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# **Long-only momentum investing in the Helsinki Stock Exchange**

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**UNIVERSITY OF VAASA****School of Accounting and Finance**

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**ABSTRACT:**

This thesis investigates long-only momentum investing in the Helsinki Stock Exchange during the period 2012-2022. Typically, in momentum-related research the performance of losers is evaluated as well, and then short sell these stocks. Momentum has been a popular research topic within the field of finance since the 1990s' when Jegadeesh and Titman presented their results from the US market. Since then, momentum has been a subject of research in many markets across the globe. The Finnish market has been a subject of research as well, but the amount of research is smaller than in many other market areas. However, the results from the Finnish market indicate that momentum investing can be a profitable strategy. Taking only long positions in the winner stocks may be a more realistic approach to the Finnish market.

The Finnish market includes many stocks with small market values and low trading volumes. Therefore, shorting of such stocks may not be possible. Long-only momentum investing has been able to generate returns that have exceeded the index returns for instance in India. This thesis investigates the Finnish stock market between 2012-2022. All the listed stocks are considered when the momentum portfolios are constructed. The stock returns are monitored based on the returns from 2, 5, or 12 months. One month will be excluded. Then the portfolios are held for 3 months or 6 months. The returns are compared to the performance of the OMXH index.

The results indicate that certain momentum strategies are more useful than others. Strategies with 5-month measurement periods produce results that should be most interesting for investors. Furthermore, previous academic research indicates that these returns are not entirely random. However, the achieved results are not statistically significant. In addition, the risk-adjusted returns of each long-only momentum strategy are not able to exceed the OMXH index performance.

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**KEYWORDS:** Investing, Stock Market, Anomalies, Efficient Market

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**TIIVISTELMÄ:**

Tämä pro gradu -tutkielma tutkii momentum sijoittamista vain ostamisen näkökulmasta. Usein momentum-sijoittamisessa tarkastellaan myös huonommin suorituneiden osakkeiden tuottoja ja myydään näitä osakkeita lyhyeksi. Momentum-sijoittaminen on ollut suosittu tutkimuksen aihe rahoituksen alalla 1990-luvulta lähtien. Jegadeeshin ja Titmanin 1990-luvun alun momentum-tuottoja käsitellyttä tutkimusta on seurannut ilmiön tutkiminen useilla eri markkinoilla ympäri maailmaa. Suomen osakemarkkinoita on tutkittu myös, mutta laajuus on pienempää kuin monien muiden markkinoiden osalta. Tulokset Suomen osakemarkkinoilta ovat silti osoittaneet momentum-sijoittamisen toimivan tuottavana strategiana. Pelkkään voittajaosakkeiden ostamiseen keskittyvää strategiaa voi pitää realistisempänä strategiana Suomen markkinoille.

Suomen markkinoilla on lukuisia osakkeita, joiden kaupankäyntivolyymit ja markkina-arvot ovat pieniä. Tästä johtuen osakkeiden lyhyeksi myyminen ei välttämättä ole realistista. Vain voittajaosakkeiden ostamiseen keskittyvä strategia on kuitenkin tuottanut indeksisijoittamista paremmin esimerkiksi Intian osakemarkkinoilla. Tämä tutkielma tarkastelee Suomen osakemarkkinaa vuosien 2012 ja 2022 välillä. Kaikkia Helsingin pörssiin listattuja osakkeita tarkastellaan, kun momentum-portfolioita rakennetaan. Osakkeiden tuottoja tarkastellaan edellisen kahden, viiden tai 12 kuukauden perusteella. Yksi kuukausi jätetään huomiotta tarkasteluperiodin jälkeen, jonka jälkeen voittajaosakkeiden parasta desiiliä omistetaan joko kolmen tai kuuden kuukauden ajan. Strategioiden tuottoja verrataan OMXH-indeksin tuottoihin.

Tutkimuksen tulokset osoittavat, että osa momentum-strategioista toimii paremmin kuin toiset. viiden kuukauden mittausperiodi tuottaa tuloksia, jotka ovat sijoittajien kannalta mielenkiintoisimpia. Myös aiempi akateeminen tutkimus osoittaa tämän ajanjakson toimivuutta. Toisaalta, tuottojen tilastollinen merkitsevyys on heikkoa. OMXH-indeksin tuotot ovat myös riskikorjattuina paremmat kuin yhdelläkään momentum-strategialla.

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**AVAINSANAT:** Sijoittaminen, Osakemarkkinat, Anomaliat, Tehokkaat markkinat

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## 1 Introduction

Covering the momentum effect has been a popular research topic during the last decades. According to Asness et al. (2013), there has been a remarkable amount of discussion regarding momentum and market efficiency. Different explanations and theories have been developed to explain the momentum anomaly. The core idea of momentum investing is to benefit from the latest trends in the development of stock prices. To achieve momentum returns, the investor buys stocks that performed well over a specific time and sells stocks that have underperformed. These portfolios are held for typically six months to one year before the procedure is repeated. However, the efficient market hypothesis states that such activities should not benefit the investor.

Different explanations and theories have been developed to explain the momentum anomaly. Leivo and Pätäri (2011) note that there is no clear consensus on what explains the momentum returns. Some researchers estimate that momentum returns are due to underreaction or overreaction in stock prices to publicly available data whereas other explanations concentrate on risk factors that are not entirely discovered.

Jegadeesh and Titman (1993) introduce their results from the US stock market from the period 1965-1989. The findings of Jegadeesh and Titman challenge the concept of efficient markets. For instance, the trading strategy that chose stocks based on the last six-month performance and then these stocks were held for six months was able to deliver significant excess returns, 12,01 % on average each year.

Since the 1990s, momentum research has been made in various markets around the world. For instance, Asness et al. (2013) discovered that momentum premia can be found in different markets and assets. Bird and Whitaker (2003) discover that momentum investing has performed strongly in the European markets, at least over the period 1990 to 2002. Rey and Schmid (2007) re-examine the results of Bird and Whitaker by stating that momentum investing has been a profitable strategy in the Swiss market. The different momentum strategies can yield significant returns, measured by annual-

ized geometric mean returns. The results are described as robust and the sample includes both bull and bear market periods. Raju and Chandrasekaran (2019) have investigated the performance of long-only momentum in the Indian stock market. The results from India indicate that long-only momentum investing can yield higher returns than the index. Furthermore, the returns can be higher on a risk-adjusted basis, too.

The purpose of this study is to discover how profitable the long-only momentum strategies have been in the Finnish Stock Market during the period 2010-2022. The Finnish stock market has been able to deliver competitive returns. According to Saario (2007), the Finnish publicly listed companies were able to generate an average annual return of 13,7 % between 1994-2006. For instance, the S&P 500 index produced an average annual return of 10,8 % during the same period.

## **1.1 Structure of the study**

This thesis has the following structure. The first chapter is an introduction chapter that explains the motivation behind this topic. The second chapter covers the theoretical background that is related to momentum. The third chapter introduces the research question and the hypothesis for this thesis. The fourth chapter discusses the methodology and data that are required to perform the empirical study. The fifth chapter discusses the results of the empirical part. The sixth chapter is for the conclusions and the findings of the study, and the limitations are discussed. Furthermore, possible suggestions for future research may be discussed.

## 2 Theoretical background

The distinction between traditional and behavioral finance is a typical division of finance theory. Traditional finance is typically thought of as a normative theory that focuses on finding a logical answer to the choice dilemma by creating theories and financial tools for how investors should behave rather than how they do. Behavioral finance is descriptive in this regard since it provides explanations of what occurs as opposed to what should occur (Razek, 2011). Even though many theories and assumptions used in traditional finance do not hold in practice, these theories such as the efficient market hypothesis or the Capital Asset Pricing Model, continue to be important concepts. In this theoretical background section, theories and behavioral concepts are discussed.

The Finnish stock market is small compared to many other European markets and especially compared to the US market. Furthermore, the Finnish market may be less lucrative for many international investors because of its geographical location next to unstable Russia. However, NATO membership could reduce this risk. Ahmed et al. (2022) analyze whether the geographical location as a neighbor of Russia would impact the stock market. In the study, Ahmed et al. (2022) state discuss that many European countries have some exposure to the conflict between Russia and Ukraine. Ahmed et al. (2022) aim to determine whether the sample companies from Poland, Finland, and Norway which are countries bordering either Russia or Ukraine or both, show asymmetric features. The study shows that there is no substantial above-market reaction, a result mostly supported by the positive, but non-significant, market reaction by companies from the Norwegian market. However, Shaker et al. (2022) mention that Norway has a border with Russia, and it is a NATO member. Finland was not a NATO member at the time, which may indicate that the Finnish market might have been perceived as riskier.

The academic literature has some previous discussions of the characteristics of the Finnish market. Therefore, possible special features may increase interest in performing more research on the Finnish market. Grinblatt and Keloharju (2000) state that for-

eign investors are the most knowledgeable participants in Finland's financial markets. International investors appear to use momentum using momentum strategies. Finnish investors, especially households, seem to be contrarian investors, purchasing losers and dumping winners (Grinblatt & Keloharju, 2000). In addition, Grinblatt and Keloharju (2001) argue that Finnish investors prefer stocks of Finnish companies because of near proximity and communication in Finnish. Furthermore, top executives from the same cultural background are appreciated by Finnish investors. Therefore, Finnish stocks are more likely to be traded by investors. In comparison to both families and less smart institutions, the impact of distance, language, and culture is less pronounced among the most investment-savvy institutions (Grinblatt & Keloharju, 2001).

Leivo and Pätäri (2011) describe that foreign investors escape from the Finnish market during unstable times. As Finnish stocks do not have significant liquidity, the price changes can be noticeable when many foreign investors want to sell their shares at the same time. However, Leivo and Pätäri (2011) note that the Finnish market may perform stronger during positive periods than many other developed markets. Therefore, active investing methods may be useful in the Finnish market and the herding behavior of investors can impact momentum returns.

The momentum anomaly has been a point of interest in the finance literature since the 1990s'. Therefore, investors have had a few decades to investigate this phenomenon. For instance, algorithmic trading and increased awareness of the phenomenon may impact momentum returns in a way that abnormal returns cannot be detected. Still, it may be that the Finnish market is more inefficient. According to Shaker (2013), the Finnish market would not be efficient in the weak form, based on the daily returns from the OMXH25 index between 2003 to 2012.

According to Huij et al. (2014), it is unclear which strategy—long-only or long-short—is the best one to use when using factor investing. Huij et al. (2014) compare the two approaches and find that, despite the long-short approach's theoretical superiority, the

long-only approach seems to be the preferable option in most situations. The study shows that costs can have a negative impact on the value that a long-short implementation may deliver. Israel and Moskowitz (2013) find that short-selling gains become less important for momentum strategies when the size of the companies is smaller. Furthermore, Raju and Chandrasekaran (2019) state that the long-only approach has been a profitable investing strategy in the Indian market.

## **2.1 The efficient market hypothesis**

Fama (1970) argues that the capital market exists because it is a tool to allocate resources. Prices in the market give accurate information on how the resources should be allocated. If the market functions optimally, investors should be able to rely on prices that reflect all the information that is related to stock prices (Fama, 1970). An efficient market is a market where prices are correct, and reflect all the available information (Fama, 1970).

The efficiency of the market can be investigated on three levels. The difference between the levels is the amount of information that the stock prices include. According to Fama (1970), there are three forms of efficiency. The weak form of efficiency indicated that only the past price data impacted the stock prices (Fama, 1970). The semi-strong form of efficiency includes historical private information and the available public information, such as the announcements made by publicly listed companies (Fama, 1970). The strong form of efficiency states that all possible information is reflected in the stock prices, for instance, insider information (Fama, 1970). The more advanced concept includes the previous concept, for instance, the strong form includes both the semi-strong form and the weak form (Fama, 1970).

Shleifer (2000) defines the characteristics of a rational investor. A rational investor concentrates on the fundamentals of the security. For instance, the estimated future cash flows can be calculated and then discounted to the present moment with a cost of cap-

ital that takes the risk profile of the security into account. Good news should have an impact on the intrinsic value of a stock as investors begin to buy the stock. On the other hand, investors would consider bad news as a factor that has a negative impact on stock prices (Shleifer, 2000).

Shleifer (2000) states that the Efficient Market Hypothesis cannot be ignored by changes in the investor's awareness and capabilities. Even though the market would have fewer rational participants, the market can still be considered as efficient. Shleifer (2000) presents that irrational investors can buy and sell stocks without a strategy. However, these transactions can eliminate each other when many investors trade without a strategy. The stock prices should be close to the fundamental values even if the investors might not have considered fundamental factors. Shleifer (2000) writes that it is important that the irrational investors' trading activities do not correlate so that the assumptions presented will hold.

Shleifer (2000) discusses the concept of arbitrage which can be defined as taking advantage of the mispricing of securities. For instance, a stock can become overpriced in comparison to its fundamental factors, such as future growth or profitability. Arbitrageurs would sell the stock or possibly short sell it and purchase a similar security and possibly earn profit from this trading. The overpriced stock should experience a price decrease and the new price should be set closer to the fundamental value (Shleifer, 2000). Therefore, Shleifer (2000) argues that the actions of arbitrageurs should maintain the stock prices near their fundamental values even if there is a certain number of irrational investors in the market. However, the securities in the market should have near replacements.

The concept of momentum challenges the concept of efficient markets. The momentum effect conflicts with each of the three forms of efficiency. Therefore, according to the theory, momentum investing should not work because the past price information should not be able to help the investors achieve unusually high stock returns (Inglis et

al., 2019). Maheswari and Dhankar (2017) argue that a significant part of academicians accepts the possibility that analyzing past stock return data can yield excess returns. During the latest decades, various empirical results have been introduced and these market anomalies challenge the concept of efficient markets.

According to Malkiel (2003), the concept of random walk is used in the finance literature to describe a price series where all subsequent price changes indicate random deviations from earlier prices. Therefore, it is connected to the efficient market hypothesis (Malkiel, 2003). According to the random walk theory, if information flows without restrictions and is quickly reflected in stock prices, tomorrow's price movement will only reflect tomorrow's news and will be unrelated to today's price fluctuations. However, since news is by nature erratic, price fluctuations that follow from it should also be erratic and random (Malkiel, 2003). Therefore, prices should accurately reflect all available knowledge, and even uneducated investors purchasing a diverse portfolio at the current market prices, should receive a rate of return that should not differ from professional investors' performance (Malkiel, 2003).

## **2.2 The momentum effect**

Based on the previously explained concept of efficient markets, it should not be possible to generate unusually high stock returns by using information that all participants in the financial markets have access to. However, different inefficiencies and anomalies exist. According to Jegadeesh and Titman (1993), equities that had better returns in the preceding year often had higher returns in the following year. Therefore, the positive development in stock prices tends to continue. However, Fama and French (1996) mention that other factors may impact the stock returns, too. Factors such as size or book value of equity to the market value of equity have been mentioned as possible explaining factors (Fama & French, 1996). If the patterns in stock returns cannot be explained by the Capital Asset Pricing Model, there may be anomalies (Fama & French, 1996). According to Inglis et al. (2019), present market theories view momentum as an abnormal phenomenon. Current portfolio theory creates portfolios with the best possible

returns while minimizing risks (Inglis et al., 2019). However, momentum investing generates returns with equally-weighted portfolios and may ignore risks (Inglis et al., 2019). According to Inglis et al. (2019), momentum maintains a slow price trend, arbitrage pricing theory claims that prices move swiftly to stable levels due to transactions. Theoretically, momentum implementation requires two past price points per security and index membership, despite the weak form of the efficient market hypothesis argues past price information cannot predict future stock returns (Inglis et al., 2019).

According to Inglis et al. (2019), investors with little knowledge tend to lose money in the equity market. Inexperienced investors may view buying securities at low prices and selling them at higher prices as a typical strategy. However, according to Inglis et al. (2019), the price movements are caused by what the market believes to be correct. Therefore, novice investors might buy securities when the timing is not optimal (Inglis et al., 2019).

According to Inglis et al. (2019), by executing the common-sense adage successfully, an investor can purchase at high returns even when stock prices are at a high level and sell or short sell at low returns even when prices are at a lower level. This approach is referred to as momentum investing when equally weighted zero-cost portfolios are attached to the strategy. Inglis et al. (2019) argue that the strategy can perform well in the majority of market circumstances, According to Inglis et al. (2019), momentum investing forms the basis of a number of stock market strategies and is used by professionals within the finance industry.

Inglis et al. (2019) specify that the foundation of momentum investing is the persistence of winners and losers. Investors select stocks that have produced the best and worst returns during recent months. Investors expect that the winning stocks continue their profitable performance. According to Inglis et al. (2019), a general approach to the implementation of the momentum technique is to categorize stocks based on recent returns, create an equally weighted zero-cost portfolio, and then sell the lowest

decile and buy the highest decile. The winners minus losers (WML) portfolio is kept for a set amount of time. The process will be repeated each month and the purpose is to generate a systematic profit (Inglis et al., 2019). Inglis et al. (2019) argue that the momentum strategy has also other benefits, as it does not require significant knowledge and is not labor intensive.

According to Jegadeesh and Titman (1993), the momentum strategy can yield unusually high returns. The tests performed by Jegadeesh and Titman (1993) reveal that by using this strategy, an investor can achieve significant returns. However, the returns remain noticeable with a holding period of 3 to 12 months. The most successful of the momentum was able to achieve an excess return of 12,01 % per year on average. Furthermore, Jegadeesh and Titman (2001) write that the profitable performance of momentum investing continued over the 1990-1998 period. These findings might indicate that momentum gains are not purely due to data manipulation (Jegadeesh & Titman, 2001).

Jegadeesh and Titman (1993) discuss the performance of mutual funds that execute momentum strategies in the investment process. The unusually high returns generated by the strategy might be due to the possibility of the returns being misleading (Jegadeesh & Titman, 1993). Another consideration is that the unusually high returns may not be related to the fund managers' habits to buy the past winner stocks (Jegadeesh & Titman, 1993). According to Jegadeesh and Titman (1993), certain evidence indicates that industry professionals tend to buy stocks based on the securities performance over the previous 3 to 12 months.

Jegadeesh and Titman (1993) add that the stock price development that is estimated using the past performance, may not last on holding periods that exceed 12 months. The negative abnormal gains occur approximately 12 months from the construction of the portfolios. As an example, Jegadeesh and Titman (1993) report that the gains for a momentum strategy based on the performance from 6 past months and the holding

period being 12 months, the returns are 9,5 % for the holding period. However, the returns diminish noticeably in the following two-year period.

Bird and Whitman (2003) describe that momentum investing follows the logic of simple technical analysis. Momentum investor aims to benefit from recent trends. A reason for using a strategy that relies on simple rules may derive from the behavior of the market, as the market atmosphere supports the development of stocks (Bird & Whitman, 2003). Therefore, the phenomenon can support itself (Bird & Whitman, 2003). Bird and Whitman (2003) argue that the most significant attention concentrates on price development in the medium term. For example, the choices of Jegadeesh and Titman (1993) are mentioned as they used the 3-12 month holding periods.

Executing the momentum investing strategy requires trading activities. The trading costs exist, and they cause friction in the market. Lesmond, Schill, and Zhou (2004) discuss that various trading costs, such as bid-ask spread, the commission of the broker, or short-selling related costs should be considered. The performance of momentum strategies may appear too positive if the trading costs are underestimated. The findings of Lesmond, Schill, and Zhou (2004) indicate that the trading costs are higher for the stocks that are the most important sources of momentum returns.

Lesmond, Schill, and Zhou (2004) reassess the trading cost estimates used by Jegadeesh and Titman in 1993. The trading costs for the smaller stocks may be higher when the trade-weighted measure is not used. Another factor to consider is that trading costs vary over the sample period. A noticeable portion of the momentum returns is due to shorting stocks that have had a weak past performance. Maintaining the short position creates costs and therefore, these costs should not be left without attention (Lesmond et al., 2004). Israel and Moskowitz (2013) argue that there is weak evidence suggesting that momentum returns increase when trading costs rise, especially for small companies. However, there is little proof that these return premia have been significantly impacted by changes in trading costs (Israel & Moskowitz, 2013). In addi-

tion, Moskowitz and Israel (2013) discover that there is an insignificant correlation between size, value, and momentum return premia and hedge fund growth or institutional ownership, except for a reduction in the size premium with higher institutional ownership.

According to Novy-Marx (2012), momentum is not largely determined by the propensity of rising and falling stocks to continue rising and falling, but rather by businesses' performance 12 to 7 months before portfolio construction. Especially among the largest market capitalization stocks and the most liquid stocks, strategies that utilize recent prior performance produce positive returns but might be less lucrative than those based on intermediate horizon previous performance (Novy-Marx, 2012). Novy-Marx (2012) adds that this mentioned information does not specifically relate to the momentum effect shown in the US equity market cross-section.

Novy-Marx (2012) states that recent returns' predictive ability appears to have declined with time, while intermediate past returns appear to possess predictive power. In the 1950s and 1960s, the past stock returns had robust predictive power and the returns were positive. However, the effectiveness of past returns has declined (Novy-Marx, 2012). Over the past 40 years, strategies relying on the intermediate horizon have consistently performed profitably. The returns have been detected in different asset classes, such as commodities and currencies. Novy-Marx (2012) argues that when compared to strategies based on intermediate horizon past performance, recent past performance-based methods seldom produce unusually high returns.

Raju and Chandrasekaran (2019) discuss the persistence of momentum anomaly. Jegadeesh and Titman (1993) mention that the near-term existence of momentum can be robust in the near term and after 12 months, the effect should disappear. Raju and Chandrasekaran (2019) add that considering the holding period length is reasonable in momentum research. The results of Raju and Chandrasekaran (2019) indicate that the momentum phenomenon is present in the near term and degrades longer term. The

explanation may be the tendency of investors to overreact to different signals and news. Furthermore, the overconfidence may have an impact as well (Raju & Chandrasekaran, 2019). According to Raju and Chandrasekaran (2019), investors should adjust their portfolios to control the impact of the bias.

### **2.3 Momentum in different geographical areas**

According to Jegadeesh and Titman (1993), buying winners and selling losers was a profitable strategy in the US stock market between 1965 and 1989. Asness et al. (2013) find that momentum can be detected in different markets and different assets. There may be common factors that impact the momentum returns regardless of the geographical area (Asness et al., 2013). However, Japan may be an exception. Asness et al. (2013) discovered that momentum does not provide significant results in Japan. The results from 1974-2011 indicate that momentum is positive also in the Japanese market, the momentum premia is not statistically significant.

Chui, Titman, and Wei (2010) state that there are differences among cultures in how people consider their skills. In an individualistic culture, such as the United States culture, people tend to consider their abilities to be above average. The Japanese culture is different as it is considered to be more collective. In a such culture, this tendency to overestimate abilities might not be as strong (Chui et al., 2010).

Raju and Chandrasekaran (2019) write using a long-only momentum strategy in the Indian market can yield significant excess returns. Their study includes the stocks from the NIFTY100 index which includes the most liquid stocks in the Indian market. The Indian market does not have publicly traded momentum exchange-traded funds. This may reduce the demand for momentum stocks (Raju & Chandrasekaran, 2019). Maheshwari and Dhankar (2017) discuss that the Indian market can be viewed as an interesting area as it is outside various developed markets. Still, the economy in India de-

velops constantly. The results indicate that the momentum is profitable in the Indian market. Momentum strategies with a formation time of three to six months yield strong momentum profitability (Maheshwari & Dhankar, 2017). The data from India indicates that the momentum gains of past short-term winners perform stronger than the past short-term losers and these results support the previous findings from the US market and other developed markets (Maheshwari & Dhankar, 2017).

Fama and French (2012) find that momentum returns are present in the European markets, too. On average the monthly return is 0.92 %. The momentum returns are even more significant for small European companies, on average the monthly return is 1.34 %. Fama and French note that the majority of the nations in Europe are members of the European Union, and those that are not officially members, such as Switzerland, take part in most of the open market rules in Europe. The Asia Pacific area, which is a smaller area, has the least reliable market integration (Fama & French, 2012).

Rey and Schmid (2007) report that momentum strategies on Swiss blue-chip stocks are comparable to those from momentum techniques that are permitted to invest in all publicly listed stocks on the American market. In particular, the arbitrage techniques enjoy annualized geometric mean returns between 9,19% and 43,79% p.a. depending on the duration of the formation and holding time (Rey & Schmid, 2007).

Bird and Whitaker (2003) investigate the performance of momentum investing in different European markets. The performance of momentum investing is strong for portfolios with a holding period of three months. The six-month holding period maintains the positive performance of momentum. However, for the 12-month return measurement period shorter holding periods perform better, with the excess returns for past winners in comparison to losers being approximately four percent in six months. Bird and Whitaker (2003) discover that the most noticeable impact on the momentum strategy originates from past winners. An investor might experience fewer difficulties in

the execution of the strategy as the acquisition of the relevant stocks is more realistic (Bird & Whitaker, 2003).

Rouwenhorst (1998) discusses medium-term momentum gains across different European markets from the period 1978-1995. The findings indicate that long-short momentum investing can generate roughly one percent monthly return. Furthermore, Rouwenhorst (1998) specifies that the phenomenon is detected in many markets instead of certain specific markets. Momentum was stronger for firms with small size (Rouwenhorst, 1998). The mean payoffs to purchasing winner stocks and selling loser stocks should, however, be considerably smaller if return continuance is predominantly caused by nation momentum when the geographical structure of relative strength portfolios is considered (Rouwenhorst, 1998). Rouwenhorst (1998) argues that return persistence can continue to be present in portfolios of country-neutral relative strength if medium-term durability represents unique company success.

Bhattacharya et al. (2015) analyze the years 1965 through 2012 in US markets. The period was divided into three different periods. The first subperiod covers the Jegadeesh and Titman (1993) sample period, 1965–1989, the second subperiod the Jegadeesh and Titman (2001) "out of sample period", 1990–98, and the third subperiod the period 1999–2012. Bhattacharya et al. (2015) performed a test for the out-of-sample era that began at the start of the year 1999 after Jegadeesh and Titman's (2001) "out-of-sample period" ended.

Bhattacharya et al. (2015) observed from the 1999-2012 sample period that the momentum strategies proposed by Jegadeesh and Titman (1993) did not generate profits during more recent years. This specific period is notable because it experienced significant events such as the dot-com bust. Furthermore, the financial crisis and the subsequent stock market downturn, which was the most substantial since the Great Depression in the 1930s (Bhattacharya et al., 2015). A noticeable concern when examining this period is whether the recent economic turbulence, characterized by frequent stock

market losses and significant levels of market volatility, may have impacted the profitability of momentum investing (Bhattacharya et al., 2015).

## **2.4 The Finnish stock market and the Nordic stock market**

According to Leivo and Pätäri (2011), the Finnish market can be described as an intriguing target market for research. According to Leivo and Pätäri (2011), the Finnish market may be subject to "periphery syndrome". International institutional investors may leave the farthest stock markets during volatile periods (Leivo & Pätäri, 2011). The withdrawal process causes stock values to drop more sharply than concurrent decreases in more established stock markets because of the comparatively low liquidity of the Finnish stock market (Leivo & Pätäri, 2011). The tendency has recurred, for instance, during the financial crisis in 2008-2009 (Leivo & Pätäri, 2011).

Leivo and Pätäri (2011) write that the stock prices in Finland tend to rise more during positive periods than they do in the main stock markets due to relatively low trade volumes. Finland's average stock market volatility is therefore greater as well (Leivo & Pätäri, 2011). Consequently, there may be a justification to pursue active investing methods in the Finnish market. Leivo and Pätäri (2011) argue that under certain circumstances, it is likely that the price mistakes that generate the value premium are more significant. Furthermore, Leivo and Pätäri (2011) note that certain findings demonstrate that institutional investors' herding tendency can drive momentum.

Grinblatt and Keloharju (2000) discuss the performance of momentum and contrarian strategies in the Finnish market. The knowledge level of the investors might impact the tendency to use momentum strategies in the market to achieve excess returns (Grinblatt & Keloharju, 2000). The buy ratio of future winning Finnish stocks is compared to the buy ratio of prospective losing shares to determine success. The investor's behavior that results in performance with this metric is consistent with the investor's

capacity to predict which stocks will beat others throughout a timeframe of six months or three months (Grinblatt & Keloharju, 2000).

According to Grinblatt and Keloharju (2000), a large number of positive purchase ratio differences demonstrates the positive average performance of foreign investors who use momentum methods. The buy ratio disparities are positive 56% of the time based on, with the results being statistically significant (Grinblatt & Keloharju, 2000). Different financial entities can be considered as the second most affluent group of investors (Grinblatt & Keloharju, 2000). They are short-term contrarians and unresponsive to historical long-term gains (Grinblatt & Keloharju, 2000). In 55% of cases, these entities demonstrate considerable success with favorable buy ratio differences (Grinblatt & Keloharju, 2000). The buy ratio discrepancies demonstrate the poor average performance of household investors who utilize a contrarian style (Grinblatt & Keloharju, 2000). With the extent of the portfolios varying, households have positive unadjusted purchase ratio variations of 44–46% during the research period (Grinblatt & Keloharju, 2000).

Grobys and Huhta-Halkola (2019) discuss the characteristics of the Nordic stock market. In contrast to the well-established US equity market, the Nordic stock market is relatively recent but has matured significantly (Grobys & Huhta-Halkola, 2019). Finland, Denmark, Norway, Iceland, and Sweden are considered the Nordic countries. However, consistent with previous research, Grobys and Huhta-Halkola (2019) exclude the Icelandic equity market in their research. The Icelandic stocks are typically omitted from consideration due to small market capitalization, therefore, making it a less common subject in empirical studies.

According to Grobys and Huhta-Halkola (2019), the Nordic markets have experienced an increase in foreign ownership during the latest decades. Simultaneously, the economies have experienced development and become more dynamic. In addition, the number of stocks and trading volumes has increased (Grobys & Huhta-Halkola, 2019).

The Nordic markets, including the Finnish market, might be called peripheral markets (Grobys & Huhta-Halkola, 2019). A characteristic of such markets is their tendency to high volatility, especially during periods of economic uncertainty (Grobys & Huhta-Halkola, 2019). Investors often seek a safer location for their funds which may lead to withdrawal of their assets from remote market areas, such as the Finnish market (Grobys & Huhta-Halkola, 2019). However, Grobys and Huhta-Halkola (2019) estimate that the Nordic markets might have a lower risk profile than before and the markets have become a noticeable part of the European markets.

Grobys and Huhta-Halkola (2019) write the Nordic stock markets experienced development in the 1990s Grobys and Huhta-Halkola describe the Nordic markets as relatively young and liquid. Therefore, the Nordic markets may offer diversification opportunities for investors beyond the conventional focus on the US market. However, according to Nasdaq Helsinki Oy (2022), the limits for large-cap companies and small-cap are different, as the large-caps in the Helsinki Stock Exchange need to have a market capitalization of over one billion euros. The small-cap companies have a market capitalization of less than 150 million euros. According to Forbes (2022), the US market has a different criterion. The market capitalization for a large-cap company is ten billion dollars or above. In addition, the S&P MidCap 400 Index follows the performance of US companies that have a market capitalization between two billion dollars and eight billion dollars.

Grobys and Huhta-Halkola (2019) argue that Nordic countries offer a stable political landscape, low-levels of corruption, and low-risk profiles. To highlight the risk-profile, Grobys and Huhta-Halkola (2019) mention that the bond yields of Nordic nations have closely paralleled those of the United States. Several other peripheral or emerging markets have not experienced the same (Grobys & Huhta-Halkola, 2019). However, Finland has not been able to maintain the highest credit rating whereas other Nordic countries have succeeded in it (Grobys & Huhta-Halkola, 2019).

## 2.5 Long-only momentum investing

Raju and Chandrasekaran (2019) demonstrate that the momentum anomaly is present in the Indian equity market. Furthermore, the winning stocks have a more significant impact on the momentum premium than loser stocks. The winner stocks with smaller market values make the most noticeable contribution to the momentum premia. However, the winning stocks with higher market values have performed stronger than the winners with smaller market values in recent history (Raju & Chandrasekaran, 2019). Raju and Chandrasekaran (2019) argue that a systematic, monthly-rebalanced, long-only momentum portfolio based on the most liquid NIFTY100 components can outperform the NIFTY100 on both nominal and risk-adjusted returns. Furthermore, Maheshwari and Dhankar (2017) find that winner stocks have the most significant contribution to the momentum profits in the Indian market.

Raju and Chandrasekaran (2019) discuss the limitations that are related to the long-short momentum approach. Short selling can be difficult for ordinary investors. Alternative methods for short selling exist but they might be expensive and have execution risks that are not theoretically considered (Raju & Chandrasekaran, 2019). Moreover, in the lack of liquid ETFs on the Indian market, ordinary investors seeking exposure to the momentum factor could create factor-tilt long-only portfolios at minimal expense and with no administrative burden.

Huij et al. (2014) argue that it is not apparent whether long-only or long-short is the optimal choice to apply factor investing most efficiently. Huij et al. (2014) compare the two strategies and discover that, despite the long-short strategy's theoretical superiority, the long-only strategy appears to be the better choice in most cases after taking into account practical considerations like benchmark limits, implementation costs, and factor decay. The research demonstrates that expenses and decay may cancel out the value that a long-short implementation adds. Therefore, investors should weigh the advantages and disadvantages of both long-only and long-short approaches.

According to Huij et al. (2014), the primary distinction between the long-only and long-short strategies is the long-short strategy's noticeable reliance on shorting a sizable number of stocks. A lot of investors are hesitant to use shorting on this magnitude. Limitations on how much shorting is permitted may even make the long-short technique practically impossible. Huij et al. (2014) state that reasonable arguments exist to limit short-selling activities because the activity involves risks that are not included in more traditional risk indicators like volatility. For instance, shorting is an OTC transaction that includes counterparty risk and margin requirements (Huij et al., 2014). Additionally, it exposes investors to the risk of short squeezes, the possibility of limitless losses, and the chance of being compelled to terminate positions at the wrong time. Some of the most desirable short positions may not be available for investors. The long-only strategy, in comparison, does not include these challenges (Huij et al., 2014).

Israel and Moskowitz (2013) discuss the costs related to shorting stocks. Some investors are prohibited from short-selling activities, such as certain mutual funds. Furthermore, maintaining short positions typically costs more than maintaining long positions. Therefore, if shorting would be a significant contributor, the net trading cost returns from taking short positions may be significantly lower and inaccessible to many investors (Israel & Moskowitz, 2013).

According to Israel and Moskowitz (2013), the contribution from long holdings dominates the return premia to size, value, and momentum for an investor who is solely interested in the raw returns. If investors stress about returns concerning a benchmark, such as the market portfolio, can shorting matter. Israel and Moskowitz (2013) state that long positions make up 50% of the momentum return premium when looking at market-adjusted returns. Momentum variants that are long-only produce positive and large alphas with relation to the market. Israel and Moskowitz (2013) discover that the momentum premium is prevalent and consistent across all size groups when examining

businesses of various sizes. Over the 86 years, there is scant evidence that momentum would be significantly higher among small-cap equities.

Israel and Moskowitz (2013) state that as size increases, short-selling earnings become less significant for value strategies and more important for momentum strategies. Conversely, as size drops, short-selling gains become less important for momentum strategies and more important for value strategies. In general, these patterns seem to hold across time (Israel & Moskowitz, 2013). Value and momentum strategies that are long-only consistently produce positive alpha across size categories, markets, asset classes, and time. In general, the momentum premium tends to be stronger, whether the investors have a long-short or a long-only strategy, especially among large-cap stocks where the value premium is more insignificant (Israel & Moskowitz, 2013).

Durham (2015) discusses of long-only momentum strategy in the US bond market. Durham (2015) compares the US Treasury term structure's momentum results to comparable price record results for different security types. The findings indicate the presence of momentum. According to Durham (2015), the atypical relative returns that are index-duration-neutral are positively skewed, exhibit positive alphas in relation to anticipated forward-term premiums, and are significantly larger than tracking error. Additionally, they show no correlation with conventional risks. Additionally, selecting a long-only approach can preserve investors from the possible trading expenses that come with shorting illiquid stocks or absorbing fluctuations in repurchase contract fees (Durham, 2015).

## **2.6 Factors behind the momentum anomaly**

Razek (2011) discusses different concepts in finance that are typical assumptions. The first assumption is that investors are rational. The second assumption is that markets are efficient. The third assumption build portfolios following the principles of mean-variance portfolio theory. The fourth assumption is that expected returns are only due to risk. Razek (2011) discusses the behavioral perspective of these assumptions. Re-

Regarding the first assumption, the behavior of investors should be considered normal, instead of rational. The behavioral perspective for the second assumption concerning market efficiency is that markets are not efficient, yet it is challenging to achieve higher returns than the average market return. The third assumption, regarding the construction of portfolios, is that mean-variance portfolios are insignificant, and investors build the portfolios with the impact of behavioral biases. The answer to the fourth assumption is that beta is unable to capture the entire risk and expected returns are explained by other factors as well (Razek, 2011).

According to Inglis et al. (2019), there is no conclusive explanation for the occurrence of the momentum anomaly, despite the existence of a number of risk-based and behavioral concepts. The arbitrage pricing theory and the efficient market hypothesis state that an anomaly that is widely recognized by market participants and often utilized, such as momentum, should eventually disappear (Inglis et al., 2019). As described by Inglis et al. (2019), a favorable holding period and a decrease in profitability should occur.

Inglis et al. (2019) present that even if the momentum anomaly might persist, it may not necessarily be fixed. Instead, there are large variations in gains and brief intervals of considerable negative returns (Inglis et al., 2019). Because of the contradiction, many academics have proposed that some of the alternative explanations of momentum can be relevant, depending on the conditions the market is experiencing at a particular moment (Inglis et al., 2019).

Kadiyala and Rau (2004) present that the research on behavioral finance includes two opposing theories of the illogical habits of investors. According to the first approach, when firms update new information to the market, investors may overreact to information (Kadiyala & Rau, 2004). An overreaction can result in a trend of long-term return reversals (Kadiyala & Rau, 2004). An alternative reaction is underreaction to information. As an example, Kadiyala and Rau (2004) write that when companies disclose

corporate events like share repurchases, investors may underreact to the new update, resulting in long-term return continuations.

Barberis et al. (1998) present a model that is based on conservatism and representativeness heuristic. According to Barberis et al. (1998), conservatism is defined as investors' reluctance to modify their opinions in the face of fresh information. Conservative people may choose to ignore the complete contents of some company announcements, such as earnings reports, because they may consider there is a significant amount of fluctuating variation in the figure (Barberis et al., 1998). Furthermore, the investors may continue to adhere to their earlier earnings projections (Barberis et al., 1998). As a result, they may barely modify their estimates of the company value in reaction to the release (Barberis et al., 1998).

Barberis et al. (1998) describe the representativeness heuristic as investors' tendency to believe random sequences can have a specific structure. Investors may estimate that a company's past track record of growing profits over several years, even in the presence of positive evaluations of its management and offerings, may indicate future earnings growth (Barberis et al., 1998). Barberis et al. (1998) write that a steady trend of rapid growth may be the result of chance for a few fortunate companies. However, investors can interpret this as "order among chaos" and conclude that the company is part of a specific group of companies and can maintain favorable development (Barberis et al., 1998). Therefore, investors who apply the representativeness heuristic may not understand that for instance, the development of earnings may disappoint in the future (Barberis et al., 1998). The investors may have valued the company incorrectly and in case the expected future scenarios are not fulfilled, investors will be disappointed, and it can have implications for the company value (Barberis et al., 1998).

According to Kadiyala and Rau (2004), behavioral models can forecast an anomalous return sequence with a short-term trend that eventually turns. Kadiyala and Rau (2004) discuss that biases called representativeness and conservatism drive the model of in-

vestor behavior as discussed by Barberis, Schleifer, and Vishny (1998). Investors who adhere to conservatism tend to adjust their opinions relatively gradually in response to additional information (Kadiyala & Rau, 2004). Due to representativeness, investors may overemphasize current patterns in the data even if the likelihood of realization for such patterns is low (Kadiyala & Rau, 2004). When combined with the representativeness bias, the conservatism bias causes investors to underreact in the near term, which results in long-term return reversals. In the immediate future, the conservatism bias may cause investors to react insufficiently, which can in combination with the representativeness bias cause long-term changes in the stock gains (Kadiyala & Rau, 2004).

Kadiyala and Rau (2004) discuss behavioral models developed by Daniel et al. (1998), and Hong and Stein (1999). Both papers discuss the development of stock prices in the short term and long-term. According to Daniel et al., knowledgeable investors frequently place excessive importance on the insider information they acquire about a stock's valuation. Biased self-attribution increases the degree of trust when it fits with their private signals and public data. On the other hand, biased self-attribution causes people to write off information that conflicts with their signals as noise. Kadiyala and Rau (2004) view that the model of Daniel et al. predicts that investors would jointly underreact to signals from public information and overreact to private information.

Kadiyala and Rau (2004) view that the concept presented by Hong and Stein (1999) proposes that the market is made up of two main investor categories that make trades using various sets of data. A trend of underreaction in stock returns is produced by informed investors who base their decisions on signals of future cash flows (Hong & Stein, 1999). These transactions might cause a gradual transfer of knowledge into the market (Hong & Stein, 1999). Investors who rely on technical analysis may exaggerate trends since they are based on a small historical price data set (Hong & Stein, 1999). This pattern ultimately can result in a reversal of gains by causing the prices of past winners to diverge from fundamental values (Hong & Stein, 1999).

Kadiyala and Rau (2004) summarize that the three models discussed by Barberis et al., Daniel et al., and Hong and Stein, have different views on the behavior of investors. Still, the models assert that investors tend to overreact to historical trends and underreact to publicly available data (Kadiyala & Rau, 2004). Theoretical models might not explain why investors seem to underreact to events like share repurchases while overreacting to corporate events like mergers and acquisitions in which stocks are used (Kadiyala & Rau, 2004). These examples may make it more challenging to reconcile the theories with the empirical evidence for long-run unusually high stock returns (Kadiyala & Rau, 2004).

The findings of Kadiyala and Rau (2004), the findings support underreaction concept. The results indicate that investors underreact to information provided by the event as well as to past knowledge, which results in the various trends, return reverses, and return continuations that are shown in long-horizon returns (Kadiyala & Rau, 2004). Using various methods, Kadiyala and Rau (2004) discover no evidence in favor of the overreaction approach.

Bird and Whitaker (2003) discuss that the reason for the outperformance of momentum investing may still be obscure. According to Bird and Whitaker (2003), the reason behind the robustness of momentum returns is the tendency for positive news to follow previous positive news more likely than positive news would be followed by negative news. Furthermore, Bird and Whitaker (2003) state that the market might not incorporate new information completely into stock prices.

According to Novy-Marx (2012), positive short-lag autocorrelations in prices are produced by common behavioral causes based on errors investors experience in processing information. These theories propose that security prices underreact to news, which is slowly integrated into stock prices and as a result, there would be a momentum effect impacting stock prices. Similar predictions of short-lag autocorrelations in

prices are made by arguments based on positive correlations between previous performance and risk sensitivity (Novy-Marx, 2012).

Conrad and Kaul (1998) argue that the cross-sectional variations in expected stock returns can possess a vital impact on the evaluation of the momentum performance. The time-series structures in returns that serve as the foundation of return-based trading methods are unrelated to the cross-sectional volatility (Conrad & Kaul, 1998). The cross-sectional deviation in the average gains recorded across different time horizons might theoretically provide the observed gains of the most consistently lucrative strategies (Conrad & Kaul, 1998). According to Conrad and Kaul (1998), their research results suggest that there are cross-sectional disparities in mean returns based on the empirical breakdown of profits, Monte Carlo simulation tests, and rival approximations depending on weekly profit data.

Conrad and Kaul (1998) discuss that their findings suggest an opportunity that momentum strategy gains and the common failure of contrarian strategies may both be explained by the cross-sectional volatility in the average returns. The discovery alone may raise concerns about the viability of trading methods (Conrad & Kaul, 1998). Furthermore, it can also highlight the challenge of the informational effectiveness of stock prices (Conrad & Kaul, 1998).

Chan et al. (1996) write that the earnings of companies impact stock prices and might be useful in explaining momentum returns. Chan et al. (1996) discuss that there might be a connection between stock price momentum and the market's underreaction to earnings-related news. Another view supporting the profitability of momentum methods is overreaction brought on by trading tactics that use positive feedback. Therefore, in the lack of fundamental knowledge, investors relying on trends amplify price fluctuations in past winner and loser stocks. According to Chan et al. (1996), this concept can lead to the prediction that stock price reversals will occur for both previous winners and losers.

Chan et al. (1996) state that market under-reaction to various sources of evidence may be taken advantage of by strategies based on either previous returns or earnings surprises. For instance, a price momentum strategy may profit from the market participants' weak response to a wider range of data, such as the company's long-term potential in the form of growth in earnings or revenues. An earnings momentum strategy might gain from the market's lack of reaction to signals linked to expected earnings in the near future. In this situation, Chan et al. (1996) anticipate that each momentum strategy succeeds on its own and that no effect is supplanted by another. Accounting statistics might not accurately reflect actual economic performance. Therefore, the reported earnings might be dissatisfying but the actual potential of the firm can be brighter (Chan et al., 1996).

Bhattacharya et al. (2015) discuss the declining momentum of profits in the US market after the year 1999. Three theories are discussed to account for the diminishing momentum profits: investors discovering an anomaly, the risk premium on the industrial output component dissipating, and improvements in market efficiency. The initial justification suggests that momentum profits decreased after 1998 as a result of investors learning about the advantages of using the momentum strategy. Therefore, a correction in the stock prices of the firms identified as winners and losers during the formation period would occur more quickly during the most recent subperiod compared to earlier subperiods (Bhattacharya et al., 2015). As a result, it may be that heightened responses to both winning and losing stocks during the identification phase may diminish the return continuation during the holding phase. Furthermore, there may occur a weakened reversal in the stock returns during the post-holding phase.

The second theory is that a significant portion of the momentum earnings may be explained by macroeconomic factors like the growth rate of industrial production (Bhattacharya et al., 2015). Still, according to Bhattacharya et al. (2015), the marginal productivity factor has little impact on stock prices in the most recent subperiod. The

third theory looks at the potential for advancement in market efficiency. Bhattacharya et al. (2015) utilize the delay to evaluate the increase in market efficiency, which gauges the degree to which stock returns respond to previous market returns. Except for the largest portfolio, Bhattacharya et al. (2015) observe a considerable reduction in latency, which may indicate better market efficiency.

As mentioned previously, Hong and Stein (1999) present a model that includes two different roles for investors. These roles differ in the way investors value information. The first role is the investors who follow the news in the market. The investors in this role base their projections on indicators of future fundamentals that they notice. However, Hong and Stein (1999) consider as a limitation that these investors do not take into account current or previous pricing. The second role is traders who make assumptions about prior price changes. However, they are restricted in that they may rely on forecasts based on simple assumptions (Hong & Stein, 1999).

Furthermore, Hong and Stein (1999) assume something that may be viewed as uncommon. They argue that the population of news consumers has become gradually aware of private information. From this and the two previously discussed presumptions, Hong and Stein presume that when there are only investors that concentrate on the news on the market, prices should respond to new information slowly. In other words, there should be underreaction, but there should not be overreaction. This result arises from the combination of gradual information transmission and the presumption that news consumers do not infer information from prices (Hong & Stein, 1999).

Hong and Stein (1999) suggest that behavioral asset pricing theories should be evaluated using certain standards. According to one of the criteria, a theory should be based on investor behavior assumptions that are either a priori plausible or consistent with casual observation. For instance, it should be logical people can process a small portion of the information that is available in an objective manner. Furthermore, constrained rationality means that arbitrageurs frequently rely on straightforward momentum

methods. This implication appears to be compatible with what can be seen in the real world (Hong & Stein, 1999).

Daniel et al. (1998) argue that different effects, for instance, momentum and book-to-market are present in different markets and at various points in time. Daniel et al. (1998) do not share the view that the effects would be random variations and acceptable in the efficient market. Instead, the return patterns have been robust and been present in different periods. In the financial markets, equity analysts and investors gather information for investment decisions using different techniques, such as speaking with management, checking rumors, and studying financial statements (Daniel et al., 1998). An investor may experience forecasting mistakes if the investor overestimates the ability to provide information or to see the importance of current data that others overlook. A typical sign of being overconfident is to overestimate the investor's analysis and results and refuse to consider public signals (Daniel et al., 1998). More complicated and discursive tasks face more overconfidence, and some evidence indicates that experience may create overconfidence among professionals (Daniel et al., 1998).

Daniel et al. (1998) state that the overweighted private signals cause stock prices to overreact. According to Daniel et al (1998), the main argument of their paper is that stock prices overreact to signals based on insider information while underreacting to signals based on information available to everyone. Daniel et al. (1998) demonstrate that the overreaction-correction structure complies with unconditional excess volatility which is what would be obtained with completely logical investors and long-run negative autocorrelation in stock returns.

Daniel et al. (1998) anticipate that less liquid stocks will be more severely impacted by overconfidence's consequences. When learning about a new market that has fixed set-up costs, sensible arbitrageurs will cause the stocks of the biggest and most liquid companies to be more reasonably priced. According to Daniel et al. (1998), it is simpler

to cover the stable research costs in large stocks. However, it may be that the pricing of small stocks is therefore inefficient. As the returns are more predictable for large companies, the pricing of small stocks may be more inefficient. Furthermore, the adverse selection of bid-ask spread may also have an impact on the momentum effect (Daniel et al., 1998).

## **2.7 The survivorship bias**

The survivorship bias has been considered in the creation of portfolios in the data and methodology sections. The theoretical background section provides background for the bias. Bodie et al. (2014) state that survivorship bias refers to activity where unsuccessful financial securities and their performance are left without evaluation. Only the successful securities are considered. Bodie et al. (2014) add that certain businesses frequently liquidate their weakest mutual funds. Only the success of long-term survivors will be reflected in average fund returns if return evaluations only include mutual funds for which returns are accessible for the course of the sample period. The average measured performance of mutual fund managers will be higher than one might reasonably anticipate from the entire group of managers since the failing funds have been omitted from the evaluation (Bodie et al., 2014).

Rohleder et al. (2011) discuss that survivorship bias and its reasons are frequently discussed in the financial literature. It appears during the evaluation of financial securities when just the remaining securities are considered. These actions can result in exaggerating the performance of securities. Rohleder et al. (2011) add that this can lead to the disappearance of funds that have generated weaker returns in comparison to the stronger performers. Rohleder et al. (2011) mention that the challenges of the survivorship bias are present in the performance of various funds. The estimates of the magnitude of the bias have variation, according to previous academic research the impact can be from 1 to 271 basis points annually (Rohleder et al., 2011).

Carpenter et al. (1999) investigated the effect of survivorship bias on mutual funds in the US market. The findings indicate that when survival depends on performance across multiple periods, survivorship bias provides a reversal effect that controls the persistence phenomenon, even though there might occur cross-sectional heteroskedasticity in fund alphas. Furthermore, Carpenter et al. (1999) argue that forward-looking biased techniques and missing final-period gains can distort statistics, even though samples contain all non-surviving securities. The survivorship bias is unable to account for the robustness of returns observed experimentally when mortality rates are adjusted to mutual fund-related information (Carpenter et al., 1999). Carpenter et al. (1999) add that in a robust process that can produce returns, weak performers can vanish and the effect may be different from survivorship bias. If performance is consistent, fund managers' return histories should be taken into account when choosing between rival funds. In addition, the question of continuity in stock returns has significant ramifications for investors' trading methods (Carpenter et al., 1999).

## **2.8 The Sharpe Ratio**

According to Bodie et al. (2014), investors tend to be interested in extra yield that they may obtain by switching from a risk-free rate, such as T-bills, to a riskier investment. Even though there may be fluctuations in the risk-free rate over time, the nominal rate can be predicted if the T-bill for instance is bought and retained until it matures (Bodie et al., 2014). To potentially earn more than the risk-free rate, other investments often require assuming some risk. According to Bodie et al. (2014), risk can be measured by the standard deviation of excess returns. Bodie et al. (2014) add that investors price risky assets so that the risk premium will be proportionate to the risk of that estimated excess returns.

According to Bodie et al. (2014), the Sharpe ratio can be described as a reward-to-volatility metric. The name of the metric is from the initial developer of the concept, William Sharpe. Bodie et al. (2014) add that the measure is frequently used to assess

the effectiveness of professional investors and fund managers. The Sharpe ratio divides the risk premium by the standard deviation.

### **3 Research question and hypothesis**

This thesis aims to explain whether using long-only momentum strategies between 2012-2022 investors could generate higher returns than investing in the passive OMXH index. The results may indicate whether the long-only momentum strategy might have practical use for investors in the Finnish market.

H0: The long-only momentum investing strategies generate higher returns than investing in the OMXH index.

If the null hypothesis becomes rejected, it may be possible that long-only momentum investing is not a recommended strategy for the Finnish stock market. However, it may still be useful to investigate whether the risk-adjusted returns could indicate that long-only momentum investing could still be considered among investors.

H1: The returns generated by long-only momentum strategies offer higher risk-adjusted returns than the OMXH index.

## 4 Data and methodology

The data and methodology used to produce this thesis are described in this chapter. The sample data's primary characteristics are introduced first. Second, an explanation of the portfolio construction and return calculations is provided. Furthermore, the analysis of the returns is included in this section.

### 4.1 The data

Orbis database and Nasdaq OMX Nordic provided the information for this thesis. Stock price information is the monthly price data for the stocks in the Helsinki Stock Exchange. The sampling window spans 10 years, beginning in December 2011 and ending in December 2022. The data for the OMXH Index is from the Nasdaq OMX Nordic website. The data is monthly.

The purpose is to evaluate the recent performance of long-only momentum investing in the Finnish market. Therefore, the period spans a relatively short time. Still, there were significant events during the period, such as the COVID-19 crash in spring 2020 and the crisis in the eurozone at the beginning of the 2010s.

### 4.2 The methodology

To calculate the stock returns, the price at the end of the month  $t$  will be divided by the price at the beginning of the month  $t$ . The returns for stocks are monthly returns. Also, logarithmic returns will be used. In the formula,  $r_{i,t}$  is the monthly return of the stock  $i$ ,  $\ln$  is the natural logarithm,  $P_{i,t}$  is the price of the stock  $i$  on the last day of the month  $t$ .  $P_{i,t-1}$  is the price of the stock  $i$  on the last day of the month  $t-1$ .

$$r_{i,t} = \ln \left( \frac{P_{i,t}}{P_{i,t-1}} \right) \quad (1)$$

Six different momentum strategies are used in this study. The strategy is called M x E x H. M is the measurement period in months. E refers to the month that is excluded. H refers to the holding period. Jegadeesh and Titman (1993) used various trading strategies. For instance, the 3-month, 6-month, and 12-month periods were used to choose the winners and losers. Furthermore, the holding periods included similar periods. This thesis does not use all the periods Jegadeesh and Titman used but instead some of them. According to Novy-Marx (2012), intermediate past returns can have predictive power for the returns. Therefore, the 6-month (or 5-month because the sixth month would be ignored) is used. In addition, the 3-month and 12-month periods are included in the measurement periods to investigate how a shorter and a longer period would perform. In addition, Asness et al. (2013) included the 12-month cumulative returns as a method to form momentum portfolios. Asness et al. (2013) mention that for instance, Novy-Marx (2012) discovered that 7- to 12-month returns may be better predictors than 2- to 6-month returns. However, Asness et al. (2013) add that using 2-12-month returns should provide robust results.

Asness et al. (2013) state that skipping the return of the most recent month is typical in momentum research. The purpose is to avoid short-term reversals in stock returns may exist due to liquidity or challenges in microstructure (Asness et al., 2013). Chiang et al. (2021) add that previous trading activity and returns have a significant impact on the short-term dynamics of stock prices. Short-term reversals relate to low trading activity, whereas short-term momentum is connected with strong trading activity (Chiang et al., 2021). Chiang et al. (2021) write that previous studies have noted that lower liquidity can indicate higher return reversal. In the Helsinki Stock Exchange, as mentioned by Leivo and Pätäri (2011), liquidity is lower in comparison to other developed markets.

For instance, the strategy 5 x 1 x 3 refers to the method where the returns are measured from the previous six months. However, the return from the sixth month would be ignored. Then the portfolio would be kept for three months. Furthermore, all the stocks in each momentum strategy will have equal weights. The holding periods concentrate on the near-term periods. For instance, Jegadeesh and Titman (1993) have discussed diminishing returns over longer holding periods. However, the 12-month holding period is not included in the research even though it may be considered a certain threshold as a holding period.

**Table 1.** The long-only momentum strategies.

Measurement period (in months)	A month that is excluded	Holding period (in months)
11	1	6
11	1	3
5	1	6
5	1	3
2	1	6
2	1	3

The long-only momentum strategies that will be used are presented in Table 1. The winner portfolios will consist of the 10 % of stocks that have been the most profitable during the measurement period. Furthermore, to avoid the previously discussed survivorship bias, the study includes stocks that are no longer traded in the Helsinki Stock Exchange but may have been listed during the time these long-only portfolios were created.

In order to discover the most profitable stocks during the measurement period and calculate the holding period returns, cumulative returns will be calculated. For instance, to calculate the necessary stock returns for the 2 x 1 x 3 strategy with the measurement period beginning in January, the log returns of January and February will be summed for all the stocks. Then these returns will be ranked and the top 10 % of the returns will be used to find the stocks for the holding period. The holding period returns for the selected stocks will be calculated by summing the returns of April, May, and June.

In the calculations, trading costs and taxes are ignored. This is done also by Raju and Chandrasekaran (2019) in their paper that examines the performance of long-only momentum investing in the Indian stock market. Raju and Chandrasekaran argue that trading costs should be relatively small. Furthermore, they discuss that there are brokers that may offer low fees.

The statistical significance of the results will be calculated, too. T-test will be performed with the significance levels of 10 %, 5%, and 1 %. In the formula below,  $t$  refers to the t-value,  $\bar{x} - \mu_0$  is the difference between the sample mean and the hypothesized mean,  $\sigma$  is the standard deviation of the sample, and  $n$  is the number of observations in the sample.

$$t = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}} \quad (2)$$

The risk-adjusted returns will be evaluated, too. The Sharpe ratio will be used to evaluate the risk-adjusted performance of the long-only momentum strategies. In the formula,  $R_p$  refers to the return of the long-only momentum portfolio,  $R_f$  is the risk-free rate and  $\sigma_p$  is the standard deviation of the long-only momentum portfolio. In addition, the interest rates during the period that this thesis covers, that is 2012-2022, the interest rates have remained unusually low.

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p} \quad (3)$$

**Table 2.** The returns of long-only momentum portfolios

Strategy	Portfolio return, annualized	Max return, during H months	Min return, during H months	Standard deviation, annualized	Sharpe ratio
11 x 1 x 6	0,090 (0,757)	0,356	-0,172	0,226	0,393
11 x 1 x 3	-0,027 (-0,026)	0,147	-0,289	0,267	-0,106
5 x 1 x 6	0,108 (0,432)	0,388	-0,458	0,267	0,401
5 x 1 x 3	0,110 (0,510)	0,205	-0,232	0,220	0,493
2 x 1 x 6	-0,021 (-1,694)*	0,128	-0,306	0,171	-0,134
2 x 1 x 3	-0,006 (-1,177)	0,171	-0,217	0,147	-0,050
OMXH Index	0,064 (1,886)*	0,219	-0,084	0,112	0,555

As previously discussed, the strategy is M x E x H, where M is the measurement period, E is the month that will be excluded, E is the month that will be excluded, and H is the holding period. The values inside the parantheses are t values. For the t values: \*\*\* = 1 % significance level (t value > 2,576), \*\* = 5 % significance level (t value > 1,960), level, \* = 10 % significance level (t value > 1,645).

In Table 2, the returns of the momentum strategies are presented. The returns are presented in the form of annual returns to make the comparison of the returns easier. Furthermore, the standard deviation is presented also in the annual form. The table includes the maximum return and the minimum return for each strategy in a holding period H. The Sharpe ratio, which is a measure of risk-adjusted returns, is also calculated. The values inside parentheses are t-values. \*\*\* would indicate a 1 % significance level, \*\* would indicate a 5 % significance level and \* indicates a 10 % significance level. However, most of the returns were unable to achieve statistical significance. Only the 2 x 1 x 6 momentum strategy was statistically significant at the 10 % level, with the t-value being negative in 2 x 1 x 6 results.

The standard deviations of portfolios with a 2-month measurement period were the lowest. On the other hand, the average returns were negative for these strategies. The returns improve when the measurement period for the winner stocks is 5 months. The returns are higher than the return of the OMXH index with both 3-month and 6-month holding periods. However, the risk-adjusted returns are lower for these two strategies in comparison to the OMXH index returns. The results from the 11-month measurement period produce different results, depending on the holding period. With the holding period of three months, the returns are negative. With the holding period of 6 months, the returns are positive, the standard deviation is lower and the Sharpe ratio is higher.

The results indicate that the 5 x 1 x 3 strategy has generated the highest average annual return of approximately 11 %. The annual standard deviation has been 22 %. The value of the Sharpe ratio is 0,493, which is the highest risk-adjusted return for a momentum strategy. However, the OMXH index has offered higher risk-adjusted returns, with a Sharpe ratio of 0,555.

	Strategy					
	2 x 1 x 3	2 x 1 x 6	5 x 1 x 3	5 x 1 x 6	11 x 1 x 3	11 x 1 x 6
R-squared	0,4671	0,01089	0,6865	0,004287	0,9613	0,5705

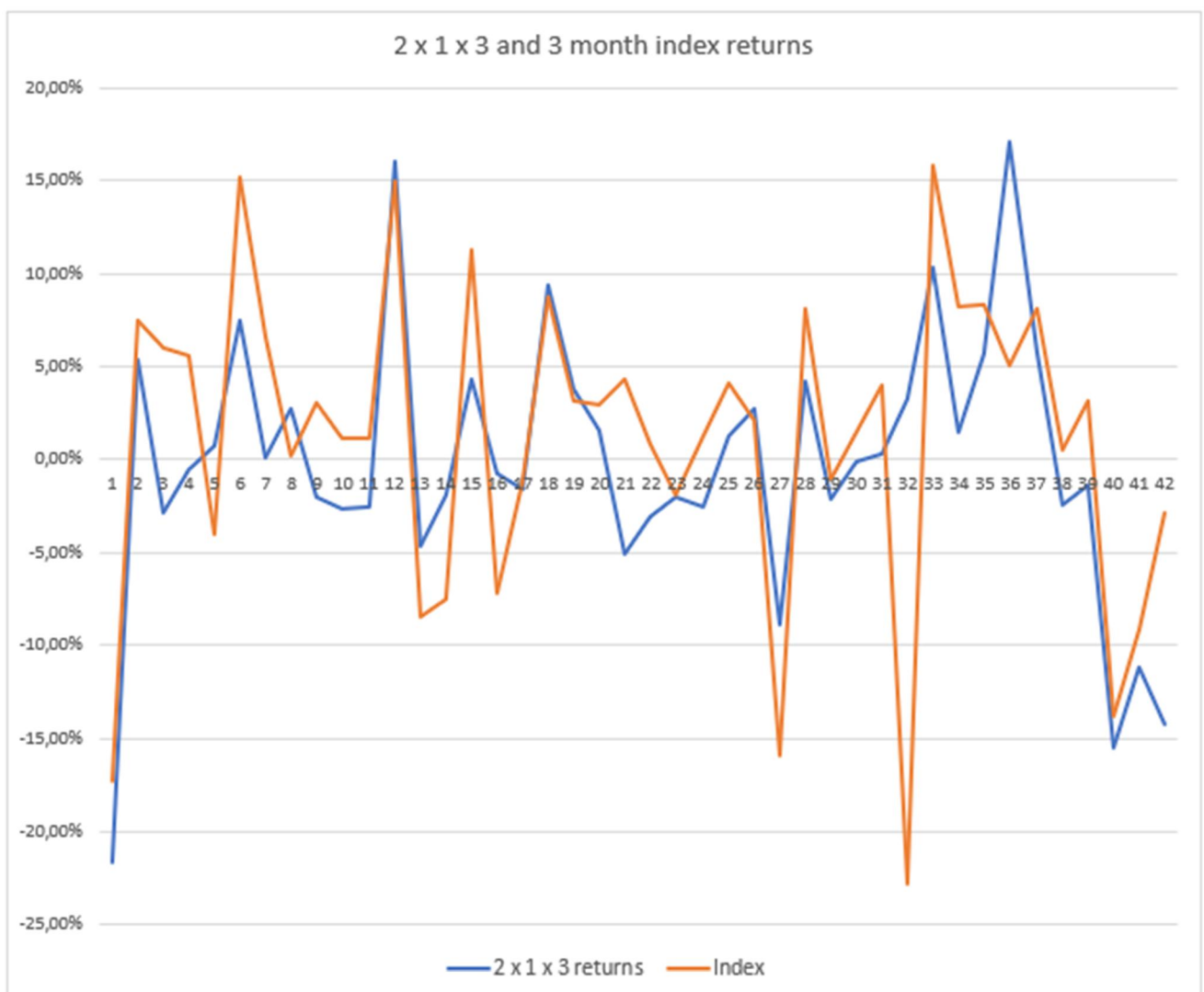
**Table 3.** Results of regression analysis (OMXH returns as an independent variable)

Table 3 summarizes how the OMXH index can explain the variance of momentum strategies. In general, the table suggests that R-squared is higher for momentum strategies that are held for three months rather than six months. Therefore, the movements in momentum portfolios are more reliably explained by movements in the OMXH index. In 2 x 1 x 3 and 2 x 1 x 6 strategies, the difference in R-squared is noticeable. With the holding period of six months, the R-squared is significantly lower. The same phenome-

non can be noticed in the 5 x 1 x 3 and 5 x 1 x 6 strategies, which were also the strategies that generated the highest returns. In the 11 x 1 x 3 and 11 x 1 x 6 strategies, the difference between the holding periods exists, but the R-squared is high for the 11 x 1 x 3 strategy and quite high for the 11 x 1 x 6 strategy.

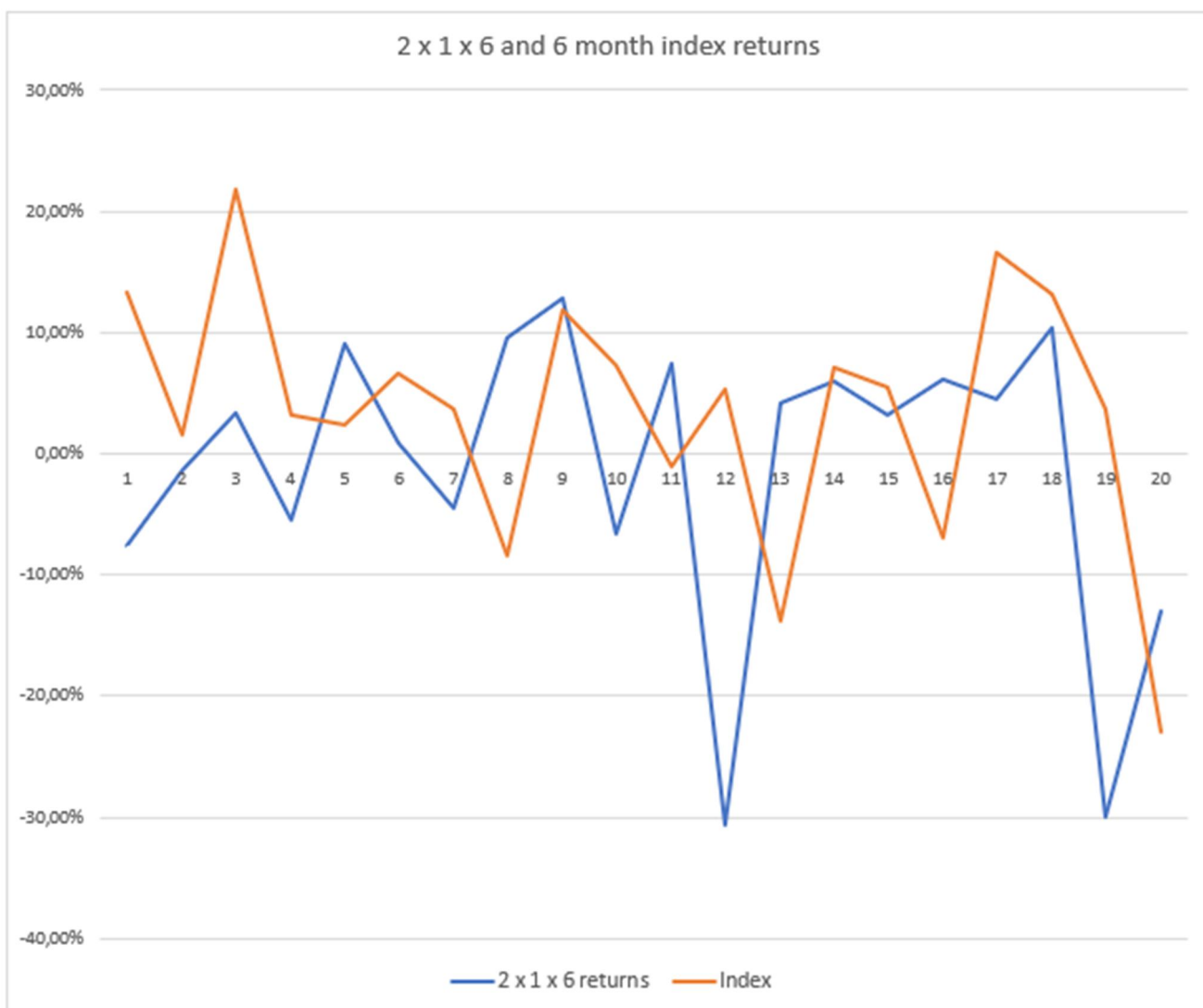
## 5 The results of the study

The long-only momentum portfolios deliver more volatile returns than the OMXH index. According to Raju and Chandrasekaran (2019), investors who are not willing to take much risk may not benefit from the momentum strategy. This study finds that the momentum portfolios are more volatile and this result was detected in the paper written by Raju and Chandrasekaran (2019).



**Table 4.** The returns of 2 x 1 x 3 portfolios and three months of OMXH index

In Table 4, the performance of 2 x 1 x 3 portfolios and three months OMXH index are compared. The average annual return for the 2 x 1 x 3 strategy was approximately -0,6 % and the standard deviation was approximately 14,7 %. The annual return and the standard deviation for the OMXH Index were 6,4 % and 11,2 %, respectively. This would indicate that using this strategy systematically, the results would not be profitable.

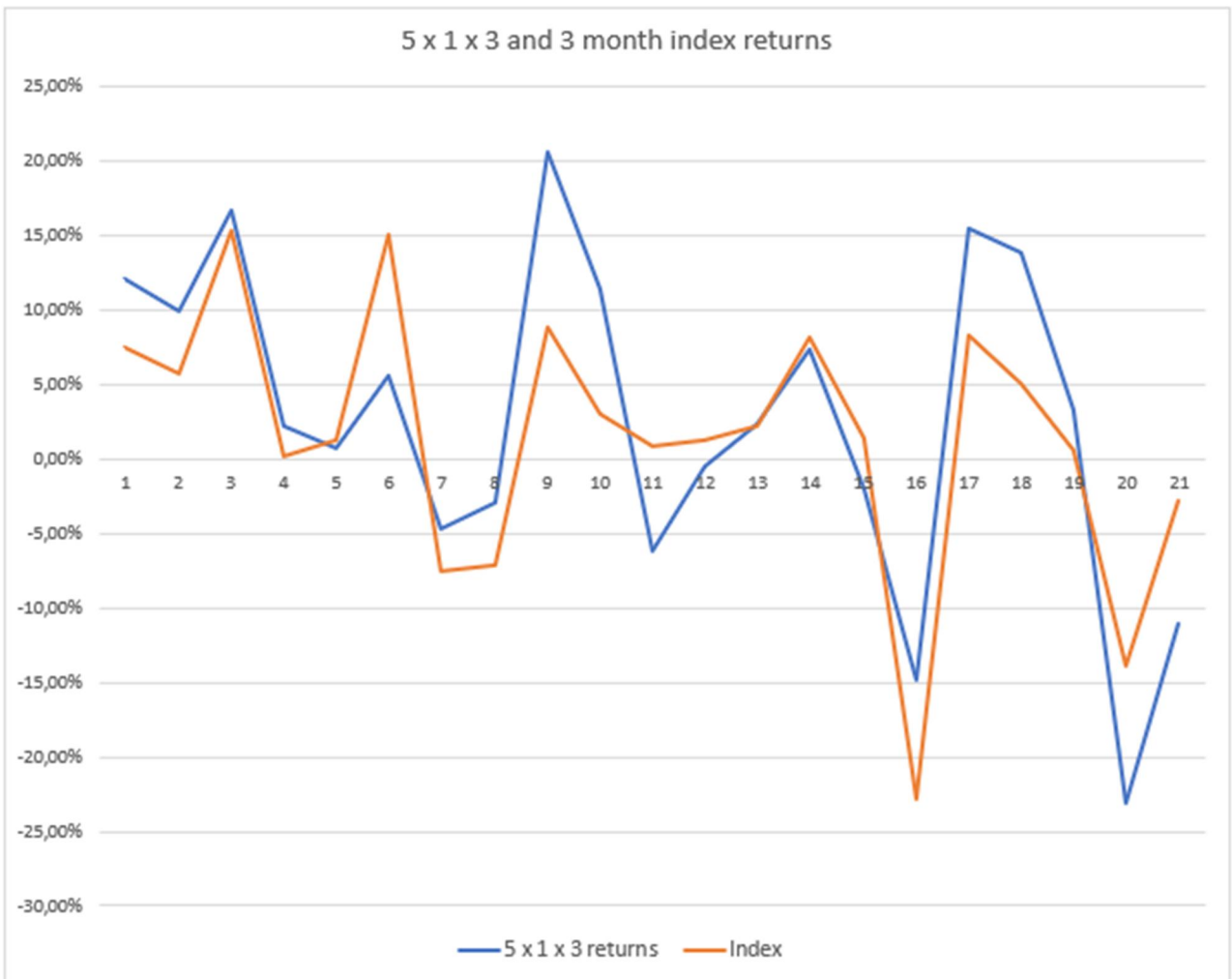


**Table 5.** The returns of 2 x 1 x 6 portfolios and six months of OMXH index

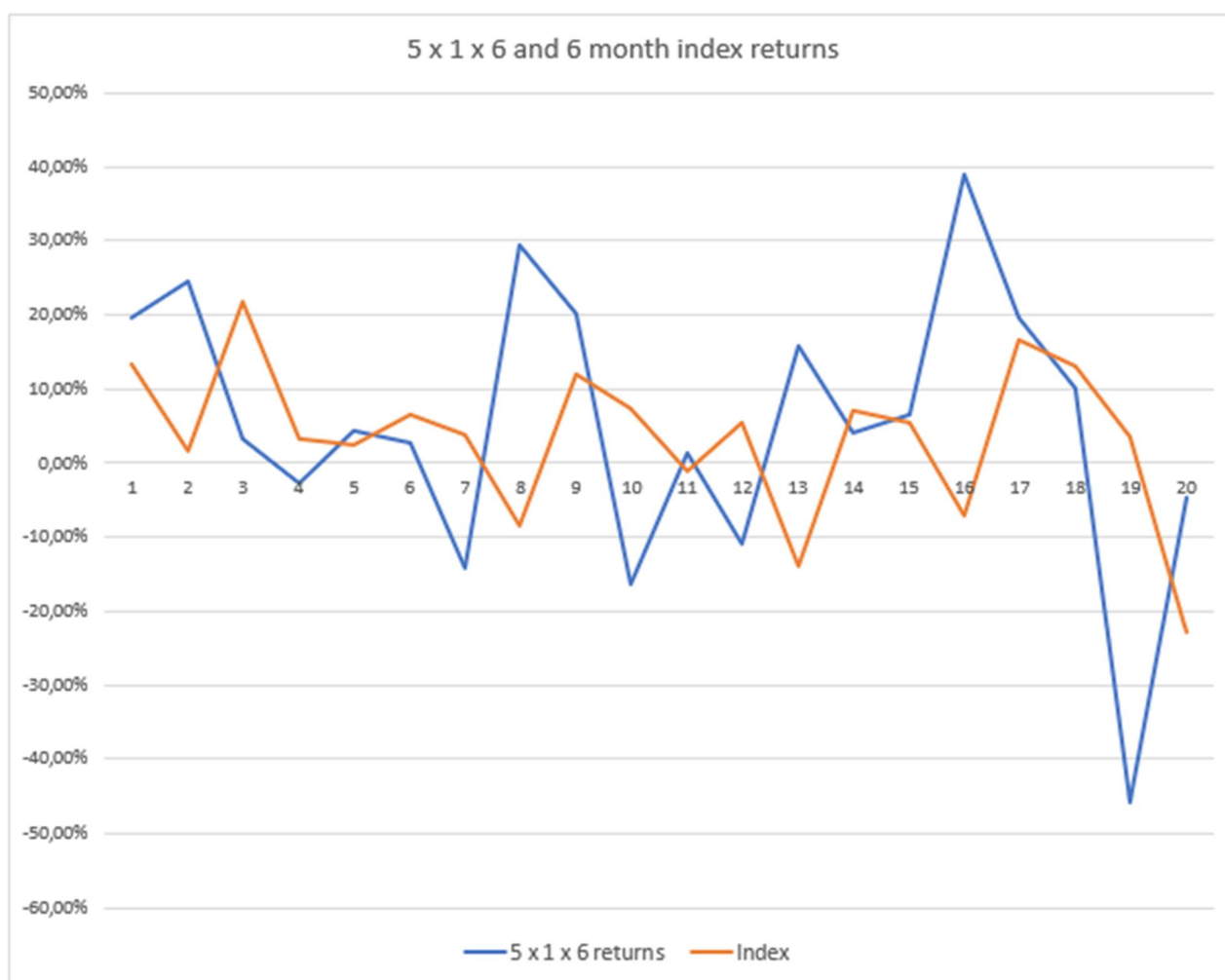
In Table 5, the performance of 2 x 1 x 6 portfolios and six months OMXH index are compared. The average annual return for the 2 x 1 x 6 strategy was approximately -2,1 %

and the standard deviation was approximately 17,1 %. The annual return and the standard deviation for the OMXH Index were 6,4 % and 11,2 %, respectively. This would indicate that using this strategy systematically, the results would not be profitable. Based on the Sharpe ratio, the performance of this strategy is weaker in risk-adjusted terms compared to the 2 x 1 x 3 strategy, with the Sharpe ratio being -0,134. Also, the findings of Novy-Marx (2012) indicate that the recent past performance can experience difficulties in generating unusually high stock returns, which may indicate that the intermediate past performance may produce different results.

**Table 6.** The returns of 5 x 1 x 3 portfolios and three months of OMXH index



In Table 6, the performance of 5 x 1 x 3 portfolios and three months OMXH index are compared. The average annual return for the 5 x 1 x 3 strategy was approximately 11 % and the standard deviation was approximately 22 %. The annual return and the standard deviation for the OMXH Index were 6,4 % and 11,2 %, respectively. In terms of absolute returns, this 5 x 1 x 3 strategy generated the highest average annual return. Furthermore, the return exceeds the average annual return of the OMXH index. However, the risk-adjusted return is lower than the risk-adjusted return of the OMXH index as the Sharpe ratio is 0,493 for the momentum strategy and 0,555 for the OMXH index.

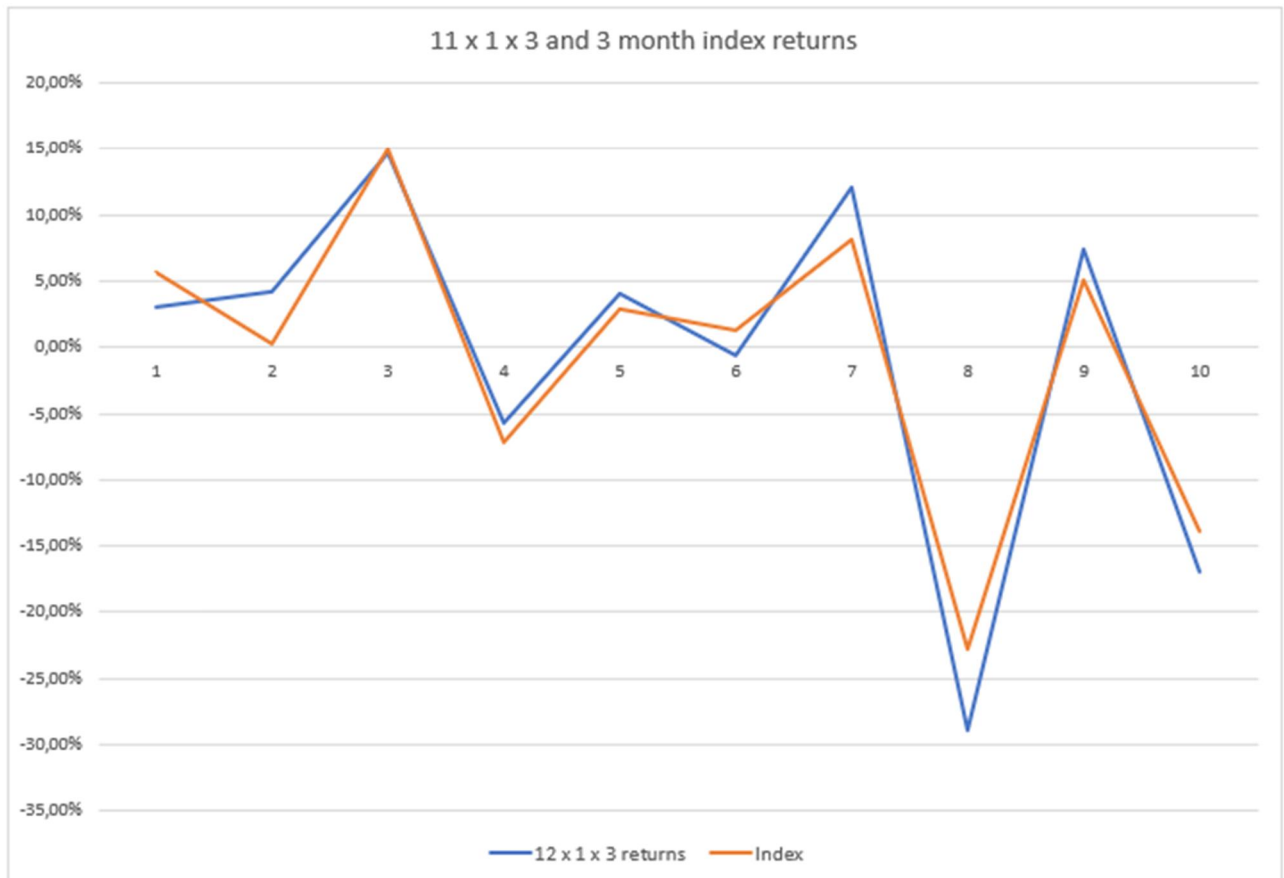


**Table 7.** The returns of 5 x 1 x 6 portfolios and six months of OMXH index

In Table 7, the performance of 5 x 1 x 6 portfolios and six months OMXH index are compared. As the low value of R-squared in Table two indicates, the development of the OMXH index and the strategy are noticeably different. The average annual return for the 5 x 1 x 6 strategy was approximately 10,8 % and the standard deviation was approximately 26,7 %. The annual return and the standard deviation for the OMXH Index were 6,4 % and 11,2 %, respectively. In terms of absolute returns, this 5 x 1 x 6 strategy generated the second-highest average annual return. Furthermore, the return exceeds the average annual return of the OMXH index. However, the risk-adjusted return is lower than the risk-adjusted return of the OMXH index and the 5 x 1 x 3 momentum strategy, with the Sharpe ratio being 0,401. The 5 x 1 x 3 and 5 x 1 x 6 strategies generate the highest average annual returns, and they are the only two strategies with the same measurement period that can generate positive average annual returns with both 3-month and 6-month holding periods.

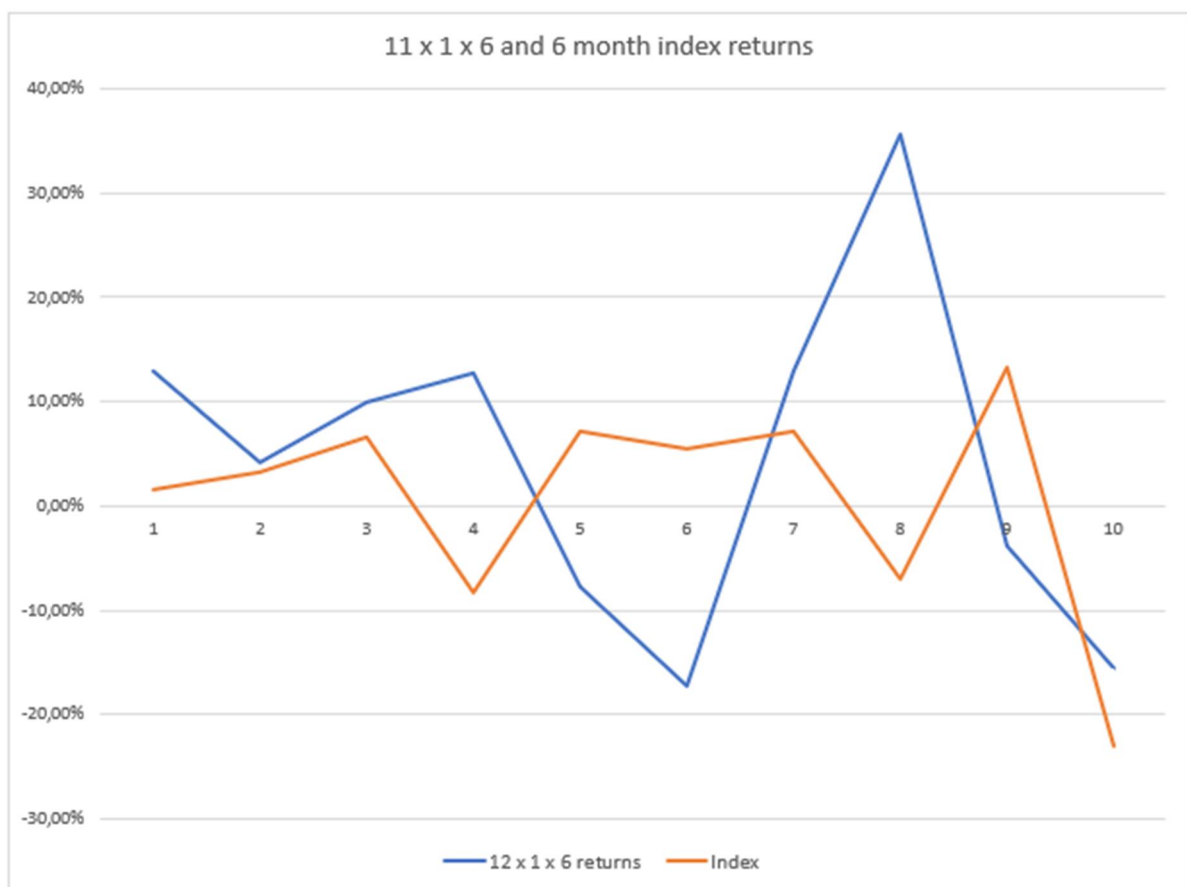
The 5 x 1 x 6 strategy produced a return of almost 39 % during January 2020-June 2020. The profitable performance continued during the remaining half of the year 2020. Therefore, this strategy worked well during the Covid-19 pandemic. Leivo and Pätäri (2011) argue that winner stocks may contribute to the returns most significantly when the market experiences uncertainty and negative returns based on the evidence from the Finnish market from the early 2000s'.

The findings of Chan et al. (1996) indicate that the performance of stocks from the latest six months can help to predict future stock returns. Chan et al. (1996) write that the market can react to fresh information gradually. The momentum impact appears to be focused on future earnings reports. For instance, approximately 41 % of the price momentum strategy's first six months of improved performance occurred around earnings release days. Furthermore, if the market is shocked by either positive or negative earnings announcements, it often continues to be surprised similarly over the next releases in the near term (Chan et al., 1996).



**Table 8.** The returns of 11 x 1 x 3 portfolios and three months of OMXH index

In Table 8, the performance of 11 x 1 x 3 portfolios and three months OMXH index are compared. As the low value of R-squared in Table two indicates, the development of the OMXH index and the strategy are noticeably different. The average annual return for the 11 x 1 x 3 strategy was approximately -2,7 % and the standard deviation was approximately 26,7 %. The annual return and the standard deviation for the OMXH Index were 6,4 % and 11,2 %, respectively. The development of the 11 x 1 x 3 strategy and OMXH index are quite similar and the value of R-squared 0,9613 indicates that index development can explain these momentum returns.

**Table 9.** The returns of 11 x 1 x 6 portfolios and six months of OMXH index

In Table 8, the performance of 11 x 1 x 6 portfolios and six months OMXH index are compared. The average annual return for the 11 x 1 x 6 strategy was approximately 9 % and the standard deviation was approximately 22,6 %. The annual return and the standard deviation for the OMXH Index were 6,4 % and 11,2 %, respectively. This strategy offers the third largest Sharpe ratio of the momentum strategies, 0,393. The

movements between index returns and momentum returns are noticeably different in comparison to the 11 x 1 x 3 strategy. The values of R-squared from Table 2 support this graphical presentation, too.

In general, the results are not statistically significant. Only one of the long-only momentum strategies, the 2 x 1 x 6 strategy, produces statistically significant results at a 10 % level. The development of momentum strategies appears to follow the development of OMXH index but 2 x 1 x 6 and 2 x 1 x 3 strategies seem to have more independent development in comparison to the index.

H0 stated that long-only momentum strategies generate higher returns than the OMXH index. Three out of six strategies were able to generate higher returns whereas the remaining strategies did not. Therefore, the hypothesis can be accepted, at least partially. Still, the results are not statistically significant. However, due to the sample size and the period length, the reliability of the results can be limited. H1 stated that the risk-adjusted returns of the long-only momentum strategies would exceed the OMXH index. This hypothesis can be rejected because each of the long-only momentum strategies generated lower risk-adjusted returns than the OMXH index.

## 6 Conclusions

This thesis has investigated long-only momentum investing in the Finnish Stock Market between 2012 and 2022. The concept of momentum refers to the tendency of past winner stocks to continue profitable performance whereas loser stocks continue to decrease in price. The long-only momentum examination concentrates on past winners only. The purpose was to discover, whether long-only momentum would be a recommended investing strategy in the Finnish market. The results of the empirical section indicate that the results cannot confirm that the strategies are reliable. The average annual returns are relatively low or negative for three momentum strategies out of six. Three strategies exceeded the average annual return of the OMXH index, with the measurement period of 5 months being able to indicate positive returns for both 3-month and 6-month holding periods. However, the results were not statistically significant and therefore, may be subject to chance.

The Finnish stock market is worth considering for investors because the returns have been satisfying in the past, for instance, Saario (2007) writes that the average return of Finnish publicly traded companies between 1994-2006 was 13,7 % which exceeds the returns from the S&P 500 index from the same period. However, international investors and many institutions may perceive the Finnish market as less tempting due to its geographical location next to Russia and the amount of many small companies with low trading volumes.

Leivo and Pätäri (2011) studied the momentum effect in the Finnish market between 1993-2008. They argue that using momentum strategies in the Finnish market can create value for investors. Using momentum criteria, the average annual returns were able to increase by 2,84 percent (Leivo & Pätäri, 2011). In general, the winner portfolios deliver a noticeable amount of outperformance. Therefore, the long-only momentum approach can be a justified choice for an investor in the Finnish market.

Many papers that investigate the performance of momentum investing include the impact of the loser by including the shorting of loser stocks. However, in this thesis, only the impact of long positions is considered. This choice is supported by certain arguments. Certain limitations might make short selling of stocks impossible. For instance, Huij et al. (2014) present various related to the challenges of short-selling. Shorting can include risks that investors might not often consider, for example, shorting is an OTC transaction that includes counterparty risk and margin requirements. Furthermore, the risks include short squeezes, the theoretical possibility of limitless losses, and the chance of being compelled to close positions when the price levels are not optimal. Some interesting stocks might not be available for shorting purposes. The long-only strategy might be more realistic and simpler as it does not include many of these challenges.

Three out of six long-only momentum strategies were able to generate average annual returns higher than the OMXH index between 2012-2022. The measurement period of five months was able to produce average annual returns higher than the OMXH index with both holding periods, three months, and six months. The measurement period of two months generated negative average annual returns with both holding periods. The finding of Novy-Marx (2012) can support this because the recent past performance may have difficulties in predicting unusually high stock returns and the intermediate past performance can be more reliable. However, it needs to be noted that the results were not statistically significant. In addition, the momentum strategies are not able to generate higher risk-adjusted returns in comparison to the OMXH index.

Investors might benefit more from this research if the measurement period were longer and trading costs would be considered in more detail. Therefore, this thesis has some limitations. The value component might be considered in future research in this area. For instance, Bird and Whitman (2003) mention that using various requirements in the portfolio construction phase can improve the return.

In addition, the impact of NATO membership on the returns of the Finnish market could be investigated in the future, or the performance of non-NATO countries and NATO countries in the European market. The long-only momentum strategies with a 5-month measurement period seem to have the most potential for investors willing to execute these strategies in the Finnish market. Still, it may be that a more recommended strategy for an investor in the Finnish Stock Market could be investing in the OMXH index instead of long-only momentum portfolios due to the risk-adjusted performance measured by the Sharpe ratio. However, the performance of long-short strategies could also be a subject for future research, even though executing shorting strategies in the Finnish Stock Market is difficult due to many companies with low trading volumes and small sizes.

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