Master's Thesis

M.Sc. in Economics and Business Administration

Value and Momentum Investing

– Discovering Anomalies in the Danish Equity Market

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Abstract

Through recent years value and momentum investing are investment approaches increasingly employed by institutions and individual investors. This was to be expected as academic studies have found such strategies capable of outperforming traditional benchmarks. However, most of these studies focus on the stocks traded in United States and other major economies, while only limited research exists on stocks traded in Denmark. The thesis focuses on stocks traded in Denmark, and strives to extend current research by providing evidence on performance of value and momentum investing in Denmark.

A vast amount of academic studies exists on either value or momentum investing whereas only a limited number of studies emphasize the combination of the two approaches. The thesis examines the historical performance of value and momentum per se, however, in particular how these approaches ideally complement each other in a combined strategy.

The empirical analysis of momentum and value investing is inspired by the approaches of Jegadeesh and Titman (1993) and Bird and Whitaker (2004). The theories of behavioural finance are applied to understand the herd behaviour behind momentum and value premiums.

The thesis finds that book-to-market ratios in combination with price momentum are able to identify stocks on the Danish equity market that over the past 17 years tend to outperform the market. These stocks are characterized as value stocks with recent price momentum, and preferred to hold for the investor. In addition, stocks characterized as growth stocks without price momentum tend to underperform, and the investor can short these to finance his investment strategy.

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1. Introduction

1.1 Motivation

Two phenomena within capital markets have been studied extensively, namely the serial correlation in price movements over periods, referred to as "momentum" in price, and the correlation between book-to-market ratios and returns referred to as the "value" phenomenon. Studies of momentum present empirical evidence that price continuation exists, and the trend in price for last period has predictive power on the price in the next period, which allow the investor who is investing in stocks trending upwards in price to produce excess return. Similarly, literature provides empirical evidence that companies categorized as value stocks with high book-to-market ratios provide higher mean returns than growth stocks with low book-to-market ratios, especially in Unites States. The premium from holding these stocks is referred to as the "value" effect.

The concept of value investing stems back to 1928 at Colombia University in New York, when Ben Graham and David Dodd taught about the principles of using fundamental analysis to invest in companies with relatively low market value compared to current earnings. Inevitably to mention in this regard is Warren Buffet, a student who worked for Graham. Warren Buffet is today a legend among investors, and a person who has managed to generate a very impressive track record by following the value principles throughout his entire life as an investor.

Momentum, on the contrary, relies on price continuation in the short term, and the ability to exploit the trend and reversal effect of asset prices. Similarly to value investing, momentum has produced excess return historically, especially as a strategy combined with value investing.

In spite of extensive research on momentum and value investing over the past, the explanation for these premiums is ambiguous in literature. Traditional finance theorists

including Eugene Fama have, in spite of several decades of research, failed to convincingly explain the premiums and how these align with the idea of efficient markets.

Investors using the efficient market view as one way to think about asset pricing, but acknowledging that markets are not always efficient, and a "risk free excess return" is associated with value and momentum strategies, have managed to profit and generate strong achievements over the past. Warren Buffet is an example of an investor who has achieved strong returns by firmly sticking to the value principles over his long career.

Theorists from the behavioural finance school including Laknishok, Shleifer, and Whitaker provide concepts and insights that seem to be surprisingly robust in explaining the premium from value as well as from momentum.

Research on both value and momentum strategies are especially provided in United States, Japan and the largest stock markets in Europe. The research on the Danish stock market is rather limited and will therefore be in focus in this study. In addition, most studies study either value or momentum while this study will also shed light on the possibilities of combining the two.

One of the most difficult questions to answer in finance in general, and in particular for the investor who is searching for investment opportunities, is whether patterns found in historical data will persevere in the future.

The study will contribute with insights from the most recent years, and strive to elaborate and emphasize some of the possible explanations for the anomalies from value and momentum. It will not answer the question, but hopefully help guiding the investor closer to an answer, and how she may be able to exploit the opportunities related to the anomalies.

1.2 Research questions and objectives

The thesis will provide insights to the topic by answering the following overall research question:

In recent years, did value and momentum strategies produce an excess return on the Danish stock market, and how can the investor use the historical insights from value and momentum strategies?

The overall research question strives to address the effect from momentum and value strategies, and how these insights from momentum and value strategies in isolation and in combination can help the investor in her investment decisions. The following sub questions will be used throughout the thesis to address the overall question.

To investigate and understand whether the value premium has been present in the Danish stock market over the recent years, and how the phenomenon potentially can be capitalized in an investment strategy, the following sub research questions will be emphasized.

- *To what extent did the value premium occur over the recent years on the Danish stock market?*
- *Did the value investor achieve returns higher than that of the market on the Danish stock market?*
- *What is possibly explaining the value premium existence?*

To investigate and understand the profit from the momentum strategy, and how this strategy can possibly be used in combination with value, the following sub research questions will be analysed and discussed.

- *To what extent did the momentum strategy provide a profit over the recent years on the Danish stock market?*
- *What is possibly explaining the profit from momentum strategies?*

The following sub research questions will be investigated in order to understand, whether it has been favourable to combine value and momentum strategies in recent years on the Danish stock market to produce an even higher return of what can be achieved in isolation.

- *How has a combination of momentum and value strategies performed in the recent years?*
- *What should the investor be aware of before applying such strategy in the future?*

The sub research question will be answered throughout the thesis and guide the reader through the most interesting insights from the analysis and previous research.

1.3   Introduction to sources and data

Data used for the analysis in this study use Thomson Reuters Datastream, which is an internationally known and respected data provider. The data from the database are used for a wide range of academic studies including Israel and Moskowitz (2013) and Gregor (2012), as well as financial institutions. The primary database used for the analysis in this study is therefore considered to be of high reliability. Additionally, the data extracted from the data base are compared with and validated towards data from the Bloomberg Terminal, which is discussed even further in section 3.

In spite of the database being used vastly, a limited amount of errors related to individual observations and companies were found throughout the study, and thus emphasising the importance of treating the data with caution. To accommodate these, and increase the reliability of the analysis, approaches from Ince and Porter (2006), Griffin et al. (2010) and Schmidt (2011) are applied in the methods used for data extraction and processing. This is also further discussed in section 3.

1.4   Methodology

The data used for this study are to the most possible extent limited to one data source in order to mitigate joining data sources with different definitions. Similarly, the definitions provided are used for key indicators and metrics to avoid calculating these manually, and thereby being exposed to changes in accounting standards and the like over time.

As mentioned above, other data sources are used to check the validity of the data, but not used directly in the core analysis of the study.

The study further relies on the methodology and approaches that are used in several other studies to avoid the risk of data mining and data snooping on the results. This will be further discussed in section 3, but relevant to stress already now given the relatively small size of the Danish stock market and hence the sample.

1.5   Demarcation

To ensure the study analyse the research question in depth to provide meaningful insights that are robust, some limitations are necessary for the thesis. The limitations will be elaborated below in the following section.

In spite of other phenomena causing anomalies in the market, and hence being interesting to the investor, the study is narrowed to solely analyse and discuss value and momentum strategies. Furthermore, value and momentum is likely creating anomalies in more asset classes, but the study will only focus on equities, and those publicly traded.

Momentum and value strategies are investigated across equities markets across the world which the study will draw on to provide insights, however, the Danish stock market is the only one subject to data analysis in this study. Risager (2013) investigate value investing within large cap stocks in Denmark, but the evidence for small cap within value, and momentum in general is rather limited in Denmark. The thesis will therefore focus on publicly traded stocks in Denmark.

Value and momentum is primarily identified with one criteria which is book-to-market ratio and price, respectively. It is relevant compare several different metrics, as well as combining several metrics within value and momentum. However, the study is not focusing on the best method of how value and momentum are identified but rather whether it exist, and how the strategies are performing combined. The approach used in the thesis is very much inspired from Bird and Whitaker (2004) to minimize the risk of data mining.

The thesis will include both the risk based view and behavioural finance view on the value and momentum premium. However, since the literature is more limited on the latter, which seems to provide a rather robust explanation of why the anomalies appears, the behavioural finance view will be the one particular emphasised to understand the phenomena.

2. Literature Review and Theory

The following section will draw on current literature to understand where the value and the momentum premiums have been present in the past. Additionally, it will shed light on the explanations provided from literature, why these premiums appear to foster the understanding and allow the reader to determine whether he should expect these to occur in the years to come.

2.1   Value investing

Traced back to Benjamin Graham and David Dodds' book about Security Analysis in 1934, the concept of value investing, where the investor searches for fundamental value in firms at a relatively low price, has existed for a long time. Value investors including Warren Buffet have generated excess returns by strongly committing to the concept over the years. Attention from academia intensified following the paper by Fama and French in 1992 that found a correlation between book-to-market ratios and stock returns. Laknishok, Shleifer and Vishny (1994) further contributed to the research with their paper providing further evidence of value strategies yielding higher returns, while claiming the excess return was explained by the suboptimal behaviour of the investor and not because the strategies are fundamentally riskier.

Initial research was primarily focusing on the equity market in United States, and it is still the region with the strongest evidence for the value premium. However, after the initial research several studies have investigated and produced evidence for the premium in equity markets across Europe and Japan. In the following paragraphs, the thesis will elaborate on some of the evidence produced across the different regions over the past.

Davis, Fama and French (Davis, et al., 2000) investigated the value premium from 1929 until 1997, and hence cover a long period following the great depression. Their sample includes all industrial companies traded on the New York Stock Exchange. They expanded their sample to include all firms traded on AMEX and Nasdaq from the year 1954. To investigate whether the value companies yield excess returns the stocks were allocated in three groups according to the book-to-market values. The first group was the growth stocks and contained the 30 percent lowest book-to-market stocks. Second group of stocks was the middle range book-to-market values and contained 40 percent of the sample. The third group was the 30 percent highest book-to-market value stocks and hence the value stocks. To accommodate for a size factor, they divided the groups in small and large cap dependent on the company's market capitalization. The study ranked the stocks according to the book-to-market ratios end of year, and then constructed the portfolios end-June to allow the investor to actually receive the information of the book-to-market ratios in the annual report before portfolio formation. The returns were recorded yearly end-June together with a rebalancing of the portfolios. Using value weighted returns, Davis, Fama and French found an annual value premium over the period that amounted to about 5.5 percent across all the stocks in the sample, which was statistically significant with a t-value of 4.24. When the samples were divided into respectively small and large cap, the value premium exists with significance in both studies, but with a slightly higher premium for the small cap stocks.

Lakonishok, Schleifer, and Vishny (Laknishok, et al., 1994) further provided evidence that it is worth to search for deep value stocks. By dividing the stocks into percentiles, they investigated the value premium associated with only holding the 10 percent of stocks with the highest book-to-market value. They provided evidence that holding stocks with the 10 percent highest book-to-market value provides significant higher return, but also combining book-to-market measure with price-to-cash flow as a second value criteria is providing a stronger value premium.

The two studies above use samples excluding financial firms in United States. Barber and Lyon studied the value premium for financial firms in the period from 1973 to 1994 (Barber

& Lyon, 1997). They determined value firms by ranking firms in percentiles based on book-to-market ratio, and find a value premium of 1.1 percent per month in financial firms while the value premium for non-financial firms amounts to 1.4 percent. The difference indicating a lower value premium within financials is not statistically significant.

Risager added to the research by investigating the value premium in the period from 1998 to 2010 which both included the dot.com bobble and the financial crisis. His research shows that the value premium still exists over the period, however, the premium is smaller than what was experienced in the preceding years. Furthermore, in the years 1998 and 1999 the value premium disappeared, and growth stocks outperformed. This is most likely explained by the hype around the IT companies in the years before the bubble.

In sum, there are several studies that provide evidence of a value premium in United States over the years. The size of the value premium varies over the years, but historically over longer time horizon, the existence is evident.

Japan

Looking at Japan, another of the largest advanced equity markets in the world, there are several studies providing evidence of a value premium's existence. Chan, Hamao and Lakonishok (1991), analysed the period from 1971 to 1988 using a sample of firms traded at Tokyo Stock Exchange. Regardless of identifying value stocks based on earning yields, book-to-market multiples or cash flow yields, a value premium was found in the period. Using the two latter to categories the value and growth stocks produced the most significant and highest value premium though.

Cai (1997) investigated the value premium in the years from 1971 to 1993, and hence including the bursting of the equity bubble. Financial stocks and utilities are excluded from the sample. The study uses book-to-market, cash-flow-yield, earnings per share, and past sales growth to group the stocks according to their value percentile. All the measures except for earnings per share produce an annual excess mean return in the range of 6 percent to 11.3 percent for the period, which is in line with other studies. Earnings per share only indicate an excess return of 1.3 percent. Accelerated depreciation is allowed in Japan, which

implies that earnings are often distorted especially in capital-intensive firms. Earnings constitute the numerator in the measure, and distorted earnings will thus take away the predictive power of the price earnings ratio and explain the significant lower value premium when using this measure (Cai, 1997).

Risager (2013) investigated the value premium in the following years from 1998 to 2010, and found a value premium, which is similar to what the studies from United States indicated. The value premium disappeared in 1999 and 2005, but remained consistent over the remaining years and amounted to a mean excess return over the period of 4.05 percent.

Europe

In United Kingdom, Dimson, Nagel and Quigleu (2003) used a similar approach to Fama and French (2000) and found a mean monthly value premium of respectively 0.48 and 0.50 percent in large and small cap stocks for the period 1955 to 2001. The value premium was relatively stable over the period, and only disappeared in 11 of the years. It was in particular in early 1990s and late 1990s growth stocks were outperforming.

Fama and French (1998) investigated the value premium in France, Switzerland, Germany, Sweden, Italy, The Netherlands, and Belgium in the years from 1975 to 1995. They used book-to-market, price-to-cash flow, price-earnings ratio, and dividend yield as metrics to identify value in these markets and defined the value portfolio as the top 30 percent and the growth as the lower 30 percent. The results were convincingly showing a value premium in the European countries especially in France. Italy was standing out by only indicating a value premium when sorting value on price-to-cash flow.

Bird and Whitaker (2003) were investigating the European stock market in the years from 1990 to 2002 using book-to-market to identify value stocks into quintiles. Their portfolio formation varied in holding periods, but the results were in line with Fama and French (1998) and indicated a value premium. Common for both studies were difficulties with significant t-statistics due to the relatively small samples for which reason the markets were pooled.

Risager (2013) investigated the twenty largest firms in Denmark traded on Nasdaq OMX in the period from 1950-2010. Using both trailing and current price-earnings ratios, Risager found a value premium. However, it was only with current price-earnings ratio he was able to find statistically significant evidence of a value premium. The value premium varied throughout the period, and the deviation was expected to be explained by the numbers of firms, and hence firms' specific events influencing the value premium. The difference in the market value of the twenty largest firms made the choice between using value and equally weighted returns particularly important since some of the stocks were worth much more than others, which will imply that the results were sensitive towards a selection of stocks, and how these were affected by company specific events. Risager, was also emphasising and discussing how Novo Nordisk, Maersk and Vestas had an impact of the performance of the portfolios. This study also includes small and mid cap firms, and applies an equally weighted return, for which reason it is very interesting to see how the reported results vary from what Risager found.

2.2   Explaining the value premium

In spite of extensive studies on the value premium and the consensus about its existence in academia, the explanations for why the value premium exists is ambiguous.

Fama and French, and Lakniskok, Schleifer and Vishny provided evidence of the value premium, however, their explanation for its existence varied. Fama and French were in their number of papers on the value premium all taking the efficient market view on the excess return to value stocks, which is referred to as the traditional finance theory (1992, 1996, 2006). Laknishok, Shleifer and Visny on the other hand, presented an explanation stemming from the behavioural finance view where the investors' behaviour and expectation also rely on emotion and not always on rational behaviour.

The traditional financial theory evolves around the efficient market hypothesis, and the concept of risk and return that goes hand in hand. The efficient market hypothesis therefore suggests that the premium related to investing in value stocks is a compensation for an equally higher risk associated with investing in value stocks. The behavioural explanation on the other hand relies on the psychology of the investor, and his emotions and reasoning influence his investment behaviour causing the markets to not always efficiently price assets. The following section will therefore shed light on the different views, and how these differ.

2.2.1 The value premium explained from traditional finance theory

The advocates for the efficient market hypothesis attempt to explain the value premium as a compensation for taking increased risk. The value stocks will hence have to be more risky than growth stocks for the hypothesis to hold.

Volatility in return, or the standard deviation of return is a measure for risk. It is the most common and widely used metric of risk in financial markets, and assumes returns symmetrically distributed around their means. Relying on the efficient market hypothesis, value portfolios are expected to have a higher standard deviation of returns because of the increased exposure to risk.

Cai (1997) investigated whether the value stocks in Japan were typically associated with a higher variation in return, and thus explaining the excess returns. By looking at standard deviation of returns, Cai found a minimal difference between value and growth stocks, and the volatility related to value stocks was therefore not explaining the premium in Japan in the period. Risager was also investigating the volatility in return across the different equity markets without finding a significant difference between value and growth stocks able to justify the premium (2013). In other words, neither Cai nor Risager was able to justify the excess returns from a risk perspective, when measuring risk in standard deviation of return.

Davis, Fama and French (2000) researched the standard deviation on the US stock market from 1929 to 1997. In the most recent period from 1963 to 1997 the standard deviation of the value portfolio was a bit lower, while in the preceding period from the 1929 to 1963 it was the other way around. Over the entire period value stocks were slightly more volatile than growth stocks, however, the difference was only able to account for a minor fraction of the premium. Davis, Fama and French also failed to convincingly explain the value premium by increased risk from measuring it as increased volatility of return on stocks in US.

In the traditional asset pricing model CAPM, the risk is measured by the portfolios covariance with the market, and denoted beta. The higher the beta of a given portfolio the more the returns varies with changes in market return, and thus the riskier the portfolio. As standard return is not able to capture the increased risk that is expected to be associated with value stocks, beta as a different measure may be able to and hence justifies that risk and return goes hand in hand.

Basu (1977), Lakonishok, Schleifer and Vishny (1994), Fama and French (1992) and others contributed with papers investigating whether the difference in betas was able to explain the value premium. Some of these studies found a slightly higher beta related to value portfolios but the difference was very limited and broad consensus still exists about the higher level of systematic risk is not explaining the value premium in United States.

According to Basu (1977) and Ilmanen (2011) it appears that the beta of value portfolio is actually lower than those of growth. They concluded, the beta is therefore not able to justify the higher return related to value stocks (Ilmanen, 2011).

Fama and French applied the International CAPM to explain the value premium in several of their studies, however, the model also failed to justify the excess return (1996, 1998). The beta of value portfolios exceeded those of growth in some of their analysis, but the difference was still minimal and hardly explaining the value premium.

Furthermore, Cai (1997) was investigating how value stocks were performing relatively to growth in the period of the recession in Japan, and found the value premium also existed

when the market was going down. If growth stocks neither outperformed value stocks in bull nor bear markets, CAPM was hardly explaining the value premium.

As CAPM failed to explain the value premium, Fama and French (1992) proposed a three-factor model to explain the value premium. The model used a size factor, book-to-market factor, and the overall development in the market. If the efficient market view are to hold, the risk related to the value premium needs to be hidden for the traditional risk measures discussed above, and something that the three-factor model will capture.

The model was able to explain some of the variation in return, however, both Fama and French and other empirics did not convincingly prove the three factor model when applied to new data (Gregory, et al., 2001). As Fama and French (1996) also pointed out in their paper, it was also worth to mention the model may also capture irrationalities and mispricings that were in contradiction with the efficient market view.

In general, empirics of the view have still not succeeded to measure the additional risk justifying the value premium, and for the theory to hold the risk will have to be hidden and not measurable in the traditional risk measures. A tangible and unambiguous way of measuring risk and thereby proving the efficient market hypothesis hold is still to be developed and researched upon.

2.2.2 Behavioural arguments for the value premium's existence

As the traditional efficient market view is not particularly helpful in understanding and explaining why the value premium occurs, one might turn to the behavioural finance view, that draws on insights from both psychology and economics to understand the premium. In the following the thesis will shed light on some of the insights that behavioural finance can provide in the quest to understand why the value premium occurs, and how these relate to the traditional view.

According to Barberis and Thaler (2003), and Ackert and Deaves (2009) the value premium is an example of investors being affected by emotions and as a result too optimistic about growth stocks. More specifically, the past high growth of the stocks makes the investor forget that even these fantastic companies, who have historically grown at high rates, can be bought at a price that is too high. Later, when the investors collectively realize the price is driven by a too optimistic prospect of the company the correction sets in, and the price and hence returns will drop.

The growth stocks will often disappoint investors while the value stocks are priced according to lower earnings growth. Moreover, lower historic growth from these companies may even have caused limited or bad attention by analysts, the media, and investors in general, and as a result implies the value stocks may even be under-priced. The lower expectations towards value stocks allow the performance of value stocks to meet or exceed expectations. If investors expect the value stocks to struggle with financial distress and declining earnings, simply maintaining earnings may even allow the stocks to exceed expectations.

Lakonishok, Schleifer and Vishny (1994) investigated whether the value premium was explained by a suboptimal behaviour of the investor and not because value stocks were fundamentally riskier. In the article past performance was measured using past growth in sales, earnings and cash flow, and future expectations were measured using multiples of price to current earnings and cash flow. In other words, they tested whether investors were extrapolating past performance of growth stocks to far out in the future. From the research it appeared that growth stocks proved very strong returns and growth in the three years prior to portfolio formation, but in turn the growth were generally declining following formation.

In spite of the data showing that growth declined following portfolio formation, from the price multiples it was apparent that the investors extrapolate past growth into the future, and thus have high expectations to these stocks. Value stocks on the other hand, indicate a negative return the years prior to portfolio formation and are therefore not subject to the high expectations from investors which they cannot meet. Lakonishok, Schleifer and Vishny

were analysing US value and growth stocks from 1963 to 1990. They were identifying value stocks as the 10 percent with the highest book-to-market and growth the lowest. These findings will be further discussed later in the thesis, and whether similar patterns exist for the stocks in the sample will be analysed as well.

Building on the hypothesis that growth companies are more likely to disappoint investors, it is relevant to draw on the findings from La Porta, Lakonishok, Shleifer and Vishny's (1997) article, which investigates the returns around earnings announcement days of stocks traded on NYSE, AMEX and Nasdaq in the period from 1971 to 1993. More specifically, they compared the mean returns from one day before quarterly earnings announcements to one day after. Comparing the returns to the mean daily returns of non-announcements days they found that growth stocks, sorted by book-to-market ratios, were systematically more likely to decline in the days of earnings announcements. It may be argued that a decline on the time of earnings announcements was explained by growth stocks failing to meet investor's expectations, and hence supporting the hypothesis of investors being too optimistic about growth stocks (Shleifer, 2000).

Cooper, Gulen, and Schill (2008) provided a similar analysis around earnings announcement, but with a sample extending over the period from 1970 to 2003. Instead of using book-to-market they looked at asset growth as an indicator for growth companies. They provided statistical significant evidence of growth stocks producing a negative return of 10 basis points below non-announcement days. Value companies with low asset growth produced a positive return on announcements equivalent to 16 basis points.

The lower return for growth stocks on earning announcements days are inconsistent with the risk based explanation, and rather shedding light on the plausibility of investors simply being too optimistic about the prospect of growth stocks.

Additionally, it is known that analysts in general are too optimistic about stocks and therefore issue too many buy recommendations relatively to sell (Doukas, et al., 2002) (Easterwood & Nutt, 1999). Analysts are paid by investment and brokerage banks, and have an interest in spreading optimism allowing them to receive higher fees, which does not make

the above finding surprising. However, Doukas et al. (2002) also studied the extent to which analysts are biased and more optimistic for either value or growth stocks in US from 1976 to 1997. It appears from their paper that analysts' actually issue more optimistic forecast for growth stocks. Research on stocks in UK was not able to find a difference in the error or optimism towards growth stocks, but rather equally optimistic about value and growth stocks (Levis & Liodakis, 2001). The research was inconclusive on whether analysts were further fostering the optimism around growth stocks.

In sum, the behavioural finance school argues that investors are too optimistic about the prospects of growth companies, and the growth companies historically have not been able to maintain the growth and performance to justify the expectations. The value premium is thus a reflection of growth companies being priced relatively too high compared to value stocks.

In the light of some stocks potentially being priced below their fair value, and others priced to high, it is very relevant for the investor to widen the understanding of how markets with potential inefficiencies should be timed. Knowing as an individual, that a stock is trading below its fair value is not adding value per se, other investors have to acknowledge it as well, and the value will not increase before others start to invest in the stock as well. The next section will therefore shed light on momentum investing which may provide a better understanding of short term trends in equity markets.

2.3   Momentum investing

In contrast to value investors who are searching for stocks that appear relatively cheap, a momentum investor seeks to identify stocks with an upward or downward trend in price in the hope of continuation (Ackert & Deaves, 2015). Momentum investing therefore relies on the notion of stock prices having serial correlation, which implies stocks that have been rising in price over the previous period are likely to continue the trend in the period to come.

Although the idea of momentum contradicts the efficient market view (Fama, 1965), and in particular Random Walk, the evidence provided in literature is too extensive to ignore.

Central to momentum strategies are the formation and the holding period. The holding period is the timeframe used to identify and rank the stocks based on their performance. Stocks with the best performance in the formation period referred to as "winners", is the group of stocks expected to exhibit the best performance in the period to come. The worst performing stocks, referred to as the losers, is the group of stocks with the worst performance in the formation period. The time horizon of the formation period is simply important because it determines what stocks the investor will hold. Equally as important is the holding period. The holding period is simply the period of which the investor hold on to the stocks, and since the momentum profit are primarily appearing in the short and intermediate term, the holding period is strictly related to the performance of the strategy. The formation and holding period are therefore two of the main determining factors of momentum strategies.

The momentum phenomenon is vastly researched by many scholars since the first publications on the topic. Jegadeesh and Titman (1993) were among the first to show that positive price momentum exists in US stocks in the short term. More specifically, they investigated the correlation between stock returns over a 3 to 12 months period and the previous 3 to 12 months. In particular, they divided the stocks into deciles based on return in the first period, and compared it to return of the groups in the next period. They found that a portfolio long the best performing stocks and short the worst, over the previous six months, on average produced a 0.95 percent excess return per month in the next six months. Ignoring transaction costs, by going long winners and short losers, the portfolio was cost neutral, and hence the profit was "free".

In a later version of their first study, they extended the sample to include the years from 1965 to 1997 and thus extended the period with eight additional years (Jegadeesh and Titman, 2001). In the updated paper, they found the same patterns addressing the allegations of data mining or data snooping. Evidence was also provided, that extending the holding

period from 6 to 12 months also produce an excess return. However, in the study it appeared that returns 13 to 60 months after the portfolio formation were negative. This will be further discussed in the section about mean reversal.

Rouwenhorst (1998) did a similar study to investigate the existence of momentum outside of United States boarders. The sample includeed twelve European countries including Denmark in the years from 1978 to 1995. From the paper it appeared that returns continuation was present in all the twelve countries for about one year. Rouwenhorst's findings on return continuation in Europe were in line with Jegadeesh and Titman's conclusions for US stocks. Liu, Strong and Xu (1999) arrived at the same conclusion for the study of momentum in United Kingdom. Asness, Moskowitz and Pedersen (2013) and Chui, Titman and Wei (2010) contributed evidence from global studies on momentum, and hence there was broad consensus on the existence of return continuation in the literature.

The size of the profit varies from momentum strategies across the studies. Jegadeesh and Titman first reported an average monthly profit of 0.95 percent in US stocks, while Rouwenhorst reported a profit of 0.93 percent in Europe. Griffin, Ji and Martin (2003) reported a profit of 0.77 percent in Europe for the period 1975 to 2000. As earlier mentioned, the period of formation and holding was relevant in understanding the difference in profit. Griffin, Ji and Martin (2003) used a 12 months holding period while Rouwenhorst six month holding and formation period.

Literature also emphasizes it is not only the period of formation and holding that have an impact on the profit. The size and the turnover play a role as well. Rouwenhorst (1998) showed return continuation is negatively correlated with firm size, and momentum strategies will therefore perform particularly well in smaller firms. Hong, Lim and Stein (2000) investigated the impact of the size of and the analyst coverage of the stocks as well. In the paper they found small firms with low analyst coverage exhibited higher momentum. The profit of a momentum strategy will thus seem to be more attractive in smaller firms, however, it is important to note the liquidity is typically lower which will increase the spread of the stocks and increase the transaction costs in practice.

Glaser and Weber (2003) documented momentum is more prevalent in stocks with high turnover than stocks with low turnover contradicting the results from Rouwenhorst (1998). The sample based on German stocks from 1988 to 2001 also showed that both size, industry and the book-to-market have an impact on the magnitude of momentum. Interestingly, Swaminathan (2000) also documented that momentum is more prevalent in stocks with high turnover.

It is clear from above, that the period of portfolio formation and holding the portfolio is two determining variables in a momentum strategy. The time used to analyse the return as well as holding the stocks can be adjusted, but will remain central to the profitability of the momentum strategy. In the above studies, they are primarily suggesting to use periods up to one year for both formation and holding. In spite of some ambiguity on the holding and formation period most evidence exist suggests that using a formation and holding period of two to twelve months are the most profitable.

2.3.1   Mean reversal

From above, it is clear that a momentum premium exists in the intermediate term. However, several studies report a negative return when the holding period is extended to more than a year. In particular, Jegadeesh and Titman (2001), and DeBondt and Thaler (1985) reported negative returns when the holding period exceeds twelve months. This effect appears to be present from 13 to 60 months after formation and is referred to as the mean reversal effect. Mean reversal is the notion of the stock returning towards the mean return or its fair value. It implies that winner stocks do not maintain their momentum over longer horizons, but rather converge towards a return that is closer to the mean. DeBondt and Thaler (1985) found this effect starting to kick in after a year, implying that winner stocks will have a negative return in the period from 13 to 60 months following formation. It will further imply that stocks categorised as losers are the best performing stocks when the holding period is three years.

Mean reversal is also documented over very short holding periods. Lo and MacKinaly (1990), and Jegadeesh (1990) actually showed a mean reversal within the first month with a strategy of holding winners for a single month performs worse, than holding losers. This is also why most studies are ignoring returns in the first month when analysing momentum returns.

The fact that past performance and trends are able to predict future price movements is a contradiction of the Random Walk hypothesis and the efficient market hypothesis, which will be discussed further later in the thesis.

2.4 Explaining the profit from momentum strategies

Extensive research on the premium from momentum strategies have been produced, and empirical evidence has been presented hereof. However, similarly to the value premium, the reason why it appears is rather ambiguous in the literature.

2.4.1 Traditional risk based view

The traditional view explains increased return with additional risk, and in this case momentum investors must therefore be compensated for taking on more risk (Ackert & Deaves, 2015). More specifically, it will imply a portfolio with winner stocks will be riskier to hold and the excess return is a compensation hereof rather than an anomaly in the market.

As previous mentioned, the volatility is a common measure of risk, and the volatility of the portfolio with winner and loser stocks will therefore be relevant to analyse. If returns of the portfolio with winner stocks are related to a higher volatility, it will explain why these produce a higher return. Rouwenhorst (1998) investigated this relation, and documented that portfolios containing winner stocks are not related to higher volatility, and hence the

volatility is not able to explain the premium for momentum strategies. In fact, the study shows additional mean volatility related to a portfolio with loser stocks.

Jegadeesh and Titman (1993) used beta as a measure for risk by applying CAPM to the portfolios. Similar to Rouwenhorts (1998), they showed that the portfolio of loser stocks are associated with a higher risk than winner stocks. The systematic risk measured in beta is therefore also not able to explain the premium from momentum strategies. The findings from both publications are not able to explain the profit by a higher risk, but rather raise questions by showing a higher volatility related to the portfolio of loser stocks.

The impact from macroeconomic cycles on the profitability of momentum strategies is relevant to investigate, and whether the risk from these is able to explain the premium related to momentum strategies. Several scholars including Griffin, Ji, and Martin (2003) have analysed whether macroeconomic risk is able to explain momentum profits. Their studies present evidence that there is no statistically significant relation between macroeconomic cycles and the profit of momentum strategies, hence macroeconomic risk is not explaining the momentum premium.

Fama and French (1993, 1996) applied their three-factor model and CAPM in an attempt to explain profit from momentum strategies. They showed that small companies are associated with a higher risk, but failed to convincingly explain the momentum profit by additional risk related to the portfolio with winner stocks.

Rouwenhorst (1998) investigated the average size of the stocks in the winner and loser portfolio, and found that the winner stocks are not smaller than those of the portfolio with losers. The profit from momentum strategies are therefore not explained by a size premium on small cap stocks either. Jegadeesh and Titman (1993, 2001), Grundy and Martin (2001) and Rouwenhorst (1998) also indicated that risk-based asset pricing models like the CAPM are not able to explain the momentum profit.

From above, it is clear that there is not one answer to the momentum profit by applying the traditional risk based view. The finding contradicts the notion of a Random Walk, and it is

appropriate to continue the quest for an explanation of the premium analysing some of the behavioural arguments.

2.4.2 Behavioural arguments to explain profit from momentum strategies

A previous section of this thesis attempts to explain the premium from momentum strategies by applying the traditional view where one assumes the investor is always rational and the absence of anomalies. The following will include the psychology of investors to explain the premium.

Several studies strive to explain the momentum profit by applying behavioural arguments. Among these are DeBondt and Thaler (1985), Baberis, Schleifer and Vishny (1998), Jegadeesh and Titman (2001), Griffin, Ji and Martin (2003) and Daniel, Hirshleifer and Subrahmanyam (1998). There is a consensus that the market is slow to react to new information causing an underreaction initially, while the market tends to overreact over longer periods. The first causes the price continuation, while the latter causes the mean reversal after roughly 12 months. However, the publications present slightly different explanations for the drivers behind the market trends.

Barberis, Schleifer and Vishny (1998) developed a model of investor sentiment that strives to explain how investors underreach to certain information such as earnings announcement while overreach to series of good or bad news. According to the paper, the under reaction to news in a horizon of 1 to 12 months causing the autocorrelation is a result of investors' conservatism and hence persistence in beliefs. When the investors are presented to a pattern of news (good or bad) pointing in the same direction they tend to view these as typical or representative of the stocks and ignore the law of probability. This is when the over reaction occurs according to the paper, and referred to as *representativeness heuristic* behaviour. They described representative heuristic as the tendency for the investors to believe that the extraordinary growth they have seen in the past will continue in the future in spite of the prices being at artificially high levels. Although, the conservatism in isolation will lead to

an underreaction, it will in conjunction with this behavioural tendency lead to an overreaction over time. In other words, these stocks with a string of good news receive extremely high valuations and the valuation therefore tends to converge towards the mean in the 3 to 5 years horizon, and hence dissapoint the investor (Shleifer, 2000).

Daniel et al. (1998) proposed the idea of informed traders suffering from "self-attribution" bias. In their model, investors observed positive signals about stocks in which some of them performed well after the signal. The cognitive bias of the trader will lead him to attribute the good performance of the winners to his stock selection skills, while that of the ex post losers to bad luck. The investor becomes over confident as a result and over the signals in the future which in turn keep pushing the prices to increase above the fundamental values. At a later point in time, the prices of these stocks will reverse to reflecting fundamentals.

Hong and Stein (1999) did not adhere to behavioral biases, but rather propose that two types of investors exists, who trade on different sets of information. The first group is the informed investor or as they refer to as the "new watchers", who trade based on some private information, but fails to extract information on prices. The other group is the "momentum traders" who trades on limited information of the prices, and try to follow the trend. The first group is causing the prices to react to news, but since not all are trading on the information it caused an underreaction at first. The latter group is trading bounded on the recent trend or price information, and is thus driving the overreaction, as they are not able to see prices being driven away from fundamentals.

Jegadeesh and Titman (2001) tested whether the behavioral explanations seem plausible from the momentum profits experienced in their study. The behavioral explanations above are in line with the profits found in their sample. The behavioral explanations vary in why the investor is expressing the reactions, and this is still widely debated today. Nevertheless, the insights from behavioral finance are providing valuable insights to what may explain the momentum premium.

In spite of academia not being able to provide a clear explanation of the profit from momentum strategies, the vast amount of research on the topic confirms its existence.

Extensive research has strived to measure and document the additional risk associated with momentum strategies, but all without luck. It leaves the question, whether the research has not been of sufficient quality or an anomaly which allow the investor an excess return without taking on additional risk is actually found?

If the latter is the case, the investor will benefit from using momentum strategies when selecting stocks to hold in her portfolio. Applying the insights from momentum strategies will allow the investor who is already exposed to fundamental risk, to increase the risk adjusted return by capitalizing on the insight that stocks include autocorrelation.

2.5   Combination of momentum and value

Knowing that both momentum and value strategies produce an excess return which academia has not been able to explain by increased risk, it is desirable to investigate whether these strategies are able to provide a synergy for the investor. The two strategies are rather different in nature, as the value strategy relies on a long holding period and stocks that are out of the spot light while momentum strategies are primarily useful in the short or intermediate term and focusing on stocks that are already in a trend discovered by investors.

In general, the key consideration when combining different investment strategies is to identify methods that add value in their own way, and has a low correlation with the added value from the other method (Asness, 1997). Given the difference in nature of value and momentum investing, it is rather interesting evaluating how well these strategies are able to perform combined.

Litterature on combining value and momentum strategies are unfortunately limited. Asness (1997), Swaminathan and Lee (2000), Bird and Whitaker (2004), Asness, Moskowitz, and Pedersen (2013) are among the few studies that analyse how momentum and value strategies can be combined.

Asness (1997) documented a negative correlation between value and momentum strategies, and investigated how the strategies are peforming holding the other one constant. From the study it is argued that value performs best holding momentum constant, and vice versa. In spite of the negative correlation between the two strategies, the study concluded both strategies are appropriate in isolation. More than a decade later, Asness, Moskowitz and Pedersen (2013) presented a study showing combining the two strategies provided an excess return.

Bird and Whitaker's (2004) published a paper that includes an analysis of how more complex combinations of value and momentum strategies pay off. In particular, they combined the criterias from both momentum and value to understand the performance of momentum within value stocks, and within growth stocks. They built on the knowlegde from Bird and Gerlach (2003) that a large share (approximately 55 percent) of the value stocks underperform, and the excess return from using a value strategy is driven from a selection of very strong value stocks. Sorting by both a value and momentum criteria allowed them to form portfolios with some of the better value stocks.

The findings are similar to Swanminathan and Lee (2000), who also documented that using both value and momentum criteria when forming portfolios were advantagous, and capable of providing strong return.

It appear from research that combining momentum and value, the investor is able to increase the return additionally compared to the strategies in isolation. The next section will elaborate on some of the explanations for why combining the two strategies may be advantagous.

2.6   Value trap

The fact that the return of value strategies increases when the investor is not blindly buying value stocks from the book-to-market ratio, but includes other metrics as well such as momentum, is a strong indicator that not all value stocks are a good purchase. In the light

of Bird and Gerlach's (2003) finding that 55 percent of value stocks do not outperform, it is relevant to go a layer deeper and understand why some of the value stocks are not delivering.

Value companies characterized by their book-to-market ratio is trading at a low price. However, there are several reasons why the company are trading at the low price. The low price is possibly a result of investors and the market in general underestimating the company, and as found by Laknishok, Shleifer and Vishny (1994), the earnings are to remain stable or increase in the near future, and hence a good purchase. This will be further discussed in section 6. However, the low price may also be explained by a company where the underlying fundamentals truly fall apart, and hence the low value is for a very good reason. These companies are referred to as "value traps", and buying such a company which prices continue to fall is like catching "falling knives" (Truitt, 2013).

The good value investor becomes quite a bargain hunter who strives to identify and buy the companies that are truly bargains, and not just trading at a low price. Warren Buffett quoted in his letter to his shareholders in 1989, after realising an investment in a company at a low price, that is not necessarily equal to a return describes the concept very well:

"It's far better to buy a wonderful company at a fair price than a fair company at a wonderful price."

Berkshire Hathaway (1989)

The quote sums it quite well, that in spite of the low price not all value companies are a bargain. He has since used the quote quite frequently, and emphasized that the good value investor is the investor who is able to identify these companies and avoid investing. He even go as far as, to say that minimizing your mistakes is what makes a good investor (Berkshire Hathaway, 1989).

The high returns achieved by Bird and Whitaker (2004) is likely explained by having less value traps in their portfolio. It is a very rough way of sorting out value traps, but the fact that they are sorting out stocks that have not increased in price over the past six months will practically imply, that the portfolio includes less companies where the fundamentals are

truly out of line. After a value trap start falling in price, it will most likely keep falling and as a result not meet the momentum criteria to qualify for the portfolio. Combining momentum and value is therefore likely to be a good way to enhance the value strategy, and ensure that the quality of the value stocks in the portfolio is higher. The value stocks that are characterized as winners, are value stocks that is acknowledged by other investors, and more likely not to be a value trap. However, the fact that the value stocks the investor are holding have increased in price over the last six months, will obviously imply that you are not buying the stocks at the very lowest point.

3. Research Design and Methodology

The method used in the thesis is inspired from other academic studies on similar data sets to make the findings as robust as possibly avoid bias, errors and other pitfalls. However, findings and conclusions of this study rely to a large extent on the results from analysis of large data sets. These data sets extracted from different data sources, and the reliability of these data sources are therefore crucial to this study. If the data sources contain unreliable data or errors it will jeopardize the results of the study. This section will therefore shed light on the data sources used, the methodology for conducting the analysis, and how the data are processed and validated.

3.1   Sources and creditability

Thomson Reuters Datastream and Bloomberg are the two data sources used to extract the data on the stocks traded on Copenhagen Stock Exchange. To gather, and analyse the raw data Microsoft Power BI and Microsoft Excel are used. The use of four applications, and how they have complimented each other to provide the results of this thesis will be described in the following.

3.1.1   Thomson Reuters Datastream

Datastream is a financial time series database that contains historical data from financial markets across the world. It is a well-known and commonly used database within the financial industry. Raw data on the stocks traded on Copenhagen Stock Exchange including price, market value, book-to-market value and other metrics used in the analysis is extracted using the Excel plug-in and access provided by Copenhagen Business School.

3.1.2 Bloomberg Terminal

The Bloomberg Terminal is maybe the most respected and well known system to extract and analyse data within the financial sector. The Bloomberg Terminal contains similar data sets but since it is a different provider, the data are useful to validate the data provided by Datastream. Additionally, return on indices such as the C20 is extracted from the Bloomberg Terminal.

3.1.3 Microsoft Excel

Microsoft Excel is the tool used to gather the data from Datastream and Bloomberg in a structure that allows an analysis of the performance across the portfolios. The application is also used to screen, sort and correct the data provided by the databases. Excel is the primary tool used to analyse the data, and a very transparent tool that allow a validation of every step in the analysis process.

3.1.4 Microsoft Power BI

Microsoft Power BI is an application that allows analysis of larger data sets, and hence allows a more complex data modelling than what Excel is capable of processing. Both applications are provided by Microsoft which implies that data are easily transferred among the two applications. In the analysis process, Microsoft Power BI is used when the complexity exceeds what is feasible in Excel.

3.2 Data screening

One thing is to ensure the credibility of the source and tools to process the data for analysis meet expectations, but equally as important is it to screen and test the reliability of the data extracted. Screening the data should generally be done in all the stages throughout the analysis process with an exhaustive screening of the raw data before initiating the analysis. The screening approach is inspired by the approach recommended in the article by Ince and

Porter (2006) where they investigated the best way to handle data from Datastream to avoid bias and errors in samples.

The screening of the data is divided into a static and dynamic screening. The static screening ensures the raw data meet expectations while the dynamic ensure the quality of the data throughout the analysis.

3.2.1 Static data screening

The static screening is based on the raw data to ensure the sample only consists of the right asset classes and types of stocks. The static screening will allow the sample to be adjusted for: i) dual listings, ii) different asset classes, and iii) different types of shares.

3.2.1.1 Dual listings

Several companies are listed with several stocks on Copenhagen stock exchange. A. P. Møller-Mærsk is one of the companies which are listed with both an A stock and B stock. Unless one of the stocks is removed, the performance of the company will be weighted with twice the weight and make the results biased. The sample is therefore analysed for dual listings, and all stocks that are not the primary stock of the company are excluded from the sample. Datastream categorize these stocks as "Major" and the sample is filtered only to include "Major" listings. Furthermore, a few companies are listed on several stock exchanges, and sorting by "Major" stocks are also excluding stocks from different countries with minor part of their capitalisation listed on Copenhagen Stock Exchange.

3.2.1.2 Asset classes

This study is limited only to analyse the performance of equity, and all other asset classes are therefore excluded. Datastream categorizes assets into "Stock Types" where "Equity" is the category including all equities. To ensure Exchange Traded Funds and other similar notes traded on Copenhagen Stock Exchange are excluded, the "Trade Description" in Datastream is used to only include "Ordinary Shares".

Additionally, to ensure the sample is only containing common shares and not preferred shares, "Advance Search" function in Datastream allows a further sorting by "Common Shares"

3.2.2   Dynamic data screening

Following the static screening of the data, a dynamic screening was made to ensure the stocks include reliable and all the required data throughout the entire period of the sample.

3.2.2.1 Missing data

The static screening of the sample reduced the listings to 287 listings. However, not all of these listings include the required data for the analysis. All the listings which did not include reliable data on Price, Market Value, Price-to-Book Value and Total Return Index were also excluded from the entire period. The listings with missing data imply the sample is further reduced only to include 262 listings. Dependent on whether the missing data are randomly distributed across the population or it is more common between specific types of companies excluding companies from the sample can create bias. For instance, if small companies are more exposed to errors and missing data it may imply bias in the sample. This is further explained in the section about bias.

3.2.2.2 Mergers and delistings

The Total Return Index, which will be mentioned later in the thesis, accounts for stock splits and dividends, but not mergers, takeovers and delistings. The Total Return Index will show a return of zero in the periods following these events, and if not adjusted correctly it will likely imply a biased return. Every time a merger, takeover or delisting occurs the Total Return Index will report a return of zero in all the following periods. These are manually adjusted by simply excluding these. The Total Return Index will therefore reflect what the investor will actually receive. A similar problem occurs in case of companies going bankrupt. In these instances, Datastream reports a return of zero which will have no impact

on the portfolio return. The observation is therefore adjusted to reflect – 100 percent in cases where the investor is holding a stock which becomes worthless.

3.2.2.3 Penny stocks

Datastream is only including two decimals in the price. If the price of a stock is very low, rounding the price will imply artificial high return. Furthermore, two other observations in the dataset seem to be very high due to an error in the data set. Three return observations have therefore been removed to account for either error or penny stocks with a rounding in price causing unrealistic returns. The approach of removing these observations is similar to the study by Schmidt et al. (2011)

3.3   Elaboration of the sample

There are several aspects of the sample which are important to understand before analysing the results. The time period chosen and the size of the sample are crucial in order to understand the reliability of the sample. The following section will shed light of the reasoning behind this along with what biases it may imply and how these are treated to maintain the reliability of the results.

3.3.1   Size and time period of the sample

In choosing the time period subject to analysis, it is advantageous to include as many observations as possible since too few periods will make it more difficult to find statistical significant results. However, it is also crucial to include enough observations to mitigate the results being determined by a few companies maybe within the same industry making the results biased and not necessarily a result of either the momentum or the value phenomenon.

Datastream contains data back to 1973, however, the amount of observations is very limited in the first years. Furthermore, Schmidt et al. (2011) also reported issues with the data in the first years. The study is limited to companies traded on the Copenhagen Stock Exchange, and the stocks with reliable data before late 1990s are primarily large cap companies. The study strives to include the impact from mid and small cap stocks on both value and momentum strategies since the empirical evidence including these companies is very limited. The sample is therefore including stocks from June 1999 up until 2017.

3.3.2 Bias

The static and dynamic screening described previously serves the purpose of eliminating errors and thereby avoiding bias in the sample. Errors, and unreliable data will cause the sample not to be representative for the population, and the output of the analysis useless. In spite of such screening, there are several other elements that may cause bias to the sample used for the analysis.

If the few corrections are randomly distributed, the damage will be limited. However, if the corrections are related to a specific industry, size of company or other characteristics it will imply a bias in the sample.

Another reason for unreliable results is what is referred to as "data mining" or "data snooping". It is a typical pitfall which arises when an analysis of data is completed with a certain outcome in mind or desired. This study strives to find anomalies which result in excess returns from using the principles of value and momentum strategies to form the ideal portfolio. The person doing the analysis may therefore in the quest to find the highest excess return unconsciously change the approach in favour of the desired outcome. For instance, if the period used to identify momentum adjusted several times, or the definition of other criteria for constructing the portfolio is adjusted based on what produce the very highest excess return, the results will be due to "data snooping". It will imply the results hold within

the sample, but not necessarily out of sample. This will produce results which only appear in the used sample, and therefore not replicable out of sample. Data snooping or data mining issues will therefore not provide valuable information to the investor, but rather mislead the investor in constructing a portfolio that will not succeed in the future. Most of the first academic studies were in particular criticized from advocates of efficient markets for publishing findings based on "data snooping". This is one of the reasons why Jegadeesh and Titman (2001) published a paper ten years after their first publication of the findings with a sample extended with 8 more years.

Back testing a sample as has been done in this study will also be exposed to look-a-head bias if one is not careful. An example of such, is constructing the portfolio based on data which were not available to the investor at the given point of time. The book-to-market value for the end of year will not be available to the investor before the annual report is published, and look-ahead-bias is why the study uses book-to-market values from December to form the portfolio in July the following year.

3.4   Portfolio Construction

3.4.1   Value and momentum indicators for trading

To construct the portfolios, the thesis is inspired by the approach used by Bird and Whitaker (2004) and Asness, Moskowitz and Pedersen (2013). In both studies they highlighted that they used a single criteria for value and momentum, as they were not seeking to come up with the best predictor of returns in each asset class, but rather test whether the strategy yielded an excess return. The benefit from testing several different criteria to find the best proxy has proved to yield only marginal improvement while it may increase the risk of data snooping. Using only one criteria, and not trying several different across the sample to back test which criteria yields the very best return in this sample, will therefore provide better insights for what the investor is able to expect out of sample. The thesis is therefore primarily using one criteria for value, and one criteria for momentum.

3.4.2 Definition of value

In particular, all the stocks are ranked separately and accordingly to one criteria at a time. For value, the criteria used to rank all the stocks are book-to-market value. Similarly to Asness et al. (2013) and Risager (2013) the book-to-market value is lagged 6 periods to avoid look-a-head bias. The investor is simply not able to respond to the reported book-to-market value before the earnings announcements are published which will be accommodated by lagging the book-to-market value 6 periods in the sample.

Based in the book-to-market ratio, the highest 30 percent of the stocks are categorized as value stocks. The middle 40 percent is excluded, while the lower 30 percent is categorized as the growth stocks. In some academic studies, the stocks are ranked into percentiles, however, these definitions are widely used in academic studies including Fama and French (1992).

3.4.3 Definition of momentum

For momentum, the stocks ranking are accordingly to their percentage change in price from six months to one month prior portfolio formation, to avoid an impact from the mean reversal. See equation below, where t is the period in months and m is the variable used for determining the degree of momentum:

$$m_t = \frac{P_{t-1}}{P_{t-6}}$$

Based in the degree of price momentum, the stocks are divided into winners and losers, respectively. All the stocks are used in momentum strategies, and hence 50 percent with the highest increase in price prior formation are referred to as winners, while the 50 percent with the lowest increase in price are referred to as losers.

In the strategies where value and momentum are combined, the stocks are first ranked into value, middle and growth stocks dependent on criteria described above. Secondly, the stocks

within the categories are then divided into winners and losers dependent on the price momentum defined above.

3.4.4   Formation and holding of portfolios

As previous mentioned the investment horizons of a value and momentum investor are different in nature, since the momentum strategies rely on shorter term profits while value typically is associated with profits over long time horizons. The interval between holding and rebalancing of momentum and value portfolios would usually deviate as a result. However, as this thesis strives to determine the ideal investment strategy capitalising on the best from value and momentum, it seeks to use the ideal interval for combining the strategies, and these horizons will therefore be applied on all the portfolios used throughout the analysis.

Rebalancing the portfolios every month is sometimes used within momentum investing, and is a reasonable period for an investor who wishes to capture momentum profits (Shleifer, 2000). In value investing, rebalancing every month is a high frequency. Many value investors hold the stocks for one year with success and therefore avoid unnecessary transaction costs and capture the full value (Risager,2013; Fama and French 1998; Asness et al. 2013). To capture the value added from both strategies this study will use a holding period of one year.

3.5   Calculation methodology

To calculate the return of the portfolios, the Total Return Index (RI) is used which calculates the return adjusted for both stock splits and dividend paid out. RI is calculated as follows, on the individual stock level (RI_i) where dividend is D_i and price of the stock is P_i:

$$RI_{i,t} = RI_{i,t-1} * \frac{P_{i,t} + D_{i,t}}{P_{i,t-1}}$$

The return of the stock is derived as change in RI from last period. A simple arithmetic average is used across the stocks to calculate the cumulative return over several periods of the portfolio (RI_p).

$$RI_p = \sum_{i=1}^{n} \frac{1}{n} * RI_i$$

The analysis is primarily using equally weighted returns as calculated from above calculation. However, when the value weighted returns deviates or for other reasons is relevant, the results will be included. The value weighted returns will be calculated as follows, where MV_i is the market value of the individual stocks and MV_p the market value of all the stocks in the portfolio.

$$RI_p = \sum_{i=1}^{n} \frac{MV_i}{MV_p} * RI_i$$

The analysis is including both the equally weighted returns and the value weighted returns in the thesis, but if the results are similar the thesis will primarily discuss equally weighed as this will not be biased towards the performance of a few very large companies. On the Danish Stock Exchange, and in the Danish C20 index, the value weighted returns is heavily dependent on Novo Nordisk and Maersk due to their relatively high market capitalization. The value weighted returns may therefore be an indication of Novo Nordisk and Maersk's performance rather than the returns provided by momentum and value strategies. However, the market capitalization of a company may have an impact both on risk and transaction cost for which reason it is valuable information to both the value and momentum investor when the two returns deviate, and hence the thesis will shed light on this.

To test whether the return from the different portfolios are significantly different, a simple calculation of the t-statistics is used. The approach is similar to Bird and Whitaker (2004), where the mean returns of the portfolios are compared to determine whether the excess returns from holding the preferred portfolios are significant.

The thesis is also using the Sharpe ratio as a simple way to understand whether excess returns is easily explained by increased risk, or it is actually an anomaly or something that is more difficult to explain with the risk based argument. Similarly, the risk measure used in CAPM, beta is used to measure and understand risk associated with the different portfolios.

4. Empirical Results and Research Findings

This section of the thesis will show the results from the analysis on value and momentum strategies. The results will be presented to answer the research question of this study, and hence in particular shed light on the details that are relevant for the investor who seek to exploit and capitalize on the insights from value and momentum investing.

The thesis will first present empirical findings from an isolated analysis of the value premium to provide insights on whether the value premium have been present over the recent years, and to what degree. The findings from this analysis will allow the reader to get an idea of the benefit from including the value strategies in the combined portfolio.

With results presented on the value premium, the thesis will shed light on the results on the momentum premium, and focus on presenting to what extent an additional return would have been produced from applying a momentum strategy over the recent years on the Danish stock market.

The thesis will then present results on how the insights from the first two analysis have provided a deeper understanding to allow the analysis for the best combination of the two. The combination of these is building on previous research in particular the study by Bird and Whitaker (2004), along with the findings from analysing value and momentum individually.

Lastly, the study will apply the behavioural explanation of the value premium provided by Lakonishok, Schleifer and Vishny (1994) to the data from the Danish stock market, as this is one of the explanations that have received increasingly consensus throughout the past decades in explaining the value premium. The study will also shed light on the model presented by Shleifer (2000), which is in line with Warren Buffet's Mr. Market who states momentum profits is a reflection of markets being slow in reacting to new information. The two phenomena will be discussed in depth, as it is obviously crucial for the investor to know

why momentum and value strategies have produced excess returns in order to have an idea of whether the premiums should persevere in the future.

4.1   Value premium

Analysing the stocks traded on Copenhagen Stock Exchange over the last 17 years it appears from figure 1, that the value investor has been able to generate the highest mean annual return compared to the growth portfolio, the entire sample, and OMX Copenhagen 20 (C20) Index. By holding a portfolio with the 30 percent of the stocks with the best value based on book-to-market, the value investor produced a mean annual return of 12.8 percent. The annual returns is 5.1 percent higher than the portfolio containing growth stocks, and 3.5 percent higher than all the stocks in the sample, representing the market portfolio. The value premium seems to be present, and hence excess returns has been produced by holding value stocks over the full period compared to holding growth stocks, but also compared to all the stocks traded on Copenhagen Stock Exchange.

Figure 1
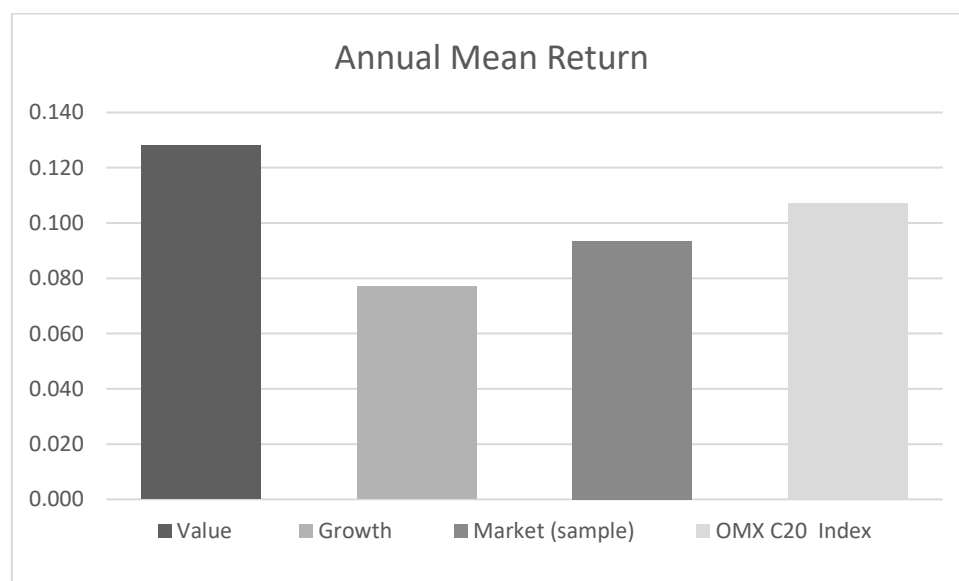
A common portfolio to hold for the investor in Denmark is a replication of the C20 Index which contains the 20 most traded stocks on Copenhagen Stock Exchange. It is a market value weighted portfolio, which differs from the returns in the rest of figure 1 which is equally weighted. The investor who replicated the C20 Index would have been 2.1 percent worse off than the value investor over the last 17 years. It is also worth noticing from table 1 that the standard deviation of return of the C20 Index is higher than the standard deviation of holding the value portfolio, which may indicate a higher risk associated with C20. The standard deviation will be further discussed later in the thesis, however, it is important to keep in mind the C20 Index is limited to 20 stocks, and the value weighted returns further implies returns are highly correlated to the stocks with the highest market capitalization. Stocks such as Novo Nordisk and A.P. Møller-Mærsk are worth significantly more than the smaller stocks in the portfolio, and a good (or bad) year for these individual stocks will have an impact on the returns. Novo Nordisk did particularly well in 2015, but disappointed in 2016, which both is reflected in the returns of the respective years.

From figure 1 it is clear the value premium has been present over the full period, however, the value premium does not appear in all the years of the sample. Looking at the particular years in table 1, the value premium disappeared in 2000, 2004, 2006, 2011, 2012, 2014 and 2015.

Recall from the literature mentioned in the first section of this thesis, the value premium is generally outperforming on average across several years, and in some years disappearing. The value premium disappeared in 1998, 1999, 2007 and 2009 in United States, while 1999 and 2005 in Japan (Risager, 2013). From the results, it is therefore not possible to make any conclusion on whether or not the value premium is present to a lesser extent in Denmark. The value investor should simply not expect to generate excess returns every year, but rather on average over longer time horizons. However, it is worth noting the fact that the value premium has actually not been present in the last four out of six years on the stocks in the sample representing the Danish stock market.

Table 1

	Value	Growth	Market (sample)	Value Premium	OMX C20 Index
2000	0.310	0.578	0.401	-0.268	0.228
2001	-0.112	-0.144	-0.135	0.032	-0.137
2002	-0.029	-0.315	-0.179	0.287	-0.263
2003	0.434	0.202	0.306	0.232	0.225
2004	0.367	0.433	0.388	-0.065	0.173
2005	0.543	0.318	0.395	0.225	0.373
2006	0.235	0.262	0.250	-0.027	0.122
2007	-0.027	-0.145	-0.091	0.118	0.051
2008	-0.212	-0.314	-0.280	0.102	-0.466
2009	0.204	-0.011	0.100	0.215	0.359
2010	0.014	0.000	0.025	0.013	0.349
2011	-0.121	-0.051	-0.079	-0.070	-0.148
2012	0.040	0.045	0.046	-0.005	0.272
2013	0.336	0.108	0.195	0.227	0.241
2014	-0.009	0.108	0.039	-0.118	0.209
2015	0.064	0.146	0.096	-0.082	0.362
2016	0.139	0.092	0.111	0.048	-0.128
Mean Return	0.128	0.077	0.093	0.051	0.107
Std. Dev	0.209	0.234	0.202	0.148	0.242
t-stat	2.523	1.361	1.909	1.421	1.825
p-value	0.0113	0.0962	0.0372	0.0872	0.0433
	Value	Growth	Market (sample)	Value Premium	OMX C20 Index
Mean Return	0.128	0.077	0.093	0.051	0.107
Std. Dev	0.209	0.234	0.202	0.148	0.242
Sharpe Ratio	0.61	0.33	0.46	0.34	0.44

Looking at the t-statistics from table 1, it is clear the value portfolio produces significant positive returns at a 5 percent significance level. The returns from going long the value stocks while shorting growth stocks produce a lower return, which is only significantly different from zero at a 10 percent level. The profit from cost neutral portfolio by going long value stocks and short growth stocks has produced a sizable return over the past, however, not significant at a 5 percent level. The mean annual return from holding value stocks has also been able to beat both average for the full sample and the C20 Index.

From an investor point of view, if she is able to short the market the cost neutral portfolio has been satisfactory while the investor without these possibilities would also have been able to beat the market. The findings of the value premium is in line with previous research

discussed in earlier sections, and it is therefore alluring for the investor to set up a portfolio based on the same sorting criteria for the future. However, it is important to remain sceptical for the findings, and keep in mind that findings from historic data are not necessarily equal to the future. On a side note, as Warren Buffet wrote to his shareholders in 2008:

"Investors should be sceptical of history based models. Constructed by a nerdy-sounding priesthood using esoteric terms such as beta, gamma, sigma and the like, these models tend to look impressive. Too often, though, investors forget to examine the assumptions behind the symbols. Our advice: beware of geeks bearing formulas".

Berkshire Hathaway (2008, p. 15)

This study strives to deduce learning from past trends, and capitalize on these in the future for which reason the message from Warren Buffet is highly relevant. The findings assume the past looks like the future, which is obviously not always the case, for which reason it is very important to understand the drivers and what may cause these to change.

This is also one of the reasons why this study strive to discuss what is actually the underlying psychological drivers behind the anomalies and patterns discovered by value and momentum investing. If the investor understands what assumptions, and behavioural patterns are required to exist for momentum and value premiums to appear, she may be more qualified in determining what to expect in the future.

4.1.1 Risk in the portfolios

From previous section, it is clear that value stocks traded on Copenhagen Stock Exchange have produced an excess return over the full period. However, as mentioned in the literature review, the traditional risk based view attempts to explain the excess returns by increased risk. Whether the value portfolio is associated with additional risk compared to the growth portfolio can be evaluated by analysing the standard deviation of return, the Sharpe ratio of the portfolio, and the beta from the asset-pricing model CAPM.

If we compare the standard deviation of the two portfolios from table 2, it actually appears that the standard deviation of the value portfolio is lower than the growth portfolio. The standard deviation of the value portfolio is also lower than both the growth and the C20 Index while the return is higher, and hence the argument from the risk based view does not appear very convincing based on the sample from this study.

If we continue to derive the Sharpe ratio from the return and standard deviation, the risk adjusted returns of the value portfolio is therefore still exceeding the growth and C20 Index. The cost neutral portfolio is associated with a lower standard deviation compared to the remaining portfolios, however, adjusted for risk the Sharpe ratio is still highest for the pure value portfolio. Especially in terms of capital and current assets, the investor profile will have an impact in whether the pure value portfolio or the cost neutral portfolio is advantageous. This will be further addressed later in the thesis.

From both the standard deviation and Sharpe ratios associated with the different portfolios, if the risk based view claiming additional risk associated with increased returns, it is not something which is captured in the traditional measures for risk standard deviation of returns, in the sample of this study.

Table 2

	Value	Growth	Market (sample)	Value Premium	OMX C20 Index
Mean Return	0.128	0.077	0.093	0.051	0.107
Std. Dev	0.209	0.234	0.202	0.148	0.242
Sharpe Ratio	0.61	0.33	0.46	0.34	0.44

Dimson, Marsh and Staunton (2009) investigated the long term return relative to return variances across a number of countries. The detailed overview is provided in appendix 1. In Denmark they found a return to risk ratio of 0.22 and across the countries it was on average 0.3. The standard deviation found related to the value portfolio being lower than the growth, however, if we use the ratios presented by Dimson et al. 2009 and crudely estimate the hypothetical standard deviation required to make the risk based explanation hold, it will have to be significantly higher. In particular, using the value from Denmark and the average from all the markets they investigated, a one percentage point increase in risk should be

associated with 0.22 and 0.3 percentage point increase in return respectively. It will further imply the excess return of 5.1 percentage points will have to be explained by approximately 23 percentage point higher standard deviation for Denmark, and 17 percentage point higher on average across the countries. The calculations are very crude, and should therefore be treated with caution, however, it illustrates that the standard deviation of returns associated with the value portfolio will have to be significantly higher to justify the excess return by the level of volatility associated with the value portfolio.

The finding is similar to the evidence presented in literature, and discussed in previous sections. The risk captured in volatility is simply having difficulties explaining the return from value stocks over the past years. This will be further discussed later in this thesis.

A different and very used measure of risk is beta, which is in particular crucial in the well-known asset pricing model, CAPM, we continue the increased risk explanation, and compare the findings to CAPM, and how risk is measured by the covariance of the market, reported in table 3.

Table 3

	Value	Growth
Beta	0.912	1.035

From table 3, it appears the beta of the growth portfolio is higher than the beta associated with the value stocks. CAPM is therefore not indicating a higher risk associated with investing in value stocks, and hence this explanation for the value premium is also not convincing.

4.1.2 Value premium and market size

A correlation between size and the book-to-market value is likely to exist, and stocks characterized as value stocks may in general have a smaller market capitalization than growth stocks, or vice versa. The size of a company is likely to say something about the

returns, and Fama and French (1993) showed that small cap stocks produce a higher return than large cap.

If value stocks in general have a smaller market capitalisation than growth, the size may have an impact on the return produced, and explaining some of the findings above. It is therefore relevant to understand the market value in the portfolios, and whether the value premium can be explained by a large number of small cap stocks.

Table 4 shows the average market value of the stocks included in the three groups based on book-to-market value. From the table it is clear that value stocks in general are smaller than growth stocks.

Table 4

	Share of stock count	Avg. Market Value (mDKK)
Value	30%	3453
Remaining stocks	40%	4927
Growth	30%	5320

Fama and French (1993) showed that on stocks in the United States, there was a size premium related to smaller stocks, and hence it could explain some of the value premium. It is therefore relevant to understand whether small cap stocks have produced a higher return than large cap on the Danish stock market in the period. Figure 2, shows that there is a premium related to small cap stocks, however, the premium is rather small and hence not able to justify the full value premium found.

Figure 2
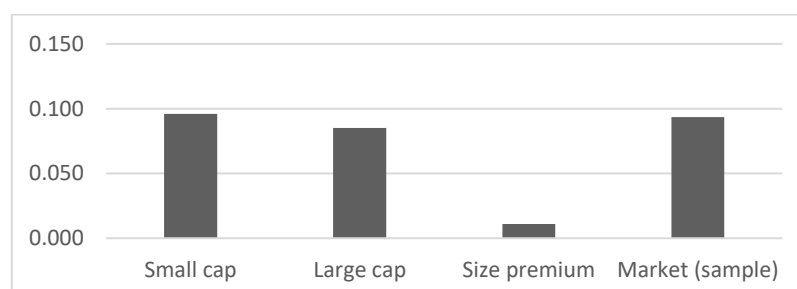
Intuitively, the fact that small cap stocks seem to outperform large cap makes sense, since the risk related to these are said to be higher and the liquidity lower which will require the investor who are holding small cap stocks to be compensated. However, the risk argument is not holding when these are in a value portfolio related to both a lower standard deviation and beta.

4.1.3 Conclusion

From the results, it is clear that sorting stocks based on the book-to-market value will allow the investor to produce significant positive returns, which seems to beat the market represented by the full sample, and the C20 Index. Not all returns produced from holding value stocks are statistical significantly different at low alpha levels, however, the results replicate trends and returns which have been presented in different literature using other independent samples, and the insights are therefore valuable to the investor.

Neither the standard deviation nor beta from CAPM is able to justify the value premium by showing an additional risk associated with value stocks. The risk based view is therefore not convincingly explaining the findings.

Returning to our sub research questions asking to what extent the value premium occur in recent years, one can conclude that the value premium occurs in some years but not all. In particular, it is worth to notice that the value premium has been limited over the past six years. However, the value investor who sticks to the principles, and in this case has value stocks in her portfolios over the full period of the sample was rewarded, and hence the next sub question is addressed.

4.2   Momentum premium

This section will shed light on the performance of applying a momentum strategy on the stocks traded on Copenhagen Stock Exchange over the past 17 years, and provide an overview of the profits achieved over the years from applying such. It will further investigate the volatility and other details that are relevant for an investor who strives to understand and use the insights to construct an investment strategy. As described in the previous section, the method of which the momentum portfolio is constructed is inspired from Bird and Whitaker (2004) to minimize the risk of data snooping in the results.

Figure 3 shows that applying a momentum strategy with a period of six months as the basis for forming the portfolio, and a holding period of minimum a year for the winners produce annual mean returns of 13.5 percent during the full period. The winner portfolio is thus producing an excess return of 4.2 compared to the market, and 8.3 compared to the portfolio containing past losers. Holding a cost neutral portfolio where the investor goes long winners, and short losers produces a profit corresponding to an annual mean return of 8.3 percent over the full period.

Figure 3
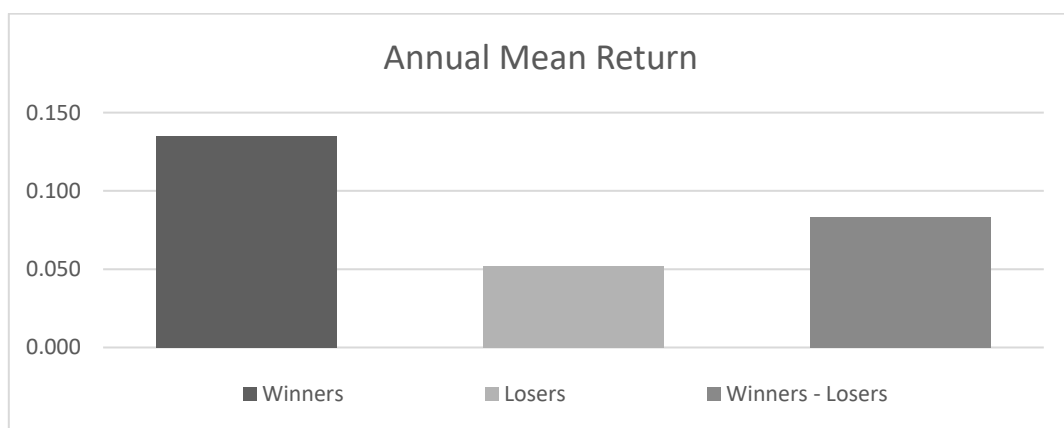
The profit is low from the cost neutral portfolio compared to the profit of approximately 11.4 percent reported by Jegadeesh and Titman (1993), and as mentioned in the literature review. The market, the time period, and the holding period may be some of the factors that caused the momentum strategy to be more favourable applied in their study. They studied stocks in United States from 1965 to 1989, and used a holding period of 6 months. The returns from using a holding period of only six months is also investigated in this study, and reported in table 5.

Table 5

1 year holding	Winners	Losers	Winners – Losers	Market (sample)
Mean return	0.135	0.052	0.083	0.093

6 months holding	Winners	Losers	Winners – Losers	Market (sample)
Mean return	0.141	0.046	0.095	0.093

A shorter holding period produces higher mean return of 14.1 percent which corresponds to an excess return of 4.8 percent compared to the market, and a profit from going long winners and short losers of 9.5 percent. This is closer to the profit achieved in the study by Jagadeesh and Titman in 1993. However, the returns is only marginally higher, and as the study strives to construct the best combination of momentum and value strategies, and not the best momentum strategy in isolation, the study will therefore use a year as the holding period. Bird and Whitaker (2004) showed that in the case of combining momentum and value strategies, a holding period of one year may be advantageous to exploit the synergies from both strategies. Value investing is in general a strategy with a longer time horizon which is why a holding period of six months is not necessarily a sufficient horizon to extract additional returns from value stocks. This will be further addressed in the next section. For now, it is worth noting that a holding period of six months produces marginally higher

returns over the entire period, but given the objective to find the ideal combination of momentum and value, the one year holding period will be the one discussed in detail.

From table 6, the annual returns with a holding period of one year for winners and losers are reported. Additionally, the profit from constructing a cost neutral portfolio by going long winners, and short losers is also reported in table 6. Except for three years, the premium from holding winners occurs in all years over the period. The standard deviation of holding the winners is lower than what is associated with buying losers, and from the results it appears that investing with these holding periods, it is paying off to buy stocks that are upward trending in price. The mean annual returns of holding winners even exceeds the value premium on the stocks in Denmark over the period from 2000 to 2017.

Table 6

	Winners	Losers	Winners - Losers
2000	0.580	0.222	0.358
2001	-0.090	-0.180	0.090
2002	0.019	-0.377	0.396
2003	0.350	0.263	0.087
2004	0.309	0.467	-0.158
2005	0.410	0.381	0.029
2006	0.252	0.248	0.004
2007	0.010	-0.191	0.201
2008	-0.311	-0.248	-0.063
2009	-0.009	0.209	-0.218
2010	0.034	0.015	0.019
2011	0.012	-0.170	0.182
2012	0.050	0.042	0.008
2013	0.338	0.053	0.285
2014	0.053	0.024	0.028
2015	0.116	0.075	0.041
2016	0.175	0.047	0.128
Mean Return	0.135	0.052	0.083
Std. Dev	0.209	0.224	0.160
t-stat	2.661	0.950	2.153
p-value	0.0085	0.1781	0.0234

The profit from holding a cost neutral portfolio is on average over the period producing a return of 8.3 percent. It is worth to notice, the standard deviation of the cost neutral portfolio is rather low which will be discussed further in relation to the risk associated with the

momentum portfolios. Additionally, both the winner and cost neutral portfolio produce significant returns.

4.2.1 Risk and momentum investing

Similar to what was discussed in relation to the value portfolios, it is relevant to take a look at the risk related to holding the momentum portfolios. As previously described, if the risk based view is to describe the profit from the cost neutral trading strategy, and why winners produce a higher return than losers, the variance in return must be higher. The following will start out by discussing how the standard deviation of returns varies and how that can be related to the returns produced. Hereafter, the covariance of the returns compared to the market, will be used as a different measure for risk, and referred to as beta from CAPM.

From table 7, it appears the standard deviation related to the momentum strategy of buying past winners is 1.5 percentage point lower than holding losers. This is very much on the contrary to the risk based argument which states the higher the returns, the higher the risk associated, and hence standard deviation. It further implies that the Sharpe ratio of holding the portfolio with winners are higher than losers, and the investor should strive to identify and hold winners as a result.

Table 7

	Winners	Losers	Winners - Losers
Mean Return	0.135	0.052	0.083
Std. Dev	0.209	0.224	0.160
Sharpe Ratio	0.65	0.23	0.52

The zero cost portfolio of going long winners and short losers are related to a lower Sharpe ratio, however, as previously described, there are some advantages of holding a cost neutral portfolio. The standard deviation of the cost neutral portfolio is remarkable low, and this portfolio seems to produce a persistently positive return. The annual return produced of

going long winners and short losers provide a return 5.2 percentage points below the winner portfolio, but also a standard deviation that is 4.9 percentage points below the portfolio of winners.

To analyse how the return of the two portfolios move with the market return, the beta is reported in table 8. From the results, the risk related to holding the winner portfolio seems to be lower, and hence the beta is not convincingly explaining why there is a premium related to winner stocks.

Table 8

	Winners	Losers
Beta	0.904	0.979

4.2.2 Conclusion

From the results, it appears that a relatively simple investment strategy of buying stocks that have performed well in the past six months, and selling stocks that have performed poorly produce a positive return. Similarily, buying stocks that have performed well in the past and hence holding the winner portfolio produce a return above that of the losers, and the market. Neither the standard deviation nor the beta of the portfolios is able to explain a higher risk related to this investment strategy.

Returning to the sub research questions, the momentum strategies have proved to deliver a profit over the recent years on the Danish stock market. It is only in three out of the seventeen years of the sample the strategy has not been associated with a profit. Several precautions are required before one is considering whether the same trend will appear in the future. It is an interesting discussion but something that is a part of the coming sections.

4.3   Momentum and value combined

From the two previous sections, it appears that both applying value and momentum strategies in the sample have paid off, and produced an excess annual return. In the period from 2000 to 2017, the investor would therefore have benefited from choosing one of these strategies in isolation on stocks traded on Copenhagen Stock Exchange. This section presents performance that could be achieved if one was to combine the two strategies.

The interaction between momentum and value is determining whether combining these strategies will provide an even higher return than what can be achieved in isolation. Combining the two strategies strives to capitalize on the different underlying factors related to the two strategies, and construct a portfolio that produces an even higher return than what can be achieved in applying value and momentum individually. Bird and Gerlach (2003) showed that one of the downsides of value investing is that the majority (typically around 55 percent) of the value stocks do in fact not outperform the market. The reason for this being that the low market expectations are actually sometimes correct, and the profitability of these companies never improves for which reason some of these stocks are a very bad investment. Momentum may very well improve the profitability of value investing by sorting out the winners among value stocks which are the stocks that are in the phase of improving profitability and at the same time being acknowledged by the investors.

4.3.1   Value stocks with momentum

The following will present results from investigating how the group of value stocks perform over time if they are divided in two, into winners and losers respectively. Next, the growth stocks will be similarly divided into losers and winners respectively, to allow the investor to determine whether momentum varies across value and growth stocks, and hence understand where momentum is ideally applied. Lastly, the performance of winners from value and growth will be compared. It will allow the investor to determine whether there is

any remarkable difference from investing in cheap or expensive winners and losers, and whether these trends have been consistent throughout the period of the sample.

In table 9, the value stocks are divided into winners and losers respectively, dependent on whether the price of the stocks has been trending upward or downwards over the past six months. As, in the previous sections the strategy is based on the equally weighted portfolios. From the table, it appears that the stocks that fall into the half with the highest increases in price over the past six months perform particularly well, and produce a positive return in 12 out of the 16 years of the sample. The strategy of going long winners characterized as value stocks and short losers also within value, actually produces a mean annual profit of 10.2 percent. The table clearly indicates that sorting value stocks into winners and losers to exploit the opportunities from price continuation would have paid off over the past years. Both by holding "cheap" winner stocks, and by holding a cost neutral long winners and short losers portfolio, one would have been able to beat the market.

Table 9

Value

	Winners	Losers	Winners - Losers
2000	0.365	0.255	0.110
2001	-0.037	-0.187	0.150
2002	-0.009	-0.049	0.040
2003	0.484	0.384	0.100
2004	0.417	0.318	0.099
2005	0.598	0.488	0.110
2006	0.285	0.185	0.100
2007	0.098	-0.152	0.250
2008	-0.159	-0.264	0.105
2009	0.229	0.179	0.050
2010	0.089	-0.061	0.150
2011	-0.121	-0.120	-0.001
2012	0.090	-0.011	0.101
2013	0.371	0.301	0.070
2014	0.041	-0.060	0.101
2015	0.116	0.012	0.104
2016	0.189	0.089	0.100
Mean Return	0.179	0.077	0.102
Std. Dev	0.209	0.213	0.051
t-stat	3.535	1.491	8.211
p-value	0.0014	0.0778	0.0000
	Winners	**Losers**	**Winners - Losers**
Mean Return	0.179	0.077	0.102
Std. Dev	0.209	0.213	0.051
Sharpe Ratio	0.86	0.36	1.99

Remarkable from table 9 is also the standard deviation related to the cost neutral portfolio is very low, and the strategy is very consistently producing a positive return. Only in one out of the 16 years, the investor would have realised a negative profit.

4.3.2 Growth stocks with momentum

In table 10, the growth stocks were grouped similarly into the half with the strongest price increase and the lowest over the past six months. The performance of the winners and losers within growth stocks differs from value, and hence an indication that a synergy can be achieved by combining the two strategies. From table 10, a mean annualized return of 11.7

percent is presented for the winners, whereas a 3.7 percent for losers. The profit from a cost neutral strategy would imply an annual mean return of 8 percent.

Table 10

Growth

	Winners	Losers	Winners - Losers
2000	0.643	0.513	0.130
2001	-0.094	-0.194	0.100
2002	-0.270	-0.360	0.090
2003	0.237	0.167	0.070
2004	0.463	0.403	0.060
2005	0.363	0.273	0.090
2006	0.287	0.237	0.050
2007	-0.025	-0.265	0.240
2008	-0.263	-0.364	0.101
2009	0.004	-0.026	0.030
2010	-0.010	0.010	-0.020
2011	-0.026	-0.076	0.050
2012	0.085	0.005	0.080
2013	0.138	0.078	0.060
2014	0.146	0.071	0.075
2015	0.186	0.106	0.080
2016	0.132	0.052	0.080
Mean Return	0.117	0.037	0.080
Std. Dev	0.232	0.238	0.051
t-stat	2.084	0.640	6.486
p-value	0.0268	0.2656	0.0000
	Winners	Losers	Winners - Losers
Mean Return	0.117	0.037	0.080
Std. Dev	0.232	0.238	0.051
Sharpe Ratio	0.51	0.16	1.57

From table 9 and 10, it is clear that momentum appears both within value and growth stocks. The profit from a momentum strategy going long winners and short losers is actually very consistent over the entire period both within value and growth, and the strategy provides a profit with a very low standard deviation of return. However, if one seeks to exploit the opportunities of a cost neutral portfolio, it actually appears that shorting growth losers while buying value winners actually provides the highest profit.

4.3.3 Value and growth with momentum

From table 9 and 10 the profit of momentum winners within value and growth are illustrated. It appears, that the remarkable high annual mean return of 17.9 percent from the winner portfolio of value stocks outperform the winners among growth stocks. Furthermore it appears, that losers within growth are actually performing worse than losers within value. In other words, according to the results from this sample the investor will construct the best cost neutral portfolio by shorting expensive losers while going long cheap winners. The strategy will produce a remarkable annual mean return of 14.2 percent. The remarkable performance is reported in table 11.

Table 61

	Winners (value)	Losers (growth)	Difference
2000	0.365	0.513	-0.148
2001	-0.037	-0.194	0.157
2002	-0.009	-0.360	0.352
2003	0.484	0.167	0.317
2004	0.417	0.403	0.014
2005	0.598	0.273	0.325
2006	0.285	0.237	0.048
2007	0.098	-0.265	0.363
2008	-0.159	-0.364	0.205
2009	0.229	-0.026	0.255
2010	0.089	0.010	0.078
2011	-0.121	-0.076	-0.045
2012	0.090	0.005	0.085
2013	0.371	0.078	0.292
2014	0.041	0.071	-0.030
2015	0.116	0.106	0.010
2016	0.189	0.052	0.138
Mean Return	0.179	0.037	0.142
Std. Dev	0.209	0.238	0.152
t-stat	3.535	0.640	3.847
p-value	0.0014	0.2656	0.0007

From table 12, it is clear that standard deviation of the cost neutral portfolio is lower than that of both the winners and the losers portfolio, however, higher than the standing deviation of the cost neutral porfolio within either growth or value. The profit of 14.2 percent is the

highest achieved from a cost neutral portfolio in this study, and a strategy that should be considered. However, it is again, important to take some precautions before assuming a similar pattern will appear in the future. These will be discussed later in the thesis.

Table 72

	Winners (value)	Losers (growth)	Winners - Losers
Mean Return	0.179	0.037	0.142
Std. Dev	0.209	0.238	0.152
Sharpe Ratio	0.86	0.16	0.93

It is also important to note, that dividing the stocks into growth and value before sorting by momentum makes the number of stocks in each portfolio smaller. As discussed previously, a selection of a few stocks in the portfolio of cheap winners may have an impact on the high profit achieved, or a few stocks in the portfolio of expensive losers with poor performance may drag the performance of these down. However, the findings are in line with those of Bird and Whitaker (2004), and the standard deviation of return over the period is reasonable. One should still be very cautious with the strategies though.

4.3.4 Conclusion

From the previous section, it is clear that momentum exists within both value and growth stocks. The momentum strategy is profitable within both types of stocks, and delivering a low standard deviation of return.

Applying the strategy of going long cheap winners and short expensive losers over the past 17 years would have produced a cost neutral profit that exceeds those of using either value or momentum strategies alone. Furthermore, the annual mean return from holding cheap winners seems to exceed those of either holding value stocks or winners alone. It would therefore have been favourable for the investor to combine value and momentum on the Danish stock market over the past 17 years.

5. Sensitivity and Composition

Alluring results were presented on value and momentum strategies in the previous section, and one might quickly think applying these strategies in the future will be advantageous. It is unfortunately not that simple, and before even considering doing so, it is very important to keep the data limitations in mind which have been discussed previously, but it is also relevant to discuss some of the components the strategies are sensitive towards. The following will therefore shed light on how the portfolio weighting of returns influences returns and how the composition of industries may have an impact as well.

5.1   Portfolio weight

The research and studies on value and momentum can in general be divided into two groups. One group uses equally-weighted portfolios, and among others include Jegadeesh and Titman (1994, 2001), Rouwenhorst (1998), Grundy and Martin (2001) and Scowcroft and Sefton (2005). The other group including Moskowitz and Grinblatt (1999), and Risager (2010) primarily uses value-weighted returns.

The thesis primarily uses equally weighted returns. Most analysis throughout the thesis test the results from both equally weighted and value weighted portfolios, and include both when relevant. However, the thesis strive to include the impact from small and mid cap stocks as well, and are therefore primarily applying equally weighted

In general, applying value weighted portfolios will obviously imply stocks with a larger market capitalization to have a higher impact on the results. Recall the examples from C20 Index, where the performance of Novo Nordisk in some years had a clear impact on the overall performance of the index. The smallest portfolios throughout the thesis include 40 stocks, and most include more than 80 stocks, for which reason a single stock will not be able to significantly change the performance across a portfolio using equally weighted. However, using value weighted portfolios will imply that a group of large cap stocks will have an impact of the performance in the portfolio. Additionally, small cap firms are

expected to and sometimes produce a higher return than large cap firms. This and other characteristics that are related to small cap stocks will appear to a larger extent when equally weighted returns are used, while a value weighted portfolio may mitigate these. Recall from figure 2, that the returns from small and large cap stocks are not deviating significantly, and hence the effect seems not to be very strong in Denmark over the past 17 years.

Recall from the literature review, that Glaser and Weber (2013) and Lee and Swaminathan (2000) presented evidence of a stronger momentum effect in stocks with high turnover. There is not strong consensus of this finding, however, the turnover in stocks is correlated with the market capitalisation of the stocks (Girard & Omran, 2009). It will further imply that momentum strategies are producing a higher return among large cap companies. A value weighted portfolio that is including returns relative to market cap is hence likely to provide a higher profit from applying momentum strategies. However, the trend is not significant for the sample of the Danish traded stocks, and momentum applying value weighted stocks are not significantly different. Whether it is due to the momentum not being stronger among high turnover stocks or the correlation between turnover and market capitalization not being strong enough is out of the scope of this study.

To quantify the impact from large cap given a value weighted portfolio, figure 4 illustrates the market value as a function of the number of stocks in the sample used for the study. From the figure, it appears that the 10 percent of the stocks with the highest value actually accounts for 39 percent of the market value in the entire sample. It is therefore clear, why the value weighted and equally weighted returns varies if the performance varies across size. However, keep in mind that economic up or down turns usually have a good or bad impact on both large and small cap stocks, and the mean annual return over the full period is similar.

Figure 4
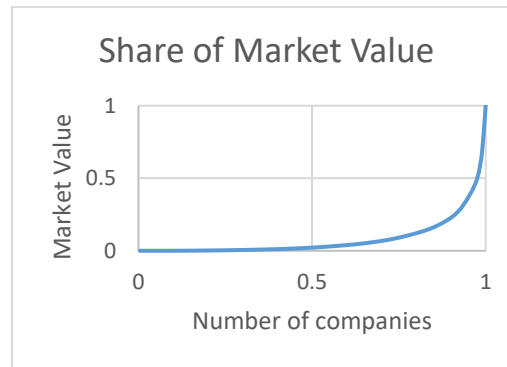
Above figure shows the average over the period from 2000 to 2016, however, the shares change over time, and the impact from large or small cap stocks will therefore vary over time when using value weighted return. Dimson et al. (2002) showed that the 10 percent largest companies from 1900 and onwards have changed roughly 10 percent over the years.

The thesis strives to investigate and understand the general drivers behind the value and momentum premium, and is therefore only including value weighted returns when the results varies from equally weighted and is a relevant concern for the investor.

5.2   Industry overhang and financials

Stocks traded on the Danish stock market in the period, and the sample analysed in this thesis contain a certain composition of industries. To ensure the findings of the study is not caused by patterns in a single industry, but rather representative for the general trend it is worth to mention the industries included and what the share of total stocks in these industries constitutes.

First, the count of stocks within the different industries is relevant when we use the equally weighted returns to evaluate the strategies. The count of stocks in the sample contains a somewhat fair distribution of companies across different industries. The industries are more concentrated when we look at value returns.

Novo Nordisk, Chr. Hansen Holding, Genmab, Lundbeck, Novozymes are Health Care stocks traded on Copenhagen Stock Exchange all belongs to the C20 Index, and have a very

large market capitalisation. Value weighted returns will as a result be influenced by the industrial specific performance of the Health Care industry. The value of these specific companies have increased significantly over the past two decades, and the exposure of a value weighted returns towards the Health Care industry is not constant over time and would have blurred the results even further. To get an understanding of the value and momentum premium caused by investment behaviour and not this particular industry it is appropriate to use equally weighted returns. This is one of the reasons why the study focuses on the equally weighted returns.

The value within an industry is one thing that is important when using value weighted returns within an industry. Another issue that needs to be considered even when applying equally weighted portfolio, is that a specific industry may have a strong characteristic that causes specific patterns. For instance, the nature of financial stocks implies relative high book-to-market ratio, and they tend to be heavily represented in the value portfolios. To avoid the performance of the value portfolio being skewed towards the financial industry some studies decide to exclude this. These studies include Fama and French (1992) and Chan et al. (1991). The results vary only marginally, and one could keep financials in the sample. The sample is already limited in size given the small nature of the Danish stock market, and in this light it is not favourable for providing robust statistics to take out more stocks.

6. Precautions and Understanding the Findings

Before continuing to how the strategies and the insights from the strategies potentially can be used in a portfolio, it is important to consider the main drivers behind these phenomena. The study will therefore recall the insights from the literature review along with the findings to evaluate the most plausible explanations for these premiums.

The appearance of the value and momentum premium is in line with a vast amount of studies. However, the reason why they appear, and the investor has been able to follow momentum and value strategies and produce an excess return without traceable additional risk in the past is still not clear. The findings are based on historical data, and as many investors including Warren Buffet, Charlie Munger, and J. M. Keynes said, one should be very careful to assume the past is like the future. It will obviously never be possible to test the strategies on future data, however, a deeper understanding of why the premium occurs may help the investor to see whether he should expect the premium to exist in the future.

The risk based view, and explaining why the premium assuming markets are efficient have been vastly pursued by Fama and French (1992, 1998) and many others for several decades now but without convincingly justifying the premiums. The thesis will therefore try to draw out some of the most convincing arguments from the behavioural school, and test whether these could justify the findings of this study. All with the purpose of providing better insights of the underlying drivers, and help the investor to better understand whether he should expect these phenomena to persist or disappear in the future.

6.1 LSV Hypothesis and the Danish stock market

The following will discuss some of the arguments that have been presented to test the behavioural finance view on the Danish stocks in the period, and how well this can explain

the value premium. The purpose is to provide the investor with a deeper understanding of why it appears and what changes in society will likely have an impact on the value premium in the future.

Recalling from the literature review, the behavioural finance school argues that investors get too excited about the prospects of growth companies (Barberis and Thaler, 2003; Ackert and Deaves 2009). The investor believes the companies related to the high growth are fantastic companies that cannot be bought at a price that is too high, and as a result he assumes the growth will maintain at the very high levels in the future. To test whether this phenomenon exists in the Danish stock market in the period from 2000 to 2016, the thesis will simply compare the earnings growth before and after portfolio formation. The same comparison to value companies will allow the investor to understand whether these actually exceed or meet expectations.

This explanation of investors extrapolating growth too far out in the future was first presented in a comprehensive manner by Lakonishok, Shleifer and Vishny (1994) who studied how US growth stocks from 1963 to 1990 failed to deliver earnings and cash flow growth as expected. The explanation is referred to as the LSV hypothesis in literature, and in the thesis hereinafter. Appendix 2 shows a detailed view of the earnings and cash flow growth of value and growth stocks before and after portfolio formation. It is clear from the table that growth stocks have high earnings and cash flow growth prior to formation and the growth rate of both decline post formation. Value stocks on the other hand, do not have the same growth in cash flow and earnings before formation, but present growth post formation. Similar patterns are found by Cai (1997) for Japan in the period 1977 to 1991, and reported in Appendix 3. Risager (2013) investigated whether the same is true on a number of large cap stocks in Denmark from 1950 to 2004, and found the same trend. His table is included in Appendix 4.

To deepen our understanding and the plausibility of the argument presented on the stocks analysed in this study, whether the earnings growth before and after portfolio formation varies from the value to growth stocks is presented in table 13. The table reveals that growth

stocks present strong growth prior to formation, and hence the reason for being categorized as growth stocks. However, following portfolio formation, they are not capable of delivering the same strong growth, and comparing the growth rates one year prior and post, it has on average declined by 10.4 percentage points. If the investor believes that the growth companies are companies that will continue to present strong growth in the future as discussed in literature, and hence priced accordingly to this high growth, that is likely an explanation for why the growth companies disappoint. From the results, it appears that growth companies should rather be priced or expected to deliver 10.4 percentage points below past growth, which is a notable difference. From the table, it further appears that value stocks do not experience the same decline in growth, but rather constant or a small increase in earnings growth.

The results give an indication that value stocks do either exceed or meet expectations while growth stocks disappoint. It is also important to note, that value stocks are not having a higher earnings growth than growth stocks in the period following formation, but it is merely the change in earnings growth that causes the disappointment. The growth stocks are still subject to the highest growth rates one year after formation, however, it is the relative changes in growth rates which are driving the expectations and prices.

Table 83

	Time to formation:	Value:	Growth:	Difference:
Average earnings growth	2 years prior	0.097	0.191	-0.094
Average earnings growth	1 years prior	0.091	0.272	-0.181
Average earnings growth	1 years post	0.136	0.168	-0.032
Average earnings growth	2 years post	0.151	0.146	0.005

The data for the Danish stocks are not able to reject the LSV hypothesis, and hence it is plausible that the hypothesis explains the value premium. Naive investors who extrapolate

the past too far into the future, even though the future does not warrant such extrapolation, are likely to be investing in the Danish stock market as well, and hence allowing value strategies to exploit their mistakes.

6.2   Momentum, efficient markets and Mr. Market

Understanding what have caused the price continuation to exist across equity markets over the past decades, and on the Danish stocks analysed in this study, will not promise the existence in the future, but it will likely help the investor to understand whether he should expect the same price continuation to appear in the future.

Shleifer (2000) presented a model of investor sentiment, and provided an explanation that seemed to be surprisingly robust on the matter. His model showed that momentum was caused by underreaction in the short run followed by an overreaction over longer time horizons by the market. More specifically, the investor had prior views about stocks based on emotions and exhibited a conservatism when faced with new information. The investor did not immediately react to the information as much as the Bayesian statistics warrants but rather slowly over time. The excitement and emotions about the stock intensifies throughout time, and in spite of reaching the price level warranted by the presented information the stock continues to increase to artificially high levels. Suddenly the market will realise that the price of the stock is out of line with fundamentals, and the price will start to revert to the fair price (Shleifer, 2000). In other words, it takes time for the market to price in new information, and when the information is priced in accordingly, excitement and emotions often cause the stock price to keep trending in the same direction, and out of line with fundamentals.

Similarly to Shleifer, Warren Buffet who is known for achieving extraordinary returns from sticking to his value principles, argues that the market is slow in reacting to information by acknowledging what Ben Graham described as Mr. Market. Ben Graham was basically

emphasising that the market is not always pricing stocks correctly, but sometimes driven by emotions and feelings. He used Mr. Market as a way to think about the market, as a manic depressive man who was setting a price based on his emotions which was in contrast to the efficient market hypothesis (Risager, 2013).

It is impossible to test the efficient market hypothesis due to the dual hypothesis problem. Testing for market efficiency requires an equilibrium pricing model that takes different risk factors into account, and one will always be able to argue that the model is not including all types of risk whether it is due to market inefficiency or unaccounted risk.

The study will therefore not be able to provide a definite answer, however, it will draw on one out of several instances where the efficient market view hardly explained the price and Mr. Market seemed to be a more reasonable way to think about the price.

In March 2003, a company named Palm and 3com selling network systems decided to spin-off the Palm division through an IPO. They decided to sell 5% of the division to the public, and the remaining shares would go to the shareholders of 3com. 3com shareholders would automatically receive 1.5 Palm stocks per share in 3com. Based on this information the 3com share should be worth at least 50 percent more than those of Palm. The day Palm went public, the stock price went below that of 3com, and hence implying 3com to have stocks with negative value (Risager, 2016). In spite of heavy media coverage, the mispricing went on for months, and the market was very slow reacting to the information (Thaler and Lamont, 2003). Thaler and Lamont (2003) argued that extreme excitement caused the Palm stock to trade at prices which could not be explained by the efficient market hypothesis but only by emotions and Mr. Market. It may not be as easy to exemplify, however, why should the market not react slow to changes in earnings prospects if it reacts slow to an obvious case like the one above. And which is also in line with the findings from Shleifer.

6.3   Conclusion

It seems to be plausible, that the investor believe growth stocks are able to maintain the level of earnings and cash flow growth in the future, which seems not to be the case according to the data for the Danish stock market, and hence they disappoint. The LSV hypothesis of investors extrapolation high growth to far out in the future, is therefore likely explaining some of the value premium.

The model by Shleifer, and the way Graham and Buffet describes the market as being driven by emotions which causes the market to react slow to new information, while over longer time horizons driving prices to levels out of line with fundamentals aligns with the results from the analysis on the Danish market. The behavioural explanation is therefore likely to explain some of the profit from momentum investing.

7. Perspective and Implementation of the Strategy

To determine the prospects of the strategies, and how the investor may benefit from these, it is important to discuss some of the potential challenges in following the strategy as an investor. The following will shed light on the challenges related to shorting and executing the transactions.

7.1   Shorting possibilities

All the cost neutral portfolios assume the investor is able to short the market, and in some situations, it may not be feasible to implement the cost neutral portfolios as a result.

As an individual investor it may be difficult to find trading providers that offer shorting possibilities at reasonable prices without trading significant volumes. Additionally, it may also be difficult to find a counterpart when shorting the smallest and most illiquid growth losers (maybe facing bankruptcy), but required to receive the desired exposure for the strategy. As a result, many investors will most likely have to be satisfied with investing their

savings in the value stocks with a price momentum. Assuming that an investor has capital at hand, it will also provide higher returns on the capital compared to both C20 Index and losers.

Some institutions are also legally restricted from shorting the market, which will prevent them from exploiting the cost neutral portfolio. In 2008, the Danish government imposed restrictions in a limited time period on shorting the market, which will prevent the strategy as well.

7.2   Transaction costs

The results presented are not including transactions cost, and the transactions cost is therefore an important issue before implementing the strategy. Illiquidity and a high frequency of rebalancing the portfolios are two of the main drivers of transactions cost.

The study includes stocks of small market capitalization, which generally have a lower trading volume and therefore less liquidity, and in turn increasing the transaction costs. The profit which would have been realised from the trading strategy is therefore lower than what is presented in the results. However, the most important driver of transaction cost is the frequency of which the portfolio is rebalanced. The study uses a frequency which is lower than most studies, and the profit is therefore not expected to be entirely mitigated by transaction costs. Franzzini, Israel and Moskowitz (2014) investigated the magnitude of transaction costs, and concluded that value and momentum strategies in particular provide a robust profit when adjusted for transaction costs as well. The transaction cost is limited, and only jeopardizing strategies that rebalance with a higher frequency than a month.

Asness et al. (2013) argued that it is difficult to include all transaction costs, since a high exposure in the strategy may drive the price of the stock up (or down) making the transaction cost higher, especially in relation to small stocks. Additionally, the transaction costs vary also dependent on market access provider, and whether you are an institutional or individual investor. Transaction costs are indeed something the investor should be critical towards, and try to estimate before endeavouring the strategy.

8. Recommendation

The following section will discuss how the investor potentially can capitalize on the findings from the study in the future. As repeatedly mentioned throughout the study, there is no guarantee that results from the Danish stock market, which is a relatively small sample, over the last 17 years will repeat itself in the future. However, with the fact in mind, that the conclusions are in line with studies from other markets, it is therefore meaningful to go through how the findings could be applied into an investment strategy.

Time horizon and investor profile

Prior to investing, it is also wise to take a step back, and consider that the investment profile varies significantly from an institution, to the private investor who is dependent on the pension being invested in the near future. The following will briefly discuss how these elements play a role.

First, the premium from both value and momentum strategies are providing a satisfactory return over a long time horizon, but not consistently every year. Before endeavouring into investment strategies based on the findings, it is important that the investor realizes that this is a strategy that pays off over a long time horizons and not in the short run. If the investor is confident sticking to the strategy for a long time period, he should consider using the insights, otherwise not.

It is also essential for the investor to determine whether he has capital at hand, such as a pension or savings he wants to invest. The capital at hand determines whether is it favourable to only go long in the best performing stocks and earn profit on the capital, or whether a cost neutral trading strategy is favourable. The latter also requires the investor to have access to shorting possibilities.

The risk profile of the investor is also essential to fully understand before engaging in the strategies. The investor is required to both psychologically and financially withstand a negative return for a period to hold the position open in order to responsibly engage in the

strategies. If the investor opens the position in a market prior to a year(s) with negative return (e.g. 2011), and financial capital requirements or lack of emotional control forces him to close the position and lose the exposure, she will end up with a loss. In other words, there are several factors that may prevent the investor from holding the position open for the period required to achieve the excess return. The findings simply assume a long time horizon, and if the investor is not able to meet this regardless of reason, the profitability is very different.

Additionally, it is important to understand, that in applying the insights and expecting to generate the same profit in the future, you simply assume the market and society will repeat itself. Many economic cycles have repeated itself over the past 100 years, and according to many including Lloyd Blankfein using the past is the best estimator available for predicting the future (Blankfein, 2016). However, there is an additional risk related using statistical finding out of sample which simply needs to be considered.

Strategies with shorting possibilities

After taking the appropriate precautions, and with access to shorting the stock market, the investor will according to the findings of this study, and previous literature, benefit from combining the anomalies created by the price momentum in stocks, and by applying simple metrics such as book-to-market to identify stocks that are traded at a relatively low price.

In particular, applying a value investment strategy where a portfolio with the value stocks characterized as the highest 30 percent based on book-to-market ratios are bought, and the growth stocks characterized as the lowest book-to-market ratios are shorted, provide an annual mean return of 5.1 percent. The premium is only significant at 10 percent significance level, but it is an indication that there is a profit to gain from value investing.

If the investor is to apply a momentum strategy that implies buying 50 percent of the stocks with the highest increase in price over the past 6 months while shorting the stocks with the worst momentum in price over the last 6 months, she would from the analysis have achieved

an annual mean return of 8.3 percent. The profit from the momentum strategy is significant at a 5 percent significance level, and based on the sample it is a wise investment strategy.

The two strategies above are worth considering, but if the investor strives to achieve the highest possible returns, it is sensible to combine both a value and momentum criteria to form the best portfolio. Sorting the value stocks characterized as the 30 percent with the highest book-to-market ratio further into the half with most price momentum over the past 6 months will identify the best stocks to include in the portfolio. Buying these stocks for the portfolio while shorting the growth stocks characterized as the group of stocks with the worst price momentum over the past 6 months will create a cost neutral portfolio with the highest return.

In other words, shorting the expensive growth stocks while being long cheap winners would have provided annual mean profit of 10.2 percent. The remarkable profit is significant at a 5 percent level, and the cost neutral portfolio with the highest return.

Strategies without shorting possibilities

The portfolios discussed in the previous section are all cost neutral which implies that the cost is more or less limited to the transaction cost from bid and ask spreads. In practice most investors are either not able to short the market for legal or practical reasons. Very large institutional investors may open systematic short positions, but most investors do not (Blenman, et al., 2010). The following will therefore discuss some of the best portfolios to construct from the findings in the sample without possibilities of shorting.

If we start out by looking at the value strategies, it appears from the findings that the mean annual returns over the past 17 years from holding the 30 percent with the lowest book-to-market ratios amounts to 12.8 percent. It is higher than the return from holding a market portfolio and the C20 Index, for which reason it has been favourable to use book-to-market ratios to identify value stocks for one's portfolio. The standard deviation of returns holding the entire market is marginally lower, implying the investor needs to be extremely risk averse to prefer holding the market portfolio.

Applying a simply momentum strategy where the investor buys stocks that have been trending upwards in price for the last six months, and hold the portfolio for a year produce a return that amounts to an annual mean of 13.5 percent over the full period. The mean annual return is therefore higher than the one achieved by holding the value portfolio, the entire market, and the C20 Index.

However, it further appears that a large share of the value stocks are actually not outperforming. The phenomenon is referred to as the value trap, and implies that means of sorting out the worst value stocks will enhance performance. Combining value with momentum will allow the investor to form a portfolio that contains value stocks of higher quality. A combination of the value and momentum is therefore the preferred strategy for the investor who is not able to go short.

Holding a portfolio of value stocks that have been trending upwards in price over the six months prior to formation is favourable. Such a strategy has over the past 17 years on the Danish stock market provided a mean annual return of 17.9 percent. The standard deviation is not particularly high compared to the other portfolios, however, years without a positive return did occur, so a longer time horizon is required for this strategy as well.

9. Conclusion

This thesis investigated the existence of a premium from applying value and momentum strategies on the Danish stock market from 2000 to 2017. Only at a 10 percent significance level a value premium was found from applying the strategy of buying value stocks while selling growth stocks over the past 17 years on the Danish stock market. The thesis found a premium from applying a momentum strategy of buying past winners while selling past losers over the same period.

In extension, the thesis investigated whether a combination of value and momentum investing would increase performance of the strategies. The thesis found a combination of value and momentum that implies buying past winners among value stocks, while selling past losers among growth stocks, increased the return that would have been achieved over the past 17 years on the Danish stock market.

The thesis also discussed possible explanations why an excess return can be achieved from applying relatively simple investment strategies based on value and momentum principles. It is impossible to test and reject the efficient market hypothesis due to a dual hypothesis testing problem. However, with traditional risk measures such as standard deviation and beta, it is difficult to justify the premiums from a risk based view. The behavioural explanations for the existence of premiums appear to sound more convincingly.

The findings from the strategies suggest that stocks with high book-to-market ratios and recent price momentum are likely to present strong performance, and hence they are the most alluring stocks for the investor to hold. To finance the value stocks with price momentum, the investor can consider to short growth stocks without price momentum. However, shorting the market entails some difficulties in practice for most investors.

In the light of the limitations of the study discussed, the investor should be careful with applying the findings in the future. Relying on the findings with support from other research papers from different periods and equity markets as well, is suggested, given the Danish stock market is small in nature and only includes a limited number of stocks traded. That said, the findings of the study are in line with several other papers including the authors Bird and Whitaker (2004).

10. Future Research

The thesis found stocks characterized as value stocks based on book-to-market ratios include a number of stocks with strong performance, and a very simple and rough way of excluding stocks without price momentum increase the concentration of these strong performers or "bargains" as value investors would refer to them. Next and very interesting step is to investigate a more sophisticated way of identifying the strong value stocks and exclude more of the value traps. If shared characteristics of value stocks of high quality or of low quality exist (e.g. particular industries), the investor is likely able to sort out even more of the value traps and increase the overall quality of the value portfolio, and hence increase return even further.

If such more sophisticated measures of "quality" are available, the next thing would be to challenge the value definition as the 30 percent with the highest book-to-market ratios.

Recalling from Warren Buffet's quote, that you want to buy a wonderful company at a fair price, is a fair price only feasible within the 30 percent highest book-to market ratios? It is seen from the value traps, and underperformance of companies within the 30 percent threshold, that not all the stocks are trading at fair prices. Is it the same the other way around, or is it possible to find companies that are bargains with market-to-book ratios classifying them in the middle group? It is most likely very difficult to find bargains that are trading at ridiculously high prices compared to the book values, however the value definition may not be as clear cut as to say it is within an exact percentage.

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Appendix 1

Market returns and risk, 1900-2008.

Country:	Real return	Std. dev. Real return	Return/Risk
Australia	7.3	18.1	0.40
Belgium	1.9	22.5	0.08
Canada	5.9	17.0	0.35
Denmark	4.6	20.7	0.22
France	3.2	23.3	0.14
Germany	3.0	32.2	0.09
Ireland	3.5	23.2	0.15
Italy	1.9	29.2	0.07
Japan	3.8	30.1	0.13
Netherlands	4.7	21.7	0.22
Norway	3.8	27.3	0.14
South Africa	7.1	22.7	0.31
Spain	3.5	22.2	0.16
Sweden	7.2	22.9	0.31
Switzerland	4.1	19.9	0.21
United Kingdom	5.1	20.0	0.26
United States	6.0	20.4	0.29
World USD Portfolio	5.2	17.6	0.30

Source: Dimson, March and Staunton, Credit Suisse Global Investment Return Yearbook, 2009

Appendix 2

	Time to formation:	Value:	Growth:	Difference:
Average earnings growth	5 years prior	-0.274	0.309	-0.583
Average cash flow growth	5 years prior	-0.013	0.217	-0.23
Average sales growth	5 years prior	0.03	0.091	-0.061
Cummulative stock returns	3 years prior	-0.119	1.455	-1.574
Average earnings growth	5 years post	0.436	0.05	0.386
Average cash flow growth	5 years post	0.07	0.127	-0.057
Average sales growth	5 years post	0.02	0.062	-0.042

Source: Lakonishok et al (1994), Table V.

Note: Value and growth are 10 percent

Appendix 3

	Time to formation:	Value:	Growth:	Difference:
Average cash flow growth	5 years prior formation	0.048	0.187	-0.139
Average cash flow growth	5 years post formation	0.086	0.078	0.008
Cummulative stock returns	3 years prior formation	0.213	1.402	-1.189

Source: Cai (1997)

Appendix 4

Average earnings growth before and after portfolio formation, 1950-2004.

Earnings growth

	3 year before	3 years after
Low P/E	0.100	0.117
High P/E	0.154	0.067

	2 year before	2 years after
Low P/E	0.136	0.094
High P/E	0.181	0.074

	1 year before	1 years after
Low P/E	0.064	0.278
High P/E	0.431	0.123