AN EMPIRICAL EVIDENCE OF OVER REACTION HYPOTHESIS ON KARACHI STOCK EXCHANGE (KSE)

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ABSTRACT

Purpose: There is extensive international evidence that contrarian strategy yields positive abnormal returns for long-term periods. However, this topic has received scarce attention in Pakistan. This research study in line with De Bondt and Thaler (1985) examines the winner-loser anomaly on Karachi Stock Exchange (KSE) using cumulative abnormal returns (CAR). Design/Methodology: To substantiate the purpose, this study has calculated cumulative abnormal returns (CAR) of each company listed on KSE for a period of 2000-2015 and constructed both the corresponding Equally Weighted and Value Weighted portfolios returns. To check the risk adjusted performance of these portfolios, a system-based estimation via the Generalized method of moments (GMM) with Newey-West standard errors corrected for heteroscedasticity and serial correlation is employed. Findings: This study reports significant evidence of Contrarian Investment strategies in KSE over the entire sample period. Results show that both Equally Weighted and Value Weighted portfolios formed on CAR generates abnormal returns of 9.89% and 3.64% per annum in the long run on KSE. Further a system of equations based on Generalized Methods of Moments (GMM) showed that Capital Asset Pricing Model (CAPM) is misspecified in case of KSE as it fails to explain the cross-sectional variation in portfolios returns based on contrarian investment strategies but 3-factor and 5-factor (Fama and French, 1996;2016) have explained their risk-adjusted abnormal return. Research Limitation/Implications: The study can be improvised by including other fundamentals and macroeconomic variables and determining their impact on contrarian investment strategies in different sectors and markets of Pakistan. Practical Implications: Policymakers and Investors need to take in to account contrarian investment strategies for evaluating asset returns. Contrarian Investment strategies are profitable in the long run on KSE and investors when taking their portfolio selection decisions can long the portfolios with lowest CAR value shares and short the higher CAR values portfolios. Originality/Value: The study aims to make the first attempt in investigating the risk adjusted performance of portfolios based on contrarian strategies by using not only CAPM but also 3-factor and 5-factor Fama and French (1996;2016) on Karachi Stock exchange.

Contribution/ Originality: The paper contributes the first logical anlsysis in investigating the risk adjusted performance of portfolios based on contrarian strategies by using not only CAPM but also 3-factor and 5-factor Fama and French models (1996 and 2016) on Karachi Stock exchange.

1. INTRODUCTION

A substantial part of the traditional finance theory is the Efficient Market Hypothesis (EMH). According to this hypothesis, share prices fully reflect all available information. Any new information that comes in is immediately and fully incorporated in its price, thus no chances of earning excess abnormal returns. In such a market best strategy is to purchase and hold the market portfolio. The basic assumption behind this strategy is that markets are fully efficient and investors are rational and any arbitrage that arises is quickly removed.

Over the past couple of decades, major critique has been subjected to EMH as the existence of anomalies has called the definition of market efficiency into question. Any evidence that contradicts the traditional finance theory is called an anomaly. Financial literature is replete with evidence of anomalies (see: Fama and French (2008)). The winner-loser anomaly is also such an example; it is also one of the several anomalies that have refuted the EMH. It has highlighted a trading strategy that makes earning of abnormal profits possible (see: (Bondt and Thaler, 1985; Conrad *et al.*, 1997; Mazouz and Li, 2007)). According to them stocks that have outperformed previously tend to perform poorly in the corresponding periods and vice versa. This anomaly refers that a negative correlation exists between excess returns. The strategy is based on the belief that past performance will reverse and buying past losers and selling past winners will generate a significant excess return. Persistence and presence of this anomaly have been proven in various financial markets however causes are still subjected to considerable disagreement.[1]

Supporters of EMH, Fama (1970;1991;2004) and Lo and MacKinlay (1988) debate that these excess abnormal returns are nothing other than temporary deviations from its intrinsic price, yet its presence has been proven in various financial markets for several decades. Persistent predictability of stock returns may imply that stock markets are inefficient. There are research studies that give explanations to the persistent predictability of stock returns due to the survivorship, statistical and data-snooping, biases (see: (Lo and MacKinlay, 1990; Brown *et al.*, 1992)). Another explanation is presented by Schwert (2003) in line with the Fama (1970;1991;2004) that market inefficiencies are potential shortcomings in the implied asset pricing models. Further, behavioural theorists by using various psychological and sociological behaviours have tried to explain this deviation from efficiency.

The existence of winner-loser anomaly has been confirmed in international data. In a number of European Markets, Bird and Whitaker (2003) document significant return reversals. Additional evidence has been recorded by Dubois and Bacmann (1998) in France, Baytas and Cakici (1999) in Italy, France, UK and Germany, Brouwer *et al.* (1997) for UK, France, Netherlands, and Germany, Schiereck *et al.* (1999) and Stock (1990) in Germany, Forner and Marhuenda (2003) and Alonso and Rubio (1990) in Spain. Apart from the European markets evidence of the contrarian returns throughout the world surfaces from China (Kang *et al.*, 2002; Wang and Xie, 2010) Australia (Lo and Coggins, 2006) New Zealand (Chin *et al.*, 2002) Japan (Chou *et al.*, 2007; McInish *et al.*, 2008) and India (Locke and Gupta, 2009). Finally, Barros and Haas (2008) proved this anomaly in 15 developing markets report significant abnormal returns by applying the contrarian investment strategy. Various studies have been conducted in the developing markets of the world to detect the presence and causes of this anomaly, however, no significant literature is available for Pakistan. This research study for the first time aims to fill this gap. The Pakistani market is still in its phase of transition and its history is full of surprises related to security returns and trading activities. Because this market is not fully developed there is a possibility that fund managers are earning abnormal profits by

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[1] Multiple explanations of the causes for the winner-loser anomaly exist. According to the defenders of the EMH, the reason of the anomalous returns has to do with model misspecification. Fama and French (1996) argue that a multifactor asset pricing model explains the contrarian returns. Conrad and Kaul (1993) claim that measurement errors as well as microstructure biases of the market such as price discreteness, bid-ask bounce and non-synchronous trading causes short term contrarian profits. In UK Clare and Thomas (1995) determine that the overreaction effect is subsumed by the size effect. The behavioral paradigm purports that psychological biases such as herding Kang, Liu and Ni (2002) overreaction Bondt and Thaler (1985) over confidence and noise trading may cause abnormal returns.

following the contrarian strategy. This study incorporates all stocks registered in KSE from 2000 to 2015 to detect the presence of the overreaction effect using Cumulative abnormal return (CAR) adopted by Bondt and Thaler (1985).

The second aspect of this study focuses on the risk-adjusted performance of contrarian strategy using commonly used asset pricing models in line with Schwert (2003) and Fama (1970;1991;2004). Chan (1988) proves CAPM is fully able to explain the profitability of the contrarian returns. According to him, these abnormal returns are a compensation for the additional risk undertaken in this strategy. In the UK contrarian returns are explained by three-factor Fama French model (see: Galariotis *et al.* (2007)). They suggest size and value risk factors drive these abnormal returns. In line with Chan (1988); Clements *et al.* (2009) confirm the disappearance of abnormal returns of the contrarian strategy, when risk factors are accounted. Jordan (2012) provides evidence that a time-varying CAPM explains the profitability of the winner-loser anomaly. On the other hand, several studies such as De Bondt and Thaler (1987); Balvers *et al.* (2000) and Nam *et al.* (2001) establish that risk factors are unable to account for the excess abnormal returns generated by these contrarian strategies. The rest of this study is structured as follows. Section 2 explains the literature review in detail. Section 3 provides the details for the employed dataset and empirical procedure. Section 4 offers the empirical results and Section 5 concludes the study.

2. LITERATURE REVIEW

The winner-loser anomaly was first discovered by Bondt and Thaler (1985); De Bondt and Thaler (1987). According to them, stocks that have performed poorly in the past 3 to 5 years have a tendency to yield excess abnormal returns over the accompanying 3 to 5 years, and vice versa for winner stocks. They incorporated monthly data from the New York Stock Exchange (NYSE) from the time period 1926-1982 and discovered that in the 16 non-overlapping three-year test periods, the loser portfolio outperforms the market by an average of 19.6%. On the other hand, the winner portfolio underperformed the market by almost 5%, indicating 24.6% profitability from the contrarian strategy. The presence of this anomaly rejects the EMH and bring forward plenty of related examination throughout the world. In the similar guidelines, Richards (1997) applied the contrarian methodology on national indices and provided evidence of excess abnormal returns greater than 6%, with this tendency being greater in small capitalization markets. In US Conrad and Kaul (1993); Mun *et al.* (2001); Larson and Madura (2003) and Balvers and Wu (2006) documents significant contrarian returns. Statistically and economically significant returns have been reported in the UK stock market by Mazouz and Li (2007) even after taking into account for time-varying risk, firm size and seasonality. Further evidence of a long-run reversal in the UK has been provided by Power and Lonie (1993); Campbell and Limmack (1997) and Dissanaike (2002).

Often short-run reversals and long-run return reversals are not distinguished. Short run return reversals have been recorded over varying holding periods such as Howe (1986) monthly Lehmann (1990) weekly, Bremer and Sweeney (1988) daily. As observed by Bremer and Sweeney (1988) stocks whose value had fallen by greater than 10% earned returns of 3.95% over the next five consecutive days. Such results were reinforced by Cox and Peterson (1994) who found that after extreme price declines, return reversals were observed for the first three days. Larson and Madura (2003) observed extreme one-day events were caused due to significant overreaction to events. Evidence that considerable one-week reversals remained after taking into account bid-ask spreads and transaction costs were shown by Lehmann (1990). It was also found that a profit was yielded 90% of the time by a one-week contrarian strategy and the unusual returns were most likely the product of investor overreaction or short run illiquidity. This anomaly has also been proved on daily price changes in Japan, Korea and Hong Kong by Schaub *et al.* (2008) and they found that the overreaction phenomena is limited to securities that have a history of poor performance. Following an excessive decline, the indices of the three countries reversed by 35 to 45%. For past winners, no such reversal was documented.

However, all evidence does not exist in support of this anomaly. In the Australian stock market, Allen and Prince (1995) and Brailsford (1992) found no evidence of this anomaly, while a similar conclusion was reached by Kryzanowski and Zhang (1992) for the Canadian stock market.

Multiple explanations of the causes for the winner-loser anomaly exist. According to the defenders of the EMH, the reason of the anomalous returns has to do with model misspecification, which is in turn caused by inaccurate quantification of costs and risks that are involved in executing a contrarian strategy. On the other hand, according to the behavioural paradigm return reversals do in fact exist and remain due to the irrationality of investors which may be caused by cognitive biases such as overconfidence, noise trading, herding and overreaction. January and size effects have also been identified as the root causes of return reversals.

3. DATA AND METHODOLOGY

3.1. Data

The data set is collected through Thomson Reuters DataStream and Karachi Stock Exchange from (Jan 2000-Dec 2015.[2] The unit of analysis is (KSE) all index, both listed/delisted (dead or alive) companies. Mutual Funds, Unit Trust and ADRs have been excluded from this study (see: (Fletcher and Kihanda, 2005; Florackis *et al.*, 2011)). A screening criterion on the sample has been imposed, firms with any missing value for 24 consecutive months have been excluded as the 24-month rank period return is necessary to calculate the CAR statistics. The Number of companies available for the analysis is 655 out of 895 for the period of 2000-2015. The reason to incorporate both dead and alive companies is to avoid the potential survivorship bias (see: Florackis *et al.* (2011)). KSE Value Weighted Index and Pakistan 6-month T-Bills rate are used as proxies for the market returns and the risk-free rate, respectively. To construct Small minus Big (SMB) we use Thomson Reuters DataStream yearly market value (MV). To calculate High minus Low (HML) loading factor following Gregory *et al.* (2001); Hussain (1996) and Lin *et al.* (1999) we have used Thomson Reuters data stream common equity (WC03501) minus total intangibles (WC02649). For investment factor (RMW-robust minus weak) following Fama and French (2016) we used Thomson Reuters data type total asset (WC02999) every year at the end of December 2000-2015. To calculate the profitability factor (CMA-conservative minus aggressive), operating profit (WC01250) minus dividends paid (WC04551), is used. Details on the construction of SMB, HML, RMW and CMA factor loadings are available in the appendix-A.

3.2. Methodology

This research tests for the existence of the winner-loser anomaly in KSE, by adopting the CAR method. The CAR technique is identical to that of Bondt and Thaler (1985) and has two steps. Firstly, firms with a complete set of returns from January 2000 to December 2001 are identified (rank period). Their monthly performance relative to the market is calculated using the following formula:

$$u_{it} = R_{it} - R_{mt} \qquad (1)$$

Where u_{it} is the market-adjusted excess return of stock 'i' in month 't', R_{it} is the monthly continuous return on stock 'i' in month 't', and R_{mt} is the monthly return of Value Weighted KSE All index in month 't'. At the end of the ranking period (December 2001), securities are arranged in ascending order based on their CAR.

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[2] The reason for using this simple period is that KSE data was computerized in 2000 and before that the quality of the data is not good. Further, there are around 40% listed companies with missing data. In 2016 the KSE index merged into Pakistan stock exchange (PSX) therefore our sample period ends in December 2015.

$$CAR_i = \sum_{t=-24}^{0} u_{it} = \sum_{t=-24}^{0} R_{it} - \sum_{t=-24}^{0} R_{mt} \qquad (2)$$

Where, CAR_i is the cumulative market adjusted excess return for stock 'i' over the period from 24 months prior to the start of the test period.

Decile portfolios are constructed based on CAR, with the loser portfolio comprising of 10% stocks with the lowest CAR value and the winner portfolio comprising of 10% stocks with the highest CAR. This process of formation of the winner-loser portfolio is repeated for 24-month non-overlapping periods for the rank periods, 2001-2, 2002-3, 2004-5.....2013-2014. For each of the rank period, a non-overlapping 12, 24 & 36 months test periods for the decile portfolios have been defined. Average CAR of the winner and loser portfolio of the test periods are then calculated using the following formula:

$$ACAR_{Wt} = \frac{1}{n} \sum_{t=1}^{2} \left(\sum_{t=1}^{24} R_{Wit} - \sum_{t=1}^{24} R_{mt} \right) \qquad (4)$$

$$= \frac{1}{n} \sum_{t=1}^{n} \sum_{t=1}^{24} R_{Wit} - \sum_{t=1}^{24} R_{mt}$$

$$= ACRR_{Wt} - CRR_{mt}$$

$$= ACAR_{Lt} = \frac{1}{n} \sum_{t=1}^{n} \left(\sum_{t=1}^{24} R_{Lit} - \sum_{t=1}^{24} R_{mt} \right)$$

$$= \frac{1}{n} \sum_{t=1}^{n} \sum_{t=1}^{24} R_{Lit} - \sum_{t=1}^{24} R_{mt}$$

$$= ACRR_{Lt} - CRR_{mt} \qquad (5)$$

Where $ACAR_{Wt}$ ($ACAR_{Lt}$) is the average cumulated excess return of the winner (loser) portfolio during 't' months in the test period. $ACRR_{Wt}$ ($ACRR_{LT}$) is the average cumulative raw return of the winner (loser) portfolio in month 't'. CRR_{mt} is the cumulative return of the value-weighted market index up to month 't'. Difference between the average cumulative excess returns of the winner and loser portfolios can be defined as

$$DACAR_t = ACAR_{Lt} - ACAR_{wt}$$

$$= ACRR_{Lt} - ACRR_{Wt} \qquad (6)$$

An important point to note here is that the cumulative return of the value-weighted market index will not affect DACAR as it is deducted from both the winner and loser portfolio's return. Thus the hypothesis is to test whether, in the long run, the loser portfolio outperforms and the winner portfolio underperforms the market. That is whether $ACAR_{Wt} < 0$ and $ACAR_{Lt} > 0$, most importantly, is $ACAR_{Lt} - ACAR_{Wt} > 0$. If the winner-loser anomaly holds in the long run then the loser (winner) portfolio will outperform (underperform) the market and investors will be able to generate excess abnormal returns by constructing portfolios based on this contrarian strategy.

We also use the following commonly used asset pricing models to see the risk-adjusted performance of decile portfolios. Firstly, we estimate Jensen alpha from the CAPM:

$$R_{i,t} - R_{ft} = \alpha_{(jensen)} + \beta_{i,MKT}(R_{m,t} - R_{ft}) + \varepsilon_{i,t} \qquad (7)$$

Where: $(R_i,)$ is the return of portfolio 'i' in month t, (R_{ft}) is the risk-free rate for month 't' captured by 6 monthly T-bill rate, (R_m) is the return on market portfolio, captured by Karachi Stock Exchange all index, $(R_m, - R_{ft})$ is the excess market portfolio return in month 't', $(\beta_{i,MKT})$ is the exposure of portfolio 'i' to the (market return). Secondly, we compute the 3-factor alpha the intercept of the Three-factor Fama and French (1996) model:

$$R_{i,t} - R_{ft} = \alpha_{(3-factor)} + \beta_{i,MKT}(R_{m,t} - R_{ft}) + \beta_{i,SMB}SMB + \beta_{i,HML}HML + \varepsilon_{i,t} \qquad (8)$$

Where $\alpha_{(3-factor)}$ is the Fama-French 3-factor alpha, SMB is a size factor, HML is value risk factor, $\beta_{i,SMB}$ and

$\beta_{i,HML}$ are their respective coefficients, which captures the risk sensitivity of size and value factors. Thirdly, we

estimate the 5-factor alpha the intercept of the five-factor Fama and French (2016) model:

$$R_{i,t} - R_{ft} = \alpha_{(5-factor)} + \beta_{i,MKT}(R_{m,t} - R_{ft}) +$$
$$\beta_{i,SMB}SMB + \beta_{i,HML}HML + \beta_{i,RMW}RMW + \beta_{i,CMA}CMA + \varepsilon_{i,t} \qquad (9)$$

Where $\alpha_{(5-factor)}$ is the Fama-French 5-factor alpha, RMW is investment factor, CMA is profitability risk factor,

$\beta_{i,RMW}$ and $\beta_{i,CMA}$ are coefficients, which captures the risk sensitivity of investment and profitability factors.

In order to be able to test for the joint significance of the ten portfolio's alphas and to mitigate the potential errors-in-variable problem. We use a system-based estimation. In particular, we report alphas estimated via the Generalized method of moments (GMM) with Newey-West standard errors corrected for heteroscedasticity and serial correlation (see; Cochrane (2005)). [See Appendix B for GMM explanation]. Apart from the significance of the return differential among the extreme deciles, an interesting question is to what extent an asset pricing model can explain the time series behaviour of CAR sorted portfolios. To evaluate the significance of the model's pricing errors, we test the joint significance of the estimated alphas of all portfolios. To this end, we use a Wald test which is equivalent to Gibbons *et al.* (1989). For every model specification considered, the Wald test rejects the null hypothesis of jointly zero alpha estimates.

4. RESULTS AND DISCUSSION
4.1. Portfolio Characteristics

Table 1 below contains various descriptive statistics for each CAR portfolio for the whole sample period, January 2000- December 2015. The rank periods for these portfolios are 24 months and the test period is 36 months. We first report that there is a significant variation in average CAR across the ten portfolios, showing that CAR is a meaningful sorting criterion. Even though there is no particular size pattern across CAR portfolios, it is important to note that P10 (highest CAR shares) typically contains shares with significantly higher average market value relative to the remaining portfolios. Similarly, even though there is no gradient in the portfolio returns betas, shares in P10 exhibit significantly higher betas than the counterpart shares in portfolio P1 (lowest CAR firms). As a result, according to the mean-variance framework, we would expect P10 to yield a higher average return relative to P1. Instead, the portfolio with the lowest CAR value shares (P1 = -2.71 %p.a. for EW and 14.08 %p.a. for VW , P2 =-5.26 %p.a. for EW and 9.53 %p.a. for VW , P3 = -1.30 %p.a. for EW and 10.95 %p.a. for VW) yield a significantly higher average excess return relative to highest value CAR shares (P10 = -12.60 %p.a. for EW and 10.45 %p.a. for VW , P9 =-2.49 %p.a. for EW and 7.19 %p.a. for VW , P8 = -5.88 %p.a. for EW and 12.35 %p.a. for VW) in panel A with test period 36-months. A similar pattern is evident in both the 24-months and 12 months test

periods. The spread P1-P10 for the case of value- (equally-) weighted returns for a 36-month test period is equal to a statistically significant 3.64% (9.89%) per annum (p.a.). As the test periods are reduced (i.e 24 & 12 months) these spreads disappear. In line with the findings of Mazouz and Li (2007) for the UK market, our study provides strong support for the argument that contrarian anomaly persists in the long run.

4.2. Risk-Adjusted Performance

Table 2 below exhibits the alphas of 10 value-weighted portfolios formed on the basis of CAR. Results show that the contrarian premium we documented in Table 1 panel-A for 36-month test period remains intact even after adjusting for market risk factor of CAPM. The spread strategy P1–P10 yields an abnormal performance of 10.49% p.a. (t-value=1.78) under the CAPM. However, under 3-factorFama and French and 5-factor Fama and French models, the abnormal performance disappears as the alphas become statistically insignificant (7.47% p.a. t-value=0.92 and 4.99% p.a. t-value=0.56). These findings support the argument that the contrarian investment strategy is profitable only in the long run (i.e. 36-months test period) and CAPM fails to explain this anomaly. However, more risk factors like SMB, HML, CMA and RMW are incorporated; the profitability of this investment strategy disappears.

Apart from the significance of the return differential among the extreme deciles, an interesting question is to what extent an asset pricing model can explain the time series behaviour of CAR portfolios. To evaluate the significance of the model's pricing errors, we test the joint significance of the estimated alphas of all portfolios. To this end, we use a Wald test which is equivalent to Gibbons *et al.* (1989). For CAPM, the Wald test rejects the null hypothesis of jointly zero alpha estimates. This result shows that portfolios constructed on the basis of CAR yield abnormal returns that cannot be accounted by CAPM. However large values of Wald statistics for both 3 and 5 factor Fama and French models support the joint hypothesis that there is no difference between the alphas of portfolios formed on CAR 36-month investment strategy. As the test periods are reduced to 24 and 12 months, CAPM, 3-factor and 5-factor Fama French models all explain the profitability of the contrarian anomaly.

Similarly, Table 3 below exhibits the alphas of 10 Equally Weighted portfolios sorted on the basis of CAR. Results show that the contrarian premium, we documented in Table 1 also remains intact even after adjusting for the commonly used risk factors in the long run (i.e. 36-months test period). Specifically, the spread strategy P1-P10 yields an abnormal performance of 10.71% p.a (t-value=2.73) under the CAPM, 12.41% p.a. (t-value=2.42) under the 3-factor Fama and French model and 10.37% p.a. (t-value=1.87) under the 5-factor Fama and French model. It is evident from the results that contrarian strategy is profitable in the long run (i.e. 36 months) and above commonly used asset pricing models fails to explain this anomaly for the 36-month test period. This is further confirmed by the Wald test, which is applied to test the joint significance of Alphas. These results are also inconsistent with the results of VW portfolio returns, where CAPM unable to explain the contrarian profitability for the 36-month test period. However, as the test period is reduced to 24 and 12 months results are different and commonly used asset pricing models used above all explain the profitability of the contrarian anomaly.[3]

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[3] We have also constructed the portfolios on Buy and Hold (BHR) strategy to see contrarian effect. The results are in line with CAR that is contrarian strategies yield higher significant returns only in long run. As we reduce the test rank period profitability of portfolios decrease. BHR results are available on request.

Table-1. Characteristics of CAR with Rank Period = 24 months and Test period = 12,24 & 36 months in Deciles Portfolios of Sample, (2000-2015)

PANEL A: Test Period = 36 months												
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P1-P10**	**T-values**
Average CAR	-1.26	-0.79	-0.55	-0.38	-0.22	-0.06	0.06	0.20	0.45	0.86	-2.12	-131.13**
EW returns, % p.a.	-2.71	-5.26	-1.30	-3.94	-1.00	-11.36	-6.84	-5.88	-2.49	-12.60	9.89	2.70**
VW returns, % p.a.	14.08	9.53	10.95	9.94	13.80	12.60	3.20	12.35	7.19	10.45	3.64	1.61*
MV (Rs-M)	1341.16	3674.75	7836.50	11410.19	6084.48	7361.45	6342.29	10666.12	15297.88	11938.72	-10597.56	-11.83***
CAPM (beta)	0.80	0.83	0.86	0.95	0.87	0.90	0.95	1.05	1.03	1.05	-0.25	1.98***
PANEL B :Test Period = 24 months												
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P1-P10	T-values
Average CAR	-1.21	-0.79	-0.59	-0.40	-0.23	-0.10	0.02	0.20	0.43	0.86	-2.07	-114.43**
EW returns, % p.a.	-3.78	-10.34	1.16	-3.58	0.78	-7.58	-13.20	-5.28	-3.62	-7.80	4.02	0.51
VW returns, % p.a.	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	7.21	0.79
MV (Rs-M)	1304.04	2336.18	4561.01	7781.69	16228.90	6597.80	10088.41	10021.69	12056.35	10699.09	-9395.05	-14.72***
CAPM (beta)	0.89	0.95	1.00	1.05	0.85	0.90	0.85	0.95	1.05	1.10	-0.21	1.74**
PANEL C :Test Period = 12 months												
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P1-P10	T-values
Average CAR	-1.31	-0.89	-0.63	-0.44	-0.27	-0.13	0.00	0.19	0.46	0.90	-2.21	-117.44**
EW returns, % p.a.	4.23	-9.42	-3.24	-2.25	-3.36	-3.60	-9.73	-5.84	-0.60	-2.93	7.16	0.74
VW returns, % p.a.	9.09	-4.15	10.27	14.34	8.03	9.20	0.49	12.12	9.63	17.06	-7.97	-0.79
MV (Rs-M)	971.0	2300.6	4099.5	11322.4	18346.49	1111.11	8820.06	8837.07	13114.21	11111.11	-13352.92	-13.49***
CAPM (beta)	0.95	0.85	0.80	0.90	0.96	0.98	1.00	1.05	1.05	1.02	-0.07	1.90*

The table represents the characteristics of CAR with Rank Period = 24 months and Test Period = 12, 24 & 36 months in deciles portfolios from the period of Jan 2000-Dec 2015. All the shares listed in KSE during this time period are sorted by month (t) in ascending order and then they are divided into 10 portfolios. P1 comprises of firms with the lowest CAR whereas, P10 represents the highest CAR companies. P1-P10 shows the level of the spread between extreme adjacent portfolio which if results in positive significant value shows that the overreaction hypothesis exists in KSE. Equally Weighted (EW) returns are the annualized average monthly returns of EW portfolios. Value Weighted (VW) represents annualized average monthly returns of VW portfolios. MV represents the average market value of shares in each portfolio. CAPM beta shows the sensitivity of market risk which is an estimate of VW returns. The last column shows the t-statistics which represent the significance of each characteristic. Where the single (*) means 10% chance of rejecting the true null hypothesis that there exists no difference in means between the P1 & P10 characteristic. On the other hand, (**) and (***) shows 5% and 1% respectively.

Table-2. Value Weighted Returns of CAR Rank Period = 24 months and Test period = 12,24 & 36 months in Deciles Portfolios of Sample, (2000-2015)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P1-P10	Wald Test
PANEL A :Test Period = 36 months												
CAPM Alpha	14.12	9.69	10.32	11.81	14.02	9.74	10.40	12.65	7.67	3.63	10.49	19.51
	(2.14)	(0.99)	(1.16)	(1.30)	(2.02)	(1.21)	(0.94)	(1.75)	(1.08)	(0.50)	(1.70)*	0.03
Three Factor Alpha	15.16	10.49	10.28	9.64	10.84	14.24	9.13	12.84	11.67	7.69	7.47	12.97
	(1.77)	(0.83)	(0.86)	(0.83)	(1.18)	(1.35)	(0.61)	(1.34)	(1.28)	(0.83)	(0.92)	0.23
Five Factor Alpha	13.10	6.34	4.68	5.88	8.18	11.99	5.21	8.88	9.70	8.11	4.99	6.65
	(1.40)	(0.45)	(0.35)	(0.46)	(0.81)	(1.05)	(0.31)	(0.84)	(0.98)	(0.79)	((0.56)	0.76
PANEL B :Test Period = 24 months												
CAPM Alpha	17.45	3.54	14.25	7.89	12.42	6.67	6.77	11.84	9.18	8.63	8.83	18.42
	(2.05)	(0.43)	(1.75)	(0.96)	(1.86)	(0.89)	(0.94)	(1.60)	(1.30)	(0.80)	(0.92)	0.05
Three Factor Alpha	20.50	8.31	17.19	6.28	11.20	8.79	5.24	10.75	12.95	6.30	14.21	12.97
	(1.85)	(0.79)	(1.56)	(0.59)	(1.25)	(0.91)	(0.56)	(1.11)	(1.42)	(0.43)	(1.09)	0.23
Five Factor Alpha	17.61	5.19	13.70	4.17	9.25	5.86	1.24	6.58	9.35	3.78	13.83	6.25
	(1.44)	(0.44)	(1.16)	(0.36)	(0.97)	(0.53)	(0.12)	(0.60)	(0.93)	(0.24)	(0.98)	0.79
PANEL C :Test Period = 12 months												
CAPM Alpha	3.87	-4.37	10.14	16.03	8.08	10.13	0.49	12.02	10.07	16.78	-12.91	17.30
	(0.34)	(-0.50)	(1.16)	(1.83)	(1.19)	(1.51)	(0.08)	(1.54)	(1.50)	(1.98)	(-1.26)	0.07
Three Factor Alpha	-1.60	-1.55	10.63	13.94	5.78	14.87	0.63	17.57	14.76	18.34	-19.94	14.42
	(-0.11)	(-0.14)	(0.92)	(1.24)	(0.64)	(1.70)	(0.07)	(1.75)	(1.70)	(1.66)	(-1.45)	0.15
Five Factor Alpha	-8.09	-4.52	3.67	10.47	2.06	15.93	-0.84	16.05	13.26	14.30	-22.39	9.58
	(-0.49)	(-0.35)	(0.28)	(0.83)	(0.21)	(1.69)	(-0.09)	(1.46)	(1.41)	(1.19)	(-1.47)	0.48

This table reports the abnormal performance of the decile value-weighted CAR portfolios with Rank Period = 24 months and Test Period = 12, 24 & 36 months in deciles portfolios from the period of Jan 2000-Dec 2015. All the shares listed in KSE during this time period are sorted by month (t) in ascending order and then they are divided into 10 portfolios. P1 comprises of firms with the lowest CAR whereas, P10 represents the highest CAR companies. P1-P10 shows the level of spread i.e. the hedge portfolio which if results in positive significant value show that the overreaction hypothesis does exist in KSE. Portfolios are rebalanced on monthly basis. CAPM alpha is the annualized alpha estimate derived from the Capital Asset Pricing Model. Three-Factor Fama-French alpha is the annualized alpha estimate derived from the Fama-French three-factor model. Five-Factor Fama-French alpha is the annualized alpha estimate derived from the Fama-French five-factor model. T-statistics are reported in parentheses at 1%, 5% and 10% level respectively. The last column reports the chi-square statistic of the Wald test referring to the null hypothesis that the 10 portfolio alphas are jointly equal to zero; p-values are reported below the statistic.

Table-3. Equally Weighted Returns of CAR Rank Period = 24 months and Test period = 12,24 & 36 months in Deciles Portfolios of Sample, (2000-2015)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P1-P10	Wald Test
PANEL A: Test Period = 36 months												
CAPM Alpha	-2.92	-6.51	-1.89	-5.16	-0.76	-12.91	-7.40	-6.13	-2.61	-13.63	10.71	22.59
	(-0.52)	(-0.74)	(-0.30)	(-0.90)	(-0.13)	(-1.42)	(-1.17)	(-1.01)	(-0.42)	(-2.50)	(2.73)***	0.05
Three Factor Alpha	0.35	-2.99	-1.71	-7.84	0.72	-9.31	-7.10	-5.96	-1.32	-12.06	12.41	16.11
	(0.05)	(-0.26)	(-0.20)	(-1.04)	(0.10)	(-0.78)	(-0.87)	(-0.75)	(-0.16)	(-1.71)	(2.42)**	0.09
Five Factor Alpha	-1.51	-7.75	-6.05	-10.82	-1.63	-13.57	-6.53	-8.19	-2.40	-11.88	10.37	17.33
	(-0.19)	(-0.60)	(-0.63)	(-1.29)	(-0.20)	(-1.00)	(-0.73)	(-0.94)	(-0.27)	(-1.52)	(1.87)*	0.08
PANEL B: Test Period = 24 months												
CAPM Alpha	-4.37	-10.56	0.77	-4.21	0.60	-8.51	-14.74	-6.03	-4.04	-8.51	4.14	13.36
	(-0.67)	(-1.50)	(0.12)	(-0.67)	(0.10)	(-1.48)	(-2.43)	(-0.93)	(-0.62)	(-0.94)	(0.49)	0.20
Three Factor Alpha	-1.29	-10.23	1.29	-2.32	0.35	-5.35	-13.31	-4.85	-1.09	-8.46	7.17	5.58
	(-0.15)	(-1.12	(0.15)	(-0.28)	(0.05)	(-0.72)	(-1.68)	(-0.58)	(-0.13)	(-0.71)	(0.64)	0.85
Five Factor Alpha	-3.48	-12.89	-1.52	-3.93	-0.67	-7.68	-15.50	-8.93	-2.74	-10.31	6.83	7.50
	(-0.37)	(-1.26)	(-0.16)	(-0.44)	(-0.08)	(-0.92)	(-1.76)	(-0.96)	(-0.29)	(-0.79)	(0.56)	0.68
PANEL C: Test Period = 12 months												
CAPM Alpha	2.35	-10.72	-4.11	-3.32	-3.03	-4.33	-10.65	-6.23	-0.52	-3.10	5.45	7.63
	(0.24)	(-1.40)	(-0.62)	(-0.54)	(-0.55)	(-0.79)	(-1.70)	(-0.95)	(-0.08)	(-0.45)	(0.53)	0.66
Three Factor Alpha	1.43	-11.09	-1.98	-6.41	-0.90	0.60	-8.61	-3.30	1.97	-2.45	3.88	3.38
	(0.11)	(-1.11)	(-0.23)	(-0.80)	(-0.12)	(0.08)	(-1.07)	(-0.39)	(0.23)	(-0.28)	(0.29)	0.97
Five Factor Alpha	-0.20	-14.97	-5.68	-10.73	-3.62	-0.35	-7.79	-5.70	1.51	-5.10	4.90	5.16
	(-0.01)	(-1.31)	(-0.58)	(-1.21)	(-0.46)	(-0.05)	(-0.87)	(-0.61)	(0.16)	(-0.53)	(0.32)	0.88

This table reports the abnormal performance of the decile equally-weighted CAR portfolios with Rank Period = 24 months and Test Period = 12, 24 & 36 months in deciles portfolios from the period of Jan 2000-Dec 2015. All the shares listed in KSE during this time period are sorted by month (t) in ascending order and then they are divided into 10 portfolios. P1 comprises of firms with the lowest CAR whereas, P10 represents the highest CAR companies. P1-P10 shows the level of spread i.e. the hedge portfolio which if results in positive significant value show that the overreaction hypothesis does exist in KSE. Portfolios are rebalanced on a monthly basis. CAPM alpha is the annualized alpha estimate derived from the Capital Asset Pricing Model. Three-Factor Fama-French alpha is the annualized alpha estimate derived from the Fama-French three-factor model. Five-Factor Fama-French alpha is the annualized alpha estimate derived from the Fama-French five-factor model. T-statistics are reported in parentheses at 1%, 5% and 10% level respectively. The last column reports the chi-square statistic of the Wald test referring to the null hypothesis that the 10 portfolio alphas are jointly equal to zero; p-values are reported below the statistic.

5. CONCLUSION

The overreaction hypothesis proposed by Bondt and Thaler (1985) has attracted a lot of attention from both academic and practitioners. In most studies, overreaction hypothesis has occupied a central place in asset pricing literature. In this regard, results of the CAR method indicate loser portfolios outperform winners in 36 months after portfolio formation in the non-overlapping test period. The EW & VW returns of the hedge portfolio (P1-P10) are 9.89% and 3.64% respectively. For both EW & VW portfolio returns, CAPM fails to explain this anomaly as it rejects the null hypothesis for the 36-month test period. However, as more risk factors like SMB, HML, CMA and RMW of 3-factor and 5-factor Fama and French models are incorporated in the risk-adjusted performance of portfolios formed on CAR, the profitability of contrarian anomaly disappears. It is evident from the t-statistics of the hedge portfolios and the Wald test of EW & VW returns of the test periods of 12 and 24 months that CAPM, 3-factor Fama and French and 5-factor Fama and French models, all explain the profitability of the contrarian anomaly. Therefore, we can conclude that contrarian strategy is profitable only in the long run on KSE and investors can long the portfolios with lowest CAR value shares and short the higher CAR values portfolios.

REFERENCES

Allen, D.E. and R. Prince, 1995. The winner/loser hypothesis: Some preliminary Australian evidence on the impact of changing risk. Applied Economics Letters, 2(8): 280-283. *View at Google Scholar | View at Publisher*

Alonso, A. and G. Rubio, 1990. Overreaction in the Spanish equity market. Journal of Banking & Finance, 14(2-3): 469-481. *View at Google Scholar | View at Publisher*

Balvers, R., Y. Wu and E. Gilliland, 2000. Mean reversion across national stock markets and parametric contrarian investment strategies. Journal of Finance, 5(2): 745-772. *View at Google Scholar | View at Publisher*

Balvers, R.J. and Y. Wu, 2006. Momentum and mean reversion across national equity markets. Journal of Empirical Finance, 13(1): 24-48. *View at Google Scholar | View at Publisher*

Barros, J.L. and J.R. Haas, 2008. Momentum and reversal puzzle in emerging markets. ICFAI Journal of Behavioral Finance, 5(3): 54-71. *View at Google Scholar*

Baytas, A. and N. Cakici, 1999. Do markets overreact: International evidence. Journal of Banking & Finance, 23(7): 1121-1144. *View at Google Scholar | View at Publisher*

Bird, R. and J. Whitaker, 2003. The performance of value and momentum investment portfolios: Recent experience in the major European markets. Journal of Asset Management, 4(4): 221-246. *View at Google Scholar | View at Publisher*

Bondt, W.F. and R. Thaler, 1985. Does the stock market overreact? Journal of Finance, 40(3): 793-805. *View at Google Scholar*

Brailsford, T., 1992. A test for the winner-loser anomaly in the Australian equity market:1958–87. Journal of Business Finance & Accounting, 19(2): 225-241. *View at Google Scholar | View at Publisher*

Bremer, M.A. and R.J. Sweeney, 1988. The information content of extreme negative rates of return. Working Paper, Claremont McKenna College February.

Brouwer, I., J. Van Der Put and C. Veld, 1997. Contrarian investment strategies in a European context. Journal of Business Finance & Accounting, 24(9&10): 1353-1366. *View at Google Scholar | View at Publisher*

Brown, S.J., W. Goetzmann, R.G. Ibbotson and S.A. Ross, 1992. Survivorship bias in performance studies. Review of Financial Studies, 5(4): 553-580. *View at Google Scholar | View at Publisher*

Campbell, K. and R.J. Limmack, 1997. Long-term over-reaction in the UK stock market and size adjustments. Applied Financial Economics, 7(5): 537-548. *View at Google Scholar | View at Publisher*

Chan, K.C., 1988. On the contrarian investment strategy. Journal of Business, 61(2): 147-163. *View at Google Scholar | View at Publisher*

Chin, J.Y., A.K. Prevost and A.A. Gottesman, 2002. Contrarian investing in a small capitalization market: Evidence from New Zealand. Financial Review, 37(3): 421-446. *View at Google Scholar | View at Publisher*

Chou, P.H., K.J. Wei and H. Chung, 2007. Sources of contrarian profits in the Japanese stock market. Journal of Empirical Finance, 14(3): 261-286. *View at Google Scholar | View at Publisher*

Clare, A. and S. Thomas, 1995. The overreaction hypothesis and the UK stock market. Journal of Business Finance & Accounting, 22(7): 961-973. *View at Google Scholar*

Clements, A., M. Drew, E. Reedman and M. Veeraraghavan, 2009. The death of the overreaction anomaly? A multifactor explanation of contrarian returns investment management and financial innovations. Working Paper No. 219, QUT School of Economics and Finance.

Cochrane, J.H., 2005. Asset pricing. New Jersey: Princeton University Press.

Conrad, J., M.N. Gultekin and G. Kaul, 1997. Profitability of short-term contrarian strategies: Implications for market efficiency. Journal of Business & Economic Statistics, 15(3): 379-386. *View at Google Scholar | View at Publisher*

Conrad, J. and G. Kaul, 1993. The returns to long term winners and losers: Bid-ask biases in computed returns. Journal of Finance, 48(1): 39-63. *View at Google Scholar*

Cox, D.R. and D.R. Peterson, 1994. Stock returns following large one-day declines: Evidence on short-term reversals and longer-term performance. Journal of Finance, 49(1): 255-267. *View at Google Scholar | View at Publisher*

De Bondt, W.F.M. and R.H. Thaler, 1985. Does the stock market overreact? Journal of Finance, 40(3): 793-805. *View at Google Scholar*

De Bondt, W.F.M. and R.H. Thaler, 1987. Further evidence on investor overreaction and stock market seasonality. Journal of Finance, 42(3): 557-581. *View at Google Scholar | View at Publisher*

Dissanaike, G., 2002. Does the size effect explain the UK winner-loser effect? Journal of Business Finance & Accounting, 29(1-2): 139-154. *View at Google Scholar | View at Publisher*

Dubois, M. and J.F. Bacmann, 1998. Contrarian strategies and cross-autocorrelations in stock returns. Evidence from France. *View at Google Scholar*

Fama, E. and K. French, 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1): 3-56. *View at Google Scholar | View at Publisher*

Fama, E. and K. French, 2015. A five-factor asset pricing model. Journal of Financial Economics, 116(1): 1-22. *View at Publisher*

Fama, E.F., 1970. Efficient capital markets: A review of theory and empirical work. Journal of Finance, 25(2): 383-417. *View at Google Scholar | View at Publisher*

Fama, E.F., 1991. Efficient capital markets: II. Journal of Finance, 46(5): 1575-1617. *View at Google Scholar | View at Publisher*

Fama, E.F. and K.R. French, 2004. The capital asset pricing model: Theory and evidence. Journal of Economic Perspectives, 18(3): 25-46. *View at Google Scholar*

Fama, E.F. and K.R. French, 1996. Multifactor explanations of asset pricing anomalies. Journal of Finance, 51(1): 55-84. *View at Google Scholar | View at Publisher*

Fama, E.F. and K.R. French, 2008. Dissecting anomalies. Journal of Finance, 63(4): 1653-1678. *View at Google Scholar | View at Publisher*

Fama, E.F. and K.R. French, 2016. Dissecting anomalies with a five-factor model. Review of Financial Studies, 29(1): 69-103. *View at Google Scholar | View at Publisher*

Fletcher, J. and J. Kihanda, 2005. An examination of alternative CAPM-based models in UK stock returns. Journal of Banking & Finance, 29(12): 2995-3014. *View at Google Scholar | View at Publisher*

Florackis, C., A. Gregoriou and A. Kostakis, 2011. Trading frequency and asset pricing on the london stock exchange: Evidence from a new price impact ratio. Journal of Banking & Finance, 35(12): 3335-3350. *View at Google Scholar | View at Publisher*

Forner, C. and J. Marhuenda, 2003. Contrarian and momentum strategies in the Spanish stock market. European Financial Management, 9(1): 67-88. *View at Google Scholar | View at Publisher*

Galariotis, E.C., P. Holmes and X.S. Ma, 2007. Contrarian and momentum profitability revisited: Evidence from the London stock exchange 1964–2005. Journal of Multinational Financial Management, 17(5): 432-447. *View at Google Scholar | View at Publisher*

Gibbons, M.R., S.A. Ross and J. Shanken, 1989. A test of the efficiency of a given portfolio. Econometrica: Journal of the Econometric Society, 57(5): 1121-1152. *View at Google Scholar | View at Publisher*

Gregory, A., R.D. Harris and M. Michou, 2001. An analysis of contrarian investment strategies in the UK. Journal of Business Finance & Accounting, 28(9-10): 1192-1228. *View at Publisher*

Howe, J.S., 1986. Evidence on stock market overreaction. Financial Analysts Journal, 42(4): 74-77. *View at Google Scholar | View at Publisher*

Hussain, S., 1996. Over-reaction by security market analysts: The impact of broker status and firm size. Journal of Business Finance & Accounting, 23(9-10): 1223-1244. *View at Google Scholar | View at Publisher*

Jordan, S.J., 2012. Time-varying risk and long-term reversals: A re-examination of the international evidence. Journal of International Business Studies, 43(2): 123-142. *View at Google Scholar | View at Publisher*

Kang, J., M.H. Liu and S.X. Ni, 2002. Contrarian and momentum strategies in the China stock market: 1993–2000. Pacific-Basin Finance Journal, 10(3): 243-265. *View at Google Scholar | View at Publisher*

Kryzanowski, L. and H. Zhang, 1992. The contrarian investment strategy does not work in Canadian markets. Journal of Financial and Quantitative Analysis, 27(03): 383-395. *View at Google Scholar | View at Publisher*

Larson, S.J. and J. Madura, 2003. What drives stock price behavior following extreme one-day returns. Journal of Financial Research, 26(1): 113-127. *View at Google Scholar | View at Publisher*

Lehmann, B.N., 1990. Fads, martingales, and market efficiency. Quarterly Journal of Economics, 105(1): 1-28. *View at Google Scholar | View at Publisher*

Lin, J.B., J.I. Onochie and A.S. Wolf, 1999. Weekday variations in short-term contrarian profits in futures markets. Review of Financial Economics, 8(2): 139-148. *View at Google Scholar | View at Publisher*

Lo, A.W. and A.C. MacKinlay, 1988. Stock market prices do not follow random walks: Evidence from a simple specification test. Review of Financial Studies, 1(1): 41-66. *View at Google Scholar | View at Publisher*

Lo, A.W. and A.C. MacKinlay, 1990. When are contrarian profits due to stock market overreaction? Review of Financial Studies, 3(2): 175-205. *View at Google Scholar | View at Publisher*

Lo, K. and R. Coggins, 2006. Effects of order flow imbalance on short-horizon contrarian strategies in the Australian equity market. Pacific-Basin Finance Journal, 14(3): 291-310. *View at Google Scholar | View at Publisher*

Locke, S. and K. Gupta, 2009. Applicability of contrarian strategy in the Bombay stock exchange. Journal of Emerging Market Finance, 8(2): 165-189. *View at Google Scholar | View at Publisher*

Mazouz, K. and X. Li, 2007. The overreaction hypothesis in the UK market: an empirical analysis. Applied Financial Economics, 17(13): 1101-1111. *View at Google Scholar | View at Publisher*

McInish, T.H., D.K. Ding, C.S. Pyun and U. Wongchoti, 2008. Short-horizon contrarian and momentum strategies in Asian markets: An integrated analysis. International review of Financial Analysis, 17(2): 312-329. *View at Google Scholar | View at Publisher*

Mun, J.C., G.M. Vasconcellos and R. Kish, 2001. The contrarian/overreaction hypothesis: An analysis of the US and Canadian stock markets. Global Finance Journal, 11(1): 53-72.

Nam, K., C.S. Pyun and S.L. Avard, 2001. The asymmetric reverting behaviour of short-horizon stock returns: An evidence of stock market overreaction. Journal of Banking & Finance, 25(4): 807-824. *View at Google Scholar | View at Publisher*

Power, D.M. and A.A. Lonie, 1993. The overreaction effect: Anomaly of the 1980s? British Accounting Review, 25(4): 325-366. *View at Google Scholar | View at Publisher*

Richards, A.J., 1997. Winner-loser reversals in national stock market indices: Can they be explained? Journal of Finance, 52(5): 2129-2144. *View at Google Scholar | View at Publisher*

Schaub, M., L.B. Song and C.S. Eae, 2008. Overreaction and seasonality in Asian stock indices: Evidence from Korea. Hong Kong and Japan. In Research in Finance. Emerald Group Publishing Limited: 169-195.

Schiereck, D., W. De Bondt and M. Weber, 1999. Contrarian and momentum strategies in Germany. Financial Analysts Journal, 55(6): 104-116. *View at Google Scholar | View at Publisher*

Schwert, G.W., 2003. Anomalies and market efficiency. Handbook of the Economics of Finance, 1: 939-974. *View at Google Scholar*

Stock, D., 1990. Winner and loser anomalies in the German stock market. Journal of Institutional and Theoretical Economics, 146(3): 518-529. *View at Google Scholar*

Wang, C. and L. Xie, 2010. Information diffusion and overreaction: Evidence from the Chinese stock market. Emerging Markets Finance and Trade, 46(2): 80-100. *View at Google Scholar | View at Publisher*

APPENDIX A

Construction of Mimicking Portfolios for *SMB, HML, RMW* and *CMA* Factors:

To construct the portfolios for the Fama-French three-factor model, we followed mimicking portfolio construction used by Fama and French (1993). The size factor data was divided into two sub-groups, small (S) and bid (B) market capitalization firms, by using median as a breakup point and book-to-market equity factor data was divided into three sub-groups, high (H), neutral (N) and low (L) book-to-market equity firms, by using 30th and 70th percentiles as breakup points. The portfolios were made on 2x3 sort; where *SMB* factor is a simple average of returns on small market capitalization portfolios minus big market capitalization portfolios and the *HML* factor is a simple average of returns on high book-to-market equity portfolios minus low book-to-market equity portfolios. On the basis of 2x3 sort of *SMB* and *HML* factors the six portfolios formed, are as under:

SH = *Portfolio of small market capitalization firms and high book-to-market equity ratio firms.*

SN = *Portfolio of small market capitalization firms and neutral book-to-market equity ratio firms.*

SL = *Portfolio of small market capitalization firms and low book-to-market equity ratio firms.*

BH = *Portfolio of big market capitalization firms and high book-to-market equity ratio firms.*

BN =*Portfolio of big market capitalization firms and neutral book-to-market equity ratio firms.*

BL =*Portfolio of big market capitalization firms and low book-to-market equity ratio firms.*

The construction of portfolios for the Fama-French five-factor model, the study used 2x3 sort, used by Fama and French (2015). The size factor and book-to-market factor data were divided into 2 and 3 categories similarly to three-factor model. The profitability factor data was divided into three sub-groups, robust (R), neutral (N) and weak (W) operating profitability firms, by using 30th and 70th percentiles as breakup points. Moreover, the investment factor data were also divided into three sub-groups, conservative (C), neutral (N) and aggressive (A), same as the previous factors by using 30th and 70th percentiles as breakup points. Here, the construction of size factor is different from the three-factor asset pricing model. The size factor (*SMB*) was constructed by subtracting nine portfolios of big stocks from nine portfolios of small stock. On the basis of 2x3 sort, the study formed eighteen portfolios, are as under:

SH = *Portfolio of small market capitalization firms and high book-to-market equity ratio firms.*

SN = *Portfolio of small market capitalization firms and neutral book-to-market equity ratio firms.*

SL = *Portfolio of small market capitalization firms and low book-to-market equity ratio firms.*

BH = *Portfolio of big market capitalization firms and high book-to-market equity ratio firms.*

BN =*Portfolio of big market capitalization firms and neutral book-to-market equity ratio firms.*

BL =*Portfolio of big market capitalization firms and low book-to-market equity ratio firms.*

SR = *Portfolio of small market capitalization firms and robust profitability firms.*

SN = *Portfolio of small market capitalization firms and neutral profitability firms.*

SW = *Portfolio of small market capitalization firms and weak profitability firms.*

BR = *Portfolio of big market capitalization firms and robust profitability firms.*

BN = *Portfolio of big market capitalization firms and neutral profitability firms.*

BW = *Portfolio of big market capitalization firms and weak profitability firms.*

SC = *Portfolio of small market capitalization firms and conservative investment firms.*

SN = *Portfolio of small market capitalization firms and neutral investment firms.*

SA = *Portfolio of small market capitalization firms and aggressive investment firms.*

BC = *Portfolio of big market capitalization firms and conservative investment firms.*

BN = *Portfolio of big market capitalization firms and neutral investment firms.*

BA = *Portfolio of big market capitalization firms and aggressive investment firms*

Construction of Size, Book to Market Value, Profitability and Investment factors is explained as follows.

1 - Size Factor (SMB)

For three-factor asset pricing model, the study follows Fama and French (1993) mimicking portfolio construction and for the five-factor model, we use 2x3 sort of portfolios constructed by Fama and French (2015). The construction of *SMB* factor for three-factor asset pricing model is given in equation as follows:

$$SMB_{i,t} = \frac{(SL+SN+SH) - (BL+BN+SH)}{3}$$

And, the construction of *SMB* factor for five-factor asset pricing model is given in equation as follows:

$$SMB_{(HML)} = \frac{(SL+SN+SH) - (BL+BN+SH)}{3} = \frac{(SL-BL)+(SN-BN)+(SH-BH)}{3}$$

$$SMB_{(RMW)} = \frac{(SR+SN+SW) - (BR+BN+SW)}{3} = \frac{(SR-BR)+(SN-BN)+(SW-BW)}{3}$$

$$SMB_{(CMA)} = \frac{(SC+SN+SA) - (BC+BN+SA)}{3} = \frac{(SC-BC)+(SN-BN)+(SA-BA)}{3}$$

$$SMB_{i,t} = \frac{SMB_{(HML)}+SMB_{(RMW)}+SMB_{(CMA)}}{3}$$

For five-factor asset pricing model, first the study has to construct three size factors by taking weighted averages on the basis of book-to-market, profitability and investment factors than constructing the final size factor for the model by taking an average of all sub-factors, (see Fama and French (2015)).

2 - Book to Market Value Factor (HML)

For both three-factor and five-factor model the construction of *HML* factor is the same which is as follows:

$$HML_{i,t} = \frac{(SH+BH) - (SL+BL)}{2}$$

3 - Profitability Factor (RMW)

For the construction of portfolios for profitability, the study used 2x3 sort also used by Fama and French (2015). The construction formula is given as follows:

$$RMW_{i,t} = \frac{(SR+BR) - (SW+BW)}{2}$$

4 - Investment Factor (CMA)

The construction of investment factor is given as follows:

$$CMA_{i,t} = \frac{(SC+BC)-(SA+BA)}{2}$$

Appendix B

To estimate the Alpha's of the portfolios the following equation is used:

$$R_i, = \alpha_i + \beta_i F + \varepsilon_{i,t} \ (t = 1...T, i = 1...N)$$

Where

R = Excess return on portfolio i in time period t

N = Number of portfolio

T = Time period

F = K * 1 vector of excess return factor portfolio

B = Vector of beta's

This equation assumes that the excess returns of the portfolio are linearly related to its beta's. For simplicity sake the above equation is restated as follows:

$$R_{tx} = \alpha_i + \beta_i(f_t) + \varepsilon(t)$$

Where, $E(\varepsilon t) = 0$ and Cov $(f\ t, \varepsilon t) = 0$ $\qquad\qquad$ t = 1......T

Where $Rtx = \begin{bmatrix} R_1 \\ . \\ . \\ . \\ R_{10} \end{bmatrix}$ is a 10 × 1 vector containing excess return of the ten deciles portfolios, $\alpha = \begin{bmatrix} \alpha_1 \\ . \\ . \\ . \\ \alpha_{10} \end{bmatrix}$ is a 10 ×

1 vector containing the intercept of the model and $\beta = \begin{bmatrix} \beta_1 \\ . \\ . \\ . \\ \beta_{10} \end{bmatrix}$ is the 10 × 1 vector which measures the

sensitiveness of the portfolios to the market portfolio. F is the excess market return and $\varepsilon(t) = \begin{bmatrix} \varepsilon_1 \\ . \\ . \\ . \\ \varepsilon_{10} \end{bmatrix}$ is the error

matrix. Thus the equation can be written as follows:

$$Rtx = \begin{bmatrix} R_1 \\ . \\ . \\ . \\ R_{10} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ . \\ . \\ . \\ \alpha_{10} \end{bmatrix} + \begin{bmatrix} \beta_1 \\ . \\ . \\ . \\ \beta_{10} \end{bmatrix} * [F] + \begin{bmatrix} \varepsilon_1 \\ . \\ . \\ . \\ \varepsilon_{10} \end{bmatrix}$$

Where, $E(\varepsilon t) = 0$ and Cov $(f\ t, \varepsilon t) = 0$

Replacing α and β with θ the above GMM equation will be transformed into the following quadratic equation.

$$g(\theta)^T W_g(\theta), \text{where} \ldots \ldots g(\theta) = (\frac{1}{T}) \sum_{t=1}^{T} Z_t(\theta)$$

The GMM moment's conditions are defined at the true values of α and β as,

$$Z_t(\theta) = \begin{bmatrix} (R_{tx} - \alpha - \beta_{ft}) \\ (R_{tx} - \alpha - \beta_{ft}) \otimes [f_t] \end{bmatrix}$$