Momentum strategies
Empirical evidence from the Swedish stock market

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Abstract

**Title:** Momentum Strategies – Empirical evidence from the Swedish stock market

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**Subject:** Finance, Business Administration

**Background:** This study is based on the study of Jegadeesh and Titman (1993, 2001) which found evidence of successful trading strategies which yielded significant positive abnormal returns by exploiting a momentum pattern in stock prices.

**Purpose:** Contribute with empirical results to the discussions of efficient markets, momentum effects and behavioral finance by providing evidence from the Swedish stock market between the years 1998 and 2013.

**Method:** Stocks are ranked by their performance in the past 3, 6, 9- or 12 months. The top decile of the stocks are labeled the Winners portfolio. The bottom decile of the stocks are labeled Losers portfolio. The strategy is utilized by taking a long position in the Winners portfolio and a short position in the Loser portfolio for K months.

**Empirical foundation:** Stock prices of the companies listed on OMX Stockholm

**Conclusion:** There exists a Momentum Effect on the Swedish stock market. The utilization of momentum strategies yields significant positive abnormal returns. The Efficient Market Hypothesis is a model which might hold in the long-term, but shows limitations in the short-term. The implications of the results of this study are that short-term investor behavior and momentum profits could be partially explained by behavioral finance models but the origin of the momentum profits need to be further evaluated.

**Key-words:** Momentum Effect, Momentum Strategies, Trading Strategies, Efficient Market Hypothesis, Behavioral Finance
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I Introduction

The introduction chapter will present the topic of the study, discuss the problem of the topic which will culminate into a specific research question and the purpose of the study.

1.1 Background

Since the beginning of mankind, people are trying to improve their physical wealth. The stock market like we know it today took its form during the Industrial Revolution. Due to the huge leaps of science during the industrialization, everything else began to expand with the same velocity and strides. The corporate world was also moved by these events and that was the moment when the shape of the individual investor began to develop. The banks started to play its role as an intermediary (Bencivenga, 1991). The firms could not be financed only by themselves. Pushed by the need for money to finance the building of bigger factories, to set up more complicated business relationships and to implement more sophisticated machinery, the development of financial instruments and financial operations started. In other words the financial market as we know it today took its form.

The purpose of the capital market in general, is to link the ideas of entrepreneurs with the capitals of people who want to invest. It provides movement of money between economic actors and helps to finance the economy. It also creates opportunities to invest the idle funds of the population by carrying out transactions with derivatives securities. Investment in stocks, as any other investment, is made in order to obtain a profit (or to obtain ownership), in a long or short term. The basic ways to make a profit by investing in stocks are to get a return in the form of dividends or capital gains. That is when the question arises: How do we select which stocks to invest in? Choosing a stock to invest in and the way to conduct a trade process cannot be defined as a precise strategy. There is a certain set of criteria an investor should be aware of when picking stocks to invest in, but there is no exact way to implement it. A lot of the information, which the individual investor needs to know in order to make a proper analysis, is too difficult to be measured or to even be found to an individual investor. Individuals, contrary to all the assumptions of the economic and financial theories, are not rational and therefore the way they react to changes in the economical environment cannot be known (a new theory which takes the irrationalism of the individuals into account is the Behavioral Finance (Fromlet, 2001)). That is why many researchers have developed different theories and strategies on how to invest and construct the portfolio, in order to reach the sought rate of return. The theories are based on different assump-
tions and approaches. The actors in the financial markets can use the theories to choose the stocks which correspond the best way to their preferences, positions to risk exposure and believe.

Between 1960 and 1966, the standard form of Capital Asset Pricing Model (CAPM) was developed independently by Jack Treynor, William Sharpe, John Lintner and Jan Mossin. Elton et. al. (2011) describes it as the leading equilibrium model for asset returns until today. It suggests a linear relationship between return of an asset and its riskiness. The risk of an asset is divided into systematic risk and unsystematic risk. The unsystematic risk can be diversified away by holding a large number of securities and therefore should no investor be exposed to it. The systematic risk is the individual stock’s relationship to the market, which cannot be diversified away. A conclusion of the CAPM is as Mossin (1966) suggests that, for a given risk-free rate, the optimal portfolio to hold for any possible return at the lowest level of risk is the market portfolio. It should be impossible to an investor to earn higher (abnormal) returns without increasing the risk of the portfolio.

In 1961 Alexander Sidney published the first proof of a trading strategy that outperformed the buy and hold strategy of the market portfolio. The strategy would not outperform the buy and hold strategy if transaction cost would be accounted for, but it raised the interest for trading strategies which led to further tests of possible strategies that could earn abnormal returns.

In the year 1970, Eugene Fama published the model which would become until today the leading theory of how financial markets work and absorb information, the Efficient Market Hypothesis. It suggested that markets are different degrees of efficient, that the prices follow a “random walk” (later rejected by LeRoy (1973) and Lucas (1978)) and at all times do they fully reflect all available information. By this logic it should be impossible to consistently beat the market since a trading strategy would suggest that there are abnormal returns to be made because of a pattern in the price development or mispriced stocks.

The term “Momentum Effect” is in the short-term perspective the tendency of an asset, which has been rising, to rise further and of an asset which has been falling, to fall further. The term is in the long-term perspective the tendency of an asset which has been falling to start rising and of an asset which has been rising to start falling. This is also labeled a “mean-reverting behavior” (Shiller, 2003). De Bondt and Thaler (1985) were the first to document and utilize a long-term type of “momentum effect”. The type strategy they were
testing is called contrarian strategies which in simple terms are described as buying stocks with past low returns and sell stocks with past high returns. The results were a confirmation of their hypothesis of short-term overreaction to news at the stock market. Jegadeesh and Titman (1993) were the first to document and utilize a short-term type of momentum effect. The evidence they found would become a starting point and basis for similar tests as well as questioning of the Efficient Market Hypothesis. Their findings would also make room for the development of a new topic in finance, “Behavioral Finance”, which tries to explain why the patterns that Jegadeesh and Titman (1993) and many other have found occur.

1.2 Problem discussion

Important studies have been made and models have been developed in order to provide investors with the tools for utilizing information and risk-controlling to select stocks to construct the portfolios which suit the preferences of the investors. Such models are The Capital Asset Pricing Model and later the Fama-French Three-Factor Model.

The Efficient Market Hypothesis suggests that markets are of different degree efficient and that the stock prices at all times fully reflect all available information. By this logic, any predictable pattern in the stock prices could not exist. Consequently, a trading strategy that beats the market by exploiting such pattern could not exist. To clarify, a pattern and a trading strategy which exploits that pattern would imply that there are abnormal returns to be earned because of a pattern in the price development of securities or that the stocks are mispriced, both are contradictions to the theory.

Sidney (1961), De Bondt and Thaler (1985) and Jegadeesh and Titman (1993) are all highly cited academic papers that found exploitable patterns in the security prices. This either questions the assumption that security prices behaves as a random walk or that markets are even the weakest form of efficient in practice. Another perspective is that the “Efficient Market Hypothesis” holds in theory, but that the actual behavior, of individual investors on the market, should be explained by behavioral finance.

Fama (1970) explains the role of the capital markets as; allocation of the economy´s capital stock. In the ideal market, the prices of the securities should provide signals for resource allocation under the assumption that security prices fully reflect all available information. But if the prices do not reflect all available information, then this implies that it might lead to
inaccurate allocation of resources in practice through incorrect decisions, based on the interpretations of the signals that security prices are supposed to provide.

Critics like Malkiel (2003) expresses skepticism against the documented pattern by pointing out the lack of robustness. By lack of robustness he means that; if there ever existed a pattern that would allow investors to earn abnormal returns based on historical observations, as soon as it is discovered and published, it will disappear. The study of Jegadeesh and Titman (1993) is based on a sample of stock prices between 1965 and 1989. The subsequent study of Jegadeesh and Titman (2001) is based on a subsequent sample of stock prices between 1990 and 1998. The results are similar and provide proof of the robustness of the pattern, which by extension casts doubt on the statement of Malkiel (2003). The contradictions between the empirical results and the provided explanations to them referring to the theory, leaves a void in the understanding of security price dynamics. If the empirical results are consistent over time, then either the theory of efficient markets has to be revised or the observed patterns should be explained by behavioral finance.

The trading strategies and the theoretical models that researchers have developed are contradictory to each other and mutually exclusive. That is the reason that debates arise, questioning the theoretical models relevance for reality. Thus, we ask ourselves; is the trading strategy of exploiting the momentum effect by buying winners and selling losers still a valid strategy to earn positive abnormal returns, as the authors argue in Jegadeesh (1993), or is the financial market efficient, making historical information useless as according to the “Efficient Market Hypothesis” of Fama (1970).

1.3 Research question

- Does a “momentum effect” exist on the Swedish stock market between 1998 and 2013?

- Does the utilization of the momentum effect through buying past winners and selling past losers generate significant positive abnormal returns on the Swedish stock market?

- What implications do the significant positive abnormal returns for existing theory?
1.4 Purpose

The main purpose of the study is to contribute with empirical results from the Swedish stock market to the discussions of efficient markets, momentum effects and behavioral finance. The secondary purpose is to generate further evidence of the existence or non-existence of trading strategies that generates significant positive abnormal returns. The study contributes with empirical results which lead to implications for existing theories as well as further evidence to previous empirical results. The study will contribute to expand the knowledge of investors in general, researchers of the area of financial markets and scholars of the area of behavioral finance.

1.5 Limitations

The study is performed on the Swedish stock market. The period of time that the data is collected from is from 1998 until 2013. Because of the limited time-frame the study has to be restricted to one area and the data collection has to be restricted to a limited period of time. Transaction costs and other costs that are related to trading of stocks are not accounted for in this study.
2 Theoretical framework

The theoretical framework will present the most important theories and previous academic work regarding the Efficient Market Hypothesis, the Momentum Effect and Behavioral Finance.

2.1 Efficient Market Hypothesis

Fama (1970) was first to formulate the theory of the Efficient Market Hypothesis in the Journal of Finance. The role of the capital markets is described as allocation of the economy’s capital stock. In the ideal market, the prices of the securities should provide signals for resource allocation under the assumption that security prices fully reflect all available information. The theory is originally based on three models, the Fair Game model, Submartingale model and the Random Walk model, together with three conditions. The models and conditions which the Efficient Market Hypothesis is based upon are presented below in the subchapters.

2.1.1 Models and sufficient conditions of the Efficient Market Hypothesis

In the theory behind the Efficient Market Hypothesis, Fama (1970) first uses “Fair Game” models which states that the equilibrium expected return on a security is a function of its risk. This fact means that an increase in expected return could only derive from an equivalent increase in risk. Second Fama (1970) uses the Submartingale model which states that next periods price of an asset should be equal to or greater than the current price, ceteris paribus, given a growing economy. In other words, this model is the explanation of the on average positive yield that the stock market through period of times always produces and how the returns of a stock is related to the return of the market. The third model Fama (1970) use is the Random Walk model. The Random Walk model states that security prices behave as a random walk. The successive security returns are independent and identically distributed over time (Elton et. al., 2011). The returns cannot be predicted in advance and are explained by the release of new information (Fama, 1970). The logic behind it is; if the flow of information to all participants holds and the information is immediately reflected in the stock price, then tomorrow’s price change will reflect tomorrow’s information, independent of today’s price change. News are unpredictable which makes the price changes random (Malkiel, 2003). Fama (1970) states that the Random Walk model, which the Efficient Market Hypothesis is partly based upon is valid, as long as historical information cannot be used to make the expected profit greater than they would be under a buy and hold
model. However, the Random Walk Model is proven neither to be a valid model for explaining stock price behavior nor a sufficient condition for the Efficient Market Hypothesis to hold. Chapter 2.1.3 gives further insight to the previous statement.

Fama (1970) states that there are some “sufficient conditions” for a capital market to be efficient and reflect all available information. The first, there are no transaction costs when trading securities. The second, all information is available for all market participants without any costs. The third, all agree on the implication of current information for the current price and distributions of future prices of each security. By assuming the three conditions the market becomes frictionless. In practice though, the markets will not fully meet the conditions. Fama (1970) states that even if the conditions are sufficient they are not necessary, if a large number of investors have access to all available information.

2.1.2 Forms of efficient markets

Since there is no market that could fully meet the conditions for an efficient market, Fama (1970) categorizes the market into three different forms of markets; weak, semi-strong and strong form. The form of the market is distinguished by the level of information at which the hypothesis breaks down.

Fama (1970) stresses that the “Fair Game” model implies, that it is impossible to make an abnormal return using a trading system. A trading system implies that there is an abnormal return to be made based on historical prices, which should be impossible since all historical information already is taken into account in the current security price. The stock prices do not follow any pattern according to the Random Walk model and should be statistically independent. Fama (1970) describes the semi-strong form market efficiency as whether current security prices fully reflect both historical information and all publicly available information. The theory states that, if new information enters the market, all participants act rationally and interprets the information immediately and in the same way. Hence, it is impossible to make an abnormal return using publicly available information since security prices immediately adapt to the new information. Fama (1970) describes the strong form of market efficiency as whether current security prices fully reflect historical, public and private information. In a market with this form of efficiency should abnormal returns due to access to private information being impossible to achieve. Fama (1970) states that the strong form of efficiency is purely theoretical and does probably not exist in practice.
2.1.3 For and against the Efficient Market Hypothesis

As previously stated, a defender of the Efficient Market Hypothesis (EMH) and a pioneer in the field is Burton G. Malkiel. In his work, A Random Walk Down Wall Street, he states that the market adjusts to any information with such a velocity that it is impossible to create any buy and hold strategy, regardless if it is constructed on the grounds of fundamental or technical analysis. The author continues with the following claim:

“A blindfolded monkey throwing darts at a newspapers financial pages could select a portfolio that would do just as well as one carefully selected by the expert.” (Malkiel, 1985, pp. 194)

Shostak (1997) points out various problems with the EMH’s framework. For him, the biggest issue comes from the assumption that the individuals have the same expectations for the future stock returns. That would mean that an individual who has a short position on a given stock will have the same expectations for it, as someone who has the long position. The logic is questionable since, the seller expects the stock price to fall and the buyer expects the stock price rise. Another side of the problem would be that all individuals are assumed to have the same access to information, which even if true, also would mean that all individuals interpret the information homogenously. Shostak (1997) points out that all individuals cannot have the same knowledge. Hence-Herman Hoppe (1997) offers a philosophical approach by saying that if everyone in the world would possess the same knowledge, there would be no need to communicate. The fact that individuals do communicate, demonstrates that the individuals do not possess the same knowledge. That difference will by extension affect the individuals’ forecasts according to Hance-Herman Hoppe (1997). Another shortcoming with the EMH that Shostak (1997) points out is that the EMH presents the financial markets as independent from the real world, while they actually are not. The individuals and their reactions are the determinatives of a stocks tendency to rise or fall in value. Regarding the opinion of Malkiel, that there is no difference between any buy and hold strategy, Shostack (1997) points out the words of Pasour (1989) where he says that, as a long-run theory, the EMH has the shortcomings of focusing only on the outcomes equilibriums and not on the process to arrive to these outcomes.

Lo and MacKinlay (1999) mean that the link between the Random Walk Hypothesis and the Efficient Market Hypothesis is incorrect. They could though, under special circumstances, like risk neutrality, be equivalent. Lo and MacKinlay (1999) claim that financial
markets are predictable to some degree but not to a degree that rejects the efficiency or rationality of the markets. They also concludes that short-run serial correlations between stock prices are not zero and that too many successive moves are heading in the same direction which makes them reject the hypothesis that stock prices behaves as random walks. Lo and MacKinlay (1999) refers to LeRoy (1973) and Lucas (1978) when they are backing up the statement that the Random Walk Hypothesis is neither a necessary nor a sufficient condition for rational security pricing. In other words, a market with prices that not are possible to forecast do not need to imply a well-functioning market and prices that are possible to forecast do not imply that the market is not well functioning. It was demonstrated through examples of information-efficient markets where the Efficient Market Hypothesis holds but the prices do not follow random walks. The evidence of LeRoy (1973) and Lucas (1978) confirms that stock prices do not in fact behave as a random walk, but regardless of that fact, the Efficient Market Hypothesis still holds.

2.2 The momentum effect

2.2.1 Review of the previous research

De Bondt and Thaler (1985), Jegadeesh (1990) Lehman (1990) and Jegadeesh and Titman (1993) studies found evidence of profitable trading-strategies which would become starting points and basis for similar tests and questioning of the Efficient Market Hypothesis. Jegadeesh and Titman (1993) wrote that if stock prices under- or overreact to information, than trading strategies which can select stocks based on past behavior and be profitable would exist. Their trading strategy would benefit from a so called “Momentum Effect”. In Jegadeesh (1990) and Lehman (1990)’s case, the momentum effect is in the short-term is, the tendency of a security that has been rising to start falling and a security that has been rising to start falling. In Jegadeesh and Titmans (1993)’s case, the momentum effect in the medium-term time-horizon is the tendency for a security that has been rising to rise further and a security that has been falling to fall further. In De Bondt and Thaler (1985)’s case, the momentum effect in the long-term time-horizon is the tendency of a security which has been falling to start rising and of a security which has been rising to start falling. Summing up, the mutual conclusion of the pattern of a security that receives positive and unexpected information would be a rise in the price of the security, followed by a short-term reversal, which continues with a medium-term rise in the price and finally in the long-term ends in a reversal to the equilibrium price.
De Bondt and Thaler (1985) were the first to document a long-term type of momentum effect. The strategy they were testing is called contrarian strategy which in simple terms is described as buying stocks with past low returns and selling stocks with past high returns. The results are a confirmation of their hypothesis of an overreaction at the stock market. The portfolios of past losers had earned 25% more than the past winners, even though the winners were exposed to more systematic risk. They conclude their research by referring to experimental psychology which suggests that, in violation of Bayes rule, most people overreact to unexpected news events. Fama and French (1996) argues that these pricing anomalies is another form of value premium, they are more likely to do well because after 36 months they become value stock that will earn the value premium.

Jegadeesh (1990) and Lehman (1990) provide evidence of short-term reversals. Their strategy which selects stocks is based on the previous week or month generated significant abnormal returns. Jegadeesh (1993) explains that since these strategies are transaction intensive and based on short-term price movements, their apparent success might reflect the presence of short-term prices pressure or a lack of liquidity rather than an overreaction to new information. Lo and MacKinley (1990) also argue that a large amount of the abnormal returns is attributed to a delayed stock price reaction to common factors rather than to overreaction.

Jegadeesh and Titman (1993) test a strategy of a “relative strength” type, which is stock selection based on past returns. The stock selection is based on different historical information from three months to twelve months. The holding periods were also three to twelve months, yielding a total of 16 strategies. The strategies are tested at several different points in time by Jegadeesh and Titman (1993, 2001) and Chan, Lakonishok, Jegadeesh (1996). The best performing strategy was the one with a portfolio consisting of stocks that performed best the past six months and was with a holding period of six months. This is a medium-term pricing anomaly which Scouvercroft and Sefton (2005) points out as the most interesting finding of momentum anomalies. Their own research confirms the existence of the momentum effect as well as the medium-term strategy to be the most lucrative one. The results of the medium-term strategy are described as the hardest to explain with rational pricing models of all the momentum pricing anomalies. Fama and French (1996) described the findings of Jegadeesh and Titman (1993) and the existence of short-term anomalies as an embarrassment to their three-factor risk model because of the model’s failure of explaining the returns. Jegadeesh and Titman (1993) found evidence of an initial relative
strength of their portfolios, but in explaining the evidence, they reject the common interpretation of it being a result of under- and overreactions, as too simplistic. An interpretation they offer is that transactions by investors who buy past winners and sell past losers moves prices away from their long-run values temporarily and therefore causes the stock prices to overreact. The interpretation gets support from the work of De Long, Shleifer, Summers and Waldman (1990). Another explanation they offer is that the market underreacts to short-term information and overreacts to long-term information. This is based on the difference in the nature of the information connected to either the short- or long-term information.

Lo and MacKinlay (1999) are agreeing on the fact that there seems to exist some momentum effect in the short range in stock prices. Malkiel (2003) expresses his skepticism against the documented pattern by pointing out the lack of robustness. The patterns are not robust enough to create profitable investment opportunities, and if they ever were, after being discovered and published – they will not enable investors to earn excess returns. Malkiel (2003) agrees on the fact that the stock market may not be a perfect random walk but points out the importance of distinguishing a difference between statistical and economical significant results. Though the statistical dependencies seems to give evidence to momentum effect, the gains of utilizing it are so small that it is not economically viable for anyone paying transaction costs. Malkiel (2003) concludes in his article that the stock markets are far more efficient and far less predictable despite what many academic papers argue. He states that; whatever the anomalous behavior of stock prices is, it cannot be used to create a portfolio trading strategy which earns excess risk adjusted returns. Lo and MacKinlay (1999) concludes that even though lots of work has been done, improvement of the methods used and thousands of journal articles there is still no consensus between the financial economists whether financial markets are efficient or not. Shiller (2003) states in his work that it is important when analyses are made to ignore the presumption that financial markets are rational and transparent. As Malkiel (2003) points out regarding the financial markets, it will always be difficult to make strictly correct predictions. Anomalies will exists and sometimes those anomalies can even make patterns which can be predicted, but they will disappear in time.
2.2.2 The momentum effect in different markets and different time frames

In support to Jegadeesh and Titman’s (1993) study, several studies with the same methodology have been conducted for other financial markets. The evidence of a momentum effect has been found for other markets than the US market as well. After Jegadeesh and Titman made their first work on the matter in 1993, more international researchers decided to develop research papers for different markets in order to examine if the momentum strategy is valid for a wider spread of economies or if it is just a phenomena which appears only in markets with the US’ characteristics.

Roumenhorst (1998) proves that momentum strategy exhibits abnormal returns on the European stock market in medium-term too. In his research more than 2100 European firms are included from 12 European countries in the time frame between 1980 and 1995. The sample consists of the monthly returns in local currency of these firms, than they have been turned into Deutsche marks with the exchange rate from Financial Times. The author applies the methodology of Jegadeesh and Titman (1993). The results are consistent with the findings from the US market. The outperformance of the Winners portfolio is approximately 1% more than the Losers’ portfolio and this is observed for all the 12 European countries. This evidence confirms that the momentum profits from the US market are not due to chance and that the strategy works just as well for the European market as for the US market. That drives the conclusion that there are factors which correlate with these strategies, independently of the market characteristics.

In Chui et. al. (2000) the authors explore countries which are significantly different from those from the Western markets. In order to test the non-risk effects they choose eight Asian countries (Hong Kong, Indonesia, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand) with different cultural and institutional aspects. They argue that there are several main characteristics of the Eastern markets which differ from the Western ones. One of them is that, according to the findings in Hofstede (1991). Western countries are more “individualistic” than the Asian, which directly correlates with the characteristics like “conservatism” and “overconfidence”. Regarding the findings of Barberis, Shleifer, and Vishny (BSV) (1998) and Daniel, Hirshleifer, and Subrahmanyam (DHS) (1998) the latest two features are the key in the explanation of the momentum effect. The second reason is that in the Asian markets there are affiliations between a lot of the public companies, in so called corporate groups (e.g. keiretsu in Japan and chaebol in Korea). These group formations may
cause distortions due to the fact that for example one company is much stronger than the others, at a certain group and their actions support the prices of the weaker members. Also the transparency is lower so it is more difficult to evaluate them than the individual ones. This causes distortions at a behavioral level too. To test this statement the authors create two subsamples: one of independent firms and other of corporate groups. The authors point another characteristic will be the law system of the Asian countries, but as they argue, there is not a clear difference between the two systems and also there could be found plenty of differences within the European as in the Asian markets.

The conclusion they made in Chui et al. (2000) is that the same momentum effect that has been observed in the American- and the European markets, was present in the Asian market as well. Although, the profits are significant, they are not in such magnitude and persuasiveness. Also Japan, Indonesia and Korea make an exception. As in Japan the profits are small and not significant, there are not such in Korea and Indonesia. Some authors, like Kitayama, Takagi, and Matsumoto (1995), suggest explanations based on the behavioral theory. They argue that in Japan, people do not exhibit the so called “self-enhancing attribution” and that is why the momentum profits are weak (or zero). They suggest that in countries with features similar to those of Japan, the momentum effect results will be the same, exactly for the same reason.

As stated from the information above, the momentum effect was demonstrated in different markets, with the same success as at the American market. Jegadeesh and Titman (2001) offer a deeper explanation on some aspects found in the Jegadeesh and Titman (1993). Also, it defends the authors’ position against the critics which Jegadeesh and Titman (1993) received that the findings are due to data mining bias or compensation of the risk. Jegadeesh and Titman (2001) go further in their explanation of the momentum effect by testing for similarities with the behavioral financial theories, focusing mostly on the post-holding period and defending the findings of DeBondt and Thaler (1985). In the study they use the data from the subsequent years of their first paper, 1990-1998. They restrict the list of stocks by excluding the ones with a stock price at the beginning of the holding period less than 5$ and the smallest decile of NASDAQ. This is where the data differs from Jegadeesh and Titman (1993) and it is made because the authors want to ensure that their results are not caused by small and illiquid stocks or bid-ask bounce. They do this, because the paper of DeBondt and Thaler (1985) was criticized by Conrad and Kaul (1993) who argue that their results are due to the inclusion of low-priced stocks. Apart from the conclu-
sion that the momentum effect is not due to the data mining, the momentum effect is observed at the subsequent eight years as well. Jegadeesh and Timan (2001) show that the momentum profits are similar, even with the exclusion of the low priced stocks. The only distortion is presented in January, where the low-prices stocks show significant return reversals and that has the consequence that the momentum strategies have larger negative returns. But if the rest of the calendar year is observed, the over-performance of the Winners portfolios over the Losers portfolios is around 1%, either with or without the low-priced stocks. This finding is inconsistent with the results that Conrad and Kaul (1998) have found in their paper, that the long-term momentum (or contrarian) strategies, are due to the January effect.

2.3 Approaches to the Momentum Effect

There are different components which have been tested in order to evaluate their influence on the momentum profits and in the following pages they are summarized and explained.

A) Industry components

Moskowitz and Grinblatt (1999) examine the performance of the momentum effect, taking stocks from the same industry. They develop their paper similarly to the one of Jegadeesh and Titman (1993), but the difference is that they select stocks depending on industry instead of individual stocks. From the data sample they have, they divide it into 20 industries, and then they go long on the top three Winners and short on the top three Losers. The motivation behind that is to find out if the momentum results will be different from the studies before. The individual momentum strategies are most profitable for the medium-term horizon and not in short term and long-term. Moskowitz and Grinblatt (1999) find that the industry stock momentum profits are strongest at the short-term horizon and exhibit the same signs as the individual stock momentum for medium- and long-term periods. Due to the fact that most of the momentum profits disappear, the authors conclude that their appearance is due to an industry effect.

Also, the authors argue that the profits are mostly driven by the long side of the portfolio, which according to them is the opposite of the individual stock momentum, where the profits come mostly from the short side. The later observation could be a subject of different arguments, due to diverse opinions about it. Hong, Lim and Stein (2000) also suggest that most of the momentum profits for the individual momentum strategies come from the short side of the transaction. In Jegadeesh and Titman (2001) the results
they obtain is that the profits come from both sides of the strategies, the selling and the buying.

B) Factor components

In the paper of Grundy and Martin (2001) the results yielded the conclusion that neither cross-sectional differences in expected returns nor the industry factors are the main motivation of the momentum phenomena. The authors show empirical results as evidence, that the cause which drives the momentum profits is the stock-specific components. In the paper it is stated that buying past Winners and selling past Losers causes changes in the risk exposure factors, during the ranking period. Grundy and Martin (2001) suggest that once the model is adjusted to those dynamics of the risk exposure, the profits are more significant. In other words, the authors conclude that stock-specific components momentum models are much more profitable and less volatile than the ones based on the Fama-French three factor model or the ones already mentioned above, industry component or cross-sectional models.

C) Book-to-market value

In Asness (1997) the author examines the relation between the book-to-market values of the stocks and the momentum effect profits. Basically the three camps in that matter are: Fama and French (1992, 1993) who believe that the value strategies work because the value stocks present underlying risk and adjustments are made in order to compensate this risk. The second group believes that the values strategies are a consequence of constant errors in the predictions of the investors and that they do not want to hold values stocks. The third camp argues that there is not such correlation and that all the findings offered by the above mentioned groups of scientists are due to data mining. Asness (1997) points that while the momentum strategies work without a scent of a doubt, the evidence is not so complete for the volume strategies. According to him the Black (1993) results, whose beliefs support the third camp of opinions about the value strategies, are much stronger than those which hold up the opposite theories. Nevertheless, Asness (1997) does not reject either of the theories mentioned above, but realizes in his paper when examining whether the relation between value and momentum exist or not, that the relation exist, is negative and conditional. That would mean, that

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1 Lakonishok et al. (1994) and Haugen (1995) are the representatives of this camp.
the relation is not only stronger *ceteris paribus*, but the momentum observed is in general stronger for expensive (low book-to-market) and the volume holds stronger for firms with weak momentum (losers).

D) Trading volume

Further experiments by Lee and Shwaminathan (2000) show, that the past trading volume is an important feature of the relation between the price momentum and the values strategies. Also, Lee and Shwaminathan (2000) use the past trading volume to clarify the medium-term underreaction and the long-term overreaction. The results obtained in the paper show that the price and the traded volume are influenced in the same way by the same processes. The authors find several important characteristics about the importance of trading volume in future stock predictions, as for example:

- The trading volume is unlikely to be a liquidity proxy
- The high/low volume traded stocks exhibit lower/higher future returns (although for the past is vice-versa)
- The trading volume is not related to the firms size (hence, neither to the small-sized firm effect) or to the relative bid-ask spread.

Among the other findings in the paper, it is concluded that the price reversals are stronger for the low trades stocks. The momentum effect is noted until the 4th year, inconsistent with Jegadeesh and Titman (1993, 2001), where it is observed until the 12th month.

E) Analyst coverage

Another attempt to explain momentum effects is via the analyst coverage, Hong et. al. (2000) tests the gradual-information-diffusion model, developed by Hong and Stein (1999). There are several key finding in their results, among which if we hold ceteris paribus and test only the influence of the analysts' coverage, we will observe that the momentum is stronger with the low coverage stocks (and lower for the high). That can be explained by less-analyzed stocks exhibiting lower information diffusion, than the ones, which are more analyzed, and therefore it takes more time for them to revert to their “true” values.

F) Earnings momentum
Chan et al. (1996) tested if the future returns can be explained by the underreaction to the information about the past earnings news. It is noted that both past earnings and past returns can predict the future drifts in the stock prices, when one of them is tested, without changing the other. The study supports the theory that the market responds gradually to the information. It is also concluded that the momentum effect is stronger and lasts for longer time, than the earnings momentum strategy. In order to have a more sophisticated analysis the authors used three different measures for calculating the earnings surprise: standardized unexpected returns, abnormal returns around announcements of earnings and revisions of the analysts’ forecasts of earnings. Also, contrary to some of the above mentioned studies, Chan et. al. (1996) reject the possibility that momentum profits can be explained by market risk, size and book-to-market value.

G) Trading cost issue
According to Lesmond et al. (2004) the momentum profits are illusory. They argue that due to the fact that momentum strategies are in need of a high level of trading frequency, the dynamics of the strategies are followed by very high trading costs. The later argument is the cause that the momentum profits are regarded as impossible to achieve, as the authors ensure. The results from the paper show that the stocks with the highest trading volume are the ones which provide the profits.

2.3.1 Behavioral Finance Theory
The behavioral finance theory means; to study and analyze financial quantitative models developed in past decades and taking in consideration the psychological and sociological factors. By the year of 2000, many of the financial economists and statisticians started to believe that the stock prices were partially predictable. The predictability was based on stock price patterns and fundamental valuation and explained as psychological and behavioral elements. Many economists claim that the predictability could help investors to earn excess risk adjusted return. (Malkiel, 2003)

Hubert Fromlet (2001) gives in his article his view on the Behavioral Finance Theory (BFT), comparing different opinions and scientific works. He states that the BFT is an important addition to the classical and neoclassical theories, due to the fact that those theories accept the individuals or the markets as rational and fully transparent, which according to Hybert Fromlet (2001) is contradictory to real life. Weber (1999) observes: Behavioral Fi-
nance closely combines the individual behavior and the market phenomena and uses knowledge taken from both the psychological field and financial theory. Fromlet (2001) stresses the use of the word “combines”.

Fromlet (2001) summarizes the typical BFT phenomena:

- **Heuristic dealing with information**: due to the fact that information moves faster and faster, it becomes more and more complicated to analyze and process it. That is why it becomes more common in practice to use heuristic methods to deal with it. That means that the information has been interpreted mostly by intuition and that is why the results not can be very precise and sophisticated.

- **Varying availability of information**: not everyone has the same access to the same information, and not everyone has the same ability to deal with the information. That is why there is a difference between analysts who already had knowledge about certain event and those who do not.

- **Preference for certain news**: it is normal that human beings want to predict future events correctly. That is why when the analysts make forecasts for their clients and the actual results seems to be different than the predicted; the analysts refuse to make new predictions, due to attachment to the current position.

- **Differences in interpretations**: BFT deals with the different results of the same information, how the clients interpret it one way and the analysts another.

- **The psychology of sending messages**: there is a different impact on the individuals which depends of the way the information has been provided.

- **Anchoring**: expectations are often based on different surveys (GDP, inflation, etc.). When there are deviations from the average, it has a negative impact on the stock prices.

- **Representativeness**: there is a difference in the provided information, depending on who is providing it. This way someone may give more importance to certain information, than to another.

- **Overconfidence and control illusion**: as Robert Shiller (2000) explains it: “people think they know more than they do”. The control illusion is the same; individuals think they can control certain situations in which they actually have no influence.

- **Disposition effect**: the phenomena when individuals are “selling winners too early and riding losers too long”, Shefrin and Statman (1985). That is often explained by the attachment the individuals have with their current stocks
- **Home bias**: operating in the market of your own country, this is not due to rational reasons. Although Fromlet (2001) states that this phenomenon is losing weight, due to the globalized world we are living in.

- **Following the herd**: new investors are attracted of good performance of other investors which is repeated.

Jegadeesh and Titman (2001) refers to behavioral models in their article as an explanation to momentum effects. Their work is related to the papers of Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999), where the authors are getting to the conclusion that the post-holding period returns should be negative, using behavioral models. Continuing with the explanation of the momentum effect by using behavioral finance theory, Malkiel (2003) supports the theory that the momentum effect seems more and more realistic, as the opposite of randomness. He refers to the behavioralists who are explaining the short-term momentum patterns with the lack of reaction to changes from the individuals. In other words, people tend to “underreact” when new information is provided to them. At this point we can make a relation with one of the few phenomena Fromlet (2001) had provided and is mentioned above. This attitude of the individuals who Malkiel (2003) is talking about, is similar to the **Heuristic dealing with information preference for certain news, overconfidence and control illusion** or almost all of the characteristics of the BFT. Barberis et. al. (1998), whose work has been mentioned in Scowraft and Sefton (2005), is making the same point. They are pointing out that the investors are conservative about their portfolios and their reactions to new information are slow. That causes the prices to not reflect the news at the moment, but later.

Fama (1998) claims in his paper "Market Efficiency, Long-Term Returns and Behavioral Finance" that the behavioral finance theory is nothing but a short-term chance of events and that most of the points which BFT makes can be explained by the market efficiency theory.

### 2.3.2 The Conrad and Kaul Hypothesis and Behavioral Models

Conrad and Kaul (1998) argue that the prices of the stocks follow random walks with drifts. These drifts are unconditional and vary between the different stocks, so Conrad and Kaul (1998) explain that the momentum profits are due to the differences between those drifts. Hence, due to the fact that the profits are due to these unconditional drifts and not because of a random component of prices, in any of the periods, the profits should be the
same at any ranking period. In other words, Conrad and Kaul (1998) argue that stocks with high/low unconditional expected return in constant periods of time, will have high/low realized return in both periods. That would mean that the momentum strategies would obtain positive momentum profits for any time period due to the constant expected returns over the time. The profits from a momentum strategy than should according to Jegadeesh and Titman (1993) be the same in any post-ranking period.

Contrary to the Conrad and Kaul Hypothesis, the behavioral models explain the momentum abnormal returns in the opposite way. The behaviorists imply that the returns in the holding period are due to a delayed overreaction. That pushes the prices of the winners/losers above/below their long-term values. Due to that fact, with time we will observe return reversals, in the subsequent periods to the holding period. In other words, the returns from the losers will exceed the returns from the winners in the post-holding period. Jegadeesh and Titman (2001) examine this contradiction between the both hypotheses, by observing the returns of the ten portfolios until the 60th month. As they found in their previous work, Jegadeesh and Titman (1993), the returns are significantly positive during the first 12 months of the holding period. For the next 13th to 60th months, the cumulative returns are negative. This yields the conclusion that the behavioral approach is more consistent with the empirical results than the Conrad and Kaul Hypothesis.

Although, in Jegadeesh and Titman (2001), the authors point out that the negative returns in the long-term, which are explained by the behavioral finances models, have to be interpreted with caution. There are few observations, which have been found in the results, which cause doubts about the behavioral approach. For example, there is significant evidence that there are return reversals for the small firms, but the evidence is not equally strong for large firms. Also evidence for returns reversals is significant for the period between 1965 and 1981, but they are weak for the period 1982-1998.

Figure 2.1 illustrates the underreaction, overreaction and the Conrad and Kaul (1998) theory in the long-term. Although the three of them show positive returns in the holding period, the results are significantly different for the post-holding periods.

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2 Barberis et al. (1998) argues that a “conservatism bias” can lead investors to underreact to the information. Jegadeesh and Titman (2001) use this as an approach to test their null hypothesis which examines that the momentum effect is due to underreaction to information of the investors during the formation period. The authors explain that if this is true, the prices will tend to adjust and after the information is truly incorporated in their values the future predictability of the stock returns will be impossible. That leads to momentum profits equal to zero (in the postholding periods).
In Jegadeesh and Titman (1993) they examine the post-holding period until the third year, while in Jegadeesh and Titman (2001) the authors extend their analysis to the 60th month. In Figure 2.2 it is shown how the results from the period between 1965 and 1998 reveal that the cumulative profits increase up to 12.17% until the 12th month and afterward they start to decay until they reach the value of -0.44% in the 60th month. It can be seen that the results show significant return reversals after the 12th month. This contradicts the Conrad and Kaul Hypothesis.

Figure 2.2 Cumulative momentum returns. Jegadeesh and Titman (2001)
Nevertheless, further analyses in Jegadeesh and Titman (2001) show that the paper of Conrad and Kaul (1998) is driven by small sample biases and bootstrap experiments. They show that the cross-sectional differences, which Conrad and Kaul (1998) argue are the reason for the momentum profits, have a loose (if any) relation to the abnormal returns of the momentum strategies. The empirical findings from the paper supports the intuition that the cross-sectional differences in the unconditional returns are too small compared to the variations of the realized returns. Also there is a small possibility that the stock’s return over the past six months will have the necessary information to predict the stock’s unconditional expected returns.

In Barberis et al. (1998) the authors test the way investors form their beliefs and how that has an impact over their actions. They introduce two concepts: the “conservatism bias” and “the representative heuristic”. The first one was first documented by Edwards (1968). He basically states that investors underreact to new information when it comes to update their priorities. That suggests, that in short-term there will be momentum profits and due to the fact that the prices will slowly start to adjust to that new information, the future returns in long-term after the momentum holding period, will be zero. The later concept of the “representative heuristic” bias, which was mentioned briefly by the Fromlet (2001) classification above, the authors Tversky and Kahneman (1974) summarize as the tendency of the agents to identify a certain sample, by the characteristic features of the parent population. For stock prices, that represents the so-called overreaction in long term. As it is explained in Barberis et al. (1998) the overreaction is observed when stocks which were related to good news for long period of time in the past, continue to be overpriced in the future. The authors suggest that the mix of the conservatism and the representative biases, despite of the fact that first leads to zero returns in long term, may lead to negative future returns for stocks which had performed positively in the past. Barberis et. al. (1998) suggests the period of overreaction to be between three to five years, but in Jegadeesh and Titman (2001), the authors discuss that due to the fact that the time horizon is not specified, one cannot know what time frame should be using when testing momentum, in order to be sure that both, under- and overreaction, are represented in the event. So that could lead to the observation only to one of the phenomena.

Jegadeesh and Titman (2001) refer to other works which are offering alternative models in order to explain the short-term momentum profits and the mean reversals. In Daniel et. al. (1998) the authors represent the underreaction as a consequence of the “self-attribute”
bias, which leads to positive short-lag autocorrelation in stocks returns and the overreaction as a result of overconfidence bias, which leads to negative long-lag autocorrelation in stocks returns. Daniel et. al. (1998) explains the price overreaction in medium- and long-term with behavioral concepts. They argue that the so-called self-attribution bias\(^3\), the individuals tend to attribute a positive event to their skills and negative to bad luck, makes a buyer who had bought stocks to be more prone to buy again, in case of good news, than to sell in case of bad news\(^4\). The overconfidence, in turn, makes investors push the stocks prices of the winners too much, and they become overpriced. That results in momentum profits in short-term and to mean reversals, in long-term, when the prices start to adjust to their “real” values. Unlike Barberis et al. (1998) and Daniel et al. (1998), Hong and Stein (1999) develop their models not on the base of the cognitive characteristics of the individual as itself, but on the interaction between different group of agents. They distinguish between “news watchers” and “momentum traders”, as each one of them has the ability to “work” with different type of information. The first group, makes their predictions observing future fundamentals, the second uses past and current information. The other two assumptions are that the private information moves gradually within the “news watchers” population and both of the groups are not fully rational. The model shows that when only the news watchers are active, because of the gradual fusion of information and the lack of processing information from past prices, there is only underreaction to the information. When the momentum traders are included too, they push the prices of the past winners above their fundamental values.

\section*{2.4 Risk-adjusted returns}

In order for the mechanism of stock prices to be explained, various models have been developed during the years. Among others is the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964), Lintner (1965) and Mossin (1966). The CAPM is inspired by the idea of Markowitz (1959) about the selection of a certain portfolio on base on the mean-variance. According to Markowitz (1959) the investors choose such portfolios which will give, for a certain return, minimum risk or the other way around, for a certain level of risk, investors will expect to obtain the maximum level of return. That is how the idea of the

\(^3\) For more information: Fama (1998)  
\(^4\) Here we can refer again to the few of the basic characteristics of the BFT (i.e. preference to certain news, Fromlet 2001)
CAPM aroused: the authors present that the portfolio, chosen by the agents is a linear combination of a risk-free stock and the market portfolio, assuming that the later portfolio is efficient and according to the Markowitz’s hypothesis: it has minimum variance. The CAPM also demonstrates that the expected returns of a certain stock can be explained as the sum of the risk-free rate plus the normalized covariance of the active multiplied by the difference between the market index and the risk free rate. The so called, normalized covariance is the covariance between two stocks normalized by the variances of those variables. So in the case of the CAPM, this would be the covariance between the stock returns and the market returns, divided by the variance in the market returns. This parameter is also known as the CAPM Beta. The CAPM Beta measures the systematic risk of the stock in comparison to the market risk, or the type of risk which is impossible to diversify away. The beta represents the volatility of the returns of a certain stock, respectively to the volatility of the market index. So, that yields that if the beta is bigger than 1, the stock is riskier than the market and if it is less than 1, it is more is less risky. When it comes to calculating the betas of a portfolio, which would be the weighted sum of the betas of the stocks which the given portfolio consists of. Another parameter of interest in the CAPM will be the alpha parameter or Jensen’s alpha. That represents the risk-adjusted return of the stock. Depending on if the parameter is positive or negative, than that will indicate if there are positive or negative abnormal returns.

The Capital Asset Pricing Model has received a lot of criticism during the years. Despite the fact that the empirical evidence demonstrates that the stocks with higher betas demonstrate bigger returns, than those with lower betas, this was not enough to accept the model. In fact, there is a certain number of empirical works, developed posterior to the Sharpe (1964),Lintner (1965) and Mossin (1966), which examine the same for different international markets and the results cannot be classified as such to be supporting the CAPM (Black, Jensen and Scholes (1972), Gibbons (1982), Shanken (1985) and Rubio (1988), among others). Given that evidence, one might think that more factors are needed as measures of the systematic risk, in order for the latest to explain variations in profitability of the stocks. Based on this argument, different studies have been made in order to find how the firms’ characteristics may have an impact on the sensibility of their actives to the systematic risk. Banz (1981) offers evidence of the small firm size effect. The author explores the relationship between NYSE stocks and their market value. The evidence demonstrated that there is such a correlation which leads to the conclusion of a misspecification
of the Capital Asset Pricing Model. Banz (1981) argues that the correlation is demonstrated among very small firms; they manage to obtain higher risk-adjusted return than the average- and high market capitalization stocks. Moreover, the author explains that there is no assurance that the firm itself is “responsible” for this correlation or it could be a replica of other factors which have influence on the firm size but are unknown. Due to the last argument, Banz (1981) states that the size effect must be interpreted with caution and the results can only be used as a proxy.

The Fama-French Three Factor Model (FF3FM) is, along with other multivariate models, trying to explain the returns of a certain stock, regarding three factors: the market (as in the CAPM), the size of the firm and the book-to-market ratio of it. Starting with their work from 1992, Fama and French (1993) suggest a model which relates the expected stock returns with three risk factors. To construct the proxies of the size and the BM ratio, each year the stocks from the sample are classified in two groups: small (S) and big (B). By the same way, but independently, the stocks are arranged in three groups, according to the quotient book-to-market value from December of the last year: high ratio (H), medium (M) and low (L). From the intersection between the size groups and the book-to-market groups appear six portfolios (SH, SM, SL, BH, BM and BL), where for example, the SM portfolio is formed by the stocks of small size and medium BM ratio. Small Minus Big (SMB) is a portfolio, which is used as a proxy of the size factor and is a result of the difference between the mean of the returns from the small group of portfolios (SH, SM, SL) and the mean of the returns of the high size group of portfolios. High Minus Low (HML) is the portfolio proxy of the BM factor and is the difference between the mean returns of the portfolios of high ratio minus the one with low ratio (SH and BH; SL and BL, respectively). In its attempt to “improve” the three factor model proposed by Fama and French, Cahart (1997) includes one more variable to the FF3FM, the Winners Minus Losers (WML). This will be the proxy who replicates the momentum effect and will be presented by the difference between the returns (from a given month) of the winners and losers from the past year.
3 Methodology and data

The methodology and data chapter presents a description of how the study is conducted, how the data is collected and ends with a critical evaluation of both methodology and data.

3.1 Methodology

The methodology of this study follows the methodology of Jegadeesh and Titman (1993, 2001). The strategies are defined by the length of the formation period (J) and the holding period (K). Each strategy is thus labeled J/K, and the combinations are as follows:

<table>
<thead>
<tr>
<th>J/K</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3/3</td>
<td>3/6</td>
<td>3/9</td>
<td>3/12</td>
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<td>6</td>
<td>6/3</td>
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<tr>
<td>12</td>
<td>12/3</td>
<td>12/6</td>
<td>12/9</td>
<td>12/12</td>
</tr>
</tbody>
</table>

Table 2.1 Momentum strategies

The chronological order of the methodology can be illustrated as in figure 2.1.

<table>
<thead>
<tr>
<th>Formation Period</th>
<th>Holding Period</th>
<th>Post-Holding Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Month t-J to Month t)</td>
<td>(Month t to Month t+K)</td>
<td>(Month t+K to Month t+K+P)</td>
</tr>
</tbody>
</table>

Figure 2.1 Timeline of the sample period

The first period is a formation period. After the J (3, 6, 9, 12) months of formation period, the stocks are ranked by their historical return in the past J months in ascending order. Ten equally weighted decile portfolios are formed based on these rankings. The top deciles of the ranked stocks are then identified and put into the so called “Winners portfolio”. Long positions are taken in the stocks of this portfolio. The bottom deciles of the ranked stocks are also identified and are put into the so called “Losers portfolio”. Short positions are taken in the stocks of this portfolio. In each month t, the strategy buys the winners portfolio, sells the losers portfolio and holds them for K (3, 6, 9, 12) months. The aggregated portfolio of the long position in the Winners and the short position in the Losers is called a zero-
cost portfolio. As in Jegadeesh and Titman (1993), the strategies include overlapping periods to increase the number of observations and to increase the power of the results. Overlapping periods means in this case that every three month, regardless of strategy, a new formation period starts. The alternative would be that a new formation periods starts whenever the previous formations periods ends. Empirical research found evidence of short-term reversals after the formation period. To avoid the short-term reversals and eliminate effects of bid-ask spread, price pressure and lagged reaction effects, a week is skipped between the formation period and the holding period.

3.1.1 Analytical tools

For the purpose of deriving the momentum profits, several tools are utilized. A post-holding period of five year is examined for the purpose of connecting the empirical results to the existing theories. Furthermore, to measure if the abnormal profits derive from exposure to systematic risk, a Beta-value is calculated. A rolling Beta based on the past 12 months of the stocks is calculated and used since a static beta might not represent present firm-specific or environmental changes. Market capitalization is another factor that is measured. Low market capitalization means an increase in risk which could explain the abnormal profits. Moreover, the Capital Asset Pricing Model (CAPM) and Fama-French Three Factors Model (FF3FM) will be utilized to examine the Alphas of the models, the so called risk-adjusted returns. The Alphas would yield to a conclusion if the abnormal returns can be explained by risk factors. The additional FF3FM deepens the analysis by adding two additional risk-factors to the market risk-factor, the firm size factor and the book-to-market factor. The returns of the portfolios and the returns of the market index are subtracted by the risk free rate (Swedish 6-month Treasury bill) before they are being regressed.

3.1.2 Statistical testing

To test the statistical significance of the profits, a null-hypothesis had to be formulated. As in Jegadeesh and Titmans (1993) study, the profits of the zero-cost portfolios are of interest. The returns of such portfolio, controlling for risk, is expected to be equal to zero. Therefore the null-hypothesis is formulated as follows:

\[ H_0 : \mu_{j|K} = \mu_0 \]

\[ H_0 : \mu_{j|K} > \mu_0 \]
\( \mu_{jk} \) = average return of zero-cost portfolios of the sample

\( \mu_0 \) = population average, equal to zero

### 3.1.3 Formulas

For each stock, the weekly total return index appreciation or depreciation is obtained. The total return index value is used to calculate the monthly stock return as follows:

\[
    r_{it} = \left[ \frac{P_t}{P_{t-1}} \right] - 1
\]  

(1)

\( r_{it} \) = net return of index \( i \) at time \( t \)

\( P_t \) = return index of \( i \) at time \( t \)

To obtain the net return of a stock, for a given period, a geometric average of the monthly returns is calculated as follows:

\[
    r_{ik} = [(1 + r_{i1}) \times (1 + r_{i2}) \times \ldots \times (1 + r_{ik})]^\frac{1}{k} - 1
\]  

(2)

\( k \) = number of periods

To calculate the portfolio return, for a given period, the following formula is used:

\[
    r_p = \sum_{i=1}^{n} (X_i \cdot r_{it})
\]  

(3)

\( X_i \) = weight of \( i \) in portfolio \( p \)

To calculate the return of the zero-cost portfolios, Winners minus Losers, the following formula is used:

\[
    r_{p0} = r_{pW} - r_{pL}
\]  

(4)

\( r_{p0t} \) = return of the zero-cost portfolio

\( r_{pW} \) = return of winners portfolio

\( r_{pL} \) = return of losers portfolio

For the purpose of evaluating the strategy, the Beta-value of each stock had to be calculated. The returns are used to calculate the Beta-value for a given period as follows:

\[
    \beta_{im} = \frac{\text{cov}(r_{i}, r_{m})}{\sigma_{m}^2}
\]  

(5)

\( \beta_{im} \) = Beta value of \( i \)
\( \text{cov}(r_i, r_m) \) = Covariance of the returns of \( i \) and \( m \)

\( \sigma_m^2 \) = Variance of the returns of the market

For the purpose of testing statistical significance of the results, the \( t \)-value of the zero-cost portfolio had to be calculated as follows:

\[
t = \frac{r_{\text{pot}} - \mu_0}{s_t / \sqrt{n}} \tag{6}
\]

\( r_{\text{pot}} \) = average return of the zero-cost portfolio

\( \mu_0 \) = population average, equal to zero

\( s_t \) = standard deviation of the sample

\( n \) = number of observations

\( s_t / \sqrt{n} \) = standard error

For the purpose of obtaining the risk-adjusted return, the intercept of the Capital Asset Pricing Model will be calculated by running the following regression:

\[
r_p - r_f = \alpha + \beta (r_m - r_f) + \varepsilon \tag{7}
\]

\( r_p \) = average monthly return of portfolio \( p \)

\( r_f \) = risk free rate

\( r_p - r_f \) = excess return of portfolio \( p \)

\( r_m \) = market index return

\( \alpha \) = constant, risk-adjusted return

\( \beta \) = parameter for the market risk factor

For the purpose of obtaining the risk-adjusted return, the intercept of the Fama-French three-factor Model will be calculated by running the following regression:

\[
r_p - r_f = \alpha + \beta (r_m - r_f) + \beta_{SMB} * \text{SMB} + \beta_{HML} * \text{HML} + \varepsilon \tag{8}
\]

\( r_p \) = average monthly return for the \( p \) portfolio

\( r_f \) = risk free rate

\( r_m \) = market index return

\( r_p - r_f \) = excess return of portfolio \( p \)

SMB = Small minus Big, size factor

HML = High minus Low, book-to-market risk factor
\( \alpha = \) intercept, risk-adjusted return  
\( \beta = \) parameter for the market risk factor  
\( \beta_{SMB} = \) parameter for the size risk factor  
\( \beta_{HML} = \) parameter for the book-to-market values risk factor

### 3.2 Data

The data of this study is collected from Thomson Reuters Datastream. Datastream provides global financial information for research and financial analysis. For the purpose of this study, the raw (unadjusted) collected data from Datastream consists of total return indexes, market value and volumes of trades for 697 companies as well as price index for OMX Affärsväldens Generalindex (OMXAFGX). The unadjusted data of the study consists of all listed companies of OMX Stockholm (OMXS), 281 companies. The data also includes the delisted companies that were listed in Sweden sometime during the observation period, 416 companies. The delisted companies are included in the study to avoid survivorship bias. The period for which the data derives from is from 1998-01-05 to 2013-12-30. The period of time chosen generates 15 years of results due to the implemented strategies. This is regarded as an appropriate period of time through multiple cycles which vouch for the obtained results and the ability to generalize the results of the study.

Weekly quotes were chosen since monthly quotes would yield inadequate sample points and daily quotes would result in an unnecessary amount of data to process. The total return index is used instead of the adjusted closing price since this index grows at the total return rate, i.e. price appreciation (depreciation) inclusive of dividends. Another way would be to collect both adjusted closing prices and dividends to calculate the correct (inclusive dividends) return, but the total return index simplifies the return calculations, ensures that dividends is accounted for in a correct way and accounts for changes in the capital structure. The reason that only stocks from OMXS are included in the study is that it ensures that only the largest companies and most liquid stocks are included. These properties are important to ensure the ability to generalize the results as well as compare the results to previous studies. The reason for the choice of OMXAFGX is that it is a market capitalization-weighted index of OMXS which reinvests the dividends of the stocks. Since dividends are a part of the return of a stock, and the dividends are included in the returns of the stocks in this study, the OMXAFGX offers the most accurate foundation for calculations of the Beta for the stocks. Only primary quotes are collected for this study since the source of the
secondary quotes cannot be confirmed which yields that the correctness of the quotes cannot be ensured.

3.2.1 Data adjustments

The list of the delisted companies consists of all delisted companies of the Swedish stock market. Datastream does not provide a function for downloading only delisted companies of the OMXS, therefore all delisted companies of the Swedish stock market had to be downloaded and manually adjusted for to fairly represent only the delisted stocks of OMXS. Only delisted companies, with an average market value higher than the 100 millions are included. The value of SEK 100 million was chosen since it is an appropriate barrier considering the average market value of the listed companies. Only four listed companies of the OMXS had an average market value lower than SEK 100 million. The adjusted list of all companies included in the study, which includes listed and delisted companies of OMX is labeled; “Adjusted OMXS”. Furthermore, companies with an average volume of shares traded lower than 25 thousand are excluded from the Adjusted OMXS. The reason that they are excluded is that the return of those stocks could yield extreme values which are due to the low volume of shares traded rather than a momentum effect. The value of 25 thousand was chosen since companies with lower average volume of shares traded had a tendency of having many weeks without any trade at all. All stocks with insufficient values for the collected data types are excluded from the study. This is to ensure that the consistency of the aforementioned adjustments for the average market value and the average volume of shares traded. All stocks with less than 24 months of data are excluded from the study. This is in line with Jegadeesh and Titman (1993) and the adjustments are made because; a stock with less data than 24 months could not be included in all 16 types of strategies for any period. It is common on the Swedish stock market for one company to have two types of stocks listed. The difference between the two types of stocks is the voting right which the investor obtain by purchasing the stock. The stock with the higher voting right is less liquid and is therefore not of interest to the average investor. Since the two types of stocks follow the same price pattern, they could be considered as duplicates. Therefore, for all stocks with a duplicate, the less liquid stock of the two types is excluded from the study.

The adjustments to the raw collected yielded the following change in the data:
<table>
<thead>
<tr>
<th></th>
<th>Listed stocks</th>
<th>Delisted stocks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unadjusted data</strong></td>
<td>281</td>
<td>416</td>
<td>697</td>
</tr>
<tr>
<td><strong>Adjusted OMXS</strong></td>
<td>236</td>
<td>143</td>
<td>379</td>
</tr>
</tbody>
</table>

### 3.2.2 Process of data

The software used to process the data is Microsoft Excel. Microsoft Excel provides all necessary tools to process the data material and to implement the strategies. The software used to perform the regressions and to test the statistical significance of the results was IHS E-Views.

### 3.3 Critique of the methodology and data

Jegadeesh and Titman (1993) uses a multiple times larger sample of stocks, the New York Stock Exchange (NYSE), than this study uses. As the sample size increases, the certainty of the results increases as well which is unfavorable for the results of this study. However, the sample size is not possible to adjust and a larger sample could yield more uncertainty to the results by including small and illiquid stocks or by including multiple markets. The NYSE is also the most liquid market in the world which minimizes the necessary adjustments for stocks with low volume of trades. Jegadeesh and Titman (1993) neither present all formulas used in their research or a deeper explanation of the methodology they follow. This increases the risk of conducting this study in a different way, which if true, could results in incomparable results as well as misleading results. Both Jegadeesh and Titmans (1993) and this study suffer from the fact that all stocks are not possible to short sell in practice. While it may harm the practical value of the results from the studies, it does not affect the theoretical value. Many theories assume that all stocks can be sold short. Taxes and transaction costs have not been accounted for which may harm the practical value of the results from the studies but is at the same time necessary for generalization purposes since taxes and transaction cost exposure varies between investors. Earlier empirical results of research on seasonal effects confirms pattern of months, weeks and days with significant abnormal returns. Those results could imply a risk for the results of this study to partly derive from a seasonal effect rather than a momentum effect. However, since a zero-cost portfolio is established, by buying winners and selling losers, whatever positive return that the Winners portfolio experience due to seasonal effects would be cancelled out by the same positive re-
turns of the Losers portfolio, which is sold short and therefore becomes negative. The chosen Beta (rolling 12-months) may or may not be the Beta that best represents the implied market risk. However, a shorter period may fail to capture the actual implied market risk and a longer period may fail to represent the implied market risk at present time. The obtained factors for the Fama-French three-factor model were of monthly type without a corresponding specific date of the month. The possible mismatch in the dates of the month between the returns of the portfolios and the risk-factors SMB and HML may or may not cause results which are not exactly correct.

Datastream is a recognized source of financial information for research and in practice. But the study relies solely on Datastream to provide the correct data for every single day and every single stock, which of course is a risk. If the time-frame of the study was larger and other software was accessible, the correctness of the data could have been confirmed. Even though a confirmation to the data is not possible, the authors consider Datastream a trustworthy source of information. The large amount of data raises the risk of conducting errors when it is processed. However, focus on exactitude, systematic work process and awareness of the risk minimizes the probability of conducting these errors.
4 Empirical Results and Analysis

The chapter will present the empirical results of the study as well as an analysis of the theoretical framework and the aforementioned results.

All results are presented in average monthly return to increase comparability within the results of the study, to increase comparability to previous research and to simplify the results to the reader. All average monthly returns are in the tables and graphs presented in value-terms instead of percentage.

4.1 Zero-cost portfolio performance, the momentum strategies

For the purpose of testing if a momentum effect exists on the Swedish stock market in the period from 1998 to 2013, 16 strategies were formed by combining the different formation period (J) with the holding period (K). Each J and K could take the value of 3, 6, 9 or 12 months and for each formation period. The stocks are divided into 10 equally weighted portfolios. The Winners portfolio is labeled P1 and consists of the stocks held that performed best during the formation period. The Losers portfolio is labeled P10, which respectively consists of the stocks held that performed the worst during formation period. The zero-cost portfolio, P1-P10, is the portfolio that represents the performance of the momentum strategy by taking a long position in the Winners portfolio and a short position in the Losers portfolio. For the strategy to earn momentum profits and provide positive returns, P1 has to outperform P10. Once the returns of the portfolios for each K have been calculated and converted into average monthly, the returns of the zero-cost portfolio can be obtained by subtracting the returns of P1 by the returns of P10. The returns of the zero-cost portfolios are statistically tested, as described in the Methodology chapter, by performing a simple hypothesis test which determines if the returns are significantly different from zero. The obtained results are presented in Table 4.1 and Graph 4.1 and Graph 4.2.
Relative strength portfolios formed based on J-months and held for K-months. Values of J are presented in rows and values of K are presented in columns. The average monthly returns of these portfolios based on a sample period of 1999-2014 are presented in the table. T-values are italicized.

<table>
<thead>
<tr>
<th>J/K</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.0093</td>
<td>0.0147</td>
<td>0.0109</td>
<td>0.0094</td>
</tr>
<tr>
<td></td>
<td>0.6526</td>
<td>2.0800**</td>
<td>2.0831**</td>
<td>2.1755**</td>
</tr>
<tr>
<td>6</td>
<td>0.0056</td>
<td>0.0159</td>
<td>0.0138</td>
<td>0.0117</td>
</tr>
<tr>
<td></td>
<td>0.4049</td>
<td>2.2869**</td>
<td>2.7267***</td>
<td>2.7626***</td>
</tr>
<tr>
<td>9</td>
<td>0.0040</td>
<td>0.0134</td>
<td>0.0145</td>
<td>0.0126</td>
</tr>
<tr>
<td></td>
<td>0.2931</td>
<td>1.8607**</td>
<td>2.8305***</td>
<td>2.8667***</td>
</tr>
<tr>
<td>12</td>
<td>0.0037</td>
<td>0.0118</td>
<td>0.0111</td>
<td>0.0098</td>
</tr>
<tr>
<td></td>
<td>0.2684</td>
<td>1.6997*</td>
<td>2.1638**</td>
<td>2.3421**</td>
</tr>
</tbody>
</table>

(*** Statistically significant on 99 percent confidence level)
(** Statistically significant on 95 percent confidence level)
( Statistically significant on 90 percent confidence level)

Table 4.1 Average monthly returns of the zero-cost portfolios

All momentum strategies yielded on average positive returns. Of the 16 strategies, 13 strategies yielded significant positive abnormal returns on 90 percent confidence level, 12 strategies yielded significant positive abnormal returns on 95 percent confidence level and 5 strategies yielded significant positive abnormal returns on 99 percent confidence level. Of the significant results, the average monthly return of applying the strategies varies from 0.8% to 1.59%. The highest significance can be seen for the formation periods of 6, 9 or 12 months and for the strategies with holding periods of 6, 9 or 12 months.
As it can be seen from Table 4.1 and Graph 4.1, all strategies present positive returns for the tested period of time. The most successful formation periods are the 6-months-, 9-months- and 12-months period. The returns for the different formation periods are illustrated in Graph 4.1. The holding periods follow the same pattern, the holding periods of 6-months-, 9-months and 12-months are the holding periods which provide the most significant returns. The returns for the different holding periods can be seen in Graph 4.2. The specific strategy that earned the highest return was the J6/K6 strategy which earned an average monthly return of 1.59%. After the J6/K6 strategy follows the J3/K6 which earned
an average monthly return of 1.47% and the J9/K9 which earned an average monthly return of 1.45%.

The sample in this study is based on the Swedish stock market instead of the American stock market and the sample period is the subsequent period to the studied sample periods in Jegadeesh and Titman (1993, 2001). Regardless of those differences, the results of this study are similar to the results of Jegadeesh and Titman (1993, 2001). The average monthly returns of the zero-costs portfolios that performed best are slightly higher for this study. These results contradicts the conclusion made by Malkiel (2003) that even though price anomalies will exist and maybe even create patterns, those anomalies and pattern will disappear in time. The confirmation of the results of Jegadeesh and Titman (1993, 2001) by the addition of the new and subsequent sample period and the new market that the sample is based upon rejects the explanation which Malkiel (2003) offers to the previous empirical findings. The Fair Game model that Fama (1970) base the Efficient Market Hypothesis on implies that it is impossible to make an abnormal return using a trading strategy. A trading strategy implies that there are abnormal returns to be made based on historical information, which would be impossible since all historical information is already accounted for in the security price. The stocks do not follow any pattern according to the Random Walk model and should be statistically independent. That stock prices do follow a random walk is already rejected by LeRoy (1973) and Lucas (1978). The results of this study along with the results of Jegadeesh and Titman (1993, 2001), Roumenhorst (1998) and Chui (2000) et al. contradict the models that the Efficient Market Hypothesis are based upon. All five studies have by utilizing the same trading strategies and successfully identified exploitable patterns in the security prices. By the conclusion made by Fama (1996), this implies that in practice, historical information is not fully incorporated in the security prices and stock prices do not follow a random walk. However, according to Lo and MacKinley (1999) who refers to LeRoy (1973) and Lucas (1978), the Random Walk Hypothesis is neither a necessary or sufficient condition for rational security pricing. The statement implies that the confirmed possibility of forecast market prices does not imply that the market is not well functioning and that the Efficient Market Hypothesis could still hold. This study does confirm that an exploitable pattern exists in stock prices on the Swedish stock and that two of the models, which the efficient market hypothesis is based upon, does not hold in practice. However, the confirmation does not automatically mean that the market is inefficient since various explanations to the pattern are provided which this study cannot reject. The results are in
line with Barberis et al. (1998). Their theory states that an overreaction will occur when stocks repeatedly experience good news. The stocks which are selected for the Winners portfolio can be assumed to have been subject to good news since they appreciated the most during the formation period. To further analyze if the results support the theory of Barberis et al. (1998), the post-holding period has to be analyzed, which is done later in this chapter.

4.1.1 Individual performance of the Winners- and Losers portfolios

To further evaluate where the momentum profits derives from, the zero-cost portfolios has to be decomposed. Table 4.2 shows the return of P1, P10 and the combined zero-cost portfolio which is equal to the difference between the two portfolios.

<table>
<thead>
<tr>
<th>J/K</th>
<th>K3</th>
<th>K6</th>
<th>K9</th>
<th>K12</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Buy</td>
<td>0.0196</td>
<td>0.0140</td>
<td>0.0130</td>
<td>0.0113</td>
</tr>
<tr>
<td></td>
<td>2.4932</td>
<td>2.4986</td>
<td>2.9897</td>
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</tr>
<tr>
<td>3 Sell</td>
<td>0.0102</td>
<td>-0.0002</td>
<td>0.0020</td>
<td>0.0019</td>
</tr>
<tr>
<td></td>
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<td>-0.0216</td>
<td>0.2902</td>
<td>0.3382</td>
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<tr>
<td>3 Buy-Sell</td>
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<td>0.0094</td>
</tr>
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<td></td>
<td>0.6526</td>
<td>2.1980</td>
<td>2.2165</td>
<td>2.3178</td>
</tr>
<tr>
<td>6 Buy</td>
<td>0.0190</td>
<td>0.0175</td>
<td>0.0144</td>
<td>0.0130</td>
</tr>
<tr>
<td></td>
<td>2.8465</td>
<td>3.4232</td>
<td>3.6104</td>
<td>3.6002</td>
</tr>
<tr>
<td>6 Sell</td>
<td>0.0134</td>
<td>0.0017</td>
<td>0.0016</td>
<td>0.0013</td>
</tr>
<tr>
<td></td>
<td>0.8671</td>
<td>0.1918</td>
<td>0.2432</td>
<td>0.2404</td>
</tr>
<tr>
<td>6 Buy-Sell</td>
<td>0.0056</td>
<td>0.0159</td>
<td>0.0138</td>
<td>0.0117</td>
</tr>
<tr>
<td></td>
<td>0.4049</td>
<td>2.2869</td>
<td>2.7267</td>
<td>2.7626</td>
</tr>
<tr>
<td>9 Buy</td>
<td>0.0186</td>
<td>0.0155</td>
<td>0.0149</td>
<td>0.0138</td>
</tr>
<tr>
<td></td>
<td>1.0267</td>
<td>3.2047</td>
<td>3.6705</td>
<td>3.5010</td>
</tr>
<tr>
<td>9 Sell</td>
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</tr>
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<td>9 Buy-Sell</td>
<td>0.0040</td>
<td>0.0134</td>
<td>0.0145</td>
<td>0.0126</td>
</tr>
<tr>
<td></td>
<td>0.2931</td>
<td>1.8607</td>
<td>2.8305</td>
<td>2.8667</td>
</tr>
<tr>
<td>12 Buy</td>
<td>0.0191</td>
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</tr>
<tr>
<td>12 Sell</td>
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</tr>
<tr>
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<td>0.6730</td>
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<tr>
<td>12 Buy-Sell</td>
<td>0.0037</td>
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<td>0.0111</td>
<td>0.0098</td>
</tr>
<tr>
<td></td>
<td>0.2684</td>
<td>1.6997</td>
<td>2.1638</td>
<td>2.3421</td>
</tr>
</tbody>
</table>

Table 4.2 Decomposed zero-cost portfolios

From Table 4.2, it is clear that all of the profits of the momentum portfolios come from the long position in the Winners portfolios. Negative returns in the Losers portfolios
would increase the momentum profits, but only one slightly negative average monthly return is observed. All Winners portfolios provide positive returns that are significantly different from zero. The returns vary between an average monthly return of 1.13% and 1.91%. In comparison, no Losers portfolio provides positive returns that are significantly different from zero. The returns vary between -0.02% and 1.53%. The individual results for the portfolios of this study are similar to the results which Jegadeesh and Titman (1993) obtained when the zero-cost portfolio were decomposed. The results of both studies confirm the hypothesis that the best performing stock in the formation periods also performs best in the holding periods. Once again, the results contradict the conclusions of Fama (1996) which state that it impossible to obtain abnormal returns by using a trading strategy based on historical information and that stocks follow a random walk and are statistically independent. The decomposed portfolio returns in the studies show the difference in performance between the Winners- and the Losers portfolio. It is clear that the positive significant results of zero-cost portfolio are not a result of random positive returns of both portfolios; it is a result of the Winners portfolio strictly outperforming the Loser portfolio for any given strategy. This contradicts the claim of Hong, Lim and Stein (2000) that most of the momentum profits for the individual momentum strategies come from the short side of the transaction. In Jegadeesh and Titman (2001) the results they obtain is that the profits come from both sides of the strategies, the selling and the buying. This confirms the fact that, based on historical information, the best performing stocks in the medium-term time period can be identified.

4.2 Portfolio performance and Analysis of the J6/K6 strategy

Due to the fact that the data which was used for the study is extensive and that the methodology is complicated and time-consuming, not all the strategies can be analyzed with the same level of depth and with the entire set of analytical tools which corresponds to such analysis. That is why the focus in this study will be on the portfolios of the J6/K6 strategy. Except for the Winners-, Losers- and zero-cost portfolios, all intermediate portfolios of the J6/K6 strategy are included in the analysis. The J6/K6 strategy is chosen due to the fact that in the seminal papers of Jegadeesh and Titman (1993, 2001), which are the “fundamental” studies of the momentum effect theory and for this study, the authors use the above mentioned strategy for the deeper analysis. The specific strategy is according to Jegadeesh and Titman (1993) representative for all momentum strategies. For the CAPM and for the FF3FM regressions, the Durbin-Watson statistic needed to be examined, due to
the fact that the strategies overlap. The Durbin Watson test examines the possible presence of autocorrelation in the residuals. The presence of autocorrelation in the residuals would harm the significance of the parameters and yield incorrect results for the regression. For both models, the Durbin Watson coefficient is close to two which confirms that there is no autocorrelation in the residuals.

Table 4.3 repeats the previously presented results for the decomposed zero-cost portfolios, but only for the J6/K6 strategy which is used for the analysis. The Winners portfolio yielded an average monthly return of 1.75% and is statistically significantly different from zero on a 99% confidence level. The Losers portfolio yielded an average monthly return of 0.17% and is not statistically different from zero. The combined zero-cost portfolio yielded an average monthly return of 1.59% and is statistically significant different from zero on a 95% confidence level.

<table>
<thead>
<tr>
<th>J/K</th>
<th>K6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy</td>
<td>0.0175</td>
</tr>
<tr>
<td></td>
<td>3.4232</td>
</tr>
<tr>
<td>Sell</td>
<td>0.0017</td>
</tr>
<tr>
<td></td>
<td>0.1918</td>
</tr>
<tr>
<td>Buy-Sell</td>
<td>0.0159</td>
</tr>
<tr>
<td></td>
<td>2.2869</td>
</tr>
</tbody>
</table>

Table 4.3 Decomposed zero-cost portfolios of the J6/K6 strategy

### 4.2.1 Capital Asset Pricing Model

To further analyze the result of the J6/K6 strategy, two different models had to be utilized; the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor Model (FF3FM). That is made for the purpose of examining if the portfolio returns still are significant when they are adjusted for different risk-factors. The risk-factors are regressed against the returns of the portfolios, minus the risk free rate for all portfolios, except for the zero-cost portfolio. The alphas of those regressions represent the risk-adjusted excess return.

Table 4.4 presents the obtained results from regressing the portfolios’ excess returns to the returns of the market index minus the risk free rate. The results from the regression yielded significant CAPM Alphas for most of the portfolios, especially for the Winners portfolio (P1). The Winners portfolio yielded a positive average monthly risk-adjusted return of 1.31%. The Losers portfolio (P10) yields a negative average monthly risk-adjusted return of -0.45%, but the CAPM Alpha is not significant. The zero-cost portfolio (P1-P10) yields a
positive average monthly risk-adjusted return of 1.75 % and the CAPM Alpha is significant on 95 % confidence level. That yields to the conclusion that the momentum profits are mostly due to the long side of the strategy. P1 earns the highest average monthly risk-adjusted return and the sizes of the risk-adjusted return for the following portfolios are in descending order and finally become negative for the last portfolios. However, the risk-adjusted returns are higher for this study compared to Jegadeesh and Titman (2001) throughout the whole sample. The majority of the risk-adjusted return of the zero-cost portfolio in Jegadeesh and Titman (2001) derives from the Losers portfolio while the opposite can be observed for this study. The significance of the Alphas follow the same order, but the Alphas start to be insignificant for P7 in Jegadeesh and Titman (2001) while it first becomes insignificant for P8 in this study. The obtained risk-adjusted returns rejects the claim of Malkiel (2003) that the pattern lacks robustness and after being discovered and published, it will not enable investors to earn excess return. The betas of the portfolios forms are smaller for the portfolios in the middle and larger for the extreme portfolios. P1 is slightly (+0.0378) higher than the average beta of the sample, P10 is higher (+0.5891) than the average of the sample and the beta of the zero-cost portfolio is negative. The reason for the beta of the zero-cost portfolio being negative is that beta of the P10 is higher than for the P1. The market-risk explains, according to the CAPM regression, 65 % of the returns of the Winners portfolio, 51 % of the returns of the Loser portfolio and 7 % of the returns of the zero-cost portfolio. The risk-adjusted returns, the negative beta of the zero-cost portfolio and the adjusted r-squared of the regression imply that the returns of the momentum strategies cannot be derived to compensation for market-risk. The betas of this study are highly similar to the betas obtained in Jegadeesh and Titman (2001), further comparison and conclusion of this fact are presented later in Chapter 4.3.5.
Table 4.4 Results of the CAPM regression

<table>
<thead>
<tr>
<th>Alpha</th>
<th>Beta</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
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<td>1.1156</td>
</tr>
<tr>
<td>P2</td>
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<td>0.9322</td>
</tr>
<tr>
<td>P3</td>
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<td>0.8911</td>
</tr>
<tr>
<td>P4</td>
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<td>0.8652</td>
</tr>
<tr>
<td>P5</td>
<td>0.0059</td>
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</tr>
<tr>
<td>P6</td>
<td>0.0045</td>
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</tr>
<tr>
<td>P7</td>
<td>0.0041</td>
<td>1.0595</td>
</tr>
<tr>
<td>P8</td>
<td>0.0048</td>
<td>1.1206</td>
</tr>
<tr>
<td>P9</td>
<td>-0.0024</td>
<td>1.2632</td>
</tr>
<tr>
<td>P10</td>
<td>-0.0045</td>
<td>1.6670</td>
</tr>
<tr>
<td>P1-P10</td>
<td>0.0175</td>
<td>-0.5527</td>
</tr>
</tbody>
</table>

Table 4.4 Results of the CAPM regression

4.2.2 Fama-French three-factor model

To further examine the performance of the J6/K6 strategy the Fama-French three-factor model (FF3FM) was utilized. That is made in order to examine if the risk-adjusted returns are still significant when more risk-factors are added. Table 4.5 presents the obtained results from regressing the portfolios’ excess returns to the returns of the market index minus the risk free rate the additional two Fama-French risk-factors; excess return of small minus big (SMB) market capitalization stocks and excess return of high minus low (HML) book to market value stocks. The results from the regression yielded significant FF3FM Alphas for most of the portfolios, especially for the Winners portfolio (P1). The Winners portfolio yielded a positive average monthly risk-adjusted return of 1.42 %. The Losers portfolio (P10) yields a negative average monthly risk-adjusted return of -0.27 %, but the FF3FM Alpha is not significant. The zero-cost portfolio (P1-P10) yields a positive average monthly risk-adjusted return of 1.69 % and the FF3FM Alpha is significant on 95 % confidence level. That yields again the conclusion that the momentum profits are mostly due to the long side of the strategy. The results from the regression are demonstrating the same
pattern as in the CAPM regression descending average monthly risk-adjusted returns. P1 earns the highest average monthly risk-adjusted return and the sizes of the risk-adjusted return for the following portfolios are in descending order and become finally negative for the last portfolios. The risk-adjusted returns are again higher for this study compared to Jegadeesh and Titman (2001) throughout the whole sample, but otherwise the risk-adjusted returns follow the same pattern. The majority of the risk-adjusted return of the zero-cost portfolio in Jegadeesh and Titman (2001) derive from the Losers portfolio while the opposite can be observed for this study. It can be seen that the adjusted r-squared for this regression of the returns of P1 is slightly higher than it was for the CAPM, which means that the additional variables slightly increase the explanatory power of the portfolio returns. The firm size offered an additional 5 % of explanatory power of the returns of P1. The opposite is the case for the returns of P10, the firm size offered a decrease of the explanatory power of the returns by 1 %. The FF3FM variables also decreased the explanatory power of the returns of the zero-cost portfolio by 2 %. The explanatory power of the Fama-French variables is 4.45 % of the returns of the zero-cost portfolio. The conclusion of the results of the regression implies that a fraction of 5% of the returns in the Winners portfolio can be explained by firm size but the variables offer no explanation to the returns of the Losers portfolio and the zero-cost portfolio. The risk-adjusted returns, the non-existing relationship between the zero-cost portfolio and the additional risk-factors the adjusted r-squared of the regression confirms the results from the CAPM regression which implied that the significant positive average monthly returns of the zero-cost portfolios cannot be derived to compensation for risk-factors. It is in line with the conclusion of Chan et. al. (1996) that momentum profits cannot be explained by market risk, size and book to market value.
### Table 4.5 Results of the FF3FM regression

<table>
<thead>
<tr>
<th></th>
<th>Alpha</th>
<th>Market</th>
<th>SMB</th>
<th>HML</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>0.0142</td>
<td>1.1144</td>
<td>0.1671</td>
<td>-0.0364</td>
<td>0.7049</td>
</tr>
<tr>
<td>P2</td>
<td>0.0113</td>
<td>0.9704</td>
<td>0.1099</td>
<td>0.0689</td>
<td>0.7331</td>
</tr>
<tr>
<td>P3</td>
<td>0.0075</td>
<td>0.9176</td>
<td>0.0393</td>
<td>0.0834</td>
<td>0.7829</td>
</tr>
<tr>
<td>P4</td>
<td>0.0075</td>
<td>0.9011</td>
<td>0.0232</td>
<td>0.0510</td>
<td>0.8131</td>
</tr>
<tr>
<td>P5</td>
<td>0.0064</td>
<td>0.8972</td>
<td>-0.0247</td>
<td>0.0820</td>
<td>0.8454</td>
</tr>
<tr>
<td>P6</td>
<td>0.0049</td>
<td>1.0365</td>
<td>-0.0395</td>
<td>0.0414</td>
<td>0.8487</td>
</tr>
<tr>
<td>P7</td>
<td>0.0045</td>
<td>1.0723</td>
<td>-0.0092</td>
<td>-0.0537</td>
<td>0.8057</td>
</tr>
<tr>
<td>P8</td>
<td>0.0047</td>
<td>1.1216</td>
<td>-0.2192</td>
<td>-0.2122</td>
<td>0.6191</td>
</tr>
<tr>
<td>P9</td>
<td>-0.0009</td>
<td>1.3033</td>
<td>0.0654</td>
<td>0.0495</td>
<td>0.7691</td>
</tr>
<tr>
<td>P10</td>
<td>-0.0027</td>
<td>1.6870</td>
<td>0.1835</td>
<td>0.0739</td>
<td>0.5006</td>
</tr>
<tr>
<td>P1-P10</td>
<td>0.0169</td>
<td>-0.5727</td>
<td>-0.0164</td>
<td>-0.1102</td>
<td>0.0445</td>
</tr>
</tbody>
</table>

#### 4.2.3 Betas

Since the betas obtained by the regression is the average monthly returns of the portfolios and the average monthly return of the market index at the corresponding end date of the holding period, the betas of the regression is based on 66 observations. The authors of this study were also interested in a more accurate beta. The betas have been calculated with the weekly returns of the stocks and the return of the market index by the formula 5 in the Methodology chapter. The calculations are based on 12 months of data and the 12-months period ends when the corresponding holding period ends. That yields a beta which is obtained from 50 observations for each stock and each holding period. With an average number of 20 stocks in each portfolio, that yields a portfolio beta based on 1000 observations for each portfolio and each holding period.

The results for the average betas for each portfolio are presented in Table 4.6 and in Graph 4.3. In Table 4.6 it can be seen that the highest beta values are obtained for the Winners-(P1) and the Losers portfolio (P10). The difference between both portfolios is -0.1082. The values of the betas calculated in this subchapter are slightly different (lower) than the ones.
obtained by the regression of the CAPM and the FF3FM, but the pattern and the relationship between the Winners- and Losers portfolio is the same. An illustration of the pattern of the different beta values can be seen in Graph 4.3. The beta values are U-shaped and the highest value is obtained for P10. The calculated betas confirm the relationships of the betas which were obtained from the regressions and therefore secure any conclusion made out of them.

<table>
<thead>
<tr>
<th>J6/K6</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>0.8506</td>
</tr>
<tr>
<td>P2</td>
<td>0.7411</td>
</tr>
<tr>
<td>P3</td>
<td>0.7353</td>
</tr>
<tr>
<td>P4</td>
<td>0.7260</td>
</tr>
<tr>
<td>P5</td>
<td>0.6995</td>
</tr>
<tr>
<td>P6</td>
<td>0.7275</td>
</tr>
<tr>
<td>P7</td>
<td>0.7321</td>
</tr>
<tr>
<td>P8</td>
<td>0.8120</td>
</tr>
<tr>
<td>P9</td>
<td>0.8024</td>
</tr>
<tr>
<td>P10</td>
<td>0.9588</td>
</tr>
</tbody>
</table>

Table 4.6 Average betas for each portfolio in the J6/K6 strategy

Graph 4.3 Average betas for each portfolio in the J6/K6 strategy

4.2.4 Market capitalization

The firm size, expressed by its market capitalization can be used to analyze the momentum profits. Table 4.7 and Graph 4.4 present the average results which were obtained for the ten portfolios of the J6/K6 strategy. The average market capitalizations for the portfolios were calculated from the average market capitalizations of the stocks which correspond to each portfolio and date. The average market capitalization of all the portfolios of the sam-
ple is 13 324.42. One should keep in mind that the stocks with an average market capitalization smaller than 100 million for the observation period are excluded from the sample to avoid abnormal returns which are due to the firm size factor. From Table 4.7 and Graph 4.4 it can be seen that the portfolios P2 to P8 are not very different from each other. But the portfolios P1, P9 and P10 consist of stocks with average market capitalizations lower than the average of the sample. The same pattern was also observed in Jegadeesh and Titman (2001) and according to Banz (1981) does small firm size suggest more volatility and higher returns. In that case, one can argue that the smaller firm size is a risk factor which can partially explain the abnormal returns. As it can be seen in Table 4.7, the P10 is with the lowest market value which would suggest that the profits come from the Losers portfolio, the short side of the strategy, which was already demonstrated a number of times that that it is not the case. The results are contrary to the theory of the small firm size effect of Banz (1981). The Winners portfolio, P1, is the portfolio which provides the significant positive abnormal returns which yields the profits of the momentum strategy. As explained earlier in this chapter which treats the FF3FM, the firm size offered an additional 5% of explanatory power of the returns of P1. That leads to the conclusion that the strategy on average selects stocks with market capitalization that are smaller than the average, but it is not the source of the momentum profits.

<table>
<thead>
<tr>
<th>J6/K6</th>
<th>Market Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>9366.72</td>
</tr>
<tr>
<td>P2</td>
<td>15290.69</td>
</tr>
<tr>
<td>P3</td>
<td>18225.99</td>
</tr>
<tr>
<td>P4</td>
<td>17511.50</td>
</tr>
<tr>
<td>P5</td>
<td>15245.88</td>
</tr>
<tr>
<td>P6</td>
<td>15582.70</td>
</tr>
<tr>
<td>P7</td>
<td>15561.55</td>
</tr>
<tr>
<td>P8</td>
<td>15131.18</td>
</tr>
<tr>
<td>P9</td>
<td>7788.31</td>
</tr>
<tr>
<td>P10</td>
<td>3539.66</td>
</tr>
</tbody>
</table>

Table 4.7 Average market capitalizations for each portfolio
4.2.5 Implications of the Betas and Market Capitalizations

The betas and the market capitalization are examined in order to establish if the momentum strategies systematically selects high-risk stocks. Of the beta coefficients, the negative beta of the zero-cost portfolio is of interest. Since the beta of the Winners portfolio is lower than the beta of the Losers portfolio, the beta for the zero-cost portfolio becomes negative. The beta for the Winners portfolio is slightly (0.0378) higher than the average beta of the sample. The beta for the Losers portfolio is also higher (0.5891) than the average beta of the sample. The average market capitalizations of the Winners- and Losers portfolio implies that the strategy selects smaller than average stocks. The average market capitalization of the Loser portfolio is smaller than the average market capitalization of the Winners portfolio. The results are highly similar to the results of Jegadeesh and Titman (1993, 2001) of which the conclusion of the analysis of the betas suggested that the realized returns do not derive from the expected return component of the realized returns. In other words, the momentum profits are not due to a selection of stocks with larger expected return.

4.2.6 Post-holding period

The main purpose of this study was to test the existence of momentum effect in the medium-term time horizon. The returns for several post-holding periods are calculated in order to examine the portfolios’ performance after the end of the holding period and to relate it

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Graph 4.4 Average market capitalizations for each portfolio

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5 For further insight in the reasoning of the conclusion, the reader is referred to Jegadeesh and Titman (1993) pp. 72
with the existing theories and previous research. The post-holding period is five years. Each post-holding year's average monthly return is measured for all portfolios of the J6/K6 strategy, but the focus is on the Winners-, Losers- and zero-cost portfolios. The results for all the portfolios are demonstrated in Table 4.8. Graph 4.5 and Graph 4.6 only consider the Winners-, Losers- and zero-cost portfolios. In Graph 4.5, the holding period is included for comparison and illustration purposes.

The presented results are the post-holding periods 1, 2, 3, 4 and 5 years after the holding period. As can be seen in Table 4.8, already in the first year the Winners portfolio (P1) stops being the portfolio which produces the highest average monthly return and the Winners-, Losers- (P10) and the zero-cost (P1-P10) portfolios all produce average monthly returns which are smaller than 1%. All three portfolios are among the worst performing portfolios. The results of the second and third year are clearer, the Winners-, Losers- and zero-cost portfolios are strictly the worst performing portfolios. The zero-cost portfolio produces an average monthly return of 0%. The fourth year, the Winners portfolio is still among the worst performing portfolios while the Losers portfolio is the best performing portfolio which produces an average monthly return of 1.01%. The average monthly return of the zero-cost portfolio here becomes negative since the Losers portfolio outperforms the Winners portfolio. The fifth year, the Winners portfolio is again the worst performing portfolio while the Loser portfolio is the third worst performing portfolio. Again, the average monthly return of the zero-cost portfolio becomes negative since the Losers portfolio slightly outperforms the Winners portfolio.

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>0.0085</td>
<td>0.0032</td>
<td>0.0051</td>
<td>0.0073</td>
<td>0.0082</td>
</tr>
<tr>
<td>P2</td>
<td>0.0128</td>
<td>0.0069</td>
<td>0.0082</td>
<td>0.0098</td>
<td>0.0085</td>
</tr>
<tr>
<td>P3</td>
<td>0.0104</td>
<td>0.0096</td>
<td>0.0083</td>
<td>0.0091</td>
<td>0.0105</td>
</tr>
<tr>
<td>P4</td>
<td>0.0092</td>
<td>0.0072</td>
<td>0.0077</td>
<td>0.0085</td>
<td>0.0102</td>
</tr>
<tr>
<td>P5</td>
<td>0.0099</td>
<td>0.0075</td>
<td>0.0088</td>
<td>0.0084</td>
<td>0.0086</td>
</tr>
<tr>
<td>P6</td>
<td>0.0119</td>
<td>0.0107</td>
<td>0.0095</td>
<td>0.0087</td>
<td>0.0109</td>
</tr>
<tr>
<td>P7</td>
<td>0.0075</td>
<td>0.0107</td>
<td>0.0085</td>
<td>0.0074</td>
<td>0.0107</td>
</tr>
<tr>
<td>P8</td>
<td>0.0104</td>
<td>0.0081</td>
<td>0.0083</td>
<td>0.0067</td>
<td>0.0103</td>
</tr>
<tr>
<td>P9</td>
<td>0.0059</td>
<td>0.0061</td>
<td>0.0096</td>
<td>0.0051</td>
<td>0.0091</td>
</tr>
<tr>
<td>P10</td>
<td>0.0019</td>
<td>0.0028</td>
<td>0.0051</td>
<td>0.0101</td>
<td>0.0086</td>
</tr>
<tr>
<td>P1-P10</td>
<td>0.0066</td>
<td>0.0004</td>
<td>0.0000</td>
<td>-0.0027</td>
<td>-0.0004</td>
</tr>
</tbody>
</table>

Table 4.7 Average monthly returns for each portfolio in the post-holding period
As is illustrated in Graph 4.5 the profits of the winners portfolios are starting to fall until the third year, where they rise up again until the fifth. The Losers portfolio returns are growing until the top at the fourth year and they start to fall again in the fifth year. Due to the fact that the Losers portfolio starts to outperform the Winners portfolio at the third year and continues until the fifth year, the zero-cost portfolio returns start to fall from the first year until the fourth year.

Graph 4.5 Average monthly returns for the Winners- Losers- and zero-cost portfolio in the holding period

Graph 4.6 illustrates the pattern which the Winners- Losers- and the zero-cost portfolio follow the years after the holding period. The graph clearly illustrates a reversal for the returns of the Winners- and Losers portfolio in a longer time-horizon than the holding periods. The reversals of the two portfolios cancel each other out and an average monthly return of approximately 0 % for the zero-cost portfolio is obtained from the second year until the fifth year. At the fifth year, the returns of Winners- and Losers portfolios culminate into almost an equal amount which ends the pattern.
Table 4.8 present the results of the hypothesis tests which were performed for the purpose of statistically confirming the previously noted non-existence of momentum profits in the post-holding periods. The hypothesis tests confirmed that the zero-cost portfolio does not produce significant positive average monthly returns for any post-holding period.

<table>
<thead>
<tr>
<th></th>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
<th>4th year</th>
<th>5th year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average returns</td>
<td>0.0066</td>
<td>0.0004</td>
<td>0.0000</td>
<td>-0.0027</td>
<td>-0.0004</td>
</tr>
<tr>
<td>t-value</td>
<td>0.0486</td>
<td>0.8775</td>
<td>0.9994</td>
<td>0.3975</td>
<td>0.8056</td>
</tr>
</tbody>
</table>

Table 4.8 Hypothesis test of the zero-cost returns

Table 4.9 presents the results for the decomposed zero-cost portfolios of which the returns are tested for statistical significance. The Winners portfolio produces an average monthly return of 0.85 % for the first year of the post-holding period and the returns are significant. The returns are not significantly different from zero for the second and third year. The fourth and the fifth year, the average monthly returns are 0.73 % and 0.82 % and the returns are again significant. The average monthly returns of the Losers portfolio are not significant different from zero for the first, second and third year of the post-holding period. For the fourth year, the average monthly returns are 1.01 % and 0.86 % and the returns are significant. The zero-cost portfolio produces an average monthly return of 0.66 % the first year of the post-holding period. For the second, third, fourth and fifth year the average monthly return is approximately 0 %.
4.2.7 Implications of the post-holding results

The results of the post-holding period are consistent with the earlier research that Jegadeesh and Titman (2001) made on the American stock market. The results of the post-holding period also show a pattern consistent with the contrarian strategies that De Bondt and Thaler (1985) discovered. The contrarian strategies benefit from the reversals of past winners and past losers in the long-term time-horizon. The Winners- and Losers portfolios of this study, both show tendencies of reversals in the long-term time-horizon. The Conrad and Kaul (1998) hypothesis suggested that the momentum derived from the unconditional drift of the selected stocks of the Winners- and Losers portfolio. The momentum profits would be due to the difference in the unconditional drift of those selected stocks. The extension of that hypothesis is that the best performing stocks during the formation period continues to perform the best in any post-ranking period. The evidence from this study, along with evidence of Jegadeesh and Titman (2001) contradicts that statement. The returns of the formation period and holding period are not constant through time. The holding periods shows heavily descending returns the first year and zero-returns for the following period. The evidence found in this study and in Jegadeesh and Titman (2001) yields to the conclusion that the Conrad and Kaul (1998) hypothesis should be rejected as an explanation to the momentum profits. The behavioral finance theory of Barberis et. al., Daniel et. al. (1998) and Hong and Stein (1999) offers different explanations to the momentum profits. Barberis et. al. (1998) suggested that the short-term momentum was due to a combination of conservatism biases and representative heuristic. The representative heuristic make the investors believe that stocks which experience extraordinary earnings growth will continue to do so in the future. The combination of the two factors leads to zero returns in the long time-horizon. To clarify, the results of this study are consistent with the theory which states that there will be momentum profits in the short-term and due to the fact that the prices will slowly start to adjust to that new information, the future returns in
long-term after the momentum holding period, will be zero. Daniel et. al. (1998) suggest the argument that informed traders suffer from self-attribution bias by attributing good performance to stock selection skills and bad performance to bad luck. The overconfidence of those investors yields a delayed overreaction to the stock prices, which are eventually reversed to the fundamental value. Hong and Stein (1999) explain the momentum profits by considering different types of investors. The investors who trades based on historical information contribute to push the prices of past winners above their fundamental value. Reversals are following when the investors update and adjust to the news and the prices revert to their fundamental value. The evidence of this study does not give any evidence to the actual psychological explanations that are offered. However, a delayed overreaction by the significant positive abnormal returns and a reversal in the long-term horizon by the negative returns in the post-holding period are consistent with the results of this study.
5 Conclusion

The present thesis was made with the main purpose of exploring if momentum profits can be obtained on the Swedish stock market between the years 1998 and 2013. That was performed by applying the methodology which has been developed by Jegadeesh and Titman (1993, 2001). Despite the fact that those two works were the foundation of the present study, there are other theories used in order to provide a further and deeper overview of the studied topic. One of the most important theories is the Efficient Market Hypothesis of Fama (1970), whose implications contradict the existence of the Momentum Effect found in previous research. In order to provide satisfactory evidence to the study, several approaches and tools such as the Capital Asset Pricing Model, Fama-French Three Factor Model, Beta-values and Market capitalization were utilized in order to examine and confirm or exclude possible explanations to the abnormal returns. The results and evidence which this study provides are significant and in line with previous research on the area such as Jegadeesh and Titman (1993, 2001), De Bondt and Thaler (1985) and Roumenhorst (1998). The results and evidence are also, to some extent, in line with existing behavioral finance theories such as Barberis et. al. (1998), Daniel et. al. (1998) and Hong and Stein (1999).

The momentum strategies yield significant positive abnormal returns for almost all of the 16 strategies which confirm the fact that there exists a Momentum Effect on the Swedish stock market. The utilization of the momentum strategies yields average monthly returns that vary from 0.8% to 1.59%. The highest average monthly return is obtained for the J6/K6 strategy. The strategies which obtained the most significant results are the ones with formation periods of 6, 9 and 12 months and holding periods of 6, 9, 12 months. The examination of which side (buy/sell) of the strategies where the profits derive from yielded the conclusion that all profits derived from buying the Winners portfolios. The extension of that conclusion is that the Winners portfolio strictly outperforms the Losers in the formation period as well as in the holding period. The risk-adjusted returns obtained by regressing the returns of the momentum strategies against the risk-factors of the Capital Asset Pricing Model and Fama-French Three-Factor Model confirm that the profits cannot be derived to exposure to those risk-factors. The Betas and market capitalization of the portfolios confirmed that the obtained abnormal returns are not due to selection of stocks with higher expected returns which bear higher systematic risk. The combined evidences from the holding- and post-holding period of this study and previous research implicates and gives support to behavioral finance models, which individually use different arguments.
to the investor behavior, but all come to the same conclusion. The conclusion is that investors overreacts to positive firm-specific information which pushes the stock prices over its fundamental value in the short- or medium-term time horizon, only revert back to its real value in the long-term time-horizon. The combined evidences also give implications regarding the Efficient Market Hypothesis. The evidences are sufficient to dismiss the practical correctness of the underlying models as well as the main model, at least in a short-term time horizon. However, the market can still be efficient as the Random Walk Model is not a sufficient condition and the Efficient Markets Hypothesis is still useful as a theory. But the result of this study implies that, in the short-term, either the historical information of stocks still contain information which can be exploited or that the Momentum Effect is a risk-factor itself. Pasour (1989) clarify and confirm this conclusion by claiming that, as a long-run theory, the Efficient Market Hypothesis has the shortcomings of focusing only on the outcomes equilibriums and not on the process to arrive to these outcomes.

The final summarizing conclusion of this study is that there exists a Momentum Effect on the Swedish stock market. The utilization of momentum strategies yields significant positive abnormal returns, without taking transaction costs into account. The Efficient Market Hypothesis is a model which might hold in the long-term, but shows limitations in the short-term. The implications of the results of this study are that short-term investor behavior and momentum profits could be partially explained by behavioral finance models but the origin of the momentum profits need to be further evaluated.

5.1 Suggestions for further research

The authors of this study obtained results and evidence which are an extension of previous research. The results of this study expand evidence from the American, European and Asian stock markets. It also examines a time-frame which has not been previously examined.

Further research could take into account the trading costs or the analyst coverage. It is also suggested, that future research uses shorter overlapping periods in order to have the possibility to test the robustness of the strategies and to increase the statistical power of the results. Naturally, a similar study could be performed for different markets or time-frames which will provide additional evidence of the existence or non-existence of a Momentum Effect. Future researchers of the area are suggested to develop the methodology so that the specific explanations of the behavior of investors can be tested. Finally, it is recommended
that future research makes a clear comparison of the performance of the momentum strategies and a benchmark index.
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