

Rolling Momentum Strategy: An Empirical Analysis

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Abstract

Research background: The focus of the momentum strategy, as a procyclical investment strategy, lies in the hypothesis that the winning shares of the past will most likely develop in the same direction in the near future. The same is assumed for the performance of the loser shares. The technical trading rules of relative strength according to Levy provide the basis for this approach (Levy, 1967). The momentum strategy can thus offer investors an opportunity to outperform the market. The creation of portfolios under the momentum strategy follows simple rules: On the basis of past prices, equities are selected within a formation period according to return criteria. The stocks with the highest and lowest returns on equities in the formation period are combined into winning and losing portfolios, each with the same number. The final step is the acquisition of the winning portfolio, which is held over the specified investment period, with the loser portfolio being sold short at the same time. The empirical analysis presented in this paper focuses on the success of the momentum strategy for the STOXX Europe 600 market over a formation and investment period of six months.

Purpose of the article: The objective of this paper is to empirically test the above statements and assumptions. Portfolios are built up on a rolling basis over a period of six months and then observed with respect to their performance over a period from 1995 to 2000. The achieved returns are compared with a buy-and-hold strategy and empirically tested for return differences. Especially the years 2001, 2008, and 2020 as the crisis years of the dot-com bubble, the financial crisis, and the COVID-19 pandemic are focused on and discussed.

Methods: The data of the period are examined for performance development in a database in the form of winner and loser portfolios. The returns are calculated as AR to a reference portfolio DAX. The returns are statistically tested for significant differences to a zero return using a t test.

Findings & Value added: The results show the performance of the momentum strategy in the period from 1995 to 2000 for the stocks of the STOXX Europe 600. The strong fluctuations in the crisis years are notable.

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With few exceptions, the reference returns could only provide statistically non-significant results.

Keywords: *portfolio theory; behavioral finance; Stock Pricing*

JEL Classification: *G11; G14; G40*

1 Introduction

The focus of the momentum strategy, as a procyclical investment strategy, lies in the hypothesis that the winning shares of the past will most likely develop in the same direction in the near future. The same is assumed for the performance of the loser shares (Bajgrowicz and Scaillet, 2012; Asness et al., 2013). The technical trading rules of relative strength according to Levy provide the basis for this approach (Levy, 1967). The momentum strategy can thus offer investors an opportunity to outperform the market (Rachev et al., 2007).

The creation of portfolios under the momentum strategy follows simple rules: On the basis of past prices, equities are selected within a formation period according to return criteria. The stocks with the highest and lowest returns on equities in the formation period are combined into winning and losing portfolios, each with the same number. The final step is the acquisition of the winning portfolio, which is held over the specified investment period, with the loser portfolio being sold short at the same time (Brock et al., 1992; Hong and Stein, 1999; August et al., 2000).

In contrast to practice, which is limited to the successful compilation of winning and losing portfolios with the aim of generating outperformance, science is interested in explanatory approaches that are responsible for excess returns. Since the theses of capital market efficiency and CAPM do not seem to offer a sufficient solution, findings from behavioral finance are increasingly being taken into account (Baker and Wurgler, 2006; Baker and Wurgler, 2007). The aim is to explain the momentum effect through approaches based on behavioral science. Behavioral finance is based on social psychology and decision theory and follows the assumption that economic subjects behave rationally in their interactions only to a limited extent (Guo, 2002). The traditional aspects of capital market theory, which are based on the assumption of high information efficiency and rationally acting individuals, among other things, were questioned and confronted with more recent psychological approaches (Jegadeesh and Titman, 2001; Kim and Suh, 2018). Thus, the main research question arises as to whether a rolling momentum strategy can lead to outperformance.

Overall, regardless of its causes and scientific explanations, the momentum effect can be regarded as a phenomenon proven on the market. From the investors' point of view, the momentum effect enables the formation of corresponding investment strategies for market outperformance (Chordia and Shivakumar, 2012; Celiker et al., 2016; Fan et al., 2018; Schubert et al., 2018). Therefore, in this paper, a rolling momentum strategy is created, which is tested with regard to its performance capabilities, taking into account the above findings. Concretely, this paper is based on the strategy of Nelles, Užík, and Holtfort as published in 2007. However, a longer period and a larger group of stocks are being analyzed. Moreover, the empirical analysis presented in this paper focuses on the success of the momentum strategy for the STOXX Europe 600 market over formation and investment periods of six months.

In general, the results of the analysis show that the rolling portfolios generate positive statistically significant returns against the DAX and the MSCI World Index.

The remainder of this paper proceeds as follows: Section 2 provides the review of relevant literature. Section 3 describes the sample, the research methodology, and presents the results of the empirical analysis. Section 4 summarizes and concludes the findings.

1.1. Scientific Discussion of the Momentum Strategy

The first empirical studies on the momentum strategy refer to the US market. Between 1960 and 1965, Levy (1967) examined a sample of 200 stocks on the New York Stock Exchange (NYSE) whose weekly closing prices over a 260-week period were used as the data basis for an analysis and provided scientific evidence of the success of the momentum strategy (Jegadeesh and Titman, 1993). Jegadeesh and Titman (1993) showed that a medium-term procyclical investment strategy leads to excess returns of up to 12.01 % per year on average for the US market. At the same time, however, the study makes it clear that the excess returns of the investment universe are reduced by up to half in the long-term observation period of 24 months after the holding period.

Rouwenhorst (1998) analyzed a portfolio of twelve European stock markets. He looked at a formation and test period of several years during the observation horizon from 1980 to 1995. The results of the study showed that the portfolio from the profit values of the past shows an excess return of about 1 % per month compared to the loser values of the past. It is conspicuous that although a yield continuity could be identified for both large and small companies, it is particularly strong for smaller company segments. The findings from the European momentum study correlate highly with the results of the studies conducted on the US market.

August et al. (2000) analyzed the price data for 418 stocks on a weekly and monthly basis, which were listed on the German stock market between 1973 and 1997. A successful momentum strategy was demonstrated for risk-adjusted returns. In accordance with existing studies, a six- and twelve-month formation and test period proved to be promising. It is noticeable that in comparison to other studies, winners and losers showed an excess return of 6.12 % and 6.25 % respectively. In addition, seasonal return patterns became clear. Previous studies, conducted for the German market by Nagler (1979) and Hanel (1991), referred equally to the superiority of the momentum strategy (see also Schiereck and Weber, 1995; Hirshleifer and Shumway, 2003; Barroso and Santa-Clara, 2015; Choi et al., 2015; Bohl et al., 2016).

In the context of behavioral finance, both De Bondt and Thaler (1985) and Barberis et al. (1998) explain the momentum effect by investors tending to overestimate the importance of current information, while already known facts are given less importance. The result is an overreaction effect, which leads to excessive price development. The tendency is that the timeliness of information can cause market overreactions. Negative information leads to undervaluation of the share, while positive information leads to overvaluation. The result is a higher or lower return than, for example, the market return. The overreaction effect however requires a certain period of time until the market can find its way back to its original equilibrium state (see also Schubert et al., 2018).

Daniel et al. (1998) came to the conclusion that the momentum effect is due to behavioral anomalies such as the overconfidence effect. The investor tends to overestimate his own information through subjective perception. An overoptimism exists if, in comparison to a reference group, there is an overestimation of the probability that positive events will occur for the individual (Weinstein, 1980). If there is a certain preference, such as the acquisition of growth stocks, only one-sided information is taken into account in the individual's behavioral calculation that strengthens the original intention (Daske, 2002). The greater the amount of this information, the higher the overall overconfidence effect (Oskamp, 1965).

The Hong and Stein (1999) approach models two types of market participants that can be used to explain the momentum effect. Price movements are triggered by information and interactions of both groups of traders. Limitedly rational traders (risk-averse newswatchers) trigger an underreaction in the share price which, however, can end in an overreaction and trend reversal due to trading activities of risk-neutral momentum traders (Bank, 2003). The decisions of market participants are not necessarily based on psychological distortions (August et al., 2000; Demiret et al., 2015; Wang and Xu, 2015).

The momentum effect can be regarded as a phenomenon proven on the market. From the investors' point of view, it enables the formation of investment strategies for market outperformance (Chordia and Shivakumar, 2012; Celiker et al., 2016; Fan et al., 2018). In the following section, a rolling momentum strategy is created and tested with regard to its performance capability.

2 Methods

2.1 Data Basis and Methodology

In contrast to previous empirical procedures, a monthly rolling momentum strategy was tested for this paper. For the period from December 1994 to December 2020, a certain number of shares from the Thomsons Reuters Datastream were, on a monthly basis, identified as winners or losers from the STOXX Europe 600 investment universe on the basis of share performance. For this purpose, the discrete returns of the individual shares were measured over the six-month formation periods and ranked according to their level of return. The top 10 % formed the winning portfolio with equal weighting. Similarly, the worst 10 % were combined in the loser portfolio. In the subsequent six-month holding period, the winning portfolio was bought and the loser portfolio (empty) was sold. The DAX was selected as the benchmark. With the monthly rolling momentum approach, it is important to note that the individual formation and holding periods do not line up independently of each other. Instead, the periods overlap. However, this represents no problem for the calculation since a portfolio is always sold every six months and the return is thus realized. In the same way, the performance of the benchmark is calculated. Thus, every six months, the benchmark is sold and the return is calculated.

Following the first formation period (from December 31st, 1994, to June 30th, 1995), the first holding period began on June 30th, 1995. At this time, the necessary investment amount was invested in the winning portfolio. At the same time, the loser portfolio was sold short. In each of the following months, a new portfolio was invested in, so that at the beginning of the sixth period, the total investment amount was divided between six different winning portfolios facing six corresponding loser portfolios. On December 31st, 1995, at the end of the first holding period, the proceeds were realized by selling the winning portfolio and covering the loser portfolio so that the funds released could be reinvested at the same time as the start of the seventh holding period. The portfolios were liquidated step by step at the end of the evaluation period. The analysis covered a total of 301 holding periods.

2.2 Calculation of Yields

In the case of monthly reinvestment, it is assumed that one part of the original investment amount is reinvested at all times. After six months, the investment portfolio is completed. For each six-month holding period t , the portfolio return, excess return (abnormal return) AR_{winner} of the winning portfolio over the market portfolio, represented by the DAX, and the excess return AR_{loser} of the (empty) sold loser portfolio over the DAX is determined:

$$r_{p,t} = \ln \left(\frac{\sum_{i=1}^n P_{i,t}}{\sum_{i=1}^n P_{i,t-6}} \right) \quad (1)$$

where $r_{p,t}$ is portfolio return at t and $P_{i,t}$ is stock market price of share i at time t .

$$AR_{winner,t} (r_{winner,t} - r_{DAX,t}) \quad (2)$$

$$AR_{loser,t} (r_{loser,t} - r_{DAX,t}) \quad (3)$$

Furthermore, the overall success of $AR_{BWSL-S,t}$, the combined Buying-Winner-Selling-Loser strategy in each period is of interest:

$$AR_{BWSL-S,t} = AR_{winner,t} + AR_{loser,t} \quad (4)$$

In order to determine the investment performance over the entire period under review, the individual abnormal returns (excess returns) are additively linked over the 301 periods. For the Buying-Winner-Selling-Loser strategy, the cumulative return is calculated:

$$CAR_{BWSL-S,t} = \sum_{t=1}^{301} AR_{BWSL-S,t} \quad (5)$$

3 Results and Discussion

The results obtained show (Tab. 1) that an overall winner portfolio performance of 2,392.52 %, an overall loser portfolio performance of -230.98 %, and an overall Buying-Winner-Selling-Loser strategy portfolio performance of 1,104.54 % was achieved with a monthly rolling strategy over the selected 25.5-year period. This corresponds to an annualized return of almost 13.26 % (winner) and -3.34 % (loser). In contrast, the DAX as a benchmark with identical investment methodology only achieved an overall performance of 2.49 % every year. The outperformance (excess return) of the winning portfolios over the DAX amounted to 335.53 % and thus made a major contribution to the success of the overall strategy. The loser portfolios underperformed the DAX by around 10.54 % yearly (-1287.98 % in the overall period of 25.5 years).

What both strategies (winning and losing portfolios) have in common is that they fluctuate strongly over time. The winning strategy achieved high abnormal returns until the end of the stock boom in the end of 2000. In the subsequent bear market, the profit strategy performed poorly. Only in the final phase of the bear market, sustained positive excess returns could be recorded again. Especially after the first quarter of 2003, the end of the three-year bear market, and from the second half of 2004, during the consolidation phase (sideways movement of the stock market), and in the early phase of the subsequent upward trend, a high outperformance against the DAX can be achieved. This shows that the winning strategy works best in a positive overall market environment.

Table 1. Return overview.

	Performance Top 10 % Winner	Performance Top 10 % Loser	Performance DAX Buy& Hold (total return)	Outperforma nce Winner against DAX ARWinner	Outperforma nce Loser against DAX ARLoser	Performance BWSL- Strategy ARBWSL-S
Cumulative Return	2392.52%	-230.98%	187.37%	1335.53%	-1287.98%	1104.54%
Mean Return	7.95%	-0.77%	0.61%	4.44%	-4.28%	3.67%
Stadard Deviation	16.95%	22.20%	6.19%	12.99%	35.54%	27.91%
Max. Return	93.74%	91.77%	19.37%	71.23%	153.55%	117.03%
Min. Return	-65.70%	-86.46%	-29.33%	-36.86%	-121.65%	-108.06%
Return p.a.	13.26%	-3.34%	2.49%	10.70%	-10.54%	9.88%

Source: own representation

The loser strategy, on the other hand, shows a contrary picture. The highest abnormal returns can be achieved from the end of the first quarter of 2001 onward, after the stock market slump has established itself, until the first quarter of 2003, and during the financial crisis in 2008. After the trend reversal in spring 2003 and during the subsequent upward movement, the loser strategy fails and leads to high negative abnormal returns with the same movement in 2008. Similarly high negative abnormal returns result from the strong upward movement on the stock market, which resumed in the second quarter of 2003 and 2009. Thus, the loser strategy only works in a weak overall market environment.

Since the loser strategy only makes a small contribution to the overall success of the BWSL strategy, the justified question arises as to whether only the winning strategy should be used. For reasons of diversification, this question should be answered in the negative. Taking into account the returns of the winner and loser portfolios, at a value of -0.724, the DAX shows a high negative correlation to the loser portfolio (see Tab. 2). The returns of the winning portfolios positively correlate with the DAX and MSCI performance. Only the combination of both strategies into the BWSL strategy results in a negative correlation of -0.222 to the DAX and -0.297 to MSCI performance. The BWSL strategy is therefore an ideal addition to an equity portfolio as a portfolio module. Furthermore, any weak phases of the trend-following BWSL strategy can be identified during the period under review. The trend-following approach inevitably fails whenever there is a trend reversal on the stock market. This was the case in the end of 2000, when the bursting of the speculative bubble on the New Market triggered an almost three-year downward trend, as well as the 2008 financial crisis' influence on the stock market. Stocks which still showed a high relative strength in the formation period could no longer maintain this strength after the trend change in the following holding period and tended to have relative weakness and vice versa. The next sustained trend reversal took place in the spring of 2003. Shares that are still very weak during the formation period often become the biggest winners after the trend change, so that the loser strategy, which did not work in this phase, caused the negative returns of the BWSL strategy. The next phase of weakness in 2004 coincided with the consolidation phase, which interrupted the long-term upward trend of the stock market. As a result, the trend-following approach provided false signals, which were reflected in a negative overall performance in the short term. No trend change could be identified during the fourth weak phase. Rather, this phase fell into an intact upward trend in which the positive returns of the winning portfolios could not compensate for the negative returns of the losing portfolios.

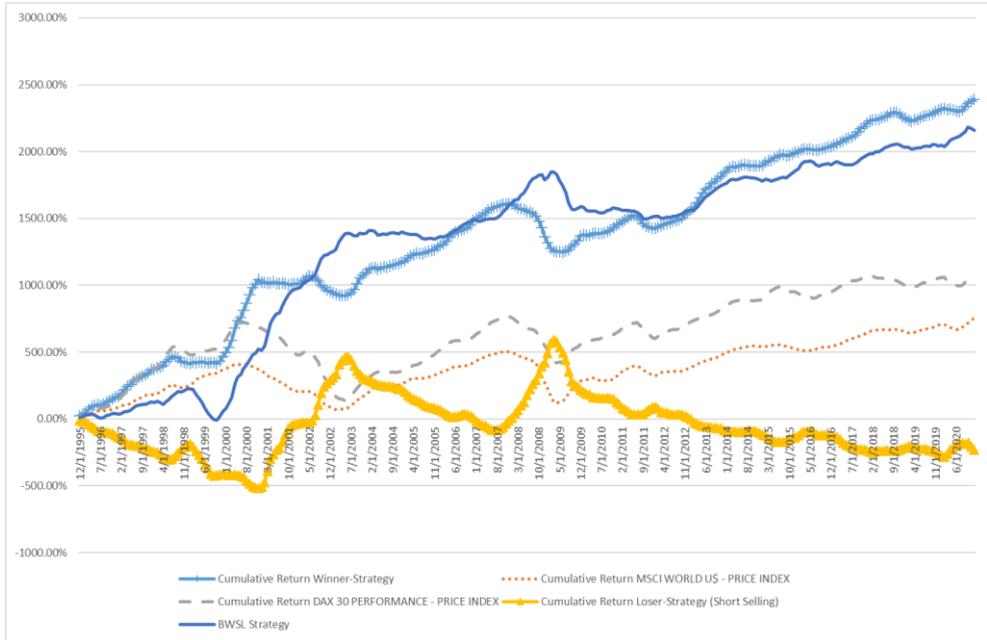


Figure 1. CAR

Source: own representation

The presentation of cumulative abnormal returns (CAR) in Fig. 1 shows that the loser strategy can only make a positive contribution to overall performance during the pronounced bear market in the beginning of the years 2000 and 2008 years. The cumulative returns reach high values, but are almost completely eroded by the end of the period due to the stock market boom. The opposite trend in the cumulative returns of the winning and losing portfolios can be seen clearly. During the bear market, equities with a high relative strength prove to be a good investment opportunity, as the cumulative returns of the winning portfolios move sideways in this phase, while the development of the cumulative returns of the DAX show a negative trend.

Table 2. Statistics and t-Tests.

One-Sample Test						
Test Value = 0						
	t	df	Sig. (2-tailed)	Mean Difference	of the Difference	
					Lower	Upper
Winner-Strategy	8.1340	300.0000	0.0000	0.0795	0.0603	0.0987
MSCIWORLD US - PRICE INDEX	3.6341	300.0000	0.0003	0.0251	0.0115	0.0387
DAK 30 PERFORMANCE - PRICE INDEX	3.8065	300.0000	0.0002	0.0351	0.0170	0.0533
Loser-Strategy	-0.5997	300.0000	0.5492	-0.0077	-0.0329	0.0175
BWSL-Strategy	8.3619	300.0000	0.0000	0.0718	0.0496	0.0940
AR Winner	5.9288	300.0000	0.0000	0.0444	0.0296	0.0591
AR Loser	-2.0898	300.0000	0.0376	-0.0428	-0.0831	0.0025
AR BWSL	2.2809	300.0000	0.0233	0.0367	0.0050	0.0684

Paired Samples Test									
Paired Differences									
	Mean	Std. Deviation	Std. Error Mean	of the Difference					
				Lower	Upper				
Pair 1	Winner-Strategy - MSCIWORLD US - PRICE INDEX	0.0544	0.1301	0.0075	0.0396	0.0692	7.250	300	0.000
Pair 2	Winner-Strategy - DAK 30 PERFORMANCE - PRICE INDEX	0.0444	0.1299	0.0075	0.0296	0.0591	5.927	300	0.000
Pair 3	Loser-Strategy - MSCIWORLD US - PRICE INDEX	-0.0328	0.3221	0.0186	-0.0693	0.0038	-1.765	300	0.079
Pair 4	Loser-Strategy - DAK 30 PERFORMANCE - PRICE INDEX	-0.0428	0.3554	0.0205	-0.0831	-0.0025	-2.089	300	0.038
Pair 5	BWSL-Strategy - MSCIWORLD US - PRICE INDEX	0.0467	0.2582	0.0149	0.0174	0.0760	3.139	300	0.002
Pair 6	BWSL-Strategy - DAK 30 PERFORMANCE - PRICE INDEX	0.0367	0.2791	0.0161	0.0050	0.0684	2.281	300	0.023

Source: own representation

The statistical analysis (Tab. 2) also shows a statistical significance of the excess returns. With the exception of the loser portfolio, all returns are significantly different from zero and positive. In addition, the paired samples test shows that once again, all strategies except the loser portfolio significantly outperform the returns of the DAX and the MSCI World Index.

4 Conclusion

In the context of the objectives set for this paper, the momentum effect was determined for the period under review. The implemented rolling momentum strategy enabled an annual outperformance of the DAX by 6.08 %. This corresponds roughly to the excess returns already determined in the literature. The rolling momentum strategy with a six-month formation and holding period also makes it possible to reduce the default risk of positive returns by reducing the respective investment amount to one sixth. A disadvantage in this context is the dependence of the returns, which occurs due to overlapping of the formation and holding periods. Further analyses have shown that the rolling momentum strategy can be managed accordingly as a function of boom and bust phases and that it can largely eliminate seasonal effects. On the other hand, the success of the classic momentum strategy depends on entry times. Furthermore, in the case of the rolling momentum strategy, equities that have a high relative strength over a longer period of time are weighted higher in the overall portfolio due to the more frequent inclusion in sub-portfolios. The same applies to the loser values. Finally, it should be noted that further empirical analyses with larger national and international portfolios should put the success of the rolling momentum strategy to the test.

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