Price momentum and dividend policy: A Dutch case

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Abstract

In this paper, we investigate the profitability of momentum strategy and whether portfolios based on an increase in dividend yield can outperform this strategy. The sample of 75 Dutch listed stocks was divided in portfolios of ten stocks, based on past performance during one quarter for dividend portfolios, one to four quarters for momentum portfolios, which were held for one to four quarters during the period 2010 to 2019. The statistical results indicate that average returns on momentum portfolios outperform the Dutch benchmark. In addition, returns of dividend based portfolios do not significantly exceed momentum strategy returns, even though the average result was that dividend portfolios did better on average. The paper confirms that momentum strategy is feasible during a time without economic downturns and that dividend portfolios do not significantly outperform momentum portfolios.

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1. Introduction

Companies use dividends and share repurchases as methods to requite their investors and shareholders. It could be considered a cycle as shareholders invest in companies, after which the companies use dividends or share repurchases in order for growth of investment for companies and shareholders. This cycle is a form of mutualism as Stein (2018) stated: in our ecosystem, mutualism is a symbiotic relationship between individuals in which both parties gain. For example, in nature, bees and flowers have such a relationship. Bees go from flower to flower to collect nectar for food production, and while landing on each flower, they pollinate the flower in order for it to help them reproduce. In finance, it is a similar relationship between a company and its shareholders. Shareholders invest in a company to fund growth with the hope on sharing in profit if business goes well.

Over the years, many literature has been written on forementioned relationship: the impact and use of dividend. Modigliani and Miller (1961) were pioneers in research on the impact of dividend. They proposed that the dividend policy of a firm has no significant relationship with the stock price. It would mean that dividend does not add to a company's value and shareholders would be indifferent between dividends and retained earnings. The theory assumed perfect markets, which hold certain assumptions of which the most important being the absence of taxes. This dividend irrelevance hypothesis was often used as starting point for further research on the matter. Some theories that were developed concurred with this, for example Black and Scholes (1974) and Bernstein (1996). The main conclusion in both studies was that they were unable to detect a direct relationship between dividend yield and stock returns. Others opposed this theory, such as Fama and French (2002) and Litzenberger and Ramaswamy (1982). The latter provided empirical evidence that the significant effect of dividends on common stock returns can be attributed to taxes. Although much empirical research has been done on the subject, no clear conclusion can be drawn from the contradicting conclusions in these papers.

The unresolved matter will remain part of the financial empirical debate. That is not because only theories vary over the years, but patterns in corporate payout policy change as well. Changes and differences in regulations and patterns between countries are among the factors which make it difficult to converge to a common conclusion. The focus of these studies were primarily on US stocks and recently more on upcoming markets such as South America as they have become a point of interest in financial research (Campello, 2012). Smaller and relatively less significant countries may be overlooked or simply ignored as conclusions in a global scale are drawn. With this in mind, this study will focus on the Dutch stock market.

Jegadeesh and Titman (1993) noted that a portfolio, consisting of companies that performed well in the past, did better in the following three to twelve months than companies that performed poorly in the same past period. This study will begin by researching the impact of past results on future returns. The research model selects the top ten and the bottom ten stocks regarding returns over several time periods in the past. For establishing the portfolio, we use the up-minus-down (UMD) strategy of buying the 'high' portfolio and selling the 'low' portfolio. We create these for four different formation periods J: 3, 6, 9 and 12 months, as Jegadeesh and Titman (1993) deemed these periods most relevant. Then we form new portfolios for our holding period K, consisting of the same numbers of months. Every month, the companies are placed in a new portfolio, consisting of 20 firms, according to their ranking in returns in the past months. The portfolios for each of the 3, 6, 9 or 12 month periods will be combined with one another which will result in a total of 16 portfolios. The sample data of the 75 firms in the three major Dutch indices is retrieved from Refinitiv Datastream and ranges from January 2010 to December 2019. The regression method in this study is the market model as initialized by Sharpe (1963). By regressing the returns of the portfolios on the monthly returns of the Morgan Stanley Capital International Index (MSCI) Netherlands Index, a Dutch representation of 85% of market capitalization in the Netherlands. We can then establish whether our strategic selection of Dutch stocks can outperform the respective equity market.

Secondly, as a continuation of the first hypothesis, this study will aim to point out that changing dividend policy affects the return. Managers use private information in the form of stock returns as a mean in deciding what dividend policy to adopt at their companies (De Cesari and Meier, 2015). This shows the importance of new private information as managers look out for market reaction and set up dividend policies based off of it. It can also be the other way around, for example, Dow and Gorton (1997) addressed the statement that market prices contain significant information for individual decision makers as a stock's history and price tells us something about past decisions made by managers and possible investment opportunities in the future. This relation between private information and decision making is regarded significant in the study of Asem (2009), which states that US companies with increasing dividends record higher returns in the following period than US companies that decreased their dividends. This could be due to the sentiment following the announcement which usually is a positive and a negative reaction, respectively. To study whether this differs from the UMD strategy proposed before, we build a model for each period of 3, 6, 9 or 12 months in which portfolios are formed by the ten stocks with the largest increase in dividend over the last quartal. These dividend policy ratings are established by comparing dividend yield in month t_i to the dividend yield in month lagged month 3, 6, 9 and 12. Resulting in four dividend portfolios, it will be possible to tell the better strategy for forming portfolios by regressing the difference of the UMD and dividend portfolios on the market return.

The remainder of this paper is organized as follows. Section 2 contains the theoretical framework with the necessary empirical background. Section 3 will highlight the data with Section 4 the used methodology. Section 5 will present the results and compare the outcomes of both hypotheses. Finally, section 6 will provide the conclusion of this study.

2. Theoretical framework

The link between a stock's return and its dividend policy has been a controversial topic over the last few decades. Multiple theories considering the influence of dividend policy on stock return have been put forward, and with many diverging outcomes, the issue whether dividend policy influences stock return remains up for debate, and if true, does it have a positive or negative correlation.

2.1 Dividend theories

The Dutch economy is characterized by being focused on international trade and foreign investments, while having seen prosperous, economic growth since the installment of the first ever dividend payments by the Verenigde Oost-Indische Compagnie in 1610-1612 (Sluyterman, 2005). Centuries later, dividends have grown into a distinct feature in the relationship between publicly traded companies and their shareholders. Every company has its own dividend policy depending on a great number of financial variables, legal issues and administrative considerations, which we will not consider for this study. Dividend policy determines the dividend payout ratio, so the allocation of profits which is how much is added to retained earnings and what part is used to payout. This can be in the form of a stock dividend or a cash dividend. In the remainder of this study, cash dividend is what is meant when dividend is mentioned. In turn, when a dividend has been paid, the value of a firm decreases as money goes out, but how does this impact the wealth of shareholders?

Modigliani and Miller (1961) stated that dividend policy does not impact the wealth of shareholders and is therefore irrelevant, which is named the dividend irrelevance theory. They assume a perfect market in their research, one without taxes and transaction costs. Part of the conclusion was that a shareholder would be indifferent between cashflow from dividend and cashflow from an increase in stock price. A certain surge in dividend would even result in an equal decline in stock price. This theory was later on supported by several papers such as Black and Scholes (1974) who stated that dividend policy does not influence stock price, and therefore concluded that a higher payout ratio does not have an equivalent higher stock return. Taxes were assumed, of which the double taxation that comes along with dividend payout would do more harm than good to the shareholder. The main addition to Modigliani and Miller (1961) was that a realistic, imperfect market was assumed. Several other empirical studies have also been in support of this viewpoint (Bernstein, 1996; Miller & Rock, 1985).

However, the dividend irrelevance theory is contradicted in later papers with studies that found dividend significantly influential of stock prices. Allen and Rachim (1996) used a sample of 173 Australian companies in their a cross-sectional regression analysis. After adding several control variables, they used a regression to investigate the relationship between dividends and stock prices. They found a significant negative relationship between dividend payout and stock price return. On the other hand, dividend was found to have a positive non-linear effect on stock prices in Litzenberger and Ramaswamy (1982). The different outcomes in these two studies could be due to the fact that the latter's model was based solely on information that was available to the investor ex-ante. Another possibility is because Allen and Rachim (1996) focused more on stock price volatility rather than the stock price as Litzenberger and Ramaswamy (1982) did in their model.

An interesting aspect of the study of Allen and Rachim (1996) is that they emphasize the effect of managerial influence in an imperfect market which would result in a principal agent-problem. A principal-agent problem is when the manager's interest does not align with the shareholders' interest. This runs counter to the assumptions of Modigliani and Miller (1961) as they assumed no conflict between shareholders and managers. Shareholders depend on the manager to make the decision which is best for the company's profit, and therefore beneficial for the shareholders. However, managers could have other interests such as growing the company by allocating profit elsewhere and with that taking possibly unnecessary risks. According to Jensen (1986), managers strongly prefer not to payout dividend as that would reduce the controllability of retained earnings and diminish the amount of money they can allocate to their preference. In order to reduce conflict of interests, firms make costs to regulate and govern managers to maximize shareholder value, these are called agency costs. Agency costs are higher when less dividend is paid out as there is more retained earnings to oversee for the managers. More cash at hand means less external funding and more funding through the capital market. One could argue that the capital market is a 'free controlling mechanism' for firms with high dividend payout ratios.

This suggests that dividend could be used to reduce agency costs. The agency-cost-theory was first conceptualized by Jensen and Meckling (1976) when they offered a possible explanation for why a firm would payout dividend. Alli et al. (1993) studied variations in dividend payout policy, while focusing on four categories of which one was the role of dividend in agency costs. They used two variables to measure the agency problem: a ratio defined as the number of shareholders to total outstanding shares and a ratio of shares held by insiders to total shares outstanding. The first ratio is to depict the distribution of ownership (Rozeff, 1982). With a growing number of shareholders, the managerial monitoring also increases. The second ratio would argue the opposite as a higher number of insider holdings would lower agency problems. Alli et al. (1993) come to the same conclusion as previous research on the agency cost theory, namely that the agency problem can be mitigated using dividends (Easterbrook, 1984; Jensen, 1986; Rozeff, 1982).

Another theory is the bird-in-hand theory, which was introduced by Lintner (1956) and later expanded by Gordon (1959) with the hypothesis that an investor buys dividend when acquiring a share. The idea behind this hypothesis is that dividend is the cash flow generated from holding a share. Note that the investor is not merely interested in the current value of the dividend but looks ahead to a constant stream of dividend payments regardless of the stock return. In the metaphor of the bird-in-hand theory, dividend represents the bird, so risk-averse investors have a higher likelihood of holding on to shares that come with a relatively high dividend. Gordon (1959) found that dividends affect share prices stronger than retained earnings. Although the theory is not generally acknowledged, the result was later supported by Linter (1962) who finds that the value of unlevered equity is independent of dividends, as long as the model is constrained to the perfect market as Modigliani and Miller (1961) described it. Under these circumstances, the net present value is not considered because invariant vectors of retained earnings reduce adequate dividend vectors to a single set. When taking a look at the realistic capital market, "the "dividend theory" that prices are equal to the present values of the cash flow to the investor remains valid even under fully generalized conditions and should be the basis for further theoretical work" (Lintner, 1962, p. 268). Others opposed this theory by explaining that dividend payout is counterproductive when reinvested in a firm and leads to the investor exposing their cash to the same risks as without dividend, unless they purchase an actual item (Easterbrook, 1984). The grey area in between sides is in fast growing firms where firms often have to invest in order to keep growing, for example in the technology sector, and payout little to no dividend. But because not all investors need their dividend straightaway as long as future dividends remain feasible and there are favorable current investment opportunities, investors remain satisfied with management and will hold their shares (La Porta et al., 2000).

A more recent study by Hartzmark and Solomon (2019) researched the apparent connection between dividend and return in the eyes of investors. The described theories, the irrelevance theory, agency-cost-theory and bird-in-hand-theory, propose different ideologies about the link between investors and dividend. Dividend is part of the equation of making profitable returns on a stock purchase. However, Hartzman and Solomon (2019) found that dividend and returns are often seen as two separate variables, not interlinking with each other, as the general perception is that stock performance is based on price changes and not on returns. Therefore, analysts often have price targets that are too high for dividend paying stocks as dividend payments are not factored in the target. The reason that prices drop is that as investors gain cash flow from dividend payout, they rarely invest the dividend back into the asset. This results in a cycle in which dividend paying stocks have diminishing returns.

Regarding these diminishing returns, dividend paying stocks tend to be less popular and relatively easier neglected as dividend payout is spent earlier than capital gains. Karpavičius and Yu (2018) found a positive premium for dividend because of the positive relation between dividend and firm value in their sample during the 1972 to 2016 period, meaning dividend paying stocks should not be neglected but appear to be more valuable. The positive premium leads to the same conclusion as Hartzmark and Solomon (2019), namely that investors prefer dividends to stock returns. This makes sense as it was earlier noted that investors spend dividend payout before they do capital gains.

2.2 Momentum strategy

Levy (1967) was one of the first empirical researchers who suggested that past long-term winners generated abnormal returns and for losers it would be vice versa. Whether either of these results is the effect of overreaction is unclear. Jegadeesh and Titman (1993) tried to shed some light on the matter by researching a strategy in which they buy and hold winners, sell and hold losers or use a combination of buying winners and selling losers. Most previous research had used very short or very long formation periods in the vicinity of respectively a week or more than 3 years. A formation period of three to twelve months was used by Jegadeesh and Titman (1993) for the New York Stock Exchange (NYSE) and American Stock Exchange (AMEX). The conclusion was partially favorable of both sides and inconclusive of prior like-minded empirical research, as they found that winners had a higher return for a medium holding period of seven months, but for a longer time-horizon in the thirteen months after that, so from t=7 to t=20, the tables were turned as losers had higher returns. However, the best resulting portfolio formed was one with a formation period of six months and a holding period of six months of the winners portfolio with a return of 12.01%. Even though this paper is an improvement to prior literature written on momentum strategy because of the wider sample coverage, the main limitation remains that it could be argued that it solely focuses on US indices which withholds a global use of the momentum strategy as outlined in this paper.

Overreaction by individuals to information on firms is a common occurrence, even more so in the current era with social media and news spreading rapidly. However, not only individuals overreact information, stock prices too tend to increase in volatility when new information arises (De Bondt and Thaler, 1985). In their study, they predicted that past losers would give higher returns than past winners, this contrarian strategy hypothesis was built upon empirical testing of Beaver and Landsman (1981). The formation period is the time before the measuring point from where we start so where t=0 and the holding period is the period after the measuring point. Losers are firms that have a negative return over a given formation period and winners are firms with a positive return over the same given period. A percentage (often a decile) of the highest winners (lowest losers) are then put together in a portfolio. De Bondt and Thaler (1985) concluded that the return of past losers was 25% higher than for past winners 36 months after the measuring point which was alongside the hypothesis. However, these results are still up for debate as some have argued this was only the result of the size effect or the systematic risk which would be plausible since past losers only outperformed past winners in Januarys.

An interesting critical viewpoint on momentum strategy is that of Conrad and Kaul (1998) who analyzed 120 different strategies from written literature on momentum and contrarian strategy on the NYSE and AMEX during the 1926-1989 period. The contrarian strategy entails buying losers and selling winners. By backtesting these strategies, they found 55 strategies (less than half) that returned significantly positive returns of which 25 were contrarian strategies and 30 momentum strategies. This is followed by a result which states that results from momentum strategy might be attributed to a possible cross-sectional variation in mean returns for individual stocks. This does not match the results and conclusion of Jegadeesh and Titman (1993). However, they also argue that momentum strategy is dominant compared to contrarian strategy when applied over a medium time-horizon which does correspond with the conclusion. Jegadeesh and Titman (2001) respond to this 'criticism' by expanding their research period with eight years. They redefined their research method and ran several tests to come to the same conclusion they arrived at earlier. The hypothesis of cross-sectional variation in mean returns for individual stocks was also tested and rejected. Furthermore, the contrarian strategy was refuted by using behavioral models conferred by Hong and Stein (1999).

Besides behavioral aspects of individual momentum traders, differences between results on contrarian and momentum strategies can be due to differences in systematic risk or behavioral aspects in cross-country analysis (Müller and Müller, 2018). Certain behavioral characteristics differ, add to that the heterogeneity of attributes in stock markets worldwide and it will enlarge momentum. Most research has been done on developing countries of which the US' indices lead as most used country (Campello, 2012). Because of this, it seems interesting to study a particular (smaller) market for itself, circumventing any cross-country bias that may be formed when selecting cross-country indices or simply applying one country's preferable strategy on another country's capital market. Research on momentum strategies in several countries has been conducted before by Chui et al. (2010). They found that in 37 of the 41 countries in their research had positive momentum returns for the portfolios with a 6-month formation and 6-month holding period. In these 41 countries, The Netherlands was included, which had a 0.83% average monthly return for this strategy in the period 1981 to 2003.

An example of research in price momentum for a specific country was conducted by Hurn and Pavlov (2003) for the Australian asset market. They conduct regressions on 200 companies and divide these in a top 50 group and the group with the leftover companies. After constructing UMD portfolios for the same periods as Jegadeesh and Titman (1993), the result was that the strategy produced significant positive returns in the case of the top 50 group and also for the leftovers group.

2.3 Dividend implemented in momentum strategy

Momentum strategy can be based on returns, but there are other financial variables to consider from which portfolios can be selected. For example, turnover when looking at liquidity (Jiun-Lin, 2012) or dividend can both be used instead of return to build portfolios for a model (Lai et al, 2018). Given the several theories on dividend and reasons behind momentum strategy, we expect an UMD portfolio in the Netherlands to outperform its benchmark. Therefore, this study will analyze the following hypothesis:

H1. Dutch stocks outperform the MSCI Netherlands Index by using the UMD momentum factor strategy.

As per the theory of Asem (2009), momentum and volatility increase when a dividend change is announced. Buying firms with increased dividends and selling firms with decreased dividends would result in higher profits. For developing our own theory, this conclusion goes hand in hand with the signaling theory which indicates that firms increase dividend to show higher levels of future cash flow are expected. Due to information asymmetry and market inefficiency, such a statement influences investors opinion of a stock. Pettit (1972) stated that a dividend announcement information could even be considered a self-assessed valuation of the share price, which is in line with the earlier mentioned study of Bhattacharya (1979). According to Chen et al. (2009), not only firms that increase dividend, but even those that decrease dividend can expect a higher share price. This research was conducted on a majority portion of large- and middle-cap Chinese equity market, which could be a reason for the different conclusion. Various studies have supported the viewpoint of firms increasing dividend results in significant abnormal returns (Asquith and Mullins, 1983; Anwar et al., 2017). In this study, we expect that buying firms on the Dutch market with the highest increase in dividend creates an even higher momentum return than the traditional UMD strategy proposed in our first hypothesis. Therefore, the second hypothesis is as follows:

H2. The portfolio return of companies that most increase their dividend exceeds that of a portfolio created by the UMD momentum factor strategy.

3. Data

3.1 Sample

The sample of this study consists of 75 firms for the period 2010 to 2019. The start of this period was chosen as the world economy in 2010 had somewhat recovered from the financial crisis in 2007-2008. In 2020, the economy experienced a very volatile year due to the COVID-19 pandemic, which is why we run our analysis up to this moment and thereby reduce macro-economic bias. The data were obtained from the financial database Refinitiv Datastream. The Dutch stocks selection in both hypotheses is limited to the Amsterdam Exchange Index (AEX), Amsterdam Midkap Index (AMX) and Amsterdam Small Cap Index (ASCX). In this selection there are dual-listed stocks of which the foreign counterpart has been excluded from our sample. In total, these indices have contained 78 stocks over the sample period. Three stocks had a subsidiary or a sister company in the sample of which the one with the earliest listing date remained in the sample and the other was excluded. Furthermore, only dividends on common stock are considered for this study. The Morgan

Stanley Capital International (MSCI) Netherlands Index was selected as a benchmark for the same period as the stocks. The MSCI Netherlands Index is a proper benchmark for our first hypothesis because it covers 85% of free float-adjusted market capitalization in the Netherlands with its 24 constituents.

3.2 Variables description

Stock returns are formally calculated as the risk-adjusted monthly returns of a single stock. This is the dependent variable which will be regressed on the risk-adjusted MSCI Netherlands Index which is our independent variable. For both stocks and index, lagged returns are calculated as follows:

$$RET_{i,t} = \frac{P_{i,t} - P_{i,t-j}}{P_{i,t-j}} \tag{1}$$

, where $P_{i,t}$ is the closing price on the first day of stock *i* at time *t* and $P_{i,t-j}$ is the lagged closing price of the first day of month *j*.

Dividend yield is an important proxy for dividend policy. Dividend yield is an independent variable in our model. It is described as a percentage of paid out dividend per share divided by its share price. We have the exact data on dividend yield for each month per stock from Refinitiv Datastream. The monthly dividend yield for stock *i* is thus computed as follows:

$$DIV_{Y,i,t} = \frac{\frac{DIV_{i,t}}{n_i}}{P_{i,t}} \tag{2}$$

, where $DIV_{i,t}$ is the monthly dividend in total for stock *i* at time *t*, n_i is the number of shares issued for stock and $P_{i,t}$ is the share's closing price on the first day of month *t* (Baskin, 1989).

Our regression will use the market model (Sharpe, 1963), which is a commonly used model in momentum strategies. Also, it is more practical than the Capital Asset Pricing Model (CAPM) because it does not require valuation of as many parameters (Xu, 1999). The formula of the market model is as follows:

$$E(R)_{i,t} = \alpha_i + \beta_i R_{M,t} + \varepsilon_{i,t} \tag{3}$$

, where $E(R)_{i,t}$ is the expected risk-adjusted excess return, $\alpha_{i,t}$ represents the return of the stock if the return of the respective market equals zero, $\beta_{i,t}$ states how much volatility of a stock or portfolio is correlated to its respective market's movements, R_M is the return of the market (the MSCI Netherlands Index) and $\varepsilon_{i,t}$ is the regression error for a single stock. The return of the MSCI is the benchmark in our regression. We use the return which is calculated by dividing the closing price at t=3 divided by the closing price at t=0 minus one. The market model assumes that the risk-free rate is absorbed in $\alpha_{i,t}$ and is a constant term for month *t*. β_i is a factor projecting the sensitivity of the market.

The descriptive statistics of all portfolios are shown in Table 1. The pattern of increasing means for all portfolios as the holding period increases stands out. This does not stand out in any of the related literature. Remarkably, based on returns in our period 2010 to 2019, the mean for the MSCI is higher than all means in every other UMD or dividend based portfolio, except for the 9x3 portfolio. This could be due to most stocks in the MSCI Netherlands Index returning a positive return during this rather bullish period, in which the index rose from 19.62 to 32.57. When something similar would have happened to the stocks from which the portfolios are derived, some stock returns in the portfolio with the ten lowest returns might have been positive. Selling these stocks then could have resulted in a lower average return for that UMD portfolio. The standard deviations are relatively close to each other between 0.0820 and 0.1479.

Table 1: Descriptive statistics of all portfolios in the period 2010-2019

Variable	Mean	Std. dev.	Min	Max
msci3m	0.0184	0.0820	-0.2452	0.1672
dividend3m	0.0137	0.0973	-0.2510	0.4570
3x3	0.0180	0.1104	-0.6668	0.1737
6x3	0.0032	0.1166	-0.4537	0.6554
9x3	0.0191	0.1296	-0.7143	0.3666
12x3	0.0168	0.1121	-0.6028	0.3800
msci6m	0.0362	0.1120	-0.3003	0.2602
dividend6m	0.0269	0.1306	-0.2744	0.4496
3x6	0.0145	0.1479	-0.6850	0.6704
6x6	0.0147	0.0932	-0.4317	0.3987
9x6	0.0252	0.1138	-0.3870	0.3485
12x6	0.0243	0.1135	-0.2891	0.3625
msci9m	0.0501	0.1355	-0.2845	0.3153
dividend9m	0.0337	0.1409	-0.2187	0.4185
3x9	0.0362	0.1552	-0.6422	0.6164
6x9	0.0312	0.1479	-0.3857	0.4246
9x9	0.0300	0.1389	-0.2857	0.6344
12x9	0.0266	0.1424	-0.6723	0.4508
msci12m	0.0593	0.1525	-0.2581	0.3517
dividend12m	0.0524	0.1491	-0.2818	0.4008
3x12	0.0314	0.1490	-0.4962	0.4678
6x12	0.0254	0.1629	-0.5964	0.3783
9x12	0.0261	0.1605	-0.3505	0.5252
12x12	0.0300	0.1547	-0.3969	0.4202

Notes: msci3m=the return for the MSCI with a 3-month holding period, dividend3m=the return for the dividend portfolio with a 3-month holding period, 3x3=the return for a stock portfolio with a 3-month formation period and a 3-month holding period, 6x3= the return for a stock portfolio with a 6-month formation period and a 3-month holding period, 9x3= the return for a stock portfolio with a 9-month formation period and a 3-month holding period, 12x3= the return for a stock portfolio with a 12-month formation period and a 3-month holding period. The other variables are established in a respective way.

4. Methodology

4.1 Portfolio formation

To be able to test the momentum strategy, several portfolios had to be established. In order to find whether historical prices are a good indicator for the future we look at the several aforementioned lags. For the Dutch stock market return portfolios, the returns for each month were calculated using formula (2) for the return. Hence, for a J-month lagged return we first looked at non-compounded returns of a particular stock *i* at time *t*. We selected ten stocks with the highest and ten lowest returns for each month for the 3, 6, 9 and 12- month lagged returns. This is slightly different from how Jegadeesh and Titman (1993) formed portfolios since we do not rank our stocks in deciles but in relatively larger portfolios with ten stocks instead of seven, which would be the case if we used deciles. The reason for this is that seven stocks would be more exposed to bias from extreme values because of the smaller sample size in this study. Having found the stocks for which we want to find the returns in the respective holding periods, we were able to construct a portfolio for the holding period. For all ten stocks in each month, we calculated the individual returns for a certain holding period. The average return of the monthly stock momentum portfolio is the sum of all ten returns divided by ten. We did this for the stocks with the highest lagged returns and the lowest lagged returns. Missing values during a certain holding period were replaced with the corresponding market return.[1] At last, we were able to get our monthly UMD portfolios by subtracting the average return of the lowest ten stocks of the average of the highest ten stocks. In order to provide a more visual representation, the cumulative product of average returns of portfolios with a 6-month holding period are presented in Figure 1 in the Appendix.

The dividend portfolios are formed in a similar way but with less variation in the formation period. The formation periods of the dividend stock portfolio were all based on a 3-month lag. The 3-month lag was chosen because most listed firms that payout dividend do so every quartal. The portfolio was formed by taking the ten stocks with the highest increase in dividend yield over the last three months. The formula to calculate this increase was:

$$DIV_{inc,i,t} = \frac{DIV_{Y,i,t}}{DIV_{Y,i,t-3}} - 1 \tag{4}$$

As mentioned before, the MSCI Netherlands Index will act as the benchmark. The return of the benchmark, used in the regression for UMD portfolios with holding periods of 3, 6, 9 and 12 months, was calculated using a respective holding period of 3, 6, 9 or 12 months at t=0 with the following formula:

$$R_{M,t} = \frac{P_{M,t}}{P_{M,t-1}} - 1 \tag{5}$$

, where $P_{M,t}$ is the price of the MSCI Netherlands Index at t=0 and $P_{M,t-1}$ is the price of the MSCI Netherlands Index in the previous month.

The Sharpe ratio is a measuring technique to gain insight into the relationship between the return and the risk that comes with that return. This will enable us to isolate profits linked with a high-risk due to high volatility. The Sharpe ratio is given by:

1. Due to the firm Corio ceasing to exist at 1-4-2015, there were 50 missing values in total for the winner portfolios and zero for the loser portfolios. All missing values fell between 1-8-2014 and 1-4-2015.

$$SR_p = \frac{RET_P - R_f}{SD_P} \quad (6)$$

, where RET_P is the return of portfolio *P*, R_f is the risk-free rate. The risk-free rate will be set to zero because the market model of our regression does not include the risk-free rate either. This is for consistency with our regression formula as we follow Xu (1999); using the market model without R_f and not the CAPM. Furthermore, SD_P is the standard deviation for portfolio *P*. The main disadvantage is that the Sharpe ratio assumes a normal distribution which is uncommon for stock returns.

4.2 Regression

The first regression we execute is that for the first hypothesis. The method for the regression is the Ordinary Least Squares regression (OLS). The MSCI return is our independent variable and the stock portfolio return is our dependent variable. We derive the following regression:

$$R_{i,t} = \alpha_{i,t} + \beta_{i,t} R_{M,t} + \varepsilon_{i,t} \quad (7)$$

, where $R_{i,t}$ is the return of the portfolio *i* at time *t*, $\alpha_{i,t}$ represents the return of the stock if the return of the respective market equals zero (the excess return), $\beta_{i,t}$ states how much volatility of a stock or portfolio is correlated to its respective market's movements, $R_{M,t}$ is the return of the market (the MSCI Netherlands Index) and $\varepsilon_{i,t}$ is the regression error for a single stock. When $R_{M,t}$ equals 1, the portfolio return will rise with factor β. The assumption is made that the average value of errors is zero and that the error has finite variance. This assumption must hold to produce a valid regression, and since we have a constant term in the regression, the assumption will not be violated. Each regression is tested for heteroskedasticity with the White (1980) test, but for stability in results, robust standard errors will be used where heteroskedasticity is significantly present. We can establish whether the UMD portfolios has excess returns compared to the market return. All UMD portfolios with different formation and holding periods are regressed on the market return. Besides the regressions, two-tailed one-sample t-tests are performed in order to see if the returns of the portfolios significantly differ from zero.

The second hypothesis was constructed in a similar way. A number of studies examine the effect of dividend on stocks or what the relationship of dividend on stocks is by including dividend payout and dividend yield as variables in a regression as Allen and Rachim (1996) did. However, this study will aim to determine not just the relationship between the two, but to see whether raw returns differ significantly and if yes, are dividend portfolios better than UMD portfolios. Four dividend portfolios are formed based on their change in dividend yield since three months ago. The portfolios for each month are formed by selecting ten stocks with the largest increase in dividend yield, which is calculated using formula (4). The dividend portfolios are then held for 3, 6, 9 or 12-month periods, so they can be compared to the UMD portfolios. Different from the UMD portfolios, if a value is missing it will select the stock with next biggest increase in dividend yield, so that we always have equal-weighted portfolios among dividend portfolios.

We create a time-series difference in returns between the dividend portfolio and the UMD portfolio. For each month, the average return of the UMD portfolio with the same holding period is subtracted from the average return of the dividend portfolio. The difference is then regressed on the market return with the alpha representing the difference in excess returns and the t-statistic states whether the difference is significant. This is illustrated in the following regression formula:

$$R_{D,t} - R_{UMD,t} = \alpha_{i,t} + \beta_{i,t} R_{M,t} + \varepsilon_{i,t} \qquad (8)$$

, where $R_{D,t}$ is the return of the dividend portfolio, $R_{UMD,t}$ is the return of the UMD portfolio and the other side of the equation is the same as in formula (7).

5. Results

5.1 UMD portfolio analysis

The results in order to test the first hypothesis are presented in this chapter. The first hypothesis stated that the UMD portfolios of the selected Dutch stocks outperform the MSCI Netherlands Index benchmark. Before we analyze the exact result of the hypothesis, let us further identify the results of the portfolios itself by looking at the average returns in Table 2. The table shows us the average returns of buying a winner portfolio, selling a loser portfolio or the UMD portfolio which constitutes a combination of the two. The asterisk stands for the significance of the two-tailed one-sample t-test, which controls for the return being different from zero.

Table 2. Average returns of portfolios in the period 2010-2019

		Holding period (K)			
Formation period (J)	**Portfolio**	**3**	**6**	**9**	**12**
3	Winner	0.0238	0.0417	0.0642	0.0774
	Loser	-0.0049	-0.0261	-0.0241	-0.0416
	UMD	0.0189***	0.0156	0.0401***	0.0358***
6	Winner	0.0180	0.0420	0.0582	0.0752
	Loser	-0.0145	-0.0257	-0.0226	-0.0454
	UMD	0.0035*	0.0163*	0.0356**	0.0356**
9	Winner	0.0218	0.0410	0.0568	0.0781
	Loser	-0.0006	-0.0202	-0.0216	-0.0465
	UMD	0.0212**	0.0288***	0.0352**	0.0315*
12	Winner	0.0158	0.0340	0.0557	0.0800
	Loser	0.0034	-0.0056	-0.0235	-0.0427
	UMD	0.0192**	0.0285**	0.0322**	0.0373**

Notes: * p<0.10; **p<0.05; *** p<0.01. The numbers for J and K are in months. A portfolio is based on J-month lagged returns and continued to be held for K- months. The other numbers are the average returns for the respective portfolios in decimals; 0.01 = 1%.

Table 2 shows a clear pattern of positive returns for buying the winner portfolios and negative returns for selling the loser portfolios, with the exception of the 3-month formation/12-month holding (henceforth in the format 3x12) portfolio. The 6x6 UMD portfolio produces a 0.0163 return. This varies strongly from previous empirical results from Chui et al. (2010), in which an average 0.0083 was found as return for the 6x6 UMD portfolio. This difference could be due to a number of factors, a different sample period, length of sample period or that this study selects about the 13% top winners and bottom losers for a portfolio and not 33%. Most UMD portfolio returns are significantly different from zero for a 0.05 significance level, except for the 3x6, 6x3, 6x6 and the 9x12 portfolios.

The most successful investing strategy according to Table 2 is buying the 12x12 winner portfolio. However, this strategy involves a formation period of 12 months and a holding period of 12 months which totals 24 months of holding. In these 24 months, you could use a combination of other portfolio strategies which might compound into a higher return. The strategy of buying the winner portfolio should outperform buying the loser portfolio (notice in Table 2 returns are given for selling the loser portfolio) in the medium to long term holding period, meaning 6 to 12 months (Jegadeesh and Titman, 1993). The results in Table 2 match those results and give higher returns for the winner portfolios in the short term, but the result is that all winner portfolios outperform loser portfolios, also in the short term. This is inconsistent with the results of Levy (1967) who found that winners outperform losers only up to a holding period of 7 months and it shifts after that. It had more results inconsistent with our findings in Table 2, such as the 6x6 portfolio having the highest excess return whereas our results show 3x9 having the highest return. Therefore, the contrarian strategy is not in line with our results. Overreaction to news, leading to winners to be overvalued and losers to be undervalued, is false for all portfolios, contradicting De Bondt and Thaler (1985).

In Table 3, the average returns for a 6x6 portfolio are given for winner, loser and UMD portfolios. The 6x6 specifically is chosen to be able to compare our findings to the results of Jehadeesh and Titman (1993). The findings present the average monthly return per month for 6x6 portfolios in the sample period 2010 to 2019. The F-statistic of 1.27 reported in Table 2 means that we cannot reject the hypothesis that the variance in all calendar months is jointly equal. This deviates from the results of Jegadeesh and Titman (1993) who found that monthly differences were significant. January is the month that produces the highest return (5.16%) for an UMD portfolio. However, reading the t-test this is not significantly different from zero. It stands out that both winner and loser portfolios perform much better in the second half of the year than in the first half. None of the t-statistics provide a significant difference from zero for the returns of the UMD portfolios whereas Jegadeesh and Titman (1993) did have significant differences for five different months.

Table 3. Average returns of portfolios per month for the period 2010-2019

Month	**Winner**	**Loser**	**UMD**	**t-stat (UMD)**
January	0.0438	-0.0078	0.0516	1.4042
February	-0.0177	-0.0333	0.0156	0.3918
March	-0.0482	-0.0814	0.0332	0.8716
April	-0.0013	-0.0315	0.0302	1.1238
May	0.0143	-0.0147	0.0290	0.6996
June	0.0371	0.0490	-0.0118	-0.4679
July	0.0535	0.0481	0.0054	0.2515
August	0.0941	0.0967	-0.0026	-0.0965
September	0.1143	0.1227	-0.0083	-0.1802
October	0.1022	0.0710	0.0312	1.2527
November	0.0854	0.0704	0.0150	0.5350
December	0.0274	0.0169	0.0105	0.2315
Feb - Dec	0.0419	0.0285	0.0134	1.9582
F = 1.27				

Notes: All numbers are the average returns for the respective portfolios in decimals; 0.01 = 1%. The t-stat tests whether the average return of the UMD portfolio is significantly different from zero.

Now that we have analyzed the data of our (UMD) return portfolios, we can compare them to the benchmark. As mentioned before, we run a regression of the UMD portfolio returns on the market return for the respective months. The alphas represent the excess of the expected return of the market model. The betas give the systematic risk of the portfolio. The regressions of all portfolios on the benchmark by use of formula (7) are given in Table 4.

The 3x3 portfolio, the portfolio with the shortest period of being active, has an intercept (α) of 0.0231 with a significance level of 5%. This represents a probability of less than 5% of encountering the results of a similar study with an intercept of at least 0.0231 if the null hypothesis of the intercept being equal to zero is true. That null hypothesis can be rejected. It does not necessarily mean that the intercept is significantly equal to 0.0231. The standard error that comes along with the alpha and beta is used to calculate the t-statistic and therefore the significance. The R^2 is a statistic that represents how much of the variance of the dependent variable is explained by the independent variable. The highest R^2 is that of the 6x3 portfolio, so the market return explains the portfolio return for 14.97%. It applies to all formation periods that the longer the holding period is, the lower R^2 becomes, which makes sense as the ten stocks in the portfolio are subjected to a longer period of volatility and possible outliers and have therefore a higher chance of diverging from the market returns. There appears to be a weak trend in the alphas as they increase with a longer holding period. The formation period has no clear pattern when it comes to the alpha or beta. The betas show the likelihood of a portfolio return moving as a reaction to a motion in the market return. The value of the beta states how much the portfolio return would move up or down as a reaction to a one standard deviation increase in the market return. It is also the slope of the linear regression line. In the 3-month holding period, all betas are significant on a 1% level. After that, the significance of the coefficient decreases, which can be seen in the 6-month holding period with only two betas left with a 5% significance level and for even longer holding periods there are few significant betas. The beta standing out is that of the 6x9 portfolio with a 1% significance level. A significant positive alpha points to the UMD portfolio outperforming the benchmark. Looking at the alpha values, the first hypothesis seems to be correct for the 5% significance level as all UMD momentum factor portfolios outperform the MSCI Netherlands Index, except for the 6x3 and 6x9 portfolios because even though the values are positive, they are statistically insignificant. We will therefore not reject the hypothesis and accept that UMD portfolios outperform the MSCI Netherlands Index. This result is consistent with the result reported by Rouwenhorst (1998) and Jegadeesh and Titman (1993). The latter also produced significantly positive returns for the UMD portfolios for all sixteen portfolios.

Table 4. Regression results of $R_{i,t} = \alpha_{i,t} + \beta_{i,t} R_{M,t} + \varepsilon_{i,t}$ for the period 2010-2019

		Holding period (K)			
Formation period (J)	**Metric**	**3**	**6**	**9**	**12**
	α	0.0231***	0.0192**	0.0285***	0.0334***
		(0.0064)	(0.0082)	(0.0094)	(0.0112)
3	β	-0.3509***	-0.2639**	-0.1538	-0.0339*
		(-0.0062)	(-0.1179)	(0.1243)	(0.0756)
	R^2	0.0934	0.0464	0.0272	0.0017
	α	0.0097	0.0208**	0.0162	0.0233**
		(0.0069)	(0.0079)	(0.0110)	(0.0127)
6	β	-0.3509***	-0.1686**	0.0814***	0.0341
		(0.0808)	(0.1122)	(0.1301)	(0.0858)
	R^2	0.1497	0.0454	0.0545	0.0016
	α	0.2460***	0.0273***	0.0431**	0.0253**
		(0.0074)	(0.009)	(0.0123)	(0.0127)
9	β	-0.2937***	-0.1137	-0.0081	0.0422
		(0.0913)	(0.1176)	(0.0864)	(0.1719)
	R^2	0.0861	0.0078	0.0001	0.0005
	α	0.0225***	0.0285***	0.0321**	0.0332**
		(0.0078)	(0.0094)	(0.0120)	(0.0136)
12	β	-0.3060***	-0.2272*	-0.1089	-0.1797
		(0.0935)	(0.1291)	(0.0946)	(0.1788)
	R^2	0.0832	0.0272	0.0134	0.0087

Notes: * p<0.10; **p<0.05; *** p<0.01. The numbers for J and K are in months. A portfolio is based on J-month lagged returns and continued to be held for K-months. The standard error is in parentheses for information purposes, but the zero mean assumption for the standard error is still dominant.

5.2 Dividend portfolio analysis

The second hypothesis stated that portfolios formed based on dividend increasing stocks outperforms the UMD momentum factor portfolios. To gain better insight in the dividend portfolios compared to the UMD portfolios and the risks involved when investing in either. The Sharpe ratios in Table 5 provide a better understanding of the risks involved in buying every single asset.

All Sharpe ratios are positive, meaning that the portfolio return was at least higher than the risk-free rate at that moment. A positive Sharpe ratio will always be higher than the risk-free rate in this study since we have assumed that to be zero. The MSCI has the highest Sharpe ratio for all holding periods. This means that the MSCI has the best risk-adjusted performance. For a 3-month holding period, all Sharpe ratios are around 0.2 except for the UMD portfolio with a 6-month formation period. There is no clear trend in Sharpe ratios with regard to the formation period. The 3-month holding period gives much higher ratios than the other holding periods. From an economic perspective, this makes sense when we look at the average returns of for example the UMD portfolio in Table 2, those of the 3-month and 6-month holding are quite similar (with the exception of the 6x3 portfolio). Similar average returns but with a shorter holding period, the 3-month holding period portfolios will have a higher Sharpe ratio. A portfolio with a longer holding period leads to greater exposure to risks. The theory of DeBondt & Thaler (1985) offers a possible explanation for this by stating that loser stocks have short term underperformance, but long term there will be a reversal pattern with losing stocks generating positive returns. This would explain why at least the UMD portfolios have lower Sharpe ratios after 3-months of holding. The dividend portfolios have a better risk-adjusted return than all UMD portfolios for the 6-month and 12-month holding periods. For the 3-month and 9-month holding periods the dividend portfolios have lower Sharpe ratios than most UMD portfolios.

Table 5. Sharpe ratios for all portfolios and the MSCI Netherlands Index for the period 2010-2019

		Holding period (K)			
Formation period (J)	**Portfolio**	**3**	**6**	**9**	**12**
-	MSCI	0.2309	0.0391	0.0555	0.0676
3	Dividend	0.1696	0.0290	0.0374	0.0597
	UMD	0.2495	0.0156	0.0401	0.0358
6	UMD	0.0453	0.0163	0.0356	0.0297
9	UMD	0.2461	0.0288	0.0352	0.0315
12	UMD	0.2072	0.0285	0.0322	0.0373

Note: the MSCI Netherlands Index (MSCI) has no formation period as it is a single pre-determined asset.

As we have established the differences in risk-adjusted returns between UMD and dividend portfolios by defining the Sharpe ratios. Table 6 provides the results of the regression of the difference between the average returns of the dividend portfolios minus the average returns of the UMD portfolios on the market return. The alpha represents the difference in excess returns between the dividend and UMD portfolios. All alphas have negative values, except for the alpha of the 6x6 portfolio regression. A negative sign tells us that the UMD portfolios give higher returns than the dividend portfolios. A minimum of two asterisks represents the significance of the difference in excess returns on a 5% level. All portfolios with a formation period of 6 months or a holding period of 12 months have no significant difference, whereas portfolios with a 3-month or 12-month formation period do have significant differences for two portfolios. In the 3x3, 6x3, 12x3, 12x6, 3x9 portfolios are the excess returns of the UMD portfolios significantly higher than for the dividend portfolios. The R^2 is highest for the portfolios with a 3-month and 6-month holding period, after that it gets much lower. This indicates that the difference in excess returns is better predicted by the market return for portfolios with holding periods till 6 months. The betas are all significant; those of the portfolios with 3-month and 6-month holding periods having the highest value. The value of the beta states by how much the difference in average returns between the dividend and UMD portfolio changes when the market returns increases by one. Portfolios whose dividends increase most do not seem to outperform UMD portfolios; we therefore reject the second hypothesis. The results are in line with the results in the study on the Australian asset market (Hurn & Pavlov, 2003). We might even derive from this that investors tend not to value an increase in dividend as much as high returns in the J-lagged period. However, many other variables could play a role in these numbers as we use the market model in this study: the market model with just one independent variable. Therefore, the model and its interpretation is vulnerable to OVB.

Table 6. Regression results of $R_{D,t} - R_{UMD,t} = \alpha_{i,t} + \beta_{i,t} R_{M,t} + \varepsilon_{i,t}$ for the period 2010-2019

		Holding period (K)			
Formation period (J)	**Metric**	**3**	**6**	**9**	**12**
	α	-0.0221**	-0.2093	-0.0321**	-0.0173
		(0.0106)	(0.0140)	(0.0154)	(0.0175)
3	β	0.9640***	0.9195***	0.5927***	0.6472***
		(0.1323)	(0.1339)	(0.1266)	(0.1204)
	R^2	0.3256	0.2822	0.1607	0.1850
	α	-0.0087	0.0208	-0.0146	-0.0073
		(0.0098)	(0.0136)	(0.0148)	(0.0187)
6	β	1.0398***	0.8624***	0.3415***	0.5792***
		(0.1261)	(0.1317)	(0.1013)	(0.1187)
	R^2	0.3864	0.2752	0.0726	0.1574
	α	-0.0236**	-0.0265*	-0.0259	-0.0084
		(0.0106)	(0.0142)	(0.0162)	(0.0203)
9	β	0.9816***	0.7750***	0.5905***	0.5846***
		(0.1165)	(0.1212)	(0.1199)	(0.1217)
	R^2	0.3321	0.2195	0.1566	0.1337
	α	-0.0215**	-0.0316**	-0.0275*	-0.0172
		(0.0105)	(0.0134)	(0.0165)	(0.0193)
12	β	0.9939***	0.9427***	0.6912***	0.6683***
		(0.1104)	(0.1130)	(0.1250)	(0.1240)
	R^2	0.3377	0.2900	0.2020	0.1648

Notes: * p<0.10; **p<0.05; *** p<0.01. The numbers for J and K are in months. A portfolio is based on J-month lagged returns and continued to be held for K- months. The standard error is in parentheses for information purposes, but the zero mean assumption for the standard error is still dominant.

These results are in line with Allen and Rachim (1996), who found that the dividend policy had a significant effect on volatility. This study does not include volatility but it does look at the returns over different periods of time, as well as at the differences in dividend yield over time. Our results of all alphas and betas being lower for the 12-month holding period portfolios than for the 3-month holding period portfolios coincides with the conclusion of Litzenberger and Ramaswamy (1982); significant return effects cannot be attributed to the information regarding the level of dividend yield. The importance of information subsides as time passes as there will have risen new information to handle on, with past increases in dividend and reports on return becoming less significant. The difference in excess returns between the dividend and UMD portfolios, which are based on returns, seems to decrease with time. The possible conclusion of this study, namely that investors value high returns over increases in dividend, does not entirely align with theory of Karpavičius and Yu (2018) which stated that dividend paying stocks appear more valuable.

6. Conclusion

This study addressed two issues in existing literature regarding price momentum and dividend: the quality and usefulness of the UMD momentum factor strategy in the Netherlands (H1) and whether companies that most increase their dividend outperform the previous studied UMD momentum factor strategy. The Netherlands is a well-developed country for which several studies on momentum strategy have been done, but few in recent years. Culture is part of the psychological decision-making process of investors and differentiates between cultures and countries. The ongoing debate on H2 in previous literature on the relationship between dividend and stock return, started by Modigliani and Miller (1961), is still a controversial topic and therefore interesting to study for the Dutch stock market specifically.

Using 75 listed Dutch firms for the period 2010 to 2019, we tested whether UMD portfolios could significantly outperform the benchmark. After creating portfolios of the ten winner and the ten loser stocks, with a formation and holding period of 3, 6, 9 and 12 months, a regression with the market model showed that fourteen out of sixteen UMD momentum factor portfolios significantly outperform the MSCI Netherlands Index; this is in line with previous research (Jegadeesh & Titman, 1993; Rouwenhorst, 1998). The second hypothesis was tested using the same sample, but with portfolios based on change in dividend yield. Ten stocks with the largest increase in dividend over the past 3 months were selected for a portfolio. These stocks were then also held for 3, 6, 9 or 12 months; average returns being compared to those of the UMD portfolios for the respective holding periods. A comparison was made by regressing the difference of the average return of both types of portfolios on the market return for the same holding period. This provided us with almost all negative alpha values of which five out of sixteen were significant. Therefore, the dividend portfolios do not significantly outperform UMD portfolios, even though they had a higher mean than most of its respective UMD portfolios.

The first hypothesis opposes the contrarian strategy, but does indicate that momentum strategy is a useful investment strategy. Even when cross-country bias is out of the picture and we focus on Dutch stocks, momentum strategy proves significantly profitable as in Rouwenhorst (1998). The result of testing the second hypothesis means that overreaction to dividend policy changes might not be as useful as overreaction in information on stock returns when deciding an investment strategy. Dividend paying stocks do not appear to be more valuable than stocks that do not pay out dividend in the eyes of the investor.

Admittedly, the research could be conducted in a different, more comprehensive way. The sample consists of mid cap and small cap assets which have a higher possibility of being illiquid and could therefore be unable to short. This creates a problem in the UMD portfolio as it sells the losers. Besides the sample, the regression results should be considered carefully as we have no other variables besides the market return in the market model and is therefore likely subjected to omitted variable bias. Instead of the market model, the Fama-French 5-factor model could be used for example to include more control variables. The CAPM is another possible method to test our hypotheses, which would include the risk-free rate. Including the risk-free rate would likely change the alphas and would increase the slope of the market function, accounting for the time value of money. Furthermore, this study excludes any period with economic downturns which could lead to the momentum strategy being unprofitable during economic crises.

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Appendix
Figure 1

Cumulative product of the time series $1+R_t$ for each portfolio and the MSCI Netherlands Index for the period 2011-2019