in volume it seems clear that earnings announcements have a larger impact on the autoregressive behavior than relative volume. When it comes to the combined affect from relative volume and earnings announcements the effect is somewhat unclear but it seems like earnings announcements have a smaller impact on the autoregressive behavior if the week with the earnings announcement experience a large positive relative change in volume.

Another way to interpret this is if we compare the regressions with and without relative volume is the following: If there is an earnings announcement in week *t* the return in week *t+1* is *less* likely to be autoregressive if week *t* shows a large positive change in relative volume but if there is no earnings announcement in week *t* the return in week *t+1* is *more* likely to be autoregressive if week *t* shows a large positive change in relative volume.

Our overall significant findings for earnings announcements is a bit different from the findings of Woodruff and Senchack who noticed that price adjustment to unexpected earnings occurred within a few hours after the earnings announcement. In our study the affect of earnings (that we do not know if they were surprised or not) lasted for a whole week for 50 % of the ten biggest companies on the Stockholm Stock Exchange. Maybe our study would have shown even more significance if we had done it on smaller capitalization stocks as described by Woodruff and Senchack.

Our overall and most important conclusion from this study is that earnings announcements affect the autoregressive behaviour more than relative changes in volume do. We find support for our conclusion from Scott, Stumpp and Xu, who have found evidence that once the company's growth rate is controlled for, the momentum-volume effect is largely explained by news. This could explain why the effect from relative volume is overall rather small and why the effect from earnings announcement is significant for half of the companies.

5.3 Suggestions for further research

During our study we have discovered that autoregressive processes in the stock market is a much larger area than we first anticipated. We will therefore below present some suggestions for further research.

- Expand the study with more stocks and exchanges.

- In our study we found a tendency for stocks in different industries to act differently. It would therefore be of interest to divide stocks into groups according to what industry they belong to and then compare the industries to see if there is any difference in the autoregressive behavior between industries.

- Expand the study with more dummy variables. One suggestion is to study various macroeconomic events to see if they have any impact on the autoregressive behavior.

- Compare the autoregressive behavior between bull and bear markets. This way one could find out if the autoregressive behavior is stronger or different in different types of markets. Does for instance the number of reversals decrease in bull markets compare to bear markets and vice versa with momentum?

- Compare the autoregressive behavior between various investments. For instance study treasury bills, commodities, stocks and indexes and compare their autoregressive behavior.

- Compare the autoregressive behavior between stocks that are in different chart patterns i.e. compare stocks that consolidate with stocks that are in long positive or negative trends.

- The analysis could be done with more econometric tests. The Hausman test to test for endogeneity behavior could be made.

6 References

6.1 Literature

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Appendix

Appendix A

The coefficients are not adjusted for heteroscedasticity or autocorrelation. The regressions can be found on the top of each page. In the tables α_0 indicates the intercept term, β values indicate different impacts and will be discussed more in detail prior to the start of each new regression. The R^2 value indicates if the r_{t+1} and r_{t+2} values are explained by the regression. If they are completely explained by the regression the R^2 value is 1 and if the regression does not explain anything the value is 0. The White sign shows the p-value from the White's test for heteroscedasticity. The DW sign shows the Durbin Watson test statistic. There is more information about how to interpret the data from the White's test and the Durbin Watson test in chapter 2.3.4.1 and 2.3.5.

The β_1 value in the regression shows the coefficient for the impact of the return in week t (r_t). The values in the regression are for the whole period, the 90th percentile and the 10th percentile.

	$r_{t+1} = \alpha_0 + \beta_1 r_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t$		
	Atlas Copco A	**90 percentile**	**10 percentile**	**Atlas Copco A**	**90 percentile**	**10 percentile**
α_0	0.0025	-0.0094	0.0039	0.0026	-0.0022	0.0038
(p-value)	0.1860	0.0834	0.4911	0.1719	0.7418	0.4678
β_1	-0.0451	**0.1715**	-0.1345	-0.0230	-0.0662	**0.3159**
(p-value)	0.2410	0.0329	0.3459	0.5458	0.4921	0.0200
R^2 (%)	0.0021	0.0681	0.0137	0.0005	0.0073	0.0805
White (p-value)	0.0054	0.0093	0.7044	0.0476	0.5050	0.8523
DW	2.0014	2.0527	1.7163	2.1202	2.0752	1.9889
	Electrolux B	**90 percentile**	**10 percentile**	**Electrolux B**	**90 percentile**	**10 percentile**
α_0	0.0011	-0.0073	-0.0031	0.0018	-0.0004	0.0081
(p-value)	0.5737	0.1493	0.6068	0.3688	0.9462	0.2127
β_1	0.0199	0.1043	0.1043	0.0046	0.1082	0.0639
(p-value)	0.6068	0.1107	0.6168	0.9057	0.1126	0.7791
R^2 (%)	0.0004	0.0387	0.0039	0.0000	0.0383	0.0012
White (p-value)	0.0000	0.3985	0.0066	0.2341	0.1616	0.0034
DW	1.9503	2.2103	2.0082	1.8627	1.6116	1.8547
	SCA B	**90 percentile**	**10 percentile**	**SCA B**	**90 percentile**	**10 percentile**
α_0	0.0011	0.0032	-0.0016	0.0013	-0.0057	0.0075
(p-value)	0.5089	0.5874	0.6934	0.4363	0.2540	0.1761
β_1	0.0142	-0.0032	-0.1180	-0.0276	0.0403	-0.2231
(p-value)	0.7111	0.9706	0.2597	0.4688	0.5876	0.1102
R^2 (%)	0.0002	0.0000	0.0195	0.0008	0.0045	0.0388
White (p-value)	0.0012	0.0002	0.2304	0.0037	0.0501	0.4813
DW	2.0822	2.2370	2.2025	2.0789	2.2186	2.1850

	$r_{t+1} = \alpha_0 + \beta_1 r_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t$		
	SKF B	**90 percentile**	**10 percentile**	**SKF B**	**90 percentile**	**10 percentile**
α_0	-0.0008	-0.0017	0.0044	-0.0001	-0.0039	0.0035
(p-value)	0.6756	0.8383	0.5084	0.9529	0.5751	0.6042
β_1	-0.0124	0.0682	0.3350	-0.0118	0.0043	-0.0656
(p-value)	0.7471	0.5820	0.0852	0.7581	0.9676	0.7404
R^2 (%)	0.0002	0.0047	0.0449	0.0001	0.0000	0.0017
White (p-value)	0.0018	0.1171	0.2960	0.0050	0.7041	0.7207
DW	2.0115	2.4081	2.3979	2.0220	2.2068	2.1651
	SHB A	**90 percentile**	**10 percentile**	**SHB A**	**90 percentile**	**10 percentile**
α_0	0.0019	0.0064	0.0009	0.0015	0.0076	-0.0040
(p-value)	0.3228	0.5148	0.8718	0.4338	0.1552	0.4768
β_1	-0.0452	-0.1193	-0.0449	**0.0878**	0.0307	-0.0132
(p-value)	0.2354	0.4371	0.7425	0.0203	0.7107	0.9246
R^2 (%)	0.0021	0.0093	0.0017	0.0081	0.0021	0.0001
White (p-value)	0.0006	0.0381	0.0171	0.0363	0.0465	0.0059
DW	2.1053	2.1827	2.1304	1.9211	1.9407	1.9609
	Sandvik	**90 percentile**	**10 percentile**	**Sandvik**	**90 percentile**	**10 percentile**
α_0	0.0020	-0.0079	0.0050	0.0020	0.0024	0.0030
(p-value)	0.2484	0.2505	0.3456	0.2456	0.7018	0.5653
β_1	0.0106	0.0646	0.0908	-0.0113	-0.1056	0.1843
(p-value)	0.7811	0.6302	0.4089	0.7674	0.3861	0.0899
R^2 (%)	0.0001	0.0036	0.0105	0.0001	0.0116	0.0436
White (p-value)	0.1320	0.2095	0.8118	0.0100	0.7603	0.8150
DW	1.8782	1.7477	2.0694	1.8502	1.8241	1.6783
	Ericsson B	**90 percentile**	**10 percentile**	**Ericsson B**	**90 percentile**	**10 percentile**
α_0	0.0013	-0.0061	0.0012	0.0015	0.0012	0.0117
(p-value)	0.6368	0.4710	0.8715	0.5774	0.8369	0.1122
β_1	**0.0833**	**0.2623**	0.1849	0.0448	0.0455	0.1486
(p-value)	0.0302	0.0019	0.3704	0.2408	0.4320	0.4502
R^2 (%)	0.0070	0.1386	0.0124	0.0021	0.0095	0.0088
White (p-value)	0.0000	0.0135	0.0024	0.0005	0.0005	0.0188
DW	1.8881	2.1373	1.7219	1.9282	1.9865	2.3891
	HM	**90 percentile**	**10 percentile**	**HM**	**90 percentile**	**10 percentile**
α_0	**0.0048**	0.0058	0.0060	**0.0045**	**0.0165**	0.0031
(p-value)	0.0129	0.3892	0.2843	0.0190	0.0044	0.5862
β_1	-0.0095	-0.0323	0.0698	0.0016	-0.0788	-0.0603
(p-value)	0.8042	0.7088	0.5439	0.9657	0.2737	0.6043
R^2 (%)	0.0001	0.0022	0.0057	0.0000	0.0184	0.0042
White (p-value)	0.0086	0.8166	0.0026	0.1213	0.6819	0.5445
DW	1.9890	2.5025	2.1196	1.9276	2.1910	2.2511

	$r_{t+1} = \alpha_0 + \beta_1 r_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t$		
	SEB A	**90 percentile**	**10 percentile**	**SEB A**	**90 percentile**	**10 percentile**
α_0	-0.0008	-0.0090	-0.0050	-0.0009	-0.0011	0.0016
(p-value)	0.7025	0.1823	0.3422	0.6944	0.9048	0.7558
β_1	-0.0425	0.1118	0.1712	**0.0759**	**-0.2662**	-0.1107
(p-value)	0.2674	0.1533	0.2793	0.0475	0.0107	0.4671
R^2 (%)	0.0018	0.0311	0.0180	0.0059	0.0961	0.0082
White (p-value)	0.0000	0.0000	0.9674	0.0000	0.0001	0.8478
DW	1.8678	1.7912	1.9191	2.0680	2.1307	1.8020
	Volvo B	**90 percentile**	**10 percentile**	**Volvo B**	**90 percentile**	**10 percentile**
α_0	0.0025	-0.0023	0.0009	0.0023	0.0007	-0.0082
(p-value)	0.2409	0.7553	0.8820	0.2714	0.9175	0.1072
β_1	0.0062	0.0313	-0.0150	0.0453	0.0545	-0.0766
(p-value)	0.8723	0.7319	0.9056	0.2413	0.5326	0.4511
R^2 (%)	0.0000	0.0018	0.0002	0.0021	0.0060	0.0088
White (p-value)	0.0370	0.3302	0.8951	0.3629	0.5363	0.5236
DW	1.9902	1.7718	2.3044	1.9851	1.8122	1.9053

The β_1 value in the regression shows the coefficient for the impact of the return in week t (r_t) and the β_2 value shows the coefficient for the impact of the return in week t (r_t) combined with relative volume (x_t). The values in the regression are for the whole period, the 90th percentile and the 10th percentile.

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$		
	Atlas Copco A	**90 percentile**	**10 percentile**	**Atlas Copco A**	**90 percentile**	**10 percentile**
α_0	0.0025	-0.0092	0.0046	0.0029	-0.0022	0.0025
(p-value)	0.2012	0.0754	0.4205	0.1299	0.7383	0.6210
β_1	-0.0495	**0.8940**	-0.7223	-0.0051	-0.2154	**1.4383**
(p-value)	0.2186	0.0013	0.1844	0.8982	0.5330	0.0044
β_2	0.0221	**-0.6023**	-0.5552	-0.0909	0.1244	**1.0603**
(p-value)	0.7069	0.0063	0.2621	0.1177	0.6526	0.0198
R^2 (%)	0.0023	0.1714	0.0330	0.0042	0.0105	0.1558
White (p-value)	0.0147	0.1202	0.8836	0.1128	0.4164	0.9570
DW	2.0005	1.8308	1.7351	2.1218	2.0753	2.0326
	Electrolux B	**90 percentile**	**10 percentile**	**Electrolux B**	**90 percentile**	**10 percentile**
α_0	0.0009	-0.0057	-0.0034	0.0015	0.0005	0.0083
(p-value)	0.6601	0.2408	0.5576	0.4302	0.9248	0.2050
β_1	-0.0225	-0.3624	-0.6992	-0.0330	-0.1455	0.4402
(p-value)	0.6102	0.0662	0.1796	0.4521	0.4901	0.4453
β_2	**0.1325**	**0.4132**	-0.9007	0.1175	0.2246	0.4219
(p-value)	0.0476	0.0135	0.0942	0.0776	0.2061	0.4769
R^2 (%)	0.0063	0.1267	0.0469	0.0047	0.0622	0.0091
White (p-value)	0.0004	0.7926	0.0451	0.2986	0.3649	0.0161
DW	1.9544	2.2759	1.9794	1.8623	1.6866	1.8866
	SCA B	**90 percentile**	**10 percentile**	**SCA B**	**90 percentile**	**10 percentile**
α_0	0.0011	0.0033	-0.0018	0.0010	-0.0060	0.0089
(p-value)	0.5292	0.5702	0.6752	0.5576	0.2222	0.1086
β_1	0.0100	0.1715	-0.1520	-0.0556	-0.3050	0.1246
(p-value)	0.8039	0.5102	0.4507	0.1622	0.1618	0.6345
β_2	0.0179	-0.1387	-0.0282	**0.1188**	0.2742	0.2885
(p-value)	0.7204	0.4759	0.8431	0.0171	0.0934	0.1229
R^2 (%)	0.0004	0.0080	0.0201	0.0093	0.0477	0.0741
White (p-value)	0.0045	0.0019	0.4190	0.0204	0.0371	0.6434
DW	2.0819	2.2479	2.1909	2.0685	2.1752	2.1907
	SKF B	**90 percentile**	**10 percentile**	**SKF B**	**90 percentile**	**10 percentile**
α_0	-0.0010	-0.0016	0.0042	-0.0003	-0.0039	0.0057
(p-value)	0.6145	0.8419	0.5330	0.8789	0.5752	0.4099
β_1	-0.0219	-0.0527	0.2439	-0.0216	0.1267	1.1830
(p-value)	0.5979	0.8972	0.7426	0.6004	0.7181	0.1165
β_2	0.0392	0.1066	-0.0816	0.0406	-0.1080	1.1188
(p-value)	0.5412	0.7558	0.8989	0.5240	0.7142	0.0867
R^2 (%)	0.0007	0.0062	0.0451	0.0008	0.0021	0.0468
White (p-value)	0.0078	0.1839	0.5218	0.0297	0.6878	0.6866
DW	2.0131	2.4050	2.4066	2.0199	2.2108	2.1631

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$		
	SHB A	**90 percentile**	**10 percentile**	**SHB A**	**90 percentile**	**10 percentile**
α_0	0.0021	0.0053	0.0009	0.0016	0.0080	-0.0020
(p-value)	0.2778	0.5945	0.8708	0.4171	0.1437	0.7116
β_1	-0.0240	0.0492	-0.0513	**0.0945**	-0.0403	-0.4812
(p-value)	0.5605	0.8917	0.8438	0.0213	0.8370	0.0651
β_2	-0.0778	-0.1357	-0.0067	-0.0246	0.0572	**-0.4899**
(p-value)	0.1839	0.6071	0.9770	0.6725	0.6887	0.0352
R^2 (%)	0.0048	0.0134	0.0017	0.0083	0.0047	0.0676
White (p-value)	0.0002	0.0804	0.0265	0.1259	0.0616	0.0481
DW	2.1078	2.1704	2.1290	1.9234	1.9307	1.9942
	Sandvik	**90 percentile**	**10 percentile**	**Sandvik**	**90 percentile**	**10 percentile**
α_0	0.0021	-0.0075	0.0050	0.0023	0.0022	0.0033
(p-value)	0.2290	0.2760	0.3621	0.1768	0.7191	0.5437
β_1	0.0120	-0.2739	0.0955	-0.0070	0.0013	0.1118
(p-value)	0.7549	0.4748	0.7761	0.8555	0.9970	0.7340
β_2	-0.0187	0.2364	0.0034	-0.0589	-0.0747	-0.0519
(p-value)	0.6911	0.3463	0.9882	0.2102	0.7435	0.8154
R^2 (%)	0.0004	0.0174	0.0105	0.0025	0.0132	0.0444
White (p-value)	0.3804	0.5645	0.9261	0.0798	0.8453	0.9775
DW	1.8780	1.7578	2.0689	1.8564	1.8094	1.7029
	Eric B	**90 percentile**	**10 percentile**	**Eric B**	**90 percentile**	**10 percentile**
α_0	0.0013	-0.0062	0.0022	0.0015	0.0015	0.0119
(p-value)	0.6193	0.4677	0.7758	0.5711	0.8087	0.1148
β_1	0.0417	0.3839	-0.3932	0.0285	-0.2400	0.0474
(p-value)	0.3513	0.3237	0.6191	0.5234	0.3800	0.9501
β_2	0.1462	-0.1323	-0.7141	0.0574	0.3106	-0.1250
(p-value)	0.0731	0.7483	0.4495	0.4800	0.2860	0.8899
R^2 (%)	0.0118	0.1400	0.0212	0.0028	0.0271	0.0091
White (p-value)	0.0000	0.0080	0.0063	0.0001	0.0067	0.0733
DW	1.8968	2.1202	1.7115	1.9304	2.0617	2.3833
	H&M	**90 percentile**	**10 percentile**	**H&M**	**90 percentile**	**10 percentile**
α_0	**0.0048**	0.0058	0.0033	**0.0045**	**0.0165**	0.0038
(p-value)	0.0126	0.3848	0.5118	0.0192	0.0045	0.5042
β_1	-0.0071	0.3893	**1.1609**	0.0019	-0.1948	-0.3535
(p-value)	0.8579	0.0932	0.0001	0.9619	0.3202	0.2611
β_2	-0.0075	-0.2491	**0.5531**	-0.0008	0.0686	-0.1487
(p-value)	0.8224	0.0514	0.0001	0.9808	0.5231	0.3149
R^2 (%)	0.0002	0.0600	0.2282	0.0000	0.0247	0.0199
White (p-value)	0.0376	0.5450	0.0345	0.2508	0.5098	0.4192
DW	1.9882	2.4278	1.9925	1.9275	2.2044	2.2334

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$		
	SEB A	**90 percentile**	**10 percentile**	**SEB A**	**90 percentile**	**10 percentile**
α_0	-0.0010	-0.0094	-0.0049	-0.0004	-0.0013	0.0012
(p-value)	0.6574	0.1465	0.3516	0.8478	0.8846	0.8173
β_1	-0.0593	**0.7224**	0.1987	**0.1299**	0.0819	-0.4723
(p-value)	0.1633	0.0040	0.7166	0.0022	0.8047	0.3700
β_2	0.0578	**-0.5394**	0.0294	**-0.1858**	-0.3075	-0.3881
(p-value)	0.3621	0.0100	0.9582	0.0032	0.2719	0.4727
R^2 (%)	0.0031	0.1273	0.0180	0.0188	0.1132	0.0162
White (p-value)	0.0003	0.0001	0.8019	0.0000	0.0023	0.7913
DW	1.8658	1.8651	1.9193	2.0661	2.1658	1.7824

	Volvo B	**90 percentile**	**10 percentile**	**Volvo B**	**90 percentile**	**10 percentile**
α_0	0.0026	-0.0022	0.0013	0.0022	0.0007	-0.0080
(p-value)	0.2167	0.7657	0.8410	0.2932	0.9201	0.1254
β_1	0.0138	-0.1003	-0.1897	0.0404	0.0813	-0.1849
(p-value)	0.7298	0.7519	0.7396	0.3114	0.7888	0.6864
β_2	-0.0490	0.1378	-0.1767	0.0314	-0.0281	-0.1095
(p-value)	0.4474	0.6649	0.7535	0.6253	0.9265	0.8083
R^2 (%)	0.0009	0.0048	0.0018	0.0024	0.0062	0.0097
White (p-value)	0.1075	0.6635	0.8305	0.5688	0.7098	0.6438
DW	1.9882	1.7733	2.3066	1.9835	1.8120	1.9071

The β_1 value in the regression shows the coefficient for the impact of the return in week t (r_t) and the β_2 value shows the coefficient for the impact of the return in week t (r_t) combined with relative dispersion (z_t). The values in the regression are for the whole period, the 90[th] percentile and the 10[th] percentile.

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$		
	Atlas Copco A	**90 percentile**	**10 percentile**	**Atlas Copco A**	**90 percentile**	**10 percentile**
α_0	0.0027	0.0035	0.0060	0.0028	0.0103	0.0017
(p-value)	0.1629	0.5138	0.2457	0.1438	0.0687	0.7778
β_1	-0.0219	-0.4124	-0.9298	0.0066	0.4783	0.3592
(p-value)	0.5947	0.2423	0.1509	0.8719	0.1889	0.6276
β_2	-0.0426	0.0715	-0.1719	**-0.0543**	-0.2197	0.1157
(p-value)	0.1197	0.5525	0.4247	0.0449	0.0797	0.6404
R^2 (%)	0.0057	0.0776	0.1125	0.0066	0.0755	0.0037
White (p-value)	0.0268	0.9035	0.3714	0.3227	0.9878	0.2392
DW	2.0120	1.6904	2.1097	2.1254	2.2544	2.3695
	Electrolux B	**90 percentile**	**10 percentile**	**Electrolux B**	**90 percentile**	**10 percentile**
α_0	0.0011	0.0051	0.0010	0.0018	-0.0034	0.0045
(p-value)	0.5734	0.4116	0.8594	0.3693	0.5916	0.4602
β_1	0.0239	-0.2023	-1.1069	0.0034	0.2269	-0.2769
(p-value)	0.5676	0.6221	0.2505	0.9354	0.5842	0.7843
β_2	-0.0067	0.0727	-0.4287	0.0020	-0.0752	-0.2247
(p-value)	0.8002	0.6111	0.1747	0.9387	0.6025	0.4977
R^2 (%)	0.0005	0.0041	0.0388	0.0000	0.0048	0.0552
White (p-value)	0.0001	0.3209	0.9959	0.5389	0.6742	0.8076
DW	1.9880	2.3789	2.1253	1.9306	2.4977	1.8829
	SCA B	**90 percentile**	**10 percentile**	**SCA B**	**90 percentile**	**10 percentile**
α_0	0.0011	-0.0018	0.0079	0.0013	0.0078	-0.0021
(p-value)	0.5274	0.7653	0.1662	0.4291	0.1511	0.7575
β_1	0.0464	0.4681	-0.1316	-0.0404	**-0.6198**	-0.5592
(p-value)	0.2482	0.1531	0.8445	0.3143	0.0351	0.4878
β_2	**-0.0555**	**-0.1712**	-0.1000	0.0221	**0.1571**	-0.0780
(p-value)	0.0111	0.0299	0.6196	0.3116	0.0251	0.7467
R^2 (%)	0.0099	0.1044	0.0198	0.0023	0.0760	0.0312
White (p-value)	0.0281	0.7387	0.3039	0.0169	0.0066	0.0816
DW	2.0123	1.9179	1.7569	1.9633	2.2517	2.0604
	SKF B	**90 percentile**	**10 percentile**	**SKF B**	**90 percentile**	**10 percentile**
α_0	-0.0007	0.0044	-0.0017	-0.0004	-0.0074	0.0045
(p-value)	0.7272	0.5452	0.7660	0.8435	0.2475	0.5608
β_1	-0.0287	0.6516	-0.5651	0.0208	-0.2922	0.2163
(p-value)	0.4964	0.0673	0.2408	0.6193	0.3422	0.7439
β_2	0.0227	-0.1730	-0.0914	-0.0455	0.0952	-0.0436
(p-value)	0.3420	0.1208	0.4374	0.0551	0.3248	0.7882
R^2 (%)	0.0015	0.0574	0.0339	0.0057	0.0152	0.0414
White (p-value)	0.0110	0.1285	0.5672	0.0038	0.7313	0.3737
DW	2.0060	1.7376	2.4407	2.0205	2.3283	1.7869

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$		
	SHB	**90 percentile**	**10 percentile**	**SHB**	**90 percentile**	**10 percentile**
α_0	0.0019	-0.0027	0.0055	0.0015	0.0075	-0.0030
(p-value)	0.3204	0.5960	0.2793	0.4349	0.1617	0.4974
β_1	-0.0407	-0.4160	-0.1830	**0.0868**	-0.3331	0.1790
(p-value)	0.3160	0.1319	0.6326	0.0313	0.2496	0.5931
β_2	-0.0083	0.1171	-0.0018	0.0017	0.1545	0.0463
(p-value)	0.7514	0.2573	0.9853	0.9470	0.1564	0.5939
R^2 (%)	0.0023	0.0515	0.0221	0.0081	0.0384	0.0047
White (p-value)	0.0025	0.9469	0.0386	0.1172	0.4910	0.1128
DW	2.0424	1.9222	1.6770	2.1548	1.9718	1.9686
	Sandvik	**90 percentile**	**10 percentile**	**Sandvik**	**90 percentile**	**10 percentile**
α_0	0.0017	0.0075	-0.0076	0.0020	-0.0021	0.0051
(p-value)	0.3177	0.1875	0.2011	0.2427	0.6716	0.2833
β_1	0.0450	-0.1497	-1.4984	-0.0136	-0.1361	-0.6097
(p-value)	0.2680	0.6634	0.0921	0.7391	0.6597	0.3915
β_2	**-0.0637**	0.0145	-0.7424	0.0042	0.0468	-0.1894
(p-value)	0.0152	0.9127	0.0120	0.8724	0.6934	0.4161
R^2 (%)	0.0090	0.0246	0.2510	0.0002	0.0033	0.0117
White (p-value)	0.4706	0.2676	0.9541	0.0181	0.2879	0.2760
DW	2.0264	2.2903	1.8688	2.0047	1.6624	1.8770
	Ericsson	**90 percentile**	**10 percentile**	**Ericsson**	**90 percentile**	**10 percentile**
α_0	0.0013	0.0048	-0.0006	0.0011	0.0021	0.0088
(p-value)	0.6335	0.5497	0.9218	0.6894	0.797	0.2682
β_1	**0.0801**	0.3203	-0.7261	**0.0996**	0.5006	-1.3337
(p-value)	0.0767	0.2885	0.3002	0.0277	0.1097	0.1261
β_2	0.0038	-0.0786	-0.3187	-0.0563	-0.1622	-0.5571
(p-value)	0.8954	0.3938	0.2057	0.0510	0.0907	0.0757
R^2 (%)	0.0071	0.0207	0.0310	0.0085	0.0441	0.0543
White (p-value)	0.0000	0.2748	0.5331	0.0131	0.0214	0.5000
DW	1.9649	1.4793	1.9537	1.8283	1.6141	2.3791
	HM	**90 percentile**	**10 percentile**	**HM**	**90 percentile**	**10 percentile**
α_0	**0.0048**	0.0041	-0.0076	0.0048	0.0089	0.0051
(p-value)	0.0129	0.3718	0.2011	0.0123	0.1408	0.2833
β_1	0.0320	-0.0004	-1.4984	-0.0124	0.0158	-0.6097
(p-value)	0.4765	0.9981	0.0921	0.7838	0.9434	0.3915
β_2	-0.0415	0.0036	**-0.7424**	0.0018	0.0047	-0.1894
(p-value)	0.0751	0.9489	0.0120	0.9376	0.9486	0.4161
R^2 (%)	0.0048	0.0006	0.2510	0.0001	0.0027	0.0117
White (p-value)	0.0273	0.7619	0.9541	0.2707	0.3849	0.2760
DW	2.0026	1.9595	1.8688	2.0202	2.3598	1.8770

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$		
	SEB	**90 percentile**	**10 percentile**	**SEB**	**90 percentile**	**10 percentile**
α_0	-0.0009	-0.0071	0.0102	-0.0008	0.0108	0.0019
(p-value)	0.6935	0.2011	0.2074	0.7109	0.0845	0.6927
β_1	-0.0302	0.1293	1.8907	0.0539	-0.0203	**-1.0699**
(p-value)	0.4875	0.4902	0.0262	0.2134	0.9232	0.0359
β_2	-0.0134	-0.0768	**0.6633**	0.0238	0.0719	**-0.4702**
(p-value)	0.5443	0.1277	0.0209	0.2798	0.2037	0.0069
R^2 (%)	0.0024	0.0990	0.0805	0.0076	0.1547	0.1504
White (p-value)	0.0000	0.0093	0.0077	0.0000	0.8449	0.4285
DW	2.0253	1.9887	2.0871	2.1123	1.9337	1.8165
	Volvo B	**90 percentile**	**10 percentile**	**Volvo B**	**90 percentile**	**10 percentile**
α_0	0.0026	-0.0017	0.0103	0.0025	0.0006	-0.0054
(p-value)	0.2097	0.8363	0.1414	0.2355	0.9380	0.4077
β_1	0.0390	0.1395	-0.8188	0.0798	-0.3668	**1.3858**
(p-value)	0.3675	0.7300	0.2655	0.0646	0.2891	0.0458
β_2	-0.0451	-0.0401	-0.3655	-0.0475	0.1136	0.3645
(p-value)	0.0910	0.7834	0.1470	0.0743	0.3616	0.1217
R^2 (%)	0.0043	0.0025	0.0484	0.0068	0.0198	0.0879
White (p-value)	0.0383	0.9428	0.8848	0.5757	0.8039	0.4975
DW	1.9994	2.1603	2.0404	1.9942	2.1515	2.0554

The β_0 value in the regression shows the coefficient for the impact of the earnings announcement in week t, the β_1 value shows the coefficient for the impact of the return in week t (r_t) for weeks with earnings announcement (d_t^1) and the β_2 value shows the coefficient for the impact of the return in week t (r_t) for weeks with no earnings announcement (d_t^2). The values in the regression are for the whole period, the 90th percentile and the 10th percentile.

	$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$			$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$		
	Atlas Copco A	**90 percentile**	**10 percentile**	**Atlas Copco A**	**90 percentile**	**10 percentile**
α_0	0.0015	-0.0112	0.0058	0.0023	-0.0057	0.0041
(p-value)	0.4482	0.0554	0.2942	0.2463	0.4321	0.4579
β_0	0.0120	0.0107	0.0065	0.0035	0.0202	-0.0205
(p-value)	0.0771	0.4357	0.8820	0.6062	0.2421	0.6340
β_1	**-0.2415**	-0.1254	1.7530	-0.1291	-0.2418	-0.2080
(p-value)	0.0281	0.4017	0.1137	0.2358	0.1973	0.8480
β_2	-0.0188	**0.2776**	-0.2036	-0.0085	-0.0073	**0.3216**
(p-value)	0.6464	0.0029	0.1449	0.8351	0.9484	0.0215
R^2 (%)	0.0114	0.1445	0.1232	0.0025	0.0417	0.0842
White (p-value)	0.0965	0.2809	0.7117	0.0798	0.7816	0.7276
DW	2.0092	2.0643	1.8269	2.1290	2.0419	2.0375
	Electrolux B	**90 percentile**	**10 percentile**	**Electrolux B**	**90 percentile**	**10 percentile**
α_0	0.0013	-0.0079	-0.0028	0.0012	-0.0063	0.0088
(p-value)	0.5359	0.1952	0.6491	0.5640	0.3067	0.1934
β_0	-0.0017	0.0023	-0.0096	0.0064	0.0195	-0.0177
(p-value)	0.7988	0.8364	0.7396	0.3363	0.0805	0.5764
β_1	-0.0011	0.0208	-1.4271	-0.0885	-0.0413	-1.5815
(p-value)	0.9911	0.8401	0.3724	0.3712	0.6911	0.3656
β_2	0.0241	0.1603	0.1313	0.0198	**0.2015**	0.0947
(p-value)	0.5668	0.0611	0.5362	0.6355	0.0205	0.6828
R^2 (%)	0.0006	0.0553	0.0186	0.0027	0.1157	0.0164
White (p-value)	0.0000	0.7283	0.0104	0.1028	0.3930	0.0092
DW	1.9515	2.2773	2.0011	1.8580	1.4034	1.8645
	SCA B	**90 percentile**	**10 percentile**	**SCA B**	**90 percentile**	**10 percentile**
α_0	0.0015	0.0029		0.0018	-0.0066	
(p-value)	0.3788	0.6400		0.3143	0.2061	
β_0	-0.0078	0.0041		-0.0075	0.0119	
(p-value)	0.2379	0.8525		0.2558	0.5269	
β_1	0.2352	0.1512		0.1270	-0.1610	
(p-value)	0.1148	0.7858		0.3925	0.7321	
β_2	0.0005	-0.0065		-0.0365	0.0477	
(p-value)	0.9895	0.9422		0.3559	0.5322	
R^2 (%)	0.0049	0.0019		0.0038	0.0137	
White (p-value)	0.0032	0.0006		0.0103	0.0934	
DW	2.0878	2.2236		2.0740	2.2498	

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 \qquad\qquad r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$$

	SKF B	**90 percentile**	**10 percentile**	**SKF B**	**90 percentile**	**10 percentile**
α_0	-0.0003	0.0044		0.0002	-0.0060	
(p-value)	0.8841	0.6398		0.9333	0.4595	
β_0	-0.0013	-0.0215		-0.0023	0.0150	
(p-value)	0.8612	0.3020		0.7507	0.4045	
β_1	0.1922	0.1553		0.0304	0.1518	
(p-value)	0.0329	0.5468		0.7346	0.4960	
β_2	-0.0636	-0.0116		-0.0240	-0.0167	
(p-value)	0.1383	0.9377		0.5743	0.8961	
R^2 (%)	0.0109	0.0303		0.0009	0.0152	
White (p-value)	0.0432	0.1579		0.0009	0.6703	
DW	2.0216	2.4351		2.0240	2.0876	

	SHB A	**90 percentile**	**10 percentile**	**SHB A**	**90 percentile**	**10 percentile**
α_0	0.0019	0.0062		0.0014	0.0051	
(p-value)	0.3456	0.5460		0.4763	0.3495	
β_0	0.0005	0.0035		0.0030	0.0312	
(p-value)	0.9441	0.9248		0.6860	0.1200	
β_1	-0.0701	-0.1935		-0.0731	-0.0121	
(p-value)	0.4626	0.4172		0.4389	0.9236	
β_2	-0.0405	-0.0528		**0.1183**	-0.0021	
(p-value)	0.3318	0.8099		0.0043	0.9854	
R^2 (%)	0.0022	0.0123		0.0132	0.0430	
White (p-value)	0.0013	0.0726		0.0827	0.0491	
DW	2.1043	2.1703		1.9284	2.0223	

	Sandvik	**90 percentile**	**10 percentile**	**Sandvik**	**90 percentile**	**10 percentile**
α_0	0.0016	-0.0094	0.0043	0.0013	0.0016	0.0021
(p-value)	0.3860	0.1986	0.4345	0.4562	0.8110	0.6936
β_0	0.0038	0.0155	0.0226	0.0070	0.0069	0.0181
(p-value)	0.5369	0.5019	0.3658	0.2564	0.7416	0.4670
β_1	-0.0859	-0.0251	-1.1517	-0.0580	-0.2861	0.1947
(p-value)	0.4673	0.9537	0.2064	0.6235	0.4671	0.8291
β_2	0.0239	0.0783	0.1035	-0.0026	-0.0849	0.1793
(p-value)	0.5550	0.5844	0.3488	0.9487	0.5140	0.1058
R^2 (%)	0.0021	0.0108	0.0501	0.0026	0.0158	0.0517
White (p-value)	0.0588	0.3831	0.8939	0.0232	0.7666	0.7241
DW	1.8782	1.7835	2.0643	1.8482	1.8059	1.6818

	Eric B	**90 percentile**	**10 percentile**	**Eric B**	**90 percentile**	**10 percentile**
α_0	0.0007	-0.0023	0.0014	0.0002	-0.0018	0.0129
(p-value)	0.8068	0.8128	0.8573	0.9413	0.8097	0.0927
β_0	0.0059	-0.0060	-0.0046	0.0129	0.0085	-0.0237
(p-value)	0.5043	0.7340	0.9033	0.1479	0.5197	0.5139
β_1	**0.3695**	**0.4854**	0.2569	0.0062	0.0087	-0.1893
(p-value)	0.0000	0.0001	0.7625	0.9443	0.9178	0.8145
β_2	0.0189	0.0419	0.1810	0.0535	0.0896	0.1753
(p-value)	0.6530	0.7001	0.4028	0.2053	0.2742	0.3932
R^2 (%)	0.0264	0.2414	0.0127	0.0056	0.0251	0.0207
White (p-value)	0.0000	0.0382	0.0051	0.0006	0.0072	0.0288
DW	1.8935	2.1754	1.7177	1.9250	1.9587	2.4000

	$r_{t+1}=\alpha_0+\beta_0 d_t^1+\beta_1 r_t d_t^1+\beta_2 r_t d_t^2$			$r_{t+2}=\alpha_0+\beta_0 d_t^1+\beta_1 r_t d_t^1+\beta_2 r_t d_t^2$		
	H&M	**90 percentile**	**10 percentile**	**H&M**	**90 percentile**	**10 percentile**
α_0	**0.0045**	0.0049		**0.0050**	**0.0175**	
(p-value)	0.0223	0.4896		0.0098	0.0042	
β_0	0.0016	-0.0003		-0.0135	-0.0058	
(p-value)	0.8680	0.9899		0.1536	0.7689	
β_1	0.1482	0.1174		0.0544	-0.1424	
(p-value)	0.1066	0.4117		0.5481	0.2363	
β_2	-0.0511	-0.1695		0.0001	-0.0044	
(p-value)	0.2340	0.1555		0.9975	0.9650	
R^2 (%)	0.0071	0.0455		0.0031	0.0383	
White (p-value)	0.0359	0.8658		0.1900	0.7073	
DW	1.9817	2.3652		1.9343	2.1825	
	SEB A	**90 percentile**	**10 percentile**	**SEB A**	**90 percentile**	**10 percentile**
α_0	-0.0008	-0.0061		-0.0014	-0.0111	
(p-value)	0.7249	0.4187		0.5372	0.2426	
β_0	-0.0005	-0.0119		0.0073	**0.0438**	
(p-value)	0.9554	0.4750		0.3831	0.0370	
β_1	-0.1001	0.2735		-0.0465	**-0.6082**	
(p-value)	0.3512	0.1139		0.6635	0.0057	
β_2	-0.0341	0.0655		**0.0939**	-0.1623	
(p-value)	0.4068	0.4552		0.0220	0.1399	
R^2 (%)	0.0023	0.0579		0.0093	0.2038	
White (p-value)	0.0000	0.0010		0.0000	0.1302	
DW	1.8673	1.7429		2.0661	2.1417	
	Volvo B	**90 percentile**	**10 percentile**	**Volvo B**	**90 percentile**	**10 percentile**
α_0	0.0025	-0.0035		0.0026	-0.0013	
(p-value)	0.2631	0.6745		0.2447	0.8706	
β_0	0.0012	0.0068		-0.0044	0.0090	
(p-value)	0.8761	0.7157		0.5554	0.6093	
β_1	0.1815	0.2740		-0.2061	-0.3115	
(p-value)	0.1147	0.1871		0.0720	0.1111	
β_2	-0.0161	-0.0265		0.0769	0.1437	
(p-value)	0.6957	0.7941		0.0608	0.1355	
R^2 (%)	0.0040	0.0338		0.0105	0.0724	
White (p-value)	0.0468	0.7895		0.2412	0.2731	
DW	1.9789	1.8777		1.9590	1.7532	

The β_0 value in the regression shows the coefficient for the impact of the earnings announcement in week t, the β_1 value shows the coefficient for the impact of the return in week t (r_t) for weeks with earnings announcement (d_t^1), the β_2 value shows the coefficient for the impact of the return in week t (r_t) for weeks with no earnings announcement (d_t^2) and β_3 value shows the coefficient for the impact of the return in week t (r_t) combined with relative volume (x_t). The values in the regression are for the whole period, the 90th percentile and the 10th percentile.

	$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$		
	Atlas Copco A	**90 percentile**	**10 percentile**	**Atlas Copco A**	**90 percentile**	**10 percentile**
α_0	0.0014	-0.0105	0.0063	0.0025	-0.0060	0.0028
(p-value)	0.4869	0.0641	0.2559	0.2038	0.4089	0.5909
β_0	0.0117	0.0075	0.0057	0.0039	0.0216	-0.0188
(p-value)	0.0832	0.5755	0.8957	0.5634	0.2150	0.6519
β_1	**-0.2678**	0.5530	1.2080	-0.0794	-0.5358	1.0522
(p-value)	0.0207	0.0904	0.3299	0.4878	0.2037	0.3739
β_2	-0.0250	**0.8673**	-0.6856	0.0033	-0.2628	**1.4359**
(p-value)	0.5501	0.0017	0.1898	0.9371	0.4468	0.0051
β_3	0.0442	**-0.5110**	-0.4570	-0.0833	0.2214	**1.0567**
(p-value)	0.4642	0.0215	0.3373	0.1638	0.4339	0.0225
R^2 (%)	0.0122	0.2149	0.1362	0.0054	0.0512	0.1586
White (p-value)	0.1879	0.2695	0.8672	0.1232	0.4899	0.8895
DW	2.0079	1.8986	1.8145	2.1299	2.0346	2.0738
	Electrolux B	**90 percentile**	**10 percentile**	**Electrolux B**	**90 percentile**	**10 percentile**
α_0	0.0010	-0.0065	-0.0029	0.0009	-0.0057	0.0088
(p-value)	0.6262	0.2755	0.6264	0.6568	0.3578	0.1922
β_0	-0.0014	0.0023	-0.0148	0.0067	0.0195	-0.0154
(p-value)	0.8364	0.8285	0.6054	0.3110	0.0808	0.6294
β_1	-0.1100	-0.3742	-2.3028	-0.1972	-0.2038	-1.2014
(p-value)	0.3235	0.0643	0.1667	0.0753	0.3297	0.5147
β_2	-0.0131	-0.3212	-0.6887	-0.0173	0.0034	0.4505
(p-value)	0.7725	0.1586	0.1912	0.7007	0.9884	0.4407
β_3	**0.1504**	**0.3952**	-0.9216	**0.1502**	0.1626	0.4000
(p-value)	0.0319	0.0252	0.0912	0.0312	0.3695	0.5063
R^2 (%)	0.0075	0.1292	0.0631	0.0097	0.1272	0.0235
White (p-value)	0.0006	0.8912	0.0522	0.1655	0.6316	0.0288
DW	1.9580	2.2985	1.9631	1.8576	1.4515	1.8920
	SCA B	**90 percentile**	**10 percentile**	**SCA B**	**90 percentile**	**10 percentile**
α_0	0.0015	0.0032		0.0014	-0.0074	
(p-value)	0.3999	0.6040		0.4305	0.1543	
β_0	-0.0077	0.0017		-0.0068	0.0172	
(p-value)	0.2447	0.9392		0.2972	0.3588	
β_1	0.2329	0.3089		0.1122	-0.5081	
(p-value)	0.1191	0.6106		0.4489	0.3122	
β_2	-0.0041	0.1628		-0.0657	-0.3251	
(p-value)	0.9215	0.5433		0.1113	0.1445	
β_3	0.0188	-0.1345		**0.1190**	0.2962	
(p-value)	0.7079	0.5017		0.0171	0.0766	
R^2 (%)	0.0051	0.0092		0.0123	0.0627	
White (p-value)	0.0081	0.0037		0.0404	0.0648	
DW	2.0874	2.2432		2.0637	2.1767	

	$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$		
	SKF B	**90 percentile**	**10 percentile**	**SKF B**	**90 percentile**	**10 percentile**
α_0	-0.0002	0.0044		0.0000	-0.0060	
(p-value)	0.9111	0.6423		0.9995	0.4629	
β_0	-0.0013	-0.0213		-0.0022	0.0148	
(p-value)	0.8557	0.3109		0.7656	0.4147	
β_1	**0.1989**	0.0419		0.0127	0.2560	
(p-value)	0.0426	0.9275		0.8964	0.5208	
β_2	-0.0618	-0.1285		-0.0288	0.0907	
(p-value)	0.1622	0.7594		0.5130	0.8027	
β_3	-0.0117	0.1027		0.0306	-0.0943	
(p-value)	0.8613	0.7656		0.6463	0.7515	
R^2 (%)	0.0110	0.0317		0.0012	0.0168	
White (p-value)	0.0673	0.1863		0.0041	0.6855	
DW	2.0214	2.4328		2.0220	2.0938	

	SHB A	**90 percentile**	**10 percentile**	**SHB A**	**90 percentile**	**10 percentile**
α_0	0.0021	0.0054		0.0014	0.0056	
(p-value)	0.2942	0.6081		0.4848	0.3129	
β_0	-0.0002	0.0015		0.0031	0.0324	
(p-value)	0.9806	0.9681		0.6802	0.1103	
β_1	-0.0135	-0.0241		-0.0786	-0.1167	
(p-value)	0.8976	0.9549		0.4494	0.6062	
β_2	-0.0254	0.1040		**0.1168**	-0.0989	
(p-value)	0.5577	0.7919		0.0066	0.6363	
β_3	-0.0797	-0.1294		0.0077	0.0799	
(p-value)	0.1935	0.6315		0.8988	0.5767	
R^2 (%)	0.0048	0.0160		0.0132	0.0478	
White (p-value)	0.0002	0.1200		0.2193	0.0745	
DW	2.1082	2.1614		1.9279	2.0101	

	Sandvik	**90 percentile**	**10 percentile**	**Sandvik**	**90 percentile**	**10 percentile**
α_0	0.0016	-0.0088	0.0041	0.0017	0.0013	0.0023
(p-value)	0.3690	0.2335	0.4683	0.3507	0.8450	0.6759
β_0	0.0038	0.0130	0.0229	0.0069	0.0079	0.0177
(p-value)	0.5409	0.5753	0.3651	0.2665	0.7079	0.4820
β_1	-0.0813	-0.2946	-1.1131	-0.0374	-0.1702	0.1472
(p-value)	0.4968	0.5818	0.2476	0.7542	0.7271	0.8773
β_2	0.0244	-0.2438	0.1458	-0.0006	0.0536	0.1272
(p-value)	0.5483	0.5432	0.6642	0.9880	0.8834	0.7036
β_3	-0.0125	0.2211	0.0303	-0.0552	-0.0951	-0.0373
(p-value)	0.7930	0.3903	0.8938	0.2443	0.6850	0.8690
R^2 (%)	0.0022	0.0225	0.0503	0.0046	0.0184	0.0521
White (p-value)	0.1691	0.6905	0.9539	0.1145	0.8344	0.9319
DW	1.8780	1.7851	2.0576	1.8548	1.7861	1.6999

	$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$		
	Eric B	**90 percentile**	**10 percentile**	**Eric B**	**90 percentile**	**10 percentile**
α_0	0.0007	-0.0034	0.0038	0.0002	-0.0003	0.0148
(p-value)	0.8036	0.7310	0.6522	0.9309	0.9686	0.0653
β_0	0.0059	-0.0027	-0.0157	0.0129	0.0042	-0.0329
(p-value)	0.5041	0.8849	0.6939	0.1474	0.7603	0.3875
β_1	**0.3486**	0.7131	-1.3612	-0.0570	-0.2871	-1.5268
(p-value)	0.0014	0.0872	0.4646	0.6008	0.3517	0.3886
β_2	0.0133	0.2561	-0.7856	0.0363	-0.1887	-0.6237
(p-value)	0.7704	0.5104	0.4377	0.4245	0.5154	0.5165
β_3	0.0298	-0.2383	-1.2461	0.0901	0.3096	-1.0301
(p-value)	0.7388	0.5660	0.3290	0.3145	0.3186	0.3955
R^2 (%)	0.0265	0.2454	0.0278	0.0071	0.0408	0.0321
White (p-value)	0.0000	0.0160	0.0160	0.0002	0.0560	0.0928
DW	1.8949	2.1577	1.6946	1.9255	2.0170	2.3466

	H&M	**90 percentile**	**10 percentile**	**H&M**	**90 percentile**	**10 percentile**
α_0	**0.0046**	0.0051		**0.0050**	**0.0175**	
(p-value)	0.0200	0.4728		0.0099	0.0045	
β_0	0.0015	0.0026		-0.0135	-0.0059	
(p-value)	0.8738	0.9123		0.1538	0.7689	
β_1	0.1749	0.3532		0.0560	-0.1489	
(p-value)	0.0724	0.1475		0.5600	0.4689	
β_2	-0.0464	0.2194		0.0004	-0.0150	
(p-value)	0.2840	0.5237		0.9923	0.9589	
β_3	-0.0289	-0.1888		-0.0017	0.0052	
(p-value)	0.4067	0.2308		0.9600	0.9689	
R^2 (%)	0.0081	0.0675		0.0031	0.0383	
White (p-value)	0.0889	0.6495		0.3224	0.6311	
DW	1.9776	2.3751		1.9340	2.1833	

	SEB A	**90 percentile**	**10 percentile**	**SEB A**	**90 percentile**	**10 percentile**
α_0	-0.0010	-0.0060		-0.0009	-0.0110	
(p-value)	0.6698	0.4048		0.6783	0.2459	
β_0	-0.0003	-0.0141		0.0067	**0.0429**	
(p-value)	0.9761	0.3716		0.4201	0.0417	
β_1	-0.1370	**0.9537**		0.0522	-0.3263	
(p-value)	0.2265	0.0017		0.6415	0.3959	
β_2	-0.0506	**0.7045**		**0.1382**	0.1025	
(p-value)	0.2517	0.0048		0.0017	0.7474	
β_3	0.0660	**-0.5725**		**-0.1763**	-0.2372	
(p-value)	0.3066	0.0064		0.0059	0.3772	
R^2 (%)	0.0039	0.1652		0.0206	0.2138	
White (p-value)	0.0002	0.0244		0.0000	0.4385	
DW	1.8646	1.7848		2.0665	2.1846	

	$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$		
	Volvo B	**90 percentile**	**10 percentile**	**Volvo B**	**90 percentile**	**10 percentile**
α_0	0.0027	-0.0035		0.0024	-0.0013	
(p-value)	0.2234	0.6735		0.2843	0.8694	
β_0	0.0009	0.0073		-0.0042	0.0093	
(p-value)	0.9055	0.6999		0.5766	0.6022	
β_1	0.2099	0.1738		-0.2295	-0.3712	
(p-value)	0.0761	0.6571		0.0514	0.3141	
β_2	-0.0080	-0.1175		0.0702	0.0896	
(p-value)	0.8479	0.7117		0.0925	0.7639	
β_3	-0.0672	0.0972		0.0555	0.0579	
(p-value)	0.3034	0.7625		0.3936	0.8480	
R^2 (%)	0.0056	0.0353		0.0116	0.0729	
White (p-value)	0.1039	0.9401		0.3999	0.4623	
DW	1.9752	1.8761		1.9548	1.7525	

The β_0 value in the regression shows the coefficient for the impact of the earnings announcement in week t, the β_1 value shows the coefficient for the impact of the return in week t (r_t) for weeks with earnings announcement (d_t^1), the β_2 value shows the coefficient for the impact of the return in week t (r_t) for weeks with no earnings announcement (d_t^2), β_3 value shows the coefficient for the impact of the return in week t (r_t) combined with relative volume (x_t) for weeks with earnings announcement and β_4 value shows the coefficient for the impact of the return in week t (r_t) combined with relative volume (x_t) for weeks with no earnings announcement. The values in the regression are for the whole period, the 90th percentile and the 10th percentile.

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2 \qquad r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$$

	Atlas Copco A	**90 percentile**	**10 percentile**	**Atlas Copco A**	**90 percentile**	**10 percentile**
α_0	0.0013	-0.0106	0.0065	0.0025	-0.0060	0.0029
(p-value)	0.5036	0.0599	0.2316	0.2060	0.4119	0.5875
β_0	0.0127	0.0034	0.0086	0.0040	0.0212	-0.0180
(p-value)	0.0659	0.8027	0.8387	0.5534	0.2405	0.6670
β_1	-0.2005	1.6833	**8.6888**	-0.0674	-0.4245	2.9771
(p-value)	0.1680	0.0809	0.0250	0.6400	0.7345	0.4279
β_2	-0.0276	**0.7662**	-0.8405	0.0028	-0.2728	**1.3961**
(p-value)	0.5102	0.0071	0.1039	0.9465	0.4536	0.0072
β_3	-0.0687	-1.3622	5.8159	-0.1035	0.1376	2.6708
(p-value)	0.6666	0.0583	0.0607	0.5125	0.8826	0.3770
β_4	0.0630	-0.4234	-0.6040	-0.0799	0.2300	**1.0189**
(p-value)	0.3338	0.0663	0.1996	0.2165	0.4425	0.0303
R^2 (%)	0.0131	0.2350	0.1937	0.0054	0.0513	0.1627
White (p-value)	0.1896	0.2463	0.7595	0.1260	0.4886	0.8504
DW	2.0088	1.8995	1.8141	2.1307	2.0321	2.1162

	Electrolux B	**90 percentile**	**10 percentile**	**Electrolux B**	**90 percentile**	**10 percentile**
α_0	0.0010	-0.0065	-0.0029	0.0009	-0.0058	0.0088
(p-value)	0.6326	0.2748	0.6289	0.6469	0.3537	0.1954
β_0	-0.0014	0.0028	-0.0001	0.0067	0.0203	-0.0340
(p-value)	0.8342	0.7941	0.9992	0.3089	0.0765	0.6199
β_1	-0.0315	-0.5006	0.1110	-0.3226	-0.3860	-4.2486
(p-value)	0.8758	0.3236	0.9902	0.1074	0.4650	0.6735
β_2	-0.0156	-0.2995	-0.6963	-0.0134	0.0348	0.4602
(p-value)	0.7333	0.2175	0.1904	0.7676	0.8901	0.4351
β_3	0.0419	0.5218	1.6188	0.3234	0.3450	-2.8071
(p-value)	0.8624	0.2945	0.8629	0.1791	0.5054	0.7881
β_4	**0.1603**	**0.3774**	-0.9302	0.1344	0.1369	0.4108
(p-value)	0.0287	0.0462	0.0912	0.0649	0.4821	0.4988
R^2 (%)	0.0078	0.1303	0.0642	0.0105	0.1293	0.0250
White (p-value)	0.0006	0.8753	0.0515	0.1592	0.5698	0.0284
DW	1.9605	2.2958	1.9563	1.8597	1.4585	1.8942

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2 \qquad r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$$

	SCA B	**90 percentile**	**10 percentile**	**SCA B**	**90 percentile**	**10 percentile**
α_0	0.0015	0.0032		0.0014	-0.0074	
(p-value)	0.3985	0.6088		0.4373	0.1540	
β_0	-0.0076	-0.0003		-0.0072	0.0109	
(p-value)	0.2540	0.9907		0.2723	0.6232	
β_1	0.2258	0.4653		0.1363	-0.0215	
(p-value)	0.1415	0.7080		0.3708	0.9833	
β_2	-0.0037	0.1547		-0.0672	-0.3501	
(p-value)	0.9300	0.5743		0.1040	0.1263	
β_3	0.0755	-0.2679		-0.0744	-0.1190	
(p-value)	0.7928	0.7766		0.7940	0.8784	
β_4	0.0170	-0.1281		**0.1251**	0.3160	
(p-value)	0.7387	0.5350		0.0136	0.0668	
R^2 (%)	0.0051	0.0095		0.0130	0.0673	
White (p-value)	0.0082	0.0036		0.0390	0.0602	
DW	2.0879	2.2422		2.0663	2.2110	

	SKF B	**90 percentile**	**10 percentile**	**SKF B**	**90 percentile**	**10 percentile**
α_0	-0.0002	0.0044		-0.0001	-0.0060	
(p-value)	0.9301	0.6388		0.9789	0.4638	
β_0	-0.0015	-0.0242		-0.0021	0.0162	
(p-value)	0.8417	0.2469		0.7813	0.3739	
β_1	0.1585	1.5134		0.0568	-0.4735	
(p-value)	0.2797	0.1580		0.6981	0.6115	
β_2	-0.0604	-0.3611		-0.0303	0.2060	
(p-value)	0.1735	0.4150		0.4932	0.5950	
β_3	0.0582	-1.2288		-0.0456	0.5658	
(p-value)	0.7714	0.1912		0.8196	0.4898	
β_4	-0.0205	0.3069		0.0402	-0.1955	
(p-value)	0.7731	0.4026		0.5704	0.5421	
R^2 (%)	0.0112	0.0679		0.0015	0.0289	
White (p-value)	0.0615	0.3183		0.0045	0.7161	
DW	2.0209	2.3683		2.0215	2.0565	

	SHB A	**90 percentile**	**10 percentile**	**SHB A**	**90 percentile**	**10 percentile**
α_0	0.0021	0.0056		0.0016	0.0054	
(p-value)	0.3068	0.5991		0.4309	0.3362	
β_0	-0.0007	-0.0064		0.0048	0.0437	
(p-value)	0.9295	0.8833		0.5288	0.0617	
β_1	0.0480	0.4369		**-0.2851**	-0.7743	
(p-value)	0.7322	0.7414		0.0399	0.2690	
β_2	-0.0289	0.0696		**0.1288**	-0.0499	
(p-value)	0.5070	0.8644		0.0029	0.8163	
β_3	-0.1664	-0.4817		**0.2986**	0.5824	
(p-value)	0.2512	0.6284		0.0372	0.2684	
β_4	-0.0608	-0.1010		-0.0557	0.0394	
(p-value)	0.3685	0.7205		0.4049	0.7908	
R^2 (%)	0.0054	0.0182		0.0207	0.0632	
White (p-value)	0.0003	0.1218		0.1931	0.0644	
DW	2.1046	2.1684		1.9255	1.9906	

	$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$			$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$		
	Sandvik	**90 percentile**	**10 percentile**	**Sandvik**	**90 percentile**	**10 percentile**
α_0	0.0018	-0.0088	0.0041	0.0017	0.0013	0.0024
(p-value)	0.3325	0.2338	0.4652	0.3399	0.8518	0.6760
β_0	0.0020	-0.0004	0.0537	0.0063	-0.0103	0.0308
(p-value)	0.7523	0.9912	0.2127	0.3146	0.7270	0.4741
β_1	-0.2434	-2.2923	7.0185	-0.0892	-2.8927	3.5957
(p-value)	0.0954	0.5017	0.4457	0.5414	0.3518	0.6959
β_2	0.0251	-0.2229	0.1369	-0.0004	0.0820	0.1234
(p-value)	0.5361	0.5816	0.6843	0.9924	0.8233	0.7141
β_3	0.4221	1.8603	6.4122	0.0836	2.1389	2.6691
(p-value)	0.0664	0.5029	0.3727	0.7162	0.3973	0.7102
β_4	-0.0318	0.2068	0.0239	-0.0614	-0.1146	-0.0400
(p-value)	0.5117	0.4261	0.9164	0.2056	0.6270	0.8606
R^2 (%)	0.0078	0.0282	0.0626	0.0052	0.0311	0.0544
White (p-value)	0.1110	0.7164	0.9368	0.1286	0.8133	0.9207
DW	1.8852	1.7829	2.0177	1.8569	1.8388	1.7086

	Eric B	**90 percentile**	**10 percentile**	**Eric B**	**90 percentile**	**10 percentile**
α_0	0.0007	-0.0010	0.0037	0.0002	-0.0024	0.0148
(p-value)	0.8068	0.9204	0.6605	0.9361	0.7496	0.0660
β_0	0.0060	0.0032	-0.0811	0.0130	-0.0007	0.0247
(p-value)	0.4972	0.8645	0.5778	0.1422	0.9582	0.8582
β_1	0.2449	**1.5879**	-13.4831	-0.2290	**-1.0249**	9.1453
(p-value)	0.1774	0.0187	0.6044	0.2077	0.0393	0.7115
β_2	0.0185	-0.2075	-0.7558	0.0450	0.2023	-0.6499
(p-value)	0.6876	0.6603	0.4589	0.3285	0.5631	0.5028
β_3	0.1776	-1.1540	-10.5816	0.3351	**1.0819**	7.1888
(p-value)	0.4308	0.0938	0.5973	0.1379	0.0352	0.7057
β_4	0.0022	0.2775	-1.2078	0.0443	-0.1254	-1.0638
(p-value)	0.9820	0.5875	0.3481	0.6493	0.7404	0.3845
R^2 (%)	0.0273	0.2791	0.0313	0.0092	0.0956	0.0351
White (p-value)	0.0000	0.0578	0.0149	0.0002	0.5041	0.0895
DW	1.8944	2.1205	1.6984	1.9226	2.0544	2.3467

	H&M	**90 percentile**	**10 percentile**	**H&M**	**90 percentile**	**10 percentile**
α_0	**0.0046**	0.0050		**0.0050**	**0.0175**	
(p-value)	0.0205	0.4774		0.0102	0.0047	
β_0	0.0016	0.0055		-0.0134	-0.0104	
(p-value)	0.8697	0.8275		0.1559	0.6248	
β_1	0.2277	0.5729		0.1204	-0.4947	
(p-value)	0.1360	0.3939		0.4243	0.3845	
β_2	-0.0471	0.1833		-0.0004	0.0418	
(p-value)	0.2774	0.6120		0.9918	0.8911	
β_3	-0.0858	-0.3648		-0.0713	0.2821	
(p-value)	0.5143	0.4872		0.5833	0.5255	
β_4	-0.0246	-0.1713		0.0035	-0.0224	
(p-value)	0.4959	0.3027		0.9216	0.8728	
R^2 (%)	0.0084	0.0694		0.0035	0.0451	
White (p-value)	0.0878	0.6391		0.3504	0.5183	
DW	1.9802	2.4028		1.9344	2.2283	

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2 \qquad r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$$

	SEB A	**90 percentile**	**10 percentile**	**SEB A**	**90 percentile**	**10 percentile**
α_0	-0.0008	-0.0060		-0.0012	-0.0110	
(p-value)	0.7145	0.3880		0.6038	0.2410	
β_0	-0.0001	-0.0059		0.0065	0.0364	
(p-value)	0.9888	0.7015		0.4306	0.0867	
β_1	**-0.3663**	-1.6824		**0.4179**	1.7543	
(p-value)	0.0150	0.1306		0.0049	0.2435	
β_2	-0.0371	**0.8222**		**0.1166**	0.0096	
(p-value)	0.4033	0.0009		0.0078	0.9762	
β_3	**0.4754**	1.6461		**-0.8293**	-1.9885	
(p-value)	0.0118	0.0769		0.0000	0.1143	
β_4	0.0120	**-0.6780**		-0.0904	-0.1540	
(p-value)	0.8602	0.0012		0.1798	0.5714	
R^2 (%)	0.0119	0.2418		0.0409	0.2398	
White (p-value)	0.0052	0.0411		0.0000	0.4359	
DW	1.8482	1.7431		2.0585	2.0938	

	Volvo B	**90 percentile**	**10 percentile**	**Volvo B**	**90 percentile**	**10 percentile**
α_0	0.0028	-0.0035		0.0023	-0.0013	
(p-value)	0.2068	0.6774		0.2913	0.8695	
β_0	0.0010	0.0084		-0.0042	0.0088	
(p-value)	0.8955	0.6651		0.5741	0.6286	
β_1	0.0921	-0.0741		-0.1921	-0.2587	
(p-value)	0.5282	0.9281		0.1872	0.7378	
β_2	-0.0046	-0.0693		0.0691	0.0678	
(p-value)	0.9131	0.8428		0.0985	0.8365	
β_3	0.2111	0.3377		-0.0330	-0.0513	
(p-value)	0.3220	0.6617		0.8767	0.9436	
β_4	-0.0960	0.0457		0.0646	0.0813	
(p-value)	0.1615	0.8981		0.3444	0.8085	
R^2 (%)	0.0084	0.0372		0.0119	0.0734	
White (p-value)	0.0939	0.9398		0.3839	0.4836	
DW	1.9727	1.8791		1.9532	1.7523	

Appendix B

The t-values are adjusted for heteroscedasticity and autocorrelation with the Newey-West method where there is heteroscedasticity or autocorrelation. The regressions and what the β values represent are described in appendix A.

The whole period

	$r_{t+1} = \alpha_0 + \beta_1 r_t$	$r_{t+2} = \alpha_0 + \beta_1 r_t$
	β_1	β_1
Aktier	**t-value**	**t-value**
Atlas Copco A	-1.0302	-0.6047
Electrolux B	0.3966	0.1185
SCA B	0.2923	-0.6318
SKF B	-0.2225	-0.2328
Volvo B	0.1246	1.1729
SEB A	-0.8328	0.9670
Ericsson B	1.5608	0.8914
HM B	-0.1908	0.0430
Sandvik	0.2780	-0.2536
SHB A	-0.8069	1.5700

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$		$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$	
	β_1	β_2	β_1	β_2
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	-1.1040	0.3458	-0.1279	-1.5665
Electrolux B	-0.4073	1.8997	-0.7524	1.7673
SCA B	0.1961	0.3694	-1.2268	2.2615
SKF B	-0.4123	0.6147	-0.4014	0.5848
Volvo B	0.3455	-0.7602	1.0130	0.4886
SEB A	-1.1323	0.6714	2.3663	-1.3283
Ericsson B	0.6647	1.6009	0.4160	0.5912
HM B	-0.1290	-0.1678	0.0478	-0.0240
Sandvik	0.3124	-0.3976	-0.1822	-1.2543
SHB A	-0.4451	-0.8075	2.3080	-0.4229

	$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$		$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$	
	β_1	β_2	β_1	β_2
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	-0.4540	-1.3422	0.1613	-2.0091
Electrolux B	0.4542	-0.2400	0.0811	0.0769
SCA B	0.9070	-1.7420	-0.9057	0.6008
SKF B	-0.5029	0.9281	0.4069	-1.6003
Volvo B	0.7318	-1.5880	1.8508	-1.7877
SEB A	-0.5383	-0.5390	0.7776	1.1820
Ericsson B	1.2046	0.0910	1.7139	-1.0814
HM B	0.4468	-1.6396	-0.2745	0.0783
Sandvik	1.1087	-2.4347	-0.2880	0.1533
SHB A	-0.6580	-0.3158	2.1576	0.0665

$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$ $\quad$ $r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$

	β_1	β_2	β_1	β_2
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	-2.2010	-0.4589	-1.1867	-0.2083
Electrolux B	-0.0120	0.4190	-0.8948	0.4743
SCA B	1.5789	0.0132	0.8556	-0.9238
SKF B	2.1379	-1.4838	0.3392	-0.5621
Volvo B	1.6619	-0.2934	-1.8020	1.8780
SEB A	-0.4277	-0.6654	-0.1822	1.3355
Ericsson B	3.3579	0.3397	0.0814	0.9279
HM B	2.2825	-0.8797	0.6009	0.0031
Sandvik	-0.7273	0.5905	-0.5003	-0.0546
SHB A	-1.1627	-0.6207	-0.7745	2.8685

$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$ $\quad$ $r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$

	β_1	β_2	β_3	β_1	β_2	β_3
Aktier	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	-2.3189	-0.5979	0.7324	-0.6942	0.0789	-1.3940
Electrolux B	-1.0366	-0.2248	2.0940	-1.7814	-0.3845	2.1596
SCA B	1.9903	-0.0756	0.3839	1.0043	-1.3909	2.2901
SKF B	2.0319	-1.3992	-0.1748	0.1314	-0.4747	0.4265
Volvo B	1.7768	-0.1918	-1.0299	-1.9513	1.6848	0.8536
SEB A	-0.5937	-0.9582	0.7195	0.2731	2.3177	-1.3753
Ericsson B	2.6207	0.2111	0.3167	-0.5509	0.5252	0.9081
HM B	1.7993	-1.0723	-0.8302	0.5832	0.0097	-0.0502
Sandvik	-0.6799	0.6007	-0.2626	-0.3132	-0.0151	-1.1653
SHB A	-0.1417	-0.4238	-0.7321	-0.7569	2.7269	0.1272

$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$ $\quad$ $r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$

	β_1	β_2	β_3	β_4	β_1	β_2	β_3	β_4
Aktier	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	-1.3803	-0.6589	-0.4310	0.9673	-0.4679	0.0671	-0.6554	-1.2369
Electrolux B	-0.1704	-0.2635	0.1949	2.0850	-1.6123	-0.2957	1.3449	1.8489
SCA B	1.8372	-0.0673	0.3985	0.3501	1.1424	-1.4150	-0.4535	2.2808
SKF B	1.0818	-1.3624	0.2906	-0.2884	0.6399	-0.4987	-0.4307	0.4867
Volvo B	0.6311	-0.1092	0.9912	-1.4015	-1.3202	1.6545	-0.1552	0.9461
SEB A	-1.2345	-0.6987	1.4613	0.1393	2.4360	2.0361	-3.8258	-0.7675
Ericsson B	1.4245	0.2875	1.3250	0.0204	-1.7508	0.6319	2.3691	0.3871
HM B	1.4926	-1.0870	-0.6525	-0.6814	0.7995	-0.0102	-0.5488	0.0985
Sandvik	-1.6698	0.6191	1.8391	-0.6566	-0.6110	-0.0096	0.3637	-1.2671
SHB A	0.5885	-0.4830	-2.2948	-0.4657	-2.0584	2.9931	2.0873	-0.8335

90^{th} percentile

$r_{t+1} = \alpha_0 + \beta_1 r_t$		$r_{t+2} = \alpha_0 + \beta_1 r_t$
	β_1	β_1
Aktier	**t-value**	**t-value**
Atlas Copco A	1.5951	-0.6909
Electrolux B	1.6172	1.6086
SCA B	-0.0325	0.5450
SKF B	0.5532	0.0407
Volvo B	0.3441	0.6273
SEB A	1.4449	-1.4925
Ericsson B	2.4531	0.6405
HM B	-0.5539	-1.1040
Sandvik	0.4837	-0.8725
SHB A	-0.5902	0.3735

$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$	
	β_1	β_2	β_1	β_2
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	3.3556	-2.8253	-0.6269	0.4523
Electrolux B	-1.8689	2.5396	-0.6942	1.2773
SCA B	0.5630	-0.7698	-1.4764	1.7260
SKF B	-0.1102	0.3176	0.3626	-0.3678
Volvo B	-0.3175	0.4352	0.2690	-0.0927
SEB A	2.9051	-3.3017	0.1585	-0.6339
Ericsson B	0.5664	-0.2064	-0.6203	0.8394
HM B	1.5699	-1.5254	-1.0019	0.6420
Sandvik	-0.7190	0.9488	0.0038	-0.3287
SHB A	0.1366	-0.5168	-0.2066	0.4025

$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$	
	β_1	β_2	β_1	β_2
Aktier	**t-värde**	**t-värde**	**t-värde**	**t-värde**
Atlas Copco A	-1.1802	0.5971	1.3280	-1.7809
Electrolux B	-0.4953	0.5110	0.4355	-0.4973
SCA B	1.4459	-2.2215	-1.7408	1.6685
SKF B	1.8614	-1.5723	-0.9570	0.9923
Volvo B	0.3969	-0.2916	-1.1719	1.2857
SEB A	0.5107	-1.3586	-0.0968	1.2841
Ericsson B	0.9279	-0.6627	1.4936	-1.4345
HM B	-0.0024	0.0643	0.0713	0.0648
Sandvik	-0.4372	0.1101	-0.4424	0.3961
SHB A	-1.5263	1.1430	-1.1618	1.4342

$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$

	β_1	β_2
Aktier	**t-value**	**t-value**
Atlas Copco A	-0.8442	3.1018
Electrolux B	0.2026	1.9072
SCA B	0.6940	-0.0636
SKF B	0.6829	-0.0584
Volvo B	1.3336	-0.2621
SEB A	1.3218	0.4483
Ericsson B	3.2866	0.3429
HM B	0.8264	-1.4375
Sandvik	-0.0584	0.5498
SHB A	-0.8167	-0.2415

$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$

	β_1	β_2
Aktier	**t-value**	**t-value**
Atlas Copco A	-1.3030	-0.0650
Electrolux B	-0.5204	2.2993
SCA B	-0.3439	0.6282
SKF B	0.6848	-0.1311
Volvo B	-1.6158	1.5122
SEB A	-2.8628	-1.4950
Ericsson B	0.0737	1.0673
HM B	-1.1957	-0.0440
Sandvik	-0.7316	-0.6563
SHB A	-0.1842	-0.0132

$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$

	β_1	β_2	β_3
Aktier	**t-value**	**t-value**	**t-value**
Atlas Copco A	1.7203	3.2782	-2.3584
Electrolux B	-1.8834	-1.4271	2.2942
SCA B	1.0038	0.5173	-0.7191
SKF B	0.0872	-0.2684	0.3215
Volvo B	0.4460	-0.3713	0.3036
SEB A	2.7245	2.6036	-3.4211
Ericsson B	0.9969	0.4230	-0.3765
HM B	1.4666	0.6413	-1.2101
Sandvik	-0.5536	-0.6113	0.8651
SHB A	-0.0568	0.2650	-0.4820

$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$

	β_1	β_2	β_3
Aktier	**t-value**	**t-value**	**t-value**
Atlas Copco A	-1.2846	-0.7656	0.7876
Electrolux B	-1.1649	0.0144	1.1436
SCA B	-1.0189	-1.4779	1.8010
SKF B	0.6458	0.2509	-0.3181
Volvo B	-1.0148	0.3017	0.1925
SEB A	-0.8550	0.3235	-0.8895
Ericsson B	1.7381	0.6621	-0.5771
HM B	-0.7287	-0.0518	0.0391
Sandvik	-0.3506	0.1473	-0.4076
SHB A	-0.5182	-0.4753	0.5612

$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$

	β_1	β_2	β_3	β_4
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	1.7752	2.7851	-1.9295	-1.8699
Electrolux B	-0.9951	-1.2462	1.0574	2.0351
SCA B	0.3763	0.5647	-0.2850	-0.6240
SKF B	1.6718	-0.7271	-1.7629	0.8509
Volvo B	-0.0906	-0.1992	0.4398	0.1286
SEB A	-1.6465	2.9564	2.0293	-3.5934
Ericsson B	2.4166	-0.4417	-1.7023	0.5454
HM B	0.8587	0.5099	-0.6989	-1.0394
Sandvik	-0.6758	-0.5540	0.6739	0.8013
SHB A	0.3315	0.1715	-0.4865	-0.3595

$r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$

	β_1	β_2	β_3	β_4
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	-0.3406	-0.7543	0.1483	0.7729
Electrolux B	-0.5734	0.1389	0.5396	0.9165
SCA B	-0.0211	-1.5499	-0.1536	1.8667
SKF B	-0.5105	0.5344	0.6948	-0.6130
Volvo B	-0.3363	0.2073	-0.0711	0.2434
SEB A	1.1778	0.0299	-1.6023	-0.5690
Ericsson B	-2.1058	0.5815	2.1546	-0.3328
HM B	-0.8760	0.1375	0.6385	-0.1607
Sandvik	-0.9382	0.2242	0.8524	-0.4884
SHB A	-1.1156	-0.2333	1.1168	0.2664

10^{th} percentile

$r_{t+1} = \alpha_0 + \beta_1 r_t$		$r_{t+2} = \alpha_0 + \beta_1 r_t$
	β_1	β_1
Aktier	**t-value**	**t-value**
Atlas Copco A	-0.9495	2.3854
Electrolux B	0.3232	0.2104
SCA B	-1.1370	-1.6195
SKF B	1.7479	-0.3327
Volvo B	-0.1190	-0.7582
SEB A	1.0911	-0.7314
Ericsson B	0.5919	0.7445
HM B	0.3018	-0.5208
Sandvik	0.8312	1.7217
SHB A	-0.2919	-0.0769

$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t x_t$	
	β_1	β_2	β_1	β_2
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	-1.3417	-1.1315	2.9545	2.3895
Electrolux B	-1.2848	-2.7951	0.8658	1.4594
SCA B	-0.7590	-0.1987	0.4777	1.5631
SKF B	0.3298	-0.1276	1.5912	1.7397
Volvo B	-0.3338	-0.3154	-0.4055	-0.2436
SEB A	0.3647	0.0526	-0.9028	-0.7224
Ericsson B	-0.3337	-0.6520	0.0652	-0.1621
HM B	1.9433	2.1290	-1.1339	-1.0129
Sandvik	0.2856	0.0149	0.3413	-0.2344
SHB A	-0.2742	-0.0531	-2.3004	-4.0998

$r_{t+1} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$			$r_{t+2} = \alpha_0 + \beta_1 r_t + \beta_2 r_t z_t$	
	β_1	β_2	β_1	β_2
Aktier	**t-värde**	**t-värde**	**t-värde**	**t-värde**
Atlas Copco A	-1.4537	-0.8035	0.4875	0.4694
Electrolux B	-1.1596	-1.3726	-0.2749	-0.6819
SCA B	-0.2186	-0.5559	-0.6978	-0.3244
SKF B	-1.7833	-1.4987	0.3281	-0.2698
Volvo B	-1.1234	-1.4679	2.0374	1.5685
SEB A	1.1343	1.0299	-2.1438	-2.7939
Ericsson B	-1.0444	-1.2783	-1.5500	-1.8057
HM B	-1.7101	-2.5870	-0.8628	-0.8185
Sandvik	-0.2794	-1.2585	1.3714	1.3699
SHB A	-0.3185	-0.0158	0.5371	0.5359

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 \qquad r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2$$

	β_1	β_2	β_1	β_2
Aktier	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	1.6042	-1.4763	-0.1924	2.3573
Electrolux B	-12.5048	0.3859	-7.9910	0.3073
SCA B				
SKF B				
Volvo B				
SEB A				
Ericsson B	1.3486	0.5338	-1.4623	0.8065
HM B				
Sandvik	-1.2767	0.9439	0.2167	1.6410
SHB A				

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t \qquad r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t$$

	β_1	β_2	β_3	β_1	β_2	β_3
Aktier	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	0.9821	-1.3257	-0.9670	0.8956	2.9070	2.3408
Electrolux B	-1.3993	-1.3214	-1.7159	-3.1955	0.8872	1.3893
SCA B						
SKF B						
Volvo B						
SEB A						
Ericsson B	-0.7045	-0.5396	-0.8468	-0.8683	-0.6524	-0.8555
HM B						
Sandvik	-1.1671	0.4362	0.1341	0.1550	0.3822	-0.1656
SHB A						

$$r_{t+1} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2 \qquad r_{t+2} = \alpha_0 + \beta_0 d_t^1 + \beta_1 r_t d_t^1 + \beta_2 r_t d_t^2 + \beta_3 r_t x_t d_t^1 + \beta_4 r_t x_t d_t^2$$

	β_1	β_2	β_3	β_4	β_1	β_2	β_3	β_4
Aktier	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**	**t-value**
Atlas Copco A	2.2975	-1.6508	1.9113	-1.2969	0.7982	2.7801	0.8899	2.2183
Electrolux B	0.0123	-1.3241	0.1734	-1.7160	-2.58E+14	0.9007	-1.74E+14	1.4257
SCA B								
SKF B								
Volvo B								
SEB A								
Ericsson B	-1.14E+13	-0.5136	-1.16E+13	-0.8118	0.3715	-0.6740	0.3794	-0.8760
HM B								
Sandvik	0.7676	0.4086	0.8980	0.1054	0.3928	0.3680	0.3733	-0.1764
SHB A								