Sources of Momentum Profits in Emerging Stock Markets : The Case of Dhaka Stock Exchange

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Abstract

This study focuses on sources of momentum strategies for the Dhaka Stock Exchange of Bangladesh. For these purposes, this study applies models based on serial correlation and lead - lag effect suggested by Jegadeesh and Titman (1993) and (1995) respectively. Results of these models find that investors' overreaction to firm- specific information is the source of momentum profits in the Dhaka Stock Exchange. Furthermore, lead- lag pattern in stock returns does not contribute to the expected momentum profits in Dhaka Stock Exchange. However, this study finds a large difference between expected and actual momentum profits for the Dhaka Stock Exchange.

Keywords: **momentum strategy, overreaction, underreaction, firm – specific information**
JEL Classification: G11, G12, G14

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Theories of standard finance stand on four basic pillars: **(1)** arbitrage principles; **(2)** portfolio principles; **(3)** capital asset pricing theory; and **(4)** option pricing theory. In these theories, investors are assumed to be 'rational agents' in the capital market. The main implication of this assumption is that investors price both private and public information fully and instantaneously. Assuming this argument is always true for the market, Sharpe (1964), Lintner (1965), Mossin (1966), and Black (1972) developed different versions of capital asset pricing models (hereafter CAPM) that basically shed light on the trade-off between systematic risk and expected return of a stock. Merton (1973) argued that CAPM models are not capable enough to explain excess returns that exist in the market. For this reason, failure of return predictability and the rational behavior of investors in CAPM models have been criticized in the recent research works of Statman (1999), Campbell and Vuolteenaho (2004), Gonza´lez (2001), Guo (2004), and Jirasakuldech, Emekter, and Rao (2008).

Another implication of rational behavior of investors is that it makes the stock market informationally efficient, which is well known as the efficient market hypothesis (hereafter EMH) in standard finance. EMH strongly argues that earning abnormal profits based on past information is not possible because stock related available information has already been priced in the market. This means that there is no prediction power in historical prices of stocks to bit the market, and hence, trading strategies based on past performance of stocks cannot produce any significant returns for the investors. This argument of EMH has also been rejected in recent finance literatures. This body of literature is led by Bondt and Thaler (1985) and followed by Jegadeesh (1990), Jegadeesh and Titman (1993), Hirshleifer, Subrahmanyam, and Titman (1994), Daniel, Hirshleifer, and Subramanyam (1998), Barberis, Shleifer, and Vishny (1998), and Odean (1998). They argued that trading strategies formed on the basis of past performance of stocks could produce significant returns for the investors. For this purpose, they applied momentum and contrarian strategies in their studies. Momentum strategy means to buy stocks that have experienced higher returns in the past and to sell stocks that have experienced poor returns in the same period. In contrast, contrarian strategy means to short past winners and go for long past losers. These strategies assume that investors may show under or overreaction to the relevant information of stocks.

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Investors' over and underreaction to information is explained through representativeness and conservativeness heuristics respectively. In representativeness, heuristic investors expect that past stock returns will be representative in the future. That is, a series of good (bad) news makes investors optimistic (pessimistic), and leads to overvaluation (undervaluation) of stocks. Shefrin and Statman (1995) found that investors are overly optimistic about past winners and overly pessimistic about past losers. On the other hand, conservativeness states that individuals are slow to change their prior beliefs in the face of new evidence, especially contradictory evidence. Daniel et al. (1998), Hirshleifer et al. (1994), and Odean (1998) argued that slow response to relevant information by overconfident investors is the reason of asset-pricing anomalies in the market. For these reasons, momentum and contrarian strategies are considered as the main weapons in the battle between standard and behavioral finance. But Fama and French (1992) in their three-factor model argued that systematic risk is the main source of profit to momentum strategies.

Objective of the Study

The contradiction about the sources of profitability of momentum strategies in recent research works is the prime motivation of this study to investigate the sources of momentum trading strategies in the Dhaka Stock Exchange (hereafter DSE).

Literature Review

Finance literature has seen a lot of debate about the sources of profitability of momentum trading strategies. Researchers believing in the efficient market hypothesis claim that profit of momentum strategies is a prize of systematic risk due to cross-sectional dispersion of mean returns in stocks rather than behavioral aspects of investors. On the other hand, researchers belonging to the field of behavioral finance claim that profit of momentum strategies is due to cognitive biases of investors. That means investors overreact or underreact to news. According to this group of researchers, investors' over or underreaction to firm-specific information produces profits of momentum strategies in the market (Hossan & Park, 2010). Hong and Stein (1999) found short-run momentum for small and low-analyst coverage stocks due to slower information diffusion and relationship between horizons of momentum traders and the pattern of return autocorrelations.

In a study on momentum trading in 12 European countries for the period from 1980 to 1995, Rouwenhorst (1998) found that momentum was present in all of those 12 countries. Between large and small firms of those 12 countries, strong momentum was reported for small firms as compared to that of large firms. Griffin, Ji, and Martin (2003) confirmed larger momentum profits and its pervasiveness for 40 countries all over the world. They suggested that momentum profits are the compensation of macroeconomic risks. They reported a weaker and insignificant momentum profit in Asia, which was 0.32% per month. From the studies of Rouwenhorst (1998) and Griffin et al. (2003), it was found that momentum profit in Asia was weaker than it was in Europe. Griffin et al. (2003) also found that price reversals of momentum portfolios were stronger in Asia than in U.S. and Europe.

In addition, Kang, Liu, and Ni (2002) found that momentum strategies are significant at the intermediate - term in China. To test whether the performance of momentum trading strategies varied across different weights of portfolios, they formed equal-weighted and value -weighted portfolios, and found that momentum profits were more distinct for value-weighted portfolios. They mentioned that stock prices lead-lag effect in China was the reason which produced more distinct profits for momentum strategies. Empirically, Jegadeesh and Titman (1993) found 1.31% return per month for a momentum strategy constructed by selecting stocks based on previous 12 months' returns with no time lag and by holding the said portfolio for 3 months for the U.S. market. In addition, Conrad and Kaul (1998) found that momentum strategy produces significant profits at medium horizons. They argued that cross - sectional differences in mean returns of securities produced momentum profits. They found no relationship between this cross-sectional variance with the time-series patterns in returns. Moskowitz and Grinblatt (1999) found that industry momentum contributed to profit of momentum strategies. However, Daniel et al. (1998) and Barberis et al. (1998) found that delayed overreaction to information during holding periods of momentum portfolios was the reason for abnormal returns.

Methodology

In order to investigate sources of profits of momentum strategies, this study applied a threefold methodology. First, test of stationarity was performed for DSE index returns in order to observe if abnormal profits from price continuation was possible. Second, this study constructed momentum trading strategies. Third, the serial correlation based model of Jegadeesh and Titman (1993) (hereafter mentioned as JT93), and the lead - lag model of Jegadeesh and Titman (1995) (hereafter mentioned as JT95) were applied to decompose sources of profits of momentum strategies constructed for DSE as similar to Hossan and Park (2010). Details of construction of trading strategies and investigation of sources of profits of these strategies are discussed in the following subsections.

↳ **Construction of Momentum Strategies :** This paper constructs momentum strategies following portfolio - based method as suggested by Jegadeesh and Titman (1993). For this purpose, firstly, return of a stock at the end of each month was calculated by taking the first difference of their month - end logarithmic price. That is,

$$r_{it} = \log P_{it} - \log P_{it-1},$$

where,

P_{it} and P_{it-1} are respectively stock prices at month t and $t-1$.

Second, stocks were ranked in ascending order based on their previous F – month returns. In momentum literature, F indicates formation month of momentum strategies. In this study, the length of F starts from the six- month and ends with sixtieth month following the steps used by Cooper, Gutierrez Jr., and Hameed (2004), Jegadeesh and Titman (1993), and Bondt and Thaler (1985). That means this study considers F = 6, 12, 18, 24, 30, 36, and 60 months. Third, based on the ranking in the second step, ten equally weighted decile portfolios were formed at the end of each month for the sample period from February 1999 to July 2007. Among these decile portfolios, the top decile was called as the "loser" decile and the bottom decile was called the "winner" decile portfolio. In this study, the Steps 1 - 3 were repeated for every month over the sample period. This repeated procedure made the portfolio formation of this study overlapping in nature. Fourth, in order to measure the performances of winner and loser portfolios in Step three, the average monthly holding - period returns of these portfolios were applied according to the suggestions of Conrad and Kaul (1993). It also started from the six month period and ended with the sixtieth month period. Therefore, the number of holding period months : H = 6, 12, 18, 24, 30, 36, and 60. In calculating holding period return of stocks, return of portfolio formation month was excluded to avoid bid - ask bounce in stock prices. Fifth, the differences in holding period returns of winner and loser portfolios were taken into account to calculate profits of return- based trading strategies at the event month. A positive difference between the holding period return of winner and loser deciles of a trading strategy indicates it as a momentum strategy (return continuation) in this study. This procedure was repeated for the whole sample period covered in this study.

↳ **Sources of Momentum Profits :** In order to decompose momentum profits, this study applied two models: **(1)** JT93 (as mentioned earlier); and **(2)** JT95 (as mentioned earlier). Details of these two methods are described below.

↳ **JT93 Model and Sources of Momentum Profits :** This model assumes that momentum profits are derived from three sources. These sources are: **(a)** cross - sectional dispersion in expected return; **(b)** cross- sectional variation in responsiveness to market portfolio returns; and **(c)** average serial covariance of idiosyncratic component of return generating model. In order to investigate the contribution of these three sources of momentum profits in DSE, the following one- factor return generating model of Jegadeesh and Titman (1993) is applied for security i :

$$r_{it} = \mu_i + b_i f_t + \varepsilon_{it} \qquad (1)$$

In the above model, r_{it} is the return on security i at time t, μ_i is the unconditional return on security i, ε_{it} is the firm - specific component of return at time t, b_i is the factor sensitivity of security i, and f_t is the unconditional unexpected return on a factor- mimicking portfolio. In this study, return on value weighted market portfolio is applied as a proxy to the factor - mimicking portfolio. If the market is efficient, then $E(f_t) = 0$ and $E(e_{it}) = 0$. In equation (1), Cov $(\varepsilon_{it}, f_t) = 0$, $\forall i$ indicates that the error term and unconditional unexpected return of value weighted market portfolio are independent on each other; Cov$(\varepsilon_{it}, \varepsilon_{jt}) = 0$, $\forall i \# j$ ensures independence of firm - specific return component of security i

at time t on the same of the security j at time $t-1$.

We know that momentum strategy earns profit from price continuation, which implies that stocks that produce higher than average returns at time $t-1$ also produce the same at time t or stocks that produce lower than average returns at time $t-1$ also produce the same at time t. In other words, it can be expressed in the following equations that:

$$E(r_{it}-\bar{r}_t|r_{it-1}-\bar{r}_{t-1}>0)>0 \qquad (2)$$

and

$$E(r_{it}-\bar{r}_t|r_{it-1}-\bar{r}_{t-1}<0)<0 \qquad (3)$$

where, $\bar{r}$ and $\bar{r}_{t-1}$ indicate cross-sectional average of returns. Equation (2) indicates that a stock which produces positive or higher than average return at time t is conditional to the same at time $t-1$, while Equation (3) expresses that a stock which produces negative or lower than average return at t is conditional to the same at time $t-1$. As discussed in the previous section (literature review) that momentum strategy generates higher than average return, therefore, it can be written in the following equation that:

$$E\{(r_{it}-\bar{r}_t|r_{it-1}-\bar{r}_{t-1})\}>0 \qquad (4)$$

In order to investigate the contribution of probable sources of such higher than average returns of momentum strategy in Equation (4), we can decompose sources of momentum profits into three components, which are as follows:

$$E(\pi^M)=\sigma^2_{\mu}+\sigma^2_{b}\,\mathrm{Cov}(f_t f_{t-1})+\overline{\mathrm{Cov}}_i(\varepsilon_{it},\varepsilon_{it-1}), \qquad (5)$$

where, $\pi^M = (r_{it}-\bar{r}_t|r_{it-1}-\bar{r}_{t-1})\ \sigma^2_{\mu}$, $\sigma^2_{b}\ (\varepsilon_{it},\varepsilon_{it-1})$ are respectively the expected return of momentum strategy, cross - sectional variances of expected returns, cross- sectional variances of sensitivities to market portfolio, and serial covariance of firm - specific component of momentum profit. There are three probable sources of momentum profits in the Equation (5): **(a)** cross - sectional dispersion in expected return, which is expressed by σ^2_{μ}. It means momentum strategies pick high - risk stocks and earn profit from it; **(b)** cross - sectional variations in responsiveness (or in b's) to serial correlation of market portfolio returns. That is, momentum strategy may select stocks with higher b's when market portfolio return is high. In Equation (5), this source of momentum profit is expressed by $\sigma^2_{b}\ \mathrm{Cov}(f_t, f_{t-1})$; **(c)** average serial covariance of firm - specific components of returns that is $\overline{\mathrm{Cov}}_i(\varepsilon_{it},\varepsilon_{it-1})$. It is assumed for Equation (5) that factor portfolio returns are normally distributed.

In case of DSE, if momentum profit derives from the first and second sources of Equation (5), then it would be considered that returns to momentum strategy are attributed to systematic risk, and hence, market would be considered as efficient. On the other hand, if profit of momentum strategy is derived from the third source of Equation (5), then it would be considered that returns to momentum strategy are the result of underreaction to firm - specific information, which will also indicate market inefficiency.

↳ **JT95 Model and Sources of Momentum Profits :** This model examines another probable reason of momentum profit named lead - lag relationship which exists in time- series of stock prices, which is not taken into account in the JT93 model. Based on this relationship, the JT95 model was applied to investigate the contribution of lead - lag relationship in stock prices of DSE to momentum profits. In this model, it is assumed that stock returns either overreact or underreact to common factors. Therefore, their return generating model is:

$$r_{it=}\mu_i+b_{1i}f_t+b_{2i}f_{t-1}+\varepsilon_{it}, \qquad (6)$$

where, μ_i is the unconditional expected return of stock i, f_t is the unexpected common factor realization at time t, b_{1i} and b_{2i} are respectively sensitivities to the contemporaneous and lagged factor realization. The positive value of sensitivity to lagged common factor (i.e.) $b_{2i} > 0$ in Equation (6), this indicates that contribution of the common factor to momentum profits is due to underreaction, while negative value of the same, that is, $b_{2i} < 0$ indicates that momentum profits is due to overreaction to contemporaneous factor realizations. Since momentum profits derive from price continuation, this study examines if price continuation is for variation in cross - sectional sensitivities to lagged

common factor. This can be done by decomposing the expected profit of momentum strategy according to the JT95 model in the following manner :

$$E(\pi)^M = \sigma^2_{\mu} + \Omega + \delta\sigma^2_f \qquad (7)$$

Each component of the above Equation (7) can be calculated as follows:

Cross - sectional risk:

$$\sigma^2_{\mu} = \frac{1}{N}\sum_{i=1}^{N} (\mu - \bar{\mu})^2 \qquad (8)$$

Direction of investors' sentiment:

$$\Omega \equiv \frac{1}{N}\sum_{i=1}^{N} \text{cov}\,(\varepsilon_{i,t}, \varepsilon_{i,t-1}) \qquad (9)$$

Lead – lag effect:

$$\delta \equiv \frac{1}{N}\sum_{i=1}^{N} (b_{1,i} - \bar{b}_1)(b_{2,i} - \bar{b}_2) \qquad (10)$$

$$\delta \equiv E(\delta)$$

In Equation (10), $\bar{b}_1$ and $\bar{b}_2$ are the cross-sectional averages of $\bar{b}_1$ and $\bar{b}_2$ respectively. Equation (7) decomposes momentum profits into three parts: **(a)** Cross-sectional variance of expected returns ,that is, σ^2_{μ}, **(b)** positive average serial covariance of the idiosyncratic components of stock returns, that is, Ω , which indicates stock price reactions to firm-specific information or investors' sentiment to a particular stock. The positive value of Ω means underreaction to firm-specific information and its continuation to the following period (or it indicates that investors' sentiment continues in the same direction), while negative value means overreaction to firm - specific information and to correct the overreaction in the following period (or it indicates change in direction of investors' sentiment), **(c)** timeliness of common factor reactions or contribution of lead - lag structure to momentum profits. Such contribution in momentum profits is expressed in Equation (7) by the product of cross - sectional covariances between contemporaneous and lagged betas with market factor variance, that is, $\delta\sigma^2_f$. In this equation, if $\delta > 0$, then the lead - lag structure contributes positively to momentum profits, while the opposite is true if $\delta < 0$.

For the empirical estimation of Equation (7), Jagadeesh and Titman (1995) constructed the following regression model similar to Equation (6) :

$$r_{it} = a_i + b_{1,i}\, r_{M,t} + b_{2,i,}\, r_{M,t-1} + e_{i,t} \qquad (11)$$

where, r_{it} is the return of stock i at time t , a_i is the unconditional expected return of stock i, r_{Mt} is the return on market portfolio at time t, $b_{1,i}$ and $b_{2,i}$ are the estimated sensitivities of stock i to the contemporaneous and lagged market returns, and $e_{i,t}$ is the residual term respectively. Equation (11) was applied to estimate a_i , b_1 and b_2 for each month and for each portfolio separately. After this estimation, average for a_i , b_1, b_2 and cov($e_{i,t}$, $e_{i,t-1}$) were calculated at each year for each portfolio. Using average figures of b_1, b_2 , and the differences in the timing of stock price reactions to the common factors, the cross - sectional covariances between contemporaneous and lagged betas can be calculated as follows:

$$\hat{\delta} = \frac{1}{N}\sum_{i=1}^{N} E\{(b_{1,i} - \bar{b}_1)(b_{2,i} - \bar{b}_2)\} \qquad (12)$$

where, $\bar{b}_1$ and $\bar{b}_2$ are the cross-sectional averages of $\bar{b}_{1,i}$ and $\bar{b}_{2,i}$ respectively. It is assumed for this covariance that contemporaneous and lagged betas are constant over time (Jegadeesh & Titman, 1995). From this covariance, an estimation of potential contribution to momentum profits can be possible. The positive covariance (i.e. $\hat{\delta} > 0$) of the

above equation indicates a positive contribution of common factors to momentum profits. The average sensitivity to the lagged factor, $\overline{b}_2$, of the Equation (12) can be applied to investigate overreaction (underreaction) to common factors. For this investigation, positive average sensitivity to the lagged factor (i.e. $\overline{b}_2 > 0$) indicates that the contribution of common factor reactions to momentum profits is due to underreaction, while the negative average sensitivity of the same ($\overline{b}_2 < 0$) is due to overreaction.

Finally, the product of covariance of Equation (12) with the variance to common factor $\delta\hat{\sigma}^2_M$ is an estimate of the profits due to common factor reactions. Ω in Equation (7) is an estimate of the profits due to overreaction to firm-specific information or direction of investors' sentiment to a particular stock, and σ^2_μ in Equation (7) is an estimate of profits unrelated to common factors and firm-specific information. The significance of all parameters in above equations is tested by the traditional $t-$test.

Data

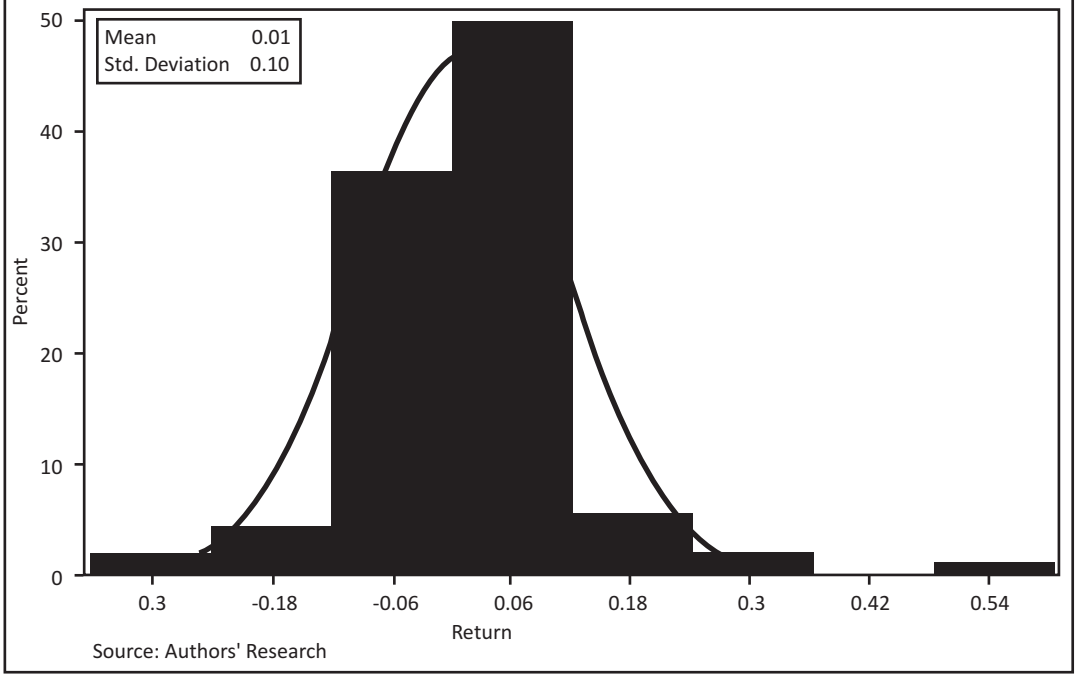
This study used month end returns of DSEALL index and individual stocks for the period from February 1999 to July 2007. DSEALL index return is used as a proxy to market return and interest rates of 28 - day treasury bill of Bangladesh Bank was used as a proxy to risk - free rate for the CAPM model. This study found discontinuation in DSEALL index data for December 2003 to March 2005. During this period, DSEGEN index data was used as a proxy to market returns

Table 1. Summary Statistics of DSE Monthly Returns

Panel A: Location and variability		
Mean		0.0097
Median		0.0003
Mode		-0.0133
Std Deviation		0.1019
Skewness		1.0351
Kurtosis		7.4413
Variance		0.0104
Range		0.9199
Interquartile Range		0.0613
Panel B: Tests for Normality		
Test	**Statistic**	***p* -Value**
Shapiro-Wilk *(W)*	0.8560	0.0001
Kolmogorov-Smirnov *(D)*	0.1579	0.0100
Cramer-von Mises *(W-Sq)*	1.4124	0.0050
Anderson-Darling *(A-Sq)*	7.3524	0.0050
Jarque-Bera (*JB*)	168.0710	0.0000
Panel C: Autocorrelation		
Lag	**Autocorrelations**	**Ljung-Box Prob. Figures**
6	-0.2000	0.0013
12	0.0300	0.0153
18	-0.1000	0.0530
24	0.0700	0.1198
30	0.0100	0.2971
36	-0.1000	0.2166
60	-0.1000	0.6583

Source: Compiled by the Authors

Figure 1. Histogram of Monthly Return Distribution of DSE Index
Period from January 1994 to August 2007



Source: Authors' Research

Table 2. Returns of Momentum Strategies in DSE

Formation Period		Portfolios	Holding Periods						
			6-months	12-months	18-months	24-months	30-months	36-months	60-months
	6-months	Winner	0.003	0.002	-0.001	-0.002	-0.002	0	0.003
		Loser	-0.008	-0.007	-0.005	-0.004	-0.003	-0.005	-0.004
		Winner - Loser	0.011	0.009	0.004	0.001	0.001	0.004	0.007
	12-months	Winner	0.005	0.002	-0.002	-0.003	-0.003	0	0.002
		Loser	-0.009	-0.006	-0.004	-0.003	-0.005	-0.008	-0.004
		Winner - Loser	0.014	0.008	0.002	0	0.002	0.007	0.007
	18-months	Winner	0.003	-0.001	-0.003	-0.004	-0.002	0.001	0.004
		Loser	-0.003	-0.003	-0.002	-0.003	-0.006	-0.009	-0.003
		Winner - Loser	0.005	0.002	-0.002	-0.001	0.004	0.01	0.007
	24-months	Winner	-0.002	-0.002	-0.004	-0.002	0	0.004	0.005
		Loser	-0.003	-0.001	-0.002	-0.006	-0.01	-0.011	-0.002
		Winner - Loser	0.001	-0.001	-0.002	0.004	0.01	0.016	0.007
	30-months	Winner	0.001	0.001	0	0.002	0.005	0.009	0.008
		Loser	0	-0.002	-0.005	-0.009	-0.012	-0.013	-0.002
		Winner - Loser	0.001	0.003	0.005	0.011	0.017	0.021	0.01
	36-months	Winner	0.003	0.004	0.005	0.007	0.009	0.011	0.011
		Loser	-0.005	-0.009	-0.009	-0.013	-0.014	-0.013	-0.004
		Winner - Loser	0.008	0.014	0.014	0.02	0.022	0.024	0.014
	60-months	Winner	0.012	0.005	0.002	0.001	0.003	0.01	NA
		Loser	-0.007	-0.003	0	0.001	0	-0.004	NA
		Winner - Loser	0.019	0.008	0.002	-0.001	0.003	0.014	NA

Source: Compiled by the Authors

Table 3. Sources of Momentum Profits in DSE According to the JT93 Model

	Components of source of momentum profits					
Strategies	$\bar{b}_i$	σ^2_{μ}	$\sigma^2_b Cov(f_t, f_{t-1})$	$\overline{Cov}_i(\varepsilon_{it}, \varepsilon_{it-1})$	$E(\pi^M)$	π^M
30/36 Strategy	0.3367	0.00058 (25.33%)	-0.00010 (-37%)	-0.00276 (-120.52%)	-0.00229	0.02126
36/30 Strategy	0.3593	0.00073 (31.88%)	0.00021 (9.17%)	-0.00323 (-141.05%)	-0.00229	0.02256
36/36 Strategy	0.3708	0.00056 (22.05%)	0.00004 (1.57%)	-0.00315 (-124.02%)	-0.00254	0.02423

Source: Compiled by the Authors

in this study. On the other hand, this study considered prices of 155 out of 274 stocks that were found to be eligible for the sample period. The remaining 119 stocks were kept beyond this study because of their different listing dates, delisting, and due to suspension reasons.

Results

Summary Statistics : The Table 1 presents summary statistics for the month end market return of DSE for the sample period. Panel A of Table 1 displays location of mean monthly market return and its variability. It includes mean, standard deviation, maximum return, minimum return, kurtosis, and skewness of monthly return of DSE. It can be seen from the Panel A of Table 1 that DSE produced, on an average, 0.97% monthly return and it varied, on an average, by 10.19% from one month to another month for the sample period. The value of kurtosis in Panel A of Table 1 is found to be greater than 3, which is the value for a normal distribution. That is, there is excess kurtosis (leptokurtic) on an average, in monthly returns of DSE. The value of excess kurtosis in DSE monthly return means that mean monthly returns spread in a wider fashion than normal distribution. So, on an average, monthly market return in DSE observed 'fat tail' risk. It also means that mean monthly return in DSE is relatively flatter than normally distributed returns. The value of skewness in Panel A of Table 1 also shows that the mean monthly return of DSE is not symmetrically distributed around its mean monthly return. In fact, monthly return of DSE is positively skewed and favors right tail, which is shown in the Figure 1. The positively skewed return distribution of DSE means that mean monthly market returns are greater than the median of the same.

Panel B of Table 1 shows results of test of normality for five different models. The *p* -figures of these tests clearly reject normality in monthly returns of DSE. Going further, Panel C of Table 1 presents results of autocorrelation in DSE returns for different lags that are applied to form momentum strategies. The Ljung-Box probability figures produced mixed results about the stationarity of monthly return in DSE. The Ljung - Box white noise probability figures in Panel C of Table 1 for six and twelve months lags imply that autocorrelation coefficient of these two lags are significantly different from zero at 5% level of significance. It means that stationarity in DSE returns is rejected for these two lags. So, stock returns in DSE are serially correlated for six and twelve months lag. In case of other five lags in Panel C of Table 1, the Ljung - Box probability figures reject autocorrelation effect in DSE returns. However, loss of normality in DSE returns means that anomalies exist in DSE returns, and making profits from such anomalies is possible.

Sources of Momentum Profits in DSE : This study reports forty eight trading strategies in Table 2 for the period from February 1999 to July 2007. Out of forty eight trading strategies, this study found 43 momentum strategies as mentioned in the methodology. In order to investigate the sources of momentum profits, this study chose three trading strategies such as 36/36, 36/30, and 30/36 on the basis of their profitability (Hossan & Park, 2010). That is, according to the percentage of profits, these three momentum strategies are ranked into first, second, and third, respectively. It was expected in this study that the contribution of potential sources to top performing momentum strategies represent the same for other momentum strategies in DSE.

Results of the JT93 Model : The Table 3 summarizes sources of momentum profits in DSE according to the JT93 model. The Columns 3,4, and 5 of the Table 3 respectively show the first, second, and third sources of expected momentum profits in Equation (5). The third column of Table 3 indicates contribution of dispersion in cross -sectional expected return to momentum profits in DSE. The figures in the third column of Table 3 were found to be positive for

all the three strategies. Such a positive figure means that dispersion in cross-sectional expected return, the first source of the JT93 model, is one of the sources of expected profits of momentum strategies in Table 3. Therefore, it can be said that the first source of JT93 model contributes in expected momentum profits of DSE. The first source of JT93 also contributes moderately (25.33%, 31.88%, and 22.05%, respectively) towards expected momentum profits of DSE in the Table 3.

The Column 4 of the Table 3 indicates contribution of variation in cross - sectional responsiveness to serial covariance in market return to expected momentum of profits in DSE. This is the second potential source of momentum profit of the JT93 model. Figures in the Column 4 of the Table 3 are found to be negative for momentum strategy 30/36 and are positive for momentum strategies 36/30 and 36/36. A negative figure means that the expected momentum profit of strategy 30/36 is not due to time factor of market portfolio return. The positive figures of strategies 36/30 and 36/36 of Table 3 imply that the expected momentum profits of these two strategies are due to the contribution of the time factor in the market portfolio. It also means that momentum profits of these two strategies arise as a consequence of selecting riskier stocks. However, it is interesting to note that selecting riskier stocks contributed less in expected momentum profit of DSE as compared to the third source in Column 5 of Table 3. The second source in Column 4 of Table 3 contributes -37%, 9.17%, and 1.57% respectively to expected profits of the sample momentum strategies. These lower percentages of contribution also mean that common factors that are not captured by beta risk play an important role to generate momentum profits in DSE. These characteristics of variations in cross-sectional sensitivities to time factor of the market portfolio support the findings of Rahman, Baten, Uddin, and Zubayer (2006) that beta negatively correlates with stock return of DSE.

The Column 5 in the Table 3 presents investors' sentiment in terms of over and underreaction to firm - specific information. This is the prime component of the JT93 model, which produces momentum profit in the U.S. stock market. In the case of DSE, figures in the 5th Column of Table 3 are found to be negative for all the three strategies. These negative figures imply that investors in DSE overreacted, on an average, to firm - specific information, and corrected it in the following month. This is the third source of expected momentum profit of JT93. The contribution of this source to expected momentum profits in DSE is -120.52%, -141.05%, and -124.02% to strategy 30/36, 36/30, and 36/36 respectively. The magnitude of investors' overreaction to firm- specific information is too high in DSE. Such attitude of investors in this market outweighs the positive role of the other two sources of momentum profits in most of the cases. This characteristic of the market is due to stock prices being pushed too high or too low by rumors (Kang et al., 2002). So, it can be said that the Bangladeshi investors who were trading in the market relied on rumors and were pushing the stock prices too high or too low from the fundamental prices. Of course, such a conclusion on the stock market of Bangladesh requires an in-depth study.

The last column of Table 3 presents actual momentum profits of the three strategies. It is found that expected momentum profits and actual momentum profits differ substantially in case of the three strategies. From this finding, it can be argued that JT93 is not capable enough to explain expected momentum profits in an emerging stock market like the DSE. The potential reasons of such mismatch in actual and expected profit might be for bid- ask spread and non-synchronous data. However, this requires developing a new model which would be able to explain expected momentum profits more accurately in emerging markets in general, and the DSE, in particular.

↳ **Results of the JT95 Model :** This model was applied to investigate if momentum profits arise from the lead- lag relationship in stock prices in DSE. The Table 4 presents the results of this model. With other results of JT95, the three potential sources of momentum profits are presented in the Columns 4,5, and 6 of the Table 4. Of these results, $\overline{b}_1$ is

Table 4. Sources of Momentum Profits in DSE According to the JT95 Model

	Components of source of momentum profits						
Strategies	$\overline{b}_1$	$\overline{b}_2$	σ^2_μ	$\delta\sigma^2_f$	Ω	$E(\pi^M)$	π^M
30/36 Strategy	0.3831	-0.1790	0.00056 (25.11%)	-0.00006 (-2.69%)	-0.00273 (-122.42%)	-0.00223	0.02126
36/30 Strategy	0.4219	-0.1917	0.00076 (31.02%)	-0.00002 (-0.82%)	-0.00319 (-130.20%)	-0.00245	0.02256
36/36 Strategy	0.4238	-0.2081	0.00055 (23.40%)	-0.00001 (-0.43%)	-0.00289 (-122.98%)	-0.00235	0.02423

Source: Authors

found to be positive and $\bar{b}_2$ is found to be negative for the three strategies in the Table 4. The negative figures of $\bar{b}_2$ in the Table 4 mean that stocks in DSE, on an average, overreacted to contemporaneous market factors, and such overreactions were corrected in the subsequent month. This behavior of investors is found to be true in case of DSE both for mid - and long - term momentum strategies. The Column 4 in the Table 4 presents variances in cross- sectional expected returns. This is the first source of expected momentum profits in the JT95 model. The contribution of this source in momentum profits is found to be 25.11%, 31.02%, and 23.40% for strategy 30/36, 36/30, and 36/36 respectively. The positive figures of variances in cross - sectional expected return means that it increases momentum profits. So, it can be a source of expected momentum profits in DSE. Its positive role for expected momentum profits might be for the reason that beta risk cannot capture some part of common factors risk in DSE. Also, the contribution of this risk factor is monotonic in nature for the three strategies reported in the Table 4. As a result, it is not possible to draw a general conclusion about it.

The Column 5 of Table 4 presents the second potential sources of momentum profits of the JT95 model. That is, the product of cross- sectional covariances between contemporaneous and lagged betas with market factor. It is also called the lead-lag component of stock prices or momentum profits due to market factor reactions. Empirically, lead - lag components are found to be negative for the three momentum strategies (Table 4). It means the lead - lag pattern in stock prices reduces momentum profits in DSE. In percentage, lead-lag pattern contributes -2.69%, -0.82%, and - 0.43% respectively to the momentum strategies 30/36, 36/30, and 36/36 in DSE. Such negative contribution of lead-lag component in momentum profits indicates that it cannot be a source of momentum profits in DSE, which is similar to the findings of Lo and MacKinlay (1990) and Jegadeesh and Titman (1993 and 1995). In their findings, the lead- lag pattern is also not a source of momentum profit for the U.S. market. In addition, it is also observed in the Table 4 that contribution of the lead - lag pattern in stock returns is monotonic in nature as the length of formation and holding period increases.

The Column 6 of the Table 4 presents the cross - sectional serial covariances of idiosyncratic risk or firm - specific component of return generating model in Equation (6). As in the JT93 model, firm - specific component is also an important source of expected momentum profit in the JT95 model. This component is found to be negative for all the three strategies reported in the Table 4. It contributes -122.42%, -130.20%, and -122.98% respectively to strategy 30/36, 36/30, and 36/36. The high magnitude of this component outweighs positive contribution of first source of expected momentum profits. According to Kang et al. (2002), a high magnitude of serial covariance of idiosyncratic terms means that stock prices are pushed too high or too low by rumors in the market. In case of DSE, this evidence is also found true both for the JT93 and JT95 model.

Further, the last 2 Columns of the Table 4 indicate high differences between expected and actual momentum profits in DSE. So, this model also is not capable enough to explain potential sources of momentum profits in DSE. The other reasons of such findings may be the small number of sample stocks and sample period covered in this study to estimate reliable parameters of the JT93 and JT95 model. However, this requires further study either by any new model or by taking a larger sample period for reliable investigation of sources of momentum profits in DSE.

Conclusion

This study extends the scope of empirical literatures on sources of profits of momentum strategies in the emerging stock market of Bangladesh. This study found that investors' overreaction to firm - specific information is the main source of momentum profits in DSE. Furthermore, the lead - lag pattern in stock returns does not contribute in the expected momentum profits in DSE. The findings of this study might explain the reasons why standard finance models such as the static market model and Fama and French's (1992) three factors model captured risk factors in smaller magnitude and also captured the unusual relationship between beta risk and stock returns in the Bangladeshi stock market in previous empirical studies.

In this area, modeling investors' excessive overreaction to firm - specific information, reasons for long - term profitability of momentum strategies, and developing new models to explain differences between expected and actual momentum profits are of interest for the future research works in the emerging stock markets.

Implication of Research Findings

The main implication of this study is that DSE is an anomaly market. Investors who want to exploit such anomalies can think about momentum strategies because this study found that momentum strategies produced positive returns in DSE. This study also found that returns of momentum strategies are mainly derived from investors' overreaction to firm - specific information rather than variances in cross - sectional expected return and lead - lag pattern in stock prices in DSE.

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