Momentum Return in the S&P500: The Explanatory Power of Market State and Turnover Rate

ABSTRACT

This research examines the performance of 16 different momentum strategies in up and down markets using the S&P500, with all the listed companies, over the period 2000-2018. With the use of monthly returns, momentum returns are compared to raw market returns. Overall, 12 out of 16 momentum strategies yield on average a higher return than the market return as tested with a student T-test. However, when controlling for bull and bear markets, momentum strategy only outperformed the market during down markets. Explaining the momentum returns with two different lengths of market states did not explain the returns. The average stock turnover rate did only explain the returns of the winner portfolio, it failed to explain the loser portfolio. The 12 month market volatility did also seem to explain the winner portfolio returns. The excess market factor of Fama-French did explain best the momentum returns compared over all the strategies.

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1. Introduction

Momentum strategy is a widely used strategy to gain excess returns relative to the market. Momentum strategy contradicts the concept of market efficiency, the theory that stock prices follow a random walk. The strategy was first documented by Jegadeesh & Titman (1993). Momentum strategy is the strategy where a set of stocks is ranked relative to each other based on the past returns, this is the formation period, which could last up to 12 months. The momentum effect is that these relatively top performing stocks, keep on outperforming the market for the upcoming months. The relatively worst performing stocks keep on underperforming for the upcoming months. This strategy can be implemented by investors by buying the best performing assets and short selling the worst performing assets. Past researches have followed a strategy of setting up portfolios of the best 30% performing stocks(Hong et al., 2000) up to setting up portfolios of the best 10% performing stocks (Grundy & Martin, 2001 and Avramov et al., 2007). Jegadeesh & Titman (1993) found that with the implementation of momentum strategy, an investor could yield an abnormal return of 1% per month, which comes down to an excess return of 12% annually. The worst performing stocks keep on underperforming relative to the market. In some papers it described that this strategy could be profitable up to 12 months (Jegadeesh & Titman, 2001). After 12 months most of the time a return reversal occurs. The best performing stocks will start to underperform and the worst performing stocks start to outperform the market (McLean, 2010).

Momentum profits are different in bull and bear markets. Several papers have examined momentum strategy in the different market states. Siganos & Chelly-Steeley (2006) examined the London Stock Exchange and found that momentum gains are the highest in bear markets. They stated that the longer the state of the bear market is defined, the higher the momentum gains. In the bull markets, the momentum strategy return will become negative when the bull state increases, so when the market returns are increasing. Rey & Schmid (2007) found that in the bear market the profitability of a momentum strategy is the highest, but they used only the blue chips stocks, the most expensive stocks in the market. Griffin et al., (2003) found that momentum strategy is profitable in both bull and bear markets. On the other hand, Cooper et al., (2004) found that in bull markets the profitability of the momentum returns is significantly positive and in down markets insignificantly negative. This shows that there is no consensus on in which market state momentum is most profitable.

This thesis will focus on several explanatory variables for the profitability of the momentum strategy using the S&P 500 companies over the period of 2000 until 2018. The explanatory variables which are used are the formation period, the holding period, the market state length and stock turnover rate. These variables will be compared in different market settings. The momentum strategy will be implemented by forming a portfolio ranked of the 10% best performing stocks and a portfolio of the 10% worst performing stocks. This will give a winner and a loser portfolio respectively. By subtracting the loser portfolio of the winner portfolio, the zero cost portfolio is created. This results in the winner minus loser portfolio. By buying the winner portfolio and short selling the loser portfolio, the momentum strategy is implemented. The explanatory variables will help to explain the returns in the different market states. This research uses 16 different momentum strategies to see if there are patterns in explaining the returns. The portfolios are formed based on the previous months (3, 6, 9, or 12 months), also known as the formation period. Besides the holding period, the portfolios also depend on the following months (3, 6, 9, or 12 months), also known as the formation period. This paper will contribute to the already existing literature, where there is little consensus on in which market state the strategy is most profitable. Besides that, Sapp & Tiwari (2004) show that mutual fund investors seem to invest in past winners and use a momentum strategy, for excess returns. This shows that momentum strategies are still widely used.

This study contains 3 different parts for examining the momentum returns. First the momentum strategies are tested to evaluate if the momentum strategies outperform the market. This is done with a student t-test. The results are plotted in average monthly returns. In this way these can be compared to each other. Secondly, this research tries to explain the momentum returns using two different market state lengths. The 6 month market return and the 36 month market return. These market states are then divided in bull and bear markets. At last the momentum return is tried to be explained by the average stock turnover rate of the portfolios. First a general regression with the winner and loser portfolio is provided. Subsequently, the winner and loser portfolio returns are regressed separately. The main findings show that the momentum strategies outperform the market during down markets. These results are partially explained by the turnover rate, the different market states fail to explain the momentum returns.

This paper has the following structure: First an extensive literature review about the momentum strategies with different formation and holding periods, market state lengths and turnover rates in chapter 2. At the end of the literature review the hypotheses will be set out. After that follows chapter 3 where the data and methodology on how the data is tested. Chapter 4 shows the results of the t-tests and regressions. At last, in chapter 5, there will be an overall conclusion and discussion.

2. Literature Review

This research will focus on several explanatory variables for momentum strategy in different market states. Past literature shows different results for several variables. The most used form of the momentum strategy is the winner minus loser portfolio, where the winner portfolio is held in a long position and the loser portfolio a short position. This means that the portfolio with the winner stocks is purchased and the portfolio with the loser stocks is sold. This strategy is also known as the zero-cost portfolio (Wang & Wu, 2011). Some papers use only the long position winner portfolio. This research will focus on the first method, which is buying the winner portfolio and selling the loser portfolio. In this part the already existing literature is set out. First, some general behavioral theories are set out, which claim to explain the cause of the momentum effect. After the behavioral theories, the formation and holding period are discussed, since these are widely related as described in literature. The formation and holding period are important to form different momentum portfolios. After the formation and holding period, the length of market state will be set out and the last explanatory variable will be the turnover rate.

2.1 Behavioral theories

Momentum strategy is not in line with the efficient market hypothesis which states that all information is already in the market and therefore stocks follow a random walk (Daniel & Titman, 1999). The momentum strategy itself shows that by buying the winner stocks and short selling the loser stocks higher excess returns could be achieved. This is contrary to the efficient market hypothesis. Risk models like the CAPM and the Fama-French 3 factor model also fail to fully explain the momentum strategy (Novak & Petr, 2011). A relatively new school in economics, behavioral economics tries to explain the momentum effect by behavioral models in which it is evaluated the momentum strategy arises due to biases and irrationality by investors. Two of such models are described in the following sections.

2.11 Overreaction to information

First the model of Daniel et al., (1998) will be discussed. Their model is based on overconfidence and self-attribution by investors. What happens is that private investors receive information about a certain stock, before the market receives this information. Because of the overconfidence of these investors, they will overvalue this information. Their overconfidence arises due to the fact that these investors suffer from the self-attribution bias. This means that these investors attribute all successes to their personal skills and attribute all failures to their surroundings but never on themselves (Daniel et al., 1998). They drive up the price when this signal is positive, they drive down the price if the signal is negative. When their signal is confirmed by the market, the private investor beliefs that the prices would go up/down and the price change was in line with their beliefs, the investors will push the prices even further up/down. This is because the investors will become even more overconfident. The drift of this price is the momentum effect. After several months the market sees that there was an over/under reaction due to the fact that all information will be available in the market. The prices were too high or too low and the reversal happens, the prices will slowly go back to their fundamental value. Daniel et al., (1998) argue that this momentum effect happens due to an overreaction.

2.12 Underreaction to information

On the other hand there is a behavioral theory which argues that momentum arises due to underreaction. Barberis et al., (1998) argue that investors underreact to earnings reports and other information that comes out in the market. Investors are conservative and they can only process a limited part of the information they receive, so the investors underreact to the earnings news. Due to underreaction the prices drift slowly up or down to a certain point, the fundamental value. Hong & Stein (2002) argue that new information in the market slowly drifts through the market, so in the short run only a few investors have the knowledge of the new information. It will take some time for the news to reach every investor and therefore there is an underreaction in the market. This price drift is the momentum effect. Chan, Jegadeesh & Lakoniskhok (1996) found that underreaction drift could be up 6 to 12 months. Gang et al., (2019) argue that the market reacts too slowly to cash flow news and news about discount rates. The winner stocks experience stronger reactions in returns due to cash flow news than the loser stocks, where the losers stock seem to drive the momentum return by underreacting to the discount rate news. Now two behavioral theories have been discussed, this paper will discuss some variables which could explain the height of the momentum returns.

2.2 Formation & Holding Period

Momentum Strategy is based on a formation and holding period. The first step for implementing the momentum strategy is sorting the best 10% and the worst 10% performing stocks at a certain point in the market based on past returns, like Jegadeesh & Titman (1993) did. This is the formation period. Secondly, two portfolios are formed, the winner and the loser portfolio. The winner portfolio consists of the 10% best performing stocks, the loser portfolio consists of the 10% worst performing stocks. The third step is taking a long position in the winner portfolio and a short position in the loser portfolio. The length of the long and short position is the holding period.

2.21 Formation period

What the papers of Siganos & Chelley-Steeley (2006), Rey & Schmid (2007) and Griffin et al., (2003) have in common is that they look at the past length of the momentum, stated as the formation period. So the formation period of the stock is the amount of time a stock keeps on outperforming or underperforming compared to the market. The formation period is relevant for the momentum strategy because the timing to buy the stocks could yield high excess returns (Eisdorfer, 2008). The profitability of the strategy depends on when to step in, on when to buy and sell the portfolios. Siganos & Chelley-Steeley (2006) found that the longer the market is stated as a bear state, the market generates negative returns, the stronger the continuation in the returns is seen. This means that the longer the market is stated as a bear state, the longer the momentum strategy seems to outperform the market. They observed this by looking at the UK stock market and implementing the 6 month formation period. Rey & Schmid (2007) looked at three different formation periods, which define the length of the market state by 3, 6, and 9 months. Their results show that a formation period of 6 months on average yields the highest return. However, this is dependent of the holding period, the period the momentum strategy portfolio is held by the investor. Cooper et al., (2004) looked at different formation periods in bull and bear markets from 6 months up until 36 months. They found that the returns of momentum strategy are the highest in a bull market, based on the past one or two years. Where most literature focuses on a formation period of quarterly data (3, 6, 9 or 12 months), there is literature that suggests to also look at weekly holding periods. Kang, et al (2002) found significant results for formation periods of 12, 16, 20, and 26 weeks. There is wide debate in the literature if the highest momentum returns are dependent on the formation period or the market state. There is a lot of literature which focuses on the formation period of the momentum strategy, with different findings. But as mentioned by Rey & Schmid (2007) the profitability of the momentum strategy is also dependent on the holding period. In this thesis 4 different formation periods will be used: 3, 6, 9 and 12 months. Therefore this paper will follow the research of Bhootra (2011).

2.22 Holding period

The formation period is widely related to the holding period in momentum strategy. The holding period is how long the investor holds on to the stocks. This is relevant because holding on too long (or too short) could decrease the profitability of the strategy (Brown, Du, Rhee & Zang, 2008). Holding on too long to the stocks could also cause the reversal to start. Then the best performing stocks will no longer outperform the market, these will start to underperform to the market (McLean, 2010). A formation period of 9 months, with a holding period of 3 months could be more profitable than a formation period of 6 months and holding period of 6 months. Miffre & Rallis (2007) used formation as well as holding periods of 1 month up until 60 months. They showed that for US commodity future the momentum strategy is most profitable for horizons of 12 months. In the long run they found reversals, the phenomena that outperforming stocks will start to underperform after 12 months and the underperforming stocks start to outperform the market. Bhootra (2011) used four holding periods and four formation periods in his analysis, both periods used 3, 6, 9, and 12 months. This resulted in 13 significant strategies, with momentum returns between 0.5% and 1.24% on average per month. The highest return was achieved by a formation period of 9 months and a holding period of 3 months. Most literature focuses on quarterly period, so for 3, 6, 9, or 12 months. Therefore this thesis will also use four holding periods, with the same length of the formation period like Bhootra (2011) did.

2.23 Avoiding frictions in forming portfolios

Between the formation and the holding period this thesis will skip one month. Jegadeesh & Titman (2011) showed that by lagging one between the formation and the holding period potential frictions could be avoided by forming the portfolios. Lehmann (1990) showed that there are short term reversals in the market. To avoid this, a month is skipped between the formation and the holding period. Another problem that could arise due to not skipping a month between the periods, are microstructure distortions due to bid-ask spreads, price pressure due to illiquid market (Kang, Liu & Ni, 2002).

2.3 The length of the Market State

This research will focus on the momentum strategy in bull and bear markets, to see where the highest returns could be achieved. The length of the market state could be of influence on the momentum strategy. So when can one achieve the highest momentum returns, after bull or bear markets? And how long should this market state be defined?

Siganos & Chelley-Steeley (2006) found that the longer the duration of the down (bear) market, the stronger the momentum returns which can be achieved. By following a single momentum strategy, they checked with several t-test when the highest return could be achieved. With the t-test they checked the difference between the market return and the momentum return. However, they also found that following a momentum strategy after a bull market, momentum strategy also generates superior momentum gains. They used four periods to denote a market state: 1, 3, 6 and 12 months. The number of market states declined when the time period increased. They attributed the high momentum gains due to the underreaction to information following bear markets. Griffin et al., (2003) confirmed that returns are higher after a bear market, with an international portfolio.

Cooper et al, (2005) found that after a bull market the momentum returns are higher, rather than after a bear market. The market states were defined as a bull markets when the market had a positive return over the past 3 years. The market was defined as a bear market when the market return was negative over the past 3 years. Huang (2006) found that momentum returns arise from up markets. Using international portfolios, he found that momentum returns seem to be the highest after 1 or 2 years of bull markets. Cooper et al., (2005) found that with the use of a 6 month formation and 6 month holding period strategy after a bull market the average monthly returns lay between 0.93% and 1.12%. After following a bear market, the average monthly returns were between -0.5% and 0.01%. They argued that longer horizons should capture more dramatic changes in the returns. Liu & Lee (2001) found that momentum strategy generates the largest losses in the bear market. They found on the Japanese stock market that momentum strategy was not profitable at all, but in the bear state the losses were the highest. Losses kept on increasing over time after bear markets.

There seems to be a conflict in the existing literature. Siganos & Chelley-Steeley (2005) used a different time window than Cooper et al., (2005). In both papers it is described that the longer the market state is defined, the higher the returns should be. Besides Huang (2006) states that after a period of one to two years momentum returns are highest. Based on this the first hypothesis is generated:

H1: The length of the market state has a positive relation with the momentum strategy returns.

To test whether momentum returns are higher after the length of bull and bear markets, this thesis will divide the market in up and down markets to see after which market state, and length of the market state momentum return are the highest. So the longer a market return is defined, the stronger the momentum returns should be.

2.4 Stock Turnover Rate

The turnover of stocks is denoted as the amount of stocks which is traded in a certain period, divided by the amount of outstanding amount of stocks in that period. The turnover rate can be seen as a proxy for volume trading (Yu, 2008). The trading volume of a stock does tell a lot about the future prices. Lee & Swaminathan (2000) did show that firms with high turnover stock, most of the time, have higher long-term earnings growth forecasts, better current performance and lower book to market ratios. They found the effect on the NYSE and American Stock Exchange Market. Glaser & Weber (2003) argue that investors use price and volume charts as an indicator of future prices. The turnover rate is determined as the average turnover per portfolio, divided for the winner (best 10%) and the loser portfolio (worst

10%)(Glaser & Weber, 2003). Since this paper follows the momentum strategy of buying the winner stocks and selling the loser stocks, the average turnover rate will consist of the winner stocks as well as the loser stocks.

Several studies have found that when the turnover rate of a stock increases the profitability of the momentum strategy increases. Glaser & Weber (2003) found the momentum strategy to be profitable in the German stock market, where turnover rate is the driver for the momentum strategy. However, they also showed that momentum returns are due to book-to-market ratios. Lee & Swaminathan (2000) found in the US stock market that higher momentum strategies are linked to high turnover stocks. They also did find that stocks with past high turnover rates did underperform in future years, these stocks experience the long term reversals. Their results show that low turnover rates are associated with high book to market ratios. Nauzer et al., (2006) argued that only high turnover stocks cause momentum strategy, where middle and low turnover rate stocks do not experience momentum returns. Chan, et al (2000) found that for international indices the momentum strategy will become more profitable when the turnover rate of these indices increases. Hameed et al., (2001) showed that in Asian markets, low turnover stocks almost do not experience the momentum strategy.

Contrary to these results, Nagel (2001) showed that turnover rates do not have an effect on the momentum strategy's profitability. Datar et al., (1998) confirm this by showing that stocks with low past turnover rates have higher future returns than stocks with past high turnover rates. Rouwenhorst (1999) also found that the turnover rate of stocks does not explain the differences in momentum profitability in emerging markets.

This paper will follow the papers of Lee & Swaminathan (2000) and Glaser & Weber (2003) because their results are based on already developed markets, this research will also follow a developed market. They argue that momentum returns are mostly driven by high turnover stocks. Therefore the following hypothesis will be tested:

H2: Momentum returns are higher when the turnover rate of the stocks is higher

Hypothesis 2 will be tested with an average of the winner and the loser portfolio to see if the momentum returns are higher when the turnover rate is higher. The hypothesis will also be tested with the winner and the loser portfolios. This will show if there is a difference between the winner and loser portfolio with the effect of the turnover rate.

3. Data and methodology

3.1 Data

The data that is used in this research is the S&P500 over the years 2000-2018. The data consists of all companies included in the index, plus the index itself. The index is used as a benchmark to compare to the momentum strategy to the market. The S&P500 contains the 500 biggest American companies and the index contains companies from New York Stock Exchange (NYSE), the American Stock exchange (AMEX) and the NASDAQ. The S&P500 is chosen because it contains a lot of bull and bear market states, as shown by Yardeni et al., (2017). The time span of 18 years is chosen because this would generate enough data to test all the hypothesis. Most papers like He & Chen (2006) and Siganos & Chelly-Steeley (2006) have a time span of 10 years, in this paper the time span is almost twice as large. Also because in the timespan of 2000-2018, there was a mayor market crash, the 2008 financial crises. This financial crises is included since other papers also include the 1929 stock market crash, like Gonzalez, et al., (2005). This is done, in order to get the most realistic market situations to test the momentum strategy. Firms with less observations than 24 months are excluded from the data, since they can't be compared in the matrix (no 12x12 holding and formation period). Besides that all companies that are closed-end funds, primes and scores, ADR and Real Estate Investment Trusts are excluded from the data, these stocks do not contain the share type code of 10 or 11 (Hong, Lim & Stein, 2007). The returns of the companies and the market index are retrieved from the Eikon Thompson Reuters Data Base. This leaves that over the period of 2000-2018 there were 947 companies in the list.

The second hypothesis is tested using the turnover rate of all the companies in the S&P500 over time period of 2000-2018. The turnover rate is separated for the winner and the loser portfolio. Taking the average turnover rate from these portfolios are regressed to the momentum return. Again observations are dropped if they have less than 24 months of consecutive data.

3.2 Forming portfolios

In this paper portfolio formation is used to set out the momentum strategy in different market settings. The portfolio formation will be done in the way as described by Jegadeesh & Titman (1993), Liu & Lee (2001) and Glass & Weber (2003). The top 10% performing stocks are sorted in the best performing portfolio, this is the winner portfolio. The worst 10% performing stocks are put in the worst performing portfolio, this is the loser portfolio. Momentum strategy is a relative ranking. The momentum strategy implemented is acquiring the top performing portfolio and short selling the worst performing portfolio.

For the formation period the best and worst performing stocks are calculated with the following formula (Jegadeesh & Titman, 1993 and Cooper et al., 2004):

$$MomR_{3month} = (1 + R_{t-1}) \times (1 + R_{t-2}) \times (1 + R_{t-3}) - 1 \qquad (1)$$

In this paper different formation and holding periods are tested, therefore this paper follows the structure of Bhootra (2011). This means this papers forms 16 different portfolios. This means 4 different holding periods and 4 different formation periods. This comes down to a total of (4x4) 16 different strategies, in the bull market as well as in the bear market. The different periods are 3, 6, 9, and 12 months for both the holding period and the formation period. The data consists of overlapping portfolios to increase the observations and therefore the power of the research. The formation period is denoted by J, the holding period as K. This is done by many different papers including Siganos & Chelley-Steeley (2006), Rey and Schmid (2007) and Bhootra (2011). Between every holding and formation period a month will be skipped due to bid-ask spread issues and short term reversal issues (Jegadeesh, 2003). The momentum return for a three month holding period is calculated by the following formula:

$$MomR_{3month} = (1 + R_{t+1}) \times (1 + R_{t+2}) \times (1 + R_{t+3}) - 1 \qquad (2)$$

Formula 3 shows how the momentum return is calculated for a winner (when the stock is in the 10% performing stocks) for a 3 month holding period. The return R_{t+1} is the first return, due to the fact that there is a month skipped between the formation and holding period. When the holding period is longer, say 6 months, the formula will hold the returns of the 6 subsequent months.

This paper follows the method of Bhootra (2011) for comparing the different holding/formation strategies. The market return is subtracted from the momentum return. The return that remains must be significantly higher than zero for the momentum strategy to be profitable.

The market return is calculated by taking the S&P500 index and taking the lognormal return of a certain period using the following formula:

$$Market\ Return: \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \qquad (3)$$

A student T-test will show if the momentum return yield significant excess returns. These combinations, could also be referred to as strategy; for an overview in table 1:

		Holding Period (J)			
Formation period (K)		3 Months	6 Months	9 Months	12 Months
	3 Months	3/3	6/3	9/3	12/3
	6 Months	3/6	6/6	9/6	12/6
	9 Months	3/9	6/9	9/9	12/9
	12 Months	3/12	6/12	9/12	12/12

Table 1: Overview of all the different strategies

After all the momentum returns are compared in every market state using a student t-test, the market will be divided in bull and bear markets. This gives an indication after which market state the momentum returns are higher. The return of the momentum strategy depends on the length of the holding period, therefore the return of the momentum strategy is compared to market return over the same length of the period. Strategies are formed to average monthly returns so that they can be compared (Jegadeesh & Titman, 2003).

Table 2 shows all the momentum strategies that are found in the period of 2000-2018 with the S&P500 companies. Every strategy has over 180 observations. Table 2 shows with (#N) the amount of strategies found over the entire sample period. These observations are decreasing over the amount of strategies, due to the fact that the length of the strategies is increasing and therefore less observations are available in a certain time period. The mean of the observation is the average monthly return found for every strategy. Every strategy yields a positive average return. The strategy with a formation period of 6 months and a 3 month holding period generates the highest return with a mean of 1.1286% average monthly returns. The profitable strategy column is the amount of profitable strategies over all the entire observations sample. The percentage denotes the percentage profitable strategies over all strategies for a certain strategy.

Momentum Strategy	N	Mean	Std. Dev.	Profitable strategy	%
3J, 3K	200	1.1916	16.6560	128	64%
3J, 6K	197	0.7648	18.4633	130	66%
3j, 9K	194	0.8365	20.6486	134	69%
3J, 12K	191	0.7362	23.4688	124	65%
6J, 3K	197	1.1286	18.1322	129	65%
6J, 6K	194	0.9683	18.8721	136	70%
6J, 9K	191	0.9670	20.8081	127	66%
6J, 12K	188	0.7246	25.0733	130	69%
9J, 3K	194	0.7509	17.0944	123	63%
9J, 6k	191	0.8877	21.9161	129	68%
9J, 9K	188	0.8868	24.9385	137	73%
9J, 12K	185	0.6826	27.4607	140	76%
12J, 3K	191	0.7195	16.9631	116	61%
12J, 6K	188	0.7849	22.5260	115	61%
12J, 9K	185	0.8719	25.8673	132	71%
12J, 12K	182	0.7632	28.9095	134	74%

Table 2: Descriptive statistics of every momentum strategy. "N" denotes the amount of observations per strategy, the mean indicates the average monthly returns, profitable strategy denotes the amount of profitable strategies of the total amount and the percentage denotes the percentage of profitable strategies of the total amount of observations..

All the momentum strategies will be checked for autocorrelation. Autocorrelation indicates that a return momentum is present for the strategy (Daniel et al., 2002). Positive autocorrelation indicates momentum return, where negative autocorrelation indicates the momentum return reversals. Since this research follows a rolling window regression, it is very likely that autocorrelation is found for every strategy. Autocorrelation is very likely to happen in time-series data. It holds that previous observations of the variables influence the current variables. Past winners, are very likely to be current winners (Sapp & Tiwari, 2004). Autocorrelation is tested with the Durbin Watson statistic. If the regressions test significant for the Durbin Watson test, which is expected, a regression with a Prais Winsten correction will be performed. This will provide a more efficient estimation of the regression. Coefficients are better to interpret because the regression will now takes autocorrelation in account.

3.3 Definition of a market condition

The focus of the paper is on explaining momentum returns after bull and bear markets with different lengths. Therefore bull and bear markets have to be defined. Because this is an ex-posts study, it is necessary to ensure that the bull and the bear state of the market are significantly different in the mean returns. Therefore this paper follows the research of Resnick & Schoesmith (2002) to require the bull and bear market to exist for a minimum of 6 months. So a bull market is defined as a bull market when the market has a minimum of 6 month upward trend. This means that the market has generated a positive return. The same holds for a bear market, but then the market should have a minimum downward trend of 6 months. So the market needs to have generated a negative return over 6 months. The trend should be based on cumulative returns like Bohl et al., (2016) did. The cumulative return looks at the total return of at least 6 months. This paper also focuses on momentum strategy with the shortest formation period of 3 months, and a holding period of 3 months, which is in total 6 months. Therefore the bull or bear state of the market must be at least 6 months.

To test the first hypothesis, if the length of a market state has a positive influence on the momentum return, several lengths will be used. Wang & Xu (2015) used 6 months market state definition and 36 month definition to determine if the market is a bull or bear market. Siganos & Chelley-Steeley (2006) used 1, 3, 6, and 12 months to define the market state before implementing momentum. The first hypothesis states that the longer the length of the market state, the higher the momentum return will be. However, Huang (2005) argues that running several market lengths will have multicollinearity issues. Therefore this research will use a correlation matrix to decide what time length to use. Values higher than 0.6 could indicate large multicollinearity issues.

	Bull6	**Bull12**	**Bull24**	**Bull36**
Bull6	1	.	.	.
Bull12	0.2749	1	.	.
Bull24	0.0682	0.3919	1	.
Bull36	0.1379	0.0446	0.1701	1

Table 3: Correlation Matrix Bull Market. Bull6 denotes, a bull market based return over the past 6 months, Bull12 over the past 12 months, etc..

	Bear6	**Bear12**	**Bear24**	**Bear36**
Bear6	1	.	.	.
Bear12	0.7319	1	.	.
Bear24	0.4684	0.5711	1	.
Bear36	0.1125	0.2836	0.7683	1

Table 4: Correlation Matrix Bull Market. Bull6 denotes, a bull market based return over the past 6 months, Bull12 over the past 12 months, etc...

Table 3 shows that for running several bull market lengths there are no multicollinearity issues as all values are below 0.6. However for the bear market, the correlation matrix of table 4 indicates such issues. The bear market state of 6 months is highly correlated with the 12 month market state, with a correlation value of 0.7319. The same holds for the 24 and 36 month bear market state, which has a correlation coefficient of 0.7683. A bear market of 12 months is also closely correlated with the bear market of 24 months with a value of 0.5711.

This research uses two different time periods to estimate the market state. Six and thirty-six month timeframes will be used to determine the market state. The minimum of 6 months is used because this research follows of Resnick & Schoesmith (2002), stating that a minimum of 6 months is needed to determine a market state. A thirty-six month time period is also used by Wang & Xu (2015) and Cooper et al., (2004). They argue that 36 month is also robust for when using 12 and 24 month market states. This gives in total 4 different market states, since 2 different lengths are used for up and down markets.

Market State				
	Bull		Bear	
T	**#N**	**%**	**#N**	**%**
6	131	64%	75	36%
36	157	76%	49	24%

Table 5: Amount of bull and bear markets during the period of 2000-2018. (#N) denotes the amount of periods, (%) denotes the percentage of periods for a certain length

Table 5 shows the amount of bull and bear markets found in the sample period. Most of the periods are denoted by a bull market states. As the length of the market state increases, the higher the percentage of the bull market states. Most bear market states are found after the financial crisis of 2008 and after a large recession in 2001 (Nordhaus, 2002). The regression for the first hypothesis will look like the following formula without control variables:

$$MOM_{return} = \beta_1 MarketReturn_{6month} + \beta_2 MarketReturn_{36month} + \epsilon_{i,t} \quad (4)$$

Where Mom_{return} is the momentum return, $\beta_1 MarketReturn_{6month}$ is the market return of the past 6 months and $\beta_2 MarketReturn_{36month}$ is the market return of the past 36 months.

3.4 Turnover Rate

The turnover rate is calculated by dividing the turnover, which is denoted as the amount of traded stocks in a month, by the amount of stocks:

$$Turnover\ Rate = \frac{Traded\ Stocks}{Outstanding\ Stocks} \quad (5)$$

What this indicates is how much a certain stock is traded during the formation period. Higher momentum returns are associated with higher turnover rates of the best performing stocks (Glaser & Weber, 2003).

High (low) trading volume could have a momentum price drift which could lead up to 6 years (Lee & Swaminathan, 2002). Therefore the regression will look like the following formula:

$$MOM_{return} = \beta_1 Turnover + \epsilon_{(i,t)} \qquad (6)$$

Where Mom_{return} is the momentum return and $\beta_1 Turnover$ is the turnover rate of the portfolio. It is expected to be a positive relationship, when turnover rates are higher, momentum returns are expected to be higher. The 6 months market return is not expected to explain the momentum return, following the results of Cooper et al., (2004). The 36 month return is expected to have a positive relation with the momentum return, following the results of Wang & Xu (2015) and Siganos & Chelley-Steeley (2006).

3.5 Control variables

First the momentum returns will be regressed with the different lengths of the market states. Second the momentum returns will be regressed with the turnover rates. These regressions will be done in order to see if there is any effect. By adding control variables, the strength of the effect is shown with other factors playing a role. The control variables which are used are the Fama French factors and market volatility.

3.51 Fama French Factors

The first control variables that are explained, are the Fama French factors. Fama & French found an asset pricing model which corrects for size premium (SMB), value premium (HML) and the excess market risk factor ($R_m - R_f$). The Fama-French alpha is denoted by the excess return minus the risk free rate. The intuition behind the model is that small firms bear higher risk than large firms and that the alpha, the excess return, needs to compensated.

$$R_{it} - R_f = \alpha_{it} + \beta_1 SMB + \beta_2 HML + \beta_3 (R_{mt} - Rf) + \epsilon_{it} \qquad (5)$$

The Fama-French factors are chosen as control variables since Nagel (2000) argued that momentum returns are highly correlated with the size premium factor. However, the winner portfolio is most of the time not correlated with the Fama-French factors. Also, the momentum returns could not be explained only by the loser portfolio, which could be explained by the Fama-French factors. Jegadeesh & Titman (2001) confirmed this, that most of time the loser portfolio is sensitive to the Fama French factors. Fama & French (2012) confirm that the size premium could partly explain momentum returns, however only for international diversified portfolios. Contrary to this results, Barosso & Santa-Clara (2015) argued that the SMB, HML and $\left(R_m - R_f\right)$ are significant negatively related to momentum returns. Rouwenhorst (2002) also showed that firm size is negative related to momentum returns. The Fama-French factors are calculated over the holding period of the momentum strategies, so that equal lengths of time periods are compared. The Fama French Factors are retrieved from the Kenneth French database.

3.52 Market volatility

The second control variable that is explained is the 24 month market volatility. Market volatility increases when markets are down (Gonzalez et al., 2005). Wang & Xu (2015) found that market volatility has strong predictive power for momentum returns. They found that especially for the loser portfolio of the momentum strategy, market volatility seems to be a good explanatory variable. Wang & Xu (2015) argued that when market volatility is relatively stable, momentum returns can be predicted pretty well. However, when there is high market volatility, momentum returns seem to be unpredictable. A way of overcoming the issue with high market volatility is shorting the winner portfolio and take a long position in the loser portfolio. This is contrary to the strategy used in this research. In their research market volatility was based on the past 12 month. This thesis also uses the 12month market volatility as a control variable. In figure 1 the month volatility is graphed over the entire period. There is a high peak around 2012, this can be attributed to macro-economic factors in Europe and the USA. Europe was facing economic problems regarding high government debt in several countries (Alsakka & Gwilym, 2014). In the USA, the unemployment rate was still high and the country was still not recovering that well from the financial crises in 2008 (Blecker, 2016). Market volatility increases during recessions and economic crises.

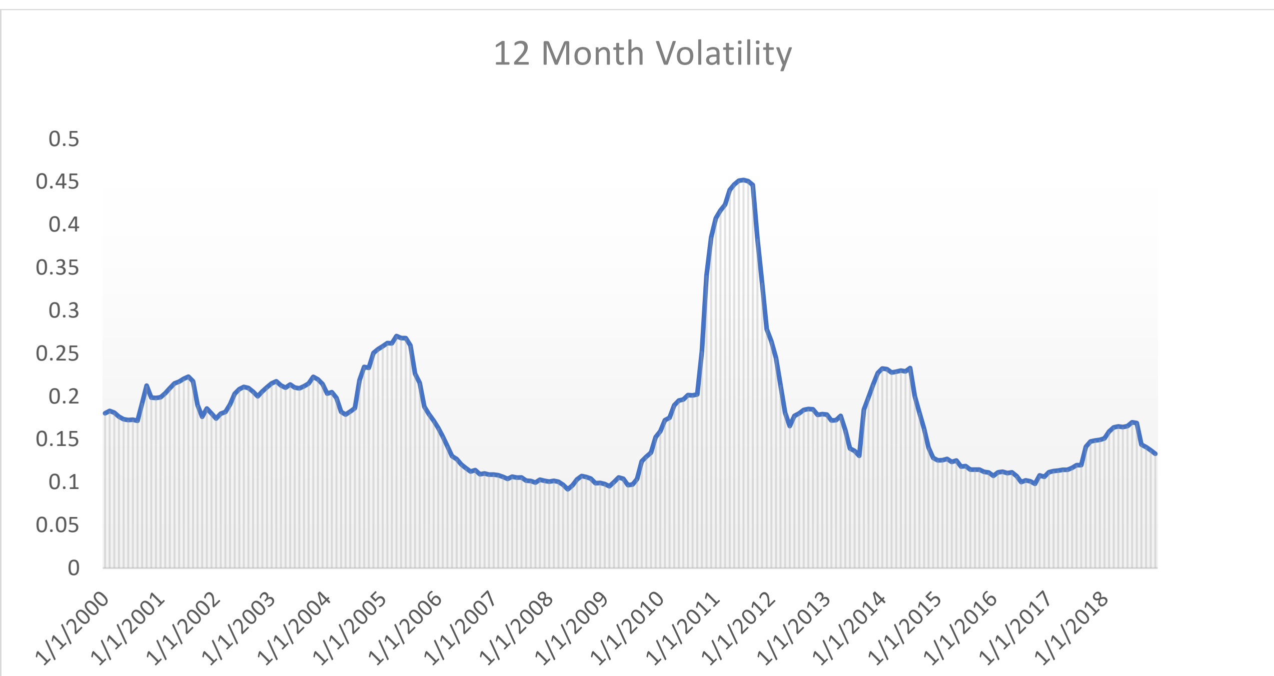

Figure 1. 12 Month Volatility over the period of 2000-2018

The regression for the first hypothesis with the control variables will look like:

$$MOM_{return} = \beta_1 MarketReturn_{6month} + \beta_2 MarketReturn_{36month} + \beta_3 HML + \beta_4 SMB + \beta_5 (R_m - R_f) + MV_{12month} + \epsilon_{i,t} \quad (6)$$

Where β_1 is the 6 month market return, β_2 the thirty six month market return, β_3 is the value premium, β_4 is the size premium, β_5 is the Fama French excess Market return and β_6 is the 12 month market volatility.

The regression for the second hypothesis with the control variables will look like:

$$MOM_{return} = \beta_1 Turnover + \beta_2 HML + \beta_3 SMB + \beta_4 (R_m - R_f) + MV_{12month} + \epsilon_{i,t} \quad (7)$$

β_1 denotes the average turnover rate of the stocks in the winner and loser portfolio.

4. Results

In this part of the thesis the results of the t-tests and regressions are set out. First the t-tests are set out to evaluate which momentum strategy yields significant excess market returns, also known as the momentum premium (Brown et al, 2008). Markets are separated into bull and bear markets to evaluate in which market condition the momentum strategy works best. After the t-tests the regressions for the first and second hypothesis are set out. The momentum returns are calculated based on the formation period and one month is skipped between the formation and the holding period. The momentum return is the winner minus loser portfolio, which holds buying the top 10% best performing stocks and selling the worst performing 10% of stocks based on the formation period.

4.1 T-test

First the momentum strategy returns are compared to the market returns based on the length of the holding period. A holding period of 3 months is compared to a 3-month market return. In this way the momentum return and the market return are based on the same length of periods. A student t-test is chosen to compare the momentum return to the raw market return. This thesis follows the research method of Huang (2006) and Siganos & Chelley-Steeley (2006). A t-test is preferred for comparing the two returns to each other because it clearly shows the differences in the mean of observations compared to each other. The t-test also shows if the difference between the market and momentum return is significant, or not. The t-test will check for three levels of significance; 10, 5, and 1 percent significance. The higher the significance level, the less likely it is that the momentum strategy is higher than the market return due to coincidences. The results of the first t-test are plotted in table 6.

Momentum Return		Holding			
		3	6	9	12
Formation	3	**0.90%**	**0.71%**	**1.60%**	**1.85%**
		*2.1022***	*1.3873*	*2.6615****	*2.6326****
	6	**0.22%**	**0.34%**	**0.53%**	**0.47%**
		*1.8668**	*2.5349***	*3.556****	*2.6681****
	9	**0.22%**	**0.41%**	**0.63%**	**0.57%**
		1.4839	*2.0862***	*2.7467****	*2.283***
	12	**0.20%**	**0.31%**	**0.59%**	**0.62%**
		1.3538	*1.48*	*2.4176***	*2.3603***

*Table 6: Average monthly differences momentum returns and market returns over the period 2000-2018. The highlighted boxes show the t-statistics. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

In table 6 are the differences between the market and momentum returns of all listed S&P500 companies over the period of 2000-2018. All momentum returns outperformed the market. Twelve out of the sixteen strategies performed significantly better the market return. The highest average monthly return was found in the strategy of a 3 month formation and 12 month holding period, this is an annual excess return of 22.2% $(18.5\% \times 12)$ over the market. All significant strategies range from average monthly returns of 0.22% to 1.85% earned from the strategies (6x3) and (3x12). The strategies (3x6), (9x3), (12x3) and (12x6) generated insignificant momentum returns compared to the market return. This indicates that the mean in returns between the market and the momentum returns did not differ from each other significantly. The results of the t-test are comparable to the results of Bhootra (2011) and Cooper et al., (2004), where all excess momentum returns are between 0 and 2 percent, and most strategies have a significant momentum premium. On the other hand, these results differ from the results of Hameed et al., (2001) where they did not found any significant momentum premium returns. In the following part of the results, the markets are split up in bull and bear markets. This will indicate if the momentum strategies are still significant higher in different market states.

4.11 Separate Bull and Bear Markets

The second part of the t-test is splitting the data in up and down markets. This is to test if the momentum strategies hold in up and down markets. Siganos & Chelley-Steeley (2006) separated the momentum strategies in up and down market and found that during down markets momentum strategy was more profitable than in up markets. Table 7 shows the amount and percentages of up and down markets. Most of the time the market is defined as an up market. The market is defined as up if the market return over the sample period was positive. If the market return was negative, than the market is defined as down. So the market return over 3 months is compared to strategies with a 3 month holding period. The strategies do differ in holding periods, therefore the average monthly returns are compared. The percentage of up markets ranges from 61% to 74%. The same length as holding period is chosen. By separating the market return in up and down, the effectiveness of the momentum strategy can be seen.

Market State				
	up		down	
T	#N	%	#N	%
3	112	61	71	39
6	124	68	59	32
9	127	69	56	31
12	135	74	48	26

Table 7: Market Returns divided in up and down markets. The market returns are separated in 4 time periods (T). The header (#N) shows the amount of up markets for a given time period. The header (%) shows the percentage of the total periods of up and down market for a given period.

First the t-tests of momentum returns and up markets are regressed in table 8. The results in the table show that the momentum returns were only in 2 out of the 16 returns higher than the market return. These positive returns were not significant, so they do not differ significantly from the market return. Five momentum strategies even significantly underperformed to the market return in up markets. This ranges from -0.78% to -0.21% average monthly returns. This means that 11 momentum strategies did not significantly differ from the market return. The results in table 8 shows that momentum strategies did not outperform the market when the entire market was going up. It even shows that using some strategies (3x3, 3x6, 6x3, 9x3 and 12x3) significantly underperformed compared to the market. So when the market was going up, the momentum return was not significantly higher. In up markets there was no significant momentum premium found in this dataset.

Positive Market Return and Momentum		**Holding**			
		3	**6**	**9**	**12**
Formation	**3**	**-0.78%**	**-0.30%**	**-0.18%**	**-0.21%**
		*-1.8251**	*-2.0967***	*-1.0496*	*-1.1352*
	6	**-0.21%**	**-0.10%**	**0.08%**	**-0.09%**
		*-1.6931**	*-0.6937*	*0.4876*	*-0.4645*
	9	**-0.30%**	**-0.13%**	**0.04%**	**-0.11%**
		*-2.1512***	*-0.8474*	*0.1888*	*-0.5563*
	12	**-0.28%**	**-0.17%**	**-0.07%**	**-0.11%**
		*-1.9841***	*-0.9541*	*-0.317*	*-0.4876*

*Table 8: Results T-tests results of Momentum returns and up markets. Returns are average monthly returns to compare the returns. The highlighted boxes show the t-statistics. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

Secondly, the results in table 9 show the outcomes of the t-tests when the markets were denoted as down markets. The results differ a lot from the up markets shown in table 8. Every momentum strategy did significantly outperform the market. The momentum strategies do range from 0.9% to 2.36% average monthly excess returns compared to the market. Fifteen out of sixteen strategies are significant on the 1% level. Only the (6/3) strategy is significant on the 5% level. Table 9 does show that the momentum strategy outperformed the market significantly in this data set, when the market return is denotes as a down market.

Negative Market Return and Momentum		Holding			
		3	**6**	**9**	**12**
Formation	**3**	**0.90%**	**1.18%**	**1.71%**	**2.36%**
		*4.4165****	*5.6104****	*7.3199****	*8.7151****
	6	**0.88%**	**1.26%**	**1.56%**	**2.06%**
		*1.8668***	*5.4129****	*5.9372****	*6.3153****
	9	**0.90%**	**1.24%**	**1.46%**	**1.95%**
		*5.95512****	*4.2652****	*4.6726****	*5.1772****
	12	**0.82%**	**1.07%**	**1.58%**	**2.06%**
		*5.8724****	*3.9435****	*5.1247****	*5.9062****

*Table 9: Results T-tests of momentum returns and down market returns. Returns are monthly averages to compare them. The highlighted boxes show the t-statistics. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

The results of the t-tests for momentum strategies in up and down market do contradict the results of Huang (2006). He found that momentum returns were higher during up markets. The results in table 8 and in table 9 show that the momentum strategies generated the highest returns compared to the market, when the market returns was negative in the holding period. The momentum premium was not significantly positive. Some strategies did even significantly underperform compared to the market return during up markets with the same length as the formation period. In the next section the momentum returns are tried to be explained.

4.2 Market State Length

This part of the research focuses on explaining the momentum returns. So it focuses on when the momentum return is the highest and what drives the momentum returns. First a general regression is set out with two market state lengths. These market lengths are 6 and 36 months. There is no difference between bull or bear markets over these periods in the first regression. The first regression results are shown in table 10. This regression indicates if there is any effect at all of the market state length on the momentum strategy return. All the strategies contained autocorrelation, which indicated that the strategies were successful implemented. No autocorrelation, or negative autocorrelation would have indicated that the strategies were not successful or suffered from reversals (Daniel et al, 2002). Therefore the results are regressed with a Prais Winsten correction.

Momentum Strategy dependent on Market state								
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
6 Month	-0.337*	-0.398**	-0.376**	-0.505***	-0.400**	-0.435**	-0.727***	-0.891***
	(-2.57)	*(-2.80)*	*(-2.82)*	*(-3.76)*	*(-2.82)*	*(-2.95)*	*(-4.25)*	*(-5.08)*
36 Month	0.0871	0.138*	0.188***	0.198***	0.224***	0.213***	0.291***	0.290***
	-1.77	*-2.57*	*-3.7*	*-3.95*	*-4.16*	*-3.82*	*-4.56*	*-4.46*
N	200	197	194	191	197	194	191	188
R2	0.034	0.048	0.073	0.095	0.086	0.078	0.121	0.142
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
6 Month	-0.460**	-0.697***	-0.809***	-1.016***	-0.696***	-0.916***	-1.016***	-1.079***
	(-2.80)	*(-4.21)*	*(-4.03)*	*(-4.61)*	*(-3.70)*	*(-4.60)*	*(-4.61)*	*(-4.62)*
36 Month	0.118	0.153*	0.144	0.158	0.0461	0.119	0.158	0.156
	-1.89	*-2.47*	*-1.93*	*-1.95*	*-0.66*	*-1.61*	*-1.95*	*-1.83*
N	194	191	188	185	191	188	185	182
R2	0.041	0.087	0.081	0.105	0.077	0.106	0.105	0.108

*Table 10: Regression results of the momentum strategy return dependent on the 6 month and 36 month market state. The Red highlighted boxes are significant negatively correlated to the momentum strategy. Green highlighted boxes denote a significant positive relation with the momentum strategy. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

The results in table 10 show that the 6 month market state has with every strategy a significant negative relation. The strategies are shown as 3x3 for example. This shows the strategy of a 3 month formation and a 3 month holding period. The 3 month formation and 3 month holding period is the only strategy with a significance level lower than 5%. All the coefficients lay between -0.337 and -1.016. These significant negative coefficients indicate that the 6 month market state moved in the opposite direction of the momentum strategy. When the 6 month market state was increasing, the momentum returns would decrease and vice versa.

The 36 month market state did not have a significant relation with every momentum return. The 36 month market state seems a good predictor for the momentum returns for strategies with a 3 or 6 month formation period. For all those strategies, except for the 3x3 strategy, the 36 month market state had a significant positive relation with the momentum returns. This means, when using 3 or 6 month formation periods, the 36 month market state did explain momentum. When the market state was positive, the momentum return is positive and vice versa. These significant coefficients lay between 0.138 and 0.290. However, for the formation periods of 9 and 12 months the 36 month market state was not a good predictor of the momentum return. The relation is for every strategy positive, but insignificant. Therefore the 36 month market state is not a good indicator for the momentum return, when using formation periods of 9 or 12 months. The overall R-squared is not high, most of the r-squared values lay below 0.1 which indicates low explanatory power of the model.

Table 11 shows the results of the regression where the momentum strategies are the dependent variable and the two market state lengths, the Fama-French factors and the 24 month market volatility are the independent variables. The Fama French factors and the Market volatility are added as the control variables. This shows if the two market states still yield significant results, under different conditions. Again the strategy 3x3 is the 3month formation and 3 month holding portfolio.

	Regression Momentum returns, market state months and Control variables							
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
6Month	-0.419**	-0.359*	-0.364	-0.274	-0.574**	-0.212	-0.366	-0.611**
	(-2.79)	*(-2.01)*	*(-1.79)*	*(-1.24)*	*(-3.29)*	*(-1.18)*	*(-1.87)*	*(-2.74)*
36 Month	0.0595	0.156	0.0946	-0.0305	0.065	0.118	0.202	0.262
	-1.04	*-1.89*	*-0.92*	*(-0.26)*	*-0.91*	*-1.15*	*-1.54*	*-1.85*
Rm - Rf	-0.0451	-0.343**	-0.303**	-0.278*	-0.154	-0.375**	-0.0751	-0.290*
	(-0.33)	*(-2.79)*	*(-2.62)*	*(-2.45)*	*(-0.96)*	*(-2.64)*	*(-0.56)*	*(-2.19)*
SMB	0.272	0.725**	0.795**	1.171***	0.278	0.31	0.239	0.861**
	-1.11	*-2.99*	*-3.14*	*-4.78*	*-0.89*	*-1.16*	*-0.89*	*-3.05*
HML	-0.0542	-0.0298	-0.126	-0.217	-0.201	-0.0059	-0.0063	-0.0238
	(-0.32)	*(-0.20)*	*(-0.87)*	*(-1.68)*	*(-0.98)*	*(-0.03)*	*(-0.04)*	*(-0.15)*
MV	-0.25	-0.603	-0.266	-0.141	-0.653*	-0.818*	-0.0843	0.277
	(-1.02)	*(-1.86)*	*(-0.67)*	*(-0.32)*	*(-2.23)*	*(-2.19)*	*(-0.18)*	*-0.55*
N	200	197	194	191	197	194	191	188
R2	0.048	0.114	0.083	0.131	0.073	0.078	0.025	0.092
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
6Month	-0.600***	-0.557**	-0.215	-0.429	-0.518**	-0.395*	-0.234	-0.326
	(-3.62)	*(-2.78)*	*(-1.01)*	*(-1.72)*	*(-3.16)*	*(-1.98)*	*(-1.07)*	*(-1.41)*
36 Month	0.0587	0.280*	0.258	0.212	0.0381	0.331**	0.323*	0.243
	-0.69	*-2.24*	*-1.67*	*-1.19*	*-0.45*	*-2.66*	*-2.05*	*-1.51*
Rm - Rf	-0.461**	-0.487**	-0.306*	-0.358*	-0.433**	-0.475**	-0.162	-0.444**
	(-2.93)	*(-3.01)*	*(-2.03)*	*(-2.24)*	*(-2.76)*	*(-2.94)*	*(-1.05)*	*(-3.03)*
SMB	0.226	0.699*	0.666*	0.383	0.248	0.861**	0.308	1.197***
	-0.71	*-2.23*	*-2.1*	*-1.13*	*-0.78*	*-2.75*	*-0.94*	*-3.81*
HML	0.011	0.0197	-0.596**	-0.121	-0.0898	0.114	-0.193	-0.162
	-0.05	*-0.09*	*(-2.81)*	*(-0.48)*	*(-0.43)*	*-0.57*	*(-0.89)*	*(-0.79)*
MV	-1.186***	-0.597	0.681	0.281	-1.393***	-0.438	0.594	0.378
	(-3.79)	*(-1.34)*	*-1.23*	*-0.45*	*(-4.44)*	*(-0.98)*	*-1.05*	*-0.66*
N	191	188	185	182	194	191	188	185
R2	0.157	0.124	0.167	0.049	0.123	0.091	0.03	0.113

*Table 11: Regression results of the momentum returns, the market states and the control variables. Rm-Rf denotes the market return minus the risk free rate, SMB is the size premium, HML is the value premium and MV is the 24 month market volatility. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

The results in table 11 show that by adding the control variables that the 6 month market condition loses its explanatory power in over half of the momentum strategies. For every strategy with a 3 month holding period, so 3x3, 6x3, 9x3 and 12x3, the 6 month market condition does have a significant negative relation with momentum returns. Almost for every strategy with a six month holding period, the 6 month market state condition did still have a significant negative relation with the momentum return. For the strategies with longer holding periods, the 6 month market return did not seem to explain anything. By adding the control variables and looking at the 36 month market state, the results change a lot. In table 10, the regressions without the control variables, the 36 month market condition did have positive significant relation with momentum return with the shorter formation periods (3 and 6 months). In table 11, the regressions with the control variables, the 36 month market condition seems to lose its explanatory power. Almost all the coefficients are insignificant when adding the control variables, there are a few significant on the 10% level. Most of the positive relations with momentum seem to be captured by the size premium (SMB) for some strategies. The size premium did always have a positive relation with the momentum returns, however not always a significant relation. The significant relation with the momentum and size premium seems to be random distributed over all strategies.

The results in table 11 do also show that for almost every momentum strategy the Fama-French factor $(R_m - R_f)$, the excess market factor, did have a significant negative relationship. This indicates that the excess market index return moved in the opposite direction of the momentum return. Only for three strategies the excess market index return was not significant negative. This Fama-French excess market return seemed to capture the effect what is lost by the 6 month market return. The other variables like the market volatility (MV), the book to market factor (HML) do not seem to explain that much for the momentum strategies over all markets. There are some significant relations for some strategies, but these seem to be randomly divided over the data. In the next part the data is divided in bull and bear markets.

4.21 Bull Market State

The data is divided in bull markets only for this regression. A momentum return is picked and regressed with the 6 month bull market state and the 36 month bull market state. Bear markets are ignored for this regression. This regression shows if the 6 month market state still has a significant negative relation with momentum returns as found in table 10. First the bull market returns are regressed without the control variables. These results are shown in table 12. In the bull markets autocorrelation was present and therefore the results are regressed with Prais Winsten test.

Momentum Returns regressed in 6 and 36 Month bull Market								
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
6Month Bull	-0.358	-0.177	0.126	0.231	0.227	0.352	-0.317	-0.345
	(-1.36)	*(-0.64)*	*-0.4*	*-0.71*	*-0.53*	*-0.88*	*(-0.70)*	*(-0.85)*
36 Month Bull	0.036	-0.0143	-0.021	0.0286	-0.0143	0.157	0.365	0.0172
	-0.4	*(-0.15)*	*(-0.15)*	*-0.19*	*(-0.08)*	*-0.77*	*-1.6*	*-0.07*
N	109	107	107	107	107	107	107	107
R2	0.008	0.025	0.01	0.002	0.005	0.03	0.036	0.02
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
6 Month Bull	-1.090*	-0.621	-0.12	-0.406	0.134	-0.331	-0.175	-0.733
	(-2.18)	*(-1.52)*	*(-0.25)*	*(-0.92)*	*-0.27*	*(-0.69)*	*(-0.35)*	*(-1.48)*
36 Month Bull	0.304	0.308	0.073	-0.0702	-0.338	-0.0713	-0.225	-0.311
	-1.31	*-1.38*	*-0.25*	*(-0.25)*	*(-1.30)*	*(-0.26)*	*(-0.73)*	*(-0.97)*
N	107	107	107	107	107	107	107	107
R2	0.059	0.047	0.025	0.024	0.023	0.022	0.027	0.055

*Table 12: Results of regressions of momentum returns with bull market returns of 6 and 36 months. Red Highlighted box shows a significant negative relation. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

Table 12 shows the results of the regressions of the momentum returns in bull markets. The results show that every bull market state had an insignificant relation with momentum return, except for the 6 month bull market in the 9 month formation and 3 month formation period. For every strategy the past bull market state did not seem to explain anything. All the regressions have a very low r-squared, which indicates that the bull market state do not seem to explain the momentum returns. Where for both markets, bull and bear displayed in table 10, the 6 month market state did explain a lot of the momentum returns and the 36 month only for several, in only the bull markets the relation is absent. These results indicate the for the S&P500 over the period 2000-2018, bull market states did not seem to significantly explain the momentum returns.

Regression results Momentum in Bull Markets with Control Variables								
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
Bull6	-0.374	0.153	-1.104*	-0.185	-0.208	0.117	-0.758	-0.19
	(-1.40)	*-0.35*	*(-2.36)*	*(-0.36)*	*(-0.75)*	*-0.29*	*(-1.83)*	*(-0.39)*
Bull36	0.0584	-0.0186	0.241	-0.127	-0.0255	0.044	0.238	-0.03
	-0.62	*(-0.11)*	*-1.39*	*(-0.60)*	*(-0.26)*	*-0.27*	*-1.34*	*(-0.12)*
Rm-Rf	-0.174	-0.266	-0.648***	-0.397**	-0.155	-0.529**	-0.502***	-0.359*
	(-1.19)	*(-1.48)*	*(-4.66)*	*(-2.70)*	*(-1.03)*	*(-3.14)*	*(-3.45)*	*(-1.99)*
SMB	0.157	0.481	1.038***	0.888**	0.0154	0.599	0.723*	0.732
	-0.69	*-1.42*	*-3.52*	*-3.04*	*-0.06*	*-1.88*	*-2.37*	*-1.95*
HML	0.0332	-0.136	0.0737	-0.0771	-0.25	-0.18	-0.0734	-0.389
	-0.16	*(-0.45)*	*-0.29*	*(-0.26)*	*(-1.09)*	*(-0.63)*	*(-0.29)*	*(-1.09)*
MV	-0.486	-0.908	-2.306**	-1.49	-0.787*	-1.863*	-2.442**	-1.672
	(-1.40)	*(-1.21)*	*(-2.88)*	*(-1.41)*	*(-2.05)*	*(-2.62)*	*(-2.91)*	*(-1.27)*
N	109	107	107	107	107	107	107	107
R2	0.035	0.043	0.252	0.138	0.049	0.139	0.181	0.112
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
Bull6	0.112	-0.628	-0.129	-0.0681	0.207	-0.359	-0.363	-0.619
	-0.36	*(-1.39)*	*(-0.27)*	*(-0.14)*	*-0.64*	*(-0.86)*	*(-0.89)*	*(-1.22)*
Bull36	-0.0437	0.186	0.0662	-0.156	0.012	0.00622	0.00686	-0.229
	(-0.33)	*-1.09*	*-0.25*	*(-0.55)*	*-0.08*	*-0.03*	*-0.03*	*(-0.74)*
Rm-Rf	-0.178	-0.733***	-0.468*	-0.530**	-0.0713	-0.404	-0.323	-0.393
	(-0.96)	*(-4.24)*	*(-2.16)*	*(-2.68)*	*(-0.36)*	*(-1.81)*	*(-1.57)*	*(-1.82)*
SMB	-0.0901	1.029**	0.418	0.896*	-0.144	0.539	0.715	0.498
	(-0.28)	*-3.13*	*-0.94*	*-2.13*	*(-0.42)*	*-1.3*	*-1.72*	*-1.07*
HML	-0.667*	-0.1	-0.282	-0.202	-0.619*	-0.179	-1.086**	-0.235
	(-2.38)	*(-0.34)*	*(-0.80)*	*(-0.51)*	*(-2.07)*	*(-0.51)*	*(-3.36)*	*(-0.55)*
MV	-1.122*	-2.120**	-1.573	-1.414	-0.781	-0.562	-1.041	-0.515
	(-2.08)	*(-2.94)*	*(-1.21)*	*(-0.96)*	*(-1.33)*	*(-0.54)*	*(-0.78)*	*(-0.31)*
N	107	107	107	107	107	107	107	107
R2	0.097	0.225	0.095	0.135	0.064	0.072	0.197	0.11

*Table 13: Regression results of Momentum Strategy with different bull market states, the Fama-French 3 factors and the Market volatility. Red highlighted boxes indicate a significant negative relation. Green highlighted boxes show a significant positive relation. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

Table 13 shows the regression results similar to table 12, except the control variables are added. The bull market states did still not seem to explain the momentum returns. The variables 6 month bull market state, as well as the 36 month market state are insignificant. The control variables, do show significant relations with the momentum strategy returns. The Fama French variables do show significant relations in the bull markets. The $R_m - R_f$ variable is always negative and in half of the strategies it is significant negative. For all the strategies with a formation period of 12 months, the relation between the momentum return and the excess market return was insignificant. The SMB variable, the size factor, is in almost every strategy positive and in half of the strategies significant and positive. There does not seem to be a pattern for which strategies it was significant. The Market volatility variable is always negative and in over half of the strategies it is significant. However, for every strategy with 12 month formation the relation is insignificant. The R-squared did increase in every regression by adding the control variables, so the explanatory power of the model did increase. The bull market states did not explain the momentum returns.

This contradicts the research results of Cooper et al, (2004) where they argued that momentum returns are higher after 6 month bull markets. This research did found that after the 6 month bull markets, momentum returns were not significant higher. Huang (2006) found higher returns after up market after both 6 and 36 months. This research also contradicts their results, since both the bull market states did not significantly explain the momentum return. Next the bear market results are shown.

4.22 Bear Market State

The bull market state did not seem to explain the momentum returns. Therefore also the market will be divided in bear markets. There are some papers which found that after bear markets, momentum returns are higher than after bull markets, like Chelley & Steely (2000). In table 14 the results of the regressions of the momentum strategies in the bear market are shown. The major part of the data is denoted by bull markets, not by bear markets. Therefore the number of observations is lower for the bear markets than for the bull markets. Also in the bear markets autocorrelation was present and therefore the regressions are regressed with Prais Winsten test which fixes for autocorrelation.

Regression Results Bear Market								
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
6 Month Bear	-0.55	-0.917*	-0.304	0.0888	-0.74	-0.572	-0.443	-0.426
	(-1.37)	(-2.54)	(-0.90)	-0.24	(-1.68)	(-1.45)	(-1.21)	(-1.20)
36 Month Bear	-0.254	0.359	0.252	-0.0477	-0.0279	0.263	0.0658	-0.464
	(-0.82)	-1.25	-0.98	(-0.17)	(-0.08)	-0.81	-0.23	(-1.64)
N	32	32	32	32	32	32	32	32
R2	0.098	0.2	0.038	0.03	0.094	0.078	0.04	0.164
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
6 Month Bear	-1.042**	-0.65	-0.329	-0.348	-1.113**	-0.770*	-0.643	-0.278
	(-2.89)	(-1.76)	(-0.86)	(-0.84)	(-3.21)	(-2.20)	(-1.56)	(-0.87)
36 Month Bear	0.25	0.412	-0.168	-0.567	0.167	0.326	-0.333	-0.361
	-0.9	-1.2	(-0.52)	(-1.68)	-0.63	-1.01	(-0.91)	(-1.28)
N	32	32	32	31	32	32	31	28
R2	0.222	0.121	0.028	0.115	0.157	0.169	0.138	0.057

*Table 14: Results of the regressions of the bear market state on momentum returns. Red highlighted boxes are significant negative relations. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

Table 14 shows the regression results of the momentum strategies in bear markets. The bear markets are divided in the 6 month bear market and the 36 month market state. The 6 month bear state is significant for some strategies, it is negative for every strategy. There does not seem to be a structure for which strategies the 6 month bear state did explain the momentum return significantly. For the 12 month formation period with 3 months of holding, the coefficient is the lowest (-1.113), with the highest t-value (-3.21). The 36 month bear market did not have any explanatory power in these regressions. The results are almost similar to the regression in the bull market, where both market states lacked any relation with the momentum returns.

Regression Results Bear Market With Control Variables								
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
6 Month Bear	-0.819	-1.161*	-0.154	-0.187	-1.016	-0.459	-0.69	-0.696*
	(-1.13)	(-2.63)	(-0.41)	(-0.47)	(-1.46)	(-0.97)	(-1.96)	(-2.63)
36 Month Bear	-0.201	0.155	0.159	0.189	0.0191	0.124	-0.0972	-0.391
	(-0.42)	-0.42	-0.48	-0.52	-0.04	-0.3	(-0.33)	(-1.60)
Rm-Rf	-0.142	-0.22	-0.581	-0.617	-0.168	-0.703	-1.085*	-0.773*
	(-0.13)	(-0.31)	(-1.15)	(-1.25)	(-0.16)	(-0.90)	(-2.28)	(-2.35)
SMB	0.786	0.72	0.615	1.585*	0.991	-0.0249	0.859	1.753***
	-0.4	-0.86	-0.86	-2.57	-0.52	(-0.03)	-1.33	-4.3
HML	-0.613	-0.00974	0.108	-0.255	-0.638	-0.317	-0.278	-0.0516
	(-0.49)	(-0.02)	-0.35	(-0.96)	(-0.53)	(-0.62)	(-0.98)	(-0.29)
MV	-0.224	-0.641	0.433	0.168	-0.153	-0.207	-0.0774	0.3
	(-0.21)	(-0.75)	-0.57	-0.22	(-0.15)	(-0.22)	(-0.11)	-0.58
N	32	32	32	32	32	32	32	32
R2	0.087	0.06	0.203	0.27	0.111	0.122	0.022	0.24
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
6 Month Bear	-1.569***	-0.459	-0.193	-0.449	-1.533***	-0.706	-0.611	-0.277
	(-4.10)	(-1.08)	(-0.46)	(-1.49)	(-4.21)	(-1.72)	(-1.39)	(-1.16)
36 Month Bear	-0.224	0.259	0.0348	-0.0624	-0.298	0.356	-0.169	-0.275
	(-0.79)	-0.6	-0.07	(-0.23)	(-1.09)	-0.92	(-0.35)	(-1.29)
Rm-Rf	-0.941	-0.452	0.837	-1.343**	-1.151*	-0.544	-0.26	-1.418***
	(-1.71)	(-0.56)	-1.52	(-3.54)	(-2.21)	(-0.74)	(-0.43)	(-4.34)
SMB	1.263	-0.0699	0.908	2.714***	1.093	0.0282	1.185	1.834***
	-1.26	(-0.08)	-0.98	-5.63	-1.14	-0.04	-1.28	-4.06
HML	-0.232	0.127	0.861	-0.483*	-0.24	-0.427	0.185	-0.458
	(-0.35)	-0.25	-1.77	(-2.17)	(-0.39)	(-0.92)	-0.42	(-1.88)
MV	-1.631*	-0.101	1.054	1.607*	-1.443*	0.295	1.041	1.088*
	(-2.66)	(-0.09)	-0.84	-2.7	(-2.45)	-0.31	-0.93	-2.25
N	32	32	32	31	32	32	31	28
R2	0.25	0.148	0.183	0.17	0.193	0.031	0.154	0.124

*Table 15: Regression results of bear market states on momentum returns. Red highlighted boxes are significant negative relations. Green highlighted boxes are significant positive relations. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

Table 15 shows the results of the regressions of the momentum strategies in bear markets with the control variables. Adding the control variables does not change much for the explanatory variables '6 month bear' market and '36 month bear market'. The 6 month bear market state is significant for 4 strategies, randomly distributed over the strategies. Like in the bull market and the regression with both markets, the 6 month market state coefficient is negative. The 36 month market bear state failed to explain momentum returns. The 36 month bear state is in most strategies positive, in other negative. There seems no relation at all between the momentum return and the 36 month bear market state.

The Fama-French control variables do show kind of similar results to bull market regression. The excess return had a negative relation with the momentum returns. In both market states the significant negative relation seems randomly distributed over the different strategies. Only in the bear market, two strategies with 12 month holding period had a significant relation, which is not there in the bull market. The size premium variable was positive in 4 strategies. There is a pattern for the size premium variable. Only the strategies with the 12 month holding period had a significant positive relation with the size premium. So it does not explain momentum returns for all strategies in this data set. The value premium variable (HML) does not seem to explain anything, it is only significant in the 9 month formation and 12 month holding strategy. Across strategies the coefficient is positive as well as negative, there seems no actual relation between the value premium and the momentum returns. The control variable 'market volatility' in table 15 shown as MV, failed to explain momentum returns in most strategies. It was often insignificant and the coefficient was not always positive nor negative. There are two significant positive coefficients for the strategies 9x12 and 12x12. There are also two significant negative relations, with the strategies 9x3 and 12x3. These are the strategies with the longer formation periods. The market volatility failed to explain the momentum returns for the strategies with the lower formation periods. For the strategies 3x3 and 6x3 the coefficients are negative, like the coefficients in 9x3 and 12x3. The coefficient 3x12 and 6x12 are positive like 9x12 and 12x12, just not significant.

The results found in this paper are different than the results of Siganos & Chelley-Steeley (2005). They found that following bear markets the momentum return is higher. The longer the bear state, the higher the momentum returns. The findings in this paper contradict their findings and find that the longest bear market state did not explain the momentum return. Daniel & Moskowitz (2016) found that momentum returns are lower after a 36 month bear state, this has to do with higher market volatility. The results in this paper show that the bear market state did not explain the momentum returns. The market volatility did also not seem to explain the momentum return. The results showed that market volatility widely varies between the strategies. This contradicts the research of Daniel & Moskowitz (2016). Muga & Santamaria (2007) found that the downside of heavy down markets for long holding periods has disastrous effects on the momentum return. However, this is not found in this data file. The 36 month bear market state failed to explain momentum returns.

For both market states, the bull and the bear market, the 6 month market state as well as the 36 month market state failed in explaining the momentum returns. Reflecting on the first hypothesis, which states that the longer the market state the higher the momentum return, this research concludes that the hypothesis can be rejected. The 36 month market state, for both market states, did not explain any of the momentum returns. The 6 month market return did show a significant and negative relation with momentum returns, but when control variables were added the market state lacked significant explanatory power. In the next part, the momentum returns are tried to be explained by the average turnover rate.

4.3 Turnover Rate

The second hypothesis claims that the higher the turnover rate, the higher the momentum returns should be. In this part of the paper the momentum returns will be the dependent variable and the turnover rate the independent variable. The turnover rate is the average turnover of the winner portfolio and the loser portfolio. Table 16 shows the first regression, without the control variables. This will indicate if there is a relation between the returns and the turnover rate.

	Regression Results Momentum and Turnover Rate							
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
Turnover	6.514	*7.232*	*5.379*	6.073	16.02*	*23.09***	*22.66**	20.80*
	-0.96	*-1.2*	*-0.78*	*-0.89*	*-2.15*	*-3.18*	*-2.57*	*-2.3*
N	198	190	185	180	195	187	182	177
R2	*0.005*	0.008	0.003	0.004	*0.023*	0.052	0.036	0.029
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
Turnover	19.17*	*26.76****	*27.13***	31.83**	30.93**	*28.58***	*25.44**	27.83*
	-2.31	*-3.41*	*-2.78*	*-3.13*	*-3.31*	*-2.99*	*-2.42*	*-2.46*
N	192	184	179	174	189	181	176	171
R2	*0.027*	0.06	0.042	0.054	*0.055*	0.047	0.033	0.034

*Table 16: Results of regressions of the momentum returns and the turnover rate. Green highlighted boxes indicate a significant positive relation. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

The results in table 16 show that without control variables, the turnover rate has a significant positive relation with the momentum returns for every strategy with a formation period of 6 month or longer. This means that when the turnover rate of the portfolios was higher, the momentum returns were higher as well. The coefficients were the highest for the strategies with a 12 month formation period. The highest coefficient for the variable turnover rate was 31.83 in the 9x9 strategy. The lowest significant coefficient was for the 6x3 period with a value of 16.02. Coefficients are larger than in previous regressions due to the fact that the returns are measured in whole numbers (3 when 3% increase for example) and the turnover rate is a percentage (value of 0.2 if the turnover rate was 20%). The turnover rate did not seem to explain the momentum returns for strategies with a formation period of 3 months. The coefficients are positive but not significant.

Regression Momentum Strategy, turnover rate and Control Variables								
Strategy	**3x3**	**3x6**	**3x9**	**3x12**	**6x3**	**6x6**	**6x9**	**6x12**
Turnover	6.645	5.504	9.008	8.349	12.22	25.29***	17.21	11.25
	-0.91	*-0.95*	*-1.35*	*-1.26*	*-1.27*	*-3.6*	*-1.93*	*-1.22*
Rm-Rf	-0.0336	*-0.356***	-0.504***	*-0.588****	-0.754**	-0.477***	-0.541***	-0.653***
	(-0.24)	*(-2.98)*	*(-3.76)*	*(-4.29)*	*(-2.85)*	*(-4.99)*	*(-4.64)*	*(-5.30)*
SMB	*0.266*	0.306	*0.25*	0.264	-0.332*	0.27	0.760**	0.935**
	-1.02	*-1.28*	*-0.88*	*-0.92*	*(-2.50)*	*-1.28*	*-2.87*	*-3.32*
HML	-0.0123	*-0.045*	-0.158	*-0.092*	0.631*	-0.211	-0.280*	-0.319*
	(-0.07)	*(-0.30)*	*(-0.96)*	*(-0.55)*	*-2.37*	*(-1.96)*	*(-2.17)*	*(-2.18)*
MV	-0.0743	-1.074***	-1.188***	-1.261***	-0.0539	-1.143***	-1.079***	-1.249***
	(-0.41)	*(-6.14)*	*(-6.23)*	*(-6.14)*	*(-0.34)*	*(-5.18)*	*(-4.22)*	*(-4.37)*
N	198	190	185	180	195	187	182	177
R2	0.011	0.187	0.209	0.213	0.082	0.234	0.207	0.221
Strategy	**9x3**	**9x6**	**9x9**	**9x12**	**12x3**	**12x6**	**12x9**	**12x12**
Turnover	-0.503	25.69**	16.05	16.84	-0.312	11.61	-4.124	-1.764
	(-0.05)	*-3.08*	*-1.59*	*-1.59*	*(-0.03)*	*-1.1*	*(-0.36)*	*(-0.14)*
Rm-Rf	-0.304*	-0.308***	-0.397***	-0.516***	-0.266*	-0.305***	-0.441***	-0.508***
	(-2.51)	*(-3.63)*	*(-3.90)*	*(-4.75)*	*(-2.17)*	*(-3.55)*	*(-4.81)*	*(-4.87)*
SMB	0.832**	0.361	0.795**	1.013***	1.178***	0.888***	1.127***	1.020***
	-3.05	*-1.67*	*-3.05*	*-3.72*	*-4.56*	*-4.02*	*-4.82*	*-3.92*
HML	-0.109	-0.164	-0.309*	-0.427**	-0.232	-0.0472	-0.118	-0.0543
	(-0.73)	*(-1.66)*	*(-2.53)*	*(-2.95)*	*(-1.66)*	*(-0.52)*	*(-1.14)*	*(-0.39)*
MV	-0.236	-0.506	-0.159	-0.508	0.146	-0.0956	-0.115	-0.34
	(-0.73)	*(-1.92)*	*(-0.53)*	*(-1.51)*	*-0.39*	*(-0.30)*	*(-0.36)*	*(-0.88)*
N	192	184	179	174	189	181	176	171
R2	0.066	0.139	0.159	0.221	0.114	0.159	0.197	0.182

*Table 17: Results of regressions of the momentum returns, turnover rate and the control variables. Green highlighted boxes denote significant positive relations. Red highlighted boxes denote significant negative relations. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

Table 17 shows the results of the regressions of the momentum returns with the turnover rate and the control variables. Comparison of the results in table 17 with the results in table 16, the turnover rate loses its explanatory power to explain the momentum returns. The control variables seem to take away the relation between the turnover rate and the momentum returns. Only for the strategy 6x6 and 9x6 did the turnover rate seem to explain the momentum returns. The positive relationship was best captured by the size variable of the Fama French factors. For the strategies with a longer formation period, 9 and 12 months, the size variable significantly explained the momentum returns. For the 3 month formation strategies the size premium variable was not significant. The turnover rate did also not explain the momentum returns as shown table 16. The only significant explanatory variables for the 3 month formation strategies was the excess market return by Fama-French and the market volatility. The relation with the Fama-French was negative and significant. Except for 3x3 strategy, where none of the variables seem to explain anything. The market excess return was for every strategy significant and negative. The coefficient is the most negative in the 6x12 strategy. This means when the Fama-French excess market return was low, the momentum strategy's return was high. The market volatility was negative and significant for almost every strategy with 3 and 6 months as formation periods. However for the strategies with the 3 month holding, the market volatility did not seem to explain anything. The market volatility also failed to explain momentum returns with 9 or 12 month formation periods.

The results in table 11, where the market states was regressed with the control variables, show kind of similar regression results compared to table 17. The Fama-French excess returns showed negative and significant relations with the momentum returns for most strategies in both regressions. The significant coefficients almost all lay in the range of -0.2 and -0.6 in both regressions. The size premium was in many of the strategies positive and significant. However, in the regression with market states, the size premium seemed to explain the 3 month formation strategies, where it failed in the regressions with the turnover rate. The market volatility explained the strategies with 3 month holding periods in the regressions with the market states. Contrary to this, the market volatility in table 17, explained the strategies with 3 or 6 month formation periods. There the results differ from each other. These results differ from the results from Glass & Weber (2003). They found that the turnover rate does significantly explain the momentum returns and that the returns are related to book to market variable (HML). This research found that the turnover rate did not explain the momentum returns and the book to market factor did not seem to have a significant relation for most strategies. It does for a few strategies, but is significant and positive for the 6x3 strategy, but significant and negative for 6x9, 6x12, 9x9, and 9x12.

Naughton et al., (2008) found that the loser portfolio has lower turnover rates than the winner portfolio. The stocks with lower turnover rates did significantly underperform to the winner portfolio with the higher turnover. However, the turnover rate loses its explanatory power for momentum return, when the control variables are added in this research. Next the momentum portfolio, the winner minus loser, will be divided in the winner and the loser portfolio. The regression take on the form where the winner or the loser portfolio is the dependent variable and the turnover rate will the independent variable. First the winner and loser portfolio turnover rates should be compared with a t-test if they actually do differ from each other (Glass & Weber, 2003). The t-test will check for the 4 different formation periods of 3, 6, 9 and 12 months. The results of the t-test are plotted in table 18:

T-test Winner - Loser		
	Mean diff	T-stat
3 Month	0.1798	6.5274***
6 Month	0.1065	7.5639***
9 Month	0.2477	7.8552***
12Month	0.2775	8.4499***

*Table 18: Results t-test Winner-Loser portfolio turnover rates. Mean diff indicates the mean in the differences between the turnover rates. T-stat indicates the t-statistic. *** indicates significant on the 1% level*

The mean of the turnover rates of the winner and loser portfolios are compared with each other. For every formation period the winner and loser portfolio turnover rates did differ significant on the 1% level. This indicates that it is useful to regress the winner and loser portfolio separately.

4.31 Winner portfolio

The winner portfolio is expected to have a positive relation with the turnover rate. The momentum strategy holds that one buys the winner portfolio. A higher turnover rate is associated with a higher momentum return. The results without the control variables are shown in table 19. The regressions are test for autocorrelation and corrected with Prais Winsten.

Regression results of the Winner portfolio and the turnover rate								
Strategy	**W3x3**	**W3x6**	**W3x9**	**W3x12**	**W6x3**	**W6x6**	**W6x9**	**W6x12**
Winner Turnover	7.413*	9.120*	14.94***	20.12***	6.976**	11.30***	15.42***	22.07***
	-2.34	*-2.42*	*-3.46*	*-3.9*	*-2.83*	*-3.47*	*-3.96*	*-4.9*
N	200	197	194	191	193	190	187	184
R2	0.027	0.029	0.059	0.074	0.04	0.06	0.078	0.117
Strategy	**W9x3**	**W9x6**	**W9x9**	**W9x12**	**W12x3**	**W12x6**	**W12x9**	**W12x12**
Winner Turnover	8.096***	13.21***	17.53***	21.17***	7.707***	12.52***	17.39***	23.81***
	-3.41	*-4.2*	*-4.87*	*-5.08*	*-3.82*	*-4.69*	*-5.24*	*-5.99*
N	191	188	185	182	186	183	180	177
R2	0.058	0.087	0.115	0.126	0.074	0.108	0.134	0.17

*Table 19: Results of the regression with the winner portfolio and the turnover rate. The green highlighted boxes indicate a significant positive relation. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

The results in table 19 show that for every winner portfolio the turnover rate has significant positive relation. This shows that the turnover rate did affect the winner portfolio. The effect was the strongest for the 6x12 strategy, with a coefficient of 22.07. The positive relation between the turnover rate and the winner portfolio was expected. This indicates that one must invest in the winner portfolio when the past turnover rate is high when he uses the momentum strategy of buying the winner and selling the loser. To test if the turnover rate is still a significant explanator for momentum returns, now the control variables are added, the results are shown in table 20.

Regression results of the Winner Portfolio, turnover rate and the control variables								
Strategy	**W3x3**	**W3x6**	**W3x9**	**W3x12**	**W6x3**	**W6x6**	**W6x9**	**W6x12**
Winner Turnover	8.084*	6.302	11.86**	8.327	7.141	8.912*	12.72**	16.76**
	-2.06	*-1.55*	*-2.78*	*-1.66*	*-1.94*	*-2.01*	*-2.69*	*-3.19*
Rm-Rf	0.115	0.068	0.0564	0.182	0.112	0.0661	0.132	0.0941
	-0.77	*-0.54*	*-0.54*	*-1.56*	*-0.94*	*-0.57*	*-1.33*	*-0.97*
SMB	0.16	-0.0802	-0.205	0.015	-0.0823	-0.261	-0.535*	-0.225
	-0.61	*(-0.35)*	*(-0.96)*	*-0.06*	*(-0.36)*	*(-1.20)*	*(-2.57)*	*(-1.06)*
HML	0.068	0.0499	-0.00955	-0.0891	0.0158	0.0284	0.14	0.0496
	-0.36	*-0.33*	*(-0.07)*	*(-0.65)*	*-0.1*	*-0.2*	*-1.13*	*-0.43*
MV	-0.116	-1.113***	-1.639***	-1.930***	-0.552**	-1.204***	-1.856***	-2.324***
	(-0.57)	*(-4.06)*	*(-5.69)*	*(-5.24)*	*(-2.93)*	*(-5.07)*	*(-7.12)*	*(-8.08)*
N	200	197	194	191	193	190	187	184
R2	0.035	0.12	0.221	0.241	0.073	0.159	0.281	0.333
Strategy	**W9x3**	**W9x6**	**W9x9**	**W9x12**	**W12x3**	**W12x6**	**W12x9**	**W12x12**
Winner Turnover	8.928*	13.04**	20.77***	22.25***	7.687*	9.991*	18.70***	28.56***
	-2.36	*-2.65*	*-4.42*	*-4.35*	*-2.2*	*-2.24*	*-3.94*	*-5.56*
Rm-Rf	0.0559	0.0539	0.00064	0.0455	0.0769	0.0196	0.0143	0.0284
	-0.49	*-0.47*	*-0.01*	*-0.53*	*-0.73*	*-0.19*	*-0.16*	*-0.34*
SMB	-0.109	-0.212	-0.361	-0.149	-0.167	-0.233	-0.527*	-0.432*
	(-0.47)	*(-0.92)*	*(-1.72)*	*(-0.76)*	*(-0.77)*	*(-1.13)*	*(-2.49)*	*(-2.23)*
HML	-0.0246	0.124	-0.00289	-0.0355	0.012	0.0934	-0.0531	-0.0391
	(-0.16)	*-0.87*	*(-0.02)*	*(-0.31)*	*-0.09*	*-0.69*	*(-0.42)*	*(-0.31)*
MV	-0.573**	-1.209***	-1.775***	-2.225***	-0.35	-1.029***	-1.601***	-2.417***
	(-3.05)	*(-4.88)*	*(-7.18)*	*(-8.47)*	*(-1.92)*	*(-4.41)*	*(-6.29)*	*(-8.99)*
N	191	188	185	182	186	183	180	177
R2	0.081	0.168	0.303	0.378	0.056	0.144	0.269	0.431

*Table 20: Results of the regression of the winner portfolio, turnover rate and the control variables. Green highlighted boxes denote significant positive relations. Red highlighted boxes denote significant negative relations. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

The results in table 20 show that for winner portfolios in most strategies the turnover rate did significantly explain the winner momentum return. The turnover rate did not lose its significant explanatory power by adding the control variables. Only for 3 strategies (3x6, 3x12 and 6x3) did the turnover rate not significantly explain the momentum return. This does show that past turnover rates did partially explain the momentum returns, when using the winner minus loser strategy. The momentum return would increase when the turnover rate increased in the winner portfolio. The Fama-French factors did not seem to explain the winner portfolio returns. The market volatility on the other hand, was in 14 out of 16 strategies, negatively correlated with the winner portfolio returns. High market volatility indicated that the winner portfolio returns will be lower.

4.32 Loser portfolio

The loser portfolio is expected to have a negative relation with the turnover rate. The momentum return should go down when the turnover rate is higher (Lee & Swaminathan, 2000). For momentum strategy to be the most profitable, it is best that the loser portfolio performs the worst. This is because an investor would short sell the loser portfolio. The results of the turnover rate and the loser portfolio returns are shown in table 21. The loser returns are checked for autocorrelation and corrected with Prais Winsten if necessary.

Regression results of the Loser portfolio and the Turnover Rate								
Strategy	**L3x3**	**L3x6**	**L3x9**	**L3x12**	**L6x3**	**L6x6**	**L6x9**	**L6x12**
Loser Turnover	-21.94**	-57.58***	-51.37***	-73.76***	5.44	-11.74	-13.12	-5.458
	(-2.79)	*(-5.95)*	*(-4.40)*	*(-5.29)*	*-0.74*	*(-1.29)*	*(-1.27)*	*(-0.43)*
N	198	195	192	189	190	187	184	181
R2	0.038	0.155	0.092	0.13	0.003	0.009	0.009	0.001
Strategy	**L9x3**	**L9x6**	**L9x9**	**L9x12**	**L12x3**	**L12x6**	**L12x9**	**L12x12**
Loser Turnover	-3.389	-29.44*	-47.39**	-62.43***	6.585	-23.52	-42.06*	-61.15***
	(-0.35)	*(-2.38)*	*(-3.34)*	*(-3.94)*	*-0.65*	*(-1.70)*	*(-2.59)*	*(-3.50)*
N	188	185	182	179	185	182	179	176
R2	0.001	0.03	0.058	0.081	0.002	0.016	0.036	0.066

*Table 21: Results of the regression of the Loser portfolio returns and the turnover rate. . Red highlighted boxes denote significant negative relations. *** denotes a significance level of 1%, ** denotes the significance level of 5% and * denotes the significance level of 10%.*

The results in table 21 show that the loser portfolio was negatively related to the turnover rate. This indicates that when the turnover rate increased in the loser portfolio the overall return of the loser portfolio decreased. When an investor used the winner-minus-loser strategy as the momentum strategy he should have looked for high turnover rates in the loser portfolio. However, the turnover rate was not always a negative relation, and surely not always a significant explanator for the returns. For all the loser portfolios with a 6 month formation period, the turnover rate did not significantly explain the return. The results in table 21 are in some extent what was expected. When a high turnover was negatively related to the loser return, the momentum return increases when the turnover rate is high in the loser portfolio. Next the control variables are added to see if the turnover rate still explained the loser returns when other variables influenced the loser portfolio returns. The results are shown in table 22, the regressions are checked for autocorrelation.

Regression results of the Loser Portfolio, turnover rate and the control variables								
Strategy	**L3x3**	**L3x6**	**L3x9**	**L3x12**	**L6x3**	**L6x6**	**L6x9**	**L6x12**
Loser turnover	-15.33	-27.65*	8.799	3.532	12.97	-13.72	-3.844	6.143
	(-1.57)	*(-2.51)*	*-0.79*	*-0.32*	*-1.17*	*(-1.10)*	*(-0.32)*	*-0.47*
Rm-Rf	0.297	0.342	0.349*	0.448**	0.459*	0.440*	0.217	0.470**
	-1.63	*-1.95*	*-2.25*	*-2.8*	*-2.46*	*-2.44*	*-1.47*	*-3.15*
SMB	-0.348	-0.569	-0.776*	-1.106***	-0.309	-0.424	-0.332	-0.829**
	(-1.14)	*(-1.75)*	*(-2.51)*	*(-3.58)*	*(-0.88)*	*(-1.26)*	*(-1.10)*	*(-2.67)*
HML	-0.0669	0.116	0.254	0.338	-0.149	0.0944	0.267	0.174
	(-0.29)	*-0.55*	*-1.3*	*-1.71*	*(-0.60)*	*-0.43*	*-1.44*	*-0.93*
MV	0.481	-0.169	-1.380**	-2.304***	0.658*	-0.184	-1.504***	-2.421***
	-1.55	*(-0.44)*	*(-3.05)*	*(-4.11)*	*-2.16*	*(-0.48)*	*(-3.41)*	*(-5.12)*
N	198	195	192	189	190	187	184	181
R2	0.043	0.091	0.113	0.201	0.062	0.051	0.097	0.212
Strategy	**L9x3**	**L9x6**	**L9x9**	**L9x12**	**L12x3**	**L12x6**	**L12x9**	**L12x12**
Loser turnover	-1.062	1.426	-4.299	4.221	17.53	-4.107	20.15	-2.489
	(-0.07)	*-0.09*	*(-0.28)*	*(-0.12)*	*-0.99*	*(-0.19)*	*-0.96*	*(-0.12)*
Rm-Rf	0.558**	0.597**	0.203	0.576***	0.564**	0.561**	0.364*	0.403*
	-2.68	*-2.84*	*-1.26*	*-3.68*	*-2.78*	*-2.65*	*-2.15*	*-2.37*
SMB	-0.349	-0.891*	-0.356	-0.949**	-0.415	-0.790*	-0.961**	-0.499
	(-0.84)	*(-2.26)*	*(-1.01)*	*(-2.89)*	*(-1.02)*	*(-1.99)*	*(-2.74)*	*(-1.38)*
HML	-0.177	-0.0563	0.361	0.414	-0.224	-0.0387	0.645**	0.495
	(-0.64)	*(-0.22)*	*-1.58*	*-1.83*	*(-0.82)*	*(-0.14)*	*-2.7*	*-1.84*
MV	0.8	-0.243	-1.656**	-2.170***	0.502	-0.135	-1.932***	-2.535***
	-1.97	*(-0.46)*	*(-3.04)*	*(-3.99)*	*-1.19*	*(-0.24)*	*(-3.36)*	*(-4.00)*
N	188	185	182	179	185	182	179	176
R2	0.062	0.066	0.085	0.206	0.06	0.062	0.151	0.169

*Table 22:Results of the regression of the Loser portfolio returns and the turnover rate. Green highlighted boxes denote significant positive relations . Red highlighted boxes denote significant negative relations. *** denotes a significance level of 1%, ** denotes the significance*

By adding the control variables the turnover rate of the losers loses its explanatory power. Only in strategy 3x6 was the turnover rate coefficient still significant. Most of the explanatory power is captured by the size premium and the market volatility. The market volatility has for every strategy with a 9 or 12 month holding period a significant and negative relation. The Fama-French size variable seemed to negatively explain the loser return for some strategies. The loser returns are however almost in every strategy positively related to the market excess return. In 4 strategies the relation was not significant but it was positive. The coefficients of the market excess return and the loser portfolio all lay between 0.3 and 0.6. This indicates that when the market excess return was high, the momentum returns would be lower, since the loser portfolio return increases.

Comparing the winner and loser portfolio shows that the turnover rate was only significant for the winner portfolio returns, it failed to explain the loser portfolio return. Where the winner portfolio only was positively explained by the turnover rate and negatively by the market volatility, the loser portfolio was positively explained by the market excess return, sometimes by the size variable and randomly negatively by the market volatility. When using a winner-minus-loser strategy for momentum returns, an investor would want that the winner portfolio keeps on outperforming as high as possible, and the loser portfolio would generate negative returns. Therefore the investor should look for high turnover rates in the winner portfolio, low market volatility and low excess market returns, since this variable is negatively related to the loser portfolio.

These results are not comparable to the results of Connolly & Stivers (2003). Their findings showed that stock returns did suffer from reversals even after one week, when using the past turnover rate to pick the past winners. The turnover in this paper did not explain the momentum returns significantly, but it certainly did not find short term reversals. The paper of Drew et al., (2007) found that the turnover rate best predicts the magnitude and persistence of the momentum strategies. They found that the loser portfolio with the lowest turnover rate did underperform to the highest turnover portfolio. Their results are similar to this research, although they found negative returns for the strategies with 12 month holding periods. Lee & Swaminathan (2000) found that both the winner and loser portfolio were insensitive to the size premium factor. The results in table 20 and 22 do show that some strategies were sensitive to the size premium factor. Where more than over half of the strategies in the loser portfolio were negative related to the size premium, and the winner portfolio is positively related to the size premium factor. For most of the winner returns the SMB was insignificant.

The second hypothesis stated that the higher the turnover rate, the higher the momentum returns. When looking at the results over the momentum portfolio, which contains the winner and loser portfolio, the turnover rate did not explain any returns. Variables which did significantly explain the returns were the size premium and the excess market return. When the momentum strategy was split up in the winner and the loser portfolio, the turnover rate did explain returns. The turnover rate was significant and positive related to the winner portfolio returns. The Market volatility is negative related to the winner returns. For the loser portfolio returns the turnover rate did not significantly explain anything. The loser portfolio returns are better explained by the market excess return and the market volatility.

5. Conclusion and Discussion

This research has looked at the S&P500 over the period of 2000-2018 as an ex-post study to evaluate if momentum strategy could outperform the market. The data contained all the returns, turnover rates and market states over the entire sample. The momentum returns were checked if these did outperform the market, in two different market states. Besides checking if momentum strategies did outperform the market, the momentum returns were also tried to be explained by the length of the market state and the turnover rate. This research has used 16 different momentum strategies. These were all based on different formation and holding periods. This paper contributes to the already existing literature regarding momentum returns by providing more recent data and using several explanatory variables. This paper has the following findings of the momentum strategies of the S&P500 over the period 2000-2019.

At first was tested if momentum returns did outperform the market. This was checked with a student t-test. This test shows if the means of the market returns and the momentum returns do significant differ from each other. Of all the 16 different momentum strategies in every market state, the results shows that 12 out of the 16 momentum strategies outperform the market. The returns are standardized to monthly returns, so these could be compared. Average monthly returns did outperform the market, with monthly returns between 0.22% and 1.85%. These results are in line with the papers of Bhootra (2011) and Cooper et al., (2002). To evaluate if the results did hold in up and down markets, the momentum returns and the market returns were divided in the two different markets. Comparing the momentum returns within up markets did show that momentum strategies did not outperform the market. Some strategies did even underperform to the market. When the market was down, the momentum strategies did significantly outperform the market in all strategies. With higher average monthly returns laying between 0.82% and 2.36%. These results were in line with Siganos & Chelley-Steeley (2006), who described that momentum returns are higher in down markets.

Secondly the momentum returns were regressed with different market states lengths in order to try to explain the momentum returns. The 6 month market return did seem to be negatively related to the momentum return, where the 36 month market state return did not explain anything. These results were not in line with the results of Wang & Xu (2015). They found that momentum was highest after a 36 month market state. When adding the control variables ‘market volatility’ and the Fama-French factors the explanatory power of the different market states lengths was gone. The Fama-French excess return factor seems to significant negatively explain the momentum return. Next the market was divided in bull and bear markets. Here the different market states lacked any explanatory power. Adding the control variables did not change anything, and these seem to randomly explain momentum returns, without any structure.

The third finding was trying to explain momentum returns by the turnover rate, also known as the trading volume of the stocks in the portfolio. Momentum returns were regressed with the turnover rate of the portfolios. The turnover rate seemed to explain the momentum return in a positive way. The higher the turnover rate, the higher the momentum return. This was in line with the research of Glass and Weber (2002). However after adding the control variables, the excess market factor seemed to negatively explain the momentum returns. The size factor does also play a positive explanatory role for the momentum returns. The portfolios were than divided in winner and loser portfolios, to test if the turnover rate did explain anything. The turnover rate did positively relate to the winner portfolio return, where there did not seem to be any relation between the loser portfolio return and the turnover rate. Market volatility is negatively related to the winner portfolio returns, where the excess market factor explains positively the loser portfolio returns. This study helps to explain were momentum returns come from and when these could be profitable.

This research has a few limitations. The first limitation can be found in testing the first hypothesis. This research has only used two different time lengths, which differ a lot from each other. Six month market returns and 36 month market returns were chosen because of little correlation issues. However, 12 month and 24 months market states could have other influences on the momentum returns. These lengths of market states could be relevant and should be investigated in future research. Arguably a 36 month market state would not have any effect on the return, since it is too far to look back. Shorter time periods could give a more realistic view on the strategies. Also this would mean that there would be more bear market states observations. In this research the amount of observations is very low in bear markets compared to the bull markets. By using different market state lengths, more bear market observations could be achieved. This will also help to achieve more robust results.

Besides that, the market volatility is one of the explanatory variables. This variable could be divided up in high and low volatility variables. Wang & Xu (2015) showed that momentum returns do significantly differ in different market volatility states. Muga & Santamaria (2007) also showed that there are major downsides of using momentum in high market volatility times in strong bear markets. Further research could try investigate the effect of different market volatility states and strong bear markets. This study did examine a lot of different strategies. However, it did not control for transaction costs and short selling which could influence the profitability of the momentum returns.

This study does show that using different momentum strategies in the S&P500, a significant higher return that the market could be achieved. This is in line with other previous papers. However, explaining were these returns come from seems to be hard and there is no pattern for every strategy what seems to explain the momentum returns. Future research should look at other different time lengths. There is a lot unknown about what drives momentum.

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