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Profitability of Momentum Strategies on the Nordic stock market

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Abstract

Title

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Purpose

The main purpose of our thesis is to examine the profitability of Momentum Strategies on the Nordic stock markets. This will provide insight and contribute to the debate on efficient markets. Finding profitable Momentum Strategies will provide strong evidence of inefficiency in the market. A secondary purpose is to examine factors which might cause or impact the profitability of the Momentum Strategy. We will look closely at the relationship between the profitability and factors such as risk (CAPM-beta), market capitalization, trading volume and seasonality.

Methodology

This is a quantitative study on how the stock market behaves in a medium-term perspective. Overlapping portfolios are made based on 1,3,6,9,12 and 24 months historical returns. These portfolios are then held for additionally 1,3,6,9,12 and 24 months, yielding 36 strategies. This procedure is conducted on the Swedish, Danish, Finnish, Norwegian and the complete “Nordic market”. A test of robustness is then performed. We also examine factors that can explain or drive the Momentum effect. These are CAPM betas, firm size, volume and seasonality.

Conclusions

Our results show Momentum profits to be made in all the Nordic stock markets with 3-12 months investment horizon. The zero-cost portfolios generate approximately 1% return monthly and the P10-portfolios (including past top performing stocks) consistently beat the market indices on average.

Key words

Momentum, Contrarian, Efficient markets, Behavioural finance, Quantitative investing strategies

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1 Introduction

Chapter 1 introduces our field of research and presents the research problem of this thesis. A short review of the "Momentum Strategy" and its implication for attaining market efficiency will be given. Thereafter, the thesis problem statement is presented with its limitations. Finally, an outline of text is provided.

1.1 Background

Some men worship rank, some worship heroes, some worship power, some worship God, & over these ideals they dispute & cannot unite--but they all worship money.
Mark Twain

Through all time man has tried to improve his financial wellbeing. In ancient times this meant that you had to try to build your wealth with whatever capital and wisdom you had at hand. With the invention of limited liability companies this all changed. Now it was possible to separate ownership and control. This sharing of risk led to growing and profitable companies; the East India Company is one example of an immensely profitable company of these early days.

Somewhere along this timeline, a more structured and standardized financial market was developed. But all this created a new problem for the investor. Since it was now possible to invest in "other people's projects", which project should be chosen? There was, of course, no short answer and the same question troubles the investors even today.

The search for the financial "holy grail" continues for those of us who believe that it must be possible to consistently beat the market. The benefit of finding a profitable investment strategy makes it hard for an investor to think about anything else. Many have tried and nearly as many have failed. Fama (1970) suggests that markets are efficient. That is, prices will always fully reflect all available information. This means that it should be impossible to consistently beat the market. Could this be true? Jensen (1968) has showed that fund managers over time do not beat the market. Since then, many similar studies claim that this is the case. But does it mean that markets are efficient?

In basic academic courses in economics we have learned about the concept of Homo Economicus (HE). This fictive person always makes the right decisions, based on what is known to him or her. HE must be able to process huge amounts of information and always be

100 percent rational in making decisions. Does this resemble a stock market investor? The behavioural finance research has found that this is not the case. Instead investors use heuristics, “rules of thumbs” methods, when they process information. This will surely cause errors of judgment. Some errors recur consistently over time. In financial market analysis this implies that particular patterns of decision making will emerge. These could be exploited by investors to gain abnormally high returns.

1.2 Introducing the problem

Our study is based mainly on the groundbreaking study by Jegadeesh and Titman (1993) which shows that investing in the past top performing stocks based on 3-12 months historical returns and holding the stocks for 3-12 months will yield significant, abnormally high profits. Jegadeesh and Titman studied the US stock market between 1965 and 1989. Using their results, an investor could form a portfolio on 12 month historical returns, buy the top performing decile and then hold the stock for an additional 3 months, the earning would then be about 25% annually. This is significantly higher than the roughly 10% that a stock index like the S&P500 generates as an average. Investing in this manner, taking long positions in top performing stocks and holding them for a period of time hoping that they should continue to rise, is called a Momentum Strategy. Another way is to short sell stocks with poor historical returns in the hope of continuation of poor performance over a certain time frame. This is also called a Momentum Strategy. A third way is also to create a zero cost portfolio where the past top performing stocks are bought and the past worst performing stocks are sold short. This is called a zero cost Momentum Strategy and profits from the spread that the investor is hoping will occur in the future between these groups of stocks (for abbreviations and concepts see Appendix 0). The results that Jegadeesh and Titman revealed with Momentum strategies should, of course, not be able to exist in an efficient market.

Another investment strategy which is closely related to Momentum is the Contrarian Strategy. This strategy was first documented by De Bondt and Thaler (1985) and relies on price reversals in the stock market. Even though a Contrarian Strategy is in many aspects very similar to the Momentum Strategy it suggests the total opposite action. A Contrarian Strategy implies buying the past worst performing stock hoping that the will turnaround or shorting the past top performing stocks hoping they will fall in the future. It is of course also possible here to make a zero cost Contrarian Strategy where the past worst performers are bought and the

past top performers are sold short. De Bondt and Thaler (1985) found evidence that the Contrarian Strategy yield abnormal returns on a long investment horizon (3-5 years). Other research by Jagadeesh (1990) and Lehman (1990) also found profitable Contrarian Strategies but within short investment horizons (up to a month).

Many empirical studies concur with the findings of both profitable Momentum and Contrarian Strategies in the stock market. It seems that both these strategies work simultaneously in the stock market but with different investment horizons. The Contrarian Strategies have been shown to be profitable in the short term (up to one month) as well as for long term (3-5 years). In the medium term (3-12 months), there seem to be profitable Momentum strategies.

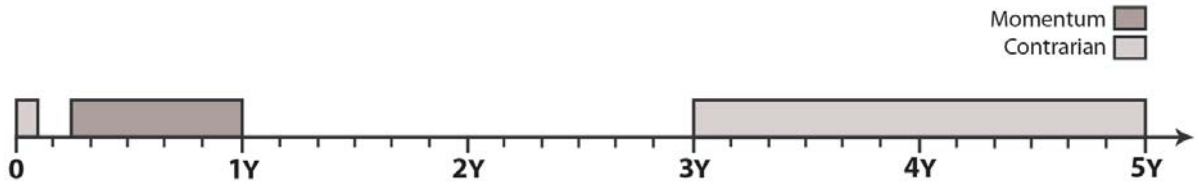


Figure 1.1The different time periods were Momentum and Contrarian Strategies show profitable outcomes, based on empirical studies

The profitability of both Contrarian and Momentum Strategies suggest that there are different patterns in the stock price movement which can be exploited. But if these patterns are known among investors, can it still be profitable to pursue them? In 2001 Jagadeesh and Titman publicized a replicated version of their study from 1993 along with additional data, including the eight years following the original publication year. The new, updated study showed that very little had changed in the presence of Momentum profits. The high returns were roughly the same as in their previous study. So how come that this very profitable strategy survives the process of limited arbitrage? An answer proposed by behavioural finance researchers is that investors are irrational decision makers. Investor may for example overreact and sometimes underreact to new information. The implication is that stock prices often deviate from their “true” (or fundamental) value. This creates investment opportunities which are important to identify in the pursuit for the largest returns.

1.3 Purpose

The main purpose of our thesis is to examine the profitability of Momentum Strategies on the Nordic stock markets. This will provide insight and contribute to the debate on efficient

markets. Finding profitable Momentum Strategies will provide strong evidence of inefficiency in the market.

A secondary purpose is to examine factors which might cause or impact the profitability of the Momentum Strategy. We will look closely at the relationship between the profitability and factors such as risk (CAPM-beta), market capitalization, trading volume and seasonality.

1.4 Limitations of the study

Our study will include the stock markets in the Nordic region. We will not investigate, nor discuss, other stock markets. The Momentum effect will be studied on the national stock exchanges and at the Nordic region as a whole, in order to make comparisons. We have chosen to exclude the Icelandic stock market from our study because we believe that the Icelandic stock market is too small for solid statistical testing. However, some of the large Icelandic stocks are cross-listed in other Nordic countries which make the empirical impact for excluding Iceland relatively small.

Our main source of price series data is Datastream by Thomson Financial. We have included all companies that exist today or have previously been present on the four exchanges and, hence, been part of the database. It is possible that some companies are missing from the database, but they are probably very few. The period covered is April 1991 to April 2006 and stocks outside this time period are excluded.

We use monthly returns because shorter frequencies of data would make the material unmanageable in Excel. The data has been adjusted for all capital changes and the companies' dividends are reinvested. The study does take into consideration delisted companies within the time period. This means that there will be no "survival ship" bias that can affect the results. Fortunately, this could be avoided since we believe that the survival ship bias might have become a serious issue for studies like ours.

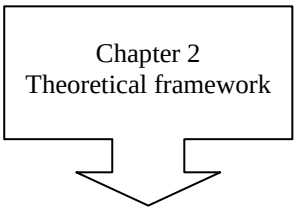
1.5 Target group

The primary target group for our study is persons with a strong interest in financial investments in the stock market, including students, teachers, practitioners and researchers

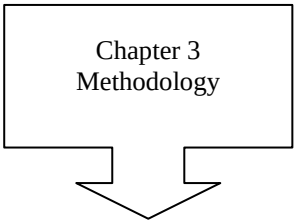
within finance. However, we believe that both our subject and result might be of interest for other people as well. In recent years, the interest in the stock market has increased in Sweden. Many people have invested their savings in stocks and funds. This study should increase the knowledge about the stock market and its behavior. We hope, by choosing our vocabulary and explanations more carefully, that our study can reach out to a larger group of people than what is usually the case for academic papers.

1.6 Outline

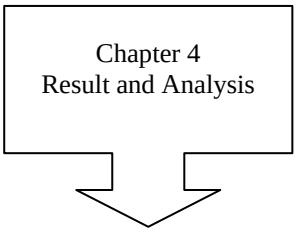
The paper is organized in the following order:



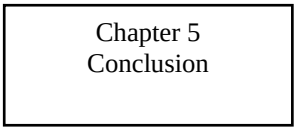
Chapter 2 presents the relevant theories and research papers pertaining to the purpose of the thesis. The reader will be provided with an understanding of the Efficient Market Hypothesis and general behavioural finance issues. The findings from financial research on Momentum strategies will be presented in detail.



Chapter 3 presents the methodology used when conducting the study. We aim to provide a detailed description of our course of investigation and explain how and why the steps of our analysis are taken.



Chapter 4 presents the results and the empirical analysis of our study. The results are presented for each of the different national markets, but also for a fictive “Nordic market”, including all stocks listed at the national stock markets.



Chapters 5 presents the conclusions from our study and provide some suggestions for further research.

2 Theoretical frame of reference

In chapter 2 is the theoretical frame of reference pertaining to the purpose of the thesis presented. This involves theories and research findings relevant for understanding how stock markets behave.

2.1 Random Walk theory

The Random Walk theory asserts that price movements are completely random and will not follow any patterns or trends. This implies that past price movement cannot be used to predict future price movement. An investor will not be able through chart reading or extending knowledge in past price behavior increase the expected gains of his investments. In fact, the theory of Random Walk states that the future price movements for a stock is no more predictable than a series of cumulated random numbers.

Most of the Random Walk theory can be traced back to the French mathematician Bachelier's thesis *The Theory of Speculation* in the 1900 (Lo and MacKinlay 1990). He described what he called a "fair game" when the expectation of the speculator was equal to zero. Unfortunately, the contribution of Bachelier was overlooked for more than fifty years. Not until the mid-1950's and the early 1960's, new empirical findings of the behavior of common stocks were summarized as a basis for some more general "fair game" model.

In 1953 Kendall shared his ideas about the prevailing assumptions regarding price series: "It has been customary to analyse an economic time-series by extracting from it a long-term movement, or trend, for separate study and then scrutinizing the residual portion for short-term oscillatory movements and random fluctuations." In his study, which examined 22 stocks and commodity price series, he concluded that "in series of prices which are observed at fairly close intervals the random changes from one term to the next are so large as to swamp any systematic effect which may be present. The data behave almost like wandering series." (Kendall,1953). The empirical findings of near-zero serial correlation of price changes seemed, at the time, to be inconsistent with the views of the financial researchers. These new research findings came to be labeled the "random walk theory". Many researchers contributed to the theory with both theoretical and empirical findings. However, it was not until 1965 that the research on the random behavior of the stock prices reached a turning point. Fama (1965) reviewed the research of stock price behavior, examined the serial

dependence and the distribution of stock market returns, and concluded that "It seems safe to say that this paper has presented strong and voluminous evidence in favor of the random-walk hypothesis." With this proclamation Fama continued and developed a well-known and yet highly debated hypothesis, the Efficient Market Hypothesis.

2.2 The Efficient Market Hypothesis

Efficiency is intelligent laziness
David Dunham

The idea of the Efficient Market Hypothesis was presented by Fama (1970) in an article in The Journal of Finance. The hypothesis states that an efficient financial market is one in which security prices always fully reflect all available information. Price movements only occur when new, relevant information, which influence the underlying security, is released. This new information can relate to anything, like new market entries or interest rates. As soon as new information reaches the investor, the price is immediately adjusted to a new equilibrium. Before new information is available and known, it will be impossible to predict stock price movements.

Fama (1970) mentioned three sufficient conditions for the capital market to be considered efficient. A market which (1) "there are no transactions costs in trading securities, (2) all available information is costlessly available to all market participants, and (3) all agree on the implications of current information for the current price and distribution of future prices of each security" are efficient.

The three conditions provide a frictionless market and are sufficient for market efficiency but not necessary. Fama mentions for example that a market can still be considered efficient if "sufficient numbers" of investors have access to all available information. In practice, no market is strictly efficient or strictly inefficient. Instead the Efficient Market Hypothesis suggests that there are three forms of efficiencies: weak, semi-strong and strong form. These three forms assume different types of information to be reflected in the stock prices. Figure 2.1 provides a graphical illustration on the relation between these different forms of efficiencies. The smallest circle represents the weak form of efficiency, which means that all historical information is reflected in the stock prices. The second circle represents the semi-strong form of efficiency which means that all historical information plus all other publicly available information is reflected in the stock price.

Finally, the outer circle represents the strong form of efficiency which means that all information relevant to the value of a certain stock is known and the stock is priced accordingly. In the following sections, we will briefly introduce the different forms of efficiencies.

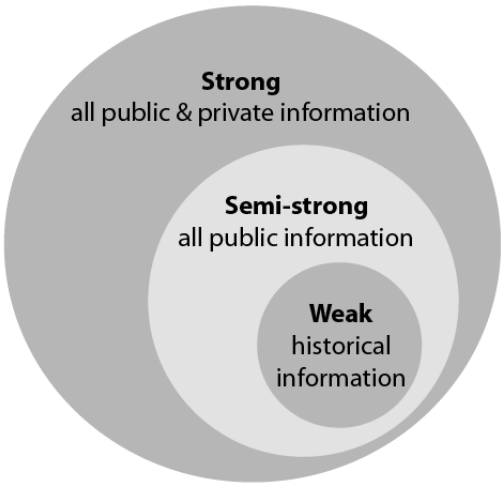


Figure 2.1 Different forms of efficiencies (Haugen, 2001)

2.2.1 The weak form of market efficiency

The weak form of efficiency means that stock prices reflect all historical price information. This implies that an investor will not be able to predict future price movements using any historical information. The price series will therefore not include any reoccurring patterns. In order to investigate if a market is efficient in the weak form, researchers can try to identify patterns in the price series. If cyclical, seasonal or any other recurring behavior of stock prices could be identified and be profitable, then the condition for the weak form of efficiency will not hold.

2.2.2 The semi-strong form of market efficiency

The semi-strong form of efficiency means that all historical and publicly available information is reflected in the stock price. This implies that information such as company reports, state of the economy and any other publicly available information that is relevant to value the stock is available for investors. Every investor is assumed to be rational and is able determine the factors which effect the stock prices. This makes it impossible for the investor to attain abnormal returns, using any form of analysis, technical or fundamental, based on publicly available information.

When new information is available to the investors, the stock prices are immediately adjusted to reflect the new information. The investors will interpret the new information and how it affects the stock price. A method to test this form of efficiency is to perform an “event study” and see how well the market adjusts stock prices after new information is made available. If the price adjustment is not immediate, the condition for semi-strong efficiency will not hold.

2.2.3 The strong form of market efficiency

The strong form of efficiency means that stock prices reflect all information, both public and private. This implies that all information about the company that insiders, such as CEO:s and board members possess, have already been included in the stock price. Under this form of efficiency, the investor will only be able to make extra money by acquiring new, private information and act quickly on it. However, the initial acquiring of new private information is more a matter of chance. In addition, efforts of seeking out new information are most likely to be costly. The activity of trading on inside information is also illegal in all the markets in this study.

Fama (1970) views the strong form of efficiency as "an extreme model to be an exact description of the world, and it is probably best viewed as a benchmark against which the importance of deviations from market efficiency can be judged." This view is shared among most of the resent studies of stock market behavior we have come across writing this thesis.

2.2.4 The efficient market hypothesis implication for our study

An implication of the Efficient Market Hypothesis is that investment strategies based solely on currently available information will have no possibility of beating the market consistently. Thus, an investor could forget about active asset management altogether and instead passively keep the market portfolio. If the Efficient Market Hypothesis is correct, the market truly knows best the value of companies and any research on stock market price developments is a waist of time and money. But, since research is costly, why do people do it if they cannot take advantage of its results? And what happens to security prices if all players in the market pursue a passive strategy? For the passive strategy to work some must bear the cost of research.

2.3 Behavioural finance theory

Of all the ways of defining man, the worst one is the one which makes him out to be a rational animal.
Anatole France

Behavioural finance is a research field which integrates insights from human psychology with financial theories. By applying scientific research on human emotions and cognitive and

emotional biases, the results will lead to a better understanding of economic decisions and how it affect the market. Models in behavioural finance theory typically explain an observed market anomaly by describing decision makers, when using heuristics and being affected by framing effects.

2.3.1 Irrational behaviors in decision making

In this section we will discuss some of the characteristics of irrational investors found in the behavioural finance theory. These ideas are reproduced from Montier (2002) and Shleifer (2000).

Over-optimism is when people exaggerate their own abilities. If a group is asked how many believe that they are better than average at driving, maybe 80% will say yes. However 30% of them must be wrong. This bias comes from the illusion of self control. People believe that they are in control far more often than they actually are. Another effect is the self attribution bias, that "good outcomes" are attributed to skills and bad "outcomes" are a strike of bad luck. People are sometimes *over confident*. In an experiment Lichenstein & Fishoff (1977) asked a group of investors to predict if 12 stocks would rise or fall within a given period. Only 47% of the predictions were right. They also asked how certain the investors were that they were right. The confidence rating was 65%. Other studies have shown that when people think that they are 100% correct, they are in fact only right about 80% of the time according to Montier (2002). When this happens, people are said to be poorly *calibrated*.

When persons are presented with evidence that they are wrong, usually a process of self denial starts. People find it hard to change views. We do not always want to face the fact that we may be wrong. This is called *cognitive dissonance*. When searching for information, we tend to look at things that reinforce our current view. This is called *confirmation bias*. This leads to a subjective view. *Conservatism bias* is when we stick to a view or forecast and find it hard to move away from our standpoint (inertia). When we finally do change opinion it is often too late and we tend to react too little. This will create under-reaction to events. Stock analysts are often accused of such behavior.

A similar phenomenon is called *anchoring*. In an uncertain situation people tend to grasp for any available information. Tversky & Kahneman (1974) performed a study where they asked

people individually how many African countries are members of the United Nations. At the same time they spun a wheel of fortune in front of them which was manipulated to stop at 10 for one group of individuals (A) and 65 for the other group (B). The mean answer by group A was 25 countries while group B answered 45 countries. The wheel of fortune had nothing to do with the question and answer, but it served as an anchor, since no other information was available. In the stock market this would imply that old stock prices function as an anchor for future prices.

Another feature of the irrational human mind is called *representative heuristics*. This means that we evaluate something with reference to how closely it resembles something rather than by using probabilities. Montier (2002) describes this phenomenon with the following excellent example:

> *Linda is 31, single, outspoken and very bright. She majored in philosophy. As a student she was deeply concerned with issues surrounding equality and discrimination. Is it more likely that Linda is (A) a bank clerk or (B) a bank clerk and active in the feminist movement?*

Most people chose the B-alternative. But we know from simple set theory that the intersection of two sets can never be greater than one of the wholes. The probabilities are ignored. This is irrational, since we know that there are far many more bank clerks than there are bank clerks active in the feminist movement.

Availability heuristics is a similar but slightly different heuristics. It is when we chose occurrences that easier come to mind instead of using probabilities. What is more likely: To die from a shark attack or to die from airplane parts falling from the sky? Most people chose the shark attack, why? The shark attacks are easier to imagine and they get much more media attention. Yet the probability of dying from falling airplane parts is 30 times higher than from a shark attack.

Ambiguity aversion means that we are uncomfortable about what we perceive to be the unknown. An example is the “home bias effect”, where investors across the world tend to have a disproportional amount invested in the home market stocks compared to the global market portfolio. In today’s world with more or less free capital flows, this may seem

irrational. One explanation of this phenomenon is that people invest in stocks that they know more about. There seems to be a preference for the known or the familiar.

Finally, we want to bring up the issue of *risk aversion* versus *loss aversion*. Say you have the following options:

A to make a certain 24 000 SEK profit

B to take a chance with the 25% probability of making 100 000 SEK, and where the probability of making 0 SEK is 75%

Most people faced with this decision will choose A. Is this rational? Not according to traditional utility theory. The expected outcome of alternative B is the highest (0,25*100 000+0,75*0=25000). Now let's assume the following scenario:

C you have a sure loss of 75 000 SEK that you can choose to pay

D you can take a chance, the probability of increasing your loss to 101 000 SEK is 75%. But you have a 25% probability of being free of losses.

In this case, most people will chose D. If losses could be avoided, people are more likely to take on a risk, even if it means accepting the alternative with the worst expected value (0,75*-101 000+0,25*0=-75 750). Why is that? People simply dislike losses more than they like profits. In other words, the pain of loosing is higher than the pleasure of gaining money. This may be one of the reasons why investors hold on to bad performing stocks and sell the good ones to quick. This could create patterns in the stock market. People do not want to make realized losses. This is another misunderstanding made by the inexperienced investor, money is not made or lost when the position is closed. The current market prices always reflect the value of the position held.

All of the examples mentioned can be considered flaws of the human mind, which come into play when investing. Both professional and individual investors can act irrationally at times. Hence, it is important to realize that one is exposed to such behavior when putting money at risk. If possible, investors should try to take into account irrational behavior in their investment strategy.

2.3.2 Behavioural finance: Implications for our study

The Efficient Market Hypothesis has a broader perspective and look at the market as a whole. The general idea then is that if a sufficient number of investors in the market compete, then they will move all prices into a "fair" equilibrium. Behavioural finance starting point is more the mind of the individual investor, a bottom up approach. If the individual investor cannot grasp all relevant information, then there sometimes could be irrational decision making. It is though not certain that these irrationalities are evened out when we move from the single individual investor to the market level. It could be so that lots of investors do same mistakes in similar settings. This would then lead to miss-pricing or in some cases stock market "bubbles". In this study we try to find rather simple investment strategies that beat the market over time. If this could be accomplished then the behavioural finance theory plays a vital role in explaining how the stock market behaves.

2.4 The Momentum Effect

If all economists were laid end to end, they would not reach a conclusion.
George Bernard Shaw

This section presents the most important empirical findings regarding the Momentum effect. We will start off by introducing the first research results, showing empirical documentation of Momentum. The Jagadeesh and Titman (1993) study, showed groundbreaking findings which still are an important source for many similar studies covering Momentum effects, including our study. Thereafter, we will present research, which has extended the knowledge of Momentum and proposed possible explanations of this effect. However, there is still an ongoing discussion among researchers about Momentum and some of the research findings are contradictory.

2.4.1 The empirical documentation of Momentum

Jagadeesh & Titman (1993) use investment strategies where they base their stock selections on 3,6,9 and 12 months historical returns. The stocks are ranked after their past performance, and then ten equally weighed portfolios are formed. The top decile, of the ranked stocks, is placed in a portfolio, called P10. The second best decile is placed in a portfolio, called P9, and

so on. The worst performing decile of stocks are placed in P1. The portfolios are then kept for 3, 6, 9 and 12 months. This generates 16 (4*4) different investment strategies.

The two researchers repeat the procedure but skip one week between the formation period and the holding period in order to minimize the so called "bid-ask spread issues" and "price impact". However, in general the differences in returns are very small between the two procedures. Using two procedures yields another 16 strategies.

All the portfolios are rebalanced every month in order to avoid starting point bias and to obtain more observations. The implication of rebalancing the portfolios can be depicted by the following example: Consider the investment strategy based on 3 months formation period (J) and 3 months holding period (K). From now on, we will denote such a strategy a "J3/K3 strategy". If we assume that it is the 1st of April, the portfolio is then based on the stock performance during January, February and Mars. The portfolio is then kept during April, May and June. On the 1st of May a new portfolio is constructed, based on the February, March and April returns and is kept in May, June and July. On the 1st of June another portfolio is created with Mars, April and May historical returns and is kept in June, July and August. Now we are on the 1st of July and the first portfolio has been held for 3 months. This portfolio is then closed and yet another portfolio will be created and so on.

The Jagadeesh and Titman study was based on empirical data between 1965-1989. They found that the best investment strategy was the J12/K3 (12 months formation period and 3 months holding period). This strategy yielded an average return of 1,92% monthly for the period. The zero cost portfolio J12/K3 strategy, that is buying the P10 stocks and shorting the P1 stocks, will yield 1,31% average monthly returns with a t-statistics of 4,28. All the zero cost portfolios are statistically significant from zero. Average monthly returns and t-stats are presented in table 2.1 below.

J	K3	K6	K9	K12
3 Buy	1,40%	1,49%	1,52%	1,56%
	3,57	*3,78*	*3,83*	*3,89*
3 Sell	1,08%	0,91%	0,92%	0,87%
	2,16	*1,87*	*1,92*	*1,87*
3 Buy - sell	0,32%	0,58%	0,61%	0,69%
	1,10	*2,29*	*2,69*	*3,53*
6 Buy	1,71%	1,74%	1,74%	1,66%
	4,28	*4,33*	*4,31*	*4,13*
6 Sell	0,87%	0,79%	0,72%	0,80%
	1,67	*1,56*	*1,48*	*1,66*
6 Buy - Sell	0,84%	0,95%	1,02%	0,86%
	2,44	*3,07*	*3,76*	*3,36*
9 Buy	1,86%	1,86%	1,76%	1,64%
	4,56	*4,53*	*4,30*	*4,03*
9 Sell	0,77%	0,65%	0,71%	0,82%
	1,47	*1,29*	*1,43*	*1,66*
9 Buy - Sell	1,09%	1,21%	1,05%	0,82%
	3,03	*3,78*	*3,47*	*2,89*
12 Buy	1,92%	1,79%	1,68%	1,55%
	4,63	*4,36*	*4,10*	*3,81*
12 Sell	0,60%	0,65%	0,75%	0,87%
	1,17	*1,29*	*1,48*	*1,74*
12 Buy - Sell	1,31%	1,14%	0,93%	0,68%
	3,74	*3,40*	*2,95*	*2,25*

Table 2.1 shows the monthly average returns (not skipping a month) generated by the different strategies during the sample period 1965-1989. The "Buy" portfolios consist of the best performing decile of stocks based on historical ranking (P10 stocks). The "sell" portfolio is the worst performing decile (P1). T-statistics presented below the returns. Source: Jagadeesh & Titman (1993)

Another question to consider is whether the abnormal returns are due to systematic risk. This is checked by calculating the CAPM-betas and the average market capitalization for the different portfolios (P10, P9…P1). The result is presented below for only the J6/K6 strategy but the pattern is very similar for all strategies.

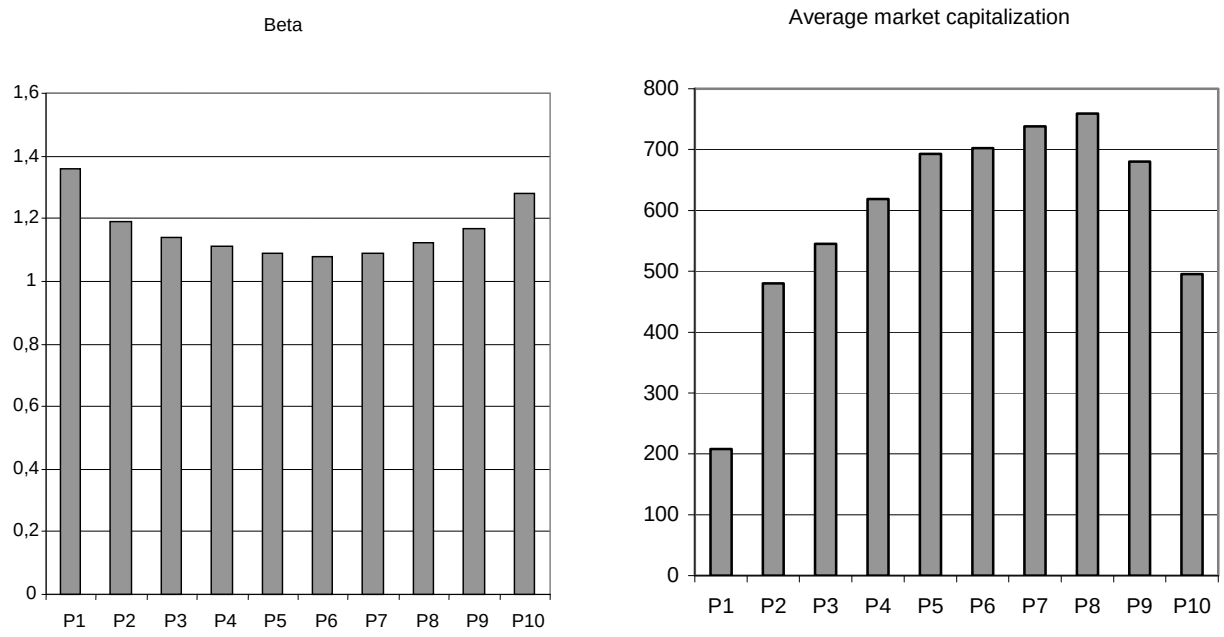


Table 2.2. The CAPM beta-value and size of the average individual company ($M) in the different portfolios using the J6/K6 strategy. Source: Jagadeesh &Titman (1993)

Table 2.2 shows that the betas of the worst performing stocks (P1) are higher than the betas from the best performing stocks (P10). The beta of the zero-cost portfolio is thus negative (-0,08). This suggests that market risk (measured as CAPM) does not explain why momentum exists. The average market capitalizations show that the P10 and P1 portfolios are smaller in comparison to the other portfolios. We also see that the P10-portfolio is larger than the P1-portfolio.

This suggests that the Momentum abnormal returns are not due to increased risk taking in small firms (the small firm effect), which could have been the case if the P10 stocks was the smallest ones, and smaller than the P1 stocks. The authors conclude that the Momentum effect can not be explained by risk factors, measured as CAPM beta or firm size.

In the next step of the analysis, the serial covariance of the 6-month returns is being examined. If the source of the momentum profits is due to this effect, then we would expect a positive value. However, the serial covariance of the equally weighted index is negative (-0,0028). This suggests that the serial covariance is an unlikely source of momentum profits. Jagadeesh and Titman also set up a model to check for "lead-lag" relationships in the data. They found that this relationship does not exist, and therefore could not explain the profitability of the Momentum Strategies.

Another study by De Bondt & Thaler (1985) found seasonal effects of profitable Contrarian Strategies (more on this below). They found most of the Contrarian profits to be made during Januaries in the US markets. With these results in mind, Jagadeesh and Titman performed a test to see how it influences the momentum results. The following results were obtained, see table 3.3 below.

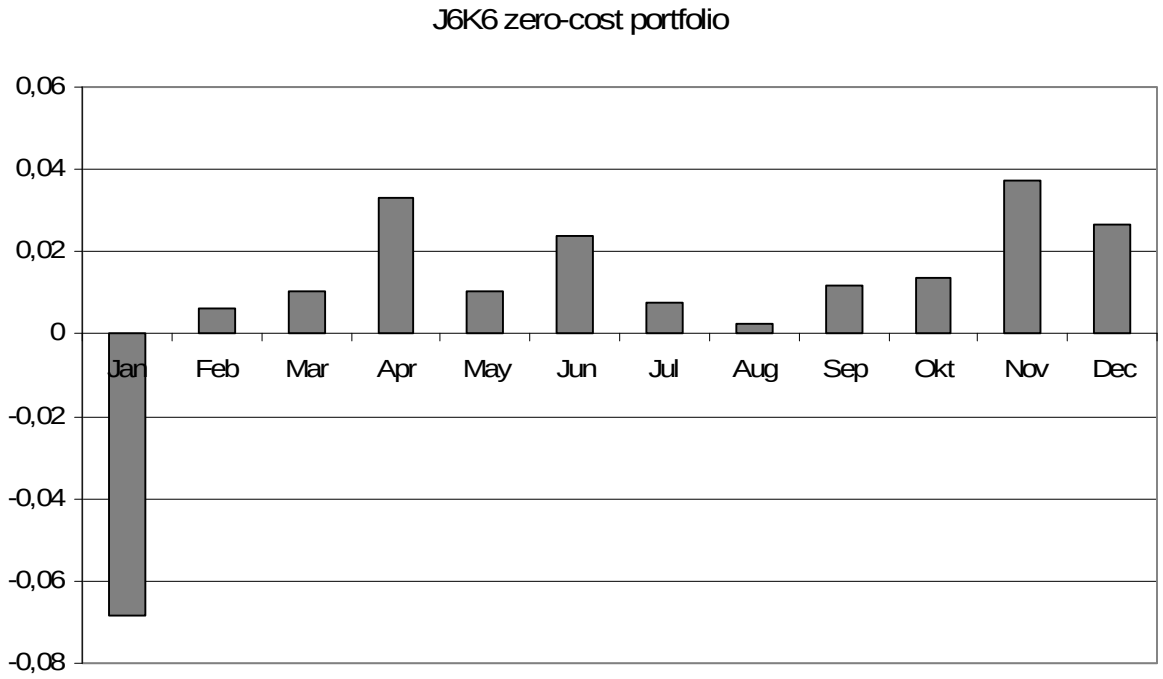


Table 3.3. Overview of the monthly returns from the zero-cost portfolio of the J6/K6 Strategy. Source: Jagadeesh & Titman (1993)

Table 3.3 show that the investment strategy yields negative return on average in Januaries. The average losses in Januaries (about 7%) are statistically significant. The table also shows differences in return between the months. Some months generate much larger returns than others, like April and November. Jagadeesh and Titman suggest that the large returns in April may be due to the fact that corporations must transfer certain funds before April 15 in order to qualify for tax deductions. However, an investor can avoid theses negative returns in January by reversing the Momentum Strategy, using the Contrarian Strategy instead. In that case the investor will gain from this anomaly, instead of in average losing out.

2.4.2 The trading cost issue

The investment strategies described in the previous section might seem relatively trading intensive. Which implication does this have to the expected returns of these strategies? Lesmond, Schill and Zhou (2004) argue that the momentum profits are an illusion. When testing, the data series contain the last trade quote of the month but in practice, the investor will have to sell at the bid price and buy at the ask price. The investor will then also face the price impact cost. Furthermore, the Momentum effect is also found to be largest for the small cap stocks. The abnormal returns will therefore be smaller since bid-ask spreads and price impact effects are largest here. In addition, when forming the zero-cost portfolios the investor will face the cost of short selling. This is usually more costly, in practice, compared to long positions. Since the poor performing stocks are the basis for a lot of the return continuation this could become an issue when using the zero-cost portfolios. There is also the risk that the stock lender will require to close the position prematurely (holding period risk). The authors argue that the J6/K6 zero-cost (P10-P1) strategy will require four trades per 6 months holding period (opening and closing of both winners and losers). The abnormal return of this strategy is 6% semi-annually. This means that the total cost per trade must be less than 1,5% in order for the strategy to remain profitable. According to the authors, this is rather unlikely. They conclude that trading costs are higher than first anticipated, but there could still be some Momentum strategies which could be profitable.

Korajczyk & Sadka (2004) uses another approach and reached a different conclusion. They use intraday data in order to calculate the price impact costs. Instead of using equal weighted portfolios they found that liquidity weighted portfolios reduces the price impact problem. Their approach is to try to find how large a fund can be before the abnormal returns are vanished. Their conclusion are that the total abnormal returns disappear after a $4,5-5,0 Billion investment (by a single fund, long only, volume weighted). The abnormal returns are statistical significant up to an investment of $1,1-2,0 Billion. They also find that in a practice value weighted portfolios will outperform equally weighted portfolios but not volume weighted ones.

2.4.3 Earnings, Momentum and analyst coverage

Chan, Jagadeesh & Lakonishok (1996) examines whether the predictability of future returns from past returns is due to market under reaction. They extend their analysis by examining if

past *earnings* surprises (measured in a number of ways) have any predictive power on future returns. They find that this is the case, but the abnormal returns spreads are smaller and persist only during a short time compared to the past *retur*n Momentum strategies. The abnormal returns cannot be explained by market risk, size or market to book factors. This suggests that the market players do not incorporate news in past earnings or past prices promptly. Instead there seems to be gradual adjustments in subsequent returns. The authors find that security analysts are slow to revise their expectations regarding earnings. One reason for this could be that analysts are initially overoptimistic and slow to adjust their recommendations. In general, there are few incentives for the analysts to lower their company outlooks. Analysts want to generate brokerage income. This will be easy if new buyers come in since short selling is perceived to be unusual. Negative recommendations may even damage the relationship between the Investment banking arm and the company, which could lead to forgone advisory fees. The authors argue that it hard for an analyst to be the first with a negative forecast because it may antagonize the analyzed firm's management. It is then better to be second or third to avoid the worst heat.

Hong et al (1999) perform another Momentum study based on size and analyst coverage, where the latter is rather interesting. They divide their sample into three portfolios based on past performance P1, P2 and P3 (worst, medium and best). They also divide the sample into three different classes depending on how many analysts that follow the stocks, Sub1, Sub2 and Sub 3 (low, medium and high). This way they obtain 9 different (3x3) portfolios. The authors tested the hypothesis of slow information diffusion. That is, information is gradually incorporated into stock prices causing under reaction patterns. The zero-cost portfolio average monthly Momentum profits are largest for the low analyst coverage stock, 1,13% versus 0,72% for the highest covered stocks. This suggests that it takes longer time for less analyzed stocks to adjust to "fair value". Another interesting finding is the strong analyst coverage asymmetry between past losers and past winners, where most of the effect is in the losers. The P1/Sub1 stocks underperform the P1/Sub3 stocks by 0,7% per month. This "loser analyst spread trade" (LAST) is size neutral but is also considered Momentum neutral, since both portfolios are P1. LAST showed to be highly significant. The authors thus argue that it is very unlikely that Momentum profits just are compensation for risk. The reason for this pattern is said to be that the management always has an incentives to push new *good* information out to the public since this will increase the share price. This could be done through analysts or increased disclosures. If the management has *bad* news, they will be more reluctant to reveal

that information. The argument then is that a large amount of analysts is more likely to be able to extract that information from management or finding out the news anyway. This way information will diffuse more slowly among stocks with low analyst coverage (size is also used as a proxy for information coverage generating the same results). The authors conclude that the slow information diffusion hypothesis does hold.

2.4.4 An industry effect

Moskowitz and Grinblatt (1999) performed a similar study as Jagadeesh & Titman (1993) but looked at industries (sectors) instead of individual stocks. They divided the NYSE, AMEX and NASDAQ companies into 20 industries based on the companies so called SIC codes. They then took a long position in the top three industry winners and short the worst three industries to make a zero-cost portfolio. The study reaches the same conclusion as Jagadeesh & Titman (1993) for medium term (3-12 months) and De Bondt & Thaler (1985) long term horizons (3-5 years). That is medium term momentum and long term reversals. But for shorter periods they find momentum, which is contrary to the findings of Jagadeesh (1990) and other later studies Assoé & Sy (2003). At the industry level there seems to be a short term Momentum and the abnormal profits are in fact largest for the one month formation and one month holding period (J1/K1 with earlier used terminology). The authors show that this strategy is still profitable after adjustments of book to market, size and cross sectional dispersion in mean returns. However, when also taking industry effects into account most of the momentum effects disappear. The authors conclude that since much of the momentum effects lies within industries, it means that the strategy is riskier than first thought (low diversification). They point out that momentum may be rather “far from arbitrage”. Later studies though have not found this effect. Lee & Swaminathan (2000) find that industry effects weaken the abnormal returns by only approximately 20%. Grundy & Martin (2001) come to this conclusion as well.

2.4.5 Volume

Lee & Swaminathan (2000) used a similar approach as Jagadeesh and Titman (1993), They also divide their sample into three different volume categories (low, medium and high volume). The authors found that price reversals are more pronounced among low volume losers and high volume winners. Conversely, Momentum is more pronounced among high

volume losers and low volume winners. Here the interesting finding is that when buying low volume winners and shorting high volume losers the price momentum continues up to the fourth year after formation. The result is contrary to the findings by Jagadeesh and Titman (1993) where momentum profits dissipate after 12 months. Straight forward data on volume thus help us explain the momentum effect. The authors also suggest that one should not look at short and long term horizons as just Contrarian opportunities and medium term horizons as Momentum opportunities. Instead they conclude that there could be a relationship between these horizons and one should not view them as rigid.

2.4.6 Momentum effects on different markets

Rouwenhorst (1998) examines the Momentum effect in 12 European countries from 1980-1995. He uses the same methodology as Jagadeesh & Titman (1993) and finds that there is a momentum effect in Europe on a 3-12 months horizon. The excess returns are approximately 1% per month. He finds that the zero cost portfolio betas are near zero, which implies that market risk is not the source of the excess returns. Average returns are also negatively related to firm size. Rouwenhorst then makes his portfolios country neutral by checking the Momentum effect in each country for the J6K6 strategy. He finds statistical significant Momentum in each individual country except Sweden. The mean monthly return for the individual countries is 0,93% which is only slightly lower than the European mean of 1,16%. The standard deviation of the individual returns is about 2-3 times larger than the European portfolio. This shows that there are some diversification benefits to international Momentum investing. The author finds that the Momentum effect is largest among small firms. To check if the Momentum effect is restricted to small firms only Rouwenhorst sort his full sample into ten size deciles. Within each size decile he sorts the stocks on six months historical returns and makes 10 portfolios based on this (P10, P9…P1). He finds that the winners minus loser (P10-P1) portfolio generate significant excess returns for all size deciles. The Momentum effect is thus not confined only to small stocks. When checking for the Fama and French (1996) SMB factor he also finds that it increases the profits rather than explain the momentum effects. Rouwenhorst also finds that the Winners-Losers strategy has negative CAPM-betas in bull markets and positive betas in bear markets. This is another indication that risk is not the issue. The correlation between the European and US momentum profits is 0,43 which the author finds to be a strong relationship. This suggests that there could be an exposure to a common factor driving the momentum profits.

Haugen & Baker (1996) perform a cross section of expected return study. They use the Russell 3000 companies from 1979 to 1993 and find 11 explanatory variables that are significant. The two variables with the highest T-statistics are 1 month excess returns (-17,04) and 12 months excess returns (7,09). This shows that short run reversals and medium term momentum are important. The other variables reflect the "expensiveness" of a stock (P/E, M/B), profitability, risk, growth potential and liquidity. Interesting to note is that risk (measured as variability of cash flow to price) does not explain as much as past returns. The authors build a model based on these 11 explanatory variables and sort the stocks into 10 deciles based on their expected returns (D10 highest expected returns, D1 lowest). The result form this strategy yields an average spread of about 35% annually between D10 and D1 over the period. The average volatility of the D1 stocks are 22,62% annually and falls to 18,50% for the D10 stocks. The strategy does seem to be less risky and will yield substantially higher returns than a buy and hold strategy. The authors then run the same model on four other markets (Japan, Germany, France and the UK). The same 11 explanatory variables are thus used and the results are similar to that of the US in all markets. There is a high degree of commonality in the factors that are most important in determining the expected returns, but the correlations of the payoffs of the different factors among the countries are low. The authors conclude that the nature of investment behaviour is similar among investors over the world. They conclude that the predictive accuracy of their model can be attributed to bias in market pricing. Their results support the idea of inefficient markets.

2.4.7 Contrarian Strategy findings

De Bondt & Thaler (1985) perform a long term reversal study where they examine the performance of the top and bottom performing deciles. They form their portfolio on 36 months historical returns and hold the portfolios for another 36 months (they also check their results by using other time horizons). The sample consists of NYSE stocks from 1926-1982. The losers outperform the market by an average of 19,6% 36 months after formation whereas the winners earn 5% less than the market. The spread is thus 24,6% which is statistical significant. The majority of the spread lies in the losers and the authors also find a strong January effect. The losing stocks earn, for some reason, great profits in Januaries. This effect remains 5 years after portfolio formation which is rather amazing. The spread between the losers and the winners is small the first 12 months, 5,4% then it increases 18,1% 2 years after

formation. A majority of the effect thus lies in the second year. The CAPM betas of the losers are lower than the winners. A strategy that takes a long position in the losers and a short in the winners will thus have negative beta. This means that it is unlikely that the reversal strategy profits are due to increased risk taking. The authors conclude that investors overreact to bad news. The long term losing stocks then get neglected and earn above market returns the subsequent years. De Bondt & Thaler (1987) do a follow up study with 5 years formation and 5 years holding periods. They find that the CAPM betas this time is positive (0,22) for the zero cost portfolio, but this rather low risk should not warrant an average annual return of 9,2%. They also find that the Contrarian profits are not primarily a small firm effect even though such a pattern exists among the small firm losers. Fama & French (1996) find that the long term reversals are due to a model misspecification since the anomaly to a large extent disappears (are no longer significant) when using their three factor model.

2.4.8 Summary of research findings regarding Momentum

Many empirical studies during the past decade have increased the knowledge of the Momentum Strategy. However, the first really groundbreaking work was made by Jagadeesh & Titman (1993). Their methodology is still used when testing for Momentum and many studies often refer to their empirical findings. With that in mind, we chose to use their study as a base for our own empirical research. However, we have systematically gone trough all the published research made until now. The most relevant and interesting results within this field has been presented above. It should be pointed out that we found some research findings which are contradictory although many findings are similar. This is still a dynamic research field and a lot remains to be done.

3 Method

Chapter 3 will provide the reader with a description on how we conducted our research. The aim is to offer detailed insights into our course of action and explain why certain steps were taken to accomplish our objectives. We will start with a description of the data, the method of processing the material and finally how the statistical tests were conducted.

3.1 Analytical approach and methodology

This is a quantitative study on how the stock market behaves in a medium-term perspective. If the stock market follows the Efficient Market Hypothesis (Fama, 1970), the stock prices are assumed to always fully reflect all available information in the market. As a result, it should be impossible to obtain abnormal returns using investment strategies based historical information. However, several empirical findings suggest that past returns can, in fact, be used to predict future stock movements (see section 2.4). These results are contradictory even to the weak form of market efficiency.

Our study contributes to the discussion about the Efficient Market Hypothesis by testing if Momentum Strategies are profitable in the Nordic stock markets. A Momentum Strategy involves buying a portfolio of stocks that performed best in the past, and/or short selling a portfolio of the worst performers. If our study can show that it is possible to generate abnormal returns using a Momentum Strategy, we have also found evidence of possible inefficiency in the stock market.

The methodology used in our study is the same as in the articles by Jegadeesh and Titman (1993) with a few exceptions. Their study involves testing for Momentum in the US stock market. Our contribution, to increase the knowledge in this field, is to apply the same methodology but in a new and different setting – the Nordic stock markets. Another distinction, compared to their study, is that we have extended the number of tested investment strategies. Our study will therefore be more extensive and we will hopefully increase the knowledge about Momentum and how it works in different markets. In addition, if we are able to determine any Momentum in the markets, we will try to test for possible sources or drivers that can explain why Momentum Strategies are profitable. We have focused our attention on four different factors, which influence the profitability of investment portfolios: the beta-value, market capitalization (size), trading volume and seasonality.

3.2 Choice of Markets

Our study consists of all stocks listed on the major Nordic stock exchanges; Stockholm Stock Exchange (SSE), Copenhagen Stock Exchange (CSE), Oslo Stock Exchange (OSE) and Helsinki Stock Exchange (HSE). By extending the research from one to several markets, we hope to gain greater knowledge about Momentum effects and how these work in different markets. The empirical part of our research is therefore exceptionally extensive since it contains a vast number of companies. Another reason for choosing the Nordic stock market is the ability to test whether there are Momentum effects on the combined Nordic stock market, including listed stocks from all the four stock markets. This will enable us to perform a test on a larger sample. Furthermore, the Nordic exchanges are interesting since OMX, the company which owns the stock exchanges in the region except for the one in Oslo, plans to implement a so-called "Nordic list" during the fall of 2006 (OMX AB, 2006). The Nordic list is planed to replace the current "A List" and "O List" in Stockholm, the "Main List", "I List" and "NM List" in Helsinki and "the List" in Copenhagen. If the implementation of the new "Nordic list" is successful, this might increase awareness and interest among investors to buy and sell stocks listed in all the Nordic countries. This integration between the stock exchanges in the region might increase the general interest in the results of our study.

It should be underlined that we have excluded the listed stocks at Iceland Stock Exchange (ICEX) from our study, even though these are part of the Nordic region. The reason for excluding ICEX is that too few companies are listed at the stock exchange; currently only 25 companies (Iceland Stock Exchange, 2006). In our opinion, Iceland has too few stock observations in order to conduct sturdy statistical tests.

3.3 Choice of data material

Our empirical data consists of historical stock prices, dividend payments, market values and trade volumes for all the registered stocks at the four Nordic stock exchanges. This forms a very large database. We have included all the stocks listed at the exchanges for a comprehensive investigation. The large number of systematic data provides a solid base for our statistical tests and makes our results reliable.

Our study will process monthly stock data over a fifteen year period. The reason for using monthly data, instead of shorter intervals, is that previous studies (see section 2.4) have shown Momentum effects within certain monthly intervals. It is more appropriate to use monthly data to compare our results with the earlier findings.

The number of listed companies included in this study is listed in Table 3.1 below. The table rows show the number of stocks in the sample from the different countries. The last row, called Nordic, is the total number of companies in the four countries. This constructed sample (Nordic) will be analyzed in the same fashion as for the individual countries.

	Listed	Delisted	Total amount
Denmark	187	171	358
Finland	163	86	249
Norway	224	212	436
Sweden	444	330	774
Nordic	1018	799	1817

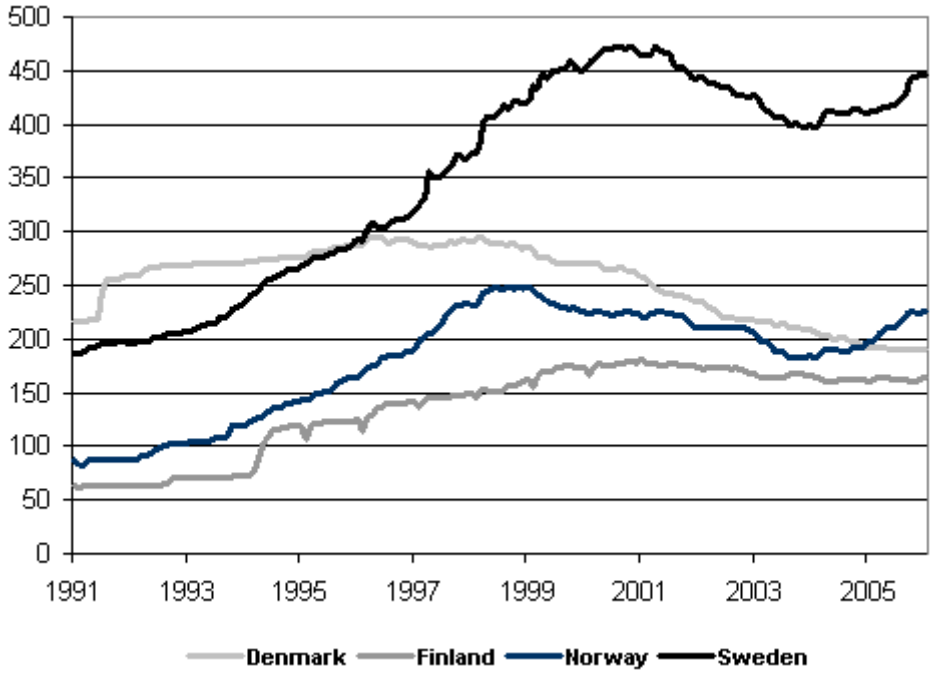
Table 3.1. Number of stocks included in this study.

The column "Listed" in table 3.1 consists of all the currently listed companies included in our sample. The column "Delisted" displays all companies included in our database, which were delisted from the stock exchange during the period of analysis. There are many reasons why companies are delisted: defaults, mergers and acquisitions, etc. To not include observations from delisted companies would distort the results as (A) they represent almost half of the number of listed stocks on the stock exchanges throughout our observation period, and (B) we would cause a so-called "survivorship bias", as the performance of delisted companies would no longer influence our results. Survivorship bias can skew the results to show higher performance of the stocks because only companies which have been "successful enough" to stay listed during the whole period would have been included.

3.4 Choice of measuring period

As indicated, our study of Momentum Strategies is based on the monthly stock prices for a fifteen year period between April 1991 and April 2006. This period was chosen for three reasons. Firstly, the length of the period should provide a large number of observations to enable a strong, solid statistical testing. By choosing a time period of fifteen years, we obtain 180 monthly stock price observations for each stock. Secondly, the number of stocks listed

fifteen years ago is not as many as today, see Graph 3.1. If we were to extend the sample period, we would face the risk of too few stock observations in the extended period. For example, before 1991, there were less than 60 companies listed at the Helsinki Stock Exchange (HSE). If we were to form ten investment portfolios, there will be a risk that one company success or failure would heavily influence that portfolio. This could be referred to as an increase in firm-specific risks of an investment portfolio. To avoid this situation, we decided not to extend the sample period further back than to 1991.



Graph 3.1. Development of the number of listed stocks at the different Nordic Stock Exchanges

The third reason for choosing this sample period is to include periods of both decreasing and increasing stock prices. This enables us to test whether there are any differences in the profitability of Momentum Strategies in a positive and negative stock market climate.

3.5 Collection of primary data material

The data material we use are collected from Datastream Advance, a database administered by Thompson Financial Limited. Collecting the kind of data used in this study can be done in several ways and through other sources. However, we find Datastream to be both reliable and more efficient than many other sources we have come across. We have gained access to the database through LINC, the financial society at the University of Lund.

3.5.1 Collection of stock observations

All the stock observations used in this study are the close price. The close price is the price paid at the last transaction of the trading day. In our case the price observation is collected once every month and represents the development of the stock since previous observation. A problem with collecting the prices is that it usually is not adjusted for events like new issuing or stock splits etc. These events usually affect the stock price very much and will distort our results heavily. We have therefore been very thorough when collecting data using Datastream Advance to only collect adjusted price series. After retrieving the data we performed some random check-ups to control the material of whether or not it has been adjusted correctly.

When calculating the net stock return it is important to include the dividend payments for each stock. The dividend payments, paid out yearly, are a way for the company to pay out excess cash to its owners. In our study we have included the most common way of dividends payment, the payment in form of real cash. This information has been collected for all the companies throughout the complete period. However, besides the cash dividends companies can make payments in form of additional stocks, stock dividends, or payments in form of assets, property dividends. These forms of payment are not included in our study because (1) difficulties and time restraints of collecting this information. (2) In our opinion, these forms of payment are not so common on the major Nordic stock exchanges.

Some of the larger companies listed on the stock exchange have divided their equity capital into stocks with different voting rights. The difference in voting rights is stated in the company statues but is also regulated by law. The stocks with higher voting rights are in general denoted A while the stocks with lower are denoted B. The difference between these types of stocks has an impact how much the stock is traded. In comparison between the two types of stocks the A stocks are usually held by large owners and long-term investors and therefore are much less traded than the B stocks. Because the stocks are issued by the same company it is likely that they will be affected by the same factors and has similar price development. This might impact the autocorrelation among the stocks and increase the firm specific risk in the portfolios. However, we have decided to include both the A and B stocks in our study. This decision lead to a larger number of stock observations, which we think is beneficial for the quality of our study.

All the stock observations have been collected in the local currency. However, Finland changed currency from Finnish Markka to Euro in January 2002. To correct this problem, the complete price series has been changed into Euro using the conversion rate from 2002 to value previous price observations. The conversion for 1 Euro was 5,94573 Markka.

To be able to aggregate data over time into a "Nordic stock exchange" (including the Danish, Finnish, Norwegian and Swedish registered stocks), we have used the exchange rates between local currencies and the Euro. The exchange rate observations have been collected monthly for the complete time period under study. The "Nordic stock market" contains all the stocks from the four different countries with stock prices converted to Euro.

3.5.2 Collecting stock indices

A key ambition behind this study is to test for profitability of Momentum Strategies. However, it will be interesting also to compare the results from these strategies with the returns from an official stock index. This comparison of results provides insights into how the profitability of certain portfolios measured up to the rest of the stock market. A stock index is needed also to calculate a beta-value (explained in section 3.8.1) for the formed investment portfolios. The indices are then used as a proxy for the market portfolio, when calculating the portfolios beta-values. Furthermore, we will use the stock index to identify periods of increasing and decreasing stock prices. This enables us to see how well the Momentum Strategies work in different economic climates.

A suitable index in the Swedish case is the "Affärsvärldens general index". This index includes all stocks listed at the Stockholm Stock Exchange (SSE). However, when considering similar all-share indices at the other stock markets (in Denmark, Norway and Finland), there are no data available for the full period. Hence, instead of creating our own index or combine several indices to cover the complete time period, we have used the MSCI indices. The MSCI equity indices are available for all the four stock markets as well as for the Nordic market in total. The MSCI, created by Morgan Stanley Capital International, is widely used and include the most influential stocks at the different markets (Morgan Stanley Capital International, 2006). Each index measures the sum of the market capitalization weighted returns of all the constituents. By using MSCI indices for comparison of all the markets our study becomes more systematic.

All the indices that we use for the study measure total stock market performance, including reinvested dividend payments. In addition, the index is calculated in local currency. This makes it easier for systematic comparisons.

3.6 Criticism of the collection of the data

Most of the data material used in our study is collected from Datastream (Thompson Financial Limited 2006). Our study is dependent on Datastream for providing us with the most reliable and otherwise correct information. We believe that Datastream can be considered a trustworthy source and that the information is not biased in a way that may negatively influence the quality of our study. However, when handling a large amount of data, there is always a risk to include factual errors in the source material. With reservation for potential minor errors, we consider the data inputs to be correct.

3.7 Processing the data material

When all the selected financial data had been collected, we started the processing in accordance with our theory and methodology. To be able to process this vast amount of the data we used Microsoft Excel. We selected this program, having compared Excel with other statistical programs, because Excel provides a simple way to process the data – using both formulas and scripts.

However, before we actually started processing the collected data, we in fact removed some of the stock observations to avoid misleading results. We decided to remove all exchange-traded funds (ETF), which are stocks which contain a basket of shares corresponding to a given index. We also removed stock observations with cross-listings between the Nordic markets. These removals were necessary to avoid including the “same” stock, when testing for Momentum effects in the Nordic stock market as a whole.

3.7.1 Calculation of the stock return

The stock prices and dividends are used to calculate the net stock return. This is done by using the following formula (Campbell et al, 1997).

$$(1) \qquad R_t = \frac{P_t + D_t}{P_{t-1}} - 1$$

Where R_t is the net return at date *t*
P_t price (ex-dividend) at date *t*
P_{t-1} price at date *t-1*
D_t Stock dividend payment at date *t*

The formula is used to calculate the monthly stock return at the end of each month. In our study we also calculated the multiperiod returns, usually referred to as compound returns. To calculate the compound returns, we use the gross return, $1+R_t$. The gross return for *k* time periods from *t-k* until *t*, we denote this as $1+R_t(k)$, is equal to the product of the *k* single period returns from *t-k+1* until *t*.

$$(2) \qquad 1+R_t(k) = (1+R_t)*(1+R_{t-1})...(1+R_{t-k+1})$$

To obtain the net return for the *k* time period we subtracted the gross return for the period (2) with 1. The above formula could be used also to calculate the monthly return, when we have already calculated the compounded return. If we assume that the single period returns are the same ($R_t = R_{t-1} = ... = R_{t-k+1}$) then (2) can be reformulated as:

$$(3) \qquad R_t(k) = \left[\prod_{J=0}^{K-1} (1+R_{t-j} \right]^{1/K} - 1$$

When calculating the returns, we have not taken into account taxes and transaction costs. However, it would be practically impossible to keep our study general if we were to adjust for taxes and transaction costs. These costs influence investors differently, depending on their economic state of affairs and behaviour. As an example, it would be reasonable to assume that

a large investor might pay less commission when buying a stock than a relatively small investor.

After calculating the returns, our material included a few extremely high values. These extreme returns were due to obvious errors in the primary data material. For example, we found stocks which had risen by more than several hundred percent during one month. To avoid distorting the results the returns higher or lower than three standard deviations from the compounded mean for each time period were removed.

However, by using this method of removing extreme values, we risk excluding actual correct returns. But to include these extreme values would probably distort the results even more. An alternative could have been to go through each and every extreme result to analyze – at the company level – whether or not these were correct, but such a procedure would not only be difficult, but also very time consuming.

3.7.2 Formation of the investment portfolios

In our study we used a similar methodology as the one by Jegadeesh and Titman (1993), but we have extended the number of strategies. Their study found a significant Momentum effect over 3-12 months holding periods. With their results in mind, we extended our study with both a shorter and a longer time period. Extending the time period allows us to test whether there is significant Momentum using other investment horizons. In addition, according to other research (see section 2.4.7) Contrarian Strategies showed to be profitable both within shorter and longer time periods. Contrarian Strategies (buying a portfolio of stocks which has performed worst in the past, and/or short sell a portfolio of the best performers) represent the diametrically different strategy to Momentum Strategy. Both types of strategies cannot be profitable at the same time.

The investment strategies that we are considering in this study are based on the compounded returns over the previous 1, 3, 6, 9, 12 and 24 months. Moreover, we have chosen to consider holding periods (the period during which the investor keeps his investment) in the same manner: 1, 3, 6, 9, 12 and 24 months. This will provide us with a total number of 36 (6*6) different strategies depending on both formation and holding periods. Figure 3.1 provides a graphic overview of the different strategies included in our study.

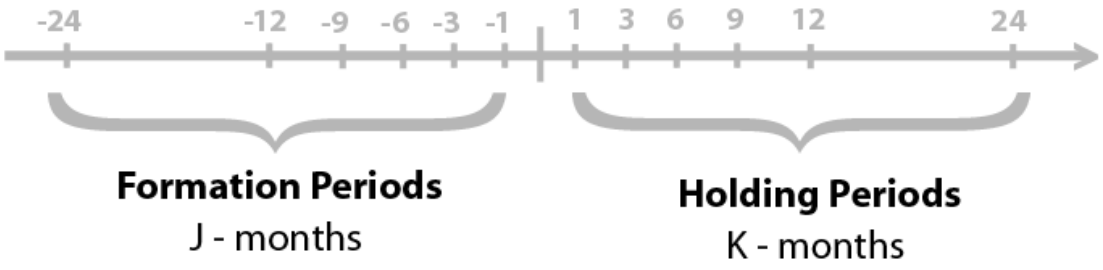


Figure 3.1. Overview of the construction of the different investment strategies

We have formed the portfolios, using the following procedure: At the beginning of every month (*t)* the stocks are ranked, based on their compounded returns over the past J-months. Then, based on the ranking, 10 equally weighted portfolios are formed. In accordance to previous studies [i.e. Jegadeesh & Titman (1993), Rouwenhorst (1998)] we have denoted the decile portfolio consisting of the 'worst performance stocks' (called the "P1"-portfolio) and continued in this manner until the tenth decile, which contains the 'best performance stocks' (called the "P10"-portfolio). For every trading strategy these ten, by us constructed portfolios are held for a period of 'K-months', where K is the holding period. A trading strategy based on the returns from the past J-months and held for K-months will be referred to as the "J-months/K-months –strategy".

All strategies that we examine include portfolios with overlapping holding periods. This implies that – for any given month *t* – the strategies include a series of portfolios formed in the current month as well as in the previous *K-1* months, where *K* is the holding period. Including overlapping holding periods will decrease the potential small sample bias and increase the power of our statistical tests.

3.7.3 Calculating the return of portfolios

In our study, the compounded returns are calculated for all the different portfolios and markets. This includes 36 investment strategies with different forming and holding periods, using stocks from five markets: Denmark, Finland, Norway, Sweden and the whole Nordic market. All these investment strategies contain 10 different portfolios plus an additional "zero-cost portfolio". Consequently, we have calculated returns for 1980 different portfolios. The obtained compounded returns was recalculated to monthly returns using the formula (3)

displayed in section 3.7.1. Using the monthly returns makes it easier to compare the portfolios with different investment horizon.

A zero-cost portfolio was created using the returns from the P10-portfolio and P1-portfolio, containing both the 'best performing stocks' and the 'worst performing stocks' during the formation period. This was achieved by buying the P10-portfolio and shot selling the P1-portfolio. For this to be possible, we have to assume that there are no transaction costs in the stock market and that all stocks can be shortened. When testing for Momentum, we are interested primarily in the returns of the zero-cost portfolios. If a zero-cost portfolio shows significant positive returns, we have confirmed Momentum in the market, see expression (4).

(4) Momentum (zero-cost) = Return (P10)-Return(P1)

Even though our main interest remains with the returns from the zero-cost portfolio we will also be using the results from the other portfolios (P1 to P10). The other portfolios will be used for comparative reasons and the ability to test sources of the Momentum effect, see section 3.8. It will also be interesting to see how the P10-portfolio performs compare to the benchmark index.

3.7.4 Statistical testing for momentum

To test the profitability of zero-cost Momentum Strategies we will compare the returns from the portfolios with the return of a benchmark. Since these portfolios are – by construction – zero-cost, the appropriate benchmark is zero. This is statistically tested using the hypothesis below.

(5) $$H_0 : \mu_{J/K} = \mu_0$$
$$H_1 : \mu_{J/K} > \mu_0$$

The Null Hypothesis, $H_0 : \mu_{J/K} = \mu_0$, states that the return from the zero-cost portfolio with the "J-months/K-months- strategy", are equal to the return of the benchmark. The alternative hypothesis, $H_1 : \mu_{J/K} > \mu_0$, is one-sided and states that the portfolio return are significantly larger than the benchmark.

The Null Hypotheses are tested using the following test statistic (Montgomery, 2005).

$$(6) \quad t_0 = \frac{\bar{y} - \mu_0}{S / \sqrt{n}}$$

Where t_0 is the t-value
$\bar{y}$ mean return of the zero-cost portfolio
S standard deviation of the sample
n number of return observation

Because the alternative hypothesis is one-sided the null is rejected if $t_0 > t_{\alpha,\, n-1}$, where α is the significance level and $n-1$ the degrees of freedom.

When performing statistical testing one should be aware of possible errors. These errors are usually denoted Type I and Type II. The Type I error is rejecting a true null hypothesis and the type II error is not rejecting a false null hypothesis. The general approach of dealing with these possible errors is to specify a value of the probability for a Type I error, and use a suitable test procedure, which provides the probability of type II error to be small. Therefore, when we perform our statistical tests of momentum, we will set the probability for a type I error, often referred to as the significance level, to be 10%.

3.7.5 Robustness Test

In order to see how well the Momentum Strategies worked during different periods we perform a robustness test. The test includes dividing the time period (1991-2006) into three sub periods and examine if there are any differences in the return from the Momentum Strategies. The sub periods are 1994-1998, 1998-2002 and 2002-2006. For some strategies the first couple of year's returns series constitute the formation period. This is why 1991-1994 is not part of the sub period testing.

3.8 Testing possible explanation of Momentum

Aside from calculating the returns of the different Momentum Strategies we will also attempt to test a few possible explanations of its profitability. In this study we have chosen to look at four different factors that can affect the profitability of Momentum in the stock market. These

four factors are the portfolios beta-value, size, volume and seasonality. In the following sections these variables are presented in more detail.

3.8.1 The CAPM Beta

The Capital Asset Pricing Model (CAPM) was introduced by Sharpe (1964), Lintner (1965) and Mossin (1966) independently. The model is used to determine the theoretical required rate of return of assets in relation to their risk. A component in the model is the so called, beta-value. The beta-value (or CAPM-beta) is a measure of risk which states how sensitive an instruments return is in comparison to the return of the market portfolio, in our case the MSCI market index. By definition, the beta-value for the index is equal to one. Consequently, if an instrument has a beta larger than one, it is assumed to be more risky than the market. The CAPM assumes that the investor should be compensated for taking on more risk, called a risk premium.

The beta is calculated using the 24 month historical returns for the individual stocks and the comparable index, the MSCI indices. We decided to use 24 months for calculating the beta, and not a longer period, because we would give up too many observations. To calculate the beta for every individual stock we used the formula below (Haugen, 2001).

$$(7) \quad \beta_{im} = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

Where β_{im} is the beta value for stock i
R_i is the return for stock i
R_m is the return for the index

The stock beta is used to calculate the beta for every portfolio at the formation date (ex ante Betas). The beta for the portfolios is equal to the mean of all the including stocks. This is because all of the portfolios are equally weighted.

3.8.2 Size

The size effect, which was first documented by Banz (1981), is that low market capitalization firms provide higher risk-adjusted returns compared to high market capitalization firms. An explanation why the size effect occurs is beyond the scope of this thesis. However, a possible

explanation for the higher returns could be due to the higher risk small companies face. The implication for our study is that high return might be explained by compensation of risk, if the portfolio consists of small firms.

The size effect is tested through comparing the ten different portfolios average company market capitalization ex ante. Therefore, when each portfolio is created, using the different investment strategies, we calculate the average market value of each firm within respective portfolio. It should be underlined that we are interested in the comparison between the different portfolios, not the actual value it self. This is because the market values are averages over 15 years which mean that the numbers per se do not tell us anything.

3.8.3 Volume

A recent research study of Momentum showed that past trading volume provided an important factor for the profitability of Momentum Strategies (Lee and Swaminathen, 2000). The return seemed to be more pronounced when the portfolio contains the low volume top performers and the high volume worst performing stocks. With these results in mind, we decided to compare the trading volume between the different portfolios. The trading volumes are calculated by multiplying the turnover per share and the share price. Because our only interest is in the relative difference between the portfolios we decided to use the daily turnover per share and the share price at the day of the portfolio formation. It would be more correct to calculate the trading volume for the portfolio during the complete forming period. However, all the portfolios are treated in the same way and we are only interested in the relative difference between the portfolios.

3.8.4 Seasonality

We are interested to examine if the Momentum Strategies perform differently during different months. Other studies have found (see section 2.4) that Momentum Strategies perform significantly better during April, June, November and December but significantly poorly during January. Can the same seasonality be found in the Nordic stock markets? To answer the questions, we will examine certain strategies and how these perform during different months.

3.8.5 Testing for differences between the portfolios

To test for differences within the investment portfolios we look at the four factors presented in the previous sections: beta-value, size, volume and seasonality. These factors are supposed to affect the profitability of the portfolios, but we want to examine if the factors are affecting the portfolios (P1 to P10) differently. A formal test for differences between portfolios (P1 to P10) can be performed by using the following hypothesis.

(8) $$H_0 : \tau_{P1} = \tau_{P2} = ... = \tau_{P9} = \tau_{P10}$$
$$H_1 : \tau_{Pi} \neq \tau_{Pj} \text{ for any } i \text{ and } j$$

The null hypothesis, H_0, states that there are no differences between the portfolios τ-value. The τ-value represents the sum of the tested factor (beta-value, size or volume) for the portfolio. The alternative hypothesis states that at least one of the portfolios are significantly different the others.

The null hypothesis can be tested using the test statistic (9) (Montgomery, 2005). If the null hypothesis is true then the ratio, F_0, is F-distributed with *a-1* and *n-a* degrees of freedom. However, if the null hypothesis is false then $F_0 > F_{\alpha,a-1,n-a}$.

(9) $$F_0 = \frac{SS_P/(a-1)}{SS_E/(n-a)}$$

Where SS_P is the sum of squares of the difference between the portfolios τ-value and the grand mean $\bar{\tau}$.
SS_E is the sum of squares of the difference of observations within the portfolios τ-value.
a is the numbers of τ-values tested
n is the numbers of observations for every τ-value

4 Result and Analysis

Chapter 4 presents the results of our Momentum study. The focus will primarily be on the Nordic stock market and J6K6 strategy in particular. The findings from the different national markets are covered briefly although; all the results are displayed in the Appendix. We will next present different explanations to why Momentum might exist. The analysis also goes through seasonal patterns, correlations and subperiod robustness tests.

4.1 Evidence of Momentum

Our empirical study is very extensive. The study includes 36 investment strategies with different forming and holding periods, using stocks from five markets: Denmark, Finland, Norway, Sweden and the whole Nordic market. All these investment strategies contain 10 different portfolios plus an additional "zero-cost portfolio". Consequently, we have calculated the monthly return and tested 1980 different portfolios. The returns for all the portfolios are displayed in Appendix 1a to 1e.

The material is so extensive that we naturally cannot present it all in this text. Therefore, in the following sections we will highlight the main results from the Nordic stock market, and the J6K6 Strategy in particular. We have chosen to focus primarily on the J6K6 strategy because it makes comparisons with Jagadeesh and Titman (1993, 2001) possible. We will also continuous trough the text do comparisons between the Nordic market and the different national markets. The results from all the national markets are displayed in Appendix 1-4.

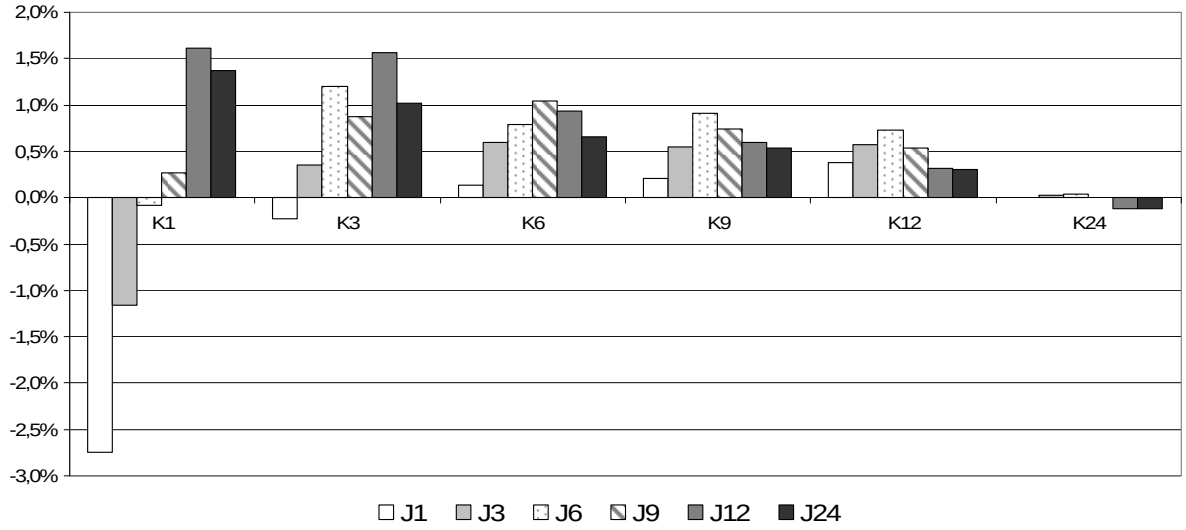
4.1.1 Momentum on the Nordic stock market

A zero-cost Momentum Strategy involves buying the past top performing stocks and short sell the past worst performing stocks. For such an investment strategy to yield positive return, the past top performing stocks have to continue to outperform the worst performing stocks. Using our terminology this means that the P10-portfolio has to provide a larger return than the P1-portfolio. The difference in return between these portfolios (P10-P1) is the zero-cost portfolio return.

The returns from the different zero-cost portfolios in the Nordic stock market are displayed in the Graph 4.1. In the graph, we see that most of the strategies show positive return within a 3-

12 months investment horizon (K3-K12). Within these investment horizons the Momentum Strategies show monthly returns between 0,14% (J1K6) and 1,56% (J12K3).

The strategies with only one month investment horizon show quite different results. In this case, the J1K1 and J3K1 strategy show large negative returns while the J12K1 and J24K1 strategy show large positive returns. If a Momentum Strategy yield negative return then it is more suitable to use a Contrarian Strategy, which is the diametrically the opposite. Using the Contrarian Strategy (P1-P10) would generate a monthly return of 2,74% (J1K1) and 1,16% (J3K1).



Graph 4.1. Graphical overview of the monthly return from the zero-cost portfolio using Nordic stocks

The Momentum Strategies show a tendency to be high for most of the strategies with a 3-12 months investment horizon but then decrease and finally vanish with longer holding periods. With a holding period of 24 months all the strategies show zero or slightly negative returns.

All the strategies were statistically tested to confirm the findings of Momentum in the Nordic stock market. We found eight of the strategies to be significantly different from zero using a significant level of 10%. The results are presented in the table 4.2 below. In the table "buy" represent the P10-portfolios and the "sell" represent the P1-portfolios. "Buy-Sell" is the zero-cost portfolios. All the t-values are shown below the returns.

Nordic Market				**MSCI Nordic**	Mean	1,37%
T - statistics					St dev	6,70%

J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
1 Buy	**-0,92%**	**0,43%**	**1,12%**	**1,11%**	**1,18%**	**1,18%**
	-1,37	*0,68*	*1,58*	*1,57*	*1,70*	*1,64*
1 Sell	**1,82%**	**0,65%**	**0,98%**	**0,90%**	**0,80%**	**1,17%**
	3,33	*1,11*	*1,44*	*1,27*	*1,16*	*1,72*
1 Buy - Sell	**-2,74%**	**-0,22%**	**0,14%**	**0,21%**	**0,38%**	**0,01%**
	-4,72	*-0,50*	*0,33*	*0,52*	*1,02*	*0,02*
3 Buy	**-0,16%**	**1,13%**	**1,07%**	**1,39%**	**1,44%**	**1,27%**
	-0,25	*1,75*	*1,74*	*2,03*	*2,05*	*1,71*
3 Sell	**1,00%**	**0,77%**	**0,47%**	**0,85%**	**0,87%**	**1,24%**
	1,68	*1,14*	*0,73*	*1,17*	*1,16*	*1,72*
3 Buy - sell	**-1,16%**	**0,36%**	**0,60%**	**0,55%**	**0,57%**	**0,03%**
	-1,85	*0,65*	*1,33*	*1,10*	*1,18*	*0,05*
6 Buy	**0,51%**	**1,50%**	**1,84%**	**1,63%**	**1,55%**	**1,31%**
	0,84	*2,45*	*2,66*	*2,40*	*2,25*	*1,71*
6 Sell	**0,59%**	**0,30%**	**1,06%**	**0,72%**	**0,82%**	**1,28%**
	0,97	*0,48*	*1,36*	*0,99*	*1,12*	*1,68*
6 Buy - Sell	**-0,08%**	**1,20%**	**0,79%**	**0,91%**	**0,72%**	**0,04%**
	-0,13	*2,39*	*1,43*	*1,93*	*1,49*	*0,06*
9 Buy	**1,02%**	**1,39%**	**1,88%**	**1,66%**	**1,63%**	**1,28%**
	1,65	*2,34*	*2,69*	*2,38*	*2,32*	*1,63*
9 Sell	**0,76%**	**0,51%**	**0,83%**	**0,92%**	**1,10%**	**1,28%**
	1,19	*0,76*	*1,10*	*1,16*	*1,39*	*1,69*
9 Buy - Sell	**0,26%**	**0,87%**	**1,05%**	**0,75%**	**0,53%**	**0,00%**
	0,42	*1,65*	*1,96*	*1,29*	*0,92*	*0,00*
12 Buy	**1,73%**	**1,90%**	**2,17%**	**1,93%**	**1,70%**	**1,27%**
	3,45	*3,20*	*3,05*	*2,59*	*2,24*	*1,53*
12 Sell	**0,12%**	**0,34%**	**1,23%**	**1,34%**	**1,38%**	**1,39%**
	0,20	*0,49*	*1,47*	*1,53*	*1,61*	*1,77*
12 Buy - Sell	**1,61%**	**1,56%**	**0,94%**	**0,59%**	**0,32%**	**-0,12%**
	3,26	*2,98*	*1,55*	*0,90*	*0,49*	*-0,16*
24 Buy	**1,33%**	**1,27%**	**1,17%**	**1,15%**	**1,07%**	**0,83%**
	3,57	*3,40*	*3,05*	*2,59*	*2,24*	*1,53*
24 Sell	**-0,04%**	**0,25%**	**0,51%**	**0,62%**	**0,76%**	**0,95%**
	0,20	*0,51*	*1,47*	*1,53*	*1,61*	*1,77*
24 Buy - Sell	**1,37%**	**1,02%**	**0,66%**	**0,54%**	**0,31%**	**-0,12%**
	3,43	*3,26*	*1,55*	*0,90*	*0,49*	*-0,16*

Significant Momentum profits
Significant Contrarian profits

Table 4.2.The monthly returns and t-statistics for J1-J24/K1-K24 strategies in the Nordic market. Light grey fields show statistical significance Momentum returns and dark grey fields show statistical significance Contrarian profits (at the 10% level).

Table 4.2 also displays the average return from the MSCI Nordic index and its standard deviation.

The table 4.3 shows only the Nordic J6K1-24 strategies from the table 4.1. The "Buy" portfolios seem to outperform the "sell" portfolios in all cases except the J6K1 strategy. Therefore, the "Buy-Sell" Portfolio show positive returns in the 3-24 months holding periods. However, for the J6K24 strategy the positive return is very small (0,04%) and far from significant. We can conclude that the Momentum Strategies work well during K3-K12 (0,72% to 1,20%) and are significant for the J6K3 and the J6K9 Strategy.

J	K1	K3	K6	K9	K12	K24
6 Buy	**0,51%**	**1,50%**	**1,84%**	**1,63%**	**1,55%**	**1,31%**
	0,84	*2,45*	*2,66*	*2,40*	*2,25*	*1,71*
6 Sell	**0,59%**	**0,30%**	**1,06%**	**0,72%**	**0,82%**	**1,28%**
	0,97	*0,48*	*1,36*	*0,99*	*1,12*	*1,68*
6 Buy - Sell	**-0,08%**	**1,20%**	**0,79%**	**0,91%**	**0,72%**	**0,04%**
	-0,13	*2,39*	*1,43*	*1,93*	*1,49*	*0,06*

Significant Momentum profits

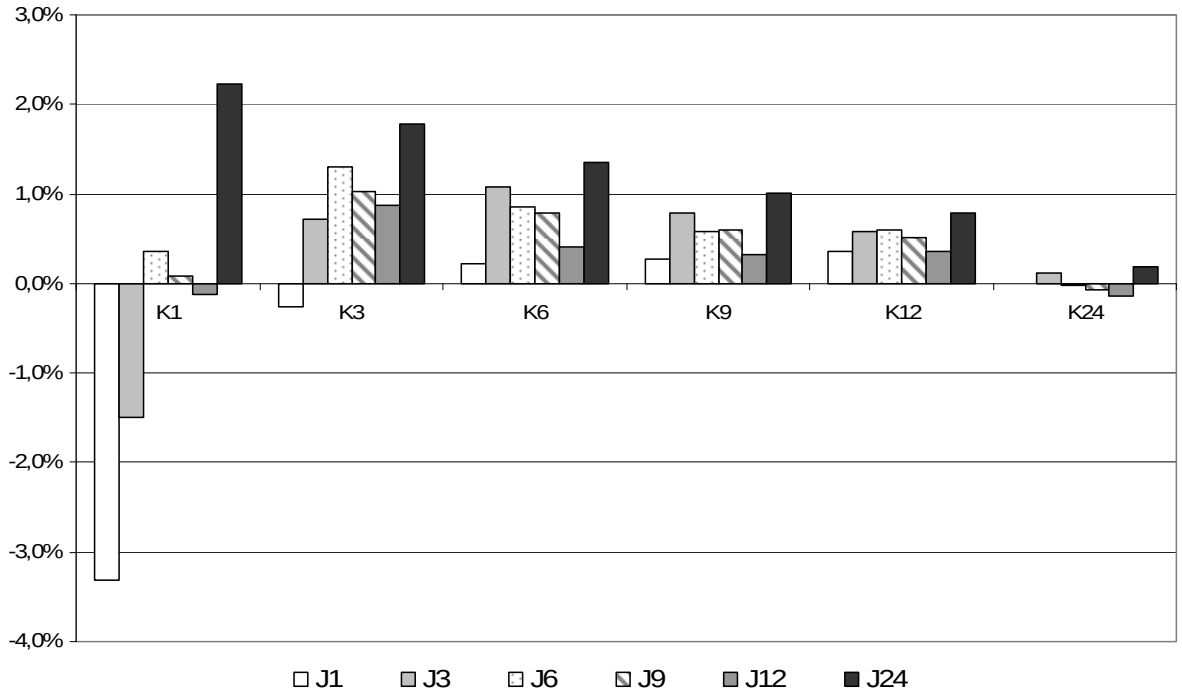
Table 4.3. The monthly returns and t-statistics for J6/K1-K24 strategies in the Nordic market. Light grey fields show statistical significance Momentum returns at the 10% level.

An alternative investment strategy is to only invest in the P10-portfolios and not short sell the P1-portfolio. The strategy could then be compared to a passive "buy-and-hold" strategy in the market index. When looking at table 4.1 above it is clear that the P10-portfolios outperform the market index within the 3-12 months investment horizon. The results show that 14 of the 16 strategies outperform the market within these horizons (J3-12/K3-12). Only the J3/K3 and the J3/K6 strategies show worse performance than the market index. Another interesting finding is that the all the strategies of J1/K1-24 and J24/K1-24 using the P10-portfolio showed to underperformed compared to the market index. Consequently, there seem to be Momentum profits to be made using the P10-portfolio in the medium term horizon but not in the short or longer term horizon.

4.1.2 Differences between the stock markets

The result from the Nordic stock market and the national markets are very similar. All the patterns we could identify in the Nordic market are also prominent at the different national markets, with slight variation and magnitude. In the Swedish market, most of the strategies show positive returns with a 3-12 months investment horizon (K3-K12), which is displayed in graph 4.4. The most prominent Momentum Strategy is the portfolio using the 24 months

forming period (J24). The strategy show positive returns for all investment horizons (K1-K24). Another similarity with the Nordic stock market is that two strategies show positive Contrarian returns, J1K1 and J3K1.



Graph 4.4. Graphical overview of the monthly return from the zero-cost portfolio using Swedish stocks

The findings at the other countries are similar to both the Nordic and the Swedish stock market (see Appendix 2a-2d). In every market most of the strategies show positive returns with investment horizons of 3-12 months. There are also significant positive returns of Contrarian Strategy for all the J1K1 and J3K1 strategies. The only market which is somewhat different from the others is the Finnish market, displayed in Appendix 2b. In this market we found two of the strategies (J1 and J3) which showed positive returns for Contrarian Strategy even for 9 months investment horizon. In addition, we found that the J1-J9 strategies show negative momentum with three months investment horizons. This could not be found at any other market.

The pattern for the Momentum Strategies using only the P10-portfolio in the national markets is similar to the findings in the complete Nordic stock market with some exceptions (see Appendix 2). The Finnish market show quite different results. At the Finnish market none of the P10-portfolios beat the market index. One reasonable explanation may be that the firm Nokia is an extremely large constituent in both the Finnish market and as well as the MSCI Finland. Since the market index is value-weighted, Nokia has a very large impact on the index

performance. Nokia has also performed very well during the complete time period. Consequently, the "weak results" of the P10-portfolios are not that just. It is rather the market index and its performance that is questionable for making good comparisons. However, the MSCI indices were chosen for the consistency of our testing (see discussion in 3.5.2).

Another difference between the Nordic stock market and the national markets is the J24/K3 strategy which beats the market in all national markets excluding Finland. The overall impression from the results is that the patterns in the national markets follow the findings from the complete Nordic stock market to large extent. This is reassuring and we believe that it strengthens our empirical findings.

4.1.3 Comparison with other studies

These results of Momentum concur with previous empirical findings in other markets. Jagadeesh and Titman (1993, 2001), presented in section 2.4.1, also found significant positive returns from Momentum Strategies with 3-12 months holding periods in the US market. Rouwenhorst (1998) found momentum with similar strategies in an international setting using stocks from 12 different European countries. What differentiates our findings from previous studies is the finding of significant positive returns using J24K1 and J24K3 zero-cost portfolio strategies.

We also found that there are Contrarian profits to be made using the J1K1 and J3K1 strategy. This finding is in line with previous research of Contrarian Strategies done by Jegadeesh (1990) and Lehman (1990). These studies found significant positive returns using Contrarian Strategies within short investment horizons (up to a month).

4.1.4 Test of Robustness

Let us return to the Nordic stock market and the J6K1-24 strategy. In order to examine how the strategies work during different periods, we perform a robustness test, where we divide the time period into three subperiods. The subperiods are 1994-1998, 1998-2002 and 2002-2006. All the subperiods begins in Aprils. The returns for the Nordic J6K1-24 (with t-statistics) are presented in table 4.5 below. We also present the MSCI index for comparisons.

Subsamples	**MSCI Nordic**	**1,84%**				
1994-1998	**St dev**	**4,63%**				
J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
6 Buy	**-0,13%**	**1,40%**	**2,08%**	**2,17%**	**2,33%**	**1,91%**
	-0,11	1,66	2,44	2,55	2,87	2,33
6 Sell	**1,30%**	**1,08%**	**1,93%**	**1,52%**	**1,72%**	**2,01%**
	2,2	*1,6*	1,6	1,96	2,11	2,22
6 Buy - Sell	**-1,42%**	***0,32%***	**0,15%**	**0,65%**	**0,61%**	**-0,09%**
	-1,33	0,44	0,15	1,03	1,15	-0,11
	MSCI Nordic	**1,29%**				
1998-2002	**St dev**	**8,56%**				
J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
6 Buy	**-0,56%**	**0,25%**	**0,36%**	**0,06%**	**0,04%**	**1,02%**
	-0,4	0,19	0,26	0,04	0,03	0,77
6 Sell	**-1,91%**	**-1,91%**	**-0,99%**	***-0,99%***	**-0,59%**	**0,50%**
	-1,3	*-1,37*	-0,7	*-0,84*	-0,6	0,86
6 Buy - Sell	**1,35%**	***2,16%***	**1,34%**	**1,05%**	**0,64%**	**0,52%**
	0,92	1,7	1,12	0,95	0,55	0,45
	MSCI Nordic	**0,86%**				
2002-2006	**St dev**	**6,77%**				
J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
6 Buy	**1,76%**	**2,17%**	**2,56%**	**2,25%**	**1,93%**	**0,91%**
	1,87	1,95	1,91	1,8	1,63	0,55
6 Sell	**1,34%**	***0,73%***	**1,25%**	**0,89%**	**0,68%**	**0,84%**
	1,14	*0,61*	0,98	*0,64*	0,47	0,52
6 Buy - Sell	**0,42%**	**1,44%**	**1,32%**	***1,36%***	**1,25%**	**0,08%**
	0,44	1,92	1,74	1,85	1,68	0,07

Significant Momentum profits
Significant Contrarian profits

Table 4.5 shows the Nordic J6K1-24 Sub period average monthly returns and t – statistics. The MSCI Nordic average monthly returns and standard deviations are presented for comparisons.

In the 1994-1998 subperiod we find that the J6K6-K24 winner strategies have outperformed the market. The zero-cost portfolios show positive returns in the 3-12 month time intervals with the highest return for the J6K9 strategy. The zero-cost portfolios returns are rather low and not statistical significant in this period, but this strategy is of course less risk than the long only (P10) alternative.

The 1998-2002 subperiod is slightly different from the other subperiods. During the period, which involves the IT bubble, we find that the P10 portfolio underperformed compared to the MSCI index. The crash of the IT stocks has probably had a large impact on the P10 stocks. The P1-portfolio showed even worse performance than the P10-stocks. This implies that the

zero cost portfolios have been profitable with a maximum return for the J6K3 strategy, 2,16%. This is significant different from zero.

The final subperiod (2002-2006), is characterised by a bull market. The P10-portfolios strongly outperform the MSCI index for all time investment horizons. We also see that the zero cost portfolios generate between 1,25% and 1,44% in the K3 - K12 horizon. These returns are also all significant different from zero.

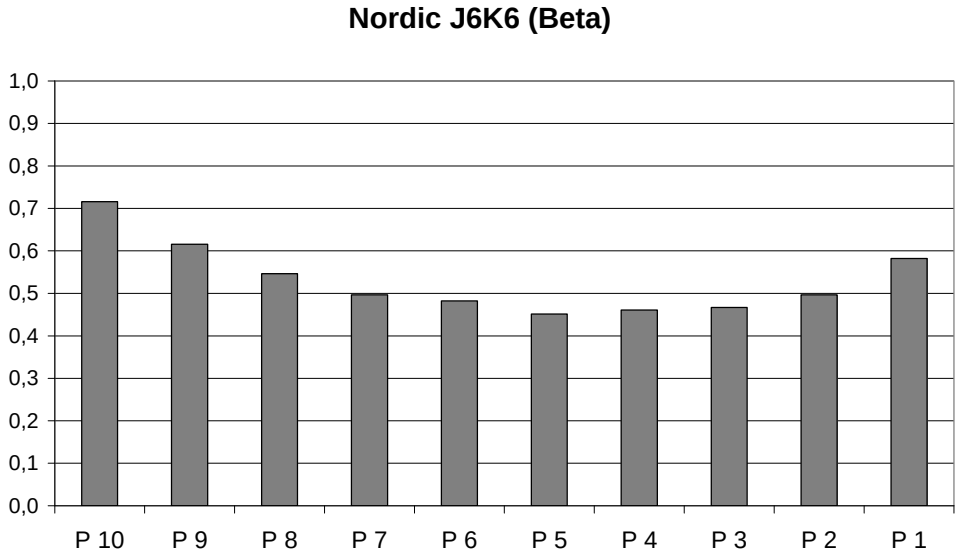
We conclude this section by establish that the 1994-1998 and the 2002-2006 is much in line with the findings for the complete period. The 1998-2002 period show lower results for the P10-portfolio. This is probably due to the fact that many IT and other “glamour stocks” were in this portfolio which subsequent performed very poor. The results for the national markets are in line with the findings from the complete period and are presented in Appendix 4a-d.

4.2 Possible explanations of Momentum

We have examined four factors that might affect the Momentum returns in the stock market. These factors are the CAPM-beta, Size, Volume and Seasonality. Although, these factors have been tested on strategies from every market, we will only present the results from the Nordic J6K6 Strategy. We believe the presentation of the Nordic J6K6 Strategy to be sufficient for displaying differences between the portfolios (P1 to P10) within the different strategies. The CAPM-beta, Size and Volume are formally statistically tested to examine if there are any significant differences between the portfolios. The Seasonality effect are not tested between the portfolios, instead it provide an overview of how Momentum Strategies have performed in different months.

4.2.1 The CAPM Beta

The Graph 4.6 show the ex ante CAPM-betas for the different portfolios using the Nordic J6K6 Strategy. The betas are calculated using 24 months historical returns and the index measured against is the MSCI Nordic index. We chose to calculate the beta with 24 months historical returns, and not longer, to avoid loosing too many observations.



Graph 4.6 The ex ante CAPM-betas for the Nordic J6/K6 strategy

The CAPM-betas in the graph 4.6 show differences between the portfolios. It is difficult to point out one specific portfolio which is significantly different from the others. However, the P10 and P9 portfolios show slightly higher values, 0,72 and 0,62 but also the highest variation. The statistical test confirms that there are significant differences among the portfolios (P=0,00). The difference between the P10 and the P1 portfolios are rather small though. The zero cost beta is only 0,13. One should bear in mind that this strategy has yielded an average annual return of nearly 10% over the sample period. The risk adjusted return is thus very high. This suggests that it is unlikely that market risk can explain Momentum.

All portfolios show beta-values below 1, which might seem strange. This is probably due to a misspecification in the MSCI index. The MSCI Nordic index only includes larger stocks whereas our portfolios include all the listed stocks. We chose the MSCI indices for the Nordic and the other markets because it was impossible to find good indices for all the national markets. However, using the MSCI indices provide a consistency between the markets. The main purpose with this test is to examine the relative differences between the portfolios and not actual values per se.

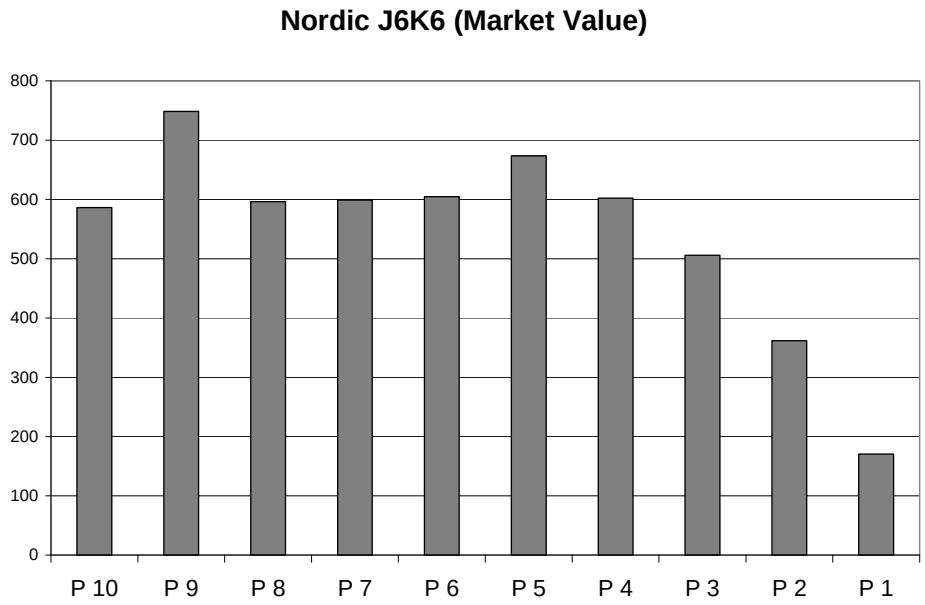
The same methodology as described above is used when calculated the CAPM betas for the submarkets and the results are presented in Appendix 3a. The distributions are slightly U-shaped for all the national markets and are therefore similar to the result from the Nordic market. The zero cost portfolio betas are slightly positive for all national markets where

Norway has the largest value (0,26). The CAPM betas in the national markets (submarkets) are thus very low in relation to the average return. The national markets add value to our study in the way that they check how robust our results are. Since the results in the submarkets are similar to the full sample this strengthens our results. The absolute beta values in the national markets are also smaller than 1 for reasons discussed above.

The CAPM-beta does not seem to explain why Momentum profits occur. Our findings are thus in line with Jagadeesh & Titman (1993) who found a slight negative market risk for their zero cost portfolio (-0,08).

4.2.2 Size

Graph 4.7 below show the average market values of the companies in the different portfolios with the Nordic J6K6 strategy. Since the currencies of the four markets are different, all the values are converted into millions Euro. It should be pointed out that the values are the average individual firm size in the portfolios during the complete 1991 – 2006 period. The value is also calculated using ex ante figures, that is when the portfolios were created.



Graph 4.7 shows the individual firms average market capitalization over the period (1991 – 2006). The figures are in millions €.

The portfolios market values seem reasonably equal, except for the P1 portfolio. One obvious explanation is that companies with poor price performance will lose market value. Testing the difference between the portfolios statistically, we find that there are a significant difference

(p=0,00). Even when allowing differences for both the P1 and P2 portfolios compared to the other, we can not significantly confirm equality between the portfolios.

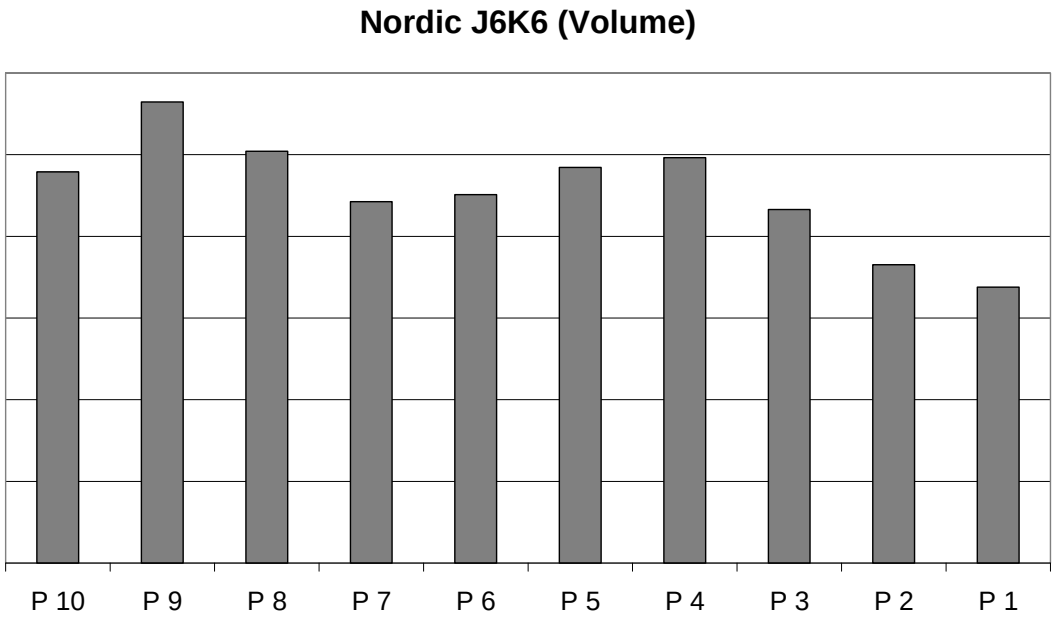
But what implications does this have for the investment strategy when it comes to risk taking? Fama & French (1996) use size and book-to-market in addition to market risk in their three factor asset pricing model. Small companies have generated larger returns historically. The excess return could be due to taking on higher risk that smaller firms face. So if the strategy we examine would generate higher returns because of investing in small firms this could be an indication that the abnormal returns just was compensation for risk. When looking at graph 4.7 we can see that the opposite is truth. The P1-portfolio, created with the past 6 months worst performers are the smallest companies and they generate the worst return in the 6 month holding period. The P10 portfolio contains much larger stocks (with lower risk) and has generated the best performance. This means that size as a risk proxy cannot explain the abnormal Momentum returns.

The same calculations have been made for the different national markets and the graphs are presented in Appendix 3b. In both the Norwegian and the Swedish markets we find that the P10 and P1 include smaller stocks compared with the other portfolios. The P1-portfolio includes smaller stocks than the P10-portfolio though. These results are very similar to Jagadeesh and Titman (1993), see table 2.2 above. In the Danish market, the P10-portfolio includes the largest stocks and the P1-porfolio is including significantly smaller stocks compared to the other portfolios. In the Finnish market the P10-portfolio is also including the larger stocks compared with the other portfolios.

In both the Nordic market and all the submarkets we see that the P10 portfolios contain larger stocks than the P1 portfolio. This suggests that size as a risk factor cannot explain the Momentum profits. This result is in line with Jagadeesh & Titman (1993)

4.2.3 Volume

Graph 4.8 displays the volume factor for the different portfolios using the Nordic J6K6 strategy. The volume factor is the turnover per stock multiplied by the stock prices for the stocks in the different portfolios. Since we use nominal values from different years the absolute values are not important. It is rather the relative differences between the portfolios we are interested in.



Graph 4.8. The relative differences in ex ante Volumes for the Nordic J6K6 strategy.

In the graph the volumes appear to be quite similar for all portfolios except P2 and P1, which are somewhat lower. The statistical test confirms the difference between the portfolios (p=0,02). However, further testing shows that the P1-portfolio causes the difference. If the P1-portfolio are excluded then no significant difference between the portfolios can be shown (p=0,16).

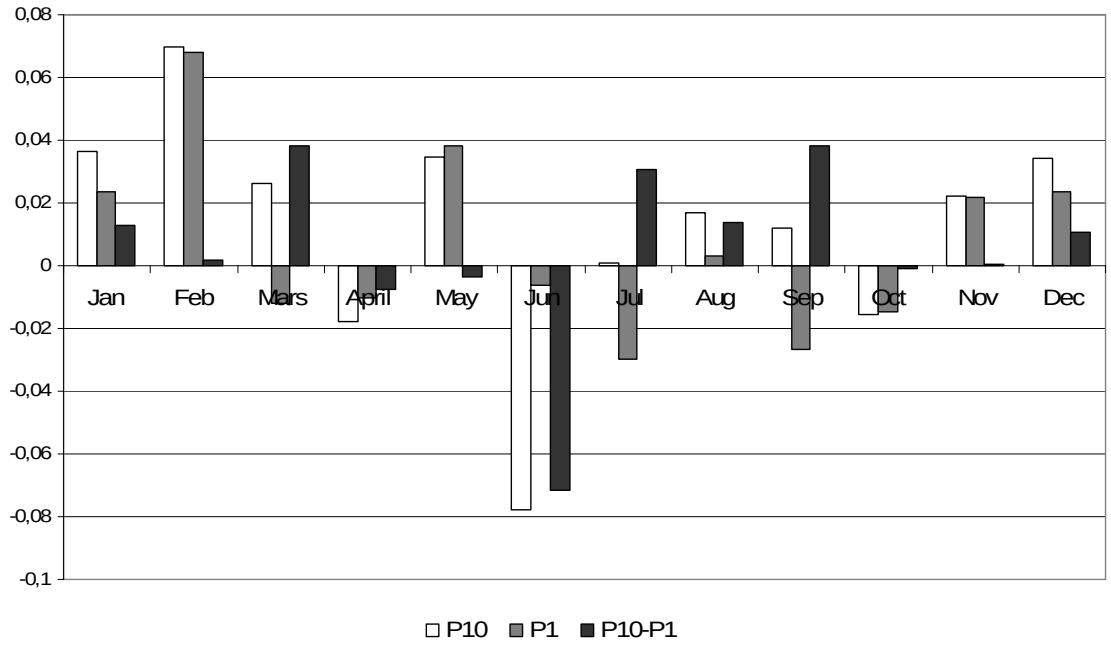
It is rather likely that the P1-portfolio include less traded stocks since it contains less "glamour" stocks. This could lead to practical implications when forming the zero-cost portfolios. If the past worst performing stocks are hard to short sell then the strategy will be difficult to implement. It is also reasonable to assume that price impact will be a more serious issue for these stocks. We believe though, from a volume basis, that the differences are not so large that the zero cost Momentum strategy will be impossible to use.

4.2.4 Seasonal effects

October. This is one of the peculiarly dangerous months to speculate in stocks. The other are July, January, September, April, November, May, March, June, December, August and February.
Mark Twain

Graph 4.9 provides an overview of the returns for the Nordic J6K6 strategy during different months. The graph displays the zero-cost portfolio (P10-P1) as well as both the P10 and P1-

portfolio. The P10 and P1-portfolio provide a sense for which of the portfolios that drives the Momentum effect.



Graph 4.9. The Nordic J6K6 average monthly return in every month of the year.

The positive returns from the zero-cost portfolio are generated during January, Mars, July, August, September and December. During April and June the portfolio generated negative returns. The return for the rest of the months is more or less zero for the portfolio.

Compared with Jagadeesh and Titman (1993), our results are quite different. They found a "January effect" with strong negative return for the zero-cost portfolio in the US market. In addition, during all the other months their J6K6 strategy generated positive returns.

We find no signs of a "January effect" in the "Nordic" stock market. The zero-cost portfolios show a positive return during January. Instead, the P10-portfolio seems to show very large negative returns in June, which strongly affect the zero-cost portfolio. We cannot find any rational explanation for this strong negative return. Other strategies on the Nordic stock market also show a negative return in June, but are much less prominent compared with J6K6 strategy. An explanation could be that this "June effect" is a statistical fluke caused by too few monthly observations.

4.3 Correlations of momentum profits.

In the case of investing in a Nordic stock market it is also important to consider correlation patterns. Generally, low correlations imply risk reduction possibilities due to diversification. High correlations will consequently reduce the benefits of investing in multiple markets. Table 4.10 below shows the correlation matrix of the returns for the zero-cost portfolios (Panel A), the P10-portfolios (panel B), the MSCI indices (Panel C) and the correlations for the national markets zero-cost portfolio versus the local market MSCI index (Panel D). The results are from the J6K6 strategies.

Panel A

Correlation matrix P10-P1	**Sweden**	**Norway**	**Denmark**	**Finland**
Sweden	1			
Norway	0,64	1		
Denmark	0,20	-0,02	1	
Finland	0,14	0,47	-0,02	1

Panel B

Correlation matrix P10	**Sweden**	**Norway**	**Denmark**	**Finland**
Sweden	1			
Norway	0,89	1		
Denmark	0,43	0,31	1	
Finland	0,51	0,71	0,31	1

Panel C

Correlation matrix MSCI indices	**Sweden**	**Norway**	**Denmark**	**Finland**
Sweden	1			
Norway	0,69	1		
Denmark	0,87	0,68	1	
Finland	0,92	0,57	0,68	1

Panel D

Correlations against index local markets	
P10-P1 Sweden vs MSCI Sweden	-0,14
P10-P1 Norway vs MSCI Norway	-0,09
P10-P1 Denmark vs MSCI Denmark	-0,10
P10-P1 Finland vs MSCI Finland	-0,08
P10-P1 Nordic vs MSCI Nordic	-0,11

Table 4.10 shows the correlation matrixes for the individual countries zero cost portfolios (Panel A), the individual countries Winner portfolios Panel(B), the MSCI country indices (Panel C) and the correlations between the country zero cost portfolio and its respective MSCI index (Panel D).

In panel A, the correlations between the different national markets zero-cost portfolios are displayed. The results are inconclusive. There is a very high correlation between the Swedish and Norwegian market and between the Norwegian and the Finnish market. On the other hand, the correlations between the Norwegian and the Finnish markets and the Finnish and

Danish markets are about zero. The results are for some markets different from the findings by Rouwenhorst (1998). Rouwenhorst found a correlation of 0,43 between the European and the US markets. High correlations could be a sign of a common factor driving the momentum profits in all markets. One explanation for this could be that investors underreact and overreact in a similar way across markets. High correlations could be a sign that investors behave in a consistently irrational way since they are all exposed to the same heuristics and biases (see section 2.3). However, it is hard to draw any certain conclusions.

Panel B shows the P10-portfolios correlations between the national markets and panel C shows the correlations for the MSCI indices for comparisons. All P10 portfolios have lower correlations than the respective indices correlations except the Swedish versus Norwegian. In the context of portfolio theory this is interesting since lower correlations means that an investor can optimize the portfolio within the mean-variance space. There seems to be some diversification benefits when momentum investing (long only) in P10 stocks.

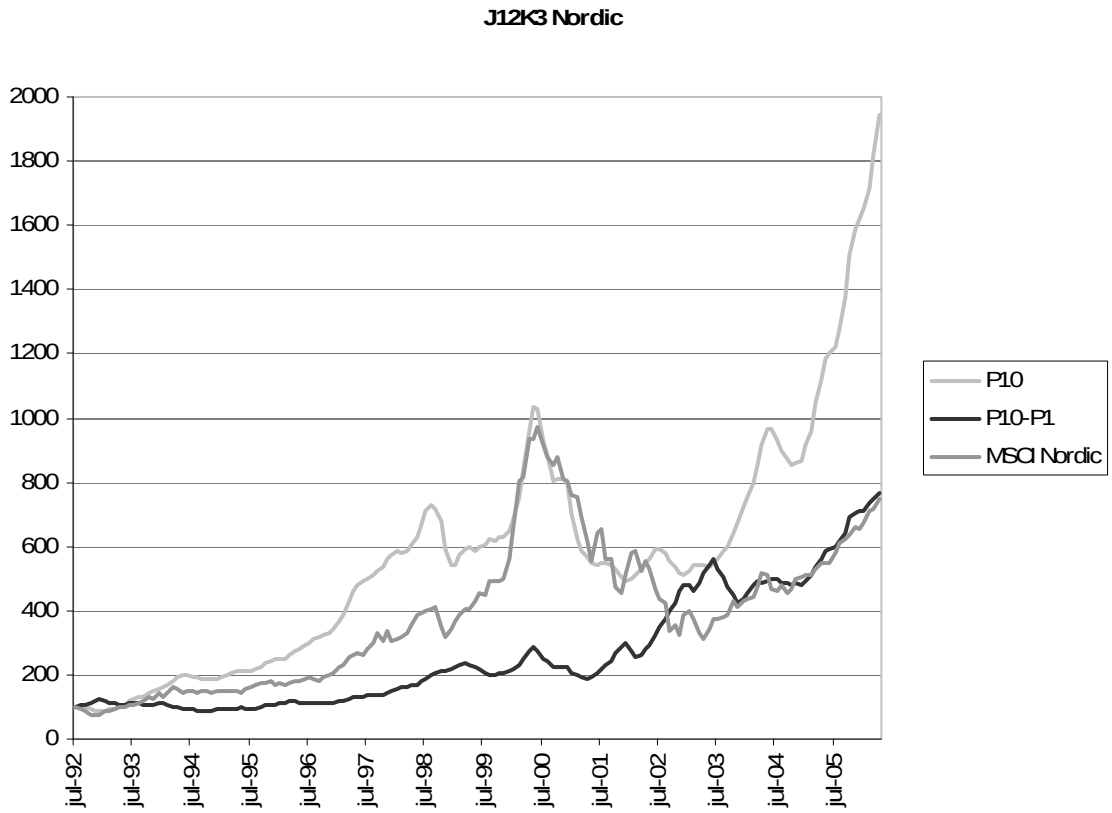
Panel D shows the correlations for the national markets zero-cost portfolios versus their respective market indices. The correlations are slightly negative. Investing in a strategy like this could thus be beneficial for large asset allocators like pensions funds to reduce risk. As can be seen from the table, all national markets show negative correlations that lie within a tight range close to the full sample correlation. This strengthens the results.

4.4 Optimal portfolio strategies

In our analysis so far we have focus much on the Nordic J6K6 strategy to be able to compare our results with earlier studies. We will now elaborate on the most profitable strategies in the Nordic stock market and the different national markets. The table 4.1 and the different national markets (Appendix 2a-d) show that there are some strategies which seems to be more profitable in all markets and sub periods. The J12K1 and the J12K3 strategies generate significant positive returns for most markets and time periods. The only exception is Finland, which do not show any significance in the sub periods. The main reason is that the Finnish market show higher volatility than the other. The t-statistics does not indicate significance even though the monthly returns mostly show a return above 1% per month. The higher volatility is probably due to the fact that the company Nokia is a large constituent in the Finnish market. At the peak of the IT era Nokia represented about 60% of the total market

value of the Finnish stock market. A lot of the movement in the market is thus generated by a single firm which means that the firm specific risk is high.

The J12K1 is in general slightly more profitable than the J12K3 strategy. The J12K1 strategy has a great weakness though. Since the holding period is just one month the portfolio must be rebalanced very often, leading to very high transaction costs. This would lead to 12 roundtrip transactions or 24 for the zero-cost portfolio. Therefore, we have chosen to present the Nordic J12K3 strategy in graph 4.11 below. This strategy has an investment horizon of 3 months which implies that the portfolio has to be rebalanced 4 times per year. The graph displays the P10-portfolio, the zero-cost portfolio and the MSCI Nordic index (for comparisons).



Graph 4.11 The development (before trading costs) of an €100 investment in the Nordic J12K3 P10 (long only) strategy and the "zero cost" P10-P1 strategy. The MSCI Nordic index is also presented for comparisons.

The graph shows the development of an investment of €100 in the Nordic J12K3 strategy. The zero-cost portfolio has been the least volatile and still performed in line with the Nordic market index. It is also interesting to see that the portfolio did not exhibit the large volatility as the market in general under the IT bubble. To invest in the winners (P10) has been very profitable and an €100 investment some 14 years ago would have been worth nearly €2000

today. If we compare the P10 strategy with the passive index investing strategy we see that the P10 strategy has outperformed the market over most of the period. At the peak of the IT bubble and the decline thereafter the strategies followed each other in a similar fashion. The P10 strategy has outperformed the market substantially during the latest 4 years bull market. For a long term long only investor it seems that a momentum strategy like this one will be much more profitable than a passive index investment strategy.

4.5 Additional comments on the empirical results

The findings of significant positive returns from Momentum Strategies imply that the markets are inefficient. According to the Efficient Market Hypothesis, it should be impossible to obtain significant abnormal returns over time using investment strategies based on historical information. Even the weak form of efficiency is not supported with the finding of Momentum. But how can this "anomaly" in the stock market be explained?

4.5.1 Issues when using Momentum Strategies in practice

Using a Momentum Strategy is far from risk free. An investor will still face a lot of the stock market uncertainty, even with a zero-cost portfolio. In addition, past price behavior is never a guarantee for the same behavior in the future. Things might happen and change the situation completely. However, the large positive returns for the Momentum Strategies could not be explained by either CAPM-beta or company size.

Our results indicate that the Momentum Strategy is superior to a passive "buy and hold"-strategy, considering the return and risk of the investment. This argument goes both for the zero-cost portfolio and investment in only the P10-portfolio. However, there are some practical implications using the zero-cost portfolio in the Momentum Strategy which affect the profitability. The strategy involves short selling stocks. In practice, short selling stocks may not be possible. Usually this is limited only to the largest and the most traded stocks. In addition, short selling stocks are more costly than taking long positions. In general the holder of the short position must pay a percentage fee to the lender of the stock. The zero-cost Momentum Strategy also doubles the numbers of transactions for the investor. Consequently, the transaction costs will be larger for these Momentum Strategies compared to the "buy and hold"-strategy.

The profitability of Momentum Strategies is also assumed to be dependent on the number of investors who uses them. If too many investors begin to use these strategies, the Momentum effect will most likely disappear. The Momentum effect will then be considered in valuations and the stocks will be priced accordingly. However, the Jagadeesh & Titman (1993) published their findings 13 years ago and the pattern can still be found in the stock market. In our most recent subsample (2002-2006) we still could confirm significant momentum returns. It seems like the market do not learn from historical price patterns very well.

Considering the practical implications of using a zero-cost Momentum Strategy, it is hard form a solid opinion of whether the strategy is beneficial compared to a "buy and hold" strategy. We can not evaluate the impact of transaction costs or taxes for the individual investor using different investment strategies. Other studies on Momentum which focused on the trading cost issue (see 2.4.2) have reached different conclusions of its effect on the profitability. However, we firmly believe that the P10 (long only) Momentum Strategy is a good strategy to use when investing. Our results and other research have show that these strategies tend to perform better than the market index over time.

4.5.2 Explaining Momentum with behavioural finance

The concept of Homo Economicus, a fictive person which constantly makes rational decisions, is far from a good description of the stock market investor. In our opinion, the investor most likely uses "rules of thumbs" when processing huge amount of information. This will surely cause errors of judgment in some cases. These types of behavior among investors can develop into patterns in the stock prices.

It is rather hard to find rational explanation for Momentum. However, using behavioural models and further empirical testing, the Momentum effect might be explained. A possible behavioural explanation could be that investors *underreact* to new information. The *underreaction* behavior can be caused by a limited ability among most of the investors to access and process information. Another reason for *underreaction* could be *overconfidence*, which leads to investors keeping their original view when facing new information. If the investors initially *underreact* to new information then the price might slowly be adjusted so

that the long-term response is the appropriate rational reaction. The stocks will then have to "catch up" with its true fundamental value. This will cause a momentum effect in the market.

Another behavioural explanation for momentum could be that investors *overreact* to information which is of doubtful relevance for pricing the stock. *Overreaction* can be caused by an unjustified creditability for information about things like "new economy" and its effect on productivity. Another reason for *overreaction* could be that investors copy each others behavior and trades, or tend to buy the stocks that have performed well recently. This type of behavior among investors is usually called Herding. If overreaction develops slowly on information with doubtful relevance then it will cause a momentum effect during a period until the prices reverse to a more appropriate level.

4.5.3 Benefits of using Momentum Strategies or other Quantitative approaches

The advantage of using a quantitative approach, when making investment decisions, is that it can reduce the irrational behavior of the investor. Following a strict investment model makes it easier for the investor to avoid the temptation of acting on emotions which could lead to irrational decisions. As an example, if one of the investors stocks has gone up with 100% in three months, should he/she sell? It sure seems tempting to realize the profit, doesn't it? What if it happens to go up 300% in a year? If the investor is following a strict investment model then the decisions are easy. However, using an investment model does not exclude the investor from using common sense (even if the "common sense" and the model could be contradictory). In practice, one could also incorporate some kind of stop-loss thinking in order to limit the downside risk of investing.

Our methodology and results could also be used by qualitative investors to combine with other strategies. Initially a study like ours could first be performed, then the search for undervalues companies could begin by evaluating the identified winner stocks. Using procedures like this might lead to more complex investment strategies and, perhaps, the strategies could become more profitable.

How can a rather simple quantitative investment strategy, using the Momentum effect, outperform the market when most of the large Investment Management firms' can not? These

Investment firms together employ numerous stock analysts who work very hard and long hours to increase their performance. A possible explanation could be that stock analysts and traditional fund managers consistently and repeatedly do errors (as discussed above) leading to under and overreactions in the market. These irrational behaviors can be exploited by quantitative Momentum strategies due to the relatively smaller group of investors which make use of these techniques. The most common way of investing relies on research of fundamentals for each stock. In comparison, using a more quantitative approach do not involve going into detail of specific companies. These strategies rather use a general overview of the market which provides insight in its behavior. The Momentum Strategy can beat the market, and continue to do so, because it identifies and exploits recurring irrationalities among the traditional qualitative investors.

5 Conclusion

Doubt is not a pleasant condition, but certainty is absurd.
Voltaire

5.1 Summary of our findings

The main purpose of this study was to evaluate the profitability of Momentum Strategies on the Nordic stock markets. The study included testing several Momentum Strategies based on different periods of historical return and different investment horizons during 1991-2006. The profitability of the strategies was also examined for different markets (Danish, Finnish, Norwegian, Swedish and "Nordic") and during different sub periods (1994-1998, 1998-2002 and 2002-2006). The secondary purpose of the thesis was to examine factors which could cause or impact the profitability of Momentum Strategies. We examine and evaluated the effects of CAPM-beta, Size-effect, trade volume and Seasonality for the profitability of the strategies.

Our findings contribute to the research field of Momentum in a number of ways. We have performed an empirical study using the same methodology as Jegadeesh and Titman (1993) but in a new and different setting the – Nordic stock markets. To our knowledge, this has not been done before. We have also extended the number of tested strategies to examine if Momentum could be found with both longer and shorter investment horizons. Previous studies have shown momentum effects in the 3-12 months investment horizons. By testing additional strategies with 1 and 24 month investment horizons we can examine whether Momentum is restricted to this 3-12 months interval.

Our results show Momentum profits to be made in all the Nordic stock markets with 3-12 months investment horizon. The zero-cost portfolios generate approximately 1% return monthly and the P10-portfolios (including past top performing stocks) consistently beat the market indices on average. However, strategies with shorter investment horizons (1 month) generate significant negative momentum profits. A more suitable strategy, in this case, would therefore be a Contrarian Strategy, diametrically different from the Momentum Strategy. Other strategies, with 24 months investment horizon show no Momentum profits due to similar returns for the P10 and P1-portfolio. Another interesting finding, compared to other research, is the possibility to generate significant Momentum profits using strategies based on

24 months historical returns with 1-3 months investment horizon. The zero-cost portfolio for the J24K Nordic strategy show a monthly return of 1,37%. The same strategy on the Swedish market show even higher monthly return, 2,23%.

We examined four factors and their effect on the Momentum profits for the J6K6 Strategy on the Nordic market. The CAPM-beta showed to be slightly higher for P10 and P1-portfolios. These portfolios are therefore a bit more risky compared with the other portfolios. However, the zero-cost portfolios betas were only slightly positive, yet they generated substantial returns. We do not believe that the higher risk could completely explain the Momentum returns. The CAPM-beta showed to be inconclusive in explaining the Momentum effect.

The firm size of the different portfolios for the Nordic J6K6 Strategy showed to be fairly equal among the portfolios except for the P1-portfolio, which seemed to include many smaller stocks. This could have been an issue since smaller firms have generated larger returns at a higher risk. If the P10-portfolio had contained smaller stocks this could have been an indication that the Momentum returns just were compensation for risk (the small firm effect). However, we saw that the opposite were the truth. This means that risk measured as firm size could not explain the Momentum effect.

The trade volumes for the different portfolios for the Nordic J6K6 Strategy were fairly equal except for the P1-portfolio. The obvious reason for P1-portfolio to be different is probably due to fewer “glamour” stocks. Lower trade volume might have impact on the zero-cost portfolio since these stocks can be difficult to short sell.

The zero-cost strategy yield significantly different results during different months. The strategy generate positive returns during January, Mars, July, August, September and December but strong negative returns in June. We are somewhat puzzled by the results of the poor performance in June and can not find any reasonable explanation for it. Our results are quite different from the findings of Jagadeesh and Titman (1993) which found strong negative returns in January while all the of the months show positive returns.

We are unsure of how the Momentum Strategy would work in practice. In our study we have allowed the possibility of short selling all the listed stocks. However, this is not possible in practice, where short selling is limited to the most large and frequently traded stocks.

Furthermore, the study has also excluded the effects of taxes and transaction costs. The transaction costs would probably have the most negative impact on the zero-cost portfolio since it involves both buying and short selling stocks.

It is rather hard to find a rational explanation why Momentum occurs in the stock market. A few potential explanations could be found by considering irrational behavior among the investors. The stock analysts and the fund managers may consistently make errors while processing huge amount of data or their judgment can be effected by emotions which lead to irrational investment decisions. Tendencies among the investors to underreact to new information or overreacting to information with doubtful relevance could potentially cause Momentum effects in the market. However, to test or confirm these explanations are very difficult and we leave this to future researchers to investigate.

A benefit of using a Momentum Strategy or any other quantitative investment approach is that the irrational behavior of the investor can be reduced. With a strict investment model it is easier to avoid the temptation of acting on emotion instead of rational decision making.

The identification of Momentum profits provides strong evidence of inefficiency in the Nordic stock markets. The Momentum Strategy, which includes using historical information, would not be profitable if the market were efficient. Therefore, our findings do not support the Efficient Market Hypothesis, even with its weakest form of market efficiency.

5.2 Suggestions for further research

While performing this study, we have thought of several ways to increase the knowledge in this field. In our study we assume that all listed stocks could be sold short, which is in practice not possible. Therefore, it would be interesting to perform a similar study as ours but only including stocks which easily can be short sold. Another interesting topic would be to examine Momentum on other markets, preferably emerging markets which can be assumed to be less efficient. Other time period could also be considered. Another aspect is to see whether other assets than stocks show similar behavior. Our study could easily be replicated by testing commodity prices, bond prices or currencies. Interesting would also be to examine and test other explanations of Momentum or other ways to increase profitability of these strategies. Finally, it could also be interesting to perform a qualitative study on how Momentum

Strategies are used in practice by fund managers. There is currently at least one fund which officially uses Momentum Strategies and a few more if you include the Contrarian Strategies.

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Morgan Stanley Capital International (24 May 2006) www.MSCI.com

OMX AB (31 May 2006) *The Nordic list* ,OMX publication, http://domino.omgroup.com/www/WebTransaction.nsf/attachments/omxlist/$file/The_Nordic_list_march06.pdf

Oslo Stock Exchange (24 May 2006) www.oslobors.no

Stockholm Stock Exchange (25 May 2006) www.se.omxgroup.com

Brainy Quotes (24 May 2006), www.brainyqoutes.com

Appendix 0 Important concepts and abbreviations

Explanations of the most important concepts and abbreviations used frequently in the thesis are listed below. There will be explanations in the text but the list can be used for easy access when reading the text.

Contrarian

Effect of reversion in a stock price. If a stock has moved in a certain direction (up or down) in period A, then it will move in the opposite direction in period B. The effect it the diametrically opposite to Momentum effect.

Momentum

Effect of continuation in a stock price. If a stock has moved in a certain direction (up or down) in period A, then it will continue to do so in period B.

Momentum Strategy

Investment strategy which exploit the effect of Momentum.

The P10, Buy or Winner portfolio

Refers to the portfolio containing the past top performing stocks.

The P1, Sell or Loser portfolio

Refers to the portfolio containing the past worst performing stocks.

The zero-cost portfolio or P10-P1

Refers to the portfolio with a long position in the P10-portfolio and a short position in the P1-portfolio. It is “zero-cost” since the cash outflow from buying P10 will be offset by the cash inflows from short selling P1.

The J/K strategy

The “J” represents the period which is used to rank the returns stocks and the “K” represents the investment horizon. Consequently, the J6/K3 strategy means that the portfolios are based on the past 6 months return and the investment horizon are 3 months.

Appendix 1a: Summary of trading strategies using *Nordic stocks*

The tables below present the monthly returns from the 36 different trading strategies using Nordic stocks. Each column represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). The table rows represent the ten different portfolios, from P10 (contains the best performing stocks over the J-period) to P1 (contains the worst performing stocks over the J-period). The returns from the zero-cost portfolio (P10-P1) can be found in the bottom row in each table.

	J1K1	J1K3	J1K6	J1K9	J1K12	J1K24
P10	-0,92%	0,43%	1,12%	1,11%	1,18%	1,18%
P9	0,98%	1,16%	1,36%	1,32%	1,20%	1,19%
P8	1,42%	1,15%	1,34%	1,25%	1,27%	1,20%
P7	1,22%	1,50%	1,33%	1,16%	1,17%	1,03%
P6	1,05%	1,20%	1,28%	1,13%	1,10%	1,09%
P5	1,60%	1,20%	1,31%	1,13%	1,06%	1,11%
P4	0,78%	0,92%	1,07%	1,15%	1,01%	1,11%
P3	1,23%	1,10%	1,13%	1,09%	0,99%	1,14%
P2	1,21%	0,93%	1,10%	0,93%	0,93%	1,13%
P1	1,82%	0,65%	0,98%	0,90%	0,80%	1,17%
P10-P1	-2,74%	-0,22%	0,14%	0,21%	0,38%	0,01%

	J3K1	J3K3	J3K6	J3K9	J3K12	J3K24
P10	-0,16%	1,13%	1,07%	1,39%	1,44%	1,27%
P9	1,27%	1,41%	1,19%	1,34%	1,35%	1,22%
P8	1,07%	1,29%	1,12%	1,21%	1,21%	1,18%
P7	0,66%	1,13%	1,02%	1,11%	1,15%	1,16%
P6	1,15%	1,24%	1,19%	1,11%	1,14%	1,10%
P5	0,94%	1,07%	1,05%	1,06%	1,06%	1,09%
P4	0,87%	1,04%	1,03%	0,99%	1,01%	1,04%
P3	0,75%	0,78%	0,68%	0,85%	0,86%	1,09%
P2	0,86%	0,63%	0,60%	0,82%	0,86%	1,12%
P1	1,00%	0,77%	0,47%	0,85%	0,87%	1,24%
P10-P1	-1,16%	0,36%	0,60%	0,55%	0,57%	0,03%

	J6K1	J6K3	J6K6	J6K9	J6K12	J6K24
P10	0,51%	1,50%	1,84%	1,63%	1,55%	1,31%
P9	1,29%	1,26%	1,43%	1,46%	1,37%	1,20%
P8	0,97%	1,15%	1,24%	1,21%	1,11%	1,08%
P7	1,06%	1,13%	1,22%	1,19%	1,16%	1,12%
P6	0,89%	1,12%	1,13%	1,12%	1,10%	1,12%
P5	0,89%	1,11%	1,03%	1,01%	1,03%	1,10%
P4	0,84%	0,85%	0,92%	0,92%	0,95%	1,08%
P3	0,80%	0,71%	0,90%	0,84%	0,88%	1,13%
P2	0,18%	0,56%	0,88%	0,77%	0,88%	1,13%
P1	0,59%	0,30%	1,06%	0,72%	0,82%	1,28%
P10-P1	-0,08%	1,20%	0,79%	0,91%	0,72%	0,04%

	J9K1	J9K3	J9K6	J9K9	J9K12	J9K24
P10	1,02%	1,39%	1,88%	1,66%	1,63%	1,28%
P9	1,55%	1,42%	1,58%	1,48%	1,37%	1,12%
P8	1,27%	1,16%	1,36%	1,28%	1,20%	1,05%
P7	0,89%	1,02%	1,23%	1,17%	1,14%	1,12%
P6	1,22%	1,11%	1,19%	1,17%	1,17%	1,06%
P5	1,01%	1,01%	1,13%	1,14%	1,16%	1,06%
P4	0,90%	0,81%	1,02%	1,02%	1,05%	1,07%
P3	0,90%	0,61%	0,87%	0,92%	0,99%	1,11%
P2	0,85%	0,63%	0,93%	0,96%	1,00%	1,16%
P1	0,76%	0,51%	0,83%	0,92%	1,10%	1,28%
P10-P1	0,26%	0,87%	1,05%	0,75%	0,53%	0,00%

	J12K1	J12K3	J12K6	J12K9	J12K12	J12K24
P10	1,73%	1,90%	2,17%	1,93%	1,70%	1,27%
P9	1,18%	1,44%	1,59%	1,51%	1,37%	1,10%
P8	1,21%	1,36%	1,42%	1,35%	1,21%	1,06%
P7	0,97%	1,17%	1,36%	1,34%	1,28%	1,08%
P6	1,01%	1,08%	1,21%	1,24%	1,19%	1,07%
P5	0,79%	1,00%	1,23%	1,26%	1,22%	1,07%
P4	0,69%	0,91%	1,21%	1,20%	1,14%	1,08%
P3	0,50%	0,63%	1,08%	1,20%	1,24%	1,16%
P2	0,34%	0,58%	1,22%	1,29%	1,26%	1,26%
P1	0,12%	0,34%	1,23%	1,34%	1,38%	1,39%
P10-P1	1,61%	1,56%	0,94%	0,59%	0,32%	-0,12%

	J24K1	J24K3	J24K6	J24K9	J24K12	J24K24
P10	1,33%	1,27%	1,17%	1,15%	1,07%	0,83%
P9	1,13%	1,11%	1,13%	1,10%	1,04%	0,84%
P8	1,00%	1,03%	1,03%	1,06%	1,02%	0,90%
P7	1,11%	1,14%	1,11%	1,01%	0,97%	0,87%
P6	1,07%	1,09%	1,05%	1,02%	0,94%	0,87%
P5	1,19%	1,14%	1,13%	1,06%	1,00%	0,86%
P4	0,93%	0,94%	1,01%	0,97%	0,95%	0,85%
P3	0,94%	0,76%	0,72%	0,82%	0,87%	0,86%
P2	0,41%	0,67%	0,69%	0,76%	0,78%	0,82%
P1	-0,04%	0,25%	0,51%	0,62%	0,76%	0,95%
P10-P1	1,37%	1,02%	0,66%	0,54%	0,31%	-0,12%

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 1b: Summary of trading strategies using *Danish stocks*

The tables below present the monthly returns from the 36 different trading strategies using Danish stocks. Each column represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). The table rows represent the ten different portfolios, from P10 (contains the best performing stocks over the J-period) to P1 (contains the worst performing stocks over the J-period). The returns from the zero-cost portfolio (P10-P1) can be found in the bottom row in each table.

	J1K1	J1K3	J1K6	J1K9	J1K12	J1K24
P10	0,11%	0,48%	0,63%	0,69%	0,75%	0,75%
P9	1,09%	0,99%	1,05%	1,02%	1,03%	0,94%
P8	0,58%	0,89%	0,89%	0,96%	0,95%	0,85%
P7	0,71%	0,94%	0,82%	0,90%	0,86%	0,87%
P6	0,43%	0,74%	0,64%	0,67%	0,73%	0,87%
P5	0,39%	0,51%	0,41%	0,51%	0,53%	0,70%
P4	0,38%	0,68%	0,42%	0,52%	0,57%	0,65%
P3	0,30%	0,33%	0,41%	0,44%	0,50%	0,72%
P2	0,84%	0,66%	0,68%	0,57%	0,57%	0,77%
P1	1,15%	0,61%	0,30%	0,46%	0,50%	0,75%
P10-P1	-1,05%	-0,13%	0,33%	0,23%	0,25%	-0,01%

	J3K1	J3K3	J3K6	J3K9	J3K12	J3K24
P10	0,62%	0,99%	1,02%	1,05%	1,06%	0,92%
P9	0,69%	1,08%	1,07%	1,05%	1,08%	0,90%
P8	0,81%	0,84%	1,01%	1,06%	1,13%	1,02%
P7	0,76%	1,05%	0,95%	0,98%	1,01%	1,03%
P6	0,31%	0,68%	0,81%	0,89%	0,92%	1,02%
P5	0,64%	0,68%	0,78%	0,76%	0,81%	0,88%
P4	0,49%	0,72%	0,76%	0,73%	0,74%	0,85%
P3	0,32%	0,46%	0,43%	0,49%	0,60%	0,73%
P2	0,34%	0,40%	0,43%	0,55%	0,60%	0,71%
P1	0,63%	0,30%	0,20%	0,27%	0,37%	0,75%
P10-P1	-0,01%	0,69%	0,82%	0,78%	0,69%	0,17%

	J6K1	J6K3	J6K6	J6K9	J6K12	J6K24
P10	1,05%	1,29%	1,24%	1,25%	1,13%	1,00%
P9	1,30%	1,31%	1,27%	1,26%	1,18%	0,94%
P8	1,03%	1,22%	1,22%	1,19%	1,21%	1,03%
P7	0,94%	1,02%	1,06%	1,09%	1,12%	1,03%
P6	0,68%	0,84%	0,70%	0,85%	0,93%	0,96%
P5	0,50%	0,76%	0,67%	0,74%	0,80%	0,80%
P4	0,51%	0,57%	0,68%	0,70%	0,74%	0,81%
P3	0,34%	0,55%	0,50%	0,62%	0,66%	0,75%
P2	0,42%	0,17%	0,48%	0,57%	0,59%	0,70%
P1	0,11%	0,10%	0,13%	0,25%	0,43%	0,83%
P10-P1	0,94%	1,19%	1,10%	1,00%	0,69%	0,17%

	J9K1	J9K3	J9K6	J9K9	J9K12	J9K24
P10	1,30%	1,37%	1,35%	1,31%	1,22%	1,02%
P9	1,08%	1,26%	1,26%	1,14%	1,06%	0,91%
P8	0,97%	1,18%	1,22%	1,21%	1,18%	1,05%
P7	0,95%	1,06%	1,17%	1,18%	1,25%	1,09%
P6	0,81%	0,88%	0,91%	1,00%	1,08%	0,98%
P5	0,75%	0,62%	0,71%	0,81%	0,88%	0,91%
P4	0,44%	0,67%	0,73%	0,81%	0,86%	0,77%
P3	0,49%	0,38%	0,51%	0,60%	0,72%	0,83%
P2	0,22%	0,29%	0,52%	0,60%	0,67%	0,75%
P1	0,14%	0,13%	0,11%	0,35%	0,59%	0,91%
P10-P1	1,17%	1,25%	1,24%	0,96%	0,63%	0,11%

	J12K1	J12K3	J12K6	J12K9	J12K12	J12K24
P10	1,43%	1,61%	1,42%	1,36%	1,23%	1,35%
P9	1,24%	1,30%	1,25%	1,25%	1,15%	1,12%
P8	1,20%	1,30%	1,31%	1,27%	1,25%	1,15%
P7	1,19%	1,20%	1,19%	1,23%	1,22%	1,22%
P6	0,78%	0,91%	1,00%	1,03%	1,11%	1,30%
P5	0,52%	0,72%	0,76%	0,93%	0,95%	1,11%
P4	0,73%	0,57%	0,71%	0,87%	0,85%	0,96%
P3	0,44%	0,44%	0,66%	0,77%	0,81%	0,93%
P2	0,38%	0,49%	0,58%	0,62%	0,73%	0,99%
P1	-0,26%	-0,08%	0,16%	0,54%	0,72%	1,27%
P10-P1	1,69%	1,70%	1,25%	0,82%	0,51%	0,08%

	J24K1	J24K3	J24K6	J24K9	J24K12	J24K24
P10	1,21%	1,13%	1,06%	0,98%	0,94%	0,77%
P9	0,94%	1,08%	1,08%	1,13%	1,05%	0,93%
P8	1,42%	1,28%	1,22%	1,25%	1,24%	0,97%
P7	1,10%	1,15%	1,18%	1,26%	1,20%	1,07%
P6	1,05%	1,25%	1,28%	1,21%	1,17%	0,99%
P5	1,11%	1,00%	1,10%	1,07%	1,02%	0,93%
P4	0,76%	0,97%	0,79%	0,83%	0,86%	0,84%
P3	0,74%	0,68%	0,62%	0,68%	0,69%	0,76%
P2	0,39%	0,66%	0,74%	0,80%	0,75%	0,70%
P1	0,19%	0,23%	0,24%	0,38%	0,57%	0,77%
P10-P1	1,02%	0,90%	0,82%	0,61%	0,36%	0,00%

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 1c: Summary of trading strategies using *Finish stocks*

The tables below present the monthly returns from the 36 different trading strategies using Finnish stocks. Each column represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). The table rows represent the ten different portfolios, from P10 (contains the best performing stocks over the J-period) to P1 (contains the worst performing stocks over the J-period). The returns from the zero-cost portfolio (P10-P1) can be found in the bottom row in each table.

	J1K1	J1K3	J1K6	J1K9	J1K12	J1K24
P10	-3,01%	-0,45%	0,60%	1,02%	1,42%	1,22%
P9	-1,87%	0,19%	0,85%	1,15%	1,25%	1,22%
P8	-1,08%	0,81%	1,02%	1,06%	1,20%	1,18%
P7	-1,16%	0,63%	1,14%	1,10%	1,09%	1,18%
P6	0,24%	0,99%	1,17%	1,21%	1,18%	1,19%
P5	1,00%	1,27%	1,34%	1,29%	1,20%	1,15%
P4	1,14%	1,11%	1,24%	1,22%	1,23%	1,17%
P3	1,16%	1,00%	1,05%	1,12%	1,19%	1,18%
P2	1,25%	0,79%	1,22%	1,37%	1,32%	1,37%
P1	1,37%	0,90%	1,06%	1,09%	1,01%	1,22%
P10-P1	-4,38%	-1,35%	-0,45%	-0,07%	0,41%	-0,01%

	J3K1	J3K3	J3K6	J3K9	J3K12	J3K24
P10	-1,38%	0,30%	0,87%	1,15%	1,40%	1,18%
P9	-0,31%	0,36%	0,83%	1,09%	1,37%	1,26%
P8	-0,14%	0,71%	1,12%	1,18%	1,38%	1,30%
P7	0,64%	1,02%	1,35%	1,14%	1,33%	1,19%
P6	-0,03%	1,55%	1,57%	1,33%	1,33%	1,35%
P5	0,58%	1,34%	1,37%	1,42%	1,42%	1,34%
P4	1,12%	1,23%	1,41%	1,36%	1,30%	1,35%
P3	0,91%	1,26%	1,33%	1,36%	1,13%	1,33%
P2	0,93%	0,95%	1,32%	1,48%	1,15%	1,19%
P1	1,19%	1,07%	0,94%	1,45%	0,98%	1,20%
P10-P1	-2,57%	-0,77%	-0,07%	-0,30%	0,42%	-0,02%

	J6K1	J6K3	J6K6	J6K9	J6K12	J6K24
P10	-1,62%	0,80%	1,07%	1,47%	1,58%	1,31%
P9	-1,33%	0,89%	1,12%	1,39%	1,50%	1,18%
P8	-0,93%	0,90%	1,07%	1,24%	1,34%	1,12%
P7	-0,11%	1,32%	1,18%	1,34%	1,46%	1,27%
P6	1,04%	1,36%	1,27%	1,42%	1,37%	1,34%
P5	1,46%	1,70%	1,52%	1,57%	1,38%	1,34%
P4	1,07%	1,52%	1,31%	1,40%	1,43%	1,29%
P3	0,76%	1,38%	1,47%	1,37%	1,27%	1,32%
P2	0,93%	1,28%	1,13%	1,23%	1,09%	1,28%
P1	0,74%	1,02%	0,86%	0,89%	0,88%	1,18%
P10-P1	-2,36%	-0,22%	0,21%	0,57%	0,70%	0,13%

	J9K1	J9K3	J9K6	J9K9	J9K12	J9K24
P10	-1,69%	0,73%	1,28%	1,46%	1,60%	1,25%
P9	-0,70%	0,71%	1,31%	1,35%	1,48%	1,11%
P8	-0,13%	1,10%	1,44%	1,53%	1,54%	1,13%
P7	0,33%	1,10%	1,26%	1,31%	1,35%	1,24%
P6	0,59%	1,09%	1,36%	1,49%	1,56%	1,26%
P5	1,02%	1,25%	1,56%	1,69%	1,46%	1,32%
P4	0,77%	1,10%	1,33%	1,30%	1,33%	1,25%
P3	0,66%	1,06%	1,24%	1,45%	1,44%	1,31%
P2	0,63%	1,17%	1,20%	1,34%	1,20%	1,19%
P1	0,71%	1,24%	0,51%	0,92%	0,92%	1,28%
P10-P1	-2,41%	-0,51%	0,77%	0,54%	0,68%	-0,03%

	J12K1	J12K3	J12K6	J12K9	J12K12	J12K24
P10	0,86%	1,64%	1,51%	1,54%	1,49%	1,12%
P9	0,20%	1,33%	1,51%	1,50%	1,46%	1,09%
P8	0,84%	1,53%	1,55%	1,49%	1,32%	1,08%
P7	0,63%	1,37%	1,39%	1,47%	1,31%	1,11%
P6	0,51%	1,05%	1,38%	1,39%	1,33%	1,19%
P5	-0,04%	1,22%	1,42%	1,49%	1,49%	1,15%
P4	0,88%	1,09%	1,39%	1,46%	1,50%	1,20%
P3	0,13%	1,01%	1,32%	1,54%	1,37%	1,21%
P2	-0,34%	0,80%	1,06%	1,21%	1,28%	1,22%
P1	-0,59%	0,58%	0,83%	1,11%	1,19%	1,31%
P10-P1	1,45%	1,06%	0,68%	0,44%	0,30%	-0,19%

	J24K1	J24K3	J24K6	J24K9	J24K12	J24K24
P10	0,91%	1,03%	1,12%	1,25%	1,06%	0,91%
P9	1,10%	0,87%	1,17%	1,03%	1,06%	0,81%
P8	1,31%	0,94%	1,10%	1,03%	0,93%	0,83%
P7	0,86%	0,96%	1,25%	1,17%	1,02%	0,93%
P6	1,32%	1,09%	1,15%	1,05%	1,01%	0,90%
P5	1,35%	1,09%	1,11%	1,20%	1,07%	0,83%
P4	1,23%	0,78%	1,10%	1,30%	1,19%	0,98%
P3	1,20%	0,68%	1,01%	1,14%	1,10%	1,16%
P2	1,04%	0,61%	0,94%	0,93%	0,99%	1,05%
P1	1,17%	0,70%	0,97%	0,95%	0,97%	1,01%
P10-P1	-0,27%	0,32%	0,16%	0,31%	0,09%	-0,10%

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 1d: Summary of trading strategies using *Norwegian stocks*

The tables below present the monthly returns from the 36 different trading strategies using Norwegian stocks. Each column represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). The table rows represent the ten different portfolios, from P10 (contains the best performing stocks over the J-period) to P1 (contains the worst performing stocks over the J-period). The returns from the zero-cost portfolio (P10-P1) can be found in the bottom row in each table.

	J1K1	J1K3	J1K6	J1K9	J1K12	J1K24
P10	0,14%	1,04%	1,14%	1,39%	1,33%	1,30%
P9	0,21%	0,72%	0,94%	1,25%	1,35%	1,27%
P8	0,36%	0,70%	0,95%	1,17%	1,15%	1,25%
P7	0,71%	1,14%	1,16%	1,21%	1,24%	1,13%
P6	1,15%	1,01%	0,97%	0,98%	1,13%	1,22%
P5	1,37%	0,93%	0,90%	1,07%	1,03%	1,05%
P4	1,02%	1,09%	1,07%	1,08%	1,02%	1,15%
P3	1,07%	1,16%	1,00%	1,06%	1,01%	1,15%
P2	1,04%	0,73%	0,95%	0,87%	1,00%	1,23%
P1	0,67%	0,30%	0,54%	0,79%	0,98%	1,30%
P10-P1	-0,54%	0,74%	0,59%	0,59%	0,35%	0,00%

	J3K1	J3K3	J3K6	J3K9	J3K12	J3K24
P10	1,43%	1,41%	1,52%	1,73%	1,57%	1,34%
P9	1,24%	1,04%	1,02%	1,16%	1,28%	1,22%
P8	0,73%	0,91%	0,98%	0,95%	1,06%	1,14%
P7	0,45%	0,83%	1,10%	1,10%	1,20%	1,20%
P6	0,75%	0,99%	0,98%	1,05%	1,08%	1,06%
P5	1,09%	0,98%	1,00%	1,08%	1,03%	1,12%
P4	0,75%	0,90%	0,97%	0,98%	1,09%	1,17%
P3	0,63%	0,62%	0,80%	0,87%	0,90%	1,16%
P2	0,45%	0,58%	0,67%	0,97%	1,02%	1,14%
P1	0,38%	0,17%	0,61%	0,81%	1,00%	1,33%
P10-P1	1,05%	1,24%	0,91%	0,92%	0,56%	0,01%

	J6K1	J6K3	J6K6	J6K9	J6K12	J6K24
P10	1,63%	1,92%	1,99%	1,99%	1,91%	1,45%
P9	1,09%	0,96%	1,19%	1,30%	1,29%	1,09%
P8	0,44%	0,74%	0,95%	1,06%	1,11%	1,07%
P7	0,93%	1,03%	0,98%	1,04%	1,14%	1,13%
P6	0,87%	1,00%	1,10%	1,08%	1,06%	1,07%
P5	1,14%	1,14%	1,06%	1,06%	1,11%	1,13%
P4	1,06%	1,15%	0,92%	0,97%	1,06%	1,25%
P3	0,33%	0,80%	0,92%	1,10%	1,21%	1,24%
P2	0,58%	0,47%	0,75%	0,82%	1,10%	1,31%
P1	0,19%	0,25%	0,51%	0,84%	0,95%	1,30%
P10-P1	1,44%	1,67%	1,47%	1,15%	0,96%	0,16%

	J9K1	J9K3	J9K6	J9K9	J9K12	J9K24
P10	2,32%	1,88%	2,00%	1,91%	1,82%	1,34%
P9	1,19%	1,28%	1,40%	1,41%	1,30%	1,04%
P8	0,93%	1,00%	1,12%	1,17%	1,17%	1,01%
P7	0,80%	0,93%	1,00%	1,07%	1,07%	0,94%
P6	1,03%	0,97%	0,96%	1,11%	1,21%	1,05%
P5	0,78%	0,92%	1,02%	1,17%	1,24%	1,07%
P4	0,78%	0,89%	0,89%	1,05%	1,08%	1,16%
P3	0,91%	1,13%	0,82%	0,94%	1,14%	1,18%
P2	0,52%	0,70%	0,68%	0,84%	1,08%	1,20%
P1	0,36%	0,02%	0,51%	0,86%	1,07%	1,29%
P10-P1	1,96%	1,86%	1,49%	1,05%	0,76%	0,06%

	J12K1	J12K3	J12K6	J12K9	J12K12	J12K24
P10	2,48%	1,88%	1,78%	1,74%	1,57%	1,12%
P9	1,49%	1,35%	1,45%	1,42%	1,26%	1,02%
P8	0,83%	1,01%	1,04%	1,20%	1,10%	0,87%
P7	1,00%	1,03%	1,19%	1,13%	1,23%	0,94%
P6	1,26%	1,20%	1,25%	1,22%	1,30%	0,99%
P5	0,86%	1,07%	1,19%	1,32%	1,34%	1,09%
P4	0,79%	0,92%	1,03%	1,17%	1,27%	1,06%
P3	1,12%	0,68%	0,75%	1,07%	1,25%	1,16%
P2	0,34%	0,73%	0,78%	0,96%	1,22%	1,34%
P1	0,11%	0,19%	0,64%	0,92%	1,04%	1,17%
P10-P1	2,37%	1,69%	1,14%	0,82%	0,53%	-0,05%

	J24K1	J24K3	J24K6	J24K9	J24K12	J24K24
P10	1,27%	1,10%	1,03%	1,03%	0,94%	1,02%
P9	1,08%	0,90%	0,94%	0,84%	0,75%	0,64%
P8	0,65%	0,97%	0,95%	0,96%	0,86%	0,68%
P7	1,07%	1,09%	1,04%	0,94%	0,94%	0,69%
P6	1,09%	1,24%	1,21%	1,08%	0,98%	0,75%
P5	1,11%	1,05%	0,93%	0,92%	0,89%	0,73%
P4	0,89%	0,97%	0,80%	0,86%	0,96%	0,85%
P3	0,77%	0,82%	0,89%	0,93%	0,96%	0,98%
P2	0,78%	0,83%	0,76%	0,90%	0,92%	1,08%
P1	0,29%	0,54%	0,68%	0,60%	0,74%	1,09%
P10-P1	0,98%	0,56%	0,35%	0,43%	0,20%	-0,06%

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 1e: Summary of trading strategies using *Swedish stocks*

The tables below present the monthly returns from the 36 different trading strategies using Swedish stocks. Each column represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). The table rows represent the ten different portfolios, from P10 (contains the best performing stocks over the J-period) to P1 (contains the worst performing stocks over the J-period). The returns from the zero-cost portfolio (P10-P1) can be found in the bottom row in each table.

	J1K1	J1K3	J1K6	J1K9	J1K12	J1K24
P10	-0,42%	0,81%	1,46%	1,47%	1,47%	1,46%
P9	1,16%	1,41%	1,59%	1,63%	1,51%	1,42%
P8	1,06%	1,26%	1,45%	1,47%	1,41%	1,36%
P7	1,33%	1,48%	1,63%	1,62%	1,43%	1,44%
P6	1,37%	1,29%	1,28%	1,27%	1,32%	1,28%
P5	0,77%	1,19%	1,29%	1,40%	1,36%	1,36%
P4	1,04%	1,16%	1,26%	1,20%	1,25%	1,34%
P3	0,81%	0,96%	1,26%	1,28%	1,28%	1,34%
P2	1,33%	0,92%	1,07%	1,14%	1,13%	1,30%
P1	2,89%	1,07%	1,24%	1,21%	1,12%	1,47%
P10-P1	-3,31%	-0,26%	0,22%	0,26%	0,35%	-0,01%

	J3K1	J3K3	J3K6	J3K9	J3K12	J3K24
P10	1,40%	1,81%	2,03%	1,83%	1,71%	1,58%
P9	1,46%	1,76%	1,86%	1,75%	1,62%	1,49%
P8	1,50%	1,74%	1,65%	1,57%	1,50%	1,41%
P7	1,41%	1,43%	1,57%	1,42%	1,34%	1,35%
P6	1,34%	1,35%	1,46%	1,38%	1,31%	1,35%
P5	2,76%	1,19%	1,20%	1,22%	1,24%	1,33%
P4	0,73%	1,02%	1,19%	1,12%	1,17%	1,28%
P3	0,76%	0,87%	1,16%	1,31%	1,16%	1,34%
P2	1,24%	0,81%	0,96%	1,03%	0,99%	1,39%
P1	2,89%	1,09%	0,96%	1,05%	1,13%	1,45%
P10-P1	-1,49%	0,72%	1,07%	0,78%	0,58%	0,13%

	J6K1	J6K3	J6K6	J6K9	J6K12	J6K24
P10	1,77%	1,92%	2,21%	1,97%	1,83%	1,53%
P9	1,97%	1,82%	1,90%	1,80%	1,66%	1,47%
P8	1,29%	1,62%	1,69%	1,63%	1,49%	1,38%
P7	1,23%	1,27%	1,41%	1,36%	1,38%	1,33%
P6	1,08%	1,21%	1,38%	1,42%	1,40%	1,38%
P5	1,00%	1,12%	1,24%	1,27%	1,26%	1,36%
P4	1,05%	1,27%	1,29%	1,26%	1,31%	1,38%
P3	0,68%	0,77%	1,20%	1,17%	1,27%	1,35%
P2	0,58%	0,64%	1,09%	1,15%	1,15%	1,36%
P1	1,42%	0,62%	1,36%	1,40%	1,24%	1,55%
P10-P1	0,36%	1,31%	0,85%	0,57%	0,60%	-0,02%

	J9K1	J9K3	J9K6	J9K9	J9K12	J9K24
P10	2,01%	1,95%	2,21%	1,97%	1,88%	1,47%
P9	1,77%	1,75%	1,81%	1,72%	1,62%	1,37%
P8	1,70%	1,43%	1,59%	1,60%	1,51%	1,28%
P7	1,39%	1,39%	1,47%	1,38%	1,41%	1,30%
P6	1,32%	1,34%	1,43%	1,42%	1,48%	1,33%
P5	1,02%	1,11%	1,36%	1,32%	1,33%	1,25%
P4	0,95%	0,92%	1,16%	1,23%	1,27%	1,26%
P3	0,97%	0,97%	1,24%	1,28%	1,35%	1,32%
P2	1,49%	1,05%	1,34%	1,41%	1,50%	1,40%
P1	1,93%	0,93%	1,43%	1,37%	1,36%	1,53%
P10-P1	0,08%	1,02%	0,78%	0,59%	0,51%	-0,07%

	J12K1	J12K3	J12K6	J12K9	J12K12	J12K24
P10	2,05%	1,97%	2,12%	2,03%	1,86%	1,38%
P9	1,97%	1,78%	1,88%	1,80%	1,60%	1,29%
P8	1,44%	1,40%	1,51%	1,48%	1,37%	1,20%
P7	1,42%	1,24%	1,44%	1,46%	1,38%	1,18%
P6	1,32%	1,40%	1,43%	1,64%	1,55%	1,23%
P5	1,30%	1,13%	1,32%	1,58%	1,35%	1,30%
P4	1,00%	1,03%	1,37%	1,62%	1,41%	1,25%
P3	1,21%	1,07%	1,53%	1,57%	1,48%	1,30%
P2	1,31%	0,91%	1,50%	1,64%	1,60%	1,37%
P1	2,18%	1,10%	1,71%	1,71%	1,51%	1,52%
P10-P1	-0,12%	0,88%	0,40%	0,32%	0,36%	-0,14%

	J24K1	J24K3	J24K6	J24K9	J24K12	J24K24
P10	1,58%	1,70%	1,52%	1,41%	1,36%	1,05%
P9	1,16%	1,23%	1,26%	1,25%	1,15%	1,01%
P8	1,17%	1,13%	1,04%	1,10%	0,99%	0,90%
P7	1,10%	1,15%	1,15%	1,04%	1,04%	1,04%
P6	1,01%	1,40%	1,26%	1,18%	1,13%	0,92%
P5	1,07%	1,11%	1,16%	1,17%	1,03%	0,96%
P4	1,18%	1,12%	1,20%	1,10%	1,02%	1,00%
P3	0,63%	0,99%	0,87%	0,96%	0,90%	1,04%
P2	0,44%	0,70%	0,71%	0,69%	0,75%	0,93%
P1	-0,65%	-0,08%	0,16%	0,41%	0,58%	0,86%
P10-P1	2,23%	1,78%	1,36%	1,01%	0,78%	0,18%

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 2a: Returns and T - stats using *Danish stocks*

The tables below present the monthly returns and t-statistics from the 36 different trading strategies using Danish stocks. The "buy" portfolios represent the P10 decile and the "sell" portfolios represent the P1 decile. "Buy-Sell" is the zero cost portfolios. Each cell represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). T-stats are presented in the cells below the returns and indicate significance differences from zero. MSCI Denmark and its standard deviation are also presented.

Denmark	**MSCI Denmark**	**1,09%**				
T - statistics	**St dev**	**5,30%**				
J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
1 Buy	**-0,92%**	**0,48%**	**0,63%**	**0,69%**	**0,75%**	**0,75%**
	-3,61	*1,42*	*1,67*	*1,53*	*1,49*	*1,35*
1 Sell	**1,82%**	**0,61%**	**0,30%**	**0,46%**	**0,50%**	**0,75%**
	5,53	*1,72*	*0,69*	*0,99*	*1,00*	*1,38*
1 Buy - Sell	**-2,74%**	**-0,13%**	**0,33%**	**0,23%**	**0,25%**	**-0,01%**
	-9,93	*-0,51*	*1,21*	*0,75*	*0,78*	*-0,02*
3 Buy	**-0,16%**	**0,99%**	**1,02%**	**1,05%**	**1,06%**	**0,92%**
	-0,61	*2,95*	*2,66*	*2,17*	*1,99*	*1,65*
3 Sell	**1,00%**	**0,30%**	**0,20%**	**0,27%**	**0,37%**	**0,75%**
	3,15	*0,77*	*0,43*	*0,53*	*0,70*	*1,38*
3 Buy - sell	**-1,16%**	**0,69%**	**0,82%**	**0,78%**	**0,69%**	**0,17%**
	-4,18	*2,51*	*2,58*	*2,15*	*1,85*	*0,41*
6 Buy	**0,51%**	**1,29%**	**1,24%**	**1,25%**	**1,13%**	**1,00%**
	1,86	*3,71*	*2,97*	*2,61*	*2,18*	*1,69*
6 Sell	**0,59%**	**0,10%**	**0,13%**	**0,25%**	**0,43%**	**0,83%**
	1,72	*0,25*	*0,29*	*0,49*	*0,76*	*1,43*
6 Buy - Sell	**-0,08%**	**1,19%**	**1,10%**	**1,00%**	**0,69%**	**0,17%**
	-0,26	*3,67*	*3,29*	*2,58*	*1,58*	*0,33*
9 Buy	**1,02%**	**1,37%**	**1,35%**	**1,31%**	**1,22%**	**1,02%**
	3,76	*3,92*	*3,21*	*2,71*	*2,45*	*1,75*
9 Sell	**0,76%**	**0,13%**	**0,11%**	**0,35%**	**0,59%**	**0,91%**
	2,27	*0,29*	*0,23*	*0,63*	*1,01*	*1,52*
9 Buy - Sell	**0,26%**	**1,25%**	**1,24%**	**0,96%**	**0,63%**	**0,11%**
	0,89	*4,14*	*3,61*	*2,38*	*1,41*	*0,20*
12 Buy	**1,90%**	**1,61%**	**1,42%**	**1,36%**	**1,23%**	**1,35%**
	6,65	*4,45*	*3,38*	*2,86*	*2,43*	*1,81*
12 Sell	**0,46%**	**-0,08%**	**0,16%**	**0,54%**	**0,72%**	**1,27%**
	1,25	*-0,19*	*0,31*	*0,91*	*1,24*	*1,77*
12 Buy - Sell	**1,44%**	**1,70%**	**1,25%**	**0,82%**	**0,51%**	**0,08%**
	4,46	*4,79*	*3,24*	*1,85*	*1,10*	*0,12*
24 Buy	**1,21%**	**1,13%**	**1,06%**	**0,98%**	**0,94%**	**0,77%**
	4,26	*3,15*	*2,55*	*1,92*	*1,69*	*1,10*
24 Sell	**0,19%**	**0,23%**	**0,24%**	**0,38%**	**0,57%**	**0,77%**
	0,62	*0,61*	*0,57*	*0,78*	*1,14*	*1,35*
24 Buy - Sell	**1,02%**	**0,90%**	**0,82%**	**0,61%**	**0,36%**	**0,00%**
	3,48	*2,79*	*2,37*	*1,44*	*0,89*	*0,01*

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 2b: Returns and T - stats using *Finnish stocks*

The tables below present the monthly returns and t-statistics from the 36 different trading strategies using Finnish stocks. The "buy" portfolios represent the P10 decile and the "sell" portfolios represent the P1 decile. "Buy-Sell" is the zero cost portfolios. Each cell represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). T-stats are presented in the cells below the returns and indicate significance differences from zero. MSCI Finland and its standard deviation are also presented.

Finland	**MSCI Finland**	**2,01%**					
T - statistics	**ST dev**	**10,46%**					
J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
1 Buy	**-0,92%**	**-0,45%**	**0,60%**	**1,02%**	**1,42%**	**1,22%**
	-0,82	*-0,53*	*0,73*	*1,28*	*1,85*	*1,56*
1 Sell	**1,82%**	**0,90%**	**1,06%**	**1,09%**	**1,01%**	**1,22%**
	3,18	*1,48*	*1,50*	*1,48*	*1,42*	*1,63*
1 Buy - Sell	**-2,74%**	**-1,35%**	**-0,45%**	**-0,07%**	**0,41%**	**-0,01%**
	-2,65	*-1,91*	*-0,70*	*-0,12*	*0,68*	*-0,01*
3 Buy	**-0,16%**	**0,30%**	**0,87%**	**1,15%**	**1,40%**	**1,18%**
	-0,18	*0,34*	*1,05*	*1,42*	*1,82*	*1,38*
3 Sell	**1,00%**	**1,07%**	**0,94%**	**1,45%**	**0,98%**	**1,20%**
	1,60	*1,53*	*1,27*	*1,56*	*1,25*	*1,46*
3 Buy - sell	**-1,16%**	**-0,77%**	**-0,07%**	**-0,30%**	**0,42%**	**-0,02%**
	-1,40	*-1,06*	*-0,11*	*-0,37*	*0,69*	*-0,03*
6 Buy	**0,51%**	**0,80%**	**1,07%**	**1,47%**	**1,58%**	**1,31%**
	0,50	*0,94*	*1,34*	*1,73*	*1,99*	*1,41*
6 Sell	**0,59%**	**1,02%**	**0,86%**	**0,89%**	**0,88%**	**1,18%**
	0,87	*1,33*	*1,05*	*1,15*	*1,08*	*1,45*
6 Buy - Sell	**-0,08%**	**-0,22%**	**0,21%**	**0,57%**	**0,70%**	**0,13%**
	-0,08	*-0,29*	*0,26*	*0,79*	*1,02*	*0,18*
9 Buy	**1,02%**	**0,73%**	**1,28%**	**1,46%**	**1,60%**	**1,25%**
	0,96	*0,85*	*1,53*	*1,65*	*1,92*	*1,30*
9 Sell	**0,76%**	**1,24%**	**0,51%**	**0,92%**	**0,92%**	**1,28%**
	1,09	*1,46*	*0,66*	*1,13*	*1,11*	*1,64*
9 Buy - Sell	**0,26%**	**-0,51%**	**0,77%**	**0,54%**	**0,68%**	**-0,03%**
	0,26	*-0,57*	*1,05*	*0,68*	*0,94*	*-0,04*
12 Buy	**1,90%**	**1,64%**	**1,51%**	**1,54%**	**1,49%**	**1,12%**
	2,75	*2,31*	*2,06*	*2,03*	*1,83*	*1,16*
12 Sell	**0,46%**	**0,58%**	**0,83%**	**1,11%**	**1,19%**	**1,31%**
	0,55	*0,68*	*0,97*	*1,21*	*1,34*	*1,68*
12 Buy - Sell	**1,44%**	**1,06%**	**0,68%**	**0,44%**	**0,30%**	**-0,19%**
	2,21	*1,58*	*1,01*	*0,59*	*0,40*	*-0,25*
24 Buy	**0,91%**	**1,03%**	**1,12%**	**1,25%**	**1,06%**	**0,91%**
	1,64	1,69	1,63	1,84	1,51	1,28
24 Sell	**1,17%**	**0,70%**	**0,97%**	**0,95%**	**0,97%**	**1,01%**
	1,77	1,05	1,22	1,22	1,27	1,67
24 Buy - Sell	**-0,27%**	**0,32%**	**0,16%**	**0,31%**	**0,09%**	**-0,10%**
	-0,45	0,62	0,23	0,46	0,13	-0,15

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 2c: Returns and T - stats using *Norwegian stocks*

The tables below present the monthly returns and t-statistics from the 36 different trading strategies using Norwegian stocks. The "buy" portfolios represent the P10 decile and the "sell" portfolios represent the P1 decile. "Buy-Sell" is the zero cost portfolios. Each cell represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). T-stats are presented in the cells below the returns and indicate significance differences from zero. MSCI Norway and its standard deviation are also presented.

Norway	**MSCI Norway**	**1,09%**				
T - statistics	**St dev**	**6,28%**				
J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
1 Buy	**0,14%**	**1,04%**	**1,14%**	**1,39%**	**1,33%**	**1,12%**
	0,25	*1,67*	*1,55*	*1,68*	*1,54*	*1,25*
1 Sell	**0,67%**	**0,30%**	**0,54%**	**0,79%**	**0,98%**	**1,17%**
	1,15	*0,44*	*0,74*	*1,01*	*1,13*	*1,36*
1 Buy - Sell	**-0,54%**	**0,74%**	**0,59%**	**0,59%**	**0,35%**	**-0,05%**
	-1,01	*1,48*	*1,08*	*1,01*	*0,64*	*-0,07*
3 Buy	**-0,16%**	**1,13%**	**1,07%**	**1,39%**	**1,44%**	**1,27%**
	-0,25	*1,75*	*1,74*	*2,03*	*2,05*	*1,71*
3 Sell	**1,00%**	**0,77%**	**0,47%**	**0,85%**	**0,87%**	**1,24%**
	1,68	*1,14*	*0,73*	*1,17*	*1,16*	*1,72*
3 Buy - sell	**-1,16%**	**0,36%**	**0,60%**	**0,55%**	**0,57%**	**0,03%**
	-1,85	*0,65*	*1,33*	*1,10*	*1,18*	*0,05*
6 Buy	**0,51%**	**1,50%**	**1,84%**	**1,63%**	**1,55%**	**1,31%**
	0,83	*2,41*	*2,64*	*2,40*	*2,25*	*1,71*
6 Sell	**0,59%**	**0,30%**	**1,06%**	**0,72%**	**0,82%**	**1,28%**
	0,96	*0,47*	*1,35*	*0,99*	*1,12*	*1,68*
6 Buy - Sell	**-0,08%**	**1,20%**	**0,79%**	**0,91%**	**0,72%**	**0,04%**
	-0,13	*2,35*	*1,45*	*1,93*	*1,49*	*0,06*
9 Buy	**1,02%**	**1,39%**	**1,88%**	**1,66%**	**1,63%**	**1,28%**
	1,65	*2,34*	*2,69*	*2,38*	*2,32*	*1,63*
9 Sell	**0,76%**	**0,51%**	**0,83%**	**0,92%**	**1,10%**	**1,28%**
	1,19	*0,76*	*1,10*	*1,16*	*1,39*	*1,69*
9 Buy - Sell	**0,26%**	**0,87%**	**1,05%**	**0,75%**	**0,53%**	**0,00%**
	0,42	*1,65*	*1,96*	*1,29*	*0,92*	*0,00*
12 Buy	**1,90%**	**2,11%**	**2,17%**	**1,93%**	**1,70%**	**1,27%**
	3,80	*3,55*	*3,05*	*2,59*	*2,24*	*1,53*
12 Sell	**0,46%**	**0,67%**	**1,23%**	**1,33%**	**1,38%**	**1,39%**
	0,75	*0,95*	*1,47*	*1,52*	*1,61*	*1,77*
12 Buy - Sell	**1,44%**	**1,45%**	**0,94%**	**0,59%**	**0,32%**	**-0,12%**
	2,92	*2,76*	*1,55*	*0,90*	*0,49*	*-0,16*
24 Buy	**1,27%**	**1,10%**	**1,03%**	**1,03%**	**0,94%**	**1,02%**
	2,31	*1,78*	*1,52*	*1,39*	*1,26*	*1,26*
24 Sell	**0,29%**	**0,54%**	**0,68%**	**0,60%**	**0,74%**	**1,09%**
	0,57	*0,83*	*0,87*	*0,79*	*0,95*	*1,23*
24 Buy - Sell	**0,98%**	**0,56%**	**0,35%**	**0,43%**	**0,20%**	**-0,06%**
	2,03	*1,06*	*0,70*	*0,92*	*0,44*	*-0,09*

Source: Own calculations based on stock observations collected by Datastream Advance

Appendix 2d: Returns and T - stats using *Swedish stocks*

The tables below present the monthly returns and t-statistics from the 36 different trading strategies using Swedish stocks. The "buy" portfolios represent the P10 decile and the "sell" portfolios represent the P1 decile. "Buy-Sell" is the zero cost portfolios. Each cell represent one strategy denoted after their forming period, J months, and holding period K months (i.e. "J6K6" represent a 6 months long forming period and a 6 months long holding period). T-stats are presented in the cells below the returns and indicate significance differences from zero. MSCI Sweden and its standard deviation are also presented.

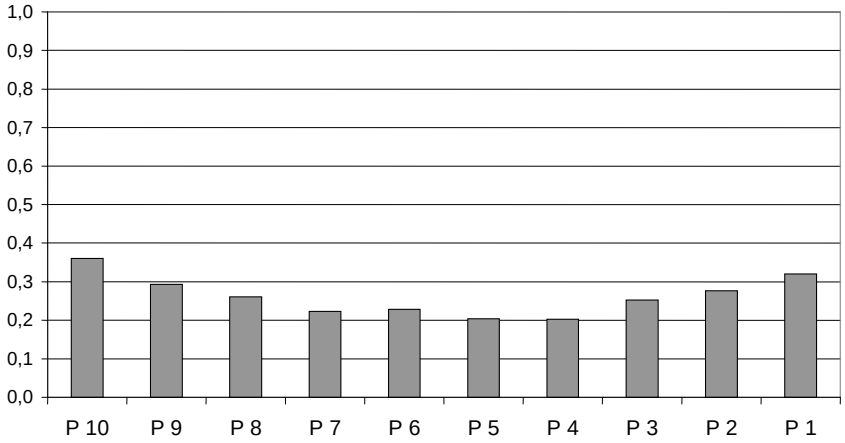
Sweden	**MSCI Sweden**	**1,48%**				
T - statistics	**St dev**	**7,26%**				
J	**K1**	**K3**	**K6**	**K9**	**K12**	**K24**
1 Buy	**-0,42%**	**0,81%**	**1,46%**	**1,47%**	**1,47%**	**1,46%**
	-0,63	*1,05*	*1,53*	*1,55*	*1,54*	*1,56*
1 Sell	**2,89%**	**1,07%**	**1,24%**	**1,21%**	**1,12%**	**1,47%**
	3,76	*1,31*	*1,31*	*1,23*	*1,15*	*1,58*
1 Buy - Sell	**-3,31%**	**-0,26%**	**0,22%**	**0,26%**	**0,35%**	**-0,01%**
	-5,14	*-0,42*	*0,34*	*0,45*	*0,57*	*-0,01*
3 Buy	**1,40%**	**1,81%**	**2,03%**	**1,83%**	**1,71%**	**1,58%**
	1,86	*2,25*	*2,17*	*1,98*	*1,87*	*1,69*
3 Sell	**2,89%**	**1,09%**	**0,96%**	**1,05%**	**1,13%**	**1,45%**
	3,01	*1,23*	*0,99*	*1,08*	*1,15*	*1,49*
3 Buy - sell	**-1,49%**	**0,72%**	**1,07%**	**0,78%**	**0,58%**	**0,13%**
	-1,65	*1,05*	*1,61*	*1,25*	*0,86*	*0,16*
6 Buy	**1,77%**	**1,92%**	**2,21%**	**1,97%**	**1,83%**	**1,53%**
	2,85	*2,75*	*2,43*	*2,21*	*1,98*	*1,64*
6 Sell	**1,42%**	**0,62%**	**1,36%**	**1,40%**	**1,24%**	**1,55%**
	1,72	*0,75*	*1,28*	*1,23*	*1,20*	*1,46*
6 Buy - Sell	**0,36%**	**1,31%**	**0,85%**	**0,57%**	**0,60%**	**-0,02%**
	0,49	*2,08*	*1,19*	*0,80*	*0,77*	*-0,02*
9 Buy	**2,01%**	**1,95%**	**2,21%**	**1,97%**	**1,88%**	**1,47%**
	3,20	*2,65*	*2,49*	*2,18*	*2,04*	*1,53*
9 Sell	**1,93%**	**0,93%**	**1,43%**	**1,37%**	**1,36%**	**1,53%**
	2,16	*1,10*	*1,31*	*1,25*	*1,25*	*1,60*
9 Buy - Sell	**0,08%**	**1,02%**	**0,78%**	**0,59%**	**0,51%**	**-0,07%**
	0,11	*1,70*	*1,11*	*0,82*	*0,65*	*-0,08*
12 Buy	**2,05%**	**1,97%**	**2,12%**	**2,03%**	**1,86%**	**1,38%**
	3,18	*2,70*	*2,49*	*2,26*	*2,01*	*1,40*
12 Sell	**2,18%**	**1,10%**	**1,71%**	**1,71%**	**1,51%**	**1,52%**
	2,34	*1,25*	*1,50*	*1,52*	*1,48*	*1,61*
12 Buy - Sell	**-0,12%**	**0,88%**	**0,40%**	**0,32%**	**0,36%**	**-0,14%**
	-0,16	*1,28*	*0,50*	*0,37*	*0,44*	*-0,15*
24 Buy	**1,58%**	**1,70%**	**1,52%**	**1,41%**	**1,36%**	**1,05%**
	2,95	*2,86*	*2,33*	*2,10*	*1,91*	*1,18*
24 Sell	**-0,65%**	**-0,08%**	**0,16%**	**0,41%**	**0,58%**	**0,86%**
	-1,20	*-0,13*	*0,23*	*0,57*	*0,85*	*1,27*
24 Buy - Sell	**2,23%**	**1,78%**	**1,36%**	**1,01%**	**0,78%**	**0,18%**
	4,51	*3,19*	*2,42*	*1,67*	*1,33*	*0,25*

Source: Own calculations based on stock observations collected by Datastream Advance

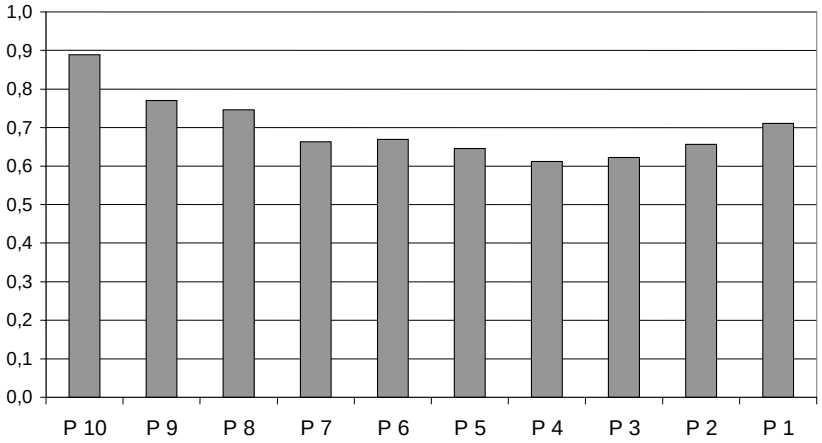
Appendix 3a. Beta

The graphs show the relative ex ante CAPM-beta for the individual countries when using the J6K6 strategy. P10-portfolio contains the past top performing stocks and P1-portfolio contains the past worst performing stocks.

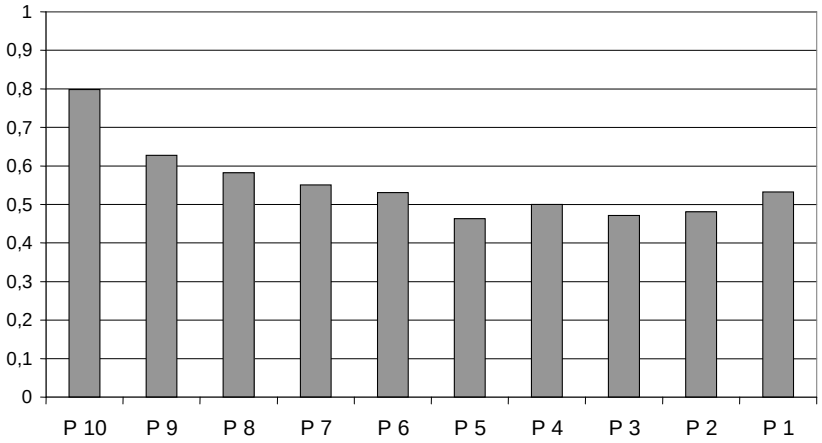
Denmark J6K6 (Beta)



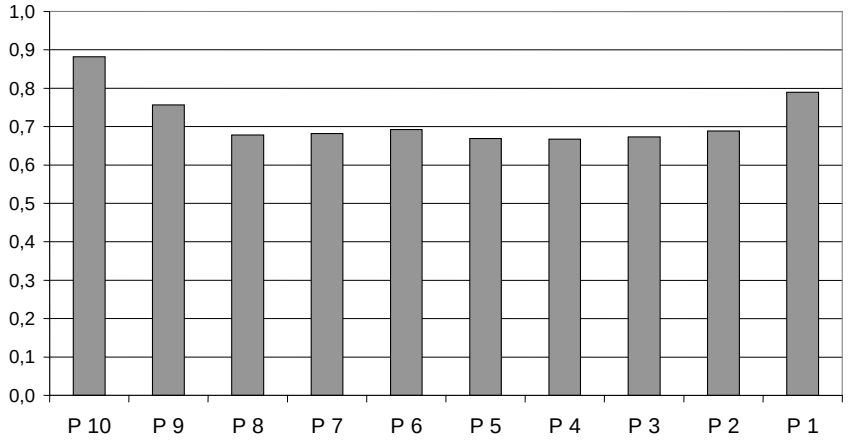
Finland J6K6 (Beta)



Norway J6K6 (Beta)



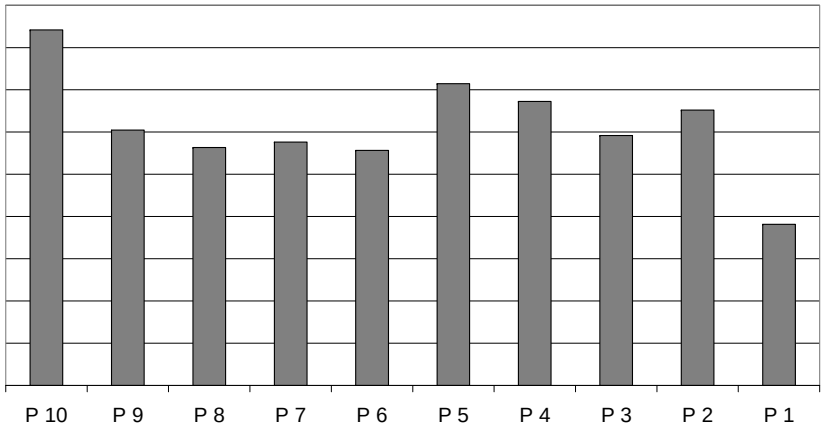
Sweden J6K6 (Beta)



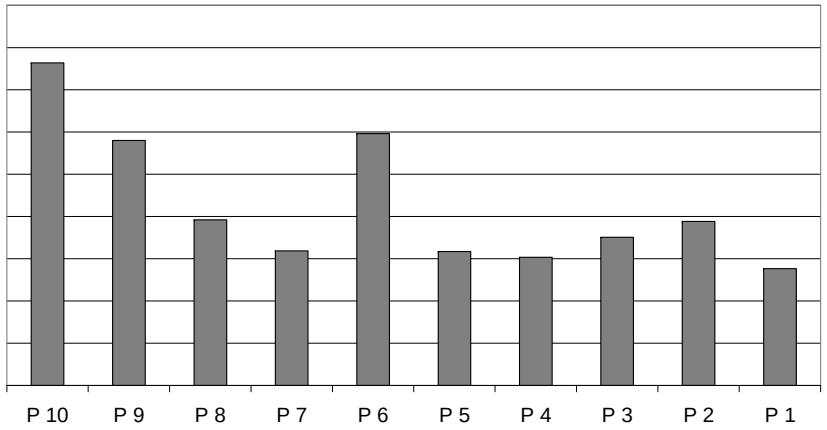
Appendix 3b. Size

The graphs show the relative ex ante Market values for the individual countries when using the J6K6 strategy. P10-portfolio contains the past top performing stocks and P1-portfolio contains the past worst performing stocks.

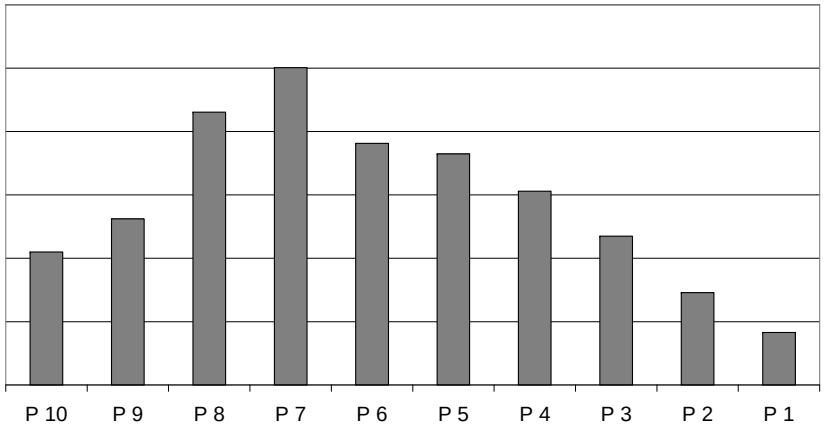
Denmark J6K6 (Market Value)



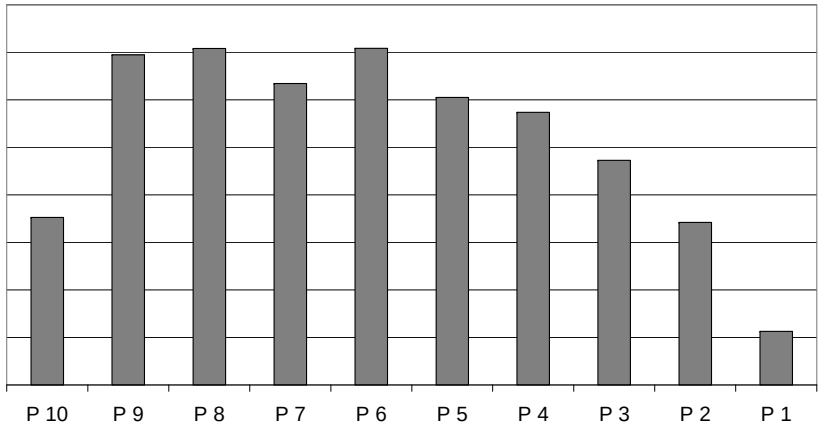
Finland J6K6 (Market Value)



Norway J6K6 (Market Value)



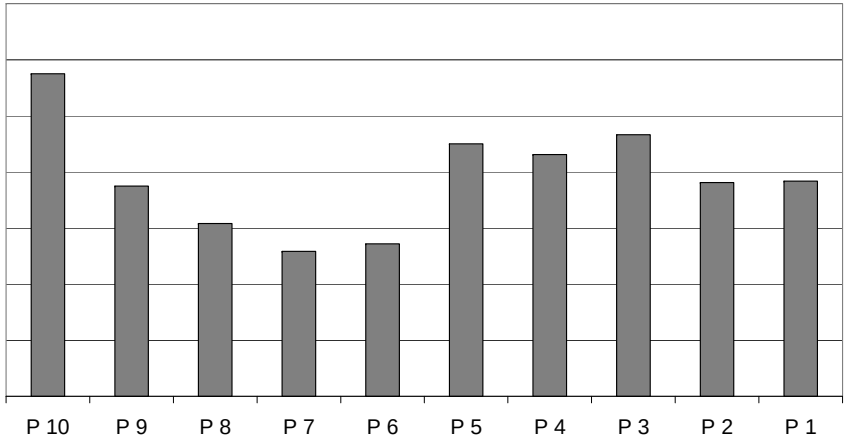
Sweden J6K6 (Market Value)



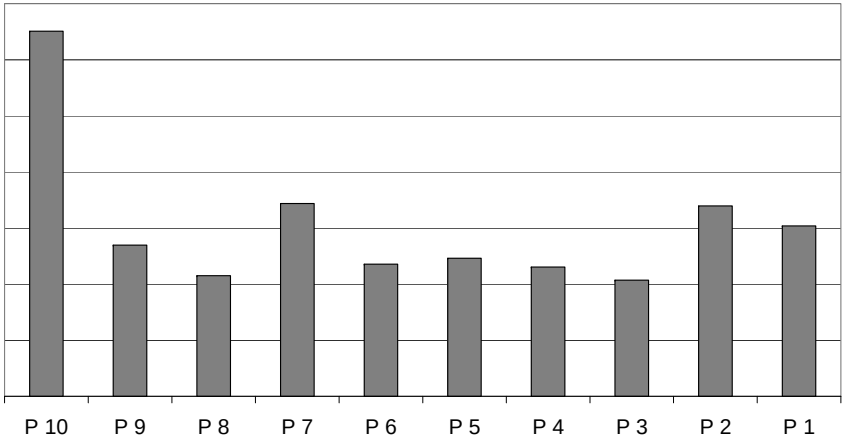
Appendix 3c. Volume

The graphs show the relative ex ante Volumes for the individual countries when using the J6K6 strategy. P10-portfolio contains the past top performing stocks and P1-portfolio contains the past worst performing stocks.

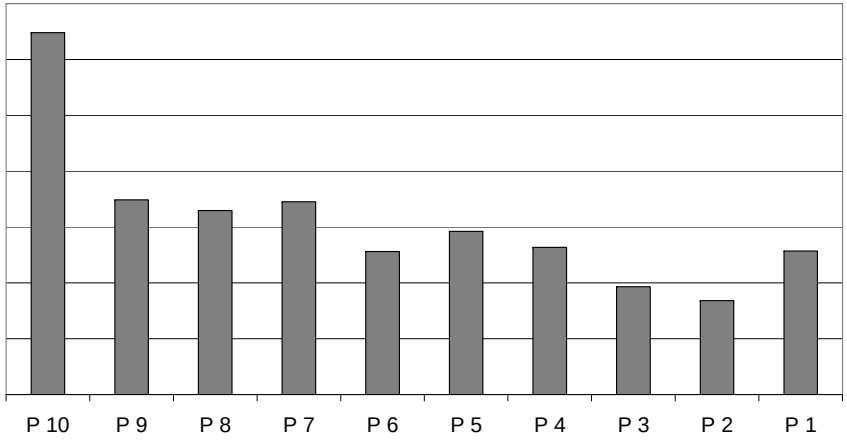
Denmark J6K6 (Volume)



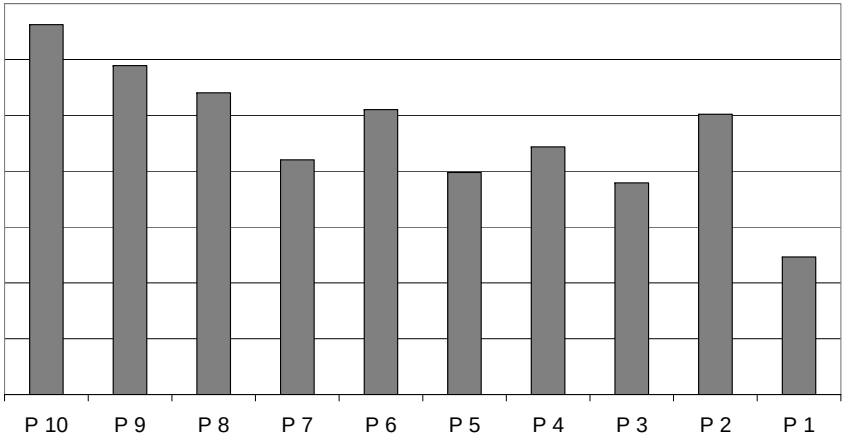
Finland J6K6 (Volume)



Norway J6K6 (Volume)



Sweden J6K6 (Volume)



Appendix 4a: Subsample (1994-1998, 1998-2002 and 2002-2006) of the Danish stock market. For explanation of terminology see Appendix 2a.

1994-1998	MSCI	Denmark:	1,57%	St dev	4,65%	
J	K1	K3	K6	K9	K12	K24
1 Buy	0,48%	0,95%	1,37%	1,48%	1,54%	1,24%
	1,32	*2,03*	*2,78*	*2,78*	*2,48*	*2,25*
1 Sell	1,91%	1,18%	1,02%	1,17%	1,32%	1,26%
	4,54	*2,36*	*1,75*	*2,23*	*2,37*	*2,40*
1 B-S	-1,43%	-0,23%	0,35%	0,32%	0,22%	-0,02%
	-4,17	*-0,56*	*0,83*	*0,73*	*0,41*	*-0,03*
3 Buy	0,63%	1,44%	1,65%	1,83%	1,81%	1,43%
	1,63	*3,27*	*3,53*	*3,37*	*2,66*	*2,42*
3 Sell	1,44%	0,71%	0,80%	1,00%	1,10%	1,30%
	3,04	*1,37*	*1,36*	*1,62*	*1,71*	*2,09*
3 B-S	-0,80%	0,72%	0,86%	0,84%	0,72%	0,13%
	-1,81	*1,66*	*1,98*	*1,64*	*1,22*	*0,16*
6 Buy	0,91%	1,61%	1,89%	2,02%	1,83%	1,45%
	2,02	*3,28*	*3,67*	*3,57*	*2,74*	*2,06*
6 Sell	0,84%	0,41%	0,65%	0,84%	1,08%	1,55%
	1,70	*0,77*	*1,15*	*1,32*	*1,64*	*2,27*
6 B-S	0,08%	1,19%	1,23%	1,18%	0,75%	-0,09%
	0,16	*2,72*	*2,53*	*2,06*	*1,14*	*-0,09*
9 Buy	1,61%	1,83%	1,96%	1,94%	1,79%	1,40%
	3,93	*3,78*	*3,63*	*3,19*	*2,62*	*1,96*
9 Sell	0,61%	0,73%	0,85%	1,15%	1,52%	1,69%
	1,35	*1,31*	*1,51*	*1,79*	*2,20*	*2,64*
9 B-S	1,00%	1,10%	1,11%	0,79%	0,28%	-0,29%
	2,39	*2,28*	*1,87*	*1,10*	*0,33*	*-0,27*
12 Buy	1,29%	1,73%	1,70%	1,71%	1,62%	1,64%
	3,20	*3,34*	*3,17*	*2,87*	*2,41*	*1,79*
12 Sell	0,79%	0,58%	0,96%	1,46%	1,68%	2,04%
	1,70	*1,00*	*1,43*	*1,88*	*2,14*	*2,85*
12 B-S	0,50%	1,15%	0,75%	0,26%	-0,06%	-0,41%
	1,09	*2,21*	*1,05*	*0,31*	*-0,07*	*-0,33*
24 Buy	1,01%	0,94%	1,14%	1,23%	1,25%	1,15%
	2,55	*1,91*	*2,18*	*2,04*	*2,11*	*2,10*
24 Sell	0,95%	0,89%	1,05%	1,41%	1,51%	1,55%
	2,42	*1,81*	*2,17*	*2,37*	*2,40*	*3,10*
24 B-S	0,06%	0,04%	0,10%	-0,18%	-0,26%	-0,40%
	0,15	*0,10*	*0,22*	*-0,31*	*-0,46*	*-0,58*

1998-2002	MSCI	Denmark:	0,71%	St dev	5,83%	
J	K1	K3	K6	K9	K12	K24
1 Buy	-0,72%	-0,80%	-0,55%	-0,55%	-0,43%	0,19%
	-2,00	*-1,23*	*-0,87*	*-0,85*	*-0,62*	*0,28*
1 Sell	-0,09%	-0,65%	-1,15%	-0,76%	-0,60%	0,11%
	-0,21	*-1,04*	*-1,70*	*-1,19*	*-0,91*	*0,19*
1 B-S	-0,64%	-0,15%	0,60%	0,21%	0,17%	0,07%
	-1,85	*-0,28*	*0,97*	*0,30*	*0,25*	*0,13*
3 Buy	-0,16%	-0,16%	-0,06%	-0,26%	-0,04%	0,42%
	-0,32	*-0,28*	*-0,11*	*-0,43*	*-0,05*	*0,75*
3 Sell	-0,62%	-1,07%	-1,33%	-1,17%	-0,86%	0,01%
	-0,89	*-1,63*	*-1,79*	*-1,76*	*-1,48*	*0,01*
3 B-S	0,46%	0,91%	1,26%	0,91%	0,82%	0,42%
	0,76	*1,73*	*2,14*	*1,23*	*1,19*	*0,70*
6 Buy	0,27%	-0,08%	-0,11%	-0,13%	-0,04%	0,48%
	0,50	*-0,15*	*-0,21*	*-0,22*	*-0,05*	*0,81*
6 Sell	-1,21%	-1,19%	-1,30%	-1,01%	-0,78%	-0,07%
	-1,63	*-1,46*	*-1,44*	*-1,35*	*-1,17*	*-0,12*
6 B-S	1,48%	1,11%	1,19%	0,88%	0,74%	0,56%
	2,41	*1,79*	*1,74*	*1,18*	*0,98*	*0,78*
9 Buy	0,14%	0,03%	0,08%	0,08%	0,16%	0,65%
	0,25	*0,05*	*0,11*	*0,10*	*0,18*	*1,09*
9 Sell	-1,01%	-1,20%	-1,34%	-1,25%	-0,85%	-0,02%
	-1,32	*-1,39*	*-1,57*	*-1,58*	*-1,36*	*-0,04*
9 B-S	1,15%	1,23%	1,41%	1,33%	1,01%	0,67%
	1,71	*1,94*	*1,92*	*1,60*	*1,36*	*1,01*
12 Buy	0,23%	0,35%	0,16%	0,11%	0,12%	1,08%
	0,42	*0,51*	*0,21*	*0,13*	*0,13*	*1,29*
12 Sell	-1,66%	-1,41%	-1,47%	-1,06%	-0,65%	0,15%
	-2,43	*-1,70*	*-1,86*	*-1,45*	*-1,04*	*0,16*
12 B-S	1,89%	1,75%	1,63%	1,17%	0,77%	0,92%
	2,99	*2,37*	*2,20*	*1,48*	*1,04*	*0,96*
24 Buy	-0,07%	-0,37%	-0,43%	-0,48%	-0,30%	0,39%
	-0,12	*-0,54*	*-0,59*	*-0,55*	*-0,35*	*0,65*
24 Sell	-1,10%	-1,23%	-1,21%	-1,06%	-0,81%	-0,23%
	-1,97	*-1,91*	*-1,85*	*-1,81*	*-1,70*	*-0,38*
24 B-S	1,03%	0,86%	0,78%	0,57%	0,51%	0,62%
	1,81	*1,40*	*1,09*	*0,67*	*0,70*	*1,14*

2002-2006	MSCI	Denmark:	1,16%	St dev	5,56%	
J	K1	K3	K6	K9	K12	K24
1 Buy	0,33%	1,13%	1,12%	1,24%	1,24%	0,83%
	0,57	*1,59*	*1,42*	*1,27*	*1,19*	*0,60*
1 Sell	1,24%	1,06%	1,06%	1,17%	1,02%	0,96%
	1,90	*1,47*	*1,19*	*1,18*	*1,02*	*0,72*
1 B-S	-0,90%	0,08%	0,06%	0,07%	0,22%	-0,13%
	-1,42	*0,14*	*0,10*	*0,11*	*0,33*	*-0,13*
3 Buy	1,39%	1,80%	1,58%	1,67%	1,58%	0,92%
	2,38	*2,44*	*1,81*	*1,51*	*1,40*	*0,64*
3 Sell	0,96%	1,04%	1,12%	1,01%	0,96%	0,96%
	1,40	*1,29*	*1,15*	*0,96*	*0,84*	*0,76*
3 B-S	0,43%	0,76%	0,46%	0,65%	0,62%	-0,04%
	0,73	*1,17*	*0,58*	*0,89*	*0,85*	*-0,04*
6 Buy	1,91%	2,30%	1,95%	1,96%	1,68%	1,02%
	3,31	*2,96*	*2,10*	*1,95*	*1,65*	*0,69*
6 Sell	0,33%	0,81%	0,98%	0,87%	0,93%	0,88%
	0,51	*0,96*	*1,21*	*0,87*	*0,76*	*0,74*
6 B-S	1,58%	1,49%	0,97%	1,08%	0,75%	0,14%
	2,54	*1,85*	*1,38*	*1,44*	*0,81*	*0,16*
9 Buy	2,02%	2,22%	2,10%	2,05%	1,80%	0,97%
	3,63	*3,08*	*2,64*	*2,25*	*2,10*	*0,66*
9 Sell	0,64%	0,57%	0,63%	0,97%	0,86%	0,88%
	1,02	*0,65*	*0,79*	*0,93*	*0,74*	*0,75*
9 B-S	1,38%	1,66%	1,48%	1,08%	0,93%	0,09%
	2,29	*2,87*	*2,84*	*1,74*	*1,28*	*0,09*
12 Buy	2,62%	2,88%	2,45%	2,25%	1,90%	1,28%
	4,43	*4,47*	*3,32*	*2,80*	*2,27*	*0,70*
12 Sell	-0,31%	0,35%	0,60%	0,81%	0,80%	1,40%
	-0,44	*0,40*	*0,57*	*0,69*	*0,68*	*1,05*
12 B-S	2,93%	2,53%	1,85%	1,43%	1,10%	-0,12%
	5,03	*3,72*	*3,04*	*2,17*	*1,65*	*-0,12*
24 Buy	2,39%	2,34%	2,08%	1,89%	1,71%	0,78%
	5,63	*4,67*	*3,61*	*2,35*	*1,63*	*0,45*
24 Sell	0,24%	0,39%	0,37%	0,38%	0,80%	0,97%
	0,41	*0,53*	*0,51*	*0,44*	*0,86*	*1,01*
24 B-S	2,15%	1,95%	1,71%	1,50%	0,90%	-0,18%
	3,68	*3,46*	*3,22*	*2,84*	*1,30*	*-0,19*

Appendix 4b: Subsample (1994-1998, 1998-2002 and 2002-2006) of the Finnish stock market. For explanation of terminology see Appendix 2b.

1994-1998	MSCI	Finland:	2,36%	St dev:	7,75%	
J	K1	K3	K6	K9	K12	K24
1 Buy	-3,31%	-0,66%	0,82%	1,46%	1,92%	1,79%
	-1,49	*-0,45*	*0,54*	*0,97*	*1,45*	*1,21*
1 Sell	1,73%	1,08%	1,45%	1,55%	1,52%	1,82%
	1,92	*1,20*	*1,29*	*1,09*	*1,14*	*1,25*
1 B-S	-5,04%	-1,74%	-0,63%	-0,08%	0,40%	-0,03%
	-2,53	*-1,29*	*-0,52*	*-0,08*	*0,40*	*-0,03*
3 Buy	-2,01%	0,23%	0,98%	1,57%	1,98%	1,84%
	-1,13	*0,15*	*0,68*	*1,05*	*1,51*	*1,19*
3 Sell	1,11%	1,35%	1,44%	2,09%	1,51%	1,75%
	1,20	*1,33*	*1,05*	*1,11*	*1,15*	*1,09*
3 B-S	-3,12%	-1,11%	-0,46%	-0,53%	0,47%	0,09%
	-1,82	*-0,77*	*-0,37*	*-0,31*	*0,44*	*0,07*
6 Buy	-2,76%	0,39%	1,03%	1,90%	2,13%	2,04%
	-1,29	*0,24*	*0,77*	*1,15*	*1,59*	*1,14*
6 Sell	0,56%	1,31%	1,37%	1,47%	1,48%	1,82%
	0,66	*1,32*	*0,94*	*1,14*	*1,08*	*1,21*
6 B-S	-3,32%	-0,92%	-0,35%	0,44%	0,65%	0,23%
	-1,56	*-0,57*	*-0,23*	*0,32*	*0,57*	*0,19*
9 Buy	-2,67%	0,20%	1,68%	2,06%	2,30%	2,11%
	-1,17	*0,13*	*1,13*	*1,43*	*1,80*	*1,30*
9 Sell	1,24%	2,11%	1,14%	1,44%	1,57%	1,96%
	1,44	*1,48*	*0,78*	*1,04*	*1,01*	*1,24*
9 B-S	-3,91%	-1,92%	0,55%	0,62%	0,73%	0,15%
	-1,83	*-1,05*	*0,39*	*0,45*	*0,71*	*0,14*
12 Buy	1,21%	1,96%	2,01%	2,24%	2,13%	2,05%
	0,89	*1,63*	*1,95*	*1,93*	*2,01*	*1,53*
12 Sell	0,12%	1,24%	1,51%	1,81%	2,05%	2,01%
	0,09	*0,95*	*0,96*	*1,15*	*1,30*	*1,27*
12 B-S	1,09%	0,72%	0,50%	0,43%	0,08%	0,05%
	0,94	*0,61*	*0,39*	*0,38*	*0,08*	*0,05*
24 Buy	1,07%	1,52%	2,02%	2,35%	2,07%	1,26%
	1,02	*1,44*	*1,97*	*2,18*	*1,97*	*1,35*
24 Sell	1,13%	1,11%	1,57%	1,39%	1,54%	1,01%
	1,13	*0,99*	*1,02*	*0,95*	*0,99*	*0,64*
24 B-S	-0,06%	0,41%	0,46%	0,97%	0,53%	0,25%
	-0,08	*0,49*	*0,37*	*0,98*	*0,42*	*0,22*

1998-2002	MSCI	Finland:	3,01%	St dev:	13,71%	
J	K1	K3	K6	K9	K12	K24
1 Buy	-4,70%	-1,83%	-0,55%	-0,15%	0,21%	0,63%
	-2,11	*-1,11*	*-0,34*	*-0,11*	*0,17*	*0,51*
1 Sell	0,13%	-0,01%	-0,37%	-0,29%	-0,35%	0,67%
	0,14	*-0,01*	*-0,29*	*-0,22*	*-0,35*	*0,72*
1 B-S	-4,83%	-1,82%	-0,18%	0,13%	0,57%	-0,04%
	-2,43	*-1,28*	*-0,14*	*0,12*	*0,57*	*-0,04*
3 Buy	-3,02%	-1,38%	-0,50%	-0,39%	-0,07%	0,69%
	-1,67	*-0,75*	*-0,30*	*-0,27*	*-0,05*	*0,44*
3 Sell	-0,64%	0,10%	-0,65%	0,28%	-0,31%	0,72%
	-0,59	*0,06*	*-0,47*	*0,17*	*-0,29*	*0,73*
3 B-S	-2,37%	-1,48%	0,15%	-0,67%	0,24%	-0,03%
	-1,43	*-0,99*	*0,13*	*-0,43*	*0,23*	*-0,02*
6 Buy	-2,11%	-0,01%	-0,14%	0,09%	0,13%	0,80%
	-1,10	*-0,01*	*-0,09*	*0,06*	*0,08*	*0,55*
6 Sell	-1,46%	-0,38%	-0,80%	-0,40%	-0,46%	0,56%
	-0,97	*-0,21*	*-0,57*	*-0,37*	*-0,53*	*0,66*
6 B-S	-0,65%	0,37%	0,66%	0,49%	0,59%	0,24%
	-0,32	*0,25*	*0,45*	*0,41*	*0,45*	*0,18*
9 Buy	-2,50%	-0,47%	-0,25%	-0,37%	-0,19%	0,80%
	-1,30	*-0,27*	*-0,15*	*-0,21*	*-0,12*	*0,53*
9 Sell	-1,57%	-0,08%	-1,13%	-0,44%	-0,10%	0,55%
	-1,02	*-0,05*	*-1,12*	*-0,43*	*-0,12*	*0,66*
9 B-S	-0,93%	-0,39%	0,88%	0,07%	-0,09%	0,25%
	-0,45	*-0,23*	*0,68*	*0,05*	*-0,07*	*0,19*
12 Buy	-1,00%	0,14%	-0,44%	-0,47%	-0,23%	0,76%
	-0,72	*0,09*	*-0,27*	*-0,31*	*-0,14*	*0,48*
12 Sell	-2,70%	-0,81%	-0,99%	-0,41%	-0,13%	0,58%
	-1,77	*-0,50*	*-0,76*	*-0,34*	*-0,14*	*0,60*
12 B-S	1,69%	0,95%	0,55%	-0,07%	-0,10%	0,18%
	1,28	*0,65*	*0,43*	*-0,05*	*-0,07*	*0,14*
24 Buy	-1,05%	-1,10%	-0,62%	-0,28%	-0,45%	0,78%
	-0,95	*-0,92*	*-0,40*	*-0,19*	*-0,31*	*0,60*
24 Sell	-0,53%	-1,08%	-0,65%	-0,11%	0,06%	0,60%
	-0,47	*-0,99*	*-0,63*	*-0,11*	*0,07*	*0,79*
24 B-S	-0,52%	-0,02%	0,03%	-0,17%	-0,51%	0,18%
	-0,41	*-0,02*	*0,03*	*-0,13*	*-0,45*	*0,15*

2002-2006	MSCI	Finland:	0,28%	St dev:	9,66%	
J	K1	K3	K6	K9	K12	K24
1 Buy	-2,24%	0,02%	0,61%	1,05%	1,19%	0,83%
	-1,26	*0,01*	*0,54*	*0,95*	*1,23*	*0,74*
1 Sell	1,83%	0,86%	1,09%	1,11%	1,05%	0,68%
	2,07	*0,90*	*1,00*	*1,06*	*0,97*	*0,57*
1 B-S	-4,07%	-0,84%	-0,48%	-0,06%	0,14%	0,15%
	-2,78	*-0,88*	*-0,47*	*-0,06*	*0,14*	*0,17*
3 Buy	-0,95%	0,70%	0,86%	1,07%	1,29%	0,66%
	-0,63	*0,50*	*0,72*	*0,95*	*1,42*	*0,55*
3 Sell	1,03%	0,70%	0,85%	1,16%	0,77%	0,64%
	1,12	*0,63*	*0,74*	*0,88*	*0,60*	*0,47*
3 B-S	-1,98%	0,00%	0,01%	-0,09%	0,52%	0,03%
	-1,51	*0,00*	*0,01*	*-0,07*	*0,50*	*0,03*
6 Buy	-1,36%	0,71%	1,11%	1,50%	1,46%	0,79%
	-0,77	*0,55*	*1,01*	*1,39*	*1,94*	*0,58*
6 Sell	0,95%	0,77%	0,75%	0,66%	0,60%	0,75%
	0,90	*0,64*	*0,61*	*0,50*	*0,40*	*0,51*
6 B-S	-2,32%	-0,06%	0,36%	0,84%	0,87%	0,04%
	-1,59	*-0,05*	*0,32*	*0,67*	*0,69*	*0,03*
9 Buy	-0,65%	0,97%	1,39%	1,49%	1,45%	0,65%
	-0,38	*0,77*	*1,35*	*1,45*	*2,26*	*0,40*
9 Sell	0,86%	0,31%	0,33%	0,39%	0,39%	1,07%
	0,81	*0,24*	*0,25*	*0,27*	*0,25*	*0,91*
9 B-S	-1,52%	0,66%	1,05%	1,10%	1,06%	-0,42%
	-0,96	*0,50*	*0,83*	*0,82*	*0,82*	*-0,30*
12 Buy	1,52%	1,83%	1,62%	1,65%	1,39%	0,37%
	1,65	*1,96*	*2,08*	*2,12*	*2,19*	*0,22*
12 Sell	0,22%	0,10%	0,24%	0,55%	0,58%	1,22%
	0,21	*0,08*	*0,17*	*0,33*	*0,35*	*1,11*
12 B-S	1,30%	1,72%	1,39%	1,10%	0,80%	-0,84%
	1,43	*1,54*	*1,17*	*0,77*	*0,60*	*-0,57*
24 Buy	1,54%	1,91%	1,55%	1,43%	1,36%	0,76%
	2,18	*2,35*	*2,26*	*2,45*	*2,08*	*0,59*
24 Sell	0,99%	1,07%	1,23%	1,28%	1,25%	1,38%
	0,86	*0,89*	*0,89*	*0,90*	*0,92*	*1,74*
24 B-S	0,55%	0,84%	0,31%	0,14%	0,11%	-0,61%
	0,55	*0,86*	*0,28*	*0,12*	*0,10*	*-0,59*

Appendix 4c: Subsample (1994-1998, 1998-2002 and 2002-2006) of the Norwegian stock market. For explanation of terminology see Appendix 2c.

1994-1998	MSCI	Norway:	0,98%	St dev	4,79%	
J	K1	K3	K6	K9	K12	K24
1 Buy	1,81%	1,99%	2,18%	2,17%	2,08%	1,60%
	2,46	*2,48*	*2,45*	*2,34*	*2,12*	*1,42*
1 Sell	1,61%	0,81%	1,05%	1,23%	1,54%	1,92%
	2,27	*1,08*	*1,32*	*1,62*	*1,97*	*1,69*
1 B-S	0,21%	1,18%	1,13%	0,95%	0,54%	-0,32%
	0,30	*1,71*	*1,18*	*1,01*	*0,62*	*-0,29*
3 Buy	-0,31%	1,35%	1,60%	1,93%	2,31%	1,91%
	-0,25	*1,46*	*1,87*	*2,34*	*2,55*	*2,23*
3 Sell	1,55%	1,64%	1,42%	1,75%	1,71%	1,93%
	2,50	*2,08*	*2,10*	*2,20*	*2,11*	*2,36*
3 B-S	-1,87%	-0,29%	0,18%	0,18%	0,59%	-0,02%
	-1,64	*-0,33*	*0,28*	*0,23*	*0,83*	*-0,03*
6 Buy	-0,13%	1,40%	2,08%	2,17%	2,33%	1,91%
	-0,11	*1,66*	*2,44*	*2,55*	*2,87*	*2,33*
6 Sell	1,30%	1,08%	1,93%	1,52%	1,72%	2,01%
	2,20	*1,60*	*1,60*	*1,96*	*2,11*	*2,22*
6 B-S	-1,42%	0,32%	0,15%	0,65%	0,61%	-0,09%
	-1,33	*0,44*	*0,15*	*1,03*	*1,15*	*-0,11*
9 Buy	2,85%	2,92%	2,72%	2,47%	2,34%	1,74%
	3,41	*3,02*	*2,76*	*2,14*	*2,25*	*1,60*
9 Sell	0,73%	0,67%	1,05%	1,17%	1,53%	2,12%
	1,06	*0,82*	*1,43*	*1,63*	*1,74*	*1,90*
9 B-S	2,12%	2,25%	1,68%	1,30%	0,81%	-0,37%
	2,60	*2,19*	*1,83*	*1,22*	*0,86*	*-0,36*
12 Buy	3,22%	2,93%	2,77%	2,45%	2,01%	1,60%
	3,60	*2,70*	*2,41*	*2,04*	*2,05*	*1,42*
12 Sell	0,40%	0,37%	0,91%	1,34%	1,71%	1,92%
	0,63	*0,55*	*1,36*	*1,75*	*1,76*	*1,69*
12 B-S	2,82%	2,56%	1,86%	1,11%	0,30%	-0,32%
	2,91	*2,53*	*1,67*	*0,96*	*0,29*	*-0,29*
24 Buy	2,32%	2,03%	1,94%	1,90%	1,56%	1,61%
	2,70	*2,14*	*1,92*	*1,72*	*1,55*	*1,82*
24 Sell	0,87%	0,76%	1,20%	1,21%	1,41%	1,97%
	1,23	*0,86*	*1,33*	*1,49*	*1,75*	*2,11*
24 B-S	1,45%	1,27%	0,74%	0,69%	0,14%	-0,36%
	1,52	*1,20*	*0,81*	*0,79*	*0,18*	*0,28*

1998-2002	MSCI	Norway:	0,32%	St dev	7,06%	
J	K1	K3	K6	K9	K12	K24
1 Buy	-3,13%	-1,57%	-1,00%	-0,68%	-0,41%	1,06%
	-4,25	*-1,44*	*-0,90*	*-0,54*	*-0,35*	*0,89*
1 Sell	-0,34%	-1,22%	-1,29%	-0,65%	-0,43%	0,26%
	-0,48	*-1,01*	*-1,06*	*-0,55*	*-0,35*	*0,26*
1 B-S	-2,79%	-0,35%	0,29%	-0,03%	0,02%	0,79%
	-4,05	*-0,41*	*0,37*	*-0,04*	*0,02*	*0,53*
3 Buy	-2,08%	-0,24%	-0,34%	-0,07%	0,03%	0,93%
	-1,42	*-0,16*	*-0,30*	*-0,06*	*0,03*	*0,72*
3 Sell	-1,23%	-1,57%	-1,54%	-0,90%	-0,50%	0,63%
	-0,87	*-1,15*	*-1,21*	*-0,71*	*-0,46*	*0,93*
3 B-S	-0,85%	1,33%	1,19%	0,82%	0,54%	0,30%
	-0,54	*0,99*	*1,11*	*0,77*	*0,53*	*0,27*
6 Buy	-0,56%	0,25%	0,36%	0,06%	0,04%	1,02%
	-0,40	*0,19*	*0,26*	*0,04*	*0,03*	*0,77*
6 Sell	-1,91%	-1,91%	-0,99%	-0,99%	-0,59%	0,50%
	-1,30	*-1,37*	*-0,70*	*-0,84*	*-0,60*	*0,86*
6 B-S	1,35%	2,16%	1,34%	1,05%	0,64%	0,52%
	0,92	*1,70*	*1,12*	*0,95*	*0,55*	*0,45*
9 Buy	-0,08%	-0,09%	-0,33%	-0,24%	-0,12%	1,21%
	-0,06	*-0,07*	*-0,24*	*-0,16*	*-0,08*	*0,90*
9 Sell	-1,50%	-1,66%	-1,24%	-0,92%	-0,67%	0,01%
	-1,17	*-1,36*	*-0,97*	*-0,80*	*-0,62*	*0,01*
9 B-S	1,42%	1,58%	0,91%	0,68%	0,54%	1,20%
	1,23	*1,65*	*0,88*	*0,54*	*0,43*	*0,83*
12 Buy	0,27%	-0,44%	-0,88%	-0,55%	-0,25%	1,06%
	0,21	*-0,32*	*-0,68*	*-0,39*	*-0,18*	*0,89*
12 Sell	-1,62%	-1,51%	-1,05%	-0,82%	-0,68%	0,26%
	-1,29	*-1,25*	*-0,80*	*-0,69*	*-0,66*	*0,26*
12 B-S	1,89%	1,07%	0,18%	0,27%	0,43%	0,79%
	1,56	*1,10*	*0,16*	*0,24*	*0,43*	*0,53*
24 Buy	-1,24%	-1,24%	-1,21%	-0,76%	-0,18%	0,92%
	-1,17	*-1,18*	*-1,20*	*-0,75*	*-0,16*	*1,18*
24 Sell	-1,03%	-1,00%	-0,84%	-0,87%	-0,44%	-0,14%
	-1,15	*-0,97*	*-0,63*	*-0,85*	*-0,44*	*-0,20*
24 B-S	-0,20%	-0,25%	-0,37%	0,11%	0,26%	1,07%
	-0,23	*-0,30*	*-0,43*	*-0,14*	*-0,35*	*1,29*

2002-2006	MSCI	Norway:	1,93%	St dev	5,87%	
J	K1	K3	K6	K9	K12	K24
1 Buy	0,82%	1,90%	1,63%	1,89%	1,62%	0,61%
	0,80	*1,44*	*1,06*	*1,12*	*0,93*	*0,30*
1 Sell	1,10%	0,99%	1,52%	1,28%	1,10%	1,14%
	0,86	*0,64*	*0,92*	*0,77*	*0,62*	*0,62*
1 B-S	-0,28%	0,91%	0,12%	0,61%	0,52%	-0,52%
	-0,26	*0,88*	*0,09*	*0,48*	*0,51*	*-0,45*
3 Buy	1,06%	1,66%	1,53%	1,83%	1,69%	0,88%
	1,16	*1,49*	*1,27*	*1,31*	*1,26*	*0,55*
3 Sell	1,64%	1,20%	1,04%	1,14%	0,97%	0,74%
	1,44	*0,93*	*0,86*	*0,84*	*0,64*	*0,45*
3 B-S	-0,59%	0,47%	0,48%	0,69%	0,72%	0,14%
	-0,67	*0,56*	*0,72*	*0,93*	*0,91*	*0,17*
6 Buy	1,76%	2,17%	2,56%	2,25%	1,93%	0,91%
	1,87	*1,95*	*1,91*	*1,80*	*1,63*	*0,55*
6 Sell	1,34%	0,73%	1,25%	0,89%	0,68%	0,84%
	1,14	*0,61*	*0,98*	*0,64*	*0,47*	*0,52*
6 B-S	0,42%	1,44%	1,32%	1,36%	1,25%	0,08%
	0,44	*1,92*	*1,74*	*1,85*	*1,68*	*0,07*
9 Buy	3,07%	2,62%	2,89%	2,58%	2,18%	0,87%
	2,72	*2,01*	*1,97*	*1,65*	*1,41*	*0,39*
9 Sell	0,26%	-0,34%	0,21%	0,89%	0,88%	1,24%
	0,20	*-0,23*	*0,11*	*0,47*	*0,45*	*0,70*
9 B-S	2,81%	2,96%	2,68%	1,69%	1,30%	-0,38%
	2,78	*2,94*	*2,16*	*1,29*	*1,15*	*-0,30*
12 Buy	2,86%	2,65%	2,71%	2,29%	1,85%	0,61%
	2,49	*2,07*	*2,05*	*1,56*	*1,23*	*0,30*
12 Sell	0,03%	0,35%	0,43%	0,82%	0,88%	1,14%
	0,03	*0,22*	*0,24*	*0,45*	*0,46*	*0,62*
12 B-S	2,83%	2,29%	2,28%	1,47%	0,97%	-0,52%
	2,75	*1,87*	*2,11*	*1,19*	*0,80*	*-0,45*
24 Buy	1,85%	1,80%	1,71%	1,49%	1,28%	0,61%
	1,94	*1,57*	*1,43*	*1,07*	*0,84*	*0,32*
24 Sell	0,21%	1,18%	0,96%	0,92%	1,11%	1,41%
	0,21	*0,80*	*0,58*	*0,55*	*0,61*	*0,77*
24 B-S	1,65%	0,62%	0,74%	0,56%	0,17%	-0,80%
	2,28	*0,66*	*0,89*	*0,75*	*0,10*	*0,86*

Appendix 4d: Subsample (1994-1998, 1998-2002 and 2002-2006) of the Swedish stock market. For explanation of terminology see Appendix 2d.

1994-1998	MSCI	Sweden	2,06%	St dev	5,05%	
J	K1	K3	K6	K9	K12	K24
1 Buy	1,29%	1,75%	1,85%	1,90%	2,39%	2,31%
	1,89	*2,43*	*2,37*	*2,07*	*1,78*	*1,67*
1 Sell	1,42%	1,04%	1,60%	1,90%	1,95%	2,24%
	1,95	*1,34*	*2,09*	*1,86*	*1,81*	*1,52*
1 B-S	-0,14%	0,71%	0,25%	0,00%	0,43%	0,07%
	-0,24	*1,11*	*0,41*	*0,00*	*0,41*	*0,06*
3 Buy	1,65%	1,67%	2,07%	2,11%	2,54%	2,28%
	2,12	*2,11*	*2,47*	*2,43*	*1,87*	*1,72*
3 Sell	0,61%	1,15%	1,38%	1,62%	1,71%	2,28%
	0,86	*1,48*	*1,89*	*1,84*	*1,77*	*1,48*
3 B-S	1,03%	0,52%	0,68%	0,49%	0,83%	0,00%
	1,44	*0,78*	*1,24*	*0,65*	*0,90*	*0,00*
6 Buy	1,98%	1,99%	2,21%	2,32%	2,48%	2,10%
	2,60	*2,48*	*2,43*	*2,48*	*2,14*	*1,75*
6 Sell	0,80%	1,10%	1,66%	1,64%	1,84%	2,42%
	1,06	*1,33*	*1,98*	*1,72*	*1,60*	*1,35*
6 B-S	1,18%	0,89%	0,56%	0,69%	0,64%	-0,33%
	1,58	*1,16*	*0,95*	*1,05*	*0,86*	*-0,26*
9 Buy	1,89%	2,03%	2,26%	2,32%	2,47%	2,09%
	2,28	*2,23*	*2,51*	*2,75*	*2,27*	*1,88*
9 Sell	1,36%	1,27%	1,35%	1,49%	1,83%	2,35%
	1,97	*1,79*	*1,81*	*1,55*	*1,38*	*1,37*
9 B-S	0,53%	0,77%	0,91%	0,82%	0,64%	-0,26%
	0,70	*1,09*	*1,43*	*1,34*	*0,95*	*-0,25*
12 Buy	2,13%	2,12%	2,13%	2,22%	2,38%	2,04%
	2,43	*2,33*	*2,59*	*2,99*	*2,12*	*1,91*
12 Sell	1,23%	1,10%	1,34%	1,56%	1,94%	2,37%
	1,82	*1,49*	*1,68*	*1,61*	*1,41*	*1,50*
12 B-S	0,90%	1,02%	0,79%	0,65%	0,44%	-0,33%
	1,15	*1,38*	*1,15*	*1,03*	*0,69*	*-0,29*
24 Buy	1,70%	1,92%	2,01%	1,96%	1,89%	1,76%
	2,20	*2,76*	*2,96*	*3,45*	*3,20*	*3,04*
24 Sell	0,36%	0,91%	1,01%	1,17%	1,53%	1,34%
	0,52	*1,32*	*1,41*	*1,50*	*1,42*	*1,15*
24 B-S	1,33%	1,00%	1,00%	0,79%	0,36%	0,41%
	2,28	*1,57*	*1,40*	*0,97*	*0,37*	*0,37*

1998-2002	MSCI	Sweden	1,01%	St dev	8,74%	
J	K1	K3	K6	K9	K12	K24
1 Buy	-1,81%	-0,37%	0,67%	0,33%	0,37%	1,23%
	-2,66	*-0,19*	*0,28*	*0,18*	*0,23*	*0,85*
1 Sell	1,15%	-0,95%	-0,77%	-0,48%	-0,10%	1,10%
	1,58	*-0,56*	*-0,43*	*-0,27*	*-0,06*	*1,25*
1 B-S	-2,96%	0,58%	1,44%	0,80%	0,47%	0,13%
	-5,23	*0,41*	*0,89*	*0,60*	*0,37*	*0,10*
3 Buy	1,32%	1,58%	1,78%	0,86%	0,88%	1,50%
	0,61	*0,75*	*0,79*	*0,53*	*0,51*	*0,82*
3 Sell	0,52%	-1,21%	-1,37%	-0,52%	0,02%	1,03%
	0,27	*-0,67*	*-0,78*	*-0,29*	*0,02*	*1,49*
3 B-S	0,80%	2,79%	3,16%	1,38%	0,86%	0,47%
	0,37	*1,67*	*2,15*	*1,05*	*0,60*	*0,28*
6 Buy	1,51%	1,57%	1,68%	0,95%	0,90%	1,49%
	0,92	*0,93*	*0,80*	*0,56*	*0,47*	*0,78*
6 Sell	-1,22%	-1,98%	-0,86%	-0,33%	-0,04%	1,01%
	-0,66	*-1,16*	*-0,46*	*-0,18*	*-0,03*	*1,30*
6 B-S	2,73%	3,56%	2,54%	1,28%	0,95%	0,48%
	1,59	*2,28*	*1,60*	*0,81*	*0,53*	*0,28*
9 Buy	1,11%	0,67%	0,98%	0,43%	0,63%	1,43%
	0,69	*0,39*	*0,49*	*0,24*	*0,30*	*0,81*
9 Sell	-0,92%	-1,14%	-0,57%	-0,32%	0,03%	0,94%
	-0,51	*-0,65*	*-0,32*	*-0,21*	*0,02*	*1,36*
9 B-S	2,03%	1,82%	1,54%	0,75%	0,60%	0,49%
	1,26	*1,19*	*1,04*	*0,45*	*0,33*	*0,30*
12 Buy	1,20%	0,62%	0,59%	0,64%	0,56%	1,34%
	0,69	*0,34*	*0,30*	*0,29*	*0,25*	*0,80*
12 Sell	-1,16%	-1,43%	-0,01%	0,13%	0,43%	0,79%
	-0,66	*-0,94*	*0,00*	*0,08*	*0,35*	*1,14*
12 B-S	2,36%	2,05%	0,59%	0,51%	0,13%	0,55%
	1,54	*1,36*	*0,39*	*0,27*	*0,07*	*0,34*
24 Buy	0,27%	0,35%	0,14%	0,18%	0,45%	1,05%
	0,20	*0,23*	*0,08*	*0,11*	*0,27*	*0,85*
24 Sell	-2,78%	-2,17%	-1,58%	-0,81%	-0,21%	0,52%
	-3,09	*-2,30*	*-1,56*	*-0,88*	*-0,27*	*0,81*
24 B-S	3,05%	2,51%	1,71%	0,99%	0,66%	0,53%
	2,88	*2,12*	*1,42*	*0,77*	*0,54*	*0,45*

2002-2006	MSCI	Sweden	1,04%	St dev	6,72%	
J	K1	K3	K6	K9	K12	K24
1 Buy	-0,79%	0,64%	1,15%	1,17%	1,13%	0,48%
	-0,69	*0,47*	*0,81*	*0,75*	*0,71*	*0,28*
1 Sell	4,26%	1,66%	1,54%	1,25%	0,86%	0,66%
	3,20	*1,21*	*1,01*	*0,77*	*0,51*	*0,34*
1 B-S	-5,05%	-1,03%	-0,39%	-0,08%	0,27%	-0,18%
	-3,82	*-0,83*	*-0,37*	*-0,08*	*0,27*	*-0,18*
3 Buy	0,40%	1,12%	1,48%	1,63%	1,52%	0,81%
	0,39	*0,86*	*0,95*	*0,96*	*0,93*	*0,49*
3 Sell	4,10%	1,99%	1,47%	1,29%	1,00%	0,63%
	2,49	*1,24*	*0,90*	*0,77*	*0,56*	*0,29*
3 B-S	-3,70%	-0,87%	0,00%	0,35%	0,52%	0,18%
	-2,28	*-0,68*	*0,00*	*0,30*	*0,39*	*0,14*
6 Buy	1,30%	1,59%	2,08%	2,06%	1,95%	0,88%
	1,27	*1,31*	*1,34*	*1,30*	*1,21*	*0,52*
6 Sell	2,75%	1,26%	1,30%	1,22%	0,85%	0,63%
	1,92	*0,84*	*0,81*	*0,65*	*0,46*	*0,31*
6 B-S	-1,46%	0,33%	0,78%	0,84%	1,11%	0,25%
	-1,15	*0,34*	*0,84*	*0,77*	*0,94*	*0,17*
9 Buy	2,14%	2,07%	2,47%	2,22%	2,02%	0,74%
	2,26	*1,77*	*1,81*	*1,56*	*1,48*	*0,39*
9 Sell	2,12%	1,17%	1,27%	1,09%	0,83%	0,96%
	1,34	*0,79*	*0,74*	*0,61*	*0,43*	*0,52*
9 B-S	0,02%	0,89%	1,20%	1,13%	1,18%	-0,22%
	0,02	*0,90*	*1,12*	*1,10*	*1,05*	*-0,14*
12 Buy	1,85%	2,21%	2,63%	2,33%	2,11%	0,63%
	2,26	*2,22*	*2,14*	*1,96*	*1,88*	*0,31*
12 Sell	2,59%	1,38%	1,35%	1,36%	0,82%	1,22%
	1,85	*0,87*	*0,75*	*0,69*	*0,43*	*0,62*
12 B-S	-0,75%	0,84%	1,28%	0,98%	1,29%	-0,58%
	-0,64	*0,68*	*1,01*	*0,75*	*1,05*	*-0,33*
24 Buy	1,87%	2,20%	1,99%	1,82%	1,62%	0,37%
	2,87	*2,92*	*2,36*	*2,09*	*1,59*	*0,20*
24 Sell	-0,58%	-0,42%	-0,01%	0,16%	0,28%	0,81%
	-0,57	*-0,31*	*0,00*	*0,12*	*0,20*	*0,55*
24 B-S	2,44%	2,62%	1,99%	1,65%	1,34%	-0,44%
	3,39	*2,70*	*2,51*	*2,10*	*1,81*	*-0,36*