Market anomalies and investor behaviour

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Abstract: Market anomalies hint at inefficiency of stock markets. The research on the root cause of market anomalies points from time to time towards investor behaviour. The paper contributes to the research through investigation of the existence and probable source of three key anomalies in Indian stock markets, namely: momentum, size and value anomaly. The paper adopts Jegadeesh and Titman's methodology for finding the existence and Du and Watkin's decomposition technique for exploration of sources. The paper develops different strategies in order to calculate excess returns utilising these anomalies and decomposes the obtained profit to test for the sources. The results obtained point towards multiple sources indicating the role of investor behaviour along with the risk factors as the underlying cause. The overall contribution of the paper is highlighting the inefficiency in Indian stock markets while also pointing towards a certain influence of investor behaviour in Indian equity markets.

Keywords: stock price movement; momentum effect; under and overreaction; investor behaviour.

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1 Introduction

One of the building blocks of efficient market hypothesis (EMH) is random walk hypothesis, i.e., stock prices move in a random fashion and therefore, direction of their movement cannot be predicted. These stocks reflect all available information and are adjusted for risk, offering only normal returns to the investors. However, using a newly found trading rule that can be seen as market anomaly, it is possible for investors to earn above normal returns (Levy, 1967). Market anomaly can be defined as the possibility of predicting movement in the stock market by using publicly available information. The presence of above mentioned anomaly in the market refutes fundamental building block of EMH and therefore, is perceived as evidence of market inefficiency. Literature lists a number of underlying factors for stock market anomalies due to effects of size, value, day-of-the-week, January, weather, momentum and mood. These effects have been studied for their influence on stock price movement, pointing out the rationale for the need and importance of market anomalies for deriving above normal returns. Handful of them have also attempted to find sources of these effects in order to reinforce the claim of EMH failure.

These stock market anomalies should stand out valid for the out-of-sample tests, also for developing markets along with developed markets, to get accepted as evidence of failure of the EMH (Fama, 1998). As per a 2018 report by Morgan Stanley, Indian equity market is one of the largest emerging markets after China with an investor base of more than 50 million and market capitalisation in upward of $2.3 trillion. Indian equity market is also the fastest growing in Asia at 10.1% CAGR and will approach or surpass some of the developed equity markets such as Australia and Japan by 2027. This large investor base and market size present a potential for research in the area of market anomalies and

their impact on stock returns. This would strengthen the existing literature in Indian equity markets by providing evidence on stock market anomalies from a developing market. The aim of this study is to test the presence of market anomalies and identify their sources in context to Indian markets that derive the relevance from behavioural biases of investors.

2 Literature review

There exist two differing approaches on reaction of a stock to its past returns. First is Mean Reversion (Poterba and Summers, 1988), i.e., recent past stock returns reverting to mean. This is a fundamentalist approach and comes from the concept of market efficiency, advocating that stocks with recent high past returns will observe the process of mean reversion in their prices in the longer horizon. Reason for this, as explained through EMH, is that stock returns always revert to their mean completely reflecting available information on their prices. On the contrary, another approach is momentum effect, i.e., persistence of recent past performance of stocks. This viewpoint diverts from EMH and suggests that stocks continue to follow their recent past performance for a short period of time, irrespective of the available information. This effect has its roots in behavioural finance, with reasonable justification from literature such as under-reaction to information (conservatism bias) (Campbell and Shiller, 2001; Barberis et al., 1998), anchoring bias (Mullainathan and Thaler, 2000) and social bias (Shiller, 2003). Other than momentum effect, the size and value effect are equally popular and often quoted along with momentum when anomalies are used as an evidence of behavioural influence on market movement. Size effect is the differential movement of prices of stocks that belong to different size groups (have different market capitalisation) and value effect is differential price movement of value stocks (high book-to-market ratio) and growth stocks (low book-to-market ratio).

A variety of anomalies in the performance of stock markets have been uncovered in the literature. These anomalies are consistent tendencies for certain classes of securities to outperform (or underperform) the stock market averages (Dimson, 1988). These anomalies are observed in stock markets of different countries using underlying factors such as calendar, season, day-of-the-week, size, value and momentum (De Bondt and Thaler, 1987; Kato and Schallheim, 1985; Barone, 1990; Levis, 1989; Thaler, 1987; Cao and Wei, 2005; Narayan and Zheng, 2010; Collins and Hribar, 2000; Agrawal and Tandon, 1994). Returns from momentum effect are earned by going long in winner portfolio and short in loser portfolio of stocks, ranked on the basis of recent past returns (Jegadeesh and Titman, 1993). There is extensive international evidence on existence of momentum profits for the duration of 3 to 12 months (Rouwenhorst, 1998; Chan et al., 2000; Moskowitz and Grinblatt, 1999; Hong et al., 2000; Lee and Swaminathan, 2000; Jegadeesh and Titman, 2001; O'Donnell and Baur, 2009; Chui et al., 2000; Sehgal et al., 2012; Sehgal and Jain, 2011, 2015; Ansari and Khan, 2012). Number of studies has also explained momentum profits. The studies by Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999) suggested that the investor's underreaction or delayed overreaction to the information being the reason for these effects. Lo and MacKinlay (1990) put forth lead-lag relationship between securities as a cause and Conrad and Kaul (1998) attributed momentum profits to risk.

Empirical evidences on sources of momentum anomaly highlighted variety of sources. Jegadeesh and Titman (1993) rejected the proposition of risk or a reaction to common firm specific factors and thus, suggested behavioural factors as a possible source. Conrad and Kaul (1998) suggested that CAPM and Fama-French three factor models do not account for all the risk in the stock markets. Therefore, rejecting risk as a possible source only on the basis of CAPM and Fama-French adjusted profits deemed to be incorrect. They further proposed that if expected returns are assumed to be time invariant then unconditional mean returns of stocks can be used as estimators of their true expected returns. Based on the same assumptions Conrad and Kaul (1998) and Bulkley and Nawosah (2009) through simulation, found that momentum can be explained by cross-sectional dispersion in mean returns, i.e., risk of the stocks. Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999), suggested positive serial correlations showing the under reaction or delayed overreaction as the main cause of momentum profits. Lo and MacKinlay (1990), resorted to the lead-lag relationship and put forth cross-serial correlations as the main cause. Jegadeesh and Titman (2002) refuted Conrad and Kaul (1998) suggesting that they failed to take small sample bias into account and if unbiased empirical tests are performed cross-sectional then dispersion in risk explains no or very little of momentum, pointing towards the possible role of investor behaviour. Bhootra (2011) similarly refuted Bulkley and Nawosah (2009) claiming that there exists microstructure bias in their empirical methods. Following the lines of Jegadeesh and Titman (2002), Bhootra (2011) also suggested behavioural factors as a source of momentum profits. Du (2012) used Du and Watkins's (2007) decomposition technique and found that US markets unconditional mean dispersions does explain momentum profits partly, and a reasonable portion of momentum profits can be explained by cross serial correlation. However, they found presence of negative cross-serial correlations and suggested that a reaction to firm specific information does not seem to affect future returns positively.

Gutierrez and Kelley (2008) motivated by all the controversy surrounding momentum profits attempted to re-examine them and suggested that they found significant long lasting momentum in weekly and monthly returns immediately after a brief reversal. Following these findings, Du and Watkins for their industry wise momentum profits and Du for their one month and six-month momentum profits, adopted a different decomposition technique to find out sources of momentum once again. This new technique was unbiased and could be applied to the decile-based strategy by Jegadeesh and Titman (1993). Chui et al. (2000) studied developing Asian markets and found evidence of momentum effect. Concentrating only on Indian stock market in short-term, Sehgal and Balakrishnan (2002) found evidence of momentum and also concluded that reversal in long-term returns happen in and around a year from ranking period. Talking about strong presence of momentum-based profits Sehgal and Jain (2011) also studied momentum-based strategies in Indian stock markets. This study was further supported by Ansari and Khan (2012), where they propagated that this momentum profit relates to the idiosyncratic part of stocks and therefore, imparts support to the role of behavioural factors. Misra and Mohapatra (2014) discussed momentum in stock index and also investigated the factors contributing in generation of momentum. They used different econometric techniques studying the response of momentum towards various firm specific factors as well as risk factors based on CAPM and four-factor model by Chordia and Shivakumar (2006). Garg and Varshney (2015) also found strong presence of

momentum effect, however in medium term, establishing it as an evidence for weak form of market efficiency in Indian stock markets. Sehgal et al. (2012) took this in another direction and found size and momentum effect in India, challenging rational asset pricing models.

Size and value profits are the profits achieved by taking different (long and short) positions in stocks that are qualified as small and big and growth and value respectively. These profits are linked directly to the differential price movements between small and big stocks; and between growth and value stocks. Size anomaly was first noticed by Banz (1981), when he found that stocks of small firms give higher average returns. Rouwenhorst (1999) observed significant size effect by examining portfolio of stocks from 20 different countries. There are other studies that have observed size effect across the globe proving that the above normal returns related to size effect are not restricted to a particular sector or market. Chan and Chen (1991) found that risk associated with smaller companies is a possible source for these above normal returns. Fama and French (1993) associated the size effect to business risk. Amihud and Mendelson (1986) have proved through their research that liquidity counts for size effect in the US market. Keim (1983) observed that most of the size effect is limited to the month of January and can therefore, be linked to the January effect. Studies dedicated only on Indian stock markets have also found the presence of size effect (Sehgal et al., 2014) and also found the business cycle factors, as the source of size effect (Pandey and Sehgal, 2016).

Value anomaly was first noticed by De Bondt and Thaler (1985) in their research when they found differential returns for the portfolio differing in stocks based on value. Instances of differential returns linked with the value of stocks were also found by Lakonishok et al. (1994) and Asness et al. (2013). Fama and French (1993) utilised value effect in their research as a representation of business risk.

Above literature establishes size, value and momentum anomalies and their effects on stock markets predominantly focusing on both developed as well as emerging markets. However, other anomalies are also investigated. In one such study Dash and Mahakud (2015) have identified market anomalies for predictability of stock returns and their role in asset pricing to investigate the alternative stock pricing model. In the same regard Amarnani and Vaidya (2014) have observed calendar anomalies in Indian markets finding the absence of day-of-the-week and month-of-the-year effect and the presence of turn-of-the-month effect. Another study by Raj and Kumari (2006) has investigated seasonal stock market anomalies and concluded their absence in Indian stock markets. However, Bodla and Kiran (2006) observed the presence of two seasonal anomalies (turn of the month effect and semi-monthly effect) in India but not in the USA. The presence of day-of-the-week stock market anomaly has also been observed in emerging Asian stock markets – India, Indonesia, Malaysia, the Philippines, South Korea, Taiwan and Thailand – concluding its significant effect on both return and volatility (Choudhary and Choudhary, 2008). Similarly, another study by Singh (2014) investigated day-of-the-week and month-of-the-year stock market anomalies in BRIC markets and concluded that except China, all other BRIC country markets are efficient.

There are large numbers of studies concentrating on developed markets. Similarly, studies on emerging and Asian markets are present but very few in numbers. Indian markets, being one of the largest emerging markets, offer an opportunity to present out-of-sample evidence in favour of EMH failure as warranted by Fama (1998). The paper attempts to present one such evidence from Indian stock market through investigation of size, value and momentum anomalies. The paper also presents

behavioural finance as a possible explanation for the inefficiency through identification of underlying sources of the above three anomalies. To carry out this study the following methodology has been adopted.

3 Methodology

First the existence of anomaly related profits in Indian equity markets is studied by applying different strategies such as 3/3, 3/6, 3/12, 6/3, 6/6 and 6/12, with and without skipping a month between ranking and holding period for momentum profits and 1/1 strategy for size and value related profits. In the above backdrop and the quest to find sources of the anomalies, this paper attempts to test for risk as a possible source by finding risk adjusted profits using CAPM and Fama-French three and five factor models and further using Du and Watkins (2007) decomposition technique to find possible sources of size, value and momentum anomalies in Indian capital markets.

3.1 Testing for momentum profits

The calculated returns have been utilised in executing the momentum strategies in this study. The strategies are termed as *R*/*H* strategy in which *R* represents months of ranking period and *H* represents months of holding period. At the beginning of each time period, all the stocks are ranked and sorted in descending order on the basis of past *R* month's average returns. Then decile are formed from the sorted list, so that upper decile consisting of stocks with highest returns forms winner portfolio and bottom decile having stocks with lowest returns forms loser portfolio. After that, loser portfolio is sold and winner portfolio is bought forming a zero cost investment portfolio which is held for the next *H* months. The process is repeated for the entire period, i.e., January 1998 to October 2015. This period is identified as per the availability of the sources. To increase the accuracy of our strategies and avoid overlapping returns, calendar time methodology utilised by Jegadeesh and Titman (1993) has been employed. Under this methodology, at the beginning of each month t stocks are ranked and held for next *H* months, in such a manner that at any given point of time we have *H* overlapping winner and loser portfolios, ranked from $t - 1$ to $t - H$ months. At the end of study period, returns of both winner and loser portfolios are calculated by taking equally weighted average across all months. Following this the profit which is long minus short (LMS) is calculated as net of winner (long) and loser (short) portfolio returns.

3.2 Testing for size and value profits

The strategy that has been applied for finding size and value linked profits is similar to the above mentioned momentum-based strategy with few key differences. The first difference between the strategies is that the ranking is done on the basis of market capitalisation for size and book-to-market ratio for value-based strategy. The second difference is that the sorting and ranking is done differently and the holding strategy that has been employed is also somewhat different. For size-based portfolio, the stocks are sorted in ascending order of market capitalisation instead of descending order that has been used for momentum-based strategy. For value-based strategy, the stocks are sorted

in descending order of book-to-market ratio of the stocks. After sorting, the ranking has been done for the past one month data and following that the same decile-based strategy has been employed for constructing winner and loser portfolios in such a manner that stocks lying in the upper decile are part of the winner portfolio and bottom decile are part of the loser portfolio. Post that long and short positions are held in winner and loser portfolios respectively and these positions are held for one month and for monthly percentage returns, LMS profits are calculated. Using the calendar time methodology, the process was repeated month after month for the entire time period under research. At the end of the period, average of all the LMS returns have been taken to arrive at the profit or loss from the strategy.

To test for presence of size and value anomaly related profits in short horizon, in Indian capital markets, only 1/1 month strategy has been adopted. The reason for using only 1/1 month strategy is that unlike stock returns the statistic for both size (market capitalisation) and value (book-to-market ratio) does not exhibit a trend and is company specific to a certain extent. Thus, these statistics are not totally independent of external forces and are updated because of market as well as company specific factors. Therefore, the effect of these statistics (if existent) on stock prices is only short lived and dies down very quickly.

3.3 Finding sources of market anomalies

Having tested for the presence of anomalies in Indian stock markets, the paper further attempts to find possible sources of these market anomalies. As evident from the primary research around the globe, there are three different possible sources of these anomalies – one is dispersion in unconditional mean that is attributable to risk, second is serial correlation, i.e., auto co-variances between stocks present return and past returns attributable to the under reaction or delayed overreaction to the firm specific information, and third is cross serial correlation, i.e., co-variances between stocks present return and other stocks past returns attributable to the lead-lag relationship. In literature, different researchers suggest different sources as the main cause for this. The paper tests the sources in two phases: first by testing the effect of risk as a possible source and second by employing a technique adopted from Du and Watkins (2007) for decomposing profits obtained from all three strategies into different sources. This technique is preferred because it is free from small sample and micro-structure biases and is rightly applicable to the decile-based strategies employed in the paper for finding the profits linked to momentum, size and value anomalies.

3.4 Testing risk as a possible source

CAPM and Fama-French three and five factor models are popular for calculating expected returns based on different market risks. In order to test for risk as a possible source; CAPM and Fama-French three and five factor adjusted profits have been calculated and tested for the significance using Newey-West HAC standard error t-ratios. The CAPM adjusted returns are calculated by regressing LMS profits with excess market return to find CAPM beta or risk factor using equation (1) and then removing the effect of market risk from LMS profits using equation (2).

$$LMS_t = const + \beta_m M_t + \varepsilon_t \tag{1}$$

where M_t = excess market return at time t and β_m = CAPM beta or market risk

$$LMS_{adj} = LMS_t - \beta_m M_t \tag{2}$$

Similarly Fama-French three factor and five factor adjusted returns are calculated using equations (3), (4), (5) and (6), shown below.

$$LMS_t = const + \beta_m M_t + \beta_s SMB_t + \beta_v HML_t + \varepsilon_t \tag{3}$$

where

M_t excess market return at time t

SMB_t small minus big (Fama-French size factor based on market capitalisation) at time t

HML_t high minus low (Fama-French value factor based on book-to-market ratio) at time t.

Also, β_m, β_s and β_v are risk factors for market, size and value respectively.

$$LMS_{adj} = LMS_t - \beta_m M_t - \beta_s SMB_t - \beta_v HML_t \tag{4}$$

$$LMS_t = const + \beta_m M_t + \beta_s SMB_t + \beta_v HML_t + \beta_r RMW_t + \beta_c CMA_t + \varepsilon_t \tag{5}$$

$$LMS_{adj} = LMS_t - \beta_m M_t - \beta_s SMB_t - \beta_v HML_t + \beta_r RMW_t - \beta_c CMA_t \tag{6}$$

3.5 Decomposition of profits

Considering a general strategy with R months ranking period and H months holding period, there are H portfolios under consideration at any given point of time. DW notes the similarity between Lo and MacKinlay (1990) and Jegadeesh and Titman (1993) strategies and suggests that Jegadeesh and Titman (1993) profits should depend on:

- positive auto-covariance between the month-t return and the lagged H-month return
- negative cross-serial covariance at the same horizon
- dispersion in mean returns.

As per Jegadeesh and Titman (1990) strategy, expected profit in month t, $E(LMS_t)$ can be written as:

$$E(LMS_t) = E\left[\frac{1}{n}\left(\sum_{i=1}^{n} L_{i,t} - \sum_{i=1}^{n} S_{i,t}\right)\right] \tag{7}$$

where n is the number of winners (losers) in each month, $L_{i,t}$ is the return of a winner asset in the investment period, and $S_{i,t}$ is the return of a loser asset in the investment period.

The direct decomposition of portfolio returns into the three aforesaid components appears very difficult. However, DW suggest a turnaround for this problem, by first decomposing individual asset returns ($L_{i,t}$ and $S_{i,t}$) into three components and then

utilising equation (7) to get the components for portfolio return. For this purpose, the following DW suggested regression equation is used:

$$r_{i,t} = \mu_i + \rho_i r^k_{i,t-1} + \varepsilon_{i,t} \tag{8}$$

where $r_{i,t}$ the return of asset i in month t, μ_i is the unconditional mean of asset i, $r^k_{i,t-1}$ is the cumulative return of asset i from month $t - k$ to $t - 1$, and $\varepsilon_{i,t}$ is a zero-mean disturbance term. ρ_i by construction is the auto-correlation co-efficient between the month-t return and the lagged k-month return (i.e., $\rho_i = \text{cov}(r_{i,t}, r^k_{i,t-1} / \text{var}(r^k_{i,t-1}))$.

As DW suggests, because μ_i is the unconditional mean of asset i, μ_i represents the return component due to the unconditional mean. Because ρ_i is the auto-correlation coefficient between the month-t return and the lagged k-month return, $\rho_i r^k_{i,t-1}$ represents the return component due to the auto-covariance between the month-t return and the lagged k-month return. $\varepsilon_{i,t}$ is net of the effects of the unconditional mean and auto-covariance between the month-t return and the lagged k-month return. Therefore, as Durbin-Watson suggests, $\varepsilon_{i,t}$ can be associated to the cross-serial co-variances among assets that are not included explicitly in the model but are intrinsically present in the calculated returns.

Thus, according to DW an asset return can be seen as consisting of three components for the purpose of profit decomposition,

$$r_{i,t} = R_i + A_{i,t} + C_{i,t} \tag{9}$$

where $A_{i,t} = \rho_i r^k_{i,t-1}$ and $C_{i,t} = \varepsilon_{i,t}$. $A_{i,t}$ is the return component due to the auto-covariance and $C_{i,t}$ is the return component due to the cross-serial co-variances among assets. Though, $\varepsilon_{i,t}$ may contain effects of other sources of profits, it can be seen as a component due to cross-serial covariances. On applying equation (9) decomposition strategy to equation (7) we get,

$$L_{i,t} = R^W_i + A^W_{i,t} + C^W_{i,t} \tag{10}$$

$$S_{i,t} = R^L_i + A^L_{i,t} + C^L_{i,t} \tag{11}$$

DW then decomposes profits into three components utilising equations (7), (10) and (11) as follows:

$$E(LMS_t) = R + A + C \tag{12}$$

where

$$R = E\left[\frac{1}{n}\left(\sum\nolimits_{i=1}^{n} R^W_i - \sum\nolimits_{i=1}^{n} R^L_i\right)\right], A = E\left[\frac{1}{n}\left(\sum\nolimits_{i=1}^{n} A^W_i - \sum\nolimits_{i=1}^{n} A^L_i\right)\right],$$

$$C = E\left[\frac{1}{n}\left(\sum\nolimits_{i=1}^{n} C^W_i - \sum\nolimits_{i=1}^{n} C^W_i\right)\right].$$

Therefore, the underlying return-generating process for selected stocks (i.e., winners and losers) can be written as:

$r_{i,t}$ = Unconditional mean dispersion + return predicted by its own past return
+return predicted by past returns on other stocks

From equation (12), it can be observed that the decomposed measures R, A and C are dependent only on the estimates of net returns and not on the cross-sectional measures R_i, $A_{i,t}$ and $C_{i,t}$. Therefore, an advantage of using DW technique is such that it only requires expected return estimator to be unbiased and not for the cross-sectional variance of sample mean returns to be an unbiased estimator of the cross-sectional variance of true expected returns; thus, enabling an unbiased decomposition of profits.

3.6 Data

Stock price, market capitalisation and book-to-market ratio of 500 companies comprising BSE 500 index has been taken from BSE archives. Reason for taking these companies is that they cover almost all major industrial sectors and account for majority of the trading volume in Indian capital markets, thus providing us with a representative picture of the stock market. Monthly returns have been calculated for all companies for the period of January 1998 to October 2015. Only stocks with available past R months' returns qualify for the R/H strategy applied.

4 Analysis and findings

4.1 Momentum profits

To test the presence of momentum in stock returns in short horizon, in Indian capital markets, six short-term strategies have been employed. Strategies are, 3/3, 3/6, 3/12, 6/3, 6/6 and 6/12. The empirical findings of the raw momentum profits obtained under each strategy are listed in Table 1 (without skipping a month between ranking and holding period) and Table 2 (with skipping a month between ranking and holding period) along with their t-ratios in brackets. The t-ratios are calculated based on Newey-West HAC standard errors with lag value set to 12, to test the statistical significance of our resultant profits.

It can be observed from Tables 1 and 2 that out of the 6 strategies employed (without skipping and with skipping a month between ranking and holding period) 6/3 strategy is the most successful with 1.616% and 1.484% monthly returns respectively. Thus, the most profitable strategy, i.e., 6/3 strategy, realises compounded excess annual returns of 19.32% and 17.45% respectively without skipping and with skipping a month between ranking and holding period. These returns are 7% and 5% more than those obtained by Jegadeesh and Titman (1993) using 6/6 strategy without skipping a month, 13% and 11% more than those obtained by Ding Du using 6/6 strategy without skipping a month and 4% and 2% more than those obtained by Sehgal and Jain (2015) using 6/6 strategy without skipping a month. However, these studies are from different time period. The annualised returns from 6/6 strategy without skipping a month were 1.2% less than Sehgal and Jain (2015). This shows that the strategy 6/3 is superior to the widely used 6/6 strategy, which implies that though the sentiment builds over the similar time horizon of

six months, it prevails for shorter time-horizon of three months than previously accepted six months.

The remaining strategies that had been employed, also yielded excess returns, ranging from 0.705% to 1.259% for strategies without skipping a month and from 0.531% to 1.154% for strategies with skipping a month. The finding suggests that momentum effect is present in Indian Stock markets and making profits using momentum-based strategy is probable irrespective of the above referred strategies even though the actual return varies a lot from strategy to strategy.

It can also be observed from Tables 1 and 2 that the strategies with shorter holding period, i.e., 3 months are more profitable than the strategies with longer holding periods like 6 and 12 months in each of the ranking group. Returns from the strategies with 12 months holding period are statistically insignificant as observed from their t-values, 1.86 and 1.44 for 3/12 strategy (without and with skipping a month respectively) and 1.46 and 1.15 for 6/12 strategy (without and with skipping a month respectively). This shows that the profits not only decreases but becomes statistically insignificant moving towards longer horizon of 12 months and more. The higher returns for a shorter horizon of three months holding that decreases and become insignificant on moving towards longer horizon of 12 months, point towards a possible behavioural influence. It can also be observed that strategies with skipping a month yielded lower returns to their respective strategies without skipping a month. This suggests that the time taken by momentum effect to overcome contrarian effect was less than 4 weeks in Indian stock markets as against the findings of Chan et al. (1996).

Table 1 Returns using momentum strategy (without skipping a month)

	3/3 months	*3/6 months*	*3/12 months*	*6/3 months*	*6/6 months*	*6/12 months*
Long	0.02966	0.02969	0.028	0.032	0.03084	0.02781
	(3.67)	(3.51)	(3.53)	(3.4)	(3.29)	(3.29)
Short	0.01815	0.01937	0.02094	0.01584	0.01825	0.02047
	(2.12)	(2.48)	(3.17)	(1.93)	(2.46)	(3.2)
LMS	0.01151	0.01032	0.00705	0.01616	0.01259	0.00734
	(2.95)	(2.56)	(1.86)	(2.86)	(2.12)	(1.46)

Note: *Values in brackets signify t-ratios tested at 5% level of significance.

Table 2 Returns using momentum strategy (with skipping a month)

	3/3 months	*3/6 months*	*3/12 months*	*6/3 months*	*6/6 months*	*6/12 months*
Long	0.02846	0.0283	0.02654	0.03087	0.03001	0.02658
	(3.37)	(3.31)	(3.37)	(3.23)	(3.14)	(3.2)
Short	0.01831	0.01903	0.02123	0.01602	0.01846	0.02094
	(2.17)	(2.47)	(3.24)	(1.98)	(2.49)	(3.26)
LMS	0.01015	0.00927	0.00531	0.01484	0.01154	0.00563
	(2.82)	(2.21)	(1.44)	(2.58)	(1.84)	(1.15)

Note: *Values in brackets signify t-ratios tested at 5% level of significance.

4.2 Size and value related profits

To test the presence of size and value anomaly related profits, in Indian stock markets, 1/1 month strategy has been employed. Empirical findings of the strategy, in terms of monthly return profit percentage, for both size and value anomaly is listed in Table 3. The profits are listed along with their t-ratios in brackets that are calculated based on Newey-West HAC standard errors. The obtained profits for size and value anomaly, 0.484% and 1.30% respectively, are not as high when compared to the momentum profits, 1.616% and 1.484% respectively for 6/3 strategy without and with skipping a month. This shows that the size and value anomaly are not the dominant ones, with size being the least dominant of the three anomalies. The excess return realised using the size-based strategy indicates the presence of size effect in Indian stock markets which is in congruence with Dash and Mahakud (2015) and Pandey and Sehgal (2016). However, the size-based return was statistically insignificant at 5% level of significance, which shows that it is difficult to gain excess returns using size differential. As far as value anomaly is concerned, the profit is substantially high at 15.6% annually and statistically significant as may be observed from Table 3. This confirms the presence of value effect in Indian stock markets. However, since both the strategies yielded a positive profit, there was a need for further examination of these profits to test for the sources of size and value effect.

Table 3 Returns using size and value-based strategy (without skipping)

	Strategy	*Return %*
LMS (size)	1/1 months	0.484349
		(1.19)
LMS (value)	1/1 months	1.3036
		(2.42)

Note: *Values in brackets signify t-ratios tested at 5% level of significance.

4.3 Risk as a possible source

LMS profits for all three strategies (momentum, size and value) were regressed, first with excess market returns to obtain CAPM beta, then with excess market returns, SMB returns and HML returns to obtain Fama-French three factor betas and finally, also with Fama-French profitability and investment factors to obtain Fama-French five factor betas. After finding betas, the adjusted LMS returns and their t-ratios were calculated as per equation (2). The data on SMB, HML and excess market returns was sourced from IIM A working paper number 2013-09-05 (Agarwalla et al., 2014) and excess market returns for RMW and CMA from Balakrishnan et al. (2018). However, size and value related LMS profits are not regressed with profitability and investment factors because the returns obtained for five factors are already doubly sorted on size. To further avoid redundancy, the size and value factors are also not regressed with themselves while calculating three factor adjusted profits. Details of the results obtained without skipping and with skipping are respectively shown in Tables 4, 5 and 6.

It can be observed from Tables 4 and 5 that momentum profits on adjusting for risk in CAPM model and Fama-French three factor model respectively, are getting reduced by 29.02% and 36.07% for 6/3 strategy without skipping a month and by 15.83% and 17.92% for 6/3 strategy with skipping a month. As far as other strategies (without and with skipping a month) are concerned, the change in profits ranges from a reduction of 10.24% and 7.97% respectively, to an increase of 14.24% and 19.7% respectively for CAPM risk adjustment; a reduction of 23.74% and 22.70% respectively to an increase of 12.07% and 20.69% respectively for Fama-French three factor risk adjustment; and a reduction of 19.7% and 0.67% to an increase of 7.73% and 15.76% respectively for Fama-French five factor risk adjustment. The above analysis reveals that in Indian stock market, adjusting for the risk did not reduce the derived profits much, which should have been the case as per fundamental explanation. These findings are in confirmation with the findings of Du (2012), Sehgal and Jain (2015) and Dash and Mahakud (2015).

Table 4 Risk adjusted momentum profits (without skipping)

	3/3 months	*3/6 months*	*3/12 months*	*6/3 months*	*6/6 months*	*6/12 months*
LMS	0.01151	0.01032	0.00705	0.01616	0.01259	0.00734
(Raw)	(2.95)	(2.56)	(1.86)	(2.86)	(2.12)	(1.46)
LMS	0.01315	0.00978	0.00707	0.01147	0.01130	0.00599
(CAPM adjusted)	(3.1)	(2.43)	(2.07)	(1.99)	(2.07)	(1.34)
LMS	0.01290	0.00878	0.00679	0.01033	0.00960	0.00458
(Three factor adjusted)	(3.08)	(2.25)	(2.08)	(1.85)	(1.87)	(1.09)
LMS	0.0124	0.00828	0.00629	0.00983	.0091	.00408
(five factor adjusted)	(2.61)	(2.25)	(1.64)	(1.85)	(1.545)	(1.07)

Note: *Values in brackets signify t-ratios tested at 5% level of significance.

Table 5 Risk adjusted momentum profits (with skipping)

	3/3 months	*3/6 months*	*3/12 months*	*6/3 months*	*6/6 months*	*6/12 months*
LMS	0.01015	0.00927	0.00531	0.01484	0.01154	0.00563
(Raw)	(2.82)	(2.21)	(1.44)	(2.58)	(1.84)	(1.15)
LMS	0.01215	0.00998	0.00598	0.01249	0.01062	0.00471
(CAPM adjusted)	(3.49)	(2.46)	(1.79)	(2.3)	(1.94)	(1.09)
LMS	0.01225	0.00971	0.00597	0.01218	0.00892	0.00332
(Three factor adjusted)	(3.45)	(2.44)	(1.84)	(2.29)	(1.74)	(0.81)
LMS	0.01175	0.00921	0.00547	0.01168	.00842	0.00282
(Five factor adjusted)	(2.16)	(2.28)	(1.56)	(2.21)	(1.48)	(0.462)

Note: *Values in brackets signify t-ratios tested at 5% level of significance

Table 6 Risk adjusted size and value related profits

	Size	*Value*
LMS	0.484349	1.3036
	(1.19)	(2.42)
LMS (CAPM adjusted)	0.367298	1.085797
	(0.97)	(2.11)
LMS (two factor adjusted)	0.112155	0.914955
	(0.28)	(1.31)

Note: *Values in brackets signify t-ratios tested at 5% level of significance.

Furthermore, the risk adjusted profits are statistically significant for short-term holding periods, i.e., less than 12 months. This clearly suggests that risk plays little role in existence of momentum profits and therefore can be rejected on the basis of most popular models (CAPM and Fama-French three and five factor) for returns based on risk. The returns from the size and value-based strategies get reduced on adjusting for risk in CAPM and Fama-French models, by 24.17% and 76.85% respectively for size anomaly and by 19.19% and 29.81% respectively for value anomaly. This suggests that in size-based returns, risk plays a major role and defines almost 76% of the movement in returns. Only 24% of the movement in returns can be associated to the factors other than risk. However, in value-based return, since the contribution of risk towards movement of returns was only up to 29%, large amount of return movement is explained through factors other than risk or market inefficiency. The finding that the presence of size anomaly can be associated with the fundamental factor such as risk and market inefficiency plays little or no role which reinforces the earlier observation of insignificant returns from size-based strategies and concurs with the findings of Pandey and Sehgal (2016), Schwert (1983) and Levis (1989). The findings in Table 6 for value anomaly, suggests no role of risk and thus, conferring with the significant returns obtained using value-based strategies. Therefore, it can be concluded from above analysis that value-based investment is far more profitable than size-based investment in Indian stock market.

It can be further noticed that apart from market risk, both the size and value related profits get affected by each other, as indicated by Fama and French (1993). This shows that the double sorted portfolios on size and value might produce higher profits than independently sorted portfolios used for the study. Since, both the effects are linked to the company related factors, the aggregate effect of investor behaviour is one possible explanation for interlinkage of size and value effects. This is because human emotions are always overlapped and therefore, a sentiment formed for the size of a company will spill over into the sentiment formed for value of the company, thus making it very much possible that the choice is a resultant of an aggregate of such sentiments.

4.4 Sources of anomalies

For decomposition of profits, data from above analysis is used and equation 8 has been employed to all winners and loser stocks as per both three months and six months strategies for momentum profit and as per one month strategy for size and value related profits. After that, equation (12) was utilised for finding the three possible sources of

momentum, size and value profits. Tables 7 and 8 provide details of the results obtained for possible sources.

Table 7 Decomposition results for momentum profits

	3/3 months	*3/6 months*	*3/12 months*	*6/3 months*	*6/6 months*	*6/12 months*
Net	0.01151	0.01032	0.00705	0.01616	0.01259	0.00734
R	0.00884	0.00752	0.00313	0.00638	0.00427	0.00428
%age	76.79%	72.89%	44.32%	39.49%	33.89%	58.35%
A	0.00669	0.0025	0.0009	0.0129	0.00877	0.00491
%age	58.12%	24.23%	12.71%	79.87%	69.62%	66.90%
C	–0.004	0.0003	0.00303	–0.0031	–0.0004	–0.0019
%age	–34.91%	2.89%	42.97%	–19.35%	–3.51%	–25.26%

It can be observed from Table 7 that auto-correlations were considerably high in the most profitable 6/3 strategy confirming that large excess return is a clear indication of market inefficiency in case of momentum anomaly. The least amount of correlation was observed in a strategy that encompasses a small horizon, three months, for building sentiment and more importantly long horizon, 12 months, for prevailing sentiment. This allows mean reversion to take over and therefore the risk factor, R, explains a significant portion of the return under 3/12 strategy. Above findings were in general consistent with the findings of Du and Watkins (2007) and Du (2012). However, the observed positive auto-correlation in all the strategies supports the findings of Barberis et al. (1998), Daniel et al. (1998), Hong and Stein (1999) and contradict the findings of Ding Du, showcasing that autocorrelation does not decrease but increase momentum.

Table 8 Decomposition results for size and value related profits

	Size	*Value*
Net	0.484349	1.3036
R	0.442391	1.079496
%age	*91.34%*	*82.81%*
A	0.044124	0.22522
%age	*9.11%*	*17.28%*
C	–0.002166	–0.00111
%age	*–0.447%*	*–0.008%*

It can be further observed from Table 7 that momentum profits have multiple sources (risk – 39% to 77%, auto-covariance – 13% to 80% and cross-serial covariance – negative 35% to 43% for different R/H strategies) instead of just one and that all the three sources explain a considerable portion of momentum profits. Contrary to the observation made for risk adjusted profits above in Tables 4 and 5, it is observed that risk does play an important role in momentum and therefore cannot be ignored on the basis of just CAPM and Fama-French models. This concurs with the suggestions of Conrad and Kaul (1998) that CAPM and Fama-French three and five factor models do not cover all the risks present in the market and therefore, rejecting risk as a possible source only on the basis of these two models, was not in consonance with the outcomes of study by Sehgal and Jain (2015) and Ansari and Khan (2012). It is also noteworthy that behavioural

sources such as under and delayed over-reactions and lead-lag relationships are also important contributory factors. Therefore, in concurrence to the findings for US markets by Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999), from the above results it can be stated that behavioural factors such as investor under reaction or delayed reaction does play a role in existence of momentum profits in Indian capital markets. Even though values of cross serial correlation might contain effect of other sources, its large value clearly shows that cross serial correlations play an important role in momentum profits. This finding for cross-serial correlation is in line with Du (2012). Therefore, it is also important to understand the effect of other stocks' returns on returns of stock under study.

The size and value profit decomposition results as shown in Table 8, also reflect upon the possibility of multiple sources of returns. For the size and value profits, risk comes out to be a significant contributor which is in conjunction with the outcome of study revealed in the section discussing CAPM and Fama-French adjusted returns. However, it can be seen that apart from risk the auto-covariance also play a significant role in forming these profits. This suggests that though, not to the extent of momentum, investor behaviour clearly plays an important role in existence of size and value anomaly in the market. Also, it can be seen that effect due to cross-serial correlations is almost non-existent, i.e., –0.447% and –0.008% respectively in case of size and value profits. This indicates towards overconfidence and representativeness biases playing a key role when looking at the company specific factors such as stock size and value.

5 Conclusions

Anomalies such as momentum, size and value effect have attracted lots of attention and have been investigated in different markets around the world. Some of the researchers have also tested these anomalies for their sources, attributing their presence to different sources. The risk is a rational source which is in accordance with EMH but the other sources such as the influence of past returns of the same stock (autocorrelation) and the influence of past returns of other stocks (cross serial correlation) are indicative of inefficiency in the stock markets indicating the role of investor behaviour. The excess positive and significant returns based on size, value and momentum anomalies confirm the presence of these anomalies in short horizon in Indian capital markets. The risk adjusted returns (calculated using CAPM and Fama-French three and five factor models) indicates the feeble effect of risk on these returns. Decomposition results indicate towards the possibility of multiple sources; fundamental (risk) and behavioural (autocorrelation and cross-serial correlation). Risk comes out as one of the underlying factors for all the three anomalies, dominating in the case of size and value anomaly. But in case of momentum and value anomaly, autocorrelation plays a significant role in the existence of excess return confirming a certain influence of investor behaviour. The paper concurs with the findings of previous researchers, Jegadeesh and Titman (1993), Du (2012), Sehgal and Jain (2011, 2015) and Ansari and Khan (2012). However, the results from the exploration of different strategies put forth 6/3 strategy as the more profitable one than the plain old 6/6 strategy used by all the previous researchers. The paper also builds further upon these previous researches and answer the left out question, what is the source of these anomaly related excess returns?

6 Implications and future scope

The study showcases the role of investor behaviour in Indian stock markets. It presents the findings that indicate the influence of investor sentiment in stock price movement. These findings offer significance for the policy makers as well as investors as discussed below:

- regulators can better predict, if any, sudden shifts in the market thus being able to take punitive actions in a timely manner to avoid large financial losses to investors
- understanding of prevailing sentiments and psychological biases will help investors to avoid getting into the sentiment wave and keep a check on the impulsive trading
- understanding the presence and role of prevailing sentiments in the markets will help policy makers to design policies robust enough to not only confer with the macroeconomic factors but also investor sentiments to develop efficient markets.

The study is restricted to size, value and momentum anomaly and the data utilised in the paper is also limited to monthly frequency. Future studies can focus on anomalies other than size, value and momentum and can also use higher frequency data for doing so. The comparison with other emerging markets and developed markets can also be studied in future.

References

Agarwalla, S.K., Jacob, J. and Varma, J.R. (2014) *Four Factor Model in Indian Equities Market*, Indian Institute of Management, Ahmedabad Working Paper, (2013-09), 05 [online] http://www.iima.ac.in/~iffm/Indian-Fama-French-Momentum/four-factors-India-90s-onwards-IIM-WP-Version.pdf.

Agrawal, A. and Tandon, K. (1994) 'Anomalies or illusions? Evidence from stock markets in eighteen countries', *Journal of international Money and Finance*, Vol. 13, No. 1, pp.83–106.

Amarnani, N. and Vaidya, P. (2014) 'Study of calendar anomalies in Indian stock markets', Amarnani, N. and Rijwani, P. (Eds.): *Perspectives on Financial Markets and Systems – Market Efficiency, Behavioural Finance and Financial Inclusion*, 1 January, Institute of Management, Nirma University, Ahmedabad, SSRN [online] https://ssrn.com/abstract=2398195.

Amihud, Y. and Mendelson, H. (1986) 'Asset pricing and the bid-ask spread', *Journal of Financial Economics*, Vol. 17, No. 2, pp.223–249.

Ansari, V.A. and Khan, S. (2012) 'Momentum anomaly: evidence from India', *Managerial Finance*, Vol. 38, No. 2, pp.206–223.

Asness, C.S., Moskowitz, T.J. and Pedersen, L.H. (2013) 'Value and momentum everywhere', *The Journal of Finance*, Vol. 68, No. 3, pp.929–985.

Balakrishnan, A., Maiti, M. and Panda, P. (2018) 'Test of five-factor asset pricing model in India', *Vision*, Vol. 22, No. 2, pp.153–162.

Banz, R.W. (1981) 'The relationship between return and market value of common stocks', *Journal of Financial Economics*, Vol. 9, No. 1, pp.3–18.

Barberis, N., Shleifer, A. and Vishny, R. (1998) 'A model of investor sentiment', *Journal of Financial Economics*, Vol. 49, No. 3, pp.307–343.

Barone, E. (1990) 'The Italian stock market: efficiency and calendar anomalies', *Journal of Banking & Finance*, Vol. 14, Nos. 2–3, pp.483–510.

Bhootra, A. (2011) 'Are momentum profits driven by the cross-sectional dispersion in expected stock returns?', *Journal of Financial Markets*, Vol. 14, No. 3, pp.494–513.

Bodla, B.S. and Kiran, J. (2006) 'Seasonal anomalies in stock returns: evidence from India and the US', *Decision*, Vol. 33, No. 1, pp.163–178.

Bulkley, G. and Nawosah, V. (2009) 'Can the cross-sectional variation in expected stock returns explain momentum?', *Journal of Financial and Quantitative Analysis*, Vol. 44, No. 4, pp.777–794.

Campbell, J.Y. and Shiller, R.J. (2001) *Valuation Ratios and the Long-Run Stock Market Outlook: An Update*, No. w8221, National Bureau of Economic Research.

Cao, M. and Wei, J. (2005) 'Stock market returns: a note on temperature anomaly', *Journal of Banking & Finance*, Vol. 29, No. 6, pp.1559–1573.

Chan, K., Hameed, A. and Tong, W. (2000) 'Profitability of momentum strategies in the international equity markets', *Journal of Financial and Quantitative Analysis*, Vol. 35, No. 2, pp.153–172.

Chan, K.C. and Chen, N.F. (1991) 'Structural and return characteristics of small and large firms', *The Journal of Finance*, Vol. 46, No. 4, pp.1467–1484.

Chan, L.K., Jegadeesh, N. and Lakonishok, J. (1996) 'Momentum strategies', *The Journal of Finance*, Vol. 51, No. 5, pp.1681–1713.

Chordia, T. and Shivakumar, L. (2006) 'Earnings and price momentum', *Journal of Financial Economics*, Vol. 80, No. 3, pp.627–656.

Choudhary, K. and Choudhary, S. (2008) 'Day-of-the-week effect: further empirical evidence', *Asia Pacific Business Review*, Vol. 4, No. 3, pp.67–74.

Chui, A.C.W., Wei, K-C. and Titman, S. (2000) *Momentum, Legal Systems and Ownership Structure: An Analysis of Asian Stock Markets*, December, SSRN [online] https://ssrn.com/abstract=265848 or http://dx.doi.org/10.2139/ssrn.265848.

Collins, D.W. and Hribar, P. (2000) 'Earnings-based and accrual-based market anomalies: one effect or two?', *Journal of Accounting and Economics*, Vol. 29, No. 1, pp.101–123.

Conrad, J. and Kaul, G. (1998) 'An anatomy of trading strategies', *Review of Financial Studies*, Vol. 11, No. 3, pp.489–519.

Daniel, K., Hirshleifer, D. and Subrahmanyam, A. (1998) 'Investor psychology and security market under-and overreactions', *The Journal of Finance*, Vol. 53, No. 6, pp.1839–1885.

Dash, S.R. and Mahakud, J. (2015) 'Market anomalies, asset pricing models, and stock returns: evidence from the Indian stock market', *Journal of Asia Business Studies*, Vol. 9, No. 3, pp.306–328.

De Bondt, W.F. and Thaler, R. (1985) 'Does the stock market overreact?', *The Journal of Finance*, Vol. 40, No. 3, pp.793–805.

De Bondt, W.F. and Thaler, R.H. (1987) 'Further evidence on investor overreaction and stock market seasonality', *The Journal of Finance*, Vol. 42, No. 3, pp.557–581.

Dimson, E. (Ed.) (1988) *Stock Market Anomalies*, Cambridge University Press, Great Britain.

Du, D. (2012) 'Momentum and behavioral finance', *Managerial Finance*, Vol. 38, No. 4, pp.364–379.

Du, D. and Watkins, B. (2007) 'When competing momentum hypotheses really do not compete: how the sources of momentum profits change through time', *Journal of Economics and Business*, Vol. 59, No. 2, pp.130–143.

Fama, E.F. (1998) 'Market efficiency, long-term returns, and behavioral finance', *Journal of Financial Economics*, Vol. 49, No. 3, pp.283–306.

Fama, E.F. and French, K.R. (1993) 'Common risk factors in the returns on stocks and bonds', *Journal of Financial Economics*, Vol. 33, No. 1, pp.3–56.

Garg, A.K. and Varshney, P. (2015) 'Momentum effect in Indian stock market: a sectoral study', *Global Business Review*, Vol. 16, No. 3, pp.494–510.

Gutierrez, R.C. and Kelley, E.K. (2008) 'The long-lasting momentum in weekly returns', *The Journal of Finance*, Vol. 63, No. 1, pp.415–447.

Hong, H. and Stein, J.C. (1999) 'A unified theory of underreaction, momentum trading, and overreaction in asset markets', *The Journal of Finance*, Vol. 54, No. 6, pp.2143–2184.

Hong, H., Lim, T. and Stein, J.C. (2000) 'Bad news travels slowly: size, analyst coverage, and the profitability of momentum strategies', *The Journal of Finance*, Vol. 55, No. 1, pp.265–295.

Jegadeesh, N. and Titman, S. (1993) 'Returns to buying winners and selling losers: implications for stock market efficiency', *The Journal of Finance*, Vol. 48, No. 1, pp.65–91.

Jegadeesh, N. and Titman, S. (2001) 'Profitability of momentum strategies: an evaluation of alternative explanations', *The Journal of Finance*, Vol. 56, No. 2, pp.699–720.

Jegadeesh, N. and Titman, S. (2002) 'Cross-sectional and time-series determinants of momentum returns', *Review of Financial Studies*, Vol. 15, No. 1, pp.143–157.

Kato, K. and Schallheim, J.S. (1985) 'Seasonal and size anomalies in the Japanese stock market', *Journal of Financial and Quantitative Analysis*, Vol. 20, No. 2, pp.243–260.

Keim, D.B. (1983) 'Size-related anomalies and stock return seasonality: further empirical evidence', *Journal of Financial Economics*, Vol. 12, No. 1, pp.13–32.

Lakonishok, J., Shleifer, A. and Vishny, R.W. (1994) 'Contrarian investment, extrapolation, and risk', *The Journal of Finance*, Vol. 49, No. 5, pp.1541–1578.

Lee, C. and Swaminathan, B. (2000) 'Price momentum and trading volume', *The Journal of Finance*, Vol. 55, No. 5, pp.2017–2069.

Levis, M. (1989) 'Stock market anomalies: a re-assessment based on the UK evidence', *Journal of Banking & Finance*, Vol. 13, Nos. 4–5, pp.675–696.

Levy, R.A. (1967) 'Relative strength as a criterion for investment selection', *The Journal of Finance*, Vol. 22, No. 4, pp.595–610.

Lo, A.W. and MacKinlay, A.C. (1990) 'When are contrarian profits due to stock market overreaction?', *Review of Financial Studies*, Vol. 3, No. 2, pp.175–205.

Misra, A.K. and Mohapatra, S. (2014) 'Evidence and sources of momentum profits. A study on Indian stock market', *Economics, Management and Financial Markets*, Vol. 9, No. 3, p.86.

Moskowitz, T.J. and Grinblatt, M. (1999) 'Do industries explain momentum?', *The Journal of Finance*, Vol. 54, No. 4, pp.1249–1290.

Mullainathan, S. and Thaler, R.H. (2000) *Behavioral Economics*, No. w7948, National Bureau of Economic Research.

Narayan, P.K. and Zheng, X. (2010) 'Market liquidity risk factor and financial market anomalies: evidence from the Chinese stock market', *Pacific-Basin Finance Journal*, Vol. 18, No. 5, pp.509–520.

O'Donnell, D.J. and Baur, D.G. (2009) 'Momentum in the Irish stock market', *Applied Economics Letters*, Vol. 16, No. 11, pp.1133–1138.

Pandey, A. and Sehgal, S. (2016) 'Explaining size effect for Indian stock market', *Asia-Pacific Financial Markets*, Vol. 23, No. 1, pp.45–68.

Poterba, J.M. and Summers, L.H. (1988) 'Mean reversion in stock prices: evidence and implications', *Journal of Financial Economics*, Vol. 22, No. 1, pp.27–59.

Raj, M. and Kumari, D. (2006) 'Day-of-the-week and other market anomalies in the Indian stock market', *International Journal of Emerging Markets*, Vol. 1, No. 3, pp.235–246.

Rouwenhorst, K.G. (1998) 'International momentum strategies', *The Journal of Finance*, Vol. 53, No. 1, pp.267–284.

Rouwenhorst, K.G. (1999) 'Local return factors and turnover in emerging stock markets', *The Journal of Finance*, Vol. 54, No. 4, pp.1439–1464.

Schwert, G.W. (1983) 'Size and stock returns, and other empirical regularities',*Journal of financial Economics*, Vol. 12, No. 1, pp.3–12.

Sehgal, S. and Balakrishnan, I. (2002) 'Contrarian and momentum strategies in the Indian capital market', *Vikalpa*, Vol. 27, No. 1, pp.13–20.

Sehgal, S. and Jain, K. (2015) 'Profitability of price, earnings and revenue momentum strategies: the Indian evidence', *Asian Academy of Management Journal of Accounting and Finance (AAMJAF)*, Vol. 11, No. 1, pp.47–84.

Sehgal, S. and Jain, S. (2011) 'Short-term momentum patterns in stock and sectoral returns: evidence from India', *Journal of Advances in Management Research*, Vol. 8, No. 1, pp.99–122.

Sehgal, S., Subramaniam, S. and De La Morandiere, L.P. (2012) 'A search for rational sources of stock return anomalies: evidence from India', *International Journal of Economics and Finance*, Vol. 4, No. 4, p.121.

Sehgal, S., Subramaniam, S. and Deisting, F. (2014) 'Tests of equity market anomalies for select emerging markets', *The International Journal of Business and Finance Research*, Vol. 8, No. 3, pp.27–46.

Shiller, R.J. (2003) 'From efficient markets theory to behavioral finance', *The Journal of Economic Perspectives*, Vol. 17, No. 1, pp.83–104.

Singh, S.P. (2014) 'Stock market anomalies: evidence from emerging BRIC markets', *Vision*, Vol. 18, No. 1, pp.23–28.

Thaler, R.H. (1987) 'Anomalies: the January effect', *Journal of Economic Perspectives*, Vol. 1, No. 1, pp.197–201.