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Short-term momentum profits in the Finnish stock markets and during 2010-2019

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ABSTRACT:
This thesis investigates short-term momentum anomaly in Finnish stock markets during 2010-2019. Momentum anomaly has been persistent on the financial markets and financial market literature since it was first founded. Momentum effect is stock prices' tendency to follow pattern where previous winners tend to win in future and previous loser tend to lose in future. From which has been generated strategy where investor takes long position in prior winners and short position in prior loser stocks.

Momentum anomaly is generally examined in 3 to 12-month periods. To broaden the momentum anomaly related literature this thesis examines the anomaly in 1-month period in Finnish stock markets.

The findings of this study show that stock's age in the stock exchange has positive relationship to future's stock price. All other regression results we not statistically significant and did not indicate that short-term momentum anomaly exists in the Finnish stock markets.

The short-term momentum effect can still exist in the Finnish stock markets in certain industries. The effect may be vanished due to normal volatility inside the sample. The topic of this thesis is extremely interesting and with different kind of approach and data categorization the effect can possibly be found.

KEYWORDS: Momentum, short-term momentum, anomaly.

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Tiivistelmä:
Tämä gradu tutkii lyhyen aikavälin momentum-anomaliaa Suomen osakemarkkinoilla vuosina 2010-2019. Momentum-anomalia on ollut pitkään rahoitusmarkkinoilla ja osa rahoituksen tutkimusta siitä lähtien kun se ensimmäistä kertaa havaittiin. Momentum-ilmiö viittaa osakkeiden hintojen taipumukseen noudattaa kaavaa, jossa aiemmat voittajat taipuvat voittamaan myös tulevaisuudessa ja aiemmat häviäjät taipuvat häviämään. Tästä on kehitetty strategia, jossa sijoittaja ottaa position aiempien voittajien osakkeista ja lyhyeksimyy aiempien häviäjien osakkeita.

Momentum-anomaliaa on useimmin tutkittu 3-12 kuukauden ajanjaksoissa. Tämän pro gradu tutkielman tavoitteena on laajentaa tutkimusta lyhyempään ajanjaksoon ja tutkia esiintyykö momentum anomalia yhden kuukauden ajanjaksoissa suomen osakemarkkinoilla.

Tämän tutkielman tulokset osoittavat, että osakkeen iällä on positiivinen suhde osakkeen tulevaisuuden tuottoihin. Kaikki muut regressionmallin tuottamat tulokset ovat tilastollisesti merkitsemättömiä ja indikoivat, että lyhyen aikavälin momentum anomalia ei esiinny Suomen osakemarkkinoilla vuosina 2010-2019.

Lyhyen aikavälin momentum anomalia voi silti olla Suomen osakemarkkinoilla tietyillä toimialoilla. Tulosten merkitsevyys saattaa heiketä normaalin volatiliteetin vuoksi ja tästä syystä regressiomalli ei tuottanut tilastollisesti merkitseviä tuloksia. Tutkielman aihe on kuitenkin hyvin kiinnostava ja toisenlaisella lähestymistavalla ja datan luokittelulla efekti voi olla löydettävissä.

Avainsanat: Momentum, lyhyen aikavälin momentum, anomalia.

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1 Introduction

The momentum effect is well known and very persistent financial market anomaly that have been first discovered by Jegadeesh and Titman (1993.) The momentum effect states that future's stock prices can be predicted with past prices. This means that stock prices have tendency of being positively autocorrelated in certain time periods. The momentum effect is usually studied in 3–12-month time periods. The general momentum strategy is to buy stocks with strong past performance and short-sell stocks with bad past performance. The momentum effect is often linked to price reversal which is a strategy that tries to identify reversals in stock price trends. Reversal strategy presume that loser stocks tend to outperform winner stocks. Jegadeesh and Titman (1993.)

The effect has been widely studied in different asset classes and in different markets and countries. The finding that future prices can be explained with past prices challenges the efficient market hypothesis (EMH) by (Fama 1970) which is one of the major assumptions in financial market related literature. He has distinguished three levels of EMH which are presented in the second chapter of this study. The momentum anomaly contradicts Fama's (1970) first level of EMH. If EMH is systematically contradicted in the long time period, financial market anomaly has been found.

This study is done in the spirit of Medhad & Schmeling (2021) who examined momentum anomaly in short term periods in US and international stock returns. They used 1-month time period contrary to the vast majority of momentum related studies which uses longer 3-12-month time periods.

1.1 Purpose of the study

Purpose of this study is to investigate the existence of short-term momentum in the Finnish stock markets during 2010-2019. Usually and originally, momentum effect is documented or investigated by using 3–12-month intervals. This study tries to capture momentum effect in the Finnish stock market. The reason for short term intervals is that

markets have been very strong during past decade which should be favorable condition to discover momentum in short term time periods. Trading volumes have been higher than ever which indicates of more rapid investor reactions.

Finnish stock markets are very small and relatively little studied market. It has only one stock exchange which is called OMX Helsinki, and it is part of Nasdaq concern. In OMX Helsinki was listed only 207 different stocks during the sample period and hence it can be considered as a small stock exchange. OMHPI which is the index of all publicly listed Finnish companies has market value of 280 billion euros in March 2023. (Nasdaq 2023.)

This study challenges the efficient market hypothesis and tries to deepen the literature of momentum anomalies. The motivation to study Finnish stock markets is to increase the awareness and research in the small market.

1.2 Hypotheses

Most of the momentum related studies have focused on 3–12-month time periods and shown that the anomaly exists and is persistent. To enlarge the field of momentum studies this thesis tries to capture the effect in one month time periods. Medhad & Schmeling (2021) appoint in their study that short term momentum exists in high turnover stock in U.S and international stock returns. This study uses similar hypothesis and methodology as Medhad & Schmeling (2021.) The hypothesis is stated as follows:

H1: The short-term momentum effect is significant in the Finnish stock markets.

1.3 Structure of the study

The remaining structure of the study is as follows: Second chapter introduces the theoretical background of underlying literature around momentum and other widely known financial market anomalies. Financial market anomalies are closely linked to market

efficiency hence, this chapter starts with efficient market theory established by (Fama 1970.)

Secondly this chapter presents the generally used and widely studied asset pricing models. It starts with most know CAPM by Sharpe (1964), Lintner (1965) and Mossin (1966) and goes through more advanced models to Fama & French (2018) six factor model.

Thirdly the second chapter discuss about the current literature around financial market anomalies and introduces the existing literature around momentum anomaly. This section also covers momentum effect in different market conditions and sub effect called momentum crash. In addition, different explanations of momentum are covered.

Fourth chapter describes the data and methodology used in this thesis. The first part presents the data, what stocks are included and what is the time period of used data. Second part focuses on describing the methodology used in the empirical part. This also includes the forming of regression to test the research hypothesis. Chapter five presents the empirical results of regression analysis and chapter six concludes the findings of this thesis.

2 Theoretical Background

In this section underlying theoretical background is described. These theories and models have been part of the research in financial markets for decades and are essential to understand the momentum anomaly.

This subsection starts with the efficient market theory established by (Fama 1970). It can be seen as a foundation of financial market anomaly studies. Thus, it is relevant to represent the theory to which most studies and findings are based on. The theory itself asserts that historical market information cannot be used to gain profits in future. This assumption provides a contrast to momentum anomalies since the momentum profits are gained with historical market data.

The second subsection presents standard asset pricing models. These asset pricing models are generally used in the momentum anomaly literature. Asset pricing models are also in the center of anomaly studies with market efficiency. Asset pricing models are trying to explain the efficient pricing of stocks.

The third subsection introduces the field of financial market anomalies which are consequences of inefficiency in the financial markets or incorrect pricing model. One of the main functions of financial markets is that anomalies should be arbitraged away over time thus, this subsection tries to find explanations why this does not always be realized. The anomalies can be divided into three main categories: fundamental, technical and calendar anomalies, which are represented in the subsection.

2.1 The Efficient market theory

Modern finance theory is built on the theory of efficient markets. It was introduced by Eugene Fama in 1965 when he defined his concept of an efficient market. Fama made his concept more complete in 1970 when he defined the sufficient conditions for efficient markets as follows:

> *"(i)There are no transactions costs in trading securities, (ii) all available information is costlessly available to all market participants, and (iii) all agree on the implications of current information for the current price and distributions of future prices of each security. In such a market, the current price of a security obviously "fully reflects" all available information." (Fama 1970.)*

Previous conditions are essential for this theory which on the other hand makes it very vulnerable in the real-life capital markets where all conditions may not be met.

The efficient market hypothesis (EMH) is the proposition that current stock prices should fully and correctly reflect all relevant information available. (Fama 1970.) Which means that no investor can gain returns more than market returns if the markets are efficient. If one could the markets would be inefficient and private information would have been used. This means that the expected abnormal return must be zero.

$$E\left(z_{i,t+1}\right) = 0 \quad (1)$$

and

$$z_{i,t+1} = r_{i,t+1} - E(r_{i,t+1}) \quad (2)$$

The expected abnormal return for stock is the difference of realized and expected returns. In the formulas $E\left(z_{i,t+1}\right)$ illustrates the expected abnormal return at time t + 1. This model is also known as "Fair Game" model which is the foundation of Fama's EMH. (Fama 1970.)

According to Kendal (1953) stock prices cannot be predicted without extraneous information. Stock prices are following so called random walk which means that today's stock prices do not contain any information of tomorrows stock prices.

Fama (1970) built an equation for Random walk model which is based on Kendal's (1953) hypothesis:

$$P_{t+1} = P_t + \varepsilon_{t+1} \quad (3)$$

Where: P_{t+1} is the stock price at time t+1.
P_t is the stock price at time t.
ε_{t+1} is the random error zero mean and finite variance.

The Previous formula implies that changes in stock prices ($\varepsilon = P$) be predicted, and it will not be dependent on previous stock prices. It can be said that random walk model is an extension of the Fair game model, therefore the random walk model is more powerful than the Fair game model.

Even if the hypotheses are built on several assumptions that must be true, Fama stated that all conditions do not have to hold completely on practice. Because the conditions may not always be met completely thus, Fama stated three forms of market efficiency. (Fama 1970.)

The first form is weak form. The weak form of EMH implies that stock prices fully reflect all historical information and market data. Thus, technical analysis has little or no value for investors who wants to yield abnormal profits. (Fama 1970.)

The second form is the semi-strong form of EMH. It asserts that all relevant publicly available information such as, announcements of annual earnings and stock splits are fully reflected in stock prices. Thus, fundamental analysis such as the analysis of balance sheet, announcements of dividend changes or income statements or any other public information has no value for the investor who wants to yield abnormal profits. (Fama 1970.)

The third form of EMH is the strong form. The strong form asserts that all information of about the markets is fully reflected in stock prices. Thus, not even a holder of insider information can yield abnormal profits. This means that stocks are perfectly priced. (Fama 1970.)

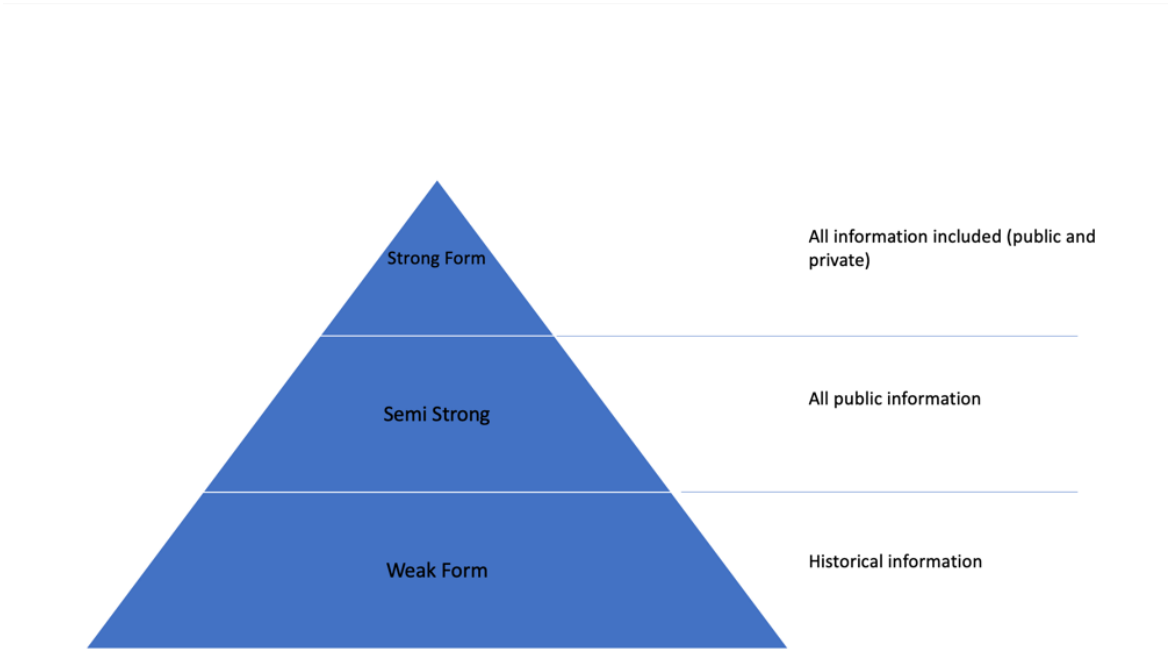

Figure 1. Forms of efficient market theory

The differences in the forms are how the stock prices reflect different kind of information. The most important finding of the transparency of the information is what kind of analysis can be used to earn excess returns. When considering the strongest form of the hypothesis where markets are efficient technical and fundamental analysis are useless because prices already reflect all information that exists. In the strongest form, there is no chance for arbitrage.

The hypothesis of the efficient markets is describing the framework and structure of the financial markets, but the hypothesis cannot be used as a tool for the asset pricing on its own.

2.2 Asset pricing models

Asset pricing is one of the key functions in the financial markets. The main idea is to get fair market price for every asset. This subsection gives a review of standard asset pricing models that are well known in the literature. These are the capital asset pricing model (CAPM) by Sharpe (1964), Lintner (1965) and Mossin (1966), Fama and French (1993) three-factor model, Fama and French five factor model (2015) and Fama and French six factor model (2018).

2.2.1 Capital asset pricing model

The capital asset pricing model (CAPM) by Sharpe (1964), Lintner (1965) and Mossin (1966) is one of the most significant developments in the modern capital market theory. It is model that describes the relationship between systematic risk and expected return. It can be used especially in valuation of stocks and to estimate the cost of equity. CAPM formula can be described as following:

$$E(r_i) = r_f + \beta_i\left[E(r_m) - r_f\right] \quad (4)$$

Where: E(ri) is the expected return on the capital asset.
rf is the risk-free rate of the interest.
βi is the beta factor which represents the sensitivity of the expected excess market returns (systematic risk).
E(rm) is the expected return of the market.
[E(em) − rf] is the equity market premium. It describes the difference between the expected market rate of return and the risk-free rate of return.

Beta coefficient is a measure of security's or portfolio's systematic risk or volatility. The coefficient is compared to the market risk. It describes the sensitivity of the asset compared to the market factor. The coefficient gets values around one which describes the level of market risk. Values over one are riskier and can be seen as an aggressive

investment and if the value is less than one it can be seen as less risky and defensive investment. If beta coefficient is 2.0 the price increase (decrease) 2 percent when market increase (decrease) one percent. The bigger the beta is the higher the systematic risk is and on the other hand the bigger the return (loss) is. If beta is zero it means that security is not exposed to the market factor and the return equals risk-free-rate. (Sharpe, 1964; Lintner, 1965; Mossin, 1966.)

CAPM should capture all the cross-sectional variation in expected returns but nevertheless it has got a lot of criticism for the additional assumptions required (Sharpe 1970), particularly by its homogenous expectations. Jensen, Black and Scholes (1972) have demonstrated in their tests that CAPM's beta factor has real failing in actual markets. High beta assets should have earned a higher return than the low beta asset however, it went the other way around. Nonetheless that the model has its lacks it is still widely used because it is only a theoretical equilibrium model.

2.2.2 Fama French three-factor model

Fama and French (1993) found another risk-based explanation for the size and book to market effects. They found out that stocks with high factor loadings compared to market-to-book earned higher returns on average and they interpret it as a consequence of a risk premium. On the account of their evidence, they provided an extension for the Capital asset pricing model which they call as a Fama-French three-factor model. They include two new risk factors in the capital asset model which are factors for market capitalization (size) and a factor for the book-to-market (value) ratio. The model can be formed in to following formula:

$$E(r_i) - r_f = \beta_1 MKT + \beta_2 SMB + \beta_3 HML \quad (5)$$

Where: $E(r_i) - r_f$ describes portfolio i's excess return.
MKT describes the excess return of the market portfolio

SMB (Small Minus Big) describes the excess return of long-short portfolio (long position in small stocks and short in big stocks)
HML (High Minus Low) describes the excess return of long-short portfolio (long position in high book-to-market (value) stocks and short in low book-to-market (growth) stocks.

These coefficients describe portfolio i's sensitivity related to the risk factors. According to their study market beta's and average stocks relation is flat, and they captured cross-sectional variation in stock returns with their size and market-to-book factors. (Fama & French 1993.)

2.2.3 Fama French five-factor model

Fama and French subsequently complemented their three-factor model with two new factors. The two new factors are profitability and investment factors.

$$E(r_i) - r_f = \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA \quad (6)$$

Where: $E(r_i) - r_f$ describes portfolio i's excess return.
MKT describes the excess return of the market portfolio
SMB (Small Minus Big) describes the excess return of long-short portfolio (long position in small stocks and short in big stocks)
HML (High Minus Low) describes the excess return of long-short portfolio (long position in high book-to-market (value) stocks and short in low book-to-market (growth) stocks).
$\beta_4 RMW$ (Robust Minus Weak) is the profitability factor which describes the excess return of long-short portfolio (long position in robust profitability stocks and short in weak profitability stocks)
$\beta_5 CMA$ (Conservative Minus Aggressive) is the investment factor which describes the excess return of long-short portfolio (long position in conservative investment behavior stock and short position in aggressive behavior stocks). (Fama & French 2015.)

Even though it is a more advanced model than the previous one, it still has some failures. Its main problem is that it fails to capture the low average returns on small stocks whose returns behave like startups and growth companies that have high invest-rates. (Fama & French 2015.)

Fama and French did empirical tests to explain the average returns related to size, book-to-market, profitability and investments. Their results show that five factor model explains 71% to 94% of the cross-sectional variance of expected returns for the size, book-to-market, profitability and investments portfolios that they studied. (Fama & French 2015.)

2.2.4 Fama French six-factor model

Once more, Fama and French extended their asset pricing models to six-factor model. As before their newest model is a nested model of CAPM. Their last factor is "momentum" factor UMD (Up Minus Down) which is defined as if HML except it is built on monthly basis. The "momentum" factor is updated every month instead of every year and the portfolios are formed based on last month's returns. The formula of the six-factor model can be formed as following:

$$E(r_i) - r_f = \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + \beta_6 UMD \quad (7)$$

Where: $E(r_i) - r_f$ describes portfolio i's excess return.
MKT describes the excess return of the market portfolio
SMB (Small Minus Big) describes the excess return of long-short portfolio (long position in small stocks and short in big stocks)
HML (High Minus Low) describes the excess return of long-short portfolio (long position in high book-to-market (value) stocks and short in low book-to-market (growth) stocks).
$\beta_4 RMW$ (Robust Minus Weak) is the profitability factor which describes the excess return of long-short portfolio (long position in robust profitability stocks and short in weak profitability stocks)

$\beta_5 CMA$ (Conservative Minus Aggressive) is the investment factor which describes the excess return of long-short portfolio (long position in conservative investment behavior stock and short position in aggressive behavior stocks).
UMD (Up Minus Down) factor is the momentum factor that describes the excess return of long-short portfolio (long position on in strong past performance stocks and short position in worst past performance stocks). (Fama & French 2018.)

2.3 Financial Market Anomalies

One of the most principal functions of financial markets is the efficient pricing of real investments (Cooper, Gulen & Schill 2008.) Financial market anomalies are cross-sectional patterns and time series in security returns that are not predicted by a central paradigm or theory. In theory market prices should comply with a pre-specified equilibrium model like Capital asset pricing model, which is on the other hand subject to efficient market hypothesis. Discovery of an anomaly requires either inefficiency on the financial markets or an incorrect equilibrium model. Thus, financial market anomalies challenge both capital asset pricing model and efficient market hypothesis.

When the anomaly has been discovered one of the most important aspects related to the efficient market theory is how durable the anomaly is. Financial market anomalies tend to disappear over time once they have been exposed. According to the efficient market theory, when the anomaly has been discovered investors should arbitrage it away. However, anomalies don´t always disappear but on the contrary they tend last over time. Therefore, if the anomaly doesn't lose its economic significance over time, this potentially implies that anomaly is an impact of an incorrect asset pricing model, not an impact of inefficiencies in financial markets. This can be concluded that real investments have been priced with risk premium which clarifies the certain expected profit on the anomaly (Schleifer & Vishny 1997).

Schleifer and Vishny (1997) have examined the limits to arbitrage anomalies away. They find out that noise trading is one of the main reasons why securities might be mispriced in the first place. Noise traders have so much financial power that they might prevent rational investors to arbitrage the anomaly away.

There are also matters that can hinder and prevent investors arbitraging anomalies away. According to Schleifer and Vishny (1997) there are many causes that might make arbitrage risky and costly. High volatility securities will exhibit greater mispricing and higher average return to arbitrage. Jeffrey Pontiff (1996) has found out that there are also other costs that limit to arbitrage such as transaction costs, arbitrage risk and information costs.

In relevant literature, anomalies have usually been divided into three categories: fundamental, technical and calendar anomalies. Fundamental anomalies are based on irregularities in the financial markets. Irregularities can be founded with fundamental analysis which is an effective way to yield excess returns from the financial markets (Abarbanell & Bushee 1998.) As can be deduced from previous if fundamental analysis is yielding something extra it is lessening the semi- strong form of the efficient market hypothesis. The most persisting fundamental anomalies are the value anomaly and the market capitalization anomaly.

According to previous section the value and glamour stock anomaly is the most known fundamental anomaly that has persist in long-term. Value stocks are stock with a high price-based accounting ratio. Value stocks can be distinguished from glamour stocks with book-to market ratio (Fama & French 1992), earning-to-price ratio (Lakonishok, Schleifer & Vishny 1994) or with cash-flow-to-price ratio (Chan, Hamao & Lakonishok 1991).

These studies show that value stocks outperform glamour stocks even when defined with various pricing multiples. According to Basu (1977) stocks with low earning-to-price (P/E) ratio yield higher return on average than stocks with high (P/E) ratio.

As mentioned in previous section the market capitalization anomaly is another important fundamental anomaly. Banz (1981) was the first who discovered and documented this effect. Banz finds that smaller firms with lower capitalization had higher risk adjusted average stock returns than larger firms.

Fama and French (1993) found another risk-based explanation for the size and book to market effects. They found out that stocks with high factor loadings compared to market-to-book earned higher returns on average and they interpret it as a consequence of a risk premium. On the account of their evidence, they provided an extension for the Capital asset pricing model which they call as a Fama-French three-factor model. They include two new risk factors in the capital asset pricing model which are factors for market capitalization and a factor for the book-to-market ratio. According to their study market beta's and average stocks relation is flat and they captured cross-sectional variation in stock returns with their size and market-to-book factors.

The momentum effect is one of the most stubborn anomalies that does not have disappeared from the stock markets. It is the strongest occurrence of technical anomaly which was explored by Jegadeesh and Titman (1993.) The momentum anomaly can be used as a trading strategy, which buys stocks with the highest past returns and sells the stocks with the lowest past returns. According to Jegadeesh and Titman (1993) the future stock returns are explained by past 2 to 12 month returns. The momentum anomaly has been very persistent over time, and it hasn't weakened after Jagadeesh's and Titman's discovery.

Calendar anomalies are anomalies that are related to specific part of a calendar year. The effects can be sort out in different days of the week, different times in a month or different months of the year related anomalies. The main discovery is that stock market returns vary regularly in different points of the week etc. There are many calendar anomalies that exist but two of the most well-known are the January effect and the Monday effect.

The January effect is also known as the turn-of-the-year effect is a financial market anomaly where stock returns increase more in January compared to the rest of the months. Watchel (1942) was one of the firsts who did research of The January effect. In his research, he found out that eleven years out of fifteen stock returns were abnormally high while the rest four bearish years were relatively insignificant. The January effect still exist, and it is persistent especially in the Finnish stock markets due to investors tax optimization.

The Monday effect was first reported by Cross (1973.) In his article, he states that returns on the stock market on Mondays will follow the prevailing trend from the previous Friday. Therefore, if the market was up on Friday, the trend should continue through the weekend and markets should continue its rise on Monday.

Engelberg, Mclean & Pontiff (2018) investigate 97 different stock market anomalies and find that anomaly returns differ on corporate news days and on earnings announcement days. The returns were 50% higher on news date and six times higher on earnings announcement days. An investor can exploit financial market anomalies to raise its wealth. One way to do so an investor can construct long- short portfolio with high average returns and with low beta. (Lochstoer & Tetlock 2016.)

The momentum anomaly is not very simple to categorize into fundamental or behavioral anomalies. It has characteristics of both. Past performance is determined fundamentally but the tendency of autocorrelated returns have elements of both types of anomalies. To conclude, the momentum anomaly consists of both fundamental and behavioral elements.

3 Literature review

In this section prevailing literature of the momentum anomaly is introduced. Just like most of the anomalies also momentum anomaly related literature can be divided into two main research fields: why momentum anomaly exists and profitability of momentum anomaly.

3.1 Existence of momentum effect

Momentum anomaly have been widely studied and it was firstly documented by Jegadeesh and Titman (1993.) The anomaly has been very pervasive in many stock markets after it was found. Jegadeesh's and Titman's (1993) paper's prior purpose was to research different kind of trading strategies and if the strategies have strong relationships with market efficiency. Despite of their initial purpose they found that past performance can be used as future's return predictor.

Jegadeesh and Titman (1993) start their data sorting by dividing stocks into deciles by previous performance. The top decile is the winner decile and bottom decile is the loser decile. The momentum portfolio is sorted by going long in top decile stocks and short in bottom decile stocks. The portfolio is then held three to twelve months.

Their evidence show that these momentum portfolios generate abnormal returns if held 3-12 months. Over one year holding period gained negative returns which they tested on their subsequent paper Jegadeesh and Titman (2001). Other important feature is the persistency which is very strong with momentum anomaly.

Jegadeesh's and Titman's (1993) one key results were also the momentums persistency regarding to holding period. As mentioned above the anomaly is very persistent in 3–12-month time frame but when the holding period exceed twelve months the abnormal returns start to diminish and even generate negative excess returns. For example, in their study Jegadeesh and Titman found that their long portfolio which was formed based on

previous six months returns yielded 9,5 percent in 12-month holding period. Remarkable is that majority of the stocks gained negative returns when the 12-month period was exceeded.

The momentum anomaly has been very widely studied in United States but also in international markets and industries and also in other asset classes such as commodities, currencies, bonds, and stock indices. For example, Gorton, Hayashi & Rouwenhorst, (2013) studied the anomaly on commodity futures returns. Menkhoff, Sarno, Schmeling & Schrimpf (2012) studied the momentum anomaly on currecies. Li & Galvani (2018) studied the anomaly on corporate bonds.

In addition to Jegadeesh's and Titman's (1993) momentum anomaly has been studied in a shorter time periods with results that suggest that the anomaly also exist in intraday timeframe. Gao, Han, Li and Zhou (2018) used high frequency exchange-traded fund (ETF) data from 1993 to 2013 to test whether momentum exist on intraday timeframe on does not.

The motivation behind their study was that if the momentum anomaly exists on intraday level and its broader sense for intraday market efficiency and high frequency trading. Their findings were statistically significant and suggest that the momentum effect is stronger when the intraday volume is higher, the market is more volatile, major macroeconomic news are released and on recession days.

Overall momentum effect is very widely studied, and it has convincing support on different markets and asset classes. Despite of that it is still have gathered quite a lot of doubts. Lesmond, Schill and Zhou (2004) argue in their paper that momentum returns, and especially larger momentum returns are illusion of actual profit. Their finding is that stocks with large momentum returns are exactly the stocks that have the biggest trading or transaction costs.

Korajczyk and Sadka (2005) are using similar perspective with Lesmond, Schill and Zhou (2004) to study the profitability of momentum anomaly after considering market frictions induced by trading. Korajczyk and Sadka (2005) use intraday data to estimate proportional and non-proportional trading costs. Main finding in their study suggests that abnormal returns gained by momentum anomaly diminish when portfolio size increases.

In addition to previous doubts about profitability of momentum strategies, the strategies may face a remarkable and sudden crash called the momentum crash. Daniel and Moskowitz (2016) examined the tendencies of momentum portfolios in volatile market conditions. They use daily and monthly US equity sample from 1927 to 2013 to examine the anomaly in poor market conditions. The study states that the two best months for a momentum as investment strategy were July and August in 1932 when the strategy returned 232% for short-portfolios and 32% for long-portfolios. In 2009 short-portfolio gained 163% and long-portfolio only 8%.

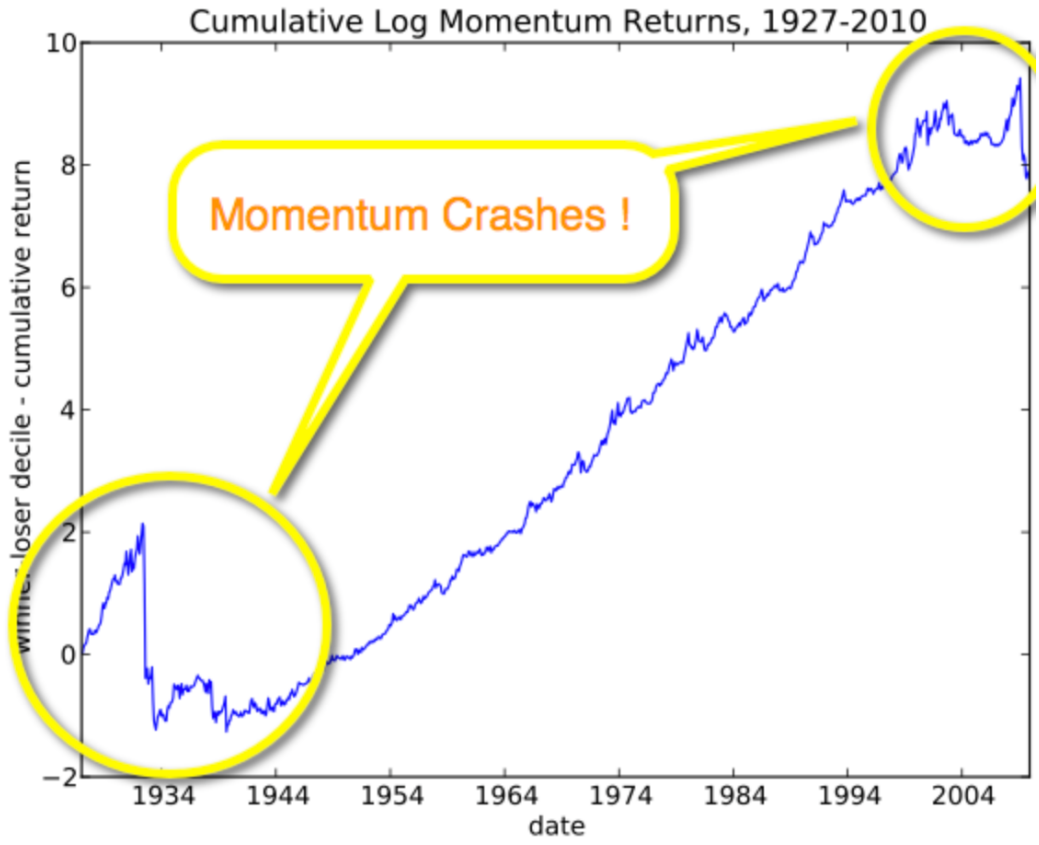

Figure 2 Examples of momentum crashes. Stockopedia (2012.)

Daniel's and Moskowitz's (2016) one of the research aspects was the predictability of momentum crash. The predictability of the crash can be major element of the profitability the strategy. Their results suggest that the crashes tend to occur when market stress on the markets is on high level. Market stress is typically measured with volatility indices such as VIX index that measures S&P 500 index's volatility. Volatility indices are interpreted so that when the index value is high the market stress is on a high level.

Daniel's and Moskowitz's (2016) findings about poor momentum returns in weak market conditions are consistent with results of Cooper, Gutierrez, and Hameed (2004) and Stivers and Sun (2010). All these studies find that momentum profit starts to decrease when three-year market return is negative. In addition, all the studies agree that the momentum profits fail in volatile market conditions.

3.2 Rational explanations

There are two main approaches that attempt to explain the momentum anomaly: rational explanations and behavioral explanations. Rational explanations propose that the momentum anomaly is an effect of information-based trading, while behavioral explanations propose that it is driven by cognitive biases and irrational trading behavior.

Rational explanations see the momentum anomaly as information-based trading behavior. According to this school of thought, investors trade on new information, and the momentum effect is a result of delayed reaction to new information. The delayed reaction can be linked to different factors, such as market frictions, information asymmetry, and investor herding behaviour. McQueen, Pinegar, & Thorley (1996).

One of the key assumptions of rational explanations is that investors are rational and have access to all available information. Therefore, the momentum effect is a result of delayed reaction to new information, rather than a result of cognitive biases or irrational trading behaviour. For example, Jegadeesh and Titman (1993) provide evidence that supports the information-based trading hypothesis. They find that the momentum effect is stronger for stocks with higher trading volume. Their results suggests that the momentum effect is a result of information-based trading.

3.3 Behavioral explanations

Behavioral explanations attribute the momentum anomaly to cognitive biases and irrational trading behavior. This school of thought argue that investors stumble into systematic biases in their decision-making, which is the major source of the momentum effect. The momentum effect itself is a result of investors overconfidence, herding behavior, and anchoring bias which are one the most known behavioral investment biases.

One of the key assumptions of behavioral explanations is that investors are not fully rational and have limited access to relevant information. Hence the momentum effect is driven by cognitive biases and irrational trading behavior, rather than a delayed reaction to new information.

Barberis, Shleifer, and Vishny (1998) provide evidence that supports the behavioral explanations. Their study suggest that the momentum effect is stronger for stocks with high retail ownership, which suggests that the momentum effect is a result of cognitive biases and irrational trading behavior.

3.4 Momentum and market sentiment

Market sentiment refers to the general attitude or mood of investors towards the stock market or a specific stock. Generally, the market sentiment is described as bullish or bearish. If investors are generally optimistic about future market performance the market is bullish and vice versa if investors are pessimistic. Market sentiment is a sum of multiple different factors that can have different emphasis in different market conditions, including news events, economic indicators, and financial statement reports. Baker and Wurgler (2006.)

Baker and Wurgler (2006) found in their study that market sentiment is a factor of momentum effect. They argue that when markets are bullish, investors tend to be more willing to take risks and invest in stocks that have performed well in the past months. This generates demand for these stocks and causes momentum effect in the stock prices. Conversely, when investors are bearish, they tend to short sell or even avoid the stocks that have performed poorly in the past, which decreases the demand for these stocks and causes the momentum effect to be persist.

However, point of view that associates market sentiment and momentum have contrarian studies as well. Jegadeesh and Titman (2001) found that momentum effect is not

related to market sentiment. Their study points out that it can be explained by information diffusion and trading frictions as factors.

3.5 Medhad & Schmeling Short-term momentum

Medhad and Schmeling (2021) study short-term momentum and short-term price reversals in their research paper published in 2021. Their sample consists of NYSE/AMEX/NASDAQ stocks, and they sort out all other than ordinary common shares. They use 1-month holding period and previous month's return as their key variables. In addition, they use previous month's trading volume as a variable. To make trading volume comparable they reduce total number of trades by total number of outstanding shares.

They use double sorting on previous month's return and turnover. They sort winner stocks from loser stock based on their previous month's return. And the second sort is based on previous month's trading activity which sorts high trading volume stock from low trading stocks. They use deciles to account nonlinearities and portfolios are rebalanced after each month.

Their main results are presented in figure 3. which shows their considerable results of momentum and reversal strategy's abnormal returns. For the purpose of this study, it's remarkable that short-term momentum strategy in high turnover decile gained 16,44% abnormal return in addition with significant abnormal returns of short-term reversal results.

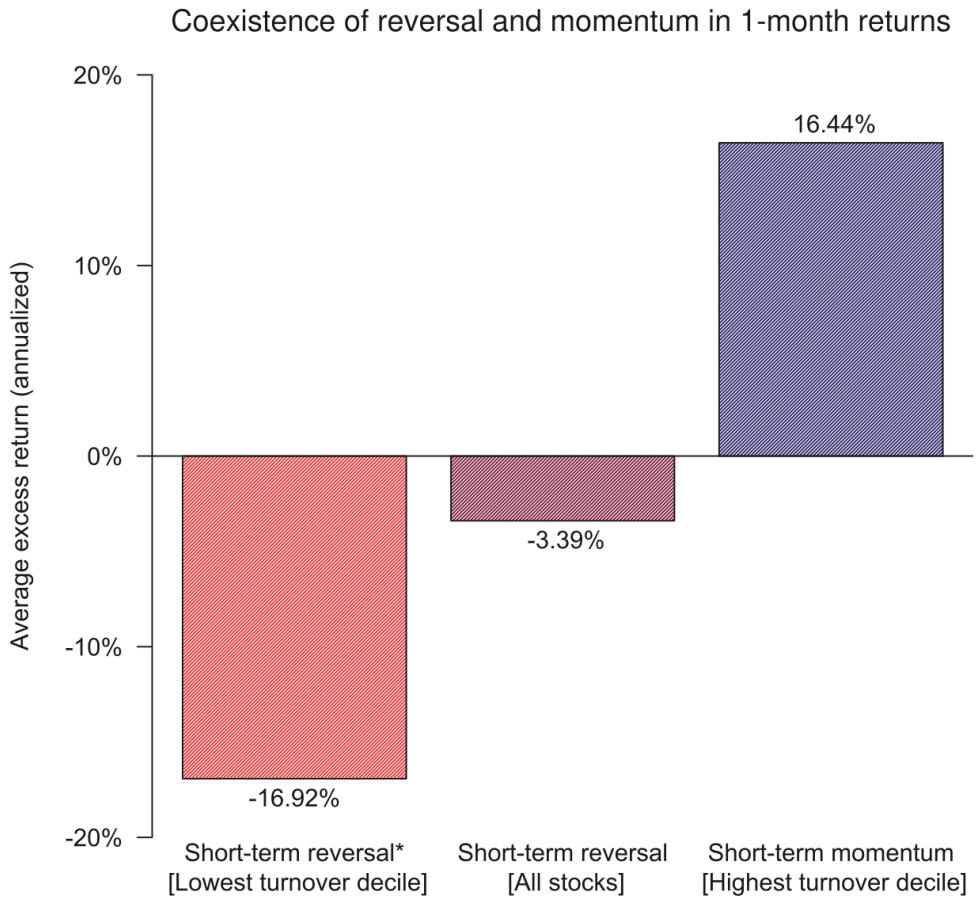

Figure 3 Coexistence of reversal and momentum in 1-month returns. Medhad and Schmeling (2021)

Their findings also show that short-term momentum persisted 12 months in their sample, and they found additional factors that increased the profitability of the strategy. Medhad and Schmeling (2021.)

In addition, their results show that abnormal short-term momentum returns are strongest among largest stocks that are very liquid and extensively covered. The common assertion in the literature of financial market anomalies is that abnormal anomaly-based returns are diminished due to transaction costs. Medhad and Schmeling (2021) show that their results survive this assertion, and the results are significant even if conservative estimates of transactions costs are taken into account.

4 Data and Methodology

Data and methodology are described and discussed in this chapter. first section starts with description of the data and explaining the key characteristics of the sample. All data is retrieved from Refinit data base and sample period is from 2010 to 2019.

The second section focuses on research methodology utilized in this thesis. This part focuses on multi factor regression model used to test short-term momentum anomaly's profitability in Finnish stock markets.

4.1 Data

All data used in this thesis is retrieved from Refinit data base. The dataset consists of 207 publicly listed Finnish common shares' monthly share prices, monthly trading volume, amount of outstanding shares per company and listing day of Finnish publicly listed companies 2010-2019. Extinct companies are included in the data to avoid survivor bias.

All companies included in the data are publicly listed companies in the Finnish stock market. Average number of companies is 150 and the months of least number of companies is February and May 2013 when there exist only 137 publicly listed companies. Compared to the last month of the sample there is 172 publicly listed companies. Hence it may be concluded that number of companies varies during the sample period.

To get reliable and comparable results, this thesis utilizes stocks' total return indices which takes into account dividends and stock splits. The stocks' total return index considers dividends and stock splits as a value adding factors consequently dividends and stock splits are reinvested into stock value without any transaction costs or other return diminishing expenses.

Figure 4 Cumulative market value in Finnish stock markets 2010-2019.

Figure 4 illustrates Finnish stock markets cumulative value during the sample period 2010-2019. The cumulative value has been rising since the begin of sample period and it's peak takes place in the last quarter of 2018.

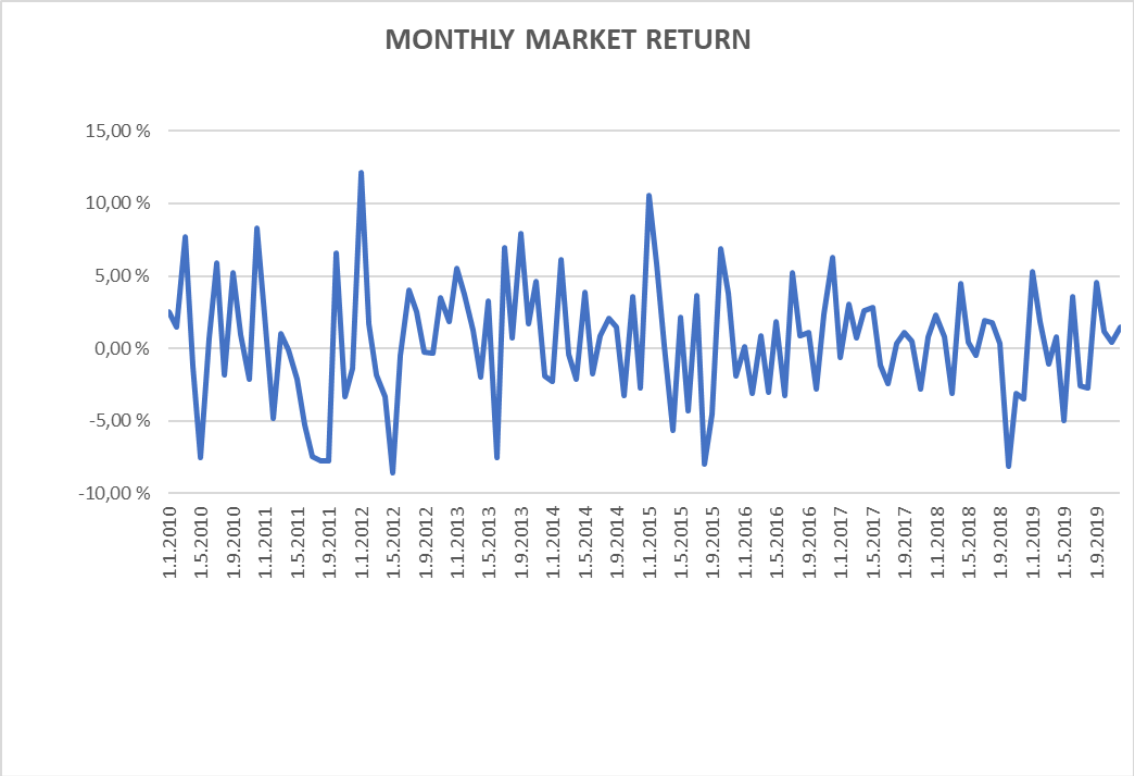

Figure 5 Monthly market return in Finnish stock markets 2010-2019**.**

Figure 5 describes the monthly market return from which can be identified its peak in 1/2011 and low in 5/2013. The average return is 0,43% with standard deviation of 4,04%.

4.2 Methodology

This section introduces the methodology used in this thesis. Since there are vast number of different ways to prevail momentum anomaly this research utilizes combination of different variables which are introduced below.

The variables are selected based on previous studies such as Medhad and Schmeling (2021) and Fama and MacBeth (1973) which uses similar independent variables in their studies to predict cross-section of monthly returns. In addition, this study uses age as an independent variable which is widely used in momentum related literature.

The empirical part of this thesis examines the existence of short-term momentum anomaly. The existence is investigated with following regression model.

$$E(r+1) = \beta 0 + \beta_1(r-1) + \beta_2 STO(r-1) + \beta_3 logAge(r-1) + \beta_4 logSize(r-1) \quad (8)$$

Where:

$E(r+1)$ = Next month's return

$\beta 0$= Intercept

$\beta_1(r-1)$= Previous month's return

$\beta_2 STO(r-1)$= Previous month's share turnover calculated as number of shares multiplied with share volume.

$\beta_3 logAge(r-1)$= Natural logarithmic value of number of days since its listing on stock market

$\beta_4 logSize(r-1)$= Natural logarithmic value of previous month's market capitalization calculated as number of shares multiplied with stock price.

The next and previous month's returns are measured with stocks' total return indices which considers dividends and stock splits as a value adding factors consequently dividends and stock splits are reinvested into stock value without any transaction costs or other return diminishing expenses.

This study uses natural logarithmic values when measuring age and size. Natural logarithmic values are used instead of absolute values because logarithmic differences are precise and easy to compare.

This model measures future stock price's dependency to previous month's return, stock turnover, age, and size. This regression is modelled to test this study's hypothesis whether short term momentum exists in Finnish stock market during sample period of 2010-2019 or not.

5 Results

This section reviews and analyses the empirical results of this thesis. The aim is to find result to the research hypothesis whether the short-term momentum anomaly exists in the Finnish stock markets or not.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,014590034
R Square	0,000212869
Adjusted R Square	5,18404E-05
Standard Error	5445,839387
Observations	24840

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	156819072,6	39204768,14	1,321932355	0,259060695
Residual	24835	7,36536E+11	29657166,63		
Total	24839	7,36693E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	909,8347562	74,28667866	12,24761657	2,17441E-34	764,2284452	1055,441067	764,2284452	1055,441067
β(r-1)	-0,002249839	0,006353437	-0,354113668	0,723256706	-0,014702953	0,010203276	-0,014702953	0,010203276
βSTO(r-1)	-0,114861364	0,486739143	-0,235981357	0,813449082	-1,068899051	0,839176323	-1,068899051	0,839176323
βLog,Age(r-1)	29,48443022	14,54369378	2,027299987	0,042642401	0,977924907	57,99093554	0,977924907	57,99093554
βLog,Size(r-1)	-12,18492947	5,699740612	-2,137804208	0,032542371	-23,35676026	-1,013098671	-23,35676026	-1,013098671

Table 1 Multiple regression results

The multiple regression model presented in the previous section yields the results provided in the table 1. The table consist of different regression statistics shown in the upper part of the table. Multiple R represents how much the change in dependent variable $E(r+1)$ can be explained by the independent variables. The value 0,014 indicates that the relationship is positive, but this cannot be interpreted as statistically significant relationship. Hence, it can be stated that change in independent variables do not explain the dependent variable.

R-square measures how much independent variables explain the variation in the next months return $E(r+1)$. As can be observed in the table 1 the value of R-square is very close to zero. This indicates that statistically none of the variation can be explained by independent variables. In addition, very high adjusted R-square indicates equal results with R-square.

The lower part of the regression result provides the regression coefficients for each independent variable. As can been seen from the table 1, only one independent variable has positive regression coefficient which is $\beta_3 logAge(r-1)$ and all other independent variables have negative relationship to dependent variable. This means that increase in stocks age increases future's stock return. All other independent variables go vice versa and has negative relationship to future's stock return.

The P-value represents the strength of the evidence in regression output. The significance level in this regression is set at 5 percent and only independent variables $\beta_3 logAge(r-1)$ and $\beta_4 logSize(r-1)$ p-values are below 5 percent significance.

The results of this multiple regression model are not statistically significant. Therefore, we no do not reject the null hypothesis that short-term momentum anomaly exists in Finnish stock markets.

6 Conclusions

The momentum anomaly is widely studied in various market and asset classes. The anomaly has been very persistent, and it have gained a lot of attention in the field of financial research. The attention has led to wide field of research papers from which this thesis has also got its inspiration.

Theoretical background of momentum anomaly is strong and comprehensive. Multiple studies have gotten statistically significant results when measuring momentum returns in short and long time periods. This asserts that momentum anomaly exists in different markets and asset classes.

The purpose of this study was to test the existence of short-term momentum anomaly in the Finnish stock markets. The data consisted of 207 different publicly listed stocks in Finnish stock markets.

The result of this study shows that only one independent variable has positive relationship to future's stock returns and only two variables are significant at 5 percent significance level. The independent variable $\beta_3 logAge(r-1)$ has statistically significant relationship to future's stock return. If this variable increases one unit, the stock price's return index rises 29 units.

Overall, the multiple regression model utilized in this study did not find statistically significant results in 1-month stock returns. Therefore, this study do not reject the hypotheses provided in the section 1.2 that "The short-term momentum effect is significant in the Finnish stock markets."

The short-term momentum effect can still exist in the Finnish stock markets in certain industries. The effect may be vanished due to normal volatility inside the sample. For example, banking sector may yield positive abnormal returns during certain month when

at the same time energy sector may yield negative abnormal returns. This kind of movement may cause the statistically not significant results.

The results of this study can be affected by relatively narrow sample data. To get significant results the sample could be broadened up or categorized by its previous performance or by certain sectors. For future research I propose developing more enhanced regression model and precisely considered categorization.

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