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Exploring the Existence of Momentum Reversal Pattern in Pakistani Equity Market

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Abstract:

This paper examines the presence of momentum reversal anomaly by applying both parametric and non-parametric approaches. The paper also aims to explore which momentum strategy is beneficial in case of the Pakistani equity market. For this purpose, the stochastic dominance approach is applied. In order to test the momentum reversal anomaly, we construct winner and loser portfolios by using 36-month holding period returns and apply the KS test of Barrett and Donald (2003). We also apply the t-test to test whether the difference between the mean return of loser and winner portfolios is statistically greater than zero. We find that the loser portfolio is stochastically dominates over the winner portfolio at all the three examined SD orders. Both the KS test and the t-test show that the loser portfolio dominates over the winner portfolio in all 36-month test periods. On average, loser stocks earn 39.8% excess returns as compared to winner stocks. These findings might have useful implications for trading strategies and investment decisions. The results of this paper help enhance our understanding of stock return anomalies in equity markets. The results also suggest that investors in Pakistan can get market-adjusted excess returns by making their investments based on the contrarian strategy.

Keywords: *Behavioral finance; Stochastic dominance approach; Momentum reversal effect; Under and overreaction effects*

1. Introduction

Behavioral and psychological biases generally affect investors' decisions, which, in turn, cause stock mispricing and leads to market inefficiency. There are several behavioral biases/aspects in a financial market, but the most common are herding behavior, cognitive and emotional biases, bubbles, and irrational exuberance (Shiller, 2006; Smith, 2008; Statman, 2010). Several studies have provided empirical evidence on the significant effects of these behavioral biases on stock prices and investment decisions of investors.

According to Shiller (2006), when there is a tendency to continuously increase in price of an asset in the same direction, it is referred as the "irrational exuberance". He further explained that there are four elements (psychological, cultural, amplification, and precipitating factors) that are likely to cause uncertainty and fluctuations in stock prices. The bubble theory explains a tendency of large overvaluation in asset pricing that persists for the long term. However, the bubble in

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prices eventually bursts itself and results in an unjusfitibale price decline before the price returning to its fair/intrinsic value.

The standard finance theory of random walks states that future prices cannot be predicted based on historical prices (Malkiel, 1973). Similarly, Efficient Market Hypothesis (hereafter EMH) given by Fama (1970) also implies that nobody can make unique investment strategies based on information to get excess stock returns. However, in the mid of 1980s', extensive literature of finance has been documented that stock prices, at least to some extent, are predictable. In addition, there is strong empirical evidence that both the short-run and the long-run serial correlations exist in stock prices instead of the random walk pattern (Dupernex, 2007).

In theory, there are many factors, for instance, seasonal trends, mean reversion, size effects, etc., that lead to momentum patterns. Similarly, Fama (1998) is also of the view that over reactional and under reaction effects break the random walk pattern. Further, Bondt and Thaler (1985) confronted the market efficiency hypothesis and rational behavior investors by demonstrating that the portfolio that experiences negative returns (loser stocks) has a tendency to outperform over the portfolio that experiences positive returns (winner stocks) during the subsequent months. They explained that such results are mainly due to a negative serial correlation and extreme optimist or pessimist behaviors of investors. Jegadeesh (1990a) and Lehmann (1990) also ascertained the mean reversion in stock returns over short horizons. Afterwards, following the article by Jegadeesh and Titman (1993), enormous number of research papers have presented the empirical evidence on the existence of the momentum effect and the momentum reversal effect in different international stock markets and for different time periods. However, it still seems hard to describe why these effects arise. In fact, this phenomenon in stock prices is referred to as one of the most puzzling anomalies in finance.

After the seminal work of Bondt and Thaler (1985), a number of studies have found the presence of the momentum reversal phenomenon, implying that loser stocks in a given time period are likely to yield high returns over the subsequent time period. Fundamental reasons for the momentum reversal effect are behavioral biases like overreaction, contrarian strategies, and herding behavior. Furthermore, the value factor is also considered another reason of the long-term reversal anomaly (Fama & French, 1996). Blume and Stambaugh (1983) have documented the winner-loser reversals. They also found no significant evidence about the loser portfolio to be

riskier. Further, they have shown that for less than one year horizon, loser stocks outperform winner stocks and for a relatively longer time period, say 3 to 4 year horizons, investors can get high returns by adopting the long position for losers stocks and the short position for winner stocks. These findings are afterward confirmed by several empirical studies including Balvers, Wu, and Gilliland (2000), Spierdijk, Bikker, and Van den Hoek (2012), and Smith and Pantilei (2013). The possible explanation of the long-run momentum reversal effect is the under reaction and overreaction behavior of investors. Another study by Antoniou, Galariotis, and Spyrou (2011) also challenged the EMH and documented the evidence on the existence of the momentum reversal effect in London Stock Exchange. They also found that loser stocks generate more returns as compared to winner stocks.

By examining the momentum and momentum reversal effect in Egyptian Stock Market, Hassan (2014) provided evidence of the presence of the short-run momentum effect and the log-run momentum reversal effect. There is also evidence of the momentum effect and momentum reversal effect in the Indian equity market. By following the momentum strategy of Jegadeesh and Titman (1993) and contrarian strategy of Bondt and Thaler (1985), Dhankar and Maheshwari (2015) found the presence of the momentum effect in the short run and the momentum reversal effect in the long run. They explained that there are certain behavioral models that support to momentum profit in the short run but the positive returns eventually reverse in the long run and the mean reversion pattern or the momentum reversal effect exists in long-term holding periods. In the context of momentum reversal and momentum anomaly, Bondt and Thaler (1985) and Jegadeesh and Titman (1993) have challenged the notion of market efficiency based on the overreaction and under reaction effects caused by investors' suboptimal investment decisions, respectively.

An important issue in the predictability of stock returns is the existence of negative or positive serial correlations. Indeed, strong correlation observed in the historical returns (Ball & Kothari, 1989; Campbell, Grossman, & Wang, 1992; Islam & Sultana, 2015). The observed correlations lead academicians and researchers to take up the two main directions in theoretical finance to challenge the traditional view of security prices. Positive serial correlations in stock returns imply that stocks having positive returns in the past are also likely to have positive returns in the future. This rising trend in stock returns is termed as the momentum effect or the underreaction effect in the behavioral finance literature (Jegadeesh & Titman, 1993).

Said differently, if the momentum effect exists, then the momentum strategy is beneficial for investors to get abnormal returns. On the other hand, the existence of negative serial correlations in stock returns implies that stocks those exhibit positive returns in the past are prone to have negative returns in the future. In other words, winner stocks become losers in the future. This reverse pattern in stock returns is known as the momentum reversal effect or the overreaction effect (Bondt & Thaler, 1985). The theoretical literature suggested that investors may earn abnormal returns by adopting the contrarian strategy in case of the momentum reversal effect.

Although previous studies have made significant contributions by exploring the existence of reversal patterns in different international contexts like the USA and the European markets. By reviewing the literature, we however find that there is a dearth of empirical evidence on the momentum reversal anomaly in developing stock markets. Yet, evidence from less developed stock markets would significantly help explain the mystery of financial anomalies. Further, limited existing studies on developing markets are not comprehensive and have used statistical tools that may suffer from several caveats.[1]Furthermore, despite the large amount of hits on the topic, research is still in its early stage in South Asian markets such as the Pakistan Stock Market (PSX). Specifically, when we review the literature on Pakistan, we find that although some scholars have tried to explore the momentum and momentum reversal anomalies in PSX (see for example, (Abbas, 2017; Zaremba, 2018), the scope of these studies is very limited. They examine the momentum anomaly in the short time horizon that is mostly up to one year. This motivates us to reexamine the momentum anomaly in the long-term horizon in Pakistani equity market. Specifically, we fill the gap left in the literature by examining the presence of the momentum reversal effect and exploring whether contrarian strategies exist in PSX.

[1]Most of the previous studies, particularly in developing countries, have used OLS, ARCH, and GARCH models to test the calendar anomalies. The main disadvantage of such techniques is that they follow normal distribution assumption in return distributions. However, the existing studies on Pakistan's equity market, for instance, Rashid and Ahmad (2008) have provided evidence that the volatility of stock returns increases with stock returns. Similarly, Khilji and Nabi (1993) have stated that PSX stock returns are leptokurtic and positively skewed. Similarly, Schwert (1991) and Beedles (1979) have also argued that stock returns can be negatively or positively skewed.

The study in hand differs from previous studies in following ways. Firstly, it considers long-term contrarian strategies to get abnormal profit as prior studies argued that momentum reversal pattern is likely to be the strongest or significant around 3-year horizon. Secondly, and more importantly, we apply both parametric (t-test) and non-parametric (Kolmogorov-Smirnov type) tests to check the difference between loser and winner stock returns. By using non-parametric approach, we propose the stochastic dominance (SD) framework to investigate the first, second, and third order of SD. These SD rules are tested by implementing the KS (Kolmogorov-Smirnov) type test of Barrett and Donald (2003) based on the SD theory. The main advantage of this test is that it can be useful for examining SD of any-pre-specified order. In addition, it does not require any pre-defined distribution of returns. The main feature of this approach is that it does not make any assumption about the normality of stock returns. In additions, this methodology does not consider the asset dominancy based on the two-parameter criteria. Namely, the main variance approach rather, the rules of SD anticipate the entire asset return distributions. Thus, by applying this test, we not only significantly depart the previous studies on Pakistan but also present more robust evidence on the presence of the momentum reversal anomaly in Pakistani equity market. Finally, we consider all publicly traded firms listed at PSX and our empirical analysis covers a relatively long-time span, which allows us to generalize the results of the paper.

The outline of the remaining of the paper is as follows. In Section 2, the literature review is presented, and hypotheses development is discussed. In Section 3, the empirical framework used in the paper is presented. In this section, we also explain the portfolio construction. Section 4 deals with the data. Section 5 presents the empirical results. Finally, Section 6 concludes the paper.

2. Literature Review

Bondt and Thaler (1985); De Bondt and Thaler (1989) are the first who published the results explaining that winners stocks tend to be the losers after 3 to 5 years. By observing the mean reversion characteristics of equity market, they argue that the overreaction effect causes return reversal and allows excess returns from the contrarian strategy. Daniel, Hirshleifer, and Subrahmanyam (1998) explained that there are excess returns in the short run due to persistent overreactions by informed

traders, who have overconfident in having the private information. However, they caused subsequent return reversals by doing corrections from the overreaction.

Subsequently, Jegadeesh (1990b) has reported that the abnormal returns derived from contrarian strategy are significant over the short-term investment horizon in US stock market. After that, Jegadeesh and Titman (1993) have constructed winner and loser portfolios based on accumulated returns for the following 3 to 12 months and compared with the portfolio of past winners. They found that the winner portfolio outperform the loser portfolio, supporting the momentum strategy.

The source of gains in the contrarian or momentum effect is divided into two strands. The first is investors' irrationality which is mainly due to overreaction or under reaction. The second one is systematic risk instigating in contribution to stock returns. Conrad and Kaul (1998) constructed the winner-loser portfolios based on different holding periods and analyzed the performance of contrarian and momentum strategies. Their results show that the contrarian strategy outperforms the momentum strategy in both the short run as well as in the long run. However, the reverse is observed in the medium-term period. In contrast, Lee and Swaminathan (2000) found that the momentum effect in the short-term horizon and the momentum reversal effect in the long-horizon. Barberis, Shleifer, and Vishny (1998) adopted a model with investors' psychology and examined the future profit expectation procedure. Their findings suggest that investors underreact to weakly intensive statistically significant information, whereas, they overreact to the highly intensive statistically insignificant information.

In addition to the investor's irrationality, systematic risk is also a source of abnormal returns from the contrarian or momentum strategy. According to the standard one-factor CAPM model by Sharpe (1964), expected return is a positive linear function of the systematic risk called the market beta. In addition, the market beta is also explained in the cross-sectional differences in expected returns. However, empirical literature shows that in addition to the market beta, the B/M ratio and firm size also affect the expected returns that weakens the principal norm of the standard one-factor CAPM. By keeping this in mind, Fama and French (1996) have empirically shown that the long-term return reversal identified by Bondt and Thaler (1985) can considerably be explained by the three-factor capital asset pricing model. Campbell, Lettau, Malkiel, and Xu (2001) argued that the idiosyncratic risk is also a very important factor that causes the momentum anomaly. One of the main reasons

is that investors might be held undiversified portfolios due to limits of arbitrage. By exploiting mispricing to get abnormal returns, arbitrageurs cannot eliminate the idiosyncratic risk.

Ang, Hodrick, Xing, and Zhang (2006) confirmed that stocks with high idiosyncratic volatility deliver low expected returns. However, Fu (2009) found a positive relationship between the conditional idiosyncratic volatility and expected returns.Wu (2016) investigated the asymmetric momentum effect over different time periods following up and down market states in the Shanghai and Shenzhen Stock Exchanges of the Chinese Class A share market. The asymmetrical pattern of the market-state-dependent momentum effect in the Shenzhen Stock Exchange outperform the Shanghai Stock Exchange. Nnadi and Tanna (2017) analysed the momentum and contrarian effects forBRICS member countries. Both, China and Brazil exihibited a significant short-term momentum reversal effect. However, South Africa shown the existence of long-term momentum reversal effect. The main justification behind the reveral effect is the higher loser returns. Lobão and Azeredo (2018) found the momentum anomaly in Portuguese Stock Market. Their findings show that the intensity of momentum anomaly is higher in growth stocks as compared to value stocks. Abbas (2017) was unable to find the momentum effect in the Pakistan Stock Exchange. Very weak and statistically insignificant evidence of the momentum anomaly was observed which he neglected while concluding his study. He provided evidence that out of 25, only 3 strategies have shown the momentum effect. His results show that taking ranking period short and holding period long generates significant abnormal return which confirms the momentum reversal effect in PSX.

Another study by Zaremba (2018) explored the short-term and medium-term momentum effect in 78 countries including Pakistan. The results revealed that those stocks with good performance over the past 6–12 months tend to out-perform in the future. Blitz, Hanauer, and Vidojevic (2018) strengthened the link between the idiosyncratic momentum profit and under reaction by showing that the idiosyncratic momentum forecasts high long-term excess return, which further causes the momentum reversal as high idiosyncratic momentum returns tends to reverse in future.

In sum, based on the review on the existing literature, we found that there is puzzling and ambiguous evidence on the momentum anomaly. In case of PSX, very

few studies have so far been done on the topic. Although they are specifically related to the short-term and medium-term momentum anomaly, they totally overlooked the momentum (reversal) anomaly over the long-time horizon. In this study, we therefore examine the momentum anomaly by constructing the long-term (3-years) winner and loser portfolios and by applying the very sophisticated statistical technique, namely, the stochastic dominance, in order to compare loser and winner portfolios' financial performance in terms of market-adjusted excess returns.

2.1. Hypotheses of the study

To achieve the objective of the study, the following hypotheses are tested by applying the *t*-test.

H1: There is a statistical difference in the mean returns of loser and winner portfolios.

The hypothesis for the KS test of Barrett and Donald (2003) is as follows.

H2: Loser stocks dominate over winner stocks at the predefined s^{th} order.

3. Research Methodology

To test momentum reversal anomaly, we used stochastic dominance (SD) approach. The main advantage of this methodology is that it does not follow the normal distribution assumption in return distributions. Von Neumann and Morgenstern (1944) stated the SD rules for set of utility functions. The SD rules are the first order, second order, and third order SD given by (Hadar & Russell, 1969). We apply the SD test, namely, the KS test given by Barrett and Donald (2003) to examine which portfolio (loser *versus* winner) stochastically dominates over the other based on its excess returns. To ensure the robustness of our results, we also apply the *t*-test on the mean returns of winner and loser portfolios.

3.1. Portfolio Construction

To start empirical investigation, loser and winner portfolios are built based on the procedure proposed by Bondt and Thaler (1985). These portfolios are constructed based on the past market-adjusted excess abnormal returns. We calculate the excess returns/residuals as $\hat{R}_{it} = r_{it} - r_{mt}$. For this, KSE-100 Index return (r_{mt},market return) is subtracted from the return of every *it* stock at each period *t*. After that, based on market-adjusted excess returns, constructions of loser and winner portfolios have taken place.

Starting in December 2002, the stocks are classified in descending order based on their cumulative continuous returns over the previous 36-months. This procedure is iterated 5 times for all non-overlapping 36-months period between January 2000 and December 2014. For portfolio construction, at every formation date, (December 2002, December 2005, December 2008, and December 2011), the cumulative average returns are ranked low to high and portfolios are constructed. Specifically, two portfolios the loser and the winner are formed. The winner portfolio includes top 50 stocks based on the cumulative average returns (*CAR*) over the prior 36 months. The loser portfolio contains the bottom 50 stocks based on the cumulative average return over the prior 36 months. Both portfolios are held for next 36 months or a 3-year holding period. Then, the average of these cumulative average returns ($ACAR$) is calculated for both portfolios between test periods. Doing so, we get the two return distributions for winner and loser portfolios named as $ACAR_W$and $ACAR_L$, respectively. Following procedure is used for portfolios construction.

1. As a first step, foreach stock *i*, which has at least consecutive 36-month returns, start from January 2000, to December 2002, (1st month to 36th months), the residual returns($\hat{R}_{it}$) are calculated. If there is any missing value, then the residual returns are calculated up to that point. This process is done for remaining time periods, for instance, January 2003 to December 2005, January 2006 to December 2008, January 2009 to December 2011 and January 2012 to December 2015.
2. For first 36-months period, for every stock *i*, we compute the cumulative residual returns, $CU_i \Sigma_{t=-35}^{t=0} R_{it}$,for prior 36 months from *t* = 35 to *t* = 0, December 2002 (month 36; the portfolio formation date"). This practice is

repeated for the rest of 36-months periods. On each four formation dates, CU_i are ranked. The topmost 50 firms are considered as loser portfolio and the bottommost 50 firms are labeled as winner portfolio. The first 36-month period is known as ranked period/formulation period. The remaining 36-month periods are considered as holding periods and the performance of portfolios is evaluated based on holding periods.

3. In each of four non-overlapping test periods (for both portfolios), starting in January 2003 and up to December 2014, we now compute the cumulative average residual returns for all securities in the portfolio (winner and loser) for next 36 months (January 2003 to December, 2005) i.e., from t =1 through t = 36. The average of excess returns$CAR_{W,n,t}, CAR_{L,n,t}$, is estimated. If a stock's return is missing in a month after portfolio formation, then, from that moment onward, the stock is dropped from the portfolio. Thus, whenever a stock drops out, the calculations involve an implicit rebalancing.
4. By usingCARs from all four test periods, average of $ACAR$for winner and loser portfolios are calculated for t = 1 to t = 36 denoted as$ACAR_{W,t}$and$ACAR_{L,t}$,respectively.

3.2. Stochastic Dominance Test

We apply the KS test (Kolmogorov-Smirnov) by Barrett and Donald (2003). This test can be applied for SD for independent distributions and sample size can be unequal. Following is the brief description regarding the KS test. Let$\{A_i\}$, *i= 1,2,….,N* be i.i.d sample of returns to dominate distribution of population with CDF, F_A(r) and assume that all CDFs have common support [0, *r*], where *r*> 0 and are continuous in [0, *r*]. From the assumption mentioned above, we define $D_A^S(r)$ as the function that integratesF_A(r) to order *s-1*. Following are the three orders of SD.

$K_A^1(\mathrm{r}) = D_A(r)$ First-order SD

$K_A^2(\mathrm{r}) = \int_0^r D_A(u)du$Second-order SD

$K_A^3(\mathrm{r}) = \iint_0^r D_A(v)dvdu$Third-order SD

Similarly, $\{B_i\}$, $i= 1,2\ldots\ldots,N,$be i.i.d sample of returns to non-dominate distribution with CDF D_B(r). For the distribution, $D_B^s(r)$is defined analogously as for D_A^s(r). Following are hypotheses of the KS test.

$$H_0^s : K_A^s(\mathrm{r}) \leq K_B^s(\mathrm{r})$$
$$H_1^s : K_A^s(\mathrm{r})) > K_B^s(\mathrm{r})$$

The null hypothesis states that the target loser portfolio*(A)*dominates over winner portfolio*(B).* For testing the null hypothesis thefollowing test statistic is applied.

$$k_s = (\frac{N^2}{2N})^{1/2} \frac{sup}{r} [K_A^{-s}(r) - K_B^{-s}(r)] (1)$$

With the help of p-values obtained through simulation, the calculation of suprema of $k_s$is done. (Barrett & Donald, 2003). In addition, we apply the *t*-test and calculate *t*-values on both returns series (loser and winner) for 36 testing periods.

4. Data Analysis

Monthly data on stock prices of all the firms listed at PSX and KSE-100 index are taken from the official website of the Pakistan Stock Exchange. The study covers the period from 2000 to 2014. Stock returns are defined as the first difference of log prices.

Descriptive Statistics of Winner and Loser Portfolio

Table 1 reports the descriptive statistics of $ACAR_W$and$ACAR_L$over 36 test periods (t = 1 to t =36). The table also presents the difference between $ACAR_W$ and $ACAR_L$. The mean of $ACAR_L$is higher as compared to the mean of $ACAR_W$. This implies that on average, the mean of the average of cumulative excess returns of loser stocks are higher than the corresponding figure for winner stocks.

Table 1: Descriptive Statistics of the Mean of $ACAR_L$, $ACAR_W$ and $ACAR_L$ - $ACAR_W$

	$ACAR_L$	$ACAR_W$	$ACAR_L$ - $ACAR_W$
Mean	43.2%	3.40%	39.8%
SD	18.0%	7.60%	11.4%
Test Period	36	36	36

Note: The mean of average of cumulative access returns (ACAR) of loser and winner portfolios of 36 test period (t =1 to t =36). Overall, mean and standard deviation of loser Portfolio are 39.8% (0.114), more than winner portfolio.

The standard deviation indicates that $ACAR_L$are more volatile as compared to the $ACAR_W$. On average, over the test period, the difference between the standard deviation of the $ACAR_W$and$ACAR_L$ is 39.8%. This observation suggests that investors may earn abnormal returns by adopting contrarian strategy. In Figure 1, we show the trend of $ACAR_W$ and $ACAR_L$ over the test periods. Inspection of the figure reveals that the spread between the $ACAR_W$ and $ACAR_L$ (loser and winner) is increasing over the time. Further, the $ACAR_L$ of loser portfolio has upward trend, suggesting taking the long position for the loser and the short position for the winner portfolio. This dominance performance of loser stocks may be attributed to the small firms effect.Richards (1997) found that around turn-of-the-year small firms mostly experience losses. In addition, he also found that in the month of January, small firms have positive and high returns.

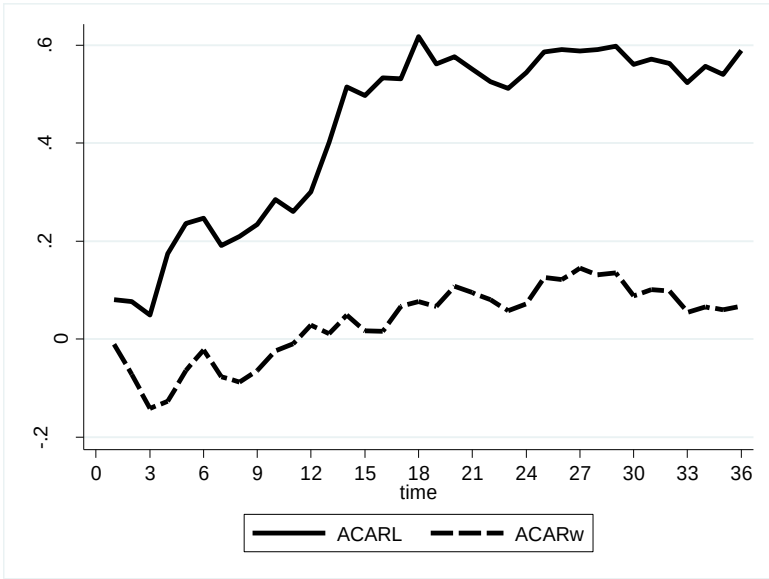

Figure1: ACARs of Loser and Winner Portfolios for 36 Test Periods

Note: *ACARs* of top 50 loser and bottom 50 winner stocks in 36 test periods.

To check whether the loser portfolio really dominates over the winner portfolio in the month of January, in Table 2, the results of mean of cumulative average returns of loser and winner portfolio are presented for the month of January. We find that on average, the cumulative average returns of loser portfolio are higher than that

of the winner portfolio in the month of January over test periods. In particular, the mean of cumulative average returns and the standard deviation for the loser portfolio across all the month of January is 35.6% and 44.5%, respectively. On the other hand, very dejected performance is appeared for the winner portfolio in the month of January.

Table 2: Descriptive Statistics of the Mean of $ACAR_L$ and $ACAR_W$ for January

	January Month			
	$ACAR_L$	$ACAR_W$	***t-test***	
Mean	35.6%	4.1%	*t*-statistics	2.860
SD	44.5%	56.8%	Mean(diff)>0	0.0077
N	12	12		

Note: The mean of average of cumulative access returns of winner and loser portfolios for January is reported.

The mean value of winner portfolio (4.1%) is relatively small with high standard deviation (56.8%). This indicates a clear-cut dominance of the loser portfolio over the winner portfolio in the month of January. This observation also provides evidence of the small firm effect. In addition, the *t*-statistics also show that the results are significant. These observations compliment the previous evidence on the January effect caused by the small firm effect. Keim (1983) and Reinganum (1981) studied small firms and found the January effect. The January effect is further affected by the Price/Earning (P/E) ratio effect and the dividend yield effect. Tax-loss selling is typically explained by January phenomenon (Roll, 1983). Stocks, which have high P/E value, are overvalued. This implies that the P/E effect is mostly the part of January anomaly. Another explanation of the January anomaly is that it exists due to the positive association between January returns and dividend yield (dividend yield is associated with the P/E ratio) (Fry, Keim, & Meiners, 1982). However, to formally test the small firm effect, there is a dire need to investigate further by constructing winner and loser portfolios based on firm size. We do not expend on these lines as this is beyond the scope of the study. However, we recommend this for future research on this issue.

Results of Momentum Reversal Effect

Descriptive statistics shown in Table 1 and Figure 1 provide preliminary evidence on the dominance of the loser portfolio over the winner portfolio. We apply the KS test to check the stochastic dominance between loser and winner portfolios. The p-values of the test statistics are presented in Table 3. The table is divided into two panels. In the first panel labeled as Loser *versus* Winner, the p-values are presented for the null hypothesis that the loser portfolio stochastically dominates over the winner portfolio at s^{th} order of stochastic dominance ($L >_s W$)**.** The second penal named as Winner *versus* Loser shows the p-values for the alternative hypothesis ($W >_s L$). The SD1, SD2, and SD3 are reported the p-values of the KS test for all the three orders of SD tested in this paper. First column of the table shows the test period from *t*= 1 to *t*= 36 for loser and winner portfolio.

The p-values for all the examined stochastic dominance orders are considerably higher than any acceptable level of significance. In fact, the p-values for the first order stochastic dominance appear 1. This implies that we are unable to reject the null hypothesis that the loser portfolio stochastically dominates over winner portfolio. These results suggest that the loser portfolio dominates over winner portfolio at t = 1 through t = 36. The p-values presented in the second panel of the table for testing the reverse hypothesis, that is, the winner portfolio dominates over the loser portfolio, confirm the dominance of the loser over the winner. By comparing the p-values across both panels, we find that the loser portfolio dominates over the winner portfolio at all the three examined stochastic orders. However, the p-values highlight that the loser portfolio more strongly dominates at the third order of stochastic dominance as compared to the other two stochastic orders. We infer this because the p-values of the reverse hypothesis are almost near to zero for the third order of stochastic dominance.

The p-values presented in the table also show that the loser portfolio dominates over the winner portfolio at the second and the third stochastic order throughout the test periods. Loser stocks strongly dominate over winner at the third order of SD. It implies that risk-averse investors prefer positively skewed stocks (loser over winner) in their investment decisions. The results of the paper suggest that in the Pakistani equity market, investors can earn handsome returns by constructing portfolios based

on contrarian strategies. The results also reveal that the momentum reversal phenomenon is mainly due to the presence of overreaction effect in the Pakistan Stock Exchange. Our results also indicate that the returns of loser stocks are significantly larger than that of winner stocks during the subsequent period with the magnitude of 52.2% (t = 36).

Our findings are consistent with several previous empirical studies. For instance, Bondt and Thaler (1985) have documented that the loser portfolio tends to outperform the winner portfolio by up to 25% during their examined period in the New York Stock Exchange.

Table 3: The results of Stochastic Dominance of Loser over Winner Portfolio

	Loser *versus* Winner $L >_s W$			**Winner *versus* Loser** $W >_s L$		
Test Period	SD_1	SD_2	SD_3	SD_1	SD_2	SD_3
t=1	0.77	0.65	0.62	0.36	0.04	0.02
t=2	1.00	0.62	0.58	0.36	0.00	0.00
t=3	1.00	0.63	0.57	0.10	0.00	0.00
t=4	1.00	0.74	0.69	0.36	0.00	0.00
t=5	1.00	0.66	0.61	0.36	0.00	0.00
t=6	1.00	0.63	0.59	0.36	0.03	0.00
t=7	1.00	0.63	0.60	0.36	0.02	0.00
t=8	1.00	0.62	0.59	0.36	0.01	0.00
t=9	1.00	0.53	0.50	0.36	0.05	0.00
t=10	1.00	0.54	0.51	0.36	0.03	0.00
t=11	1.00	0.64	0.61	0.36	0.06	0.00
t=12	1.00	0.63	0.60	0.77	0.10	0.00
t=13	1.00	0.62	0.60	0.36	0.05	0.00
t=14	1.00	0.67	0.63	0.36	0.04	0.00
t=15	1.00	0.69	0.67	0.36	0.03	0.00
t=16	1.00	0.70	0.66	0.36	0.03	0.00
t=17	1.00	0.69	0.64	0.36	0.04	0.00
t=18	1.00	0.70	0.65	0.36	0.04	0.00
t=19	1.00	0.63	0.58	0.77	0.06	0.00
t=20	1.00	0.69	0.66	0.36	0.07	0.00
t=21	1.00	0.69	0.66	0.77	0.07	0.00
t=22	1.00	0.69	0.66	0.77	0.07	0.00
t=23	1.00	0.69	0.65	0.77	0.05	0.00
t=24	1.00	0.68	0.64	0.77	0.05	0.00
t=25	1.00	0.66	0.63	0.77	0.07	0.00

t=26	1.00	0.60	0.56	0.10	0.02	0.02
t=27	0.77	0.50	0.53	0.36	0.07	0.11
t=28	1.00	0.65	0.62	0.77	0.06	0.00
t=29	1.00	0.63	0.59	0.77	0.05	0.00
t=30	1.00	0.65	0.60	0.77	0.04	0.00
t=31	1.00	0.64	0.59	0.77	0.04	0.00
t=32	1.00	0.64	0.59	0.36	0.04	0.00
t=33	1.00	0.61	0.57	0.36	0.05	0.00
t=34	1.00	0.65	0.60	0.77	0.03	0.00
t=35	1.00	0.64	0.60	0.36	0.04	0.00
t=36	1.00	0.64	0.60	0.36	0.03	0.00

Note: KS type test is applied. P-values of S.D show that loser portfolio dominates over winner portfolio from *t=1 to t=36.*

Similarly, empirical studies by Dhankar and Maheshwari (2015), Hassan (2014), and Asness, Moskowitz, and Pedersen (2013) also reported the dominance of loser stocks over winner stocks in India, Egypt, and the eight diverse market.

Empirical Results of Momentum Reversal Effect through the *t*-Test

In previous sub-section, we tested the momentum reversal anomaly in the Pakistan Stock Exchange by applying the KS test. The results provide strong evidence of the momentum reversal effect (the overreaction effect or Loser – Winner effect). In this sub-section, we use an additional test to assess the robustness of our results presented in the previous sub-section. Specifically, we use the *t*-test to test whether the difference between the mean return of loser and winner portfolios is statistically greater than zero. Several previous studies including Fong, Wong, and Lean (2005) and Wang, Burton, and Power (2004) have also used the *t*-test to examine the momentum reversal effect in loser and winner portfolios.

During the test period

If $[ACAR_w - ACAR_L] > 0$, then, it gives the signal of momentum anomaly.

and

If $[ACAR_L - ACAR_W] > 0$, then, there is an indication of momentum reversal effect.

The results are presented in Table 4. Specifically, the table presents the average of cumulative access returns (*ACAR)* for loser and winner portfolios, the difference between the $ACAR_L$ of loser portfolio and the $ACAR_W$ of winner portfolio, *t*-statistics, and the p-values to test the null hypothesis that the difference is greater than zero. The results indicate that the difference between the $ACAR_L - ACAR_W$ is

positive throughout the test period. However, by examining carefully, we find that the highest difference appears in the month t = 36 (52.2%), whereas, the lowest difference appears in the month t = 1 (9.1%). In the month t = 1, the winner portfolio return is only 1.1%, in comparison of 8% of returns of the loser portfolio. In month t = 2, again loser stocks perform well, showing 7.6% average cumulative returns. On the other hand, during the same period, winner stocks show negative returns with the magnitude of -7.2%. The abnormal returns for t = 2 period are 14.8%. This profitable pattern prevails throughout the test periods (t =1 to t =36).

Table 4: Results of *t*-Test for Loser and Winner Portfolios

Test Period	$ACAR_{L,n,t}$	$ACAR_{W,n,t}$	$ACAR_{L,} - ACAR_{W,}$	*t*-statistics	Mean (diff) > **0**
t=1	8.0	-1.1	9.1	1.676	0.096
t=2	7.6	-7.2	14.8	2.630	0.039
t=3	4.9	-14.2	19.1	2.476	0.045
t=4	17.5	-12.7	30.2	2.398	0.048
t=5	23.6	-6.5	30.0	2.794	0.034
t=6	24.7	-2.2	26.9	2.703	0.037
t=7	19.1	-7.7	26.8	2.803	0.034
t=8	20.9	-8.8	29.7	2.585	0.041
t=9	23.4	-6.5	29.9	3.023	0.028
t=10	28.5	-2.4	30.9	2.510	0.044
t=11	26.0	-1.0	27.0	2.045	0.067
t=12	30.1	2.8	27.3	2.444	0.046
t=13	40.1	1.0	39.1	2.685	0.037
t=14	51.5	4.9	46.6	2.747	0.036
t=15	49.7	1.6	48.1	2.683	0.037
t=16	53.3	1.6	51.8	2.202	0.058
t=17	53.1	6.6	46.5	1.760	0.088
t=18	61.7	7.6	54.1	2.377	0.049
t=19	56.2	6.7	49.5	1.981	0.071
t=20	57.6	10.7	46.9	1.865	0.080
t=21	55.1	9.5	45.6	1.791	0.086
t=22	52.5	8.0	44.5	1.827	0.083
t=23	51.2	5.8	45.4	1.780	0.087
t=24	54.4	7.1	47.3	1.779	0.087
t=25	58.6	12.5	46.1	1.600	0.104
t=26	59.0	12.1	46.9	2.488	0.044
t=27	58.8	14.5	44.3	1.747	0.090
t=28	59.1	13.1	45.9	1.688	0.095
t=29	59.8	13.5	46.3	1.694	0.094

t=30	56.0	8.8	47.3	1.624	0.101
t=31	57.1	10.1	47.0	1.731	0.091
t=32	56.2	9.8	46.5	1.730	0.091
t=33	52.3	5.5	46.8	1.438	0.123
t=34	55.6	6.5	49.1	1.808	0.084
t=35	54.0	6.0	48.0	1.772	0.087
t=36	58.9	6.7	52.2	1.873	0.079

However, we can also see from the table that the difference between average cumulative returns of loser and winner stocks is larger for the later test periods as compared to the initial test periods. This implies that the longer the holding (test) period the higher the abnormal returns. For example, in month t = 36, the difference between the return of both portfolios ($ACAR_L - ACAR_W$) is 52.2%.

The p-values shown in the table indicate that 14 out of 36 test periods, the differences between the abnormal returns of loser and winner portfolios ($ACAR_L - ACAR_W$) are statistically greater than zero at the 5% level of significance. Similarly, among the remaining 20 test periods, abnormal returns are statistically greater than zero at the 6% to 9% level of significance.

Taken together, the analysis suggests that the loser portfolio dominates over the winner portfolio in all 36-test periods. On average, loser stocks earn 39.8% excess returns as compared to winner stocks. These findings are consistent with the studies of Dhankar and Maheshwari (2015), Hassan (2014), Wang et al. (2004), Blume and Stambaugh (1983), and Bondt and Thaler (1985). Dhankar and Maheshwari (2015) examined the presence of statistically significant long-term momentum reversal effect in India. Hassan (2014) documented that the mean reversion pattern exists in the Egypt Stock Market, showing that in the long run, positive returns turn to negative returns and the winner portfolio becomes the loser. Similarly, Wang et al. (2004) also found the momentum reversal effect in Chinese Stock Market and concluded that this effect is more pronounced in domestic owned stocks as compared to foreign owned stocks. Blume and Stambaugh (1983) worked on data for 16 countries and concluded that loser countries are less risky than winner countries. They also provided the evidence of the momentum reversal effect. They stated that the main reason for the existence of the momentum reversal effect is market imperfections.

Analogously,Bondt and Thaler (1985) found the overreaction effect for US stock market, implying that loser stocks earn positive and high returns than winner stocks. The reason they gave for such results is that the response of investors towards negative (bad) news is larger than the response to good news. There are many reasons proposed in the literature about the dominancy of loser portfolios. For instance, major reasons that emerge from the empirical analyses are the under reaction effect (Lintner, 1965), the role of retail or institutional investor (Sakr, Ragheb, Ragab, & Abdou, 2014), the overreaction effect (Bondt & Thaler, 1985; Wang et al., 2004), and the liquidity risk factor (Asness et al., 2013). Collectively, our results contradict the notion of the weak form of the efficient markets hypothesis and pose a challenge to the existing asset pricing theories, particularly those are designed based on assigners factor and do not take into account the role of behavioral factors. From the context of momentum reversal anomaly, the notion of market efficiency has been challenged by several previous studies as well, mainly based on the presence of overreaction and under reaction effect (Bondt & Thaler, 1985; Jegadeesh & Titman, 1993).

5. Conclusion and Recommendations

In this paper, we examine whether the momentum reversal effect is present in Pakistan's equity market. In order to test the momentum reversal anomaly, we construct winner and loser portfolios by using 36-month holding period returns and apply the KS test of stochastic dominance. In addition, we apply the *t*-test to test whether the difference between the mean returns of loser and winner portfolios is statistically greater than zero. Our results suggest the existence of the momentum reversal effect in the Pakistan Stock Exchange during the examined period. Specifically, we found that the loser portfolio is stochastically dominates over the winner portfolio at all the three examined SD orders. Both tests (KS test and *t*-test) show that the loser portfolio dominates over winner in all 36-test periods. On average, loser stocks earn 39.8% excess returns as compared to winner stocks. These findings might have useful implications for trading strategies and investment decisions. Specifically, the results of this paper help enhance our understanding of stock return anomalies in equity markets. The results also suggest that investors in Pakistan can get market-adjusted excess returns by making their investments based on the contrarian strategy. Our results suggest that the equity market is not an

efficient market with respect to historical information. The supporters of EMH suggest that there should be the development of an asset-pricing model, which should rationalize the market anomalies in asset pricing context. Finally, the empirical results of this paper show that the contrarian strategies are able to generate significant positive returns in Pakistan. Evidently, a significant number of researchers pledge to the view that both contrarian and momentum strategies are the strategies that may yield significant profits, particularly, in the long-term investment horizon.

Although, we present robust results, our study has some limitations. Among them, one of the most important is that we do not consider the trading costs while constructing trading strategies. Further, we have not implicitly addressed the question of what causes trigger the momentum reversal effect in the Pakistan Stock Exchange. We conclude that the momentum or momentum reversal patterns present a bigger challenge to asset pricing literature, and that the under reaction explanation for the premium seems more likely than the various risk-based and behavioral explanations that have been proposed for conventional momentum. Farther study should be conducted to test the momentum effect by considering firm characteristics such as firm size, liquidity, and exporting behavior. Nowadays, Islamic stocks have got a greater attention from both academicians and practitioners. Therefore, it would be worth exploring the momentum effect in Islamic stocks. However, one should note that the source of the profits is widely debated in the literature. And, what factors exactly derive the momentum or momentum reversal effects are still an open to debate.

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