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Momentum returns: A portfolio-based empirical study to establish evidence, factors and profitability in Indian stock market

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Our study focusses on establishing portfolio-based momentum profits in the Indian market, and on designing a model to identify portfolio-specific and macroeconomic factors generating abnormal returns. We empirically examine returns of long-term and short-term winners and losers' portfolios to establish the existence of extra-normal profits similar to those documented by Jegadeesh and Titman (1993). Using vector autoregressive methodology, we find price-earnings ratio, price-book ratio, and net foreign institutional inflows as significant factors in momentum generation. We further decompose momentum profits to test for time-series, cross-sectional and lead-lag components. Our study provides insights to portfolio managers in exploring the concept of momentum during portfolio designing.

Introduction

No matter how enticing systematic investment strategies might look on paper, most of them fail the test of application in the real world. However, "momentum investing" is one of the few exceptions to such systematic strategies and has the ability to stand on its feet. For instance, Grinblatt, Titman and Wermers (1995) find that 77% of the US mutual funds that relied on "momentum" realised significantly better performance as compared to other funds. The finding is similar to that of Menkhoff and Schmidt (2005) who illustrated the usage of momentum and contrarian strategies by German fund managers. While the concept has withstood the test of time in its application, it has also firmly held its ground in sustaining rigorous investigation by academic researchers for more than two decades.

In simple terms, "momentum" indicates the price trend velocity (Ausloos & Ivanova, 2002). It not only conveys market direction and market pace but also highlights the trend reversal. The pace at which price changes and the trend that it follows forms the basis of building various indicators to analyse technical parameters such as change in price, daily average volume, and the overall trend.

Momentum trading can be conceptualised as an investment strategy aimed at capitalising on the continuance of existing market trends (Jegadeesh & Titman, 1993). This investment style is highly conventional in nature, which

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facilitates traders in identifying possible productive trading opportunities. While value investing focusses on buying securities at a discount and selling them at a premium, momentum investing is based on the principle of buying high, selling higher or alternatively limiting losses incurred by the loser stocks while allowing the winners to continue scaling new heights. Momentum investing unlike value investing tends to capitalise on any time gap left before mean reversal. In short, momentum investing theory relies upon devising a systematic approach of chasing "performers" with an entry and exit strategy being intact.

Momentum, irrespective of its presence in a given financial instrument, is a consequence of either normal or real earnings mirrored in the instrument's volatility and price movement. Momentum trading primarily targets early recognition of trading opportunities resulting due to very strong market movement in one or the other direction. The object is to persist with the trend and hold the position as long as the trend continues. Momentum trading is amongst proven investment strategies across major markets such as the United States (Jegadeesh & Titman, 1993) and Europe (Rouwenhorst, 1998).

Although there exists a large volume of research to back up the theory, yet one is hard-pressed to find willing traders or investors seeking returns owing to the momentum factor, particularly in case of emerging markets such as India. Taking note of the high degree of academic recognition but a relatively lower degree of practical acceptance garnered by momentum investing as an investment strategy tool, the current study attempts to ascertain the momentum effect at a portfolio level in the Indian equity market. Further, the study aims at exploring the possible set of macroeconomic- and firm- or portfolio-related factors contributing to abnormal returns. The study also deploys one-factor pricing model to decompose any extra-normal returns over the period 2005–2015 of stocks listed on the National Stock Exchange of India (NSE) to empirically confirm any contribution due to cross-sectional risk, effects arising due to lead-lag relationships and time-series pattern.

The objective of the study is not limited to realising and providing an insight into the existence of portfolio-level momentum returns in Indian markets but also identifying the firm-specific and macroeconomic factors resulting in these abnormal returns. In addition, the study aims to decompose momentum-led profits and empirically confirm any contribution due to cross-sectional risk, effects arising due to lead-lag relationships and time-series pattern. The paper also discusses the managerial implications and implications for policy formulation for a better buy-in and wider outreach of this technique. The main objective of the study is to make a short-term trader or a long-term investor realise the benefits of momentum trading and enable wider acceptance of the technique.

Literature review

In their seminal work, Jegadeesh and Titman (1993) documented the profitability of momentum-based strategies in the US stock market. The study highlighted the effectiveness of a zero-cost momentum strategy involving the mechanism of buying past winners and selling past losers over the short-term, medium-term and long-term time horizon. Similar findings were also reported by Rouwenhorst (1998) across 12 European markets. Sensing the prevalence of the widely acclaimed phenomenon, Rouwenhorst (1998–1999) widened his study horizon by encompassing 20 of the emerging equity markets. In 6 (out of 20) countries, abnormal profits were evident.

There have been contrasting interpretations and explanations about the potential causes of momentum profits. While Fama and French (1992) challenged the conventional capital asset pricing model (CAPM) by Sharpe (1964) and Lintner (1965) and proposed a three-factor asset pricing model challenging the relation between average stock returns and their associated beta, another group of researchers such as Barberis et al. (1998), Daniel et al. (1998) and Hong and Stein (1999) have attributed the consistency of "price momentum" to several theoretical (behavioural) models based on investor sentiments relying on psychological factors (such as self-attribution, overconfidence and under confidence).

Extending the work of Fama and French (1992), Carhart (1997) proposed the multi-factor (four-factor) model citing empirical evidence that associated momentum profits with business cycle risk and macroeconomic variables. Although the study established a linkage between industry returns and macroeconomic variables, the capability of the multi-factor model in explaining momentum profits was not robust enough while controlling the market forces. To add to the aforesaid finding, it was seen that while the macroeconomic model failed to forecast the time-series pattern of the momentum profits, the lagged market returns were able to explain the same. This led to the argument that the lagged market return is essential conditioning information which is appropriate in estimating the profitability of momentum strategies.

To confirm the soundness of the empirical asset pricing models in explaining the value and momentum returns across regions, Fama and French (2012) tested the models for four regions, namely North America, Europe, Japan and the Asia Pacific. The results established the significance of value premiums in average stock returns which decreased with size in case of Japanese stocks. Except for Japan, there was strong evidence of momentum returns in every other region, and the contribution in momentum returns by smaller stocks was higher as compared to their bigger counterparts. In the Indian context, Sehgal and Balakrishnan (2004) examined the effect and profitability measure of the momentum phenomenon and its reversal. The findings were similar to those of the US markets suggesting a long-term return reversal as soon as the short-term effect was controlled maintaining 1-year portfolio formation and holding period gap. A similar study on the Indian market was carried out by Rastogi et al. (2009) employing Jegadeesh and Titman's (1993) methodology to construct portfolios to test momentum and over-reaction phenomenon. The objective was to understand the size effect by listing securities based on their market capitalisation. The results substantiated a strong momentum phenomenon but relatively weak over-reaction evidence, which was limited only to midcap stocks. In another study, Ahmad and Khan (2012) examined momentum presence during the period 1995–2006. The study tried to explain the strong presence of momentum profits and their sources by testing risk-based as well as behavioural-

based models considering factors such as idiosyncratic risk, volatility and any delay in measures. While risk-based models such as CAPM and Fama-French (1996)'s model failed to explain the anomalies, a factor such as idiosyncratic risk considered in the behavioural model displayed a positive contribution in the generation of momentum.

In recent years, Misra and Mohapatra (2014, 2015) conducted a series of studies to establish the presence of momentum both at the benchmark index level and at the portfolio level. Their work tested the profitability of short-term (1×3) and long-term (3×6) momentum strategies. In addition to confirming the momentum evidence at the portfolio levels, Misra and Mohapatra (2017) examined Carhart's (1997) four-factor model to test the market anomaly by including the four major determinants of abnormal profits, that is, excess market returns (EMRs), the small minus big (SMB) portfolio returns contributing to the size factor and the high minus low (HML) portfolio return exploiting the intrinsic value alongside the winners minus losers (WML) or momentum returns.

The studies by Misra and Mohapatra (2014, 2015) were along similar lines to Fama and French (2012) which evaluates the profitability of trading strategies based on a given set of information structures. Specifically, the studies estimate the strategies not only within the common time horizon of a short duration but also consider key market information, which is publicly available to investors. As per the empirical results, the studies find that the large-cap stocks outperform the small-cap stocks in the short as well as long run. In addition, it is also seen that growth stocks with a low book-to-market ratio outperform their value counterparts with a higher book-to-market ratio. The studies identified that Indian equity market provides significant profits if investors buy stocks with large market capitalisation and sell stocks with small market capitalisation comprising the CNX-NIFTY 500. The findings are in contrast to the findings of Fama-French (1993) and Carhart (1997).

Empirical design

For a given security, daily momentum returns were defined as P = MV by Ausloos and Ivanova (2002), where (M) is the mass denoted by the standardised transactional quantity and (V) is the velocity indicated by the average rate of change in the security's price over a given time period. Fifteen days absolute momentum returns formed the basis of stock selection and, in turn, designing the winner and loser portfolios. Winner portfolios (W_i) and loser portfolios (L_i) were designed comprising stocks selected on the basis of their absolute momentum returns.

The methodology adopted by Lo and MacKinlay (1990) and Jegadeesh and Titman (1995) forms the framework for testing the existence of return reversal and return continuation in the Indian equity market. As per J x K, strategy stocks are selected depending on their formation period (i.e. J-months) returns and are held for the entire holding period (i.e. K-months). Stocks are ranked in an ascending fashion based on their formation period (1 month and 3 months) returns and equal-weighted decile portfolios are designed. Winner portfolios constitute the highest returns, whereas loser portfolios comprise the lowest returns. Holding period returns for each of the decile portfolios are calculated over the K-months (3 and 6 months, respectively). This is followed by calculating the winner minus loser returns. Momentum returns continuation is declared if the average winner minus the loser returns during the holding period "K" is positive. Otherwise, in case of negative returns, return reversal is confirmed. Based on the confirmation of momentum returns continuation or reversal, momentum or contrarian strategies are designed accordingly. As per the momentum strategy, simultaneous buying and selling of winner and loser portfolios is carried out. This position is held for the entire holding period "K". The current study involves formulating strategies based on stock selection depending on the formation period returns of 1 and 3 months and subsequently holding this position for the next 3 and 6 months, respectively. This method of portfolio designing leads to four categories of portfolios, namely, short-term winners, long-term winners, short-term losers, and long-term losers.

To explore and ascertain the common sources of portfolio momentum profits in the Indian equity market, the comparative implication of the various macroeconomic-linked and portfolio-linked factors is tested by regressing the 1×3 and 3×6 generated portfolio momentum series against the following potential sources. Macroeconomic factors: (1) Term spread (2) Net foreign institutional flows (3) Index of industrial production. Portfolio-specific factors: (1) Price-book value ratio (2) Dividend yield (3) Price-earnings ratio. This is in line with the study conducted by Chen, Roll and Ross (1986), Chordia and Shivakumar (2002), and Petkova and Zhang (2005).

The generated momentum returns for the 1×3 and 3×6 portfolios are regressed against the aforesaid macroeconomic-specific and portfolio-specific variables corresponding to the winner and loser portfolios. Realising that an expected lead-lag relationship would prevail between the variables and momentum returns, Akaike information criterion has been used to decide the optimum lead-lag period. The study has used vector autoregressive (VAR) methodology to estimate the following equation:

$$R_{it} = c_{i0} + c_{i1}DIV_{t-1} + c_{i2}PE_{t-1} + c_{i3}PB_{t-1} + c_{i4}IIP_{t-1} + c_{i5}TermSpread + c_{i6}FII + e_{it}$$

where R_{it} is the corresponding momentum returns.

The seminal market model equation is used to assess the decile portfolios for any extra-normal returns generated due to the momentum or profitability of contrarian strategies. Portfolio-specific abnormal returns might be the reason behind the generation of the extra-normal returns and the portfolio's idiosyncratic return variation is witness to it. Corporate events such as surprise earnings, stock splits, rise in dividends payout and share buy-backs can lead to a portfolio's abnormal returns.

The study deploys single-index model for estimating any extra-normal profits generated by the winners or losers' portfolios. Any abnormal returns generated are defined as a function of excess index returns. Using the following market-index model equation, relative returns for each portfolio 'i' are estimated over the prior 10-year period for every time instance 't':

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{Mt} - r_{ft}) + \varepsilon_{it}$$

where r_{it} is the portfolio i returns during the time period t; r_{ft}, one-month T-bill rate during the period t; r_{Mt}, index returns during time period t; $r_{Mt} - r_{ft}$, excess returns on index during time period t; α_i and β, parameters to be estimated; and ε_{it}, residual returns of portfolio i in month t.

The study estimates 'α_i' for each of the portfolios and the following hypotheses are tested:

Null hypothesis: Absence of any inferior or superior returns can be confirmed, if all α_i are statistically zero.
Alternate hypothesis: Presence of any inferior or superior returns coined as momentum returns can be confirmed, if all α_i are statistically significant.

Expected momentum profit (Π^m) is decomposed into cross-sectional risk(σ_μ^2), lead-lag effect $(\delta\sigma_f^2)$ and time-series pattern of stocks exhibiting any market inefficiency (Ω) as per the below representation:

$$\Pi^m = \sigma_\mu^2 + \delta\sigma_f^2 + \Omega$$

The study uses Jegadeesh and Titman's (1995) model developed using single-factor pricing to establish the contribution of all the three sources. Orthogonal least square is used to show the comparative contribution of the three sources:

$$r_{i,t} = \mu_i + b_{0,i}^t f_t + b_{1,i}^t f_{t-k} + e_{i,t}$$

where $r_{i,t}$ is the i_{th} portfolio return during period t; μ_i is the i_{th} portfolio unconditional expected return; f_t is the common factor proxied by the demeaned market return during period t; f_{t-k} is the common factor proxied by the demeaned market return during period $t-k$; $e_{i,t}$ is the random error term; $b_{0,i}$ is i_{th} stock's current beta and $b_{1,i}$ is the i_{th} stock's lagged beta.

Subsequent to finding each component's contribution, individual components are estimated as follows:

$$\text{Cross-sectional risk} = \sigma_\mu^2 = \frac{1}{N}\sum_{i=1}^{N}(\mu_i - \overline{\mu})^2$$

$$\text{Lead-lag effect} = \delta = \frac{1}{N}\sum_{i=1}^{N}(b_{0,i} - \overline{b}_0)(b_{1,i} - \overline{b}_1)$$

$$\text{Time-series pattern} = \Omega = \frac{1}{N}\sum_{i=1}^{N} Cov(e_{i,t}, e_{i,t-1})$$

Data and sample selection

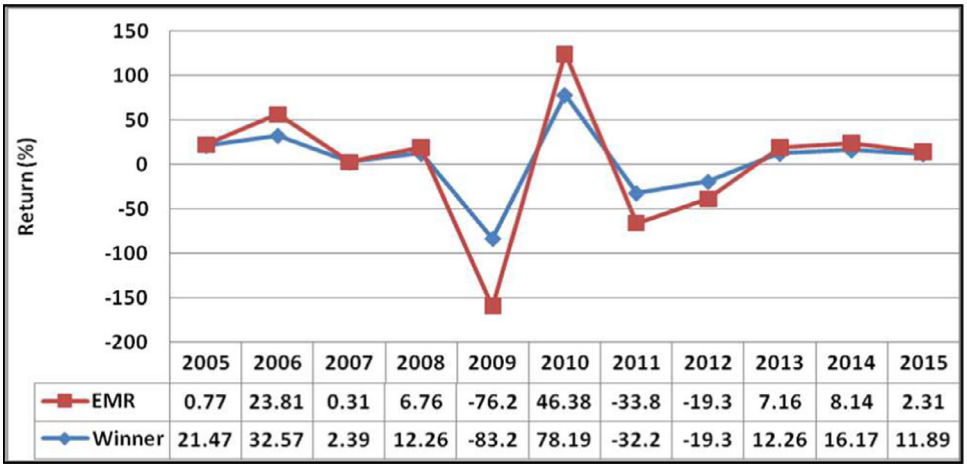
Daily closing prices of stocks listed on the NSE are collected over the period April 2005–March 2015 after adjustment for any corporate announcement. The study period has been decided to include all the significant rises and falls of prices of stocks over the last decade. This comprises the broader market rally from 2005 to early 2008, the global financial crisis of 2008–2009 and the period of consolidation and the recovery thereafter.

The study sample includes securities comprising the CNX NIFTY 500 which are used to build short-term and long-term momentum strategies. There are three major reasons for limiting the portfolio formation to index stocks. Stocks forming NIFTY 500 have a higher liquidity and market capitalisation as compared to others. In addition, the stocks comprise both old and new economy stocks representing the broader market. So, to design momentum strategies, investors tend to prefer index-based stocks with a very high correlation with index momentum.

To include stocks in the study sample, the following checks were made: (1) The stock remains listed on the NSE during the study period 1, April 2005 to 31 March 2015 and (2) The price-earnings ratio is positive for the NSE-listed stocks identified in the foregoing condition. These filtration criteria yielded an initial set of 243 listed entities for which 15 days absolute momentum returns were estimated. To design the winner and loser decile portfolios, 100 stocks with the highest absolute returns were selected from the original sample of 243 stocks. Portfolio-specific factors such as price-earnings ratio, price-book value ratio and dividend yield were calculated for the decile portfolios constructed.

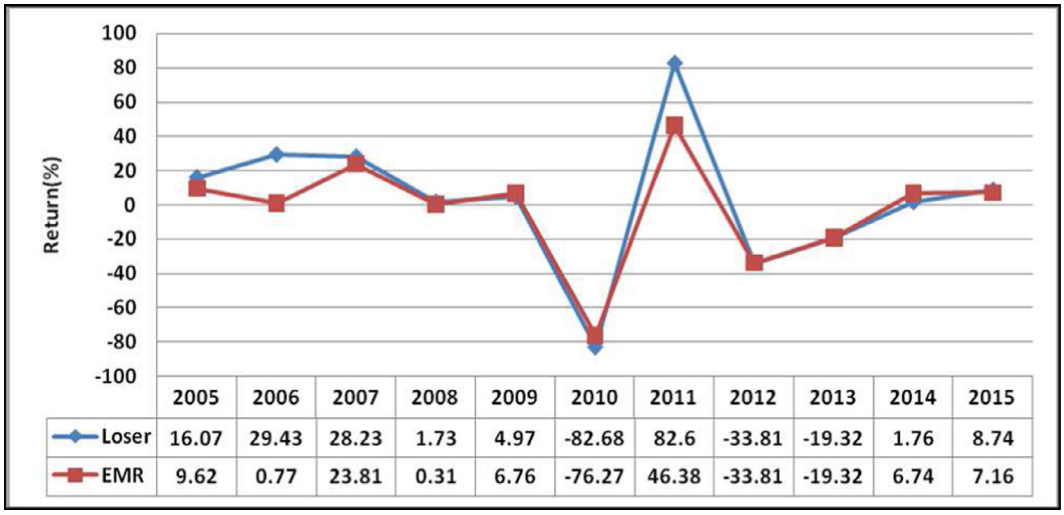
Results and discussion

The EMR and the winner and loser portfolio returns for 1 × 3 portfolios are portrayed in Figs. 1 and 2. It is observed that



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EMR	0.77	23.81	0.31	6.76	-76.2	46.38	-33.8	-19.3	7.16	8.14	2.31
Winner	21.47	32.57	2.39	12.26	-83.2	78.19	-32.2	-19.3	12.26	16.17	11.89

Figure 1 Holding period Excess Market Returns (EMR) and Winner Portfolio Returns (Winner) for 1 × 3 portfolios over the period April 2005 to March 2015.



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Loser	16.07	29.43	28.23	1.73	4.97	-82.68	82.6	-33.81	-19.32	1.76	8.74
EMR	9.62	0.77	23.81	0.31	6.76	-76.27	46.38	-33.81	-19.32	6.74	7.16

Figure 2 Holding period Excess Market Returns (EMR) and Loser Portfolio Returns (Loser) for 1 × 3 portfolios over the period April 2005 to March 2015.

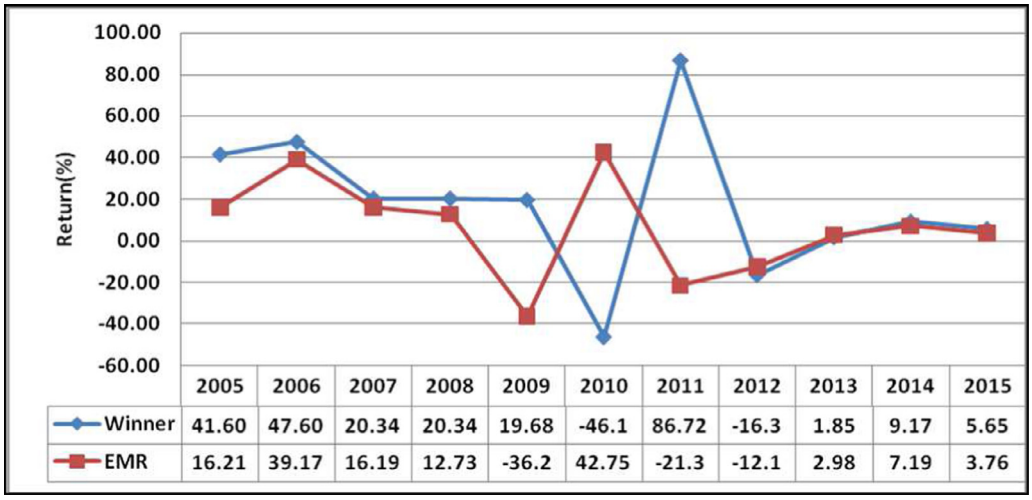
over the period of 2005–2015, during most of the years, both winner and loser portfolios have given extra-normal returns. Similar results are also found in case of 3 × 6 portfolios (Figs. 3 and 4). Presence of extra-normal profits at portfolio level is an indication of the existence of momentum returns in the Indian stock market.

The study uses VAR model to regress the 1 × 3 winner and loser portfolio momentum returns against the macroeconomic-specific and portfolio-specific factors to comprehend the interrelationship. To identify the optimum lag length amongst the factors discussed earlier (Refer Table 1), Akaike information criterion is minimised. The VAR equation is estimated with the optimum lag-length being one (Table 2).

Results shown in Table 2 indicate that while macroeconomic variables such as the net foreign institutional inflows over the holding period contribute significantly in estimating the momentum returns for 1 × 3 portfolios, extreme winners' price-book ratio over the formation period and the extreme losers' dividend yield are also significant. A lesser significance is attributed to investors' sentiment. Net foreign institutional inflows have a negative coefficient, which indicates a possibility of investors' overreaction leading to the fall in momentum returns.

A similar approach is considered to understand the interrelationship of the macroeconomic-related and portfolio-related variables. This is achieved using a VAR model to regress the momentum returns generated for the 3 × 6 portfolios against the aforesaid macroeconomic-specific and portfolio-specific variables corresponding to the winner and loser portfolios. To determine any expected lead-lag relationship prevailing between the variables and momentum returns, Akaike information criterion has been minimised (Table 3). Based on the optimal lag-length, the VAR equation is estimated (Table 4).

The significance of the factors generating 3 × 6 momentum returns is summarised in Table 5. In case of extreme winner portfolios, the price-earnings ratio and price-book value ratio are found to be significant. In case of 3 × 6



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Winner	41.60	47.60	20.34	20.34	19.68	-46.1	86.72	-16.3	1.85	9.17	5.65
EMR	16.21	39.17	16.19	12.73	-36.2	42.75	-21.3	-12.1	2.98	7.19	3.76

Figure 3 Holding period Excess Market Returns (EMR) and Winner Portfolio Returns (Winner) for 3 × 6 portfolios over the period April 2005 to March 2015.

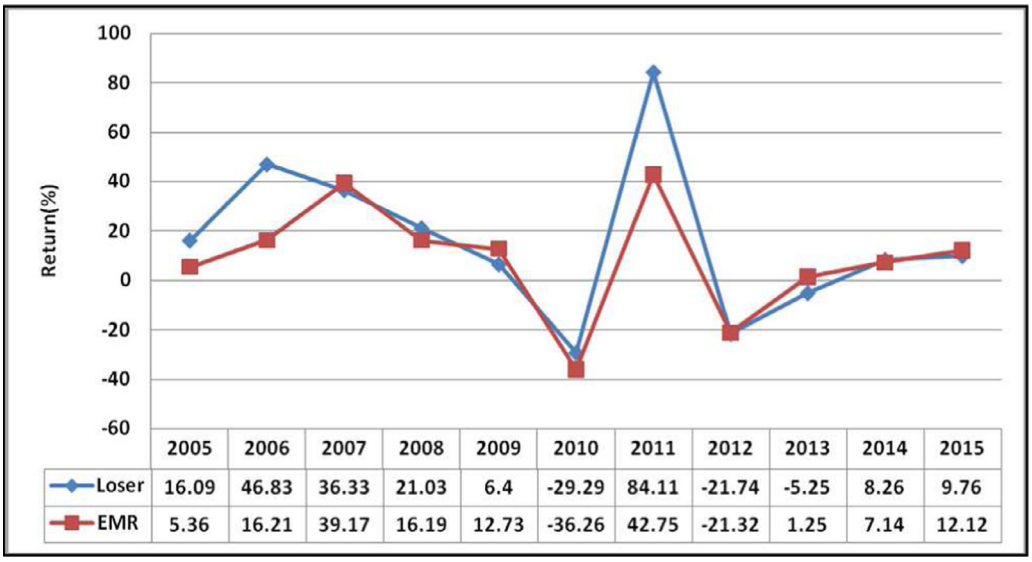


Figure 4 Holding period Excess Market Returns (EMR) and Loser Portfolio Returns (Loser) for 3 × 6 portfolios over the period April 2005 to March 2015.

Table 1 A summary of the interrelationship amongst the macroeconomic-specific and portfolio-specific factors alongside the 1 × 3 momentum returns highlighting the optimal lag length.

Lags	Loglik	p(LR)	AIC	BIC	HQC
1	−305.872		7.752*	8.105*	7.894*
2	−305.848	0.825	7.776	8.158	7.929
3	−305.742	0.645	7.798	8.209	7.963
4	−305.593	0.585	7.819	8.259	7.996
5	−305.169	0.357	7.833	8.303	8.021

Note: AIC: Akaike information criterion; BIC: Bayesian information criterion; HQC: Hannan–Quinn information criterion.

Table 3 A summary of the interrelationship amongst the macroeconomic-linked and portfolio-linked factors alongside the 3 × 6 momentum returns.

Lags	Loglik	p(LR)	AIC	BIC	HQC
1	−340.879		8.688*	9.013*	8.818*
2	−340.013	0.188	8.691	9.046	8.834
3	−339.724	0.446	8.709	9.093	8.863
4	−339.722	0.955	8.733	9.147	8.899
5	−339.035	0.240	8.741	9.185	8.919

Note: AIC: Akaike information criterion; BIC: Bayesian information criterion; HQC: Hannan–Quinn information criterion.

Table 2 A summary of the regression coefficients and measures of goodness of fit by regressing 1 × 3 momentum returns against macroeconomic-specific and portfolio-specific factors.

Variable	Coefficient	Std. error	t ratio	p value
WML	−0.0031	0.0965	−0.0328	0.9739
W1-PE	−0.0196	0.0707	−0.2772	0.7823
W1-PB	1.4886	0.6864	2.1686	0.0332
W1-Div	0.5903	0.7568	0.7799	0.4378
IIP growth rate	−6.7462	20.3071	−0.3322	0.7406
Term spread	0.1538	0.0951	1.6167	0.1101
L1-PE	−0.0535	0.1947	−0.2748	0.7842
L1-PB	0.4894	0.6203	0.7890	0.4326
L1-Div	−1.4091	0.7147	−1.9714	0.0523
Net FII	−0.0002	3.34521e-05	−6.0131	<0.00001
Sentiment dummy	4.2372	2.4426	1.7347	0.0869
Adjusted R-squared: 0.39 P value (F): 0.0031				
F(11, 75): 2.8970 Durbin-Watson: 1.8854				

Table 4 A summary of the regression coefficients and measures of goodness of fit by regressing 3 × 6 momentum returns against macroeconomic-specific and portfolio-specific factors.

Variable	Coefficient	Std. error	t ratio	p value
WML	0.4571	0.1018	4.4867	0.00003
W1-PE	−0.3440	0.1698	−2.0261	0.0463
W1-PB	2.2166	1.0883	2.0367	0.0452
W1-Div	−0.6196	1.7334	−0.3575	0.7217
IIP growth rate	−12.4224	31.6098	−0.3930	0.6954
Term spread	0.1278	0.1665	0.7677	0.4451
L1-PE	0.0139	0.2772	0.0504	0.9599
L1-PB	1.5738	1.0953	1.4369	0.1549
L1-Div	−1.6722	1.7777	−0.9406	0.3499
Net FII	0.0002	0.0001	1.7385	0.0862
Sentiment dummy	1.8590	4.0375	0.4604	0.6465
Adjusted R-squared: 0.36 P value(F): 5.01e-06				
F(11, 74): 5.2195 Durbin–Watson: 1.8917				

Table 5 A summary of the regression coefficients and measures of goodness of fit on regressing 1 × 3 winner (W_i) and loser (L_i) portfolios holding period returns over the period 2005–2015.

	Intercept(α_i)	Slope(β_i)	Adjusted R^2	F(1109)	D-W
W1	2.5122	1.0941	0.7588	504.36	1.81
	[*t ratio*: 2.7445]	[*t ratio*: 22.4581]			
	[p value: 0.0070]	[p value: <0.00001]			
W2	1.6413	1.0972	0.7897	234.02	1.34
	[*t ratio*: 1.6718]	[*t ratio*: 15.2979]			
	[p value: 0.0974]	[p value: <0.00001]			
W3	2.6732	1.0864	0.8371	400.88	1.58
	[*t ratio*: 3.3693]	[*t ratio*: 20.0221]			
	[p value: 0.0010]	[p value: <0.00001]			
W4	2.1683	1.0976	0.8244	282.41	1.57
	[*t ratio*: 2.6618]	[*t ratio*: 16.8053]			
	[p value: 0.0089]	[p value: <0.00001]			
W5	1.5749	1.1255	0.8738	612.33	1.42
	[*t ratio*: 2.2306]	[*t ratio*: 24.7454]			
	[p value: 0.0277]	[p value: <0.00001]			
L5	−1.451	−0.9309	0.7730	294.06	1.65
	[*t ratio*: −19.3551]	[*t ratio*: −17.1482]			
	[p value: <0.00001]	[p value: <0.00001]			
L4	2.8509	1.0887	0.8334	230.70	1.33
	[*t ratio*: 3.2481]	[*t ratio*: 15.1890]			
	[p value: 0.0015]	[p value: <0.00001]			
L3	1.9022	1.1723	0.8177	1.72e-31	1.99
	[*t ratio*: 1.7507]	[*t ratio*: 16.5397]			
	[p value: 0.0828]	[p value: <0.00001]			
L2	2.9685	1.1816	0.8329	328.78	1.31
	[*t ratio*: 3.3038]	[*t ratio*: 18.1323]			
	[p value: 0.0012]	[p value: <0.00001]			
L1	1.9162	1.1300	0.7717	145.00	1.49
	[*t ratio*: 1.7177]	[*t ratio*: 12.0417]			
	[p value: 0.0886]	[p value: <0.00001]			

Table 6 A summary of the regression coefficients and measures of goodness of fit on regressing 3×6 winner (W_i) and loser (L_i) portfolios holding period returns over the period 2005–2015.

	Intercept(α_i)	Slope(β_i)	Adjusted R^2	F(1107)	D-W
W1	5.239 [*t ratio*: 2.2640] [p value: 0.02559]	1.1889 [*t ratio*: 12.2459] [p value: <0.00001]	0.7083	149.96	1.73
W2	6.6506 [*t ratio*: 3.7584] [p value: 0.0002]	1.1784 [*t ratio*: 14.2247] [p value: <0.00001]	0.7737	202.34	1.99
W3	4.5029 [*t ratio*: 3.2180] [p value: 0.0017]	1.1091 [*t ratio*: 19.3211] [p value: <0.00001]	0.8133	373.30	1.12
W4	3.8419 [*t ratio*: 2.5434] [p value: 2.5434]	1.1578 [*t ratio*: 18.3058] [p value: <0.00001]	0.8048	335.10	1.29
W5	3.5787 [*t ratio*: 2.7342] [p value: 0.0073]	1.1799 [*t ratio*: 22.6439] [p value: <0.00001]	0.8637	512.74	1.32
L5	−1.606 [*t ratio*: −11.8192] [p value: <0.00001]	−1.1466 [*t ratio*: −12.8922] [p value: <0.00001]	0.8025	166.20	1.32
L4	3.2822 [*t ratio*: 1.9732] [p value: 0.0510]	1.2269 [*t ratio*: 12.8217] [p value: <0.00001]	12.8217	164.39	1.04
L3	3.79199 [*t ratio*: 2.3076] [p value: 0.0229]	1.1840 [*t ratio*: 10.2908] [p value: <0.00001]	0.8165	105.90	1.78
L2	3.2891 [*t ratio*: 1.7733] [p value: 0.0790]	1.2258 [*t ratio*: 8.4270] [p value: <0.00001]	0.7585	71.01	1.01
L1	3.7359 [*t ratio*: 1.7177] [p value: 0.0887]	1.36727 [*t ratio*: 8.4100] [p value: <0.00001]	0.7731	70.72	1.65

portfolios, unlike their 1×3 counterparts, net foreign investment inflows are found to have a lesser significance although they impart a positive influence.

Tables 5 and 6 provide the summary statistics for 3-month and 6-month holding periods. Individual portfolios contribution to the momentum profits are signified by the CAPM coefficients, α.

In the Indian context, as far as the continuation of the abnormal momentum returns is concerned, the findings cohere with those documented by Jegadeesh and Titman (1993) with regard to the relative momentum returns. However, there is lack of any reversal trend for the 3-month and 6-month returns or even for 2–5 years of long-run holding periods. This is in contrast to the long-run reversal reported by Lee and Swaminathan (2000) and Jegadeesh and Titman (2001) and Chan (2003). The aforesaid studies reported strong momentum reversal considering a 2–5 years perspective following formation period.

All the α_i observations noted in Table 7 are statistically different from zero, suggesting the existence of momentum profits. Many emerging markets reported similar results to the current study conducted in India.

The decomposition of extra-normal profit for (1×3) and (3×6) portfolios returns are given in Tables 8 and 9, respectively.

Time-series pattern represents the largest chunk of the momentum returns. The pattern is the same across both winner and loser portfolios. Cross-sectional risk also signifies a piece of momentum profits in medium-volume and high-volume stocks. However, it is less compared to the time-series pattern. In case of lead-lag effect, a decline in momentum profits is witnessed in large-volume and medium-volume stocks, arising because of the effect. Similar results are noted for 3-month as well as 6-month holding periods and are in conformance with Japanese markets as stated by McInish, Ding, Pyun and Wongchoti (2006).

Managerial implications and policy formulation

Fund managers essentially focus on two main strategies, that is, momentum-based or value-based allocation. Active fund managers relying on momentum-based strategy try to extrapolate the recent trends. There the focus is to continue

Table 7 A summary of the intercepts for the 1×3 and 3×6 winner (W_i) and loser (L_i) portfolios indicates momentum profit in Indian equity market.

Portfolio	Intercept (1×3)	Intercept(3×6)	All α_i statistically zero	1×3 Portfolio	3×6 Portfolio
W1	2.512	5.239	t statistic	4.675	5.432
W2	1.642	6.651	Degrees of freedom	9	9
W3	2.673	4.503	Critical t-value (one-tailed)	1.833	1.833
W4	2.168	3.842	Critical t value (two-tailed)	$\pm$2.262	$\pm$2.262
W5	1.575	3.579	One-tailed probability	0.00058	0.000208
L1	1.916	3.736	One-tailed probability	0.99942	0.999792
L2	2.969	3.289	Two-tailed probability	0.00116	0.000416
L3	1.902	3.792	Two-tailed probability	0.99884	0.999584
L4	2.851	3.282			
L5	$-$1.451	$-$1.606			
Mean	1.876	3.631			
St Dev	1.269	2.114			

Table 8 A summary of the decomposition of the extra-normal profits for 1×3 portfolios.

	Cross-sectional risk $\sigma_\mu^2 = \frac{1}{N}\sum_{i=1}^{N}(\mu_i - \overline{\mu})^2$	Lead-lag effect $\delta = \frac{1}{N}\sum_{i=1}^{N}(b_{0,i} - \overline{b}_0)(b_{1,i} - \overline{b}_1)$	Time-series pattern $\Omega = \frac{1}{N}\sum_{i=1}^{N} Cov(e_{i,t}, e_{i,t-1})$
Winners	2.1441	$-$0.0245	23.0109
Losers	39.7101	$-$0.1698	116.1598

Table 9 A summary of the decomposition of the extra-normal profits for the 3×6 portfolios.

	Cross-sectional risk $\sigma_\mu^2 = \frac{1}{N}\sum_{i=1}^{N}(\mu_i - \overline{\mu})^2$	Lead-lag effect $\delta = \frac{1}{N}\sum_{i=1}^{N}(b_{0,i} - \overline{b}_0)(b_{1,i} - \overline{b}_1)$	Time-series pattern $\Omega = \frac{1}{N}\sum_{i=1}^{N} Cov(e_{i,t}, e_{i,t-1})$
Winners	11.7406	$-$0.0347	139.6654
Losers	149.8350	$-$0.1658	474.8721

buying portfolios with positive returns and selling portfolios with negative returns based on their past performance. The behaviour is in contrast with value-based funds where asset managers' focus is to build portfolios exploiting the difference between current market prices and intrinsic fundamental values of the portfolios.

Considering the aforesaid approach, momentum investing is widely regarded as one of the possible reasons behind the fund managers' asset allocation decision. As a result, the asset allocation strategy contributing to the fund's overall performance seems to be impacted in two possible ways, that is, the long-term objective of the investment and the ability to time the market in the immediate term. These goals, in turn, might lead to a highly competitive environment amongst fund houses enabling better returns and opportunities for the retail investors.

Keeping in view the objective, it becomes significantly relevant for the fund managers to design and test a model targetted at establishing the portfolio-specific factors alongside the macroeconomic and global factors which impact their asset allocation decision to a great extent.

It is also to be noted that portfolio-based momentum investing is still in its nascent stage and needs a lot of diligent programming to offer frequent opportunities enabling higher returns at a significantly lower risk. Momentum investing if applied effectively helps in selective utilisation of assets exhibiting strong momentum which have a higher likelihood of appreciating in the near future. This phenomenon permits a very efficient portfolio diversification process. To add to the aforesaid contribution, we feel it is time to consider and construct an alternate index based on momentum returns as suggested by Misra and Mohapatra (2015). The proposed momentum index might certainly act as a benchmark reference for measuring the mutual funds' performance and in turn the fund managers' performance that have relied on the performance of the benchmark indices while formulating their asset allocation. Realising the popularity of momentum investing amongst asset managers, capital market regulatory bodies should also consider pioneering momentum-based funds as a better investment opportunity for retail as well as high net worth investors.

Conclusion

The present study has made an effort to examine momentum investing from the viewpoint of asset allocation suggestions of fund houses, and has found evidence to support the application of momentum investing at portfolio level considering the impact of various portfolio-specific and macroeconomic factors.

We examine the effect of short-term and long-term momentum strategies in the Indian market by constructing 1×3 and 3×6 winner and loser portfolios over the study period 2005–2015. The reported returns are similar in nature to the momentum-led relative returns observed in the case of US markets by Jegadeesh and Titman (1993). However, a stark difference is noted when the discussion shifts to momentum reversal. In case of Indian equity market, no momentum reversal is seen for returns owing to long-run holding periods spanned over 2- 5-year duration.

Using VAR methodology, we extend the application of Jegadeesh and Titaman's (1993) model. We include macroeconomic factors such as net foreign institutional flows, term spread and index of industrial production alongside the portfolio-specific factors such as price-earnings ratio, price-book ratio and dividend yield numbers present in the existing model. The newly proposed model becomes more relevant in recent times considering the fact that traders as well as investors no longer confine themselves only to the firm- or sector-specific performance but are responsive to the global context and the macroeconomy at large.

We find that while price-earnings ratio and price-book value ratio are the significant portfolio-level factors, net foreign institutional inflows are a significant macroeconomic factor. We further decompose the abnormal returns to document the effect of time-series pattern, cross-sectional risk as well as lead-lag effect for short-term as well as long-term strategies.

We believe the current study and its findings might provide an insider's view to portfolio managers to design momentum-led portfolios and generate extra-normal returns in the long as well as short run.

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