MOMENTUM RETURNS IN DIFFERENT MARKET CLIMATES

EVIDENCE FROM THE PAKISTANI STOCK MARKET

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Abstract

In our study, we investigate the risk-return relationship under different market-climates for the momentum strategy on the Pakistan stock exchange (PSX) between February 1999 and February 2019. We test three strategies with different formation/holding-periods; 3/3, 6/6 and 12/3. We use a single-factor model (CAPM) to analyze these relationships. We find that every strategy yields zero to negative average excess returns, which below the market index average of 1.14%. The 6/6-strategy showed the highest performance of a monthly average excess return of 0.01%. This indicates that momentum is not present in Pakistan during this period. These findings are statistically significant at a 5% level. Overall, we find little to no differences in returns during differing market climates with the exception being higher excess returns during bull-periods.

Keywords: Momentum Returns, Pakistani Stock Market, Market Climates, Dual Beta.

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1. Introduction

Jegadeesh and Titman (1993) define price momentum as a continuation of stock price movement based on previous prices. The momentum investment strategy attempts to exploit these movements to generate returns. Our study investigates if the momentum phenomenon is present on the Pakistan Stock Exchange (PSX) between February 1999 and February 2019 and if the momentum returns would have differed during different market climates. From our one-factor regression model with monthly excess return as the coefficient our zero-cost portfolios yielded zero to negative returns. Furthermore, from a two-factor regression model with the market climates as a dummy variable and excess returns as the coefficient, we find little to no differences in returns with the exception being higher excess returns during bull-periods.

Building upon the momentum phenomenon, Griffin, Ji and Martin (2003) discuss the possibility that momentum strategies earn positive returns and show little to no increased market correlation in negative market states. This implication is interesting because the potential lack of market correlation could mean that the application of momentum strategies could go further than only attempting to "beat the market" and act as a risk mitigator during bear markets as well.

We selected Pakistan because there have not been many studies on this area, and no study, as far as we know, has examined the risk-return relationship of momentum returns under different market climates. More specifically, we applied three different momentum strategies in this study, with 3-month, 6-month and 12-month evaluation periods respectively. The 3-month evaluation portfolio will be held for 3 months, the 6-month evaluation portfolio will be held for 6 months, and the 12-month evaluation portfolio will be held for 3 months. The return patterns of these strategies are examined by evaluating their monthly returns, which will then be followed by evaluating this performance in relation to differing market climates. Furthermore, the potential exposure to systematic risk relating to the strategies will also be explored. Our findings can provide a foundation for further studies with more data and advanced models to better understand the nature of return momentum and market risk in different climates of the Pakistani stock market.

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2. Previous Literature

In their first study, Jegadeesh and Titman (1993) revealed a tendency that buying past stock winners and shorting past losers over a holding period would generate significant positive returns. Between 1965 and 1989 their portfolio-strategy, shorting past losers and buying past winners on the U.S stock market based on the previous 6 months, yielded an annual excess return of 12.01% on average. After adjusting for systematic risk and trading costs, the results remained, which made Jegadeesh and Titman believe there was a short-term underreaction and long-term overreaction on the stock market.

Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), and Hong and Stein (1999) focus on how investors manage expectations based on future prospects of a firm, how they react to information, and how they are overconfident in their private information. According to Jegadeesh and Titman (2001) their prior work from 1993 has been subjected to a lot of criticism, saying return patterns are due to data mining. This criticism is difficult to reduce or rebut in a non-experimental setting. However, they continued to prove the strategy's profitability with a new sample between 1990 – 1998 in the U.S stock market.

Nnadi and Tanna (2017) conducted a study on momentum returns in Emerging markets and Hu and Chen (2011) in Asia, Europe and North America. Both studies found the trading strategy to be successful. However, a study conducted by Abbas (2017) on momentum returns on the Pakistani stock market showed different results, where only 3 out of 25 zero-cost strategies generated positive returns. This indicates that current findings, although not numerous, suggest that momentum returns in Pakistan are low to non-existent. In Hong, Lim, and Stein (2000) study's momentum strategies including only stocks from small companies with little analyst coverage experienced higher returns than large companies.

According to Conrad and Kaul (1998) profits from the momentum strategy are an outcome of cross-sectional differences in expected return instead of time-series pattern in data. However, Jegadeesh and Titman (2001) rejected this hypothesis and implied positive returns are a result from delayed overreaction that eventually reverses. When it

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comes to macroeconomic risk as a driver of momentum profits, neither Griffin, Ji and Martin (2003) nor Cooper, Gutierrez and Hameed (2004) could find any correlations.

Griffin, Ji and Martin (2003), the most adjacent research to our paper, investigates the relationship between momentum returns and market climates in 40 countries. They demonstrate that momentum returns are statistically large in both good and bad economic states which suggests weak correlation between momentum returns and market states. Later research by Griffin, Ji and Martin (2005) provides stronger proof of momentum in both up and down markets. Additionally, they find that momentum profits are not as highly correlated in down-markets as well as less volatile than their corresponding market indices.

3. Data

To further explore the price momentum phenomenon, we will conduct an empirical study evaluating the profitability of the momentum investment strategy on the Pakistan Stock Exchange (PSX) over a period of 20 years.

	TABLE 1: Final Sample								
This table s	This table shows the characteristics of the final sample used in the study. The monthly volatility is also noted.								
	Number of		Monthly						
	stocks		Average						
Min	339	Return	1.14%						
Max	449	Volatility	5.30%						
Average	392	No Obs.	227						

Our final sample consists of data with a maximum of 449 stocks and a minimum of 339. The original data contains monthly price data on all stocks on the PSX considered major securities and primary quotes, from February 1999 until February 2019. All values are measured in Pakistani Rupee (PKR). The original sample consists of a total of about 510 companies and includes both dead and active stocks. All observations without valid return data, or stocks with price data showing no return over twelve following months is deleted from the original data set. For the portfolio construction procedure, we calculate the monthly return in the following manner:

(1)
$$r_{i,t} = \frac{P_{i,t}}{P_{i,t-1}} - 1$$

Equation 1 shows the monthly return calculations, $P_{i,t}$ and $r_{i,t}$ is the price and return for stock i in month t respectively.

Then, we will use $r_{i,t}$ to calculate the return for the entire formation period, denoted $r_{i,f}$.

(2)
$$r_{i,t,f} = \left((1 + r_{i,t}) (1 + r_{i,t-1}) \dots (1 + r_{i,t-(f-1)}) \right)^{1/f} - 1$$

Equation 2 shows the geometric average return r for stock i in month t over the formation period f.

We compute monthly values for $r_{i,t,f}$, which are used in our stock rankings to find the best and worst performing deciles for our winner- and loser portfolios for each month *t*. As for the risk-free rate, we use 6-month Pakistani Government Bond data, and calculate the monthly rate using Equation 3:

(3)
$$r_{monthly} = (1 + r_{semi-annual})^{\frac{1}{6}} - 1$$

We calculate the monthly returns on an equal-weighted index containing all stocks from our final sample and use this as our benchmark for the market. We choose an equallyweighted index because it provides a fairer comparison with our equally-weighted portfolios in our strategies.

(4)
$$\mathbf{r}_{\text{index, t}} = \frac{1}{n} \sum_{i=1}^{n} r_{i,t}$$

Equation 4 shows that the return of the equal-weighted index in month t is the average return of all n number of stocks in the final sample in month t.

4. Method

We investigate three different portfolio strategies with different formation (J) and holding (K) periods.

- A. 3 months evaluation period, 3 months holding period (3/3).
- B. 6 months evaluation period, 6 months holding period (6/6).
- C. 12 months evaluation period, 3 months holding period. (12/3).

For strategy A we want to employ a short-term strategy to see how it compares to the other two, more frequently used strategies. Strategy B has been chosen as it is the most commonly applied strategy in momentum return studies. We selected Strategy C because it yielded the highest returns for Jegadeesh and Titman (1999).

During every month *t* over our 20-year period, stocks are ranked from highest to lowest based on their past returns over J months, referred to as the formation period (J). They are then divided into different portfolios based on evaluations form t-J to *t* and are held for a specific period of time, which is called the holding period (K). The portfolio containing the decile of the highest returns is called "Winner" (W) and the portfolio with the decile of the lowest return is called "Loser" (L). From there, the strategy will buy the "winners" and short sell the "losers", holding for K months, which we refer to as our zero-cost portfolio. All portfolios will be equally-weighted.

As done in Jegadeesh and Titman's paper, we hold overlapping portfolios, which means we hold K equal-weighted portfolios evaluated over J months, with K months in holding. Average monthly and annual returns are then evaluated based on this strategy over the period of 20 years, which will then be compared to our contructed equal-weighted stock index based on the final sample data.

4.1. Momentum Returns and Market Climates

Our definitions of months considered "Up" and positive simply refers to when the monthly market return is positive, whereas months considered "Down" refers to when it

is negative. We define the market trend to be in a Bull-state if the equally-weighted market return index simple moving 6-month average is positive and if it is negative, the market is in a Bear-state:

(5)
$$SMA_t = \frac{1}{6} \sum_{i=1}^6 r_{index,t}$$

In Equation 5, $r_{index,t}$ and SMA_t is the return and simple moving average of the equalweighted index respectively in month t.

By differentiating between market states ("Up" and "Down") and market trends (Bull and Bear), it is possible to analyze two different effects when we look at both negative and positive periods. We use the market states to measure the correlation between momentum returns and the market state when returns are negative or positive. In the same fashion, we use the market trends to assess if momentum strategies exhibit higher or lower returns during bearish or bullish market trends.

For each of our strategies, which contain overlapping portfolios of Winner (W), Loser (L) and zero-cost (W-L) we measure their respective returns. The strategy returns are measured from the month when the longest strategy (12/3) is first completed to the final month of our sample. This means that our first strategy return is recorded 15 months from our first observable month of price data.

(6)
$$r_{p,t} = \frac{1}{n} \sum_{i=1}^{n} r_{i,t}$$

In Equation 6, $r_{i,t}$ is the return on stock *i* in month *t* in the p=1,...,K portfolios. Seeing as we hold equal weighted portfolios, $r_{p,t}$ is the average return of *n* number of stocks in our portfolio.

Then, monthly returns for the W, L, and W-L portfolios are calculated as a monthly average return of the K overlapping portfolios:

(7)
$$r_{P,t} = \frac{1}{K} \sum_{p=1}^{K} r_{p,t}$$

In Equation 7, $r_{P,t}$ is the return on each of the P = W, L and W-L portfolios respectively in month t while $r_{p,t}$ is the return on each of the p = 1, ..., K overlapping portfolios. The stocks in the overlapping portfolios as well as between the overlapping portfolios are equally-weighted.

4.2. Measuring Risk

Two tests are carried out to explore if momentum returns have a connection with conventional risk measurements. We use the single-factor model with the excess return of the equally-weighted index as a representation of the market. The model is later expanded with different intercepts and factor loadings conditional on the market climate.

The following regression will then be used in the time series for each strategy's differing portfolios, where the regression intercept α_p as the excess return of the portfolio, and the slope coefficient β_p as the portfolio exposure to the systematic risk factor.

(8)
$$r_{P,t} - r_{f,t} = \alpha_P + \beta_P (r_{index,t} - r_{f,t}) + \varepsilon_{P,t}$$

In Equation 8, $r_{P,t}$ and $r_{f,t}$ is the return on portfolio P and the converted monthly rate on 6-month Pakistani government bonds month t respectively. $r_{index,t}$ is the return on our constructed equal-weighted index in month t. β_p is the portfolio's sensitivity to the market factor, α_p is the portfolio's abnormal return, and $\varepsilon_{p,t}$ is the error term.

Then, we apply the regression model in *Equation 9*, which aims to introduce different intercepts and factor loadings conditional on the market climate. Based on the previous two definitions regarding market climate we will have two regressions. The first ones, are where we have D_t as a dummy variable, which assumes a value of 1 during "down" months, according to our previous definition. In the second ones, D_t will assume a value

of 1 if the market return moves below the simple moving average of the trailing 6 months.

(9)
$$r_{P,t} - r_{f,t} = \alpha_{1,P} + D_t \alpha_{diff,P} + (\beta_{1,P} + D_t \beta_{diff,P})(r_{index,t} - r_{f,t}) + \varepsilon_{P,t}$$

In Equation 9, $\alpha_{1,P}$ and $\beta_{1,P}$ illustrate the abnormal return and factor loading respectively when the market state or trend is Up or Bull. On the contrary, $\alpha_{1,p} + \alpha_{diff,P}$ and $\beta_{1,P} + \beta_{diff,P}$ illustrate the abnormal returns and factor loading when the market state or trend is Down or Bear.

We also test to see if there is a connection between firm size and our chosen strategies. We do so by using monthly data for our median market capitalizations of our respective strategies and test the hypothesis that the average median firm size for the different W, L, and W-L portfolios are equal to the average median market firm size against a twosided alternative with a paired t-test:

(10)
$$H_0: \overline{Median_{p,t}} - Median_{index,t} = 0$$
$$H_1: \overline{Median_{p,t}} - Median_{index,t} \neq 0$$

Equation 10 illustrates the null-hypothesis where the difference between the average median market capitalization of our the portfolios in our chosen strategies and the median market capitalization of our equal-weighted index is equal.

The median is most likely a better measurement and estimator of portfolio firm size compared to a simple average, as it carries two advantages in this application. Firstly, since the portfolio returns we have calculated are equally weighted, using median sizes will give each selected firm in our portfolios equal weighting. Secondly, Fama and French (1996) used firm ranking to construct factor portfolios, which was the foundation for their investigation of firm size return differences.

5. Data discussion

We had difficulties in finding a good proxy for the risk-free rate due to low availability of data on government bonds. The bond with the shortest maturity date available to us was the 6-month bond, which we adjusted accordingly to a monthly rate. In a similar fashion, the data from Thomson Datastream on historical values for market capitalization of Pakistan companies had some missing values in their data, which may have had an impact on the results of our firm size analysis.

5.1. Data-Snooping

Parmler and Gonzales (2007) suggest that data-snooping is a prevalent problem because of its non-experimental research. More specifically, the problem is due to a gradual filtering process of a large number of models in order to find the empirically highest performing model. Subsequently, those strategies that historically perform on par or lower than the market are filtered out. As a result, investors will consider the historically profitable models as evidence for universal profitability although these survived by chance. The model will seem to pass all the statistical tests of robustness when evaluated on the same data sample, although superior models are purely accidental.

Data-snooping is common when you develop a model based on a set of historical data, and then test the model on the same set which subsequently can yield misleading results. Thus, there is no probability that the chosen strategies will be profitable in the future. Parmler and Gonzales (2007) conclude data-snooping bias can severely affect the results and conclusions of a price momentum study. For our study, the risk of data-snooping is low as the Pakistan Stock Exchange has barely been selected as a target of study.

5.2. Market Climates

Kim and Zumwalt (1979) analyze stock returns by using a conditional dual-beta model. They divide up- and down-market betas by separating the positive and negative market returns. Then, they regress stock excess returns on market excess returns. In addition, Kim and Zumwalt (1979) proposed stocks may behave differently in up- and downstates. In our study, we use these dual-betas as a method to capture variations in factor loadings and abnormal returns that depends on the market climate. Moreover, Kim and Zumwalt (1979) suggested three cut-off levels for the separation; return that exceeds the risk-free rate, zero or average long-run market return. Since these cut-off level methods yielded similar results, we decided to separate up- and down-markets with zero. We can also retrieve short-term and trend-based effects with this method. By creating dummyvariables for up- and down states, we are able to streamline interpretations and testing between the regression estimates.

Because monthly index returns lack the differentiation strength for market climates, Bowlin, Dukes and MacDonald (1987) define bull- and bear markets when the market increase or decrease from peak to peak by at least 20 percent. Pagan and Sossounov (2000) focus on systematic movements in the market, ignoring short-term effects, when they define bull- and bear markets. More specifically, simple moving averages (SMAs) of different lengths are used to capture market trends. To identify mid- to long market trends, we decided to use 6-month SMA as the cut-off point for bull and bear periods.

5.3. Empirical Evidence and Theory of Risk Measurements

By using a single-factor model we can describe the stock returns by dividing securities into three parts; a common, a systematic and a firm-specific one. For the common factor, we use our constructed equal-weighted index. The systematic factor is derived from the degree to which a portfolio's variance is affected by the variance of the common factor. With regards to the firm-specific factor, due to its independence and lack of correlation with the portfolio variance across all securities this risk is not priced on the market implying it can be diminished through diversification.

Thus, the firm-specific factor becomes smaller as the portfolio grows in size. As a result, we consider our portfolio to be well-diversified as it contains an adequately large

number of individual securities. Since small subsets of securities can experience high firm-specific risk, this has an important implication for our momentum strategy study. As a conclusion, we believe our single-factor model, with our constructed market index as a proxy, can be used as a proper benchmark to analyze the relationship between risk and return for the momentum strategies.

The use of the Fama and French three-factor model to analyze asset returns is also a potential alternative. The combination of firm size, book-to-market ratio and market factor produces better explanatory power of cross-sectional differences in expected returns than the excess returns of the market alone. Moreover, short-term momentum cannot be explained by this model according to Fama and French (1996). In addition, Jegadeesh and Titman (1993) revealed momentum is not possible to achieve by selecting small stocks for the portfolio.

6. Results

Our zero-cost momentum strategies on the Pakistani stock market yields zero to negative average monthly excess returns (Table 2). Both 3/3 and 12/3 earned negative monthly returns of -1.7% and -1.49% respectively over the sample period. The zero-cost portfolio of the 6/6-strategy had the highest average monthly return of 0.01%. These returns can be compared with the average return of the equally-weighted index, which is 1.14% per month. Moreover, all portfolios are above zero return at a 5% significance level. Since the returns from the loser portfolios are higher than the index as well as the winner returns, they have the biggest impact on the zero-cost portfolio. All zero-cost portfolios perform worse than the average index return with a significance at the 5% level. Similar results were found in a study conducted by Abbas et al. (2017) where 3 out of 25 zero-cost strategies yielded positive returns, indicating that the momentum phenomenon is not present in Pakistan.

	TABLE 2:	Average M	onthly Exce	ess Returns				
This table illu E	This table illustrates the average excess monthly returns of our different strategies. Here, Excess Return is the return of the strategy less the risk-free rate.							
Strategy Average W L W-L Ind								
3/3	Excess Return	0.0160	0.0330	-0.0170	0.0114			
6/6	Excess Return	0.0191	0.0190	0.0001				
12/3	Excess Return	0.0167	0.0316	-0.0149				

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6.1. Risk Adjusted Momentum Returns

As illustrated in table 3, all raw momentum strategies show alphas and betas are statistically different from zero with at least 95% significance. The average zero-cost alpha of -0.94% implies the average portfolio return performs worse than the market index return. Moreover, this indicates that the observed raw returns are not due to high exposure to the systematic risk component captured by our one-factor model, as indicated by our low average beta-value of -0.1363. Among the winner-portfolios the

6/6-strategy had the highest alpha whereas 3/3 had the highest among losers. All the winner and loser-portfolios for 3/3, 6/6 and 12/3 have betas below 1, suggesting that these portfolios are less risky than the market. As the individual W and L strategies tend to outperform the market with lower betas, it is quite likely that the single-factor model does not fully capture the nature of the returns, which is also indicated by the relatively high average W and L alphas of 0.0118 and 0.0208 respectively. The 12/3 strategy has the highest beta for both the winner- and loser. More specifically, the betas for the loser-portfolios are riskier than the winner-portfolio. As a result, the betas for all zero-cost portfolios are negative.

This table illustr each strategy's ind	ates Alpha as the abn dividual exposure to s	ormal return adjus systematic risk. Al	sted for systematic l values are based	c risk while Beta is l on monthly values.
Strategy		W	L	W-L
	Alpha	0.0094	0.0258	-0.0164
3/3	(p-value)	0.005	0.000	0.000
	Beta	0.5811	0.6270	-0.0459
	(p-value)	0.000	0.000	0.499
	Alpha	0.0162	0.0156	0.0006
6/6	(p-value)	0.000	0.000	0.810
	Beta	0.2507	0.2976	-0.0469
	(p-value)	0.000	0.000	0.335
	Alpha	0.0098	0.0211	-0.0113
12/3	(p-value)	0.000	0.000	0.012
	Beta	0.6069	0.9229	-0.3161
	(p-value)	0.000	0.000	0.000

 TABLE 3: Monthly Abnormal Return including Systematic Risk

6.2. Risk Adjusted Momentum Returns Conditional on the Market Climate

Generally, the up/down-regression indicates that the zero-cost momentum strategy performs poorly regardless of the market state. Moreover, every strategy demonstrates an increased correlation with the up-market. The winner-portfolio for the 6/6 strategy shows increased correlation for up-market with a p-value of 0.671, indicating that it is non-significant. Looking at the winner-portfolio for the 3/3 and 12/3 portfolios we find similar results with p-values, 0.243 and 0.211 respectively, indicating non-significance for both strategies.

By comparing the betas between the winner and loser-portfolios we can see that the loser-portfolios are more volatile, explaining the negative betas for the zero-cost portfolios. Referencing back to the average monthly excess returns this is plausible as the zero-cost portfolios performed below index, that is, when the market goes up the portfolios go down. However, we find no strong evidence for the 3/3 and 6/6 zero-cost strategies, with p-values of 0.799 for 3/3 and 0.946 for 6/6. Only 12/3 presents some relevant evidence with a p-value of 0.094.

The alpha in the winner-portfolio of the 3/3 strategy is lower than the loser-portfolio regardless of the market-states, indicating that the loser-portfolio generates higher returns during both states. However, the alphas for both winner and loser-portfolios are higher in down-market compared to up-market, suggesting that the portfolios yield returns during down-market states. When comparing these finding with the alphas from the other strategies we find no pattern. In the 6/6 strategy the alpha for up-market states are higher than for the down-market in both the winner and loser-portfolios whereas the opposite behavior is shown for the 12/3 strategy.

To summarize, all p-values for alpha indicate little to no significance. Thus, we find no overall correlation between excess returns and up/down-market states. We generally found the same to be true for the betas, indicating no little evidence for differences between momentum returns during different market states.

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TABLE 4: Alpha and Beta Regression of Up and Down States

This table illustrates the regressions of the coefficients relating to the Up and Down states of the market. Beta_{diff} is the estimated difference in systematic risk between our defined Up and Down periods, whereas Alpha_{diff} shows the difference in our observed abnormal returns. The Up state corresponds to positive returns of our equal-weighted index in month t, whereas the Down state corresponds to negative returns.

3/3	W	L	W-L
Betaup	0.7088	0.8493	-0.1405
Betadown	0.4555	0.6564	-0.2009
Beta _{diff}	-0.2533	-0.1929	-0.0603
(p-value) _{diff}	0.234	0.403	0.799
Alphaup	0.0027	0.0127	-0.0010
Alphadown	0.0060	0.0333	-0.0273
Alphadiff	0.6854	0.0206	-0.0263
(p-value) _{diff}	0.769	0.097	0.177
6/6	W	L	W-L
Betaup	0.3323	0.3363	-0.0041
Beta _{down}	0.0595	0.0750	-0.0155
Betadiff	-0.2728	-0.2613	-0.0114
(p-value) _{diff}	0.097	0.168	0.946
Alphaup	0.0126	0.0147	-0.0020
Alphadown	0.0081	0.0047	0.0035
Alphadiff	-0.0045	-0.01	0.0055
(p-value) _{diff}	0.609	0.328	0.549
12/3	W	L	W-L
Betaup	0.6233	1.2261	-0.6028
Beta _{down}	0.4215	0.5498	-0.1283
Beta _{diff}	-0.2018	-0.6763	0.4745
(p-value) _{diff}	0.211	0.017	0.094
Alphaup	0.0099	0.0057	0.0043
Alpha _{down}	0.0003	0.0091	-0.0088
Alpha _{diff}	-0.0096	0.0034	-0.0045
(p-value) _{diff}	0.264	0.819	0.387

As for the results from the bull/bear-regressions we can generally observe higher betas during bull periods and lower betas during bear periods for all of the winner-portfolios among all strategies. The beta during bear-markets are higher than for bull-markets for the loser-portfolios among all strategies.

Starting with the winner-portfolio in 3/3-strategy we can see that the beta during bullperiods is higher than during bear-periods. The opposite pattern is for the loserportfolio. This indicates that the winner-portfolio shows higher volatility in bull-markets compared to the bear-markets, whereas the loser-portfolio shows slightly higher volatility in the bear-market. There is strong evidence for the winner-portfolio with a pvalue of 0.031. Comparing these findings for the 3/3 strategy with the up and downmarket states, we can see that the results for the winner-portfolio is the same whereas the opposite result is shown for the loser-portfolio.

Regarding the betas for the 6/6- and 12/3-strategy the same patterns are found as for the 3/3 strategy. By observing the winner-portfolio we can see that the volatility is higher for bull markets. The opposite is shown for the loser-portfolio, where the volatility is higher for bear-markets. However, for the 12/3-strategy the betas are closer to 1 as oppose to 6/6, indicating that the 12/3 experience higher volatility regardless of market states. Evaluating the zero-cost portfolios, we can see that the beta difference for all strategies are lower than in the up/down market states. For all strategies, we generally find high p-values indicating weak significance for the beta.

For the alphas we can see clearer patterns, with higher values for every strategy during bull-markets than during bear-markets. The 6/6-strategy has the biggest alpha differences because of the negative alphas during bear. The p-value for this strategy is 0.000 suggesting strong significance. Generally for the zero-cost portfolios, the alphas are negative, indicating that the alphas in the loser-portfolios regardless of market states are higher than those in the winner-portfolio.

To conclude, our high p-values for our betas during different market trends indicate low significance, meaning no connections between the two. However, our low p-values among the alpha values show that there is increased excess returns during bull markets.

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TABLE 5: Alpha and Beta Regression of Bull and Bear Trends

This table illustrates the regressions of the coefficients relating to the Bull and Bear states of the market. Beta_{diff} is the estimated difference in systematic risk between our defined Bull and Bear periods, whereas Alpha_{diff} shows the difference in our observed abnormal returns.

The Bull state corresponds to positive 6-month moving average returns of our equal-weighted index from month t-6 to t, whereas the Down state corresponds to negative 6-month moving average returns.

3-3	W	L	W-L		
Beta _{bull}	0.5771	0.5636	0.0135		
Betabear	0.2888	0.5777	-0.8589		
Betadiff	-0.2883	0.0141	-0.8724		
(p-value) _{diff}	0.031	0.926	0.062		
Alphabull	0.0206	0.0360	-0.0154		
Alphabear	-0.0229	0.0009	-0.0238		
Alpha _{diff}	-0.0435	-0.0351	-0.0084		
(p-value) _{diff}	0.000	0.000	0.320		
6-6	W	L	W-L		
Betabull	0.1724	0.2066	-0.0340		
Betabear	0.1399	0.2789	-0.1390		
Betadiff	-0.0325	0.0723	-0.1050		
(p-value) _{diff}	0.723	0.537	0.366		
Alphabull	0.0306	0.0283	0.0023		
Alphabear	-0.0199	-0.0147	-0.0052		
Alpha _{diff}	-0.0505	-0.0430	-0.0075		
(p-value) _{diff}	0.000	0.000	0.213		
12-3	W	L	W-L		
Betabull	0.6466	0.8821	-0.2355		
Betabear	0.2911	0.9783	-0.6872		
Betadiff	-0.3555	0.0962	-0.4517		
(p-value) _{diff}	0.001	0.620	0.019		
Alphabull	0.0160	0.0244	-0.0084		
Alphabear	-0.0114	0.0143	-0.0256		
Alphadiff	-0.0274	-0.0101	-0.0172		
(p-value) _{diff}	0.000	0.313	0.084		

6.3. Fama-French Size Factor Exposure

Table 8 illustrates that most of our strategies tend to pick stocks with market capitalizations that differ from the market average on a statistically significant level, with the loser-portfolio for the 12/3 strategy as the exception. The winner portfolios tend to pick stocks with a higher market capitalization in general when compared to the market average, whereas the loser portfolios pick out lower market capitalization stocks. This result connects the higher returns of the L portfolios with a smaller market cap size in two out of three cases, which in turn delivered higher returns in two out of three cases as well.

TABLE 6: Average Market Capitalization

Strategy	W	L	W-L
3/3	3844	1844	2844
(p-value)	0.000	0.000	0.009
6/6	4539	1745	3052
(p-value)	0.000	0.000	0.002
12/3	4928	2587	3757
(p-value)	0.000	0.992	0.000
		2500	

In this table, firm size is measured as the average median market capitalization per strategy and month and is measured in million Pakistani Rupees (PKR). The p-values are from a twotailed, paired independent t-test between the average median market capitalization of our equal-weighted index, and average median market capitalization per portfolio and month.

6.4. Adjusted R-Square

Generally, we can conclude that Bull/Bear yields higher adjusted R-squared for all tests and portfolios. In combination with low p-values for the alphas this implies that the bull/bear alpha-predictors explains a lot of the response variability on a significant level compared with the betas for the loser-portfolios in 12/3 as well as the other regressions. In combination with low p-values for the alphas indicates that the bull/bear alphapredictors explain a lot of the response variability on a significant level as opposed to the betas for the loser-portfolios in 12/3 as well as the other regressions.

Among the bull/bear-regressions the 12/3-strategy has the highest adjusted R-squared. On the other hand, only the winner-portfolio has a low p-value for both alpha and beta. Moreover, 12/3 has the highest across all regressions indicating that the model explains relatively more of the variability of the response data around its mean than the other portfolio. Adding the p-value, only the one-factor is significant at the 5% level. Thus, this strategy fits our data the best.

Furthermore, comparing each regression among the strategies, 6/6 have the lowest onefactor and up/down values. Also, the up/down-model has relatively high p-values for alpha and beta. However, including the p-values the one-factor are relatively more significant than the other up/down. Lastly, for the 3/3 strategy the adjusted R-squared values for tone-factor and up/down are relatively low. However, only the one-factor model has low p-values. To conclude, the up/down-model has the lowest explanatory power among the three models whereas the bull/bear has the highest.

TABLE 7: Adjusted R-square									
The following	The following table illustrates the adjusted R-square from our								
	sets of regressions.								
3/3	3/3 One-factor Up/Down Bull/Bear								
W	0.2866	0.2867	0.3987						
L	0.2820	0.2918	0.3347						
W-L	-0.0024	-0.0028	0.0084						
6/6	One-factor	Up/Down	Bull/Bear						
W	0.1091	0.1122	0.4044						
L	0.1148	0.1156	0.2725						
W-L	-0.0003	-0.0072	0.0012						
12/3	One-factor	Up/Down	Bull/Bear						
W	0.4347	0.4349	0.5138						
L	0.3624	0.3766	0.3604						
W-L	0.0590	0.0726	0.0854						

7. Conclusion

In our thesis, we found that the momentum strategy on the Pakistani stock market yielded negative returns, which is similar to the results of the study conducted by Abbas (2017), further adding to the indication that there is an absence of the momentum phenomenon on the Pakistani stock market. Overall, we find little to no differences in returns during differing market climates with the exception being higher excess returns during bull-periods.

The low adjusted R-squared values for the single factor regressions indicate that the model does not capture the full nature of the portfolio returns, hence we see quite low supposed systematic risk. For future studies, we recommend to use an expanded model to capture the full nature of the portfolio returns, such as the Fama-French Five Factor Model by Fama and French, (2015) or the Carhart Four Factor Model by Carhart (1997).

From our data analysis we noticed that the price movement of multiple stocks was static over certain periods indicating potential illiquidity. By sorting for stocks that do not change in price over 12 months, we increase the real world applicability. However, this threshold might have been too low. Thus, we suggest that including a liquidity factor into the momentum model is a complementary approach for a more detailed analysis in further research.

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Appendix

Month	Index	3/3 W	3/3 L	3/3 W-L	6/6 W	6/6 L	6/6 W-L	12/3 W	12/3 L	12/3 W-L
Apr-00	0.0410	0.0933	0.1164	-0.0231	0.0703	0.0949	-0.0246	-0.0236	0.0170	-0.0406
May-00	-0.0641	-0.0380	0.0089	-0.0469	0.0674	0.1079	-0.0405	-0.0602	-0.0083	-0.0518
Jun-00	-0.0811	-0.0969	-0.0341	-0.0629	0.0356	0.0350	0.0006	-0.0716	-0.0165	-0.0551
Jul-00	0.0480	-0.0956	-0.0348	-0.0608	-0.0020	0.0350	-0.0371	-0.0219	0.0034	-0.0254
Aug-00	0.0290	-0.0207	0.0107	-0.0315	-0.0294	0.0132	-0.0426	0.0216	0.1244	-0.1028
Sep-00	-0.0118	-0.0184	0.1581	-0.1765	-0.0274	-0.0017	-0.0257	0.0315	0.0425	-0.0110
Oct-00	0.0294	0.0129	0.0584	-0.0455	-0.0409	0.0050	-0.0459	-0.0260	0.0325	-0.0586
Nov-00	-0.0402	-0.0135	-0.0007	-0.0129	-0.0380	0.0310	-0.0691	-0.0272	0.0108	-0.0380
Dec-00	-0.0287	-0.0379	0.0394	-0.0773	-0.0114	0.0583	-0.0698	-0.0235	0.0064	-0.0299
Jan-01	0.0434	-0.0161	0.0250	-0.0411	0.0055	0.0195	-0.0140	0.0120	0.0314	-0.0194
Feb-01	0.0036	0.0099	0.0359	-0.0260	-0.0019	0.0029	-0.0048	-0.0049	0.0461	-0.0510
Mar-01	-0.0395	-0.0053	0.0585	-0.0638	0.0009	0.0210	-0.0201	-0.0383	-0.0056	-0.0327
Apr-01	-0.0413	-0.0262	0.0066	-0.0328	-0.0278	-0.0143	-0.0135	-0.0413	-0.0068	-0.0345
May-01	0.0124	-0.0290	0.0068	-0.0358	-0.0101	0.0032	-0.0134	-0.0115	0.0487	-0.0602
Jun-01	0.0451	-0.0028	0.0633	-0.0661	-0.0001	0.0229	-0.0231	0.0008	0.0373	-0.0365
Jul-01	-0.0394	-0.0115	0.0295	-0.0411	-0.0207	-0.0011	-0.0196	-0.0056	0.0511	-0.0568
Aug-01	-0.0236	-0.0740	-0.0301	-0.0439	-0.0172	-0.0076	-0.0096	-0.0281	0.0246	-0.0527
Sep-01	-0.0444	-0.1865	-0.0215	-0.1649	-0.0271	-0.0028	-0.0244	-0.0186	0.0148	-0.0334
Oct-01	0.0154	-0.0158	-0.0691	0.0533	-0.0176	-0.0016	-0.0159	0.0081	0.0491	-0.0410
Nov-01	0.0662	0.0120	0.0339	-0.0219	0.0065	0.0216	-0.0151	0.0145	0.0726	-0.0580
Dec-01	-0.0102	0.0048	0.0748	-0.0700	-0.0157	-0.0023	-0.0133	0.0155	0.0517	-0.0362
Jan-02	0.0083	-0.0012	0.0470	-0.0482	-0.0039	0.0167	-0.0206	0.0298	0.0621	-0.0323
Feb-02	0.1099	0.0048	0.1050	-0.1002	0.0208	0.0437	-0.0229	0.0224	0.1051	-0.0827
Mar-02	0.0324	0.0741	0.1463	-0.0721	0.0288	0.0947	-0.0659	0.0495	0.0926	-0.0431
Apr-02	0.0320	0.1028	0.1016	0.0012	0.0260	0.0810	-0.0550	0.0928	0.0016	0.0911
Mav-02	0.0621	0.0354	0.1184	-0.0830	0.0619	0.0579	0.0040	0.0649	0.0142	0.0506
Jun-02	-0.0168	-0.0070	0.1183	-0.1253	0.0507	0.0779	-0.0272	0.0290	-0.0287	0.0577
Jul-02	0.0029	0.0048	0.1016	-0.0968	0.0580	0.0807	-0.0227	0.0043	0.0079	-0.0036
Aug-02	0.0100	-0.0141	0.0068	-0.0209	0.0196	0.0307	-0.0111	0.0245	0.0106	0.0140
Sep-02	0.0065	0.0226	-0.0077	0.0303	0.0069	0.0503	-0.0434	0.0369	-0.0116	0.0485
Oct-02	0.0413	0.0202	0.0070	0.0132	0.0167	0.0312	-0.0145	0.0835	0.0570	0.0265
Nov-02	0.0827	0.0260	0.0683	-0.0423	0.0497	0.0149	0.0348	0.1113	0.1609	-0.0496
Dec-02	0.0756	0.0566	0.1709	-0.1143	0.0726	0.0564	0.0161	0.0888	0.1282	-0.0394
Jan-03	0.0693	0.0850	0.1617	-0.0767	0.0822	0.0365	0.0457	0.0132	0.0242	-0.0110
Feb-03	-0.0648	0.0142	0.0312	-0.0169	0.0592	0.0281	0.0311	0.0160	-0.0035	0.0195
Mar-03	-0.0005	-0.0269	-0.0071	-0.0197	0.0498	0.0370	0.0128	0.0298	0.0026	0.0272
Apr-03	0.1156	-0.0067	0.0193	-0.0261	0.0581	0.0729	-0.0149	0.1104	0.1339	-0.0235
May-03	0.1340	0.0915	0.1676	-0.0761	0.0636	0.0778	-0.0142	0.1739	0.2591	-0.0852
Jun-03	0.1508	0.1600	0.1941	-0.0341	0.0853	0.0843	0.0010	0.1404	0.3222	-0.1818
Jul-03	0.1561	0.1914	0.1839	0.0076	0.1121	0.1219	-0.0098	0.1561	0.2111	-0.0550
Aug-03	0.0846	0.1421	0.1678	-0.0256	0.1505	0.1657	-0.0152	0.1299	0.0850	0.0449
Oct 03	0.0033	0.1242	0.0946	0.0295	0.1909	0.1//3	0.0064	-0.0033	0.0270	-0.0303
Nov-03	-0.1130	-0.0309	0.0412	-0.0/81	0.0592	0.1042	0.0004	-0.0584	-0.0128	-0.0455
101-05	-0.0429	-0.0704	0.1002	-0.2300	0.0505	0.0400	0.0105	-0.0577	-0.0101	-0.0427

TABLE A.1 Monthly Strategy Returns less the risk-free rate

Dec-03	0.0628	-0.0776	-0.0436	-0.0340	0.0287	0.0087	0.0200	0.0310	0.0232	0.0078
Jan-04	0.0960	0.0254	0.0863	-0.0610	0.0125	0.0259	-0.0134	0.1093	0.1032	0.0061
Feb-04	0.0867	0.0769	-0.0057	0.0825	0.0289	-0.0088	0.0377	0.0760	0.1204	-0.0444
Mar-04	0.0304	0.0389	0.1819	-0.1430	0.0004	0.0069	-0.0065	0.0870	0.1196	-0.0327
Apr-04	0.1115	0.1100	0.1203	-0.0103	0.0781	0.0495	0.0286	0.0691	0.0934	-0.0243
May-04	0.0207	0.0539	0.1933	-0.1393	0.0864	0.1440	-0.0575	0.0553	0.0693	-0.0140
Jun-04	0.0415	0.0526	0.0924	-0.0397	0.0784	0.1424	-0.0640	0.0229	0.0657	-0.0428
Jul-04	0.0064	0.0010	0.0412	-0.0402	0.0522	0.1069	-0.0548	0.0040	0.0074	-0.0034
Aug-04	-0.0173	0.1653	0.0361	0.1291	0.0433	0.0608	-0.0176	-0.0052	-0.0054	0.0001
Sep-04	-0.0131	-0.0393	-0.0085	-0.0308	0.0386	0.0455	-0.0069	0.0197	0.0045	0.0152
Oct-04	0.0476	0.0010	0.0064	-0.0054	0.0083	0.0361	-0.0278	0.0109	0.0015	0.0094
Nov-04	-0.0128	0.0044	0.0102	-0.0059	0.0005	0.0176	-0.0171	0.0356	0.0399	-0.0042
Dec-04	0.0894	0.0281	0.0665	-0.0384	-0.0041	0.0234	-0.0275	0.0368	0.0536	-0.0168
Jan-05	0.0810	0.0544	0.0777	-0.0233	0.0142	0.0143	-0.0001	0.0833	0.0948	-0.0115
Feb-05	0.0587	0.0640	0.0124	0.0516	0.0347	0.0293	0.0053	0.0485	0.0400	0.0085
Mar-05	0.0224	0.0471	0.0409	0.0063	0.0370	0.0504	-0.0134	0.0084	-0.0140	0.0223
Apr-05	-0.1034	0.0158	-0.0253	0.0411	0.0262	0.0017	0.0245	-0.0840	-0.0358	-0.0482
May-05	-0.0395	-0.0397	0.1331	-0.1728	0.0159	0.0145	0.0014	-0.0900	-0.0569	-0.0331
Jun-05	-0.0179	-0.0614	-0.0342	-0.0272	0.0090	-0.0204	0.0294	0.0116	-0.0350	0.0466
Jul-05	0.0011	-0.0205	-0.0302	0.0097	0.0013	-0.0158	0.0170	-0.0051	-0.0225	0.0175
Aug-05	-0.0197	-0.0223	-0.0085	-0.0137	0.0067	-0.0103	0.0170	0.0157	-0.0091	0.0248
Sep-05	0.0346	-0.0140	0.0283	-0.0423	-0.0272	-0.0146	-0.0126	0.0437	0.0156	0.0281
Oct-05	0.0589	0.0210	0.0391	-0.0181	0.0167	-0.0062	0.0229	0.0797	0.0579	0.0218
Nov-05	0.0391	0.0823	-0.0123	0.0946	0.0293	0.0244	0.0048	0.0795	0.1030	-0.0235
Dec-05	0.0848	0.1481	0.0932	0.0548	0.0496	0.0555	-0.0059	0.0673	0.1393	-0.0720
Jan-06	0.0564	0.0959	0.0843	0.0116	0.0450	0.0752	-0.0301	0.0611	0.1106	-0.0494
Feb-06	0.0401	0.0791	0.0690	0.0101	0.0529	-0.0837	0.1366	0.0283	0.0233	0.0049
Mar-06	-0.0542	0.0262	0.0012	0.0250	0.0594	0.0683	-0.0089	0.0601	-0.0093	0.0694
Apr-06	0.0720	0.0431	0.0060	0.0371	0.0900	0.0570	0.0330	0.0238	-0.0186	0.0424
May-06	-0.0393	-0.0032	0.0640	-0.0672	0.0471	0.0243	0.0227	-0.0274	-0.0230	-0.0045
Jun-06	-0.1077	-0.0388	-0.0400	0.0012	-0.0184	-0.0096	-0.0088	-0.0519	-0.0091	-0.0429
Jul-06	0.0393	-0.0466	0.0085	-0.0551	0.0039	-0.0073	0.0112	-0.0370	-0.0133	-0.0237
Aug-06	0.0075	-0.0211	-0.0116	-0.0094	-0.0281	-0.0103	-0.0179	0.0273	0.0101	0.0172
Sep-06	-0.0271	0.0125	0.0289	-0.0164	-0.0154	-0.0130	-0.0024	0.0213	-0.0105	0.0318
Oct-06	0.0102	-0.0057	-0.0009	-0.0048	-0.0221	-0.0237	0.0016	0.0033	-0.0188	0.0221
Nov-06	-0.0288	-0.0033	-0.0202	0.0170	-0.0115	-0.0115	0.0000	0.0088	0.0523	-0.0435
Dec-06	0.0308	0.0102	0.0485	-0.0383	0.0103	0.0248	-0.0145	-0.0081	0.0266	-0.0347
Jan-07	-0.0312	-0.0146	0.0326	-0.0472	0.0879	-0.0007	0.0886	0.0090	0.0458	-0.0369
Feb-07	0.0196	0.0153	-0.0158	0.0311	0.0113	0.0021	0.0092	0.0149	0.0052	0.0097
Mar-07	-0.0055	-0.0166	0.0006	-0.0171	0.0231	0.0173	0.0058	0.0330	0.0292	0.0038
Apr-07	0.0285	0.0280	0.0290	-0.0010	0.0069	0.0164	-0.0095	0.0449	0.0290	0.0159
May-07	0.0446	0.0275	0.0216	0.0058	0.0324	0.0356	-0.0032	0.1007	0.0884	0.0124
Jun-07	0.0995	0.1315	0.0791	0.0524	0.0487	0.0385	0.0101	0.1264	0.1486	-0.0222
Jul-07	0.1060	0.1517	0.1316	0.0201	0.0879	0.0780	0.0099	0.0643	0.0829	-0.0186
Aug-07	-0.0540	0.0661	0.0095	0.0566	0.0651	0.0458	0.0193	0.0041	0.0006	0.0035
Sep-07	-0.0136	0.0287	0.0242	0.0045	0.0600	0.0356	0.0243	0.0095	0.0307	-0.0212
Oct-07	0.0497	-0.0025	0.0011	-0.0036	0.0750	0.0298	0.0452	0.0498	0.0224	0.0275
Nov-07	0.0098	0.0144	0.0964	-0.0820	0.0645	0.0506	0.0139	0.0894	0.0424	0.0470
Dec-07	0.0512	0.0591	0.0835	-0.0243	0.0626	0.0702	-0.0075	0.0498	0.0484	0.0013
Jan-08	-0.0141	0.0368	0.0532	-0.0164	-0.0056	0.0442	-0.0498	0.0336	0.0234	0.0102
Feb-08	0.0006	0.0244	0.0388	-0.0144	0.0528	0.0202	0.0326	0.0285	0.0028	0.0257
Mar-08	0.0109	0.0207	0.0043	0.0164	0.0556	0.0260	0.0296	0.0409	0.0177	0.0232

Apr-08	0.0091	0.0355	0.0247	0.0108	0.0466	0.0265	0.0201	0.0439	0.0243	0.0195
May-08	-0.0092	0.0289	0.0347	-0.0058	0.0317	0.0162	0.0155	-0.0193	0.0054	-0.0247
Jun-08	-0.0665	-0.0098	-0.0116	0.0018	-0.0065	0.0142	-0.0207	-0.0550	-0.0315	-0.0235
Jul-08	-0.0596	-0.0369	-0.0179	-0.0191	-0.0059	-0.0181	0.0122	-0.0978	-0.0884	-0.0094
Aug-08	-0.1073	-0.0781	-0.1128	0.0347	-0.0310	-0.0186	-0.0124	-0.0813	-0.0943	0.0131
Sep-08	-0.0341	-0.0455	-0.1096	0.0640	-0.0462	-0.0223	-0.0239	-0.0555	-0.0763	0.0208
Oct-08	-0.0187	-0.0271	-0.0955	0.0683	-0.0561	-0.0440	-0.0122	-0.0170	-0.0124	-0.0047
Nov-08	-0.0149	-0.0060	-0.0294	0.0234	-0.0595	-0.0502	-0.0093	-0.0109	-0.0130	0.0021
Dec-08	-0.0110	-0.0114	-0.0083	-0.0032	-0.0367	-0.0547	0.0180	-0.0289	-0.1201	0.0912
Jan-09	-0.1757	-0.0467	-0.1061	0.0594	-0.0287	-0.0785	0.0498	-0.0415	-0.1276	0.0861
Feb-09	-0.0935	-0.1106	-0.1220	0.0114	-0.0306	-0.0682	0.0376	-0.0678	-0.1446	0.0768
Mar-09	-0.0239	-0.0842	-0.0947	0.0105	-0.0298	-0.0731	0.0433	-0.0993	0.0962	-0.1955
Apr-09	0.0980	-0.0473	0.1342	-0.1814	-0.0603	-0.0167	-0.0435	-0.1070	0.1203	-0.2273
May-09	-0.0832	-0.0161	0.1621	-0.1782	-0.0644	-0.0494	-0.0150	0.0044	-0.0081	0.0125
Jun-09	-0.0233	-0.0015	0.2338	-0.2353	-0.0691	-0.0454	-0.0237	-0.0391	-0.0411	0.0020
Jul-09	0.0092	-0.0366	-0.0020	-0.0346	-0.0410	0.0335	-0.0744	0.0044	0.0168	-0.0124
Aug-09	0.0330	0.0390	0.0241	0.0149	-0.0302	0.0494	-0.0797	0.0290	0.0660	-0.0370
Sep-09	0.0394	0.0283	0.0562	-0.0279	0.0056	0.0407	-0.0351	0.0372	0.0794	-0.0422
Oct-09	0.1252	0.0739	0.1127	-0.0389	0.0091	0.0375	-0.0284	-0.0058	0.0865	-0.0923
Nov-09	-0.0616	0.0171	-0.0188	0.0359	0.0219	0.0120	0.0098	0.0004	0.1224	-0.1221
Dec-09	0.0196	0.0190	0.1123	-0.0933	0.0278	0.0251	0.0027	-0.0016	0.0440	-0.0455
Jan-10	0.0356	-0.0057	0.0543	-0.0600	0.0302	0.0309	-0.0007	-0.0040	0.1185	-0.1225
Feb-10	0.0313	0.0156	0.0623	-0.0467	0.0111	0.0249	-0.0138	-0.0086	0.0412	-0.0497
Mar-10	-0.0366	-0.0024	0.0858	-0.0882	-0.0020	0.0555	-0.0575	-0.0045	-0.0016	-0.0029
Apr-10	0.0003	0.0158	0.0010	0.0148	-0.0015	0.0254	-0.0269	-0.0128	0.0005	-0.0133
May-10	-0.0190	-0.0123	-0.0059	-0.0064	-0.0004	0.0151	-0.0155	-0.0513	-0.0412	-0.0101
Jun-10	-0.1160	-0.0634	-0.0463	-0.0171	-0.0180	0.0036	-0.0216	-0.0179	-0.0427	0.0247
Jul-10	0.0579	-0.0356	-0.0128	-0.0228	-0.0212	0.0036	-0.0248	-0.0317	-0.0529	0.0212
Aug-10	-0.0254	-0.0400	-0.0340	-0.0060	-0.0186	-0.0309	0.0123	0.0071	-0.0056	0.0128
Sep-10	-0.0239	0.0117	0.0139	-0.0023	-0.0176	-0.0192	0.0015	-0.0165	0.0085	-0.0251
Oct-10	0.0089	-0.0540	0.0317	-0.0857	-0.0208	-0.0121	-0.0087	-0.0201	0.0355	-0.0557
Nov-10	0.0313	-0.0353	0.0231	-0.0584	-0.0125	-0.0130	0.0005	0.0006	0.1171	-0.1165
Dec-10	0.0557	-0.0054	0.1571	-0.1625	0.0173	0.0259	-0.0086	0.0360	0.0862	-0.0502
Jan-11	0.0187	0.0309	0.0856	-0.0547	0.0168	-0.0353	0.0521	0.0349	0.0083	0.0266
Feb-11	-0.0508	-0.0095	0.0021	-0.0116	0.0097	0.0171	-0.0074	0.0024	-0.0248	0.0272
Mar-11	-0.0106	-0.0232	0.0014	-0.0247	0.0067	0.0362	-0.0295	-0.0124	-0.0172	0.0048
Apr-11	-0.0094	0.0092	-0.0196	0.0288	0.0059	0.0698	-0.0639	-0.0097	-0.0299	0.0202
May-11	-0.0285	-0.0054	-0.0051	-0.0002	0.0278	-0.0107	0.0385	-0.0060	-0.0123	0.0063
Jun-11	0.0162	-0.0150	-0.0033	-0.0117	-0.0051	-0.0145	0.0094	-0.0152	-0.0159	0.0007
Jul-11	-0.0261	-0.0152	-0.0141	-0.0011	-0.0051	-0.0353	0.0302	-0.0292	-0.0360	0.0069
Aug-11	-0.0581	-0.0366	-0.0180	-0.0186	-0.0167	-0.0255	0.0088	-0.0238	-0.0212	-0.0026
Sep-11	-0.0110	-0.0243	-0.0462	0.0219	-0.0205	-0.0254	0.0049	-0.0250	-0.0311	0.0061
Oct-11	0.0102	-0.0366	-0.0260	-0.0106	-0.0226	-0.0209	-0.0017	-0.0093	-0.0048	-0.0045
Nov-11	-0.0312	-0.0214	-0.0008	-0.0206	-0.0325	-0.0280	-0.0045	-0.0245	-0.0322	0.0077
Dec-11	-0.0434	-0.0062	-0.0430	0.0367	-0.0260	-0.0195	-0.0065	-0.0402	-0.0292	-0.0110
Jan-12	-0.0074	-0.0185	-0.0304	0.0119	-0.0293	-0.0236	-0.0057	0.0115	0.0890	-0.0775
Feb-12	0.0872	0.0259	0.0403	-0.0144	-0.0168	0.0365	-0.0532	0.0271	0.6090	-0.5818
Mar-12	0.0947	0.0764	0.1522	-0.0758	-0.0056	0.1195	-0.1252	0.0540	0.5336	-0.4795
Apr-12	0.0584	0.1859	0.1618	0.0241	0.0008	0.0517	-0.0508	0.0829	0.2845	-0.2017
May-12	0.0337	0.1861	0.0992	0.0869	0.0241	0.1361	-0.1120	0.0235	0.1117	-0.0882
Jun-12	-0.0190	0.0295	0.0503	-0.0207	0.0445	-0.2236	0.2681	-0.0259	0.0199	-0.0458
Jul-12	0.0236	-0.0056	0.0197	-0.0253	0.0620	-0.2022	0.2642	0.0077	-0.0023	0.0100

Aug-12	0.0177	0.0048	-0.0001	0.0050	0.0763	0.0669	0.0094	0.0416	0.0322	0.0094
Sep-12	0.0723	0.0775	0.0579	0.0196	0.0276	0.0528	-0.0252	0.0444	0.0379	0.0066
Oct-12	0.0016	0.0481	0.0745	-0.0264	-0.0005	0.0326	-0.0331	0.0412	0.0875	-0.0463
Nov-12	0.0348	0.0728	0.0658	0.0070	0.0265	0.0282	-0.0017	0.0557	0.1124	-0.0567
Dec-12	0.1236	0.1080	0.0934	0.0146	0.0674	0.0557	0.0116	0.0978	0.0195	0.0783
Jan-13	-0.0061	0.1452	0.0524	0.0929	0.0663	0.0498	0.0164	0.0696	0.1077	-0.0381
Feb-13	0.0379	0.1138	0.0230	0.0908	0.0951	0.0868	0.0083	-0.0158	0.0462	-0.0620
Mar-13	-0.0226	-0.0167	0.0122	-0.0289	0.0404	0.0327	0.0078	0.0076	0.0194	-0.0119
Apr-13	0.0333	0.0106	0.0555	-0.0449	0.0605	0.0366	0.0239	0.0302	0.0034	0.0268
May-13	0.0414	0.0106	0.0347	-0.0240	0.0590	0.0242	0.0347	0.0795	0.0690	0.0105
Jun-13	0.0999	0.0661	0.1042	-0.0381	0.0215	0.0189	0.0026	0.0422	0.0825	-0.0403
Jul-13	0.0058	0.0419	0.0961	-0.0542	0.0397	0.0409	-0.0011	0.0510	0.0868	-0.0358
Aug-13	0.0426	0.0292	0.1001	-0.0710	0.0362	0.0346	0.0017	0.0859	-0.0049	0.0908
Sep-13	-0.0278	0.0854	0.0002	0.0852	0.0269	0.0049	0.0220	0.0019	-0.0208	0.0227
Oct-13	-0.0429	-0.0177	-0.0133	-0.0044	0.0091	0.0205	-0.0114	-0.0588	-0.0455	-0.0133
Nov-13	0.0083	-0.0661	-0.0177	-0.0485	-0.0010	0.0133	-0.0143	0.0159	0.0185	-0.0026
Dec-13	0.1004	0.0182	0.0146	0.0036	0.0400	0.0356	0.0044	0.1086	0.1384	-0.0298
Jan-14	0.1289	0.1326	0.1231	0.0095	0.0467	0.0202	0.0266	0.1613	0.1288	0.0325
Feb-14	0.0288	0.1891	0.0927	0.0964	0.0215	0.0474	-0.0259	0.0913	0.0716	0.0198
Mar-14	-0.0192	0.1008	0.0680	0.0328	0.0403	0.0633	-0.0230	-0.0110	0.0220	-0.0330
Apr-14	0.0324	-0.0138	0.0266	-0.0405	0.0594	0.0669	-0.0075	-0.0062	0.0074	-0.0136
May-14	-0.0342	-0.0448	-0.0034	-0.0414	0.0600	0.0494	0.0106	0.0238	0.0105	0.0133
Jun-14	0.0351	0.0078	0.0119	-0.0041	0.0671	0.0356	0.0315	0.0050	-0.0229	0.0278
Jul-14	-0.0320	-0.0084	-0.0170	0.0086	-0.0174	0.0111	-0.0285	-0.0093	-0.0210	0.0117
Aug-14	-0.0492	-0.0092	-0.0179	0.0087	-0.0172	-0.0180	0.0008	-0.0151	-0.0296	0.0145
Sep-14	0.0513	-0.0074	-0.0079	0.0005	0.0002	-0.0074	0.0076	0.0339	0.0129	0.0210
Oct-14	0.0483	0.0617	0.0347	0.0271	0.0127	0.0082	0.0044	0.1221	0.0587	0.0634
Nov-14	0.0372	0.1136	0.0793	0.0344	0.0291	0.0164	0.0127	0.0681	0.0594	0.0088
Dec-14	0.0246	0.0627	0.0522	0.0105	0.0236	0.0036	0.0200	0.0407	0.0333	0.0074
Jan-15	0.0368	0.0442	0.0512	-0.0070	0.0406	0.0270	0.0136	-0.0135	0.0162	-0.0297
Feb-15	-0.0100	0.0014	0.0191	-0.0177	0.0709	0.0445	0.0264	0.0001	-0.0103	0.0104
Mar-15	-0.0469	0.0092	-0.0019	0.0111	0.0314	0.0274	0.0040	-0.0314	-0.0562	0.0248
Apr-15	-0.0306	-0.0283	-0.0303	0.0020	0.0027	0.0086	-0.0059	-0.0272	-0.0593	0.0321
May-15	-0.0042	-0.0319	-0.0363	0.0044	-0.0138	-0.0091	-0.0048	0.0229	0.0137	0.0092
Jun-15	0.0600	0.0148	0.0255	-0.0107	0.0147	0.0024	0.0123	0.0569	0.0770	-0.0201
Jul-15	0.0630	0.0762	0.0713	0.0050	0.0119	0.0110	0.0009	0.1091	0.1466	-0.0374
Aug-15	0.0538	0.1016	0.1142	-0.0125	0.0238	0.0166	0.0073	0.0537	0.0407	0.0131
Sep-15	-0.0543	0.0525	0.0593	-0.0067	0.0221	0.0144	0.0077	0.0476	0.0140	0.0336
Oct-15	-0.0001	-0.0067	0.0226	-0.0294	0.0531	0.0290	0.0241	0.0395	0.0014	0.0381
Nov-15	0.0134	0.0051	-0.0151	0.0202	0.0976	0.0436	0.0540	0.0299	-0.0058	0.0356
Dec-15	-0.0232	0.0207	0.0076	0.0131	0.0553	0.0222	0.0332	-0.0070	-0.0285	0.0216
Jan-16	-0.0476	0.0004	-0.0366	0.0370	0.0178	-0.0045	0.0223	-0.0404	-0.0338	-0.0066
Feb-16	-0.0026	-0.0362	-0.0323	-0.0039	-0.0058	-0.0166	0.0108	-0.0306	-0.0286	-0.0020
Mar-16	0.0237	-0.0397	-0.0215	-0.0182	-0.0056	-0.0097	0.0041	-0.0131	0.0135	-0.0266
Apr-16	0.0178	-0.0198	0.0327	-0.0526	-0.0087	-0.0047	-0.0040	0.0132	0.0267	-0.0135
May-16	0.0465	0.0190	0.0439	-0.0249	-0.0114	-0.0036	-0.0078	0.0456	0.0713	-0.0257
Jun-16	0.0082	0.0562	0.0593	-0.0032	-0.0105	0.0098	-0.0203	0.0374	0.0570	-0.0196
Jul-16	0.0138	0.0562	0.0429	0.0133	-0.0026	0.0222	-0.0247	0.0172	0.0314	-0.0142
Aug-16	0.0869	0.0229	0.0825	-0.0596	0.0270	0.0307	-0.0037	0.0463	0.0310	0.0153
Sep-16	0.0650	0.0836	0.0193	0.0643	0.0342	0.0478	-0.0136	0.0732	0.1552	-0.0820
Oct-16	0.1176	0.0769	0.1204	-0.0434	0.0441	0.0468	-0.0027	0.0516	0.1423	-0.0907
Nov-16	0.0203	0.1419	0.0419	0.1000	0.0641	0.0345	0.0296	0.0900	0.1800	-0.0901

Dec-16	0.0413	0.1199	0.1640	-0.0441	0.0945	0.0435	0.0510	0.0783	0.0385	0.0398
Jan-17	0.0498	0.0790	0.0596	0.0194	0.0981	0.0419	0.0562	0.0892	0.0525	0.0367
Feb-17	0.0291	0.0631	-0.0245	0.0876	0.1071	0.0565	0.0506	0.0103	0.0082	0.0020
Mar-17	-0.0475	0.0054	-0.0025	0.0080	0.0591	0.0274	0.0317	0.0126	-0.0218	0.0345
Apr-17	0.0003	0.0115	-0.0147	0.0262	0.0304	0.0170	0.0134	0.0201	-0.0189	0.0390
May-17	0.0505	0.0109	0.0113	-0.0004	0.0359	0.0122	0.0237	0.0738	-0.0056	0.0795
Jun-17	-0.0358	0.0552	0.0363	0.0189	0.0555	-0.0009	0.0565	-0.0111	-0.0396	0.0285
Jul-17	-0.0562	-0.0185	-0.0294	0.0109	0.0105	-0.0108	0.0213	-0.0152	-0.0187	0.0035
Aug-17	0.0382	-0.0198	-0.0245	0.0048	0.0117	-0.0331	0.0449	-0.0511	-0.0298	-0.0214
Sep-17	-0.0631	-0.0537	-0.0303	-0.0233	0.0093	-0.0055	0.0148	-0.0208	-0.0330	0.0122
Oct-17	-0.0715	-0.0621	-0.0523	-0.0098	-0.0376	-0.0267	-0.0109	-0.0869	-0.0607	-0.0262
Nov-17	0.0035	-0.0561	-0.0638	0.0077	-0.0486	-0.0394	-0.0092	-0.0623	-0.0735	0.0112
Dec-17	-0.0492	-0.0482	-0.0458	-0.0023	-0.0486	-0.0500	0.0014	0.0117	-0.0156	0.0272
Jan-18	0.0513	-0.0103	0.0204	-0.0307	0.0013	-0.0235	0.0248	0.0113	0.0089	0.0025
Feb-18	0.0284	0.0059	0.0249	-0.0191	-0.0182	-0.0331	0.0149	0.0433	0.0616	-0.0183
Mar-18	-0.0017	0.0191	0.0549	-0.0358	-0.0223	-0.0141	-0.0081	0.0489	0.0566	-0.0077
Apr-18	0.0366	0.0280	0.0381	-0.0101	0.0235	0.0410	-0.0175	0.0161	0.0202	-0.0041
May-18	-0.0502	0.0129	0.0128	0.0001	0.0011	0.0143	-0.0132	0.0247	0.0142	0.0104
Jun-18	0.0022	0.0015	0.0053	-0.0038	0.0078	0.0351	-0.0272	-0.0038	-0.0389	0.0352
Jul-18	-0.0546	-0.0199	-0.0222	0.0024	0.0010	-0.0027	0.0038	0.0196	-0.0458	0.0654
Aug-18	0.0584	0.0097	-0.0037	0.0135	0.0203	0.0150	0.0053	0.0162	-0.0140	0.0302
Sep-18	-0.0334	-0.0045	-0.0207	0.0162	0.0131	0.0055	0.0076	-0.0213	-0.0335	0.0122
Oct-18	-0.0949	-0.0165	-0.0381	0.0216	-0.0290	-0.0299	0.0008	-0.0205	-0.0460	0.0256
Nov-18	0.0763	-0.0256	0.0497	-0.0752	0.0003	-0.0143	0.0146	-0.0133	-0.0528	0.0395
Dec-18	-0.0513	-0.0120	-0.0416	0.0295	-0.0178	-0.0293	0.0114	-0.0056	0.0238	-0.0294
Jan-19	-0.0116	-0.0145	0.0373	-0.0518	-0.0162	-0.0160	-0.0002	-0.0239	-0.0249	0.0011
Feb-19	0.0030	-0.0281	-0.0296	0.0016	-0.0247	-0.0343	0.0095	-0.0239	0.0010	-0.0249