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Testing of Equity Portfolio Selection by Using Momentum- and Value Strategies

Evidence of Nordic Markets

Finance

Master's thesis

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Momentum and value investing are different investment strategies that have been researched a lot during the past six decades. The results of previous studies have slightly varied, however, finding that both strategies have indicated ability to predict future returns. While momentum strategy focuses on buying of recently well performed stocks, i.e., winners and selling the losers and is based on relatively short-term investing, value investment strategy, however, aims to find and buy undervalued stocks and hold them long-period of time.

Approximately 30 years ago, Asness (1997) decided to combine these aforementioned investment strategies and found that the methodology turned out be efficient way to gain abnormal returns despite the negative correlation of these two strategies. Since then, the topic has been researched widely and for example small companies have proved their potential to provide higher abnormal returns under momentum and value investment strategy. The majority of previous studies have however focused on studying especially US and global markets, which motivates to study more recent data from the Nordic markets from the period between 2001 and 2020. The study is using quantitative research methods in which the companies are divided into six different decile portfolios based on their valuation status, i.e., value, growth and neutral. Additionally, the companies are divided into small and large portfolios based on their market value. An identical split will be repeated when using momentum and value investment strategies. The goodness of the method is measured with widely used four factor-regression model and t-test.

The study finds that combining momentum and value investment strategies works efficiently and the strategies can be combined also in the Nordic markets. The model indicates similar negative correlation between the strategies as in the previous studies, however all findings are not statistically significant at acceptable conventional levels. Additionally, the results indicate that momentum and value investment strategies work especially among small companies, and the results are statistically significant in most of the decile portfolios. The last interesting finding of the study indicates that usage of balance sheet-based profitability metrics works better in value investing compared to earnings-based metrics.

Key words: momentum investing, value investing, momentum- and value investing, portfolio construction, investment strategy, multiples

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Momentum- ja arvosijoittaminen ovat kaksi erilaista sijoitusstrategiaa, joita on viimeisen kuuden vuosikymmenen ajan tutkittu paljon erillisinä sijoitusstrategioina. Aiemmat tutkimustulokset ovat hieman vaihdelleet, mutta pääasiassa molemmat strategiat ovat osoittaneet kykyä tulevaisuuden tuottojen ennustamisen osalta. Siinä missä momentum- keskittyy ostamaan edellisiä voittajia ja myymään häviäjiä lyhyellä ajanjaksolla arvosijoittaminen pyrkii löytämään aliarvostetut osakkeet, ostamaan ne halvalla ja pitämään niitä pitkän ajanjakson.

Myöhemmin noin 30-vuotta sitten Asness (1997) päätti yhdistää kyseiset strategiat ja havaitsi yllättävän käänteen, sillä menetelmä osoittautui toimivaksi strategiaksi ansaita epänormaaleja tuottoja, näiden kahden sijoitusstrategian negatiivisesta korrelaatiosta huolimatta. Sittemmin aihetta on tutkittu entisestään ja esimerkiksi pienet yhtiöt ovat osoittaneet kykynsä tuottaa epänormaaleja tuottoja paremmin, yhdistäessä momentum- ja arvosijoittamisen strategiat. Suurin osa edellisistä tutkimuksista on kuitenkin keskittynyt analysoimaan etenkin Amerikan tai maailman laajuista markkinaa, joka motivoi tässä tutkimuksessa keskittymään nimenomaan Pohjoismaisiin osakemarkkinoihin vuosilta 2001–2020. Tutkimus toteutettiin kvantitatiivista menetelmää käyttäen, jossa yhtiöt jaettiin kuuteen erilaiseen desiili-portfolioon sen mukaan, oliko kyseessä arvo-, kasvu- vai neutraaliyhtiö. Lisäksi yhtiöt edelleen jaettiin markkina-arvoon perustuen joko suuriin tai pieniin yhtiöihin. Sama jako toistettiin sekä momentum- että arvosijoitusmenetelmää käyttäessä. Metodin hyvyys ja toimivuus puolestaan mitattiin paljon käytetyn neljän-tekijän regressiomallin ja t-testin avulla.

Tutkimuksen tulokset osoittavat, että momentum- ja arvosijoitusstrategian yhdistämien toimii tehokkaasti ja strategiat ovat yhdistettävissä myös Pohjoismaiden osakemarkkinoilla. Malli osoittaa aiemmissakin tutkimuksissa havaittua negatiivista korrelaatiota strategioiden välillä, mutta tulokset eivät kaikkien portfolioiden osalta ole tilastollisesti merkittäviä. Lisäksi tulokset osoittavat, että momentum- ja arvosijoitusstrategiat toimivat etenkin pienten yhtiöiden keskuudessa. Tilastollinen merkitsevyys on tämän osalta havaittavissa lähes kaikkien desiili-portfolioiden osalta. Viimeisenä mielenkiintoisena havaintona tutkimus osoittaa, että tasepohjaiset tunnusluvut toimivat tulospohjaisia tunnuslukuja paremmin arvosijoittamisessa.

Avainsanat: Momentum-sijoittaminen, arvosijoittaminen, momentum- ja arvosijoittaminen, portfolioiden muodostaminen, sijoitusstrategia, arvostuskertoimet

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ABBREVIATIONS

AMEX	American Stock Exchange
NYSE	New York Stock Exchange
B/M	Book to Market
GRS	Gibbons, Ross and Skanken test of mean-variance efficiency of assets returns
CAPM	Capital Asset Pricing Model
MSCI	Morgan Stanley's Capital International Perspectives
MOM	Momentum
E/P	Earing to price
B/P	Book to price
S/P	Sales to price
EBIT/EV	EBIT to enterprise value
EBITDA/EV	EBITDA to enterprise value
S/EV	Sales to enterprise value
SMB	Small Minus Big
HML	High Minus Low
WML	Winner Minus Loser
EMH	Efficient Market Hypothesis

1 INTRODUCTION

1.1 Background and motivation

Various investment models have been developed empirically and theoretically to anticipate the future market movements which are directly linked to the value of the investments. However, this task has been more demanding because of the generated substantial stream of literature after Markowitz (1952) wrote about portfolio selection.

Over the last six decades, many scholars have studied separately value- and momentum strategies to discover the efficient and most profitable way to invest, as the primary purpose of investing is to maximize the return of the invested capital. Costa and Soares (2004) conclude that motivation for such a research topic is explained with growing stock market and a mission for trying to forecast the future movements of the investment. Among the others Jegadeesh and Titman (1993) and Israel and Moskowitz (2013) have argued on behalf of the short-term investing, such as momentum (MOM) investing strategy. Momentum strategy aims to predict best performing stocks in the short-term by finding the recent winners in the stock market and assuming that they perform well also in the near future. If this strategy is appropriately applied, it might give a power to forecast the short-term future returns. Contrary strategies, such as value investing strategy, focuses on long-term investing. This strategy is researched e.g., by Fama and French (1992, 1998) and Porta, Lakonishok, Shleifer, and Vishny (1997), by using the book-to-market (B/M) as a value measure to prove that future profits can be predicted with value investing strategy. This strategy seeks to find stocks that are under-priced to their intrinsic value and will gain abnormal returns in the future once the under-pricing unwinds. However, under-pricing can also be related to the depression of the stock, and investors consider that it will continue for a more extended time, causing the low valuation. (Bird and Casavecchia 2007.) Therefore, when the majority of the investors consider that low valuation should be applied for the stock, while the intrinsic value suggests higher valuation, there has to be some tricker causing the unwinding of under-pricing (e.g., positive results from new implemented strategy) before the market accepts a higher price for the stock.

Both momentum- and value strategies have been applied as a single used method in history, but during the last three decades, scholars like Asness (1997), Fama and French

(2012), Leivo (2012), and Asness, Moskowitz, and Pedersen (2013) started studying momentum- and value investment as a combined investment strategy to find a new way to forecast the future profits from the investment. The result showed crucial findings by indicating the method's (momentum and value as combined) efficiency to gain abnormal returns even though the strategies were negatively correlated with each other. Furthermore, Fama and French (1998, 2012) and Loughran (1997) also found a size premium when applying these two strategies as combined since the results show that small companies are able to gain higher abnormal returns than big companies. However, due to the limitation of the earlier studies, many researchers (see e.g. Asness, Moskowitz, and Pedersen 2013), recommend studying the topic in more detail since there were still some unsolved questions and relatively low amount of evidence which motivated this study to examine the topic.

Another driving motivation to focus on specifically to the Nordic markets was the limited number of earlier studies from such geographical region as the majority of the earlier studies have been focusing on the US and global stock market data. Moreover, the latest statistics show that the number of private investors in the Nordic stock markets have been developing positively, supporting the relevance of research on investment strategies in the Nordics. For example, at the end of 2021, Euroclear statistics report that over 250 000 private investors own an equity savings account and almost 940 000 held stocks of listed companies in Finland. In addition, the number of young investors has been increasing during the last few years. (Pörssisäätiö, 2022.)

1.2 The research questions

The research questions of this study are formed based on the findings from earlier studies (Asness 1997, Bird and Whitaker 2004, Fama and French 2012, and Asness, Moskowitz, and Pedersen 2013), researching momentum- and value investment strategies to find a new way to predict the future returns from the investment. The overall results from their studies show the efficiency of the strategy, but they recommended further researching because of the limited number of earlier studies. As mentioned earlier, Asness (1997) and Bird and Whitaker (2004) found a negative correlation between the strategies. While Loughran (1997), Fama and French (2012), and Asness, Moskowitz, and Pedersen (2013) found size premium from small companies. However, some studies find size premium

only in value portfolios when applying a combination of momentum- and value investment strategies (see e.g. Israel & Moskowitz 2013).

The research questions of this study are formed as follows:

1. Does the combining of momentum and value investment strategy give a power to generate abnormal returns?
2. What type of momentum- and value portfolio provides highest returns?
3. Does the size of the firm affect the value- and momentum premium?

By answering to the research question the study provides an exciting opportunity to see whether it is relevant to combine momentum- and value investment strategies, what are the attributes to generate profitable strategy, and does the size premium exists in the Nordic stock market. The results in previous literature have systematically shown that the strategies work and are able to gain abnormal returns (see e.g. Asness 1997, Hou, Karolyi, and Kho 2001, Fama & French 2012, Leivo 2012, Asness, Moskowitz and Pedersen 2013).

1.3 Structure of the study

The study contains theory-, literature review-, data-, methodology-, results, and conclusion parts. The theory part gathers well-known financial theories, which help to understand investment strategy from various viewpoints, after which the earlier studies are examined to capture the methodology and the findings of those studies. The data and methodology parts describe the data collection process, and methodology of combining the two strategies (momentum and value) and the statistical tests applied in the study. The findings of the study and analysis of the hypotheses are presented after the literature review and discussed at the end of the results section. Conclusion part summarizes the results in line with earlier studies, answers to the research questions, and presents a discussion of the research limitations and suggested further research topics going forward.

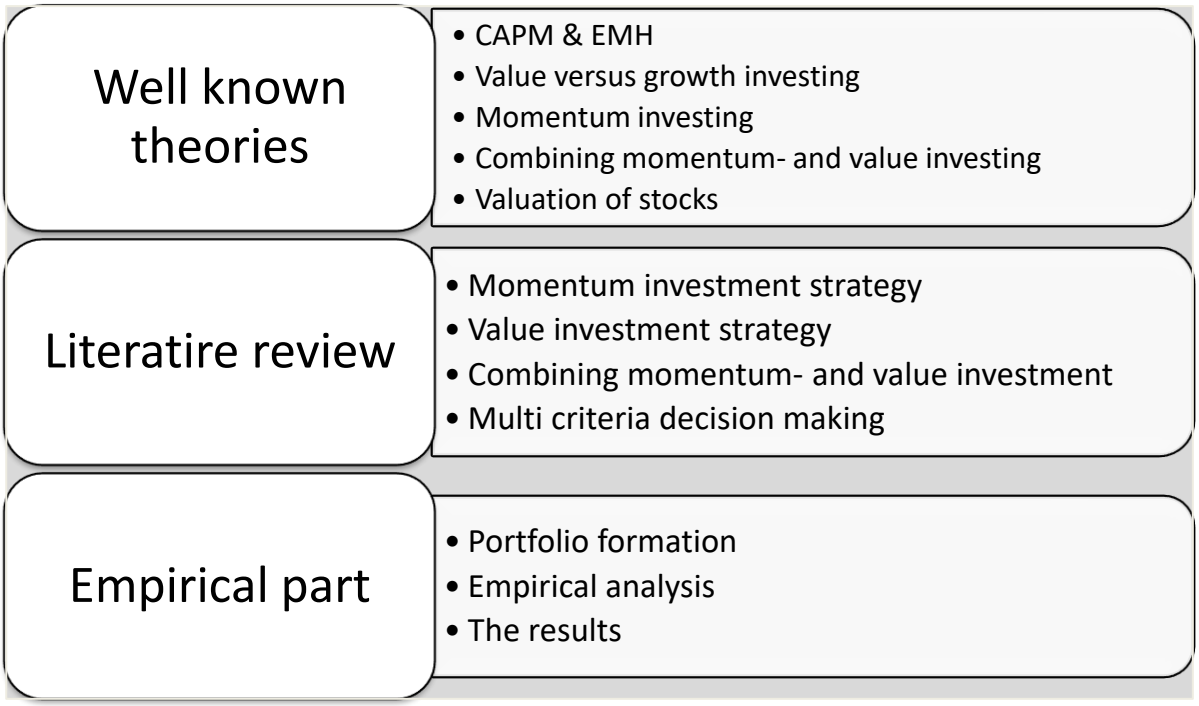

Figure 1. Research Framework

2 WELL KNOWN THEORIES

2.1 Capital Asset Pricing Model (CAPM) theory

The Capital Asset Pricing Model (CAPM) was founded in the 1960's by Sharpe, Lintner, and Mossin. CAPM has set the framework for modelling the portfolio markets. The theory assumes that when considering picking the stocks or market-timing strategy, it is not required to have active portfolio supervision and that investors have the same decision-making procedures and the amount of information. Moreover, it believes that all investors are willing to take advantage of all possible opportunities to gain risk-free profits. (Brandimarte 373-375, 2017.)

CAPM equation is as follows:

$$R - F = a + b[M - F] + e \quad (1)$$

Where R is the return of the portfolio, F is the treasury bill, a is the intercept, b is the coefficient and M is the return from the stock market if investing e.g., to index. Shortly described CAPM considers the portfolio returns by considering markets- and individual assets risk factors. The equation of CAPM can also be written as follows:

$$E[\tilde{r}_i] - r_f = \beta i \cdot \left(E[\tilde{r}M] - r_f\right) \quad (2)$$

Where E is the equation, $\tilde{r}_i$ is the return from the index, r_f is the risk-free rate, βi is the coefficient. CAPM is primarily used in academic studies when trying to explain the abnormal returns of the portfolio and if the results are statistically significant. The model is simpler compared to Carhart's four-factor- or Fama and French's three-factor model. The following assumptions stand when applying CAPM; markets are liquid, single-period investment plans are used, consideration is only for listed companies, transaction- and financial costs as well as taxes are excluded from the model, and all information of the markets is available equally for all investors. Nevertheless, the model does not expect that all investors have the same risk allowance, and the risk-free return is the market portfolio. (Brandimarte 375-376, 2017.)

In this study, in addition to CAPM, Carhart (1997) four-factor- and Fama and French (1993, 1996) three-factor regression analyses have been applied to add more explanatory

factors to the model. This refers to Fama and French's (1993, 1996) study where they found that when using CAPM as a model, where β which is the slope of the model, it gives a too simple explanation about the returns of the investment. They argued about the power of the regression performance if the company's size- (SMB) and whether the B/M of the company is high or low (HML) factors are added into the model, when trying to explain the average return cross-sections. In addition to three-factor model Carhart (1997) also applied momentum anomaly from one year to add more explanatory power to the model, also called the winner minus losers (WML) factor. This model is known as four-factor model. All three separate regression models have been applied similarly in previous studies, but Carhart's four-factor model is the most used in the latest studies. Therefore, the primary analyses are consistently carried out also in this study by using the four-factor model due to its highest explanatory power when analysing value- and momentum investment strategies as a combined strategy.

2.2 Efficient market hypothesis (EMH) theory

Even though CAPM assumes that all the information is available for all the investors simultaneously; efficient market hypothesis (EMH) theory examines the topic from a different angle. When considering about the most profitable way to invest, one of the biggest questions among the topic is whether the markets are efficient. EMH has been widely known finance, economics, and accounting since the late 1950's. (Jensen, 1978.) It is strongly linked to investment strategy and decision-making since it grants the understanding of how the stocks react to the information from the markets and whether investors can take advantage of the information. According to Fama (1991) and Niroomand, Metghalchi and Hajilee (2020) EMH assumes that markets are efficient, and all the information, which is generated, like the volume of trading in the markets and past prices, can be seen in the value of the stock as soon as the information is announced. Also, Malkiel (2003) argued that shortly right after the companies have published their financial reviews or stock releases, the information will be incorporated to the stock prices without delays.

Fama (1991) discussed of testing EMH existence alongside equilibrium models like an asset pricing model. This method allows spotting whether the information reflects prices appropriately. Jensen (1978) also supported the method by arguing that markets are

efficient when information is settled to 0, if it is impossible to make risk-adjusted net returns, i.e., taking into consideration of all costs. However, Watts (1978) and Cakici, Fabozzi and Tan (2013) conclude that abnormal returns do not refer to deficiencies from the asset pricing model but are due to the inefficient market.

Burton (2003) described in his study "random walks" and how stock prices of today are independent and random from future price changes since tomorrow's news reflects only prices of tomorrow. That develops the position in the markets where the private investors and experts are able to gain the same profits when buying diversified portfolios. According to Fama (1991), a weaker reflection of the EMH is Jensen's (1978) version where the information affects to prices until the benefits of the profits do not exceed the marginal trading costs. The theory of EMH is strongly related to value- and momentum investment since many academic researchers have tried to explain the behaviour of the markets by the EMH theory (see e.g. Cooper, Gutierrez, and Hameed 2004).

2.3 Value- versus Growth investment theory

When the future outperforming of the stock is seen as successful, but the stock is still traded with the under-price value, it is called a value stock. The main question in value investing is whether the markets are inefficient or if the stock's low price is due to the actual poor outperformance of the company. Market efficiency and value investing have been researched a lot during the last six decades, and among the others, Greenwald, Kahn, Bellissimo, Cooper and Santos (2021) and Chen and Feng (1998) found motivation behind such investing. Investors believe they are able to benefit from the strategy of buying the stock with a low trade price without taking an additional risk since the markets are inefficient. Although, Zhang (2005) argued that value stocks are riskier than growth stocks when considering the 'bad' times in the markets when the risks are more expensive.

Moreover, researchers such as Lakonish, Shleifer, and Vishny (1994) have found that value criteria can add value to the investment when focusing on picking 'cheap' stocks and avoiding 'expensive' ones. Also, Bird and Casavecchia (2007) considered whether the poor price of value stocks is due to the temporary depression while investors attribute too much weight to the mispricing since they believe the poor outperforming of the stock will continue further. Also, Chan, Jegadeesh, and Lakonishok (1995) examined the

pricing difference between value- and growth stocks and consider whether it is the result of data-snoop processing or the higher risk of the value stocks.

According to Fama and French (2006), the value premium is nearly the same with big and small entity stocks when using B/M book to market and E/P earnings to price variables. Although their results also show that when using only the E/P variable, the results are partly dependent on the firm's size, but not significantly. Although later Fama and French (2012) found a relation between small companies and size premium when using a combination of value- and momentum investment strategy. Moreover, Loughran (1997) argues that growth companies are more profitable than value companies when comparing the performance of small size entities. As discussed earlier, Fama and French (1992) have also demonstrated how future stock earnings can be predicted if using B/M as a value measure when choosing a value investing strategy. Also, Lakonishok et al., (1994) argued on behalf of using a value investing strategy and how highly C/P (cash-flow-to-price) ratio can help show the stock's future earnings. Although, Cohen, Polk, and Vuolteenaho (2003) reported that high B/M indicates slower growth of the company and its persistency to generate profits compared to growth stocks.

Despite the literature in general finds value investing to be powerful investment strategy, Loughran (1997) found conflict between the real-world profits generated by portfolio managers and the academic conclusions. Hence portfolio managers have not been able to generate as profitable results by investing in the value stocks as the literature suggests, e.g., beating the S&P500 index should be able to accomplish if predicting the market is based only on the size of the book-to-market ratios. He also concludes his study about the effect of the January seasonal pattern on the value of stock price. Typically, the average stock price of growth firms is higher when compared to value stocks, and after December, institutional and private investors are reallocating their funds to new end-of-the-year mode, which raises the demand for value stocks and hence affects to increase of the prices. (Loughran, 1997.)

2.4 Momentum investment theory

The momentum investing strategy focuses on finding stocks that have recently performed well since the strategy is assuming that these stocks will also gain profits in the near

future, and according to Bird and Casavecchia (2007), recent well-performance in this case, refers to either price- or return success. This refers to why the momentum investment strategy period is defined as short-term. (Lakonishok et al.,1994.) Among well-known researchers like Fama and French (2012), momentum investment theory is also known as ‘sell losers and buy winners’ strategy. Pätäri, Karell, Luukka and Yeomans (2018) find that momentum strategy shows the best performance in the short term compared to value investing, which has indicated the best performance in the long term. This finding is also supported by Israel and Moskowitz's (2013) research when they study the strategies of scaling the time, value, size, and momentum. They found the crucialness of the short-term periods within momentum strategies compared to value strategies.

The topic was also studied by Sapp and Tiwari (2004). They questioned whether investors are chasing only recent past winners or are they systematically trying to find momentum-styled funds, after which the results of the study conclude naively behavioural where the investors were only choosing recent large profit gained stocks. Moreover, Lee and Swaminathan (2000) find the relationship between high past trading volume and momentum price effect in their study. According to Avramov, Chordia, Jostova, and Philipov (2007), mostly momentum portfolios consist of stocks that obtain a high credit risk rather than high credit quality. Although Rouwenhorst (1998) presented an interesting turn when studying international momentum investing since the study showed only one percent higher returns compared to the loser’s portfolio after calculating the risk corrected returns. However, these results somewhat correspond with Fama and French's (2012) study since they found that momentum- and value investing combination should instead focus on local or at least similar markets rather than examining the global viewpoint. Like many other researchers, Johnson (2002) also tried to explain the ratio momentum effects on the stock market, and he suggested whether the future price shocks could be explained by the fundamental analysis such as expected dividend cash-flow growth and found the models to be applicable when testing the future earnings of the stock.

As Cooper, Gutierrez, and Hameed (2004) suggested, momentum investing theory has often been incorporated into several behavioural theory aspects to explain its capability to generate profits. For example, Daniel, Hirshleifer, and Subrahmanyam (1998) argued in their study how investors tend to react asymmetrically to the success of the stock's

performance, suggesting that investors tend to believe that their under-performance relates to external noise, while the over-performance being a result of their own skills. Therefore, good news relating to the stocks leads to an overconfidence behaviour among the investors, which will generate profits for the stocks in the near future, in other words, momentum profits. Moreover, it has also been argued that momentum occurs because of the investor's lag in reaction to the new information, according to Barberis, Shleifer, and Vishny (1998). This is also discussed in the study of George and Hwang's (2004); hence, their conclusion shows that investors see the past return as the arrival of new information.

Another aspect served for explaining the momentum appearances was explained by Delong, Shleifer, Summers, and Waldmann (1990), who presented the perspective that generating momentum profits is due to the trend-chasing in the stock markets. Jagadeesh and Titman (2001) are also discussing in their study about momentums' relation to several behavioural aspects and pointed out that momentum profits are due to the investors' overreaction, which eventually is rebalanced. Therefore, the most important fact when applying the momentum investment method is the timing of buying and selling the stocks to benefit from this investment strategy Badrinath and Wahal (2002). Because of the timing, testing momentum investment theory is usually executed by using the recent past six- or 12 months' performance of the stocks or earnings announcements as a base for ranking the portfolios. After that, the ranking of the portfolio is conducted by following the method where winners have the highest- and losers have the lowest score after holding them for one year before selling.

2.5 Combining momentum- and value theories

As discussed earlier, momentum- and value investing have been researched as single used investing methods for several decades. Asness (1997) was one of the first scholars who researched momentum and value investing methods as one combined method. He was motivated to find a new way to predict the future earnings of the investment. Asness (1997) and Bird and Whitaker (2004) studies captured the negative correlation between these two strategies but could not explain it since value strategy showed its best performance in weak momentum conditions and vice versa with momentum strategy. Later, Asness, Moskowitz, and Pedersen (2013) confirmed the exact negative correlation with the global sample, but according to their findings the link between value and

momentum negative correlation is related to the funding risk. However, only some return premium and negative correlation can be explained by the funding and liquidity risk. They argued that some of the correlation might also be explained simply because of the initial strategy of value investing, where investors tend to find undervalued stocks (cheap) and -momentum traders expensive recently winners. Hou, Karolyi and Kho (2001) also reported about the separate factors effecting to the success when combining momentum- and value investment. They showed that when adding multifactor variables such as C/P or stock price MOM these are likely affecting to the risk factors with positive way. Likewise, Vayanos and Woolley (2013) reported the relationship between these two strategies since they showed that momentum effects could be generated because of the rising cash flow among the funds after causing the decrease in the stocks, which afterwards pushes prices down, causing the value effects. This was also supported by Bird and Whitaker (2004) since they suggested that a combination of momentum- and value investing strategies can capture the performance of the stocks to the information generated in the markets. Stock market performance is cyclical, and when using a combined approach, it can benefit from the over-and-under reactions of the stocks simultaneously.

When combining momentum- and value investment strategies Fama and French (2012) found that the strategy is the most efficient with small companies. Israel and Moskowitz (2013) found no size premium from small stocks with momentum- but the value investment strategy was in line with Fama and French findings. Thus, they recommended studying more of the momentum- and value investing phenomena to see whether the results are consistent and the explanatory factor reliable for such behaviour.

2.6 Valuation of stocks

Investment analysis is part of decision-making in the stock markets, and the primary intention is to determine the correct value for the potential financial investment. First, it is essential to understand what the value is and the factors that may affect the price of the stock in the markets. In this study, the focus is on the stocks which are publicly traded, and therefore, analysis of private limited companies has been excluded from this consideration. Since the stock is publicly traded, the price of the stock depends on the demand in markets, and the demand is determined by the buyers of the stock, which can be subjective. Subjective in this case means that it depends on who is performing the

analysis, with what method, and what kind of risk factors such as risk-free interest rate and risk-free equity premium; hence these factors are likely to affect the outcome of the valuation. The outcome of the overall demands is the price of the stock today which is also known as market value. (Pinto 2020, 135-136. Palepu, Healy & Pee, 1954, 285.)

Market value is not the same as book value and therefore it can be either higher or lower compared to total book value of assets or company's book value of equity. Like Pástor and Pietro (2003) stated in their study, in over 10% of the listed companies the market value was seven times higher compared to their book value of assets. Especially newly listed stocks are under significant uncertainty and may be overvalued, which can later appear with a decrease of the stock price after the listing. Therefore, the task of valuation of an investment is one of the most complex parts when considering the investment strategy. It can be performed using various methods, including valuation multiples, which are popular among analysts because of their simplicity. (Palepu, Healy & Pee, 1954, 285.) Like in this study, multiples can be split into price-based and enterprise value-based multiples. Multiple approaches divide the amount of market- or enterprise value to chosen value measure e.g., the book value of an asset, -equity or earing based e.g., EBITDA, EBIT or net income of a company. Despite the favour of using multiples, this task has been challenging if using peer group price multiples since comparability may vary depending on which industry the company operates and whether the company focuses on differentiating or cost leadership strategy in the market. In addition, not all companies within the same industry have the same strategy, financial policy, or growth opportunities. Therefore, it is recommended to choose members from the market who shares the most similar business with the target company when using the peer group approach.

By using valuation multiples, investors tend to find mispricing and benefit from it which is also called finding arbitrage opportunities. Another aspect affecting the price of the stock and possible over-or under-pricing is the market efficiency and whether the stock is sensitive to react, e.g., analysts' recommendations or other announcements due to the company's performance. (Pinto 2020, 137.)

In this study, the valuation by using multiples is not based on the pear group approach but rather enables to observe which stocks can be classified as value- and growth stocks. Among the others, Fama and French (2012) showed in their study that stocks with high

fundamental ratios, including book-to-market ratio and earning to price, can indicate that the stock is under-priced, and by taking advantage of the mispricing, it may allow generating higher returns in the future compared to a lower ratio of fundamental i.e., growth stocks.

2.6.1 Price-based multiples

According to Fama and French (1998) and Lakonish, Shleifer, and Vishny (1994), value stocks have high earnings to price (E/P), cash flow to price (C/P), and book-to-market equity (B/M) ratios compared to growth stocks. They argued that growth stocks have a higher income than value stocks with lower earnings, and therefore companies with higher income are overvalued while the companies with lower income are undervalued.
After the market accepts higher valuation for value stocks (i.e., previously under-valued companies), the under-pricing unwinds resulting in abnormally high returns for the investors. The unwinding of under-pricing (i.e. higher bids of the company's stock) arises from e.g., once the company has proven its ability to generate higher profits e.g., through successfully executed strategy.
Since P/E and B/M are the most commonly used price-based multiples, those are also applied in this study. Moreover, Asness (1997) concluded in his study that B/P has been one of the best multiples to measure the undervalued stocks, which has led to choosing it as one of the ranking scores to measure the value stocks in the portfolio of this study. Also, S/P multiple has been applied similarly to Lakonish, Shleifer, and Vishny (1997) and Leivo's (2012) studies.

2.6.2 Enterprise value-based multiples

Motivated by Leivo (2012) and Pätäri et al. (2018), enterprise-based multiples like EBITDA, EBIT, and sales have also been applied in this study to rank the stock portfolios. In enterprise-based portfolios, EBITDA, EBIT, and sales are divided by the enterprise value, and the highest rankings are identified as the value stocks. According to Leivo (2012) the leverage of the companies is better overtaken by the EBITDA/EV multiple than E/P. Apart from Leivo (2012) and Pätäri et al. (2018) EV-based multiples have not been used in most of the previous studies when testing momentum- and value strategies. This study applies both EV- and price-based multiples to find more versatile results compared to previous studies. EBITDA is the earnings before interest, taxes,

depreciation, and amortization, which describes the company's operational success and does not consider depreciation and amortization and tax and financial items (financial income- and expenses). EBIT is the same as EBITDA, but it is the earnings after depreciation and amortisation. It briefly describes the company's capability to generate profits after fixed-and non-fixed expenses and considers the investment in machinery and equipment. Meanwhile, sales divided by enterprise value (S/EV) is considered to compare the results to the S/P portfolio.

2.7 Literature review

2.7.1 Momentum investment strategy

Jegadeesh and Titman (1993) were one of the first scholars studying the strategy of buying winners and selling losers, i.e., the momentum strategy, in 1990's. The studied sample consisted of data from period of 1965-1989 from the US stock market. The testing of the momentum strategy executed by buying the stocks based on their 6-month success after holding them for the next six months, resulted in average yearly abnormal profits of approximately 12 percent. They also tested the returns from a zero-cost winner minus loser portfolios from the following 36 months after the stocks were collected into the portfolio. Results showed interesting facts since all the portfolios generated positive returns in the first 12 months, while half of those returns were lost in the long-term after the first year of the earnings-announcement. Although comparing the results to the loser's portfolio, they started generating higher profits compared to winner portfolios after 8 or 20 months from the formation of the portfolio. Overall results from their study are consistent with DeLong, Shleifer, Summer, and Waldman (1990) suggesting that selling a loser and buying a winner creates an abnormal increase in the prices, and hence these transactions are likely to affect overreaction to prices of the stocks in a short-term period.

Similarly to Jegadeesh and Titman (1993), Chordia and Sivakumar (2006) also studied the price- and earnings momentum and whether the post-earnings are related to earnings-announcements. Their sample consisted of companies listed in NYSE and AMEX during 1972 to 1999. The 10 decile portfolios were formed by taking a long position in stocks with the highest earnings and a short position in stocks with lowest earnings. (Denoted PMN). The earnings were calculated using the method of last quarter minus earnings from

the prior year last quarter rather than using stock price, sales, or total assets to avoid biases. The standard deviation for the cross-sectional comparison was calculated using the change in earnings from the last eight quarters. They also applied six-month holding periods and calculated each stock's equally weighted returns to form the portfolios.
Moreover, they performed the three-factor model presented by Fama and French (1993, 1996) to test whether the model explains the momentum payoffs. Chordia and Sivakumar's (2006) study showed that the relationship between earning strikes and past returns and the momentum effect is strongly linked to past earnings of the stock. Results also suggest a correlation between future returns of the investment and growth in GDP, T-bills, labour income, and production-consumption.

2.7.2 Value investment strategy

Fama and French (1998) have studied a lot of asset pricing and portfolio theory, and the findings from their studies have created a framework for many other researchers. Among the other studies, they studied in 1998 the value versus growth investment strategy. The sample was extended to Europe, Australia and the Far East, and US markets to capture findings from wider area. The data was collected from NYSE (New York Stock Exchange), Amex (American Stock Exchange), Nasdaq, and MSCI (Morgan Stanley's Capital International Perspectives) data streams from 1974 to 1994. They formed portfolios for each country, however US and Japan companies representing the highest share of the total number of firms. First, value portfolios were calculated by using testing variables including B/M, CF/P E/P, and D/P, which were then ranked based on highest performed (30 percent highest from total), lowest performed (30 percent lowest from total), and highest minus lowest (highest 30 percent – lowest 30 percent) portfolios. Next, alphas, betas, abnormal returns, standard deviation, and mean variables were defined. The main findings from this study show that returns from value stocks are systematically higher compared to growth stocks, and among small stocks the value premium is higher compared to large stocks. Global value portfolios showed 3,07-5,16 percent higher average returns than a portfolio of global markets, and 5,56-7,68 percent higher returns compared to global growth portfolios. They also found that the value premium is not too large, and there is no arbitrage opportunity in the markets of value stocks. To test the statistical significance of the results, they used F-test and two-factor CAPM regression hence the slopes from the markets are more similarly to the international CAPM

regression model and found that the returns were statistically significant with f-test, but insignificant with CAPM regression analysis.

Porta, Lakonishok, Shleifer, and Vishny (1997) were studying whether the returns from the value stocks are caused by the overvaluation made by the investors. The study sample consists of stock data from NYSE, AMEX, and Nasdaq, covering the period of 1971-1993. They excluded real estate and financial companies to avoid biases. Valuation multiples including sales, earnings, cash flow, and the book value of equity divided by the stock price were used as value measures. Next, they formed decile portfolios by sorting the stocks based on the B/M, CF/P, E/P and S/P valuation multiple. Stocks with the highest B/M valuation multiple were allocated into value portfolios (B/M10) and the lowest into growth/glamorous stocks portfolios (B/M1). With C/F and S/P multiples the ranking was executed with the method of lowest CF/P, but highest S/P were allocated into the glamorous portfolio, while stocks with the highest CF/P and lowest S/P were allocated into the value portfolio. Portfolios were then held for five years with buy and hold strategy, and the study shows that after two to three years of forming the portfolios, returns from value stocks were approximately 15-20 percent higher compared to growth stocks. Their overall conclusion suggests that over-returns from value stocks were due to the overvaluation of the investors, even though this finding may also occur due to behavioural aspects. E.g., Bird and Casavecchia (2007) concluded that investors might load too much weight on the temporary depression of the stocks by believing the long continuance of the poor price of the stock.

2.7.3 Combining momentum- and value investing strategies

Asness (1997) studied value and momentum strategies as combined basis for the first time in the 1990's. Motivation for such a study was driven by the innovation of finding a new way to predict the future returns of the investment. The sample consisted of stocks from NYSE, Amex, and Nasdaq, and the data was collected from the years 1963-1994. They used three value measures to form a value-weighted portfolio: average monthly returns from the past 12-month, industry relative D/P (Dividend yield/Price of the stock), and – B/M. Variables were allocated into five different decile portfolios based on the average monthly return. The results showed that both strategies are effective but negatively correlated when combining the strategies. Furthermore, the study concluded that the value strategy was efficient only when buying the stocks with a weak momentum price, and for

gaining the momentum profits, the stock needed to buy with a poor value strategy. On the other hand, dividend yield with momentum effect showed interesting results with value strategy since the weak value strategy performed the best. The study finds that the combined strategy works efficiently, however, the underlying reason remained unclear.

Bird and Whitaker (2004) conducted a similar study by using data from European markets covering the period from 1990 January to 2002 June. The financial sector and stocks with negative book value were excluded from the sample. They ranked the sample based on the stock's recent performance from the last six-month, B/M ratio, and earnings momentum. For calculating the returns from the decile portfolios, they used several approaches, including market-weighted returns, equally weighted returns, size-adjusted equally weighted returns, and size-adjusted market-weighted returns. Finally, value measures like B/M, six-month price momentum, relative trading volume, and market capitalization of decile ranking were collected for the testing. As suggested by Asness (1997), Bird and Whitakers (2004) also find a negative correlation when combining value and momentum investment strategy with small added value of the investment. Moreover, the results show that combination of momentum- and value strategies are more efficient for a bit lower than the average market value companies. (Bird and Whitakers, 2004.)

Leivo (2012) studied the value- and momentum strategy by using Finnish listed non-financial stocks from 1993 to 2009. He sorted the data by excluding companies whose fiscal year did not end in December so that all the companies in the sample had the same comparable data for the total testing period. Moreover, he did not exclude companies whose stocks were delisted during the testing period, but those stocks were adjusted appropriately to avoid biases. The final sample size ranged from 51-122 during the total testing period. To form the portfolios, the quantile portfolios were collected first based on valuation multiples, including E/P, EBITDA/EV, CF/P, B/P, and S/P, and second based on the last six-month performance of the stock. In addition to method of creating portfolios based on traditional multiples, he created several composite value measures (first one including D/P and EV/EBITDA, the second one B/P, D/P and EBITDA/EV, and the third one B/P, D/B, and E/P) by combining different multiples to form further portfolios. Finally, the portfolios were organized into five quantile portfolios (P1 value-winners, P2 value-losers, P3 three quantile portfolios, P4 glamour-losers, and P5 sextile portfolios).

Leivo's (2012) study shows that top-sextile portfolios performed even better when included the momentum aspect into the investment strategy. The comparison of the results among the P1-P5 portfolios indicates that value portfolios formed based on the top three composite value measures performed the best. Additionally, they found that the value-winners strategy is not sufficient in the bearish market conditions, despite the fact that on average the strategy performed the best during the total testing period. They find that the reason for the overperformance from the whole testing period was due to the fact that the period was mainly bullish per se, which is more favourable for such strategy.

This topic was also studied by Fama and French (2012), where they focused on analysing the global markets. They tested whether the value premiums and momentum exist in the markets and if the size of the company affects to the average returns from the investment. The period covered in the study was from 1989 November to 2011 March. Compared to earlier studies, they took a broader range to the sample by extending it to developed countries, including North America, Asia Pacific, Europe, and Japan. They shorted the sample by using the equity market to determine the company's size, while stocks in the top 90 percent represent the big companies and the bottom 10 percent represent the small ones. Portfolios were sorted yearly using B/M highest- and lowest 30 percent method called 3 × 3. The stocks with the highest B/M were classified as value and lowest as growth stocks. Moreover, they constructed B/M portfolios for the regions using small and big and the 3 × 3 methods, which were called the 5 × 5 methods. The momentum factor was used as a single criterion when forming the portfolios with 12 months holding from time t – 1 month, also called sorted month.

They formed six portfolios similarly to this study, including small value, small neutral, small growth, big value, big neutral, and big growth. Performing the regression, they used 4-factor regression-, 3-factor regression, and CAPM analysis to compare the variation between the models. 4-factor models include market index minus risk-free rate, small minus big (SML), high minus low (HML), and winner minus losers (WML), which consider the momentum factor variables. The results of the study suggest that value premium does exist in all regions in the sample as well as momentum, except in Japan. Again, in all other regions, it was seen that the value premium was more prominent for the small companies, but in Japan, it seemed that there was no deviation depending on

the size of the company. However, WML showed similar results since smaller companies' average returns were higher than big companies. Although all three regression models showed that when using global portfolios, only the 4-factor model can be acceptable but since the GRS (Gibbons, Ross, and Skanken test of mean-variance efficiency of assets returns) test failed, it concludes that global samples are not suitable when trying to explain existence of value- and momentum premiums in the markets. The study showed that it is more suitable to study these anomalies locally or to use regions similar to each other. The local 4-factor model performed the best compared to other factor models and captured the results from the size B/M portfolio (value) even though the momentum performed poorly.

Later Asness, Moskowitz, and Pedersen (2013) studied the same topic. The sample consisted of US, UK, Europe, and Japan stock data from 1972 to 2011. Total sample included 355 companies from US, 76 from UK, 96 from Europe and 148 from Japan. They excluded all financial operators' stocks which trading price was under one dollar and less liquid stocks based on the market value of the company. They used past 12-month success of the stock as their momentum (MOM) rank by skipping the most recent month, B/M for ranking the value stocks and the combo of two of these strategies. Portfolios were then split to P1 low, P2 middle and P3 high, based on the MOM, B/M, and combo factors. To perform the regression, they used CAPM, 3-factor-, 4-factor- and 6-factor models. Moreover, correlation analysis was applied by showing negative correlation between the strategies. They argued that especially after financial crises the liquidity risk and arbitrage activity are one of the explanatory factors for this correlation, but the topic requires more studies to explain it in more detail. The conclusion was that when using these two strategies together, the results on abnormal returns are positive. However, momentum returns from individually stock portfolios were statistically insignificant in Japan, but significant in all other regions and especially in Europe. They found 3-factor regression model to be the most efficient compared to other regression models to test these strategies.

2.7.4 Multi criteria decision making strategy

Pätäri et al. (2018) combined a method of multicriteria decision making for the first time which combines a momentum and value investment strategy. Applied MCDM included four different methods, including TOPSIS (Technique for order preference by similarity

to an ideal solution), MS (median scaling), AHP (Analytical hierarchy process), and add. DEA (additive Data envelopment analysis). The period for the sample was 1971-2013, and the data consisted of companies that were listed in AMEX, NASDAQ, and NYSE. All companies from the financial sector were excluded from the sample, and they recalculated the delisting companies' data by using estimated figures for the delisting period avoiding biases and error values. Finally, they defined decile portfolios by ranking 13 various selection criteria. Criteria were as described in the table 1. (Pätäri et al. l, 2018.)

Table 1. Pätäri et al. study's selection criteria

Price based ratios	**Enterprise value-based ratios**	**Momentum**
Earnings (E/P)	EBITDA (EBITDA/EV)	Based on last six month returns
Sales (S/P)	EBIT (EBIT/EV)	
Book value of equity (BE/P)	Free Cash Flow (FCF/EV)	
Operating Cash Flow (CF/P)	Sales (S/EV)	
Common dividends (DVD/P)		
Cash flow 1 (CF1/P)		
Cash flow 2 (CF2/P)		
Cash flow 3 (CF2/P)		

Using the modified Sharpe ratio, Pätäri et al. (2018) were able to avoid validity issues if the excess returns were negative. They used raw returns and multifactor alphas to examine the results from various viewpoints and finally executed a four-factor regression analysis to consider the results of the explanatory factors of the study. The overall conclusion of their study shows that using the MCDM method can add value to the equity portfolio selection. The results show that even when compared to the single used method, the results are not statistically but economically significant when using the MCDM method. Combining one used method into one efficient measure score can give the power to predict future returns. Their four-factor alphas resulted from the best outcome with top-decile add. DEA portfolio in terms of raw- and adjusted returns.

Following table 2 summarises authors, sample, time period, method and findings from the earlier studies.

Table 2. Summary of earlier studies

Summary of earlier studies

Author	Sample	Period	Method	Results
			Momentum investing	
Jegadeesh and Titman 1993	US stock market	1965-1989	Buying based on the stocks last 6-month performance and then hold for a 6-month before selling	Approximately 12% yearly abnormal profits gained with the momentum strategy.
Chordia and Sivakumar 2006	NYSE and AMEX stocks	1972-1999	Forming 10 decile portfolios based on the earning strikes. Highest earning strikes were long- and lowest short sold.	Earning strikes are strongly linked to the past earning of the stocks.
			Value investing	
Fama and French 1998	Europe, Australia, Far East and US.	1974-1994	Ranking scores B/M, CF/P, E/P and D/P. The highest 30% of the ranking score as value, lowest 30% as growth and rest as neutral.	Value stocks performed 5,56-7,68% better than growth stocks and 3,07-5,16 % better than the markets.
Porta, Lakonishok, Shleifer and Vishny 1997	NYSE, AMEX, and Nasdaq stocks	1971-1993	Ranking scores: S/P, E/P, CF/P and B/M. Highest B/M = value and lowest = glamour. Holding of portfolios 5 years.	The results from value stocks are 15-20% higher compared to growth stocks even the risk premium is lower.
			Combining value and momentum investing	
Asness 1997	NYSE, AMEX, and Nasdaq stocks	1963-1994	Ranking scores: past 12-month returns, D/P and B/M. Holding for 1 year.	Strategies are negatively correlated but effective. Value stocks performed the best when the stocks are bought with the poor price and momentum performed the best with the weakest value ranking score.
Bird and Whitaker 2004	European stock market	1990-2002	Portfolios were formed based on past 6-month performance and B/M. Holding for 1 year.	Strategies are negatively correlated but when able to gain abnormal returns when the strategies are combined.
Leivo 2012	Finnish stock market	1993-2008	Ranking scores: past 6-month performance, E/P, EBITDA/EV, CF/P, B/P, S/P and composite value measures. Highest ranking scores= value and lowest= glamour. Holding for 1 year.	Value portfolio performed the best when included the momentum aspect into the strategy.
Fama and French 2012	North America, Asia-Pacific, Europe, and Japan	1989-2011	Ranking score: B/M ratio and momentum. 10% highest market value=big and lowest=small. 30% highest B/M =value and 30% lowest = growth, rest are neutral. Holding for 1 year.	Value- and momentum premium does exist in all regions except in Japan. The value premium was the highest in small companies. GRS test failed in 4-factor regression for global portfolios but suggest focusing to study these strategies by local in the future.
Asness, Moskowitz, and Pedersen 2013	US, UK, Europe, and Japan	1974-2011	Ranking score: B/M, MOM, and combo of both strategies. Holding for 1 year.	Momentum -and value strategies are negatively correlated which is partly explained by the liquidity risk. Strategies are gaining positive abnormal returns.
			Multi criteria decision making	
Pätäri et al. 2018	NYSE, AMEX, and Nasdaq stocks	1971-2013	Ranking scores =13 ranking valuation measures. Portfolio's allocation was done by using the method of AHP, TOPSIS, MS and add. DEA.	By using MCDM method it is possible to add value when performing equity selection. Best performed portfolio was top decile add. DEA portfolio.

2.8 Hypothesis

The hypothesis of this study was formed based on the earlier literature findings. Evidence from these studies have shown that when combining momentum- and value investment methods the strategies are negatively correlated (Asness 1997 and Bird and Whitaker 2004, Asness, Moskowitz, and Pedersen 2013). This motivated to from hypothesis one as follows:

H1: Momentum- and value investment strategies are negatively correlated but as combined an efficient way to gain abnormal returns.

Although this study does not examine what is the primary reason for the negative correlation like Asness, Moskowitz and Pedersen did. They explained that negative correlation is partly explained by the liquidity risk. Thus, they also argued that some of the negative correlation might be due to the general idea of the strategies where momentum tends to buy expensive- and value cheap stocks which was also supported by Hou, Karolyi and Kho (2001).

According to Asness (1997), Fama and French (2012), Leivo (2012) and Pätäri et al. (2018) it is possible to create abnormal returns when combining momentum- and value strategies. Vayanos and Woolley (2013) showed that the explanation for this is due to the cycle of the stock markets since after the value stocks start to generate positive abnormal profits, they will be recognized then as momentum stocks. These findings lead to form the second hypothesis as follows:

H2: Value investment (TOP) portfolio strategy provides abnormal returns when including the momentum aspect into the strategy.

Momentum- and value investing has been studied a lot, but not all have examined if the size of the company can effect on the profitability of the company. Ones who have (Fama and French 1998, 2012, Bird and Whitaker 2004 and Asness, Moskowitz, and Pedersen 2013) found appearance of the size premium with smaller companies when splitting the stocks based on the market value of the company excluding Japan's stock market. The small stocks performed better compared to big stocks among the momentum- and value

investment method. Although not all scholars have recognized the size premium in momentum strategy since e.g., Israel and Moskowitz (2013) did find size premium only among the value investment strategy. Hence, the third hypothesis will be formed as follows:

H3: Among momentum- and value investment strategy there is size premium with the smaller momentum- and value (TOP) companies.

3 DATA

3.1 Description of the data

The sample of the study consist of all Nordic listed companies (with some exceptions as discussed below) which headquarter is in Denmark, Finland, Norway, or Sweden. Yearly stock market data and valuation multiples have been collected from Thomas Reuters DataStream. The study uses company specific stock market data rather than indices, similarly to Fama and French (1998), Leivo (2012), Asness, Moskowitz and Pedersen (2013) and Pätäri et al. (2018). Only limited number of earlier studies have focused on examining Nordic markets specifically due to which this study is contributing to the literature on momentum- and value investing by bringing some new evidence from the Nordic markets. Further, while some of the earlier studies have focused on only large companies, this study also includes the small companies to capture the possible size premium effects when using momentum- and value investment strategy similarly to Fama and French (2012).

To avoid biases, companies which fiscal year was not ending in December are not considered into a sample as suggested by Leivo (2012). Also, financial sector operators and companies which B/M value was negative were excluded from the sample similarly to earlier studies (see e.g., Asness 1997 and French & Fama 2012). Moreover, further requirement to include a company into the sample, was that the 2020 financial information was already available. The period for the testing is 2001-2020, which is seen reasonable considering the reliability of the study. This period contains various events in the markets, such as the tech bubble (2001), the financial crises (2008), and Covid-19 (2020). Also, availability of the following information was required from the sample companies to be included into the final sample: market value, total assets, equity, and total investment return. To avoid biases in a specified period, price changes and relevant dividends were incorporated when calculating the total return of the stocks. Additionally, companies which stocks were delisted during the review period were appropriately processed by excluding those stocks from the portfolios after the delisting.

Alphas were calculated by using Carhart's (1997) four-factor-, Fama and French (1993, 1996) three-factor- and CAPM regression analysis. These regression methods use

explanatory factors, which have been mostly used when testing the size-, momentum-, value-, and return (raw- and abnormal returns) factors. Moreover, the modified Sharpe ratio was applied to test the riskiness of the abnormal returns. To conduct four-factor-, three-factor- and CAPM regression analysis, the data for variables such as MKT (returns from the markets), SMB (small minus big), HML (high minus low), WML (winner minus losers) and risk-free rate is collected yearly from French data library.

The total sample included 1 713 companies from the testing period of 2001 to 2020 before modifying and excluding stocks as per the criteria, after which the number of companies varied during the sample period starting from 219 in 2001 to 1 115 in 2020. Figure 2 describes the number of companies' during the sample period.

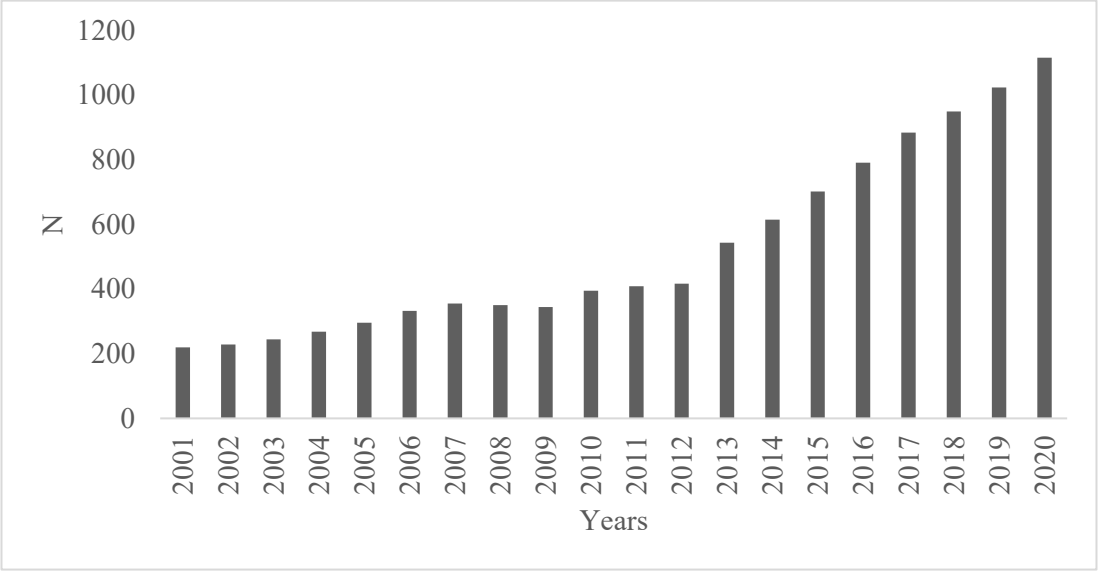

Figure 2. Number of companies in the sample during the years 2001-2020

The figure 3 below presents the overall observation per ranking score used in the regressions. Portfolio formation is described in more detail in the methodology part. The number of observations in the portfolios ranged from 8844 to 11805 during the total testing period. This number of observations is seen to be sufficient to execute the regression analysis.

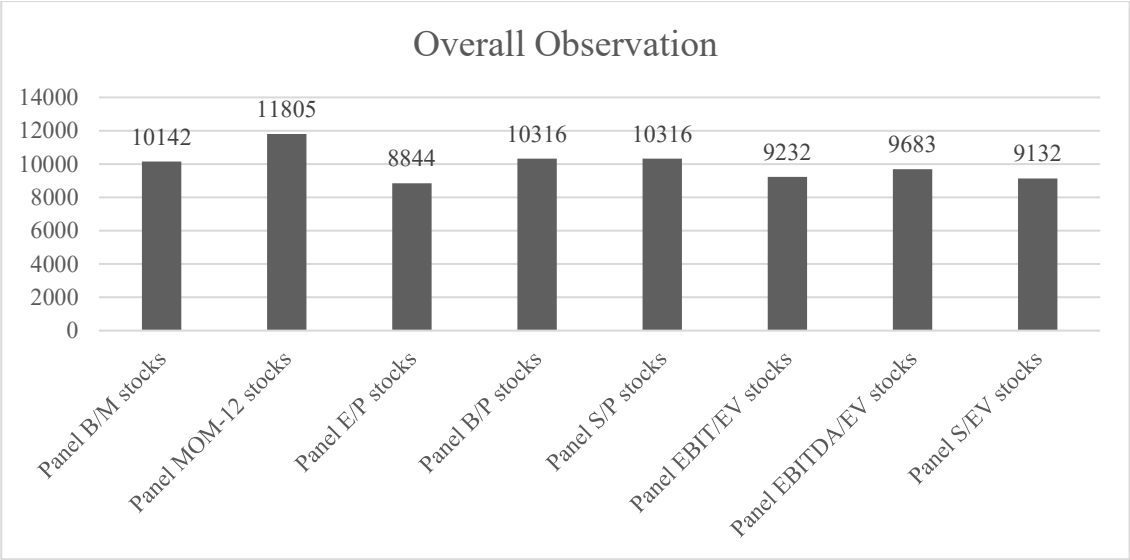

Figure 3. Number of observations used in the portfolios per ranking score

4 METHODOLOGY

4.1 Portfolio formation

This study aims to combine momentum- and value indicators to create an efficient investment strategy. As described in earlier literature, Fama and French (1998, 2012), Asness (1997), Leivo (2012) and Porta, Lakonishok, Shleifer, and Vishny (1997), and Pätäri et al. (2018) have studied value- and momentum investing as individual investment strategies as well as a combination of them. All the earlier studies include the similar idea of classifying the stocks first based on their multiple ranking scores or momentum factor.

In this study, portfolio formation includes three phases of which the first is choosing the valuation multiples. Four of the multiples were price-based, three of them were enterprise value-based and one was momentum-based multiple. Table 3 represents the list of the valuation multiples, including the MOM (momentum) variable. Valuation multiples are called ranking scores further in this study.

Table 3. List of valuation multiples (ranking scores)

Price-based ratios	**Enterprise value-based ratios**	**Momentum**
Book-to-Market (B/M)	Earnings before Interest and Taxes to EV (EBIT/EV)	Momentum based on last 6-month performance and holding for 12 months
Earnings to Price (E/P)	Earnings before Interest, Taxes, Depreciation and Amortisations to EV (EBITDA/EV)	
Books to Price (B/P)	Sales to EV (S/EV)	
Sales to Price (S/P)		

In the second stage, six decile portfolios have been formed based on the yearly performance of the ranking score. Similarly to Fama and French (1998, 2012), companies which ranking score was the highest (TOP) 30% are named as P1 Value, the lowest (BOTTOM) 30% are named as P3 Growth, and the rest in the middle are named as P2 Neutral. Next, companies have been split by using the median amount of the market value to calculate the size of the company. The companies which market value is above the median are named as big, and below the median are named as small. Finally, ranking

scores of the stocks and portfolio formation are done yearly in time *t,* at the start of the calendar year based on their last fiscal year performance from January 2000 to December 2019. Next the returns for the portfolio are calculated a year after from 2001 to 2020. Figure 4 describes the ranking of the portfolios in more detail.

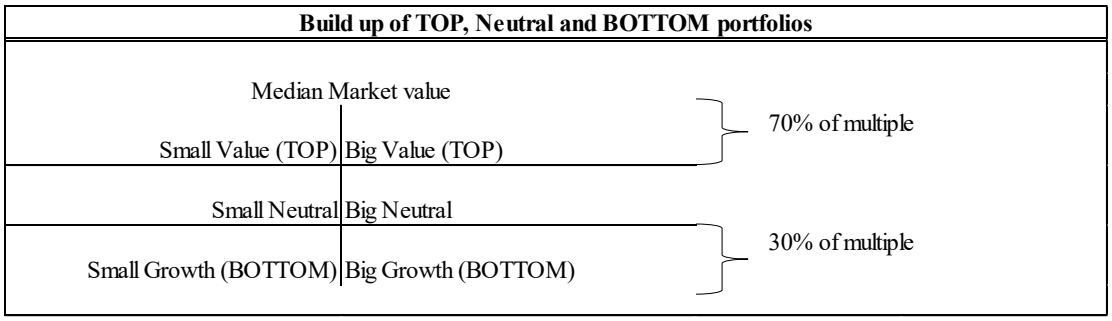

Figure 4. Description of the TOP, BOTTOM and Neutral decile portfolio formation

The third stage includes momentum ranking based on the stock's last six-month performance with a 12-holding period since the theory assumes that stocks which have performed well recently, will gain profits also in the near future. (See e.g. Jegadeesh and Titman, 1993, Chordia and Sivakumar, 2006.) The ranking is done yearly at time *t* in the beginning of the fiscal year and holding periods are from January to December. Overall portfolio formation includes eight ranking score portfolios, divided into six decile portfolios as follows: Small P1 Value, Small P2 Neutral, Small P3 Growth, Big P1 Value, Big P2 Neutral, and Big P3 Growth. Later in this study, P1 Value portfolios are called as TOP-, P2 Neutral as Neutral-, and P3 Growth as BOTTOM portfolios. Finally, portfolios are held for one year after reforming and the reformation is repeated annually. Figure 5 describes the process of portfolio formation.

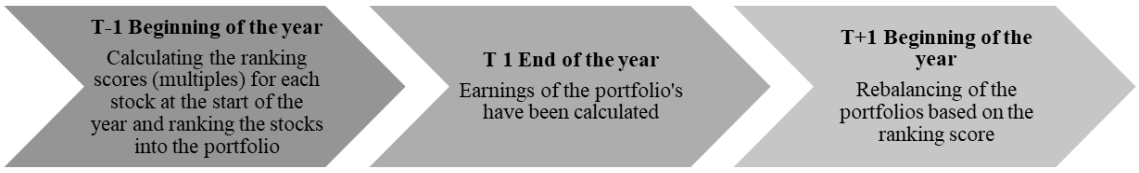

Figure 5. Process for forming the portfolios

Following table 4 summaries the variable and ranking score calculation description.

Table 4. Description of the variables

Variable description		
No	**Value measure ratios**	**Description**
1	Market value (MV)	Stock price * shares outstanding.
2	Enterprise value (EV)	Market value of equity + short-term debt + long-term debt + preferred stock value - cash and short-term investments.
3	Book value of Equity (BE)	Equity of the balance sheet excluding the minority shareholder's interest.
4	Sales (S)	Sales of the Income Statement after adjustments.
5	Earnings (E)	Net income of the Financial Year.
6	Book value an asset (B)	Book value of an Assets.
7	Earnings before Interest, Taxes, Depreciation and Amortisation (EBITDA)	Earnings before Interest, Taxes, Depreciation and Amortisation.
8	Earnings before Interest and Taxes (EBIT)	Earnings before Interest and Taxes.
Formulas for the ranking scores:		
1	B/M	Book value of Equity / Market value
2	MOM	Based on the last six-month performance
3	E/P	Earnings / Market value
4	B/P	Book value of an Assets/ Market value
5	S/P	Sales / Market value
6	EBIT/EV	Earnings before Interest and Taxes / Enterprise value
7	EBITDA/EV	Earnings before Interest, Taxes, Depreciations, and Amortisations / Enterprise value
8	S/EV	Sales/ Enterprise value

4.2 Empirical analysis

Mean abnormal returns of the portfolios are calculated by using the following equation to estimate profitability of the portfolio:

$$AR_{it} = R_{it} - E(R_{it}|x_t) \quad (3)$$

Where AR_{it} is the abnormal return, R_{it} is the actual raw return, and $E(R_{it}|x_t)$, is the expected return of the stock i at time t. Then to analyze negative and positive returns of the portfolios, modified excess returns were applied to avoid biases due to the validity issue if using the standard Sharpe ratio. (Sharpe, 1966, Israelsen, 2005.) The equation of the modified Sharpe ratio is the following:

$$SR = \frac{ri - r_f}{\sigma_i(ER|ER|)} \quad (4)$$

The definition of the equation consists of ri, which presents the portfolio i yearly average returns, r_f presents the average risk-free rate of the yearly return, σ_i presents the yearly standard deviation of the excess returns of a portfolio i, and finally ER presents the portfolio i average excess returns. Moreover, skewness and kurtosis are calculated as follows:

$$S = \frac{\sum_{i=1}^{N}(x-\bar{x})^3}{(N-1)_s^3} \quad (5)$$

$$K = \frac{\sum_{i=1}^{N}(x-\bar{x})^4}{(N-1)_s^4} \quad (6)$$

Where $\bar{x}$ is the mean of the distribution, N is the number of observations of the sample and s is the standard deviation. The equation of four-factor regression analysis is the following:

$$r_i t - rft = \alpha_i + bi(rmt - r_{ft}) + siSMB_t + h_i HML_t + m_i WML_t + \varepsilon it \quad (7)$$

Where $r_i t$ return from the portfolio, rft is risk-free rate of return, α_i is the alphas from four-factor regression, rmt is return from the stock market, SMB_t is the difference of the returns between small minus big companies' portfolios, HML_t is the difference of the returns between high minus low from book-to-market companies' variable, WML_t is the difference of the returns between winner minus loser companies' variable, εit is the residual term from the equation and the rest bi, si, h_i and m_i are the sensitivity factors

under the stock market. Moreover, three-factor- and CAPM regression analysis have been applied to test which model explains the best the returns from the B/M, MOM, E/P, B/P, S/P, EBIT/EV, EBITDA/EV and S/EV portfolios. Equation for three-factor regression is as follows:

$$r_i t - rft = \alpha_i + bi\left(rmt - r_{ft}\right) + siSMB_t + h_i HML_t + \varepsilon it \quad (8)$$

Variables in the above model are the same as in Carhart's four-factor excluding WML_t parameter unlike CAPM which applies only return from the stock market rmt – risk free rate rft into the model. CAPM regression is as follows:

$$r_i t - rft = \alpha_i + bi\left(rmt - r_{ft}\right) + \varepsilon it \quad (9)$$

T-statistic have also been applied by calculating the T-distribution of the right tail, since the size of the sample is seen reasonable for such test. T-statistics serves an alternative method to calculate the statistical significance of the results.

5 RESULTS

5.1 Portfolio statistics and overall performance

In this study, empirical research has been executed by combining value and momentum investment strategies. Furthermore, testing was executed to show whether combining these two strategies can help predict future stock market returns efficiently. For accomplishing such a study, yearly stock data from all companies of Denmark, Finland, Norway, and Sweden, excluding financial operators, companies whose B/M was negative and whose fiscal year was not ending on December have been collected from 2001-to 2020 and ranked based on portfolios B/M, MOM, E/P, B/P, S/P, EBIT/EV, EBITDA/EV and S/EV TOP, Neutral and BOTTOM ranking score. To provide comprehensive results from the study, first returns from the portfolios have been presented, including raw- and abnormal returns. Moreover, returns are examined from each decile portfolio viewpoint, after which the results from four-factor-, three-factor-, and CAPM regression analysis have introduced.

Table 5 summarizes the overall annualized mean abnormal returns, Sharpe ratios, Skewness, and Kurtosis of each portfolio by the ranking score. In earlier research, Fama and French (1998) and Porta, Lakonishok, Shleifer, and Vishny (1997) suggest B/M to be a ratio giving the power to discover the value stocks since, as table 5 shows, abnormal returns are the highest when using the B/M ranking. The B/P and S/P portfolios shows the second-highest returns. However, this table only considers the returns from the total portfolio and does not represent each portfolio's best outcome. The best outcomes are presented later when the portfolios have been split into six separate decile portfolios.

Table 5. Summary of mean abnormal- and raw returns by the ranking score

Year	Sharpe ratio	Abnormal returns	Skewness	Kurtosis
B/M stocks	0,060	0,133	-0,442	-0,757
MOM-12 stocks	0,114	0,120	-0,294	-0,926
E/P stocks	0,131	0,119	-0,285	-0,896
B/P stocks	0,060	0,130	-0,429	-0,760
S/P stocks	0,060	0,130	-0,429	-0,760
EBIT/EV stocks	0,131	0,118	-0,278	-0,880
EBITDA/EV stocks	0,131	0,117	-0,280	-0,870
S/EV stocks	0,130	0,118	-0,278	-0,882

Note: Abnormal returns are calculated by deducting the return from the index by the raw return of the ranking score portfolios

Table 6. Summary of TOP and BOTTOM portfolios' mean abnormal- and raw returns by the ranking scores

	Sharpe ratio		Abnormal returns		Skewness		Kurtosis	
Year	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**	**TOP**	**BOTTOM**
B/M stocks	0,054	0,155	0,208	0,152	0,663	-0,260	-0,102	-0,622
MOM-12 stocks	0,471	-0,146	0,566	-0,189	-0,112	-0,445	-0,960	-0,651
E/P stocks	0,128	0,157	0,117	0,138	0,179	-0,102	-0,374	-0,878
B/P stocks	0,054	0,146	0,205	0,140	0,597	-0,066	-0,066	-0,555
S/P stocks	0,053	0,146	0,191	0,142	0,467	-0,038	-0,377	-0,528
EBIT/EV stocks	0,130	0,163	0,119	0,147	0,195	-0,136	-0,407	-0,837
EBITDA/EV stocks	0,118	0,168	0,108	0,149	0,197	-0,068	-0,511	-0,561
S/EV stocks	0,127	0,158	0,115	0,140	0,209	-0,135	-0,392	-1,008

Note: Abnormal returns are calculated by deducting the return from the index by the raw return of the ranking score portfolios.

Table 6 indicates the overall performance of the TOP and BOTTOM portfolios. The momentum TOP portfolio seems to gain the best overall outcome with abnormal returns. The second-best outcome was with the B/M TOP portfolio when using the buy and hold strategy for the year based on the ranking score. An interesting part of comparing TOP and BOTTOM portfolios is the outcome of EV-based multiples since each EV-based portfolios have gained the best abnormal returns with BOTTOM portfolios, which indicates that enterprise-based multiples are not that efficient ranking scores as market value-based multiples. Sharpe ratios stabilize the return and risks since theory assumes that higher the risk higher the gains and in this study this fact seems to be in line since Sharpe ratio is the smallest with the B/M TOP portfolio. This indicates that the risk in B/M TOP portfolio is the highest, but this is respectfully in line with risk and returns relationship theory. MOM portfolio shows the highest Sharpe ratio with the TOP portfolio even its TOP portfolio mean abnormal returns are the highest, which addresses lower overall risk when using this investment method. Moreover, EV-based BOTTOM portfolios have second highest Sharpe ratios after the MOM TOP portfolio, which supports the risk and return relationship, indicating that the risk is the smallest in EV-based portfolios even though this can also be seen in the returns. Nevertheless, the skewness of the decile TOP and BOTTOM portfolios can be seen as normal, indicating the sample's goodness. This can be seen the amount of

the skewness which all are within +/- two points from zero. The same applies to kurtosis since the amount is close to three which is the normal amount known in academic studies although the values are negative which shows that the sample‘s tail is thinner when having normal distribution, but negative values are only small suggesting that kurtosis is nearly normal.

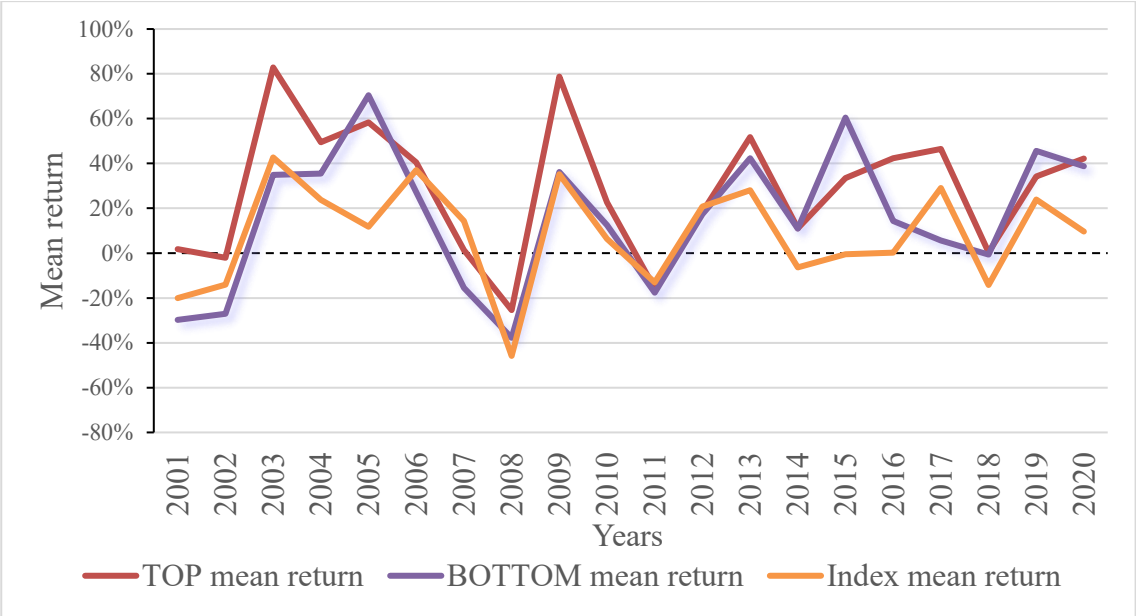

Figure 6. Mean return of the TOP and BOTTOM portfolio and benchmark index

Figure 6 shows the overall performance of the TOP and BOTTOM portfolios i.e., is the performance from P1 value and P3 Growth stocks in each portfolio. This figure captures well the difference between TOP and BOTTOM performance since, overall, the TOP portfolios have gained more returns during the total testing period, which is in line with earlier studies (see Fama & French 2012, Asness 1997, Asness, Moskowitz and Pedersen 2013) even though in 2005, 2015 and 2019, BOTTOM portfolio have exceeded TOP portfolios returns. Figure 6 also captures the changes of the market well, hence in 2001 returns are low due to the tech bubble, in 2008 after high returns due to the financial crise all returns have dropped dramatically and in 2020 small decrease is also seen because of the covid-19 which affected in stock market the most intensively in March 2020. Moreover, combining value- and momentum investment strategy seems to win the index almost every year during the testing period which relies on the fact that by using this strategy future returns can be predicted more effectively and strategy is able to gain abnormal returns. Table 7 presents the overall mean return from each portfolio annually. Since all portfolios include almost the

same stocks but in different orderliness it is expected that the returns are similar in each portfolio by the ranking score. This illustrates the importance of distributing the ranking score portfolios in six separate further decile portfolios.

Table 7. Summary of mean raw return of each portfolio based on the ranking score with 12-months buy-and-hold strategy

Mean raw returns for the portfolio by ranking score and MOM with 12 month holding strategy								
Year	**B/M stocks**	**MOM-12 stocks**	**E/P stocks**	**B/P stocks**	**S/P stocks**	**EBIT/EV stocks**	**EBITDA/EV stocks**	**S/EV stocks**
2001	-0,104	-0,130	-0,109	-0,109	-0,109	-0,109	-0,109	-0,109
2002	-0,121	-0,145	-0,124	-0,124	-0,124	-0,124	-0,124	-0,124
2003	0,610	0,572	0,610	0,610	0,610	0,610	0,610	0,610
2004	0,375	0,371	0,388	0,388	0,388	0,388	0,388	0,388
2005	0,598	0,625	0,598	0,598	0,598	0,598	0,598	0,598
2006	0,337	0,324	0,335	0,335	0,335	0,335	0,335	0,335
2007	-0,065	-0,044	-0,065	-0,065	-0,065	-0,065	-0,065	-0,065
2008	-0,351	-0,318	-0,351	-0,351	-0,351	-0,351	-0,351	-0,351
2009	0,562	0,509	0,561	0,561	0,561	0,561	0,561	0,561
2010	0,174	0,219	0,176	0,176	0,176	0,176	0,176	0,176
2011	-0,172	-0,167	-0,171	-0,171	-0,171	-0,171	-0,171	-0,171
2012	0,180	0,171	0,178	0,178	0,178	0,178	0,178	0,178
2013	0,428	0,484	0,422	0,422	0,422	0,422	0,422	0,422
2014	0,123	0,112	0,116	0,116	0,116	0,116	0,116	0,116
2015	0,422	0,419	0,424	0,416	0,416	0,416	0,416	0,416
2016	0,269	0,248	0,253	0,265	0,265	0,245	0,265	0,248
2017	0,375	0,101	0,066	0,362	0,362	0,074	0,071	0,072
2018	-0,020	0,001	-0,021	-0,022	-0,022	-0,025	-0,029	-0,029
2019	0,339	0,347	0,381	0,336	0,336	0,364	0,352	0,368
2020	0,385	0,394	0,405	0,378	0,378	0,413	0,397	0,403
Mean	**0,217**	**0,205**	**0,204**	**0,215**	**0,215**	**0,202**	**0,202**	**0,202**

Table 7 is summarising the changes in the returns during the total research period. Highest returns are generated during 2003 after the tech bubble and in 2009 after the financial crisis which is expected since after crises professional as well as other investors might see an opportunity for arbitrage e.g., the same shares that were previously acquired at a high price are now available at a lower stock price and in turn when the demand increases the price of the stocks increases too.

5.2 Testing of separate asset pricing regression analysis

The next phase presents a comparison of different regression models to find out which model has the highest explanatory power. Moreover, the analysis compares how the variables differentiates between different regression models.

Table 8. Four-factor-, three-factor- and CAPM regression analysis

Comparing alphas from 4-factor- 3-factor and CAPM regressions							
		a					
Raw returns	***intercept***	**MKT**	**SMB**	**HML**	**WML**	**R-square**	**N**
Panel B/M stocks							
4-factor	0,133*	0,662*	1,514*	-0,127	-0,150	0,100	10142
3-factor	0,122*	0,706*	1,447*	-0,103		0,099	10142
CAPM	0,159*	0,974*				0,089	10142
Panel MOM-12 stocks							
4-factor	0,106*	0,542*	1,566*	-0,234*	-0,106	0,186	11805
3-factor	0,098*	0,574*	1,517*	-0,217*		0,185	11805
CAPM	0,151*	0,844*				0,160	11805
Panel E/P stocks							
4-factor	0,100*	0,531*	1,783*	-0,249*	-0,182*	0,232	8844
3-factor	0,086*	0,588*	1,709*	-0,224*		0,230	8844
CAPM	0,141*	0,896*				0,201	8844
Panel B/P stocks							
4-factor	0,130*	0,658*	1,508*	-0,122	-0,156	0,100	10316
3-factor	0,118*	0,704*	1,438*	-0,097		0,099	10316
CAPM	0,156*	0,969*				0,089	10316
Panel S/P stocks							
4-factor	0,130*	0,658*	1,508*	-0,122	-0,156	0,100	10316
3-factor	0,118*	0,704*	1,438*	-0,097		0,099	10316
CAPM	0,156*	0,969*					10316
Panel EBIT/EV stocks							
4-factor	0,098*	0,518*	1,802*	-0,251*	-0,186*	0,232	9232
3-factor	0,084*	0,576*	1,724*	-0,225*		0,230	9232
CAPM	0,142*	0,885*				0,199	9232
Panel EBITDA/EV stocks							
4-factor	0,102*	0,502*	1,768*	-0,215*	-0,197*	0,228	9683
3-factor	0,087*	0,562*	1,684*	-0,185*		0,226	9683
CAPM	0,141*	0,866*				0,194	9683
Panel S/EV stocks							
4-factor	0,099*	0,524*	1,784*	-0,239*	-0,184*	0,232	9132
3-factor	0,085*	0,582*	1,707*	-0,213*		0,230	9132
CAPM	0,141*	0,889*				0,199	9132

*Note: */**/*** indicates the significance level of the intercepts where *is 1%-, ** is 5% and *** is 10% significance level. Otherwise, the intercept is not statistically significant from zero.*

Table 8. is summarising the results from four-factor-, three-factor- and CAPM regression analyses. These models are the most used models when illustrating the explanatory factors in terms of returns from the investments and among the others, Fama and French (1998, 2012), Chordia and Shivakumar (2006), Pätäri et al. (2018) and Asness (1997) have executed regression analysis by using these models similarly to this study. In table 8 the portfolios are not split into TOP, Neutral and BOTTOM or by the size of the company but is rather presenting the portfolios by the ranking scores. CAPM model only includes MKT which is the return from the markets minus risk free rate as an explanatory factor to the model while three-factor model is the same as four-factor excluding the WML explanatory factor. The results from table 8 conclude that R-square in each of the portfolios are the highest with four-factor regression analysis that describes the correlation coefficient of the regressions.

All the other variables in the table are statistically significant with a 99% confidence level except WML in B/M, MOM, B/P, and S/P portfolios. Alphas in all ranking score portfolios are higher in CAPM compared to four-factor model, that is most likely due to the smaller number of explanatory variables. Therefore, since MKT is the only explanatory factor, it has higher explanatory power than four- or three-factor regression. This same also applies to three-factor regression analysis since its explanatory factors are higher than within four-factor analysis, which has the highest R-square number. The overall conclusion for the models is that the four-factor model is the most suitable regression analysis for this study since it gives the power to predict the movements of the future returns with the highest R-square number and because of the higher number of explanatory factors compared to the simplicity of the CAPM- and three-factor models. These findings are similar to Fama and French (2012) study. As per this conclusion, four-factor regression analysis has been applied for the analysis of the portfolios.

5.3 Performance of momentum- and value portfolios

Table 9 presents the mean raw returns from TOP, Neutral, BOTTOM, and the total of each portfolio. N refers to the total amount of observations of portfolios before the split into decile portfolios (Decile portfolio's number of observations is described in Tables 11 and 12). Stdev is the standard deviation of the portfolios. The highest performed portfolio from the total testing period is the TOP MOM, gaining a mean raw return of

65%. The second highest performed portfolio is the TOP B/M portfolio with 29,2% mean raw return. In turn, the lowest performance is seen from the BOTTOM MOM portfolio since its mean raw return was negative at -10,5%, relying on the fact that momentum investing strategy tends to buy winners and sell losers as suggested by Jegadeesh and Titman (1993), Chan, Jegadeesh, and Lakonishok (1996), Chordia and Sivakumar (2006) and Bird and Casavecchia (2007). Table 9 proves the same observation as indicated earlier in table 6, where all EV-based portfolios are generating higher profits in BOTTOM portfolios. This illustrates that using enterprise value and earning-based when scaling the value stocks is not a relevant variable, but rather in terms of the results from this study, it can be recommended when scaling the growth or glamour stock investing method like Porta, Lakonishok, Shleifer, and Vishny (1997) used in their study. Neutral portfolios performed the worst compared to TOP and BOTTOM portfolios which corresponds with the expectation that they are expected to be neutral compared to value and growth portfolios. This expectation is also supported by the lowest standard deviation during the testing period in all the Neutral portfolios apart from E/P and S/EV portfolios.

Overall, the results in the table 9 are statistically significant from zero at least with 95% of confident level.

Table 9. Raw returns from the TOP, Neutral and BOTTOM portfolios with holding for a 12-months buy-and-hold strategy

Returns from the portfolio from total testing period per ranking score and MOM with 12 month holding strategy									
Returns	**Mean raw**	**TOP**	**Neutral**	**BOTTOM**	**N**	**Stdev all**	**Stdev TOP**	**Stdev Neutral**	**Stdev BOTTOM**
Panel B/M stocks									
Return	0,231*	0,292**	0,215*	0,236*	10142	2,201	3,817	0,661	0,981
Panel MOM-12 stocks									
Return	0,212*	0,650*	0,141*	-0,105*	11805	1,056	1,210	0,455	1,255
Panel E/P stocks									
Return	0,206*	0,201*	0,196**	0,222*	8844	0,911	0,913	0,922	0,880
Panel B/P stocks									
Return	0,228*	0,290**	0,185*	0,225*	10316	2,185	3,783	0,679	0,960
Panel S/P stocks									
Return	0,228*	0,276**	0,186*	0,227*	10316	2,185	3,625	0,689	0,973
Panel EBIT/EV stocks									
Return	0,205*	0,204*	0,176**	0,232*	9232	0,900	0,917	0,866	0,902
Panel EBITDA/EV stocks									
Return	0,204*	0,193*	0,206*	0,234*	9683	0,893	0,915	0,858	0,891
Panel S/EV stocks									
Return	0,205*	0,200*	0,199**	0,225*	9132	0,903	0,906	0,902	0,888

*Note: */**/*** indicates the significance level of the intercepts where *is 1%-, ** is 5% and *** is 10% significance level. Otherwise, the intercept is not statistically significant from zero. TOP portfolios represents the 30%t highest companies per ranking score and BOTTOM represents the lowest 30% while the Neutral is the rest of the companies. N in the table describes the total amount of observation used per ranking score in the portfolios.*

5.3.1 Statistical size effect analysis

Table 10 presents the possible size effect in split decile portfolios and focuses on finding whether the appearance of momentum- or value premium depends on the company's size, as Fama and French (1998, 2012) and Loughran (1997) suggested in their studies. Their findings show that, especially with value companies, the value premium is more extensive with small companies, and according to Asness, Moskowitz, and Pedersen (2013) and Griffin and Martin (2003), the same observation applies to the momentum strategy.

Table 10 consist of the raw return, standard deviation, and Sharpe ratios for TOP small, Neutral small, BOTTOM small, TOP big, Neutral big, and BOTTOM big by the ranking score portfolios. In terms of the analysis, returns are the highest in small TOP MOM, P/B and B/M portfolios which indicates that the value premium appearance is higher with the smaller value companies, and these findings are respectfully in line with the e.g., Fama and French (1998, 2012), Loughran (1997), findings due to the size premium. Moreover, the Sharpe ratio is the lowest, which describes whether the portfolio is able to gain adjusted returns over the risk level and the standard deviation is the highest in decile TOP small B/M and B/P portfolios; thus, it is expected because higher risk creates an opportunity to gain higher abnormal returns. Although this finding deviates from earlier studies, for example Capaul, Ian and Sharpe (1993), Cheng and Feng (1998) and Porta, Lakonishok, Shleifer, and Vishny (1997) who found that the risk is more negligible when investing with a value strategy compared to growth investing. However, in this case, the difference in the results is most likely due to the combination of momentum- and value investment strategy i.e., generally, in value investing, the portfolio is held for a long period, while in turn, in this study, portfolios were held for 12 months before selling and reforming the portfolio.

Nevertheless, the results from size analysis show interesting twists since earnings-based portfolios are systematically gaining better profits with big companies than small TOP portfolios. This finding can derive from the fact that big companies are able to benefit from economies of scale, tax planning, and other scaling benefits that affect the ability to generate higher profits in percentage compared to smaller companies. Further EV-based portfolios (both small and big companies) are again gaining better profits from BOTTOM portfolios as discussed before when analysing the results from Tables 7 and 9. Thus this is in line with Porta, Lakonishok, Shleifer, and Vishny (1997) study where they used high S/P companies to identify growth companies. The worst performed portfolios were

the Neutral decile small and big portfolios similarly to the finding of Fama and French (1998).

Table 10. Summary of mean raw returns, Standard deviation and Sharpe ratios by the ranking score and size of the portfolio

Summary of raw returns from all six decile portfolios per ranking score with 12 month buy-and-hold strategy									
Mean raw returns from the portfolio from high to low and small to big				Standard deviation			Sharpe ratios		
Raw returns	**TOP**	**Neutral**	**BOTTOM**	**TOP**	**Neutral**	**BOTTOM**	**TOP**	**Neutral**	**BOTTOM**
Panel B/M stocks									
Small	0,355	0,179	0,278	4,865	0,845	1,239	0,056	0,112	0,156
Big	0,194	0,183	0,204	0,451	0,468	0,717	0,244	0,210	0,167
Panel MOM-12 stocks									
Small	0,754	0,127	-0,123	1,097	0,246	1,224	0,611	0,174	-0,169
Big	0,586	0,155	-0,077	1,320	0,265	0,860	0,380	0,266	-0,188
Panel E/P stocks									
Small	0,201	0,183	0,210	0,607	1,035	0,808	0,192	0,095	0,155
Big	0,173	0,209	0,229	0,640	0,874	0,913	0,139	0,143	0,158
Panel B/P stocks									
Small	0,382	0,184	0,235	4,865	0,845	1,239	0,061	0,118	0,121
Big	0,173	0,185	0,215	0,451	0,468	0,717	0,197	0,216	0,183
Panel S/P stocks									
Small	0,187	0,168	0,259	0,641	0,659	1,093	0,160	0,127	0,160
Big	0,215	0,204	0,198	1,215	0,709	0,854	0,108	0,169	0,133
Panel EBIT/EV stocks									
Small	0,163	0,149	0,223	0,613	0,588	0,806	0,128	0,110	0,172
Big	0,195	0,203	0,236	0,620	0,949	0,954	0,179	0,125	0,159
Panel EBITDA/EV stocks									
Small	0,176	0,223	0,215	0,622	0,965	0,736	0,147	0,144	0,178
Big	0,206	0,189	0,244	0,632	0,804	0,971	0,193	0,130	0,164
Panel S/EV stocks									
Small	0,181	0,201	0,186	0,595	0,753	0,742	0,163	0,155	0,137
Big	0,188	0,196	0,241	0,643	0,927	0,930	0,161	0,121	0,168

TOP portfolios represents the 30% highest companies per ranking score and BOTTOM represents the lowest 30% while the Neutral is the rest of the companies.

5.3.2 Four-factor regression analysis for size split portfolios

In this section, four-factor regression analyses have been executed for TOP and BOTTOM size split portfolios separately. In contrast, the Neutral size split portfolio has been excluded from this analysis since its performance is not under the primary consideration of this study.

The following table 11 presents the TOP size split portfolios' results from a four-factor regression analysis where intercept is the alpha from the dependent variable of the regression, which in this analysis is the mean raw return from the portfolio. MKT refers to the market return minus risk-free rate, SMB is small minus big, HML is the high minus low, WML is the winner minus losers, R-square is the coefficient of determination of the regression, N is the amount of observation used in the analysis, and *a* is the intercept. The results show that especially when B/M, MOM, or B/P small portfolio's MKT or HML variable increases with one, the portfolio's return increases the most. The alphas of the intercepts in these portfolios are also the highest with MOM, B/P and B/M small portfolios, which demonstrates the difference in the returns between small and big companies already noticed in table 10. The highest size premium impact (the change of SMB) is seen in MOM small portfolio since when the portfolio size increases one, the returns of the portfolio increase by 3,356 points in small companies. EBITDA/EV, S/P and E/P portfolio shows a surprising turn among small companies' size premium (the change of SMB) suggesting that when the number of small companies increases with one, the return of the portfolio increases e.g., with EBITDA/EV by 2,295 points which is the highest number of alphas with the SMB variable in TOP portfolio regression analysis.

According to Asness (1997) and Bird and Whitakers (2004), Asness, Moskowitz and Pedersen (2013) value and momentum strategies are negatively correlated with the stock returns. This study finds similar results supported by the returns reported for WML. In contrast, MKT and SMB variables are impacting positively to returns, whereas WML shows opposite results. When WML increases with one, returns of the portfolio decrease e.g., in TOP big B/M portfolio with -0,912 points. The same trend occurs in all TOP portfolios despite the company's size. For the majority of the portfolios, the results are statistically significant with a range of 95-99% confidence level for the intercept, MKT

and SMB variables. Asness, Moskowitz, and Pedersen (2013) explained that negative correlation is partly because of the liquidity risk and the general idea when using momentum- and value investing. Momentum tends to find stocks based on their six- or 12-months success, while value focuses on picking up undervalued cheap stocks. Also, Hou, Karolyi, and Kho (2001), showed that a negative correlation is due to the general idea of momentum- and value investing since momentum effects are captured after the value stocks have started to gain abnormal profits. In this study, the focus is analysing whether the strategies are negatively correlated, so this study does not take a position in light of the negative correlation results.

Table 11. Four-factor regression analysis for size split TOP portfolio

4-factor regression analysis for TOP portfolio

				a			
Raw returns	***intercept***	**MKT**	**SMB**	**HML**	**WML**	**R-square**	**N**
Panel B/M stocks							
Small	0,305	1,107	1,453	0,744	-0,026	0,069	1861
Big	0,160*	0,410*	1,647*	0,299*	-0,912*	0,466	1181
Total B/M TOP	0,248*	0,833**	1,534	0,586	-0,351	0,075	
Panel MOM-12 stocks							
Small	0,484*	0,831*	3,356*	-1,159*	-0,136	0,249	1387
Big	0,418*	0,647*	2,311*	-0,375**	-0,038	0,263	1987
Total MOM TOP	0,443*	0,738*	2,685*	-0,703*	-0,062	0,248	
Panel E/P stocks							
Small	0,123*	0,464*	1,730*	0,039	-0,311*	0,338	753
Big	0,073**	0,452*	1,606*	-0,027	-0,287**	0,285	1261
Total E/P TOP	0,123*	0,433*	1,862*	0,209***	-0,414*	0,249	
Panel B/P stocks							
Small	0,318	1,175	1,535	0,595	-0,112	0,068	1726
Big	0,129*	0,416*	1,638*	0,293*	-0,778*	0,464	1370
Total B/P TOP	0,238**	0,847**	1,550	0,467	-0,385	0,076	
Panel S/P stocks							
Small	0,078*	0,358*	2,129*	-0,073	-0,509*	0,331	1804
Big	0,196*	0,335	1,947*	0,287	-0,775*	0,192	1174
Total S/P TOP	0,221**	0,814**	1,553	0,430	-0,382	0,075	
Panel EBIT/EV stocks							
Small	0,071**	0,648*	1,242*	0,105	-0,244***	0,334	887
Big	0,094*	0,331*	1,793*	-0,148	-0,251**	0,278	1288
Total EBIT/EV TOP	0,124*	0,405*	2,007*	0,139	-0,439*	0,243	
Panel EBITDA/EV stocks							
Small	0,079*	0,388*	2,295*	-0,034	-0,394*	0,363	1066
Big	0,106*	0,522*	1,453*	-0,144	-0,152	0,286	1276
Total EBITDA/EV TOP	0,135*	0,435*	1,959*	0,120	-0,458*	0,240	
Panel S/EV stocks							
Small	0,0510***	0,517*	1,658*	-0,275***	-0,134	0,319	1095
Big	0,129*	0,432*	1,381*	0,209	-0,349*	0,286	1079
Total S/EV TOP	0,125*	0,411*	1,940*	0,206***	-0,432*	0,247	

*Note: */**/*** indicates the significance level of the intercepts where *is 1%-, ** is 5% and *** is 10% significance level. Otherwise the intercept is not statistically significant from zero.*

Table 12. Four-factor analysis for size split BOTTOM portfolio

4-factor regression analysis for BOTTOM portfolio

				a			
Raw returns	***intercept***	**MKT**	**SMB**	**HML**	**WML**	**R-square**	**N**
Panel B/M stocks							
Small	0,172*	0,689*	1,0681***	-0,711*	0,074	0,167	1342
Big	0,051***	0,738*	1,355*	-0,992*	0,033	0,333	1697
Total B/M BOTTOM	0,106*	0,729*	1,190*	-0,871*	0,055	0,232	
Panel MOM-12 stocks							
Small	-0,186*	0,350**	1,017**	-0,070	0,014	0,108	1867
Big	-0,084	0,463**	0,512	0,083	-0,071	0,100	1987
Total MOM BOTTOM	-0,137*	0,397*	0,819**	0,009	-0,029	0,103	
Panel E/P stocks							
Small	0,072	0,627*	1,654*	-0,683*	0,150	0,268	671
Big	0,099**	0,782*	1,149*	-0,634*	0,019	0,242	1349
Total E/P BOTTOM	0,091*	0,726*	1,302*	-0,639*	0,069	0,248	
Panel B/P stocks							
Small	0,125**	0,425**	1,515*	-0,413***	0,056	0,154	1528
Big	0,059***	0,733*	1,497*	-0,903*	0,044	0,323	1565
Total B/P BOTTOM	0,090*	0,593*	1,498*	-0,673*	0,052	0,220	
Panel S/P stocks							
Small	0,130*	0,587*	1,430*	-0,825	0,016	0,194	1410
Big	0,060	0,584*	1,642*	-0,526*	0,090	0,250	1548
Total S/P BOTTOM	0,094*	0,588*	1,533*	-0,670*	0,061	0,219	
Panel EBIT/EV stocks							
Small	0,064	0,586*	1,838*	-0,865	-0,062	0,282	787
Big	0,113*	0,725*	1,128*	-0,584*	0,144	0,220	1370
Total EBIT/EV BOTTOM	0,095*	0,680*	1,387*	-0,677*	0,080	0,240	
Panel EBITDA/EV stocks							
Small	0,081***	0,732*	1,529*	-0,760*	-0,114	0,309	865
Big	0,076***	0,544*	1,475*	-0,543*	0,241	0,197	1457
Total EBITDA/EV BOTTOM	0,082*	0,619*	1,481*	-0,627*	0,078	0,228	
Panel S/EV stocks							
Small	0,044	0,584*	1,749*	-0,578**	-0,194	0,291	507
Big	0,101*	0,722*	1,254*	-0,710*	0,181	0,237	1630
Total S/EV BOTTOM	0,092*	0,721*	1,265*	-0,631*	0,063	0,242	

*Note: */**/*** indicates the significance level of the intercepts where *is 1%-, ** is 5% and *** is 10% significance level. Otherwise, the intercept is not statistically significant from zero.*

Table 12 reports results from the BOTTOM size split four-factor regression analysis of the growth portfolio. The results show that the alphas for the intercepts are the highest again in B/M small portfolios even though the effect of MKT, SMB, and HML are smaller when compared to TOP portfolios. For example, in B/M small when MKT increases with one, returns of the portfolio increase only with 0,689 points, while in TOP portfolio the increase was 1,107 points. MOM small portfolios' intercepts appear to be negative, and when the MKT or SMB increases with one, the portfolio return is over half smaller compared to the TOP small portfolios. Also, the results for HML variable are negative in the majority of portfolios meaning that when the amount of value stocks in BOTTOM portfolio increases, the returns decrease. This corresponds with the theory of value investing studied, among the others, by Fama and French (1998, 2006), Porta, Lakonishok, Shleifer, and Vishny (1997) and Loughran (1997).

Returns from BOTTOM portfolios are formed from growth stock returns, not from value stocks which is the reason for the negative impact of HML in BOTTOM portfolios. However, EV-based portfolios show that the effect of the MKT variable on returns is higher with almost all ranking scores in the BOTTOM portfolio than in the TOP portfolio. Additionally, the alphas of the HML variable in EV-based portfolios strengthen the earlier observation that in predicting growth companies' returns, one should use BOTTOM companies rather than TOP companies as the BOTTOM companies' returns are higher in the short-term. Although, Porta, Lakonishok, Shleifer, and Vishny (1997) used the S/P variable to rank the glamour stocks, which corresponds with the results from the BOTTOM portfolio since EV-based variables are earning based like the S/P. Secondly, Fama and French (1998) find E/P to be an influential variable for discovering value stocks, which on the other hand variates from the results of this study.

With the variable of WML BOTTOM portfolio analysis results contrary effect on the portfolio's returns since in the BOTTOM, the effect is mostly positive while with TOP portfolio it is negative. This finding is linked to the theory of momentum investing studied, e.g., by Jegadeesh and Titman (1993) and Chordia and Sivakumar (2006), since it supports the method of buying the stocks which have recently well performed. Well-performed refers either success of the stock price- or returns of the company which in turn increase the demand of the stock causing the over-pricing. When the stock is over-

priced, by using strategy of this study the stock is then allocated into a growth/glamour portfolio.

EV-based results with WML variable are negative with both BOTTOM- and TOP small portfolios. The size effect can also be noted from the BOTTOM portfolio since the impact on the returns varies from 0,5-to 1,8 points when the SMB increases by one, which applies to each ranking score. Although size premium is stronger in TOP portfolio. The results from the BOTTOM portfolios are statistically significant, with a 90-99% confidence level excluding WML and HML with some of the portfolios, which are not reaching this confidence level range.

5.4 Robustness check

In this study, several tests are executed to summarize whether the value-and momentum investment strategies can be combined and if the strategy gives the power to gain abnormal returns. The study's overall results show that the mean raw return from TOP portfolios is gaining better profits through the testing period compared to BOTTOM or the benchmark index. Moreover, the best abnormal returns are gained from the B/M portfolio, meaning that abnormal returns totalled to 13,3% while the second-best performed portfolio was B/P and S/P with 13% abnormal returns. All mean returns from the overall portfolios are statistically significant with a 95-99% confidence level, including returns from TOP, Neutral and BOTTOM split portfolios.

After comparing the explanatory factors of Carhart four-factor-, Fama and French three-factor- and CAPM regression analyses, the conclusion demonstrated goodness when applying the four-factor model. Therefore, the remaining analyses were executed by using the four-factor model.

Among the TOP decile size split portfolio's regression analysis highest alpha was seen from MOM small portfolio with 0,484 points, while the second and third highest number was seen in B/P with 0,318 and B/M with 0,305 in small portfolios. These results are consistent with the mean raw returns from TOP decile portfolios since the MOM small portfolio gained a 75,4% yearly mean return while the second and third highest returns were in B/P small of 38,2% and B/M small of 35,5% yearly mean return. This indicates

the same size premia within smaller companies as reported by Griffin and Martin (2003), Fama and French (2012), and Asness, Moskowitz, and Pedersen (2013) in their study. Furthermore, the same trend can be seen when comparing the decile BOTTOM size split portfolio's results since its highest alphas align with the highest mean returns from the BOTTOM size split portfolios. Hence the results from regression analysis show the highest alpha in the B/M small portfolio of 0,172 (0,278 mean raw return), while the second and third highest alphas were in S/P small amounting to 0,130 (0,259 mean raw return) and B/P small amounting to 0,125 (0,235 mean raw return).

The size premia are also seen in BOTTOM portfolios, although the magnitude of the difference between small and big companies' returns is not that high as in TOP portfolios. All alphas in the regression are statistically significant with 90-99% confidence level excluding TOP portfolio's B/M small, B/P small, BOTTOM MOM Big, E/P small, S/P Big, EBIT/EV small, and S/EV small. To see whether the results remain the same, the t-tests have been applied and presented in following table 13, where p-values are calculated based on the t-statistics. The range for statistical significance is set to a 90-99% confidence level, but only 95-99% are accepted and 90-94% are suggested still not be rejected. After running the tests, t-statistics show that TOP decile B/M small portfolio’s p-value has changed compared to 4-factor regression analysis and is statistically significant with 90% confidence level. Similar change applies to the TOP decile B/P small, BOTTOM decile S/P big and BOTTOM EV/EBIT small portfolio. The T-statistics table reports that all TOP portfolios are statistically significant with a 90-99% confidence level. Only BOTTOM decile MOM big, small and all (without size split), BOTTOM decile S/EV small, Neutral decile E/P small, EBIT/EV small, and EBITDA/EV small and big are statistically insignificant from zero.

Table 13. Summary of t-statistic for all decile portfolios per ranking score with 12-months buy-and-holding

T-statistic for all decile portfolios per ranking score with 12 months buy-and-hold				
Raw returns	**TOP**	**Neutral**	**BOTTOM**	**All**
Panel B/M stocks				
Small	1,556***	1,459***	2,898*	
Big	6,848*	4,546*	1,695*	
Total B/M TOP	2,047**	3,640*	3,405*	3,470*
Panel MOM-12 stocks				
Small	6,810*	2,399*	-4,007	
Big	11,018*	4,556*	-1,555	
Total MOM TOP	12,128*	5,278*	-3,870	6,195*
Panel E/P stocks				
Small	3,170*	0,948	1,352***	
Big	2,316*	2,220*	2,272*	
Total E/P TOP	5,259*	2,388*	2,673*	6,116*
Panel B/P stocks				
Small	1,498***	2,262*	2,428*	
Big	6,014*	4,540*	1,802**	
Total B/P TOP	1,995**	4,229*	2,982*	3,447*
Panel S/P stocks				
Small	3,007*	2,486*	2,541*	
Big	3,074*	3,320*	1,571***	
Total S/P TOP	2,005**	4,131*	3,008*	3,447*
Panel EBIT/EV stocks				
Small	2,001**	0,508	1,301***	
Big	3,133*	2,390*	2,515*	
Total EBIT/EV TOP	5,209*	2,377*	2,848*	6,176*
Panel EBITDA/EV stocks				
Small	2,456*	0,613	1,893**	
Big	3,403	3,207	1,724**	
Total EBITDA/EV TOP	5,570*	2,892*	2,601*	6,516*
Panel S/EV stocks				
Small	1,642**	1,897**	0,788	
Big	3,785*	1,815**	2,520*	
Total S/EV TOP	5,434*	2,322*	2,663*	6,168*

*Note: */**/*** indicates the significance level of the intercepts where *is 1%-, ** is 5% and *** is 10% significance level. Otherwise, the intercept is not statistically significant from zero.*

5.5 Hypothesis discussion

This study tested three hypotheses which were formed based on the earlier studies. To test the hypothesis, a four-factor regression analysis has been applied to result the p-values of the alphas. Moreover, a t-statistic test has been performed using the right-tailed t-test function since the size of the sample is limited, and therefore considering the reliability of the study, this t-test is seen as reasonable. By executing the empirical

research, the findings are then analyzed, and the following hypotheses are either accepted or rejected based on the conclusion of the outcome.

The answer to the Hypothesis 1 ‘Momentum- and value investment strategies are negatively correlated but as combined an efficient way to gain abnormal returns’ is somewhat mixed as suggested by the results from Table 11 showing that the WML variable gives a negative impact to all TOP size split portfolios when the winner minus losers increase (e.g., in TOP big B/M portfolio return decreases with -0,912 points). However, WML factor’s alphas are not statistically significant in each of the portfolios relating to the question whether the investment strategies are significantly negatively correlated. In every TOP portfolio momentum- and value strategies are negatively correlated at 95-99% confidence level apart from the following portfolios: B/M small and B/M all (without size split), MOM small, big and all (without size split), B/P small and all (without size split), S/P all (without size split), EBITDA/EV big and S/EV small. Therefore, the hypothesis for portfolios with insignificant p-value is rejected, and vice versa the hypothesis is accepted for the portfolios with significant p-value. EBIT/EV small is with 90% confidence level and hence it is not accepted but still not suggested to reject, since the depart from 95 to 99% confidence level is not material. When examining the alphas of the combined strategies the study finds the combination of momentum- and value strategy to be a powerful strategy to gain abnormal returns.

Hypothesis 2 questioned ‘value investment (TOP) strategy provides abnormal returns when including the momentum aspect into the strategy’ which based on this study can be accepted at 95% confident level as presented in table 9 and figure 6 that TOP portfolios had performed the best during the whole testing period compared to BOTTOM-portfolio and benchmark index. Therefore, H2 is accepted with a 95% confidence level, and the results are statistically significant from zero.

The Hypothesis 3 ‘Among momentum- and value investment strategy there is size premium with the smaller value- and momentum (TOP) companies’ was motivated by Fama and French (1998, 2012), Loughran (1997), Griffin and Martin (2003) and Asness, Moskowitz, and Pedersen (2013) arguments that momentum-and value premiums are more significant in small and less liquid companies. Even though Israel and Moskowitz (2013) found size premium from small companies only with value- not with momentum

strategy. However, based on the results, the same applies to findings from this study, as reported in table 10 MOM decile TOP small portfolio gained 75,4%, mean raw return over the testing period, while B/P decile TOP small gained 38,2% and B/M decile TOP small 35,5%. However, the best performed TOP big portfolio was MOM decile TOP big portfolio with 58,6% return and second-best was EV/EBITDA decile BOTTOM big with 24,4% raw return.

The statistical significance of p-values supports the results; hence MOM decile TOP small portfolio alphas are statistically significant at 99% confidence level, B/P and B/M decile TOP small at 90% confidence level, and H3 is partly accepted. Although the B/P and B/M p-value showed statistically insignificant alpha with the four-factor regression analysis, however, after running the t-test, the results were significant at 90% confidence level from zero and hence it is not accepted but suggested to not reject either.

6 CONCLUSIONS

6.1 Conclusion of the study

Motivation for executing this study was raised by studies of Asness (1997), Fama and French (2012), Asness, Moskowitz and Pedersen (2013), Leivo (2012) and Pätäri et al. (2018) who found the strength of combing momentum- and value investment strategies to a one single investment method. Another driving motivator to carry out this study by focusing on specifically to the Nordic stock markets was the fact that most of the previous studies have been focusing on the US and global stock markets.

To accomplish the study, eight portfolios were first formed based on each stock's ranking score, i.e., valuation multiples including momentum variable. Ranking scores have then sorted from highest to lowest since the theory of value investing assumes that value stocks are those whose B/M is the highest. (Fama and French 1998, 2012) To have more comprehensive results, other ranking scores have also been applied on top of the B/M, including MOM, E/P, B/P, S/P, EBIT/EV, EBITDA/EV, and S/EV. After which, the final portfolios were split by the size of the company's market value. Data was collected from 2001 to 2020 period and consisted of every listed stock from Denmark, Finland, Norway, and Sweden, excluding financial operators, those whose B/M was negative and those whose fiscal year was not ending in December.

The main purpose of the study was to find out the answers to the below research questions.

1. Does the combining of momentum and value investment strategy give a power to generate abnormal returns?
2. What type of momentum-value portfolio provides highest returns?
3. Does the size of the firm affect the momentum- and value premium?

The results from this study are partly consistent with the earlier studies, with some exceptions. The overall findings before the portfolio decile split (split to value and growth portfolios) indicated that the B/M portfolio gained the best abnormal returns with a mean 13,3% outcome and B/P and S/P were the second and third highest with 13% abnormal mean return over the total testing period with 12 months buy-and-hold strategy.

After splitting the portfolios based on their ranking scores into TOP, Neutral, and BOTTOM portfolios, the TOP portfolio showed the best performance over the total testing period compared to BOTTOM, Neutral, or index. The only time when the market (index) provided higher returns than the momentum-value portfolios was between 2007-2008, i.e., during the financial crisis, thus the results are consistent with Leivo's (2012) conclusion that value stocks are not the best performers during the bearish market conditions. To answer to the first research question, the study finds that all of the combined momentum and value portfolios provided abnormal returns ranging between 10,8% and 56,6% from the whole testing period. All the results are statistically significant.

One of the deviations was seen from the riskiness of the TOP B/M portfolios since its standard deviation was the highest at 3,917 and the Sharpe ratio was the lowest at 0,054, which indicates how risky the value portfolio was, if taking the 12-month holding and buy strategy. Cheng and Feng (1998) found that investing with a value strategy, the risk is more negligible compared to growth investing, however in this study, the opposite results are most probably explained with the short-term investing period when combining momentum- and value investment strategies. This indicates that using only the TOP MOM portfolio strategy gives the most efficient power to predict future earnings since its Sharpe ratio was also the highest with 0,471 points, indicating higher risk-adjusted returns of this portfolio. The worst performed portfolio ended up being the BOTTOM MOM with negative returns, suggesting that usage of MOM portfolio without size-splitting works only when choosing the TOP companies into the portfolio.

Table 14 summarises five best performed portfolios after size-splitting to answer what type of momentum-value portfolio provides highest returns and whether the size of the company affects to momentum- and value premium.

Table 14. Summary of Top 5 Best Performed Decile Portfolios

Rank	Portfolio	Mean Raw Return from Total Testing Period	*a*
1.	TOP MOM small	75,4%	48,4%
2.	TOP MOM big	58,6%	41,8%
3.	TOP B/P small	38,2%	31,8%
4.	TOP B/M small	35,5%	30,5%
5.	BOTTOM B/M small	27,8%	17,2%

Proceeding to analyse the size split decile TOP, Neutral and BOTTOM portfolios, the findings suggest that TOP decile MOM small portfolio was able to gain the best mean raw return during the total testing period with 75,4% returns, while TOP decile MOM big generated raw return of 58,6%. The third and fourth highest mean raw returns were seen from the TOP decile B/P small and TOP decile B/M small portfolios with 38,2% and 35,5% mean raw returns over the total testing period, respectively. Moreover, the results partially support the findings on size premium as suggested by Fama and French (2012), and Loughran (1997) and Asness, Moskowitz, and Pedersen (2013), hence answering to the third research question, it seems that there exists size premium among small companies when applying momentum and value investing strategy. However, all of the results were not statistically significant at typically accepted confidence levels (statistical significance in these portfolios were 90%).

EV-based portfolios showed the opposite results during the whole testing period since they gained the best returns when applying the BOTTOM Big portfolio strategy. EV-based multiples are more suitable when using the growth- or glamour investment method or applying them when using single value investing, and the ranking should be applied another way around (lowest to highest, not from highest to lowest). The portfolios ranked as per S/P also showed twisted results when splitting portfolio from highest to lowest and by the company's size, since its highest mean raw returns were reported in the BOTTOM small portfolio. Thus, this is supported by the earlier studies, such as Porta, Lakonishok, Shleifer, and Vishny (1997) when they applied high S/P companies to identify growth companies. Even though the four-factor regression analysis showed that if the small companies amount increases with the one, the effect on change in the returns was the highest (with 2,129 points) if applying TOP decile S/P small companies.

The overall conclusion is that momentum- and value investment strategies are negatively correlated but as combined an efficient way to gain abnormal returns. Still only some of portfolio's p-values were statistically significant and hence H1 was partly accepted. The study also showed that these two strategies could be combined as one potential strategy. Moreover, the results found that combing momentum aspect to value investment strategy will gain abnormal returns, supporting to accept H2. Furthermore, the results show that in momentum- and value investment strategy, there is an appearance of size premium since small companies gained better returns during the testing period. Apart from TOP small B/P and B/M portfolios, H3 was also accepted. TOP small B/P and B/M portfolios indicated that the hypothesis was not accepted but neither rejected because of the 90% confidence level.

6.2 Research limitations, reliability, and further research suggestion

There are a few limitations in the study. First limitation relates to data availability as the data for calculating the multiples were not available for all of the companies, hence causing deviations in the number of companies in some of the portfolios. However, the results are mainly in line with the previous studies.

Another limitation relates to taxes and transaction costs that have not been considered when calculating the portfolio returns. It should be noted that in the majority of the previous studies the transaction costs nor taxes have been considered. Generally, the returns will be smaller when considering taxes and transaction costs which affects the level of abnormal returns in this context due to relatively high-volume trading (however, this should not affect the comparability of the returns between the different portfolios). Although starting from 2021, at least private investors can avoid taxes until liquidation of the stocks, if the selling and buying of stocks will be carried out via an equity savings account.

The reliability of this study is seen as reasonable since the data of the study ranged from 2001 to 2020, which is seen as sufficiently long period, and the sample consisted of all companies from Denmark, Finland, Norway, and Sweden excluding financial operators, those whose B/M was negative, and those whose fiscal year was not ended in December. The number of companies varied from 219 in 2001 to 1 115 in 2020. Also, observations

used in the regression ranged from 8844 to 11805. This time range and the number of companies and observations is consistent with earlier studies executed using similar method. However, it is important to remember that if including other Nordic countries in the sample, the results may vary, creating some limitations when considering the reliability of the results of this study.

Suggestion for future research is to execute a similar study using indices from the Nordic stock market and see whether the results remain the same. If one would like to examine purely abnormal returns of the momentum-value strategy, the transaction costs and taxes of trading could be considered by applying deductive factor into a model, yet this might be rather complex task to formulate. Another aspect to recommend for future studies is to focus on the same area from Nordic markets but rather examine the results by the separate countries to see if there are some differences between Denmark, Finland, Norway, and Sweden stock markets. However, an exciting turn would also be if the topic is studied the other way around, i.e., ranking the overpriced stocks and forming the short-selling portfolios, and examining what kind of returns the portfolios can gain. Also, the recommendation for future studies is to focus on understanding the negative correlation between momentum- and value strategies even better.

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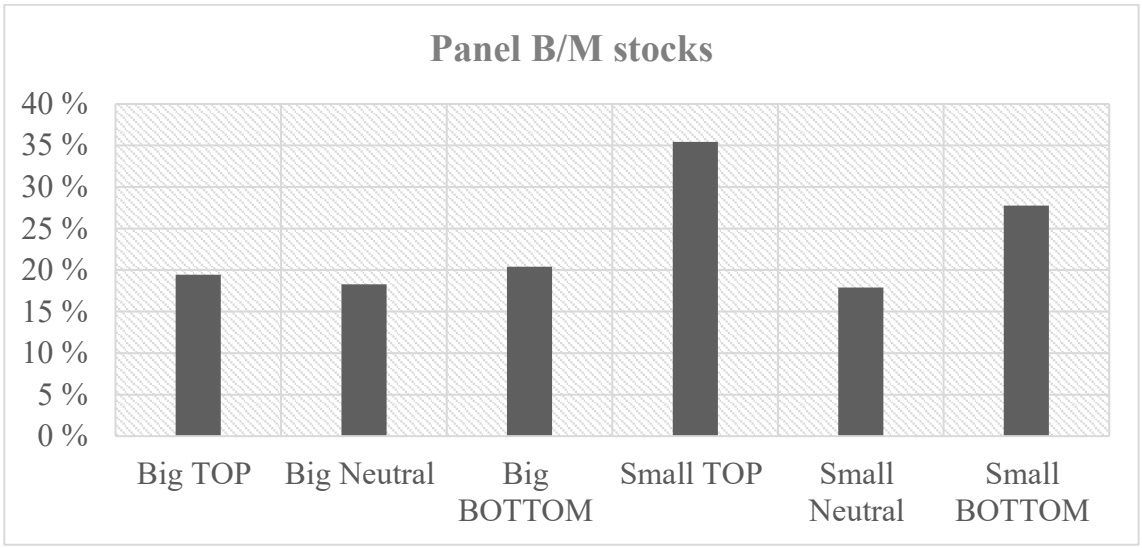
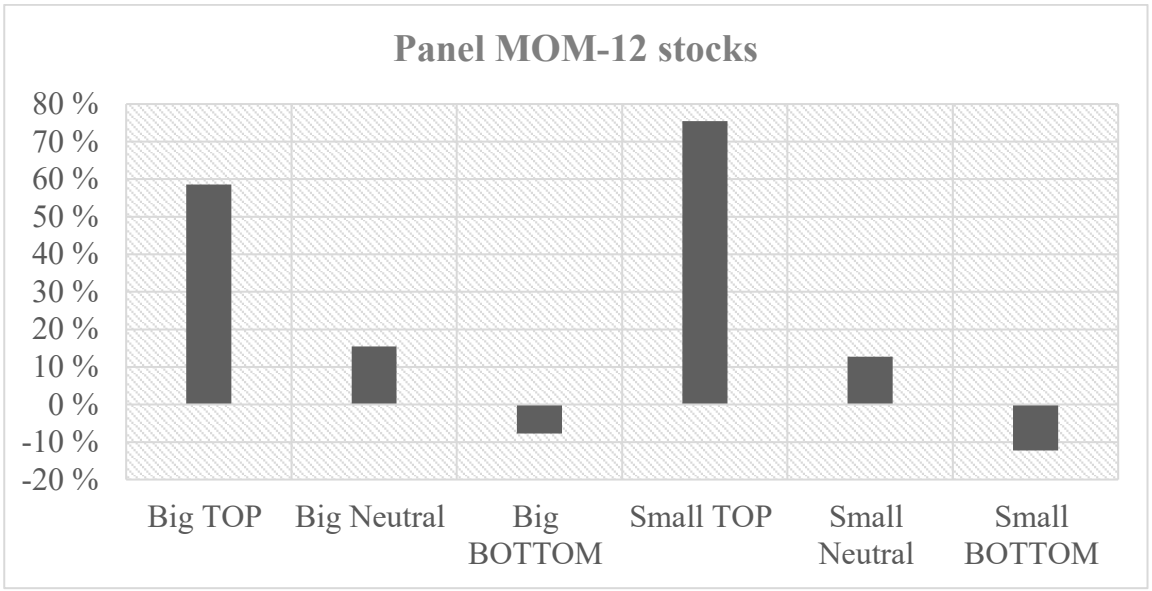
APPENDICES

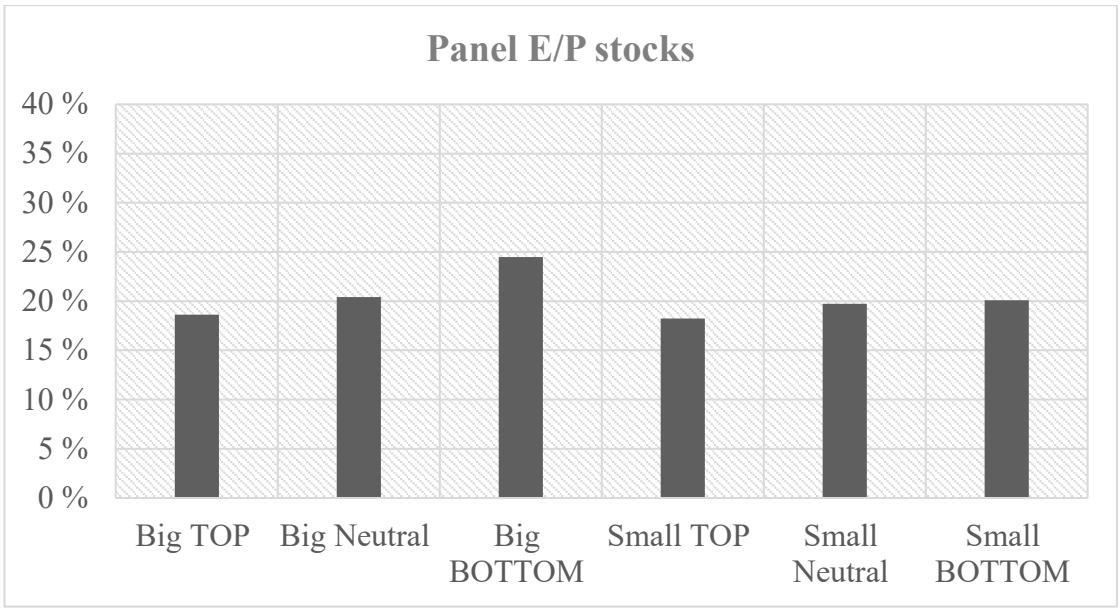
Appendix 1 B/M decile portfolio overall performance



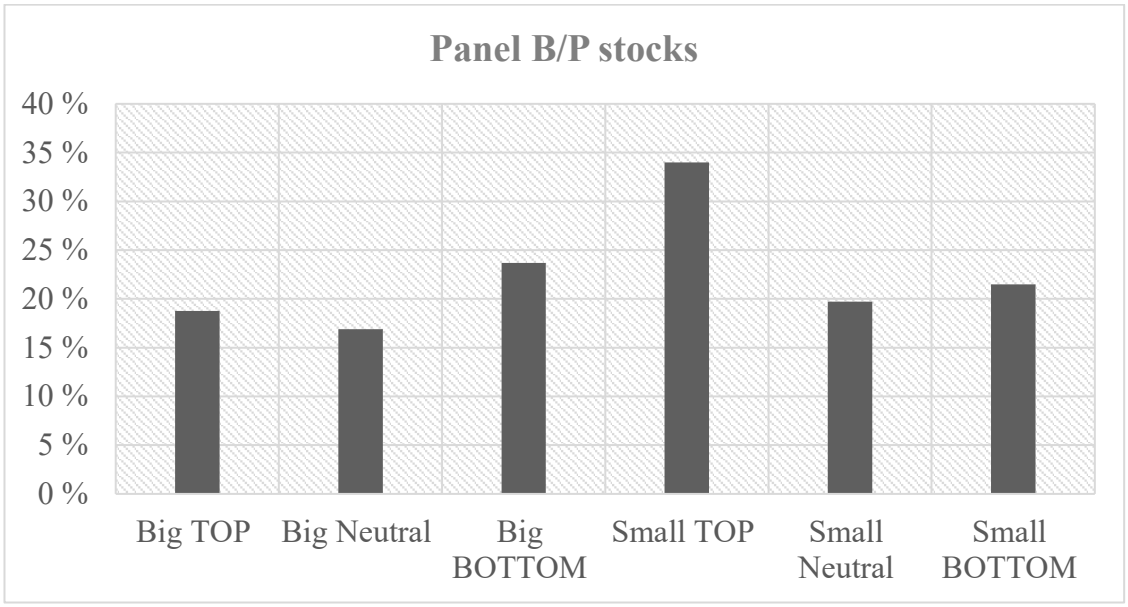
Appendix 2 MOM-12 decile portfolio overall performance



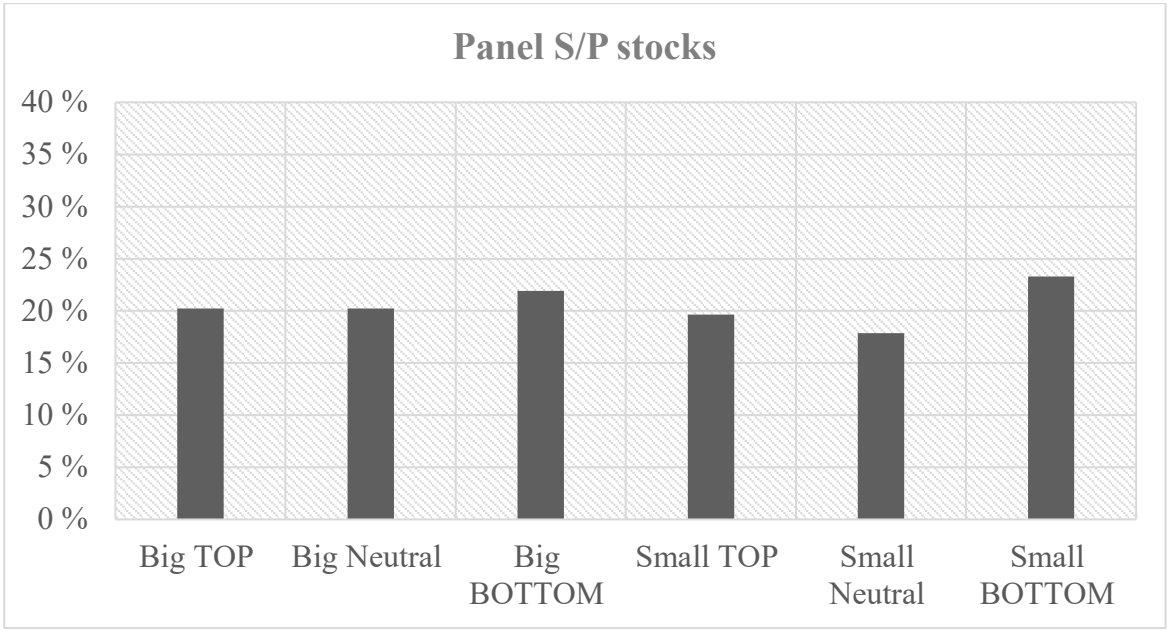
Appendix 3 E/P decile portfolio overall performance



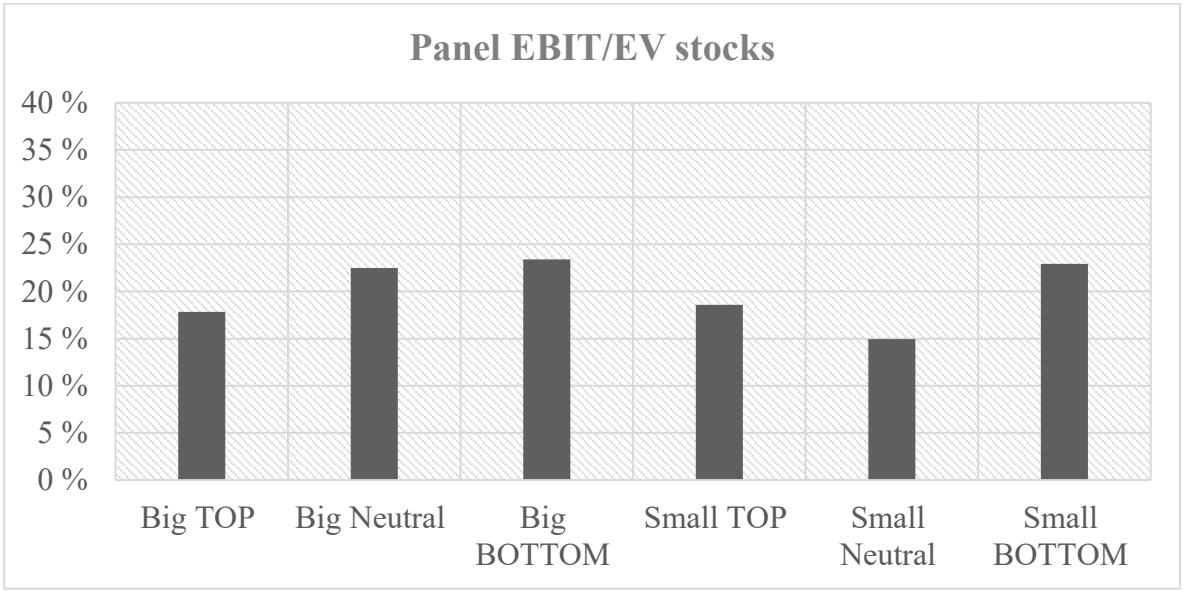
Appendix 4 B/P decile portfolio overall performance



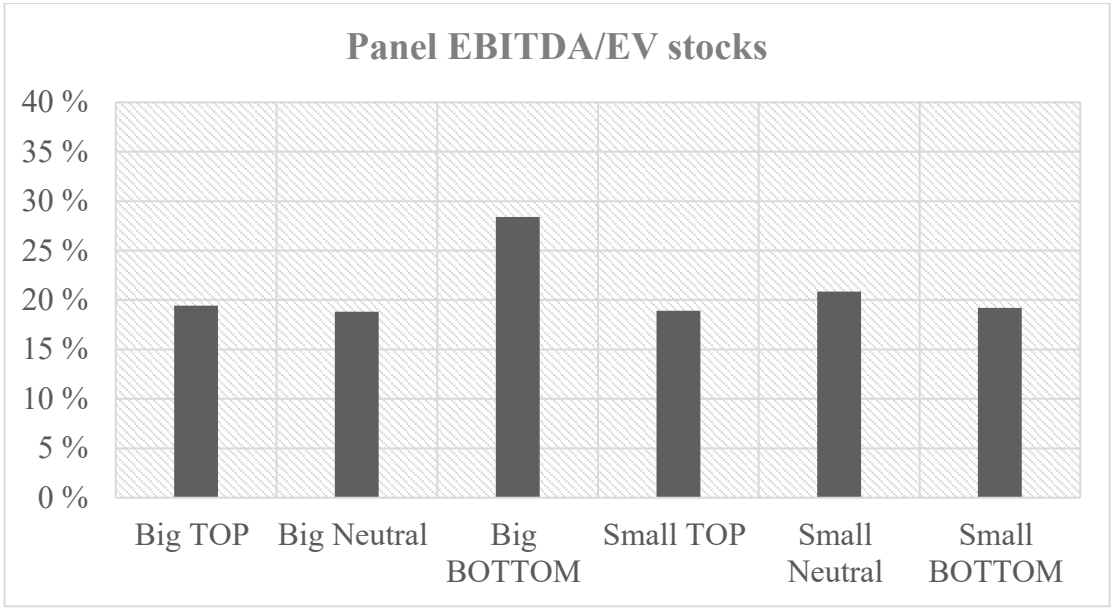
Appendix 5 S/P decile portfolio overall performance



Appendix 6 EBIT/EV decile portfolio overall performance



Appendix 7 EBITDA/EV decile portfolio overall performance



Appendix 8 S/EV decile portfolio overall performance