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STUDENT RESEARCH PROJECT

Test of Momentum Investment Strategy using Constituents of CNX 100 index

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Abstract

By using the momentum investment strategy--a strategy of buying stocks that have performed well in the past and selling stocks that have performed poorly in the past--to generate returns over a 3 to 12-month holding period, this paper provides evidence against the weak form of market efficiency theory which claims that superior returns cannot be produced on the basis of investment strategies based on historical data and if any such returns are earned it may be a mere compensation for the higher risk taken. The trading strategy has been tested using the constituents of CNX 100 for a period between 2003 and 2011. The results of the study are in sync with the findings of Jegadeesh and Titman (1993).

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I. Introduction

Investment strategies have received a lot of attention from the academic world over the last two decades. Armed with vast databases and cheap computing power, researchers have explored investment strategies across different asset classes; equities, in particular, have received a lot of focus.

Momentum investment strategy involves buying stocks that have performed well in the past and selling stocks that have performed poorly in the past. [2] The aim of this strategy is to generate significant returns over the holding period. Interest in momentum investment strategies has not just been limited to the researchers' world. They have found applications in the real world of asset management. Professional fund management companies in the United States (US) have successfully employed momentum investment strategies and launched momentum-based fund schemes. Some momentum-based funds have been running for over a decade and have billions of dollars of assets under management.

The weak form of the market efficiency hypothesis dictates that abnormal profits cannot be produced on the basis of investment strategies based on historical data and if any such returns are earned it is a mere compensation for the higher risk taken. However, near zero-beta portfolios have been created in the past, which have been found to produce superior absolute returns--much higher than risk free rate of return. [3] Momentum profits have thus remained an anomaly in the markets and provide fund managers with an excellent opportunity to create beta-neutral, superior-return portfolios.

To date, no asset-pricing model has been able to explain short-term momentum returns fully. Fama and French's three-factor version of capital asset-pricing model could explain most of the

[2] Selling of stocks can achieved through short sale or selling of futures depending on the regulations prevailing in various markets.

[3] A portfolio of assets so constructed as to have no systemic risk is referred to as a zero-beta portfolio. Systematic risk measures a portfolio's sensitivity to market price movements. A zero-beta portfolio is similar to a risk-free asset.

anomalies including long-term contrarian profits but could not explain short-term momentum returns. Grundy and Martin studied the risk sources of momentum strategies and concluded that while factor models can explain most of the variability of momentum returns, they fail to explain their mean returns. Momentum profits have also been shown to exist across various financial markets. Some view this unexplained persistence of momentum returns throughout the last several decades as one of the most serious challenges to the asset-pricing literature.

While momentum profits do exist, it is important to analyze whether the strategies based on the momentum effect remain viable after transaction costs are taken into account. In this context, Korajczyk and Sadka (2002) estimated that as much as 5 billion dollars can be invested in momentum strategies before the apparent profit opportunities vanish due to price impact induced by trades. [4]

While many studies on momentum investment strategies have been undertaken in the developed markets, very few studies have been done on Indian markets. The Indian market has undergone many changes in the last couple of decades, the volumes and liquidity have improved considerably over last two decades. The increasing role of institutional investors and the introduction of online fully automated screen-based trading have resulted in improved efficiency and effectiveness of the market. Turnover ratio has vastly improved from 32.7 percent in 1990-91 to 81.8 percent in 2006-07. [5] Trading in derivatives such as stock index futures, stock index options and futures and options in individual stocks was introduced to provide hedging options to the investors and to improve the 'price-discovery' mechanism in the market. In India, factors such as regulations allowing short sales in the cash market, reduction in transactions costs and the improved liquidity augur well for the successful implementation of momentum trading strategies.

This paper analyzes momentum investment strategy to generate significant returns over a 3 to 12 month holding period. For the purpose of this study, we have employed a methodology used commonly by researchers studying momentum investment strategies (see Section III) and the sample for the study consists of the constituent stocks from CNX 100 Index for the period 2003 to 2011. The latter serves the important purpose of not including any small cap or illiquid stock

[4] Refer to 'Explicit trading costs and price pressures' under implementation issues/considerations section.
[5] Reserve Bank of India – Equity and Corporate Debt Market Report.

and thus negates the hypothesis that profits generated in momentum investment strategies are compensation for the risks associated with small and illiquid stocks.

Our study aims at testing for existence of momentum profits and thus testing weak form of market efficiency which claims that superior returns cannot be produced on the basis of investment strategies based on historical data and if any such returns are earned it may be a mere compensation for the higher risk taken. While we essentially back-test the momentum investment strategy in this paper under the assumption of zero transaction costs, fund managers can actually test this strategy to examine its robustness in the real world.

The rest of the paper is organized as follows. Section II explains the momentum phenomenon. Section III discusses the methodology of the study. Section IV describes results and analysis. Section V discusses implementation issues. Finally, Section VI concludes the study summarizing the results and observations.

II. Momentum phenomenon

In their 1985 paper, Debondt & Thaler tested the momentum hypothesis and found significant momentum profits in the US market. In their subsequent 1987 paper, Debondt & Thaler studied the risk and size characteristics of the winning or losing firms. They found that neither risk nor size had any role to play in explaining the momentum effect. Jagdeesh & Titman (1993) studied the stock data in the US market from 1965 to 1989 and found that the strategy, which selects stocks, based on their past 6 months' returns and holds them for 6 months, realizes a compounded momentum return of 12.01 percent per year on average. Rouwenhorst (1998) reported that the momentum profits documented by Jegadeesh and Titman for the US market could also be obtained in the European markets. Chui, Titman, and Wei (2000) documented that with the notable exception of Japan and Korea, momentum profits were also obtained in Asian markets. A number of behavioral scientists have also attempted to explain the momentum phenomenon. Daniel, Hirshleifer and Subrahmanyam (1998) attributed the momentum

phenomenon to two biases of informed investors: overconfidence and biased self-attribution. [6] Overconfidence induces them to have an exaggerated view on the precision of their private signals about a stock's value, leading them to overreact to such signals. Biased self-attribution on the other hand causes informed investors to under-estimate public signals about value, especially when the public signals contradict their private signals. This overreaction, however, persists only in the short-run. With the passage of time as more information comes along, investors get a realistic picture of the impact of past information and tend to realize their mistakes that lead to reversals in the long run.

Providing a different explanation, Hong and Stein (1999) divided investors into two types- "news-watchers" and "momentum traders". The news-watchers rely purely on their private information, while momentum traders rely exclusively on the information in past price changes. Hence, price is driven initially by the news-watchers as they receive and react to their private information as soon as they come. The news gradually gets transmitted to the market, where chartists may get breakouts on their charts and react to the news. This means that there is a period of under-reaction initially, that is, till the time momentum traders begin to react to the news and subsequently, there is overreaction when momentum traders react to the news. In the long-run, however, this overreaction disappears and the price reverts to its fundamental level. A significant strand of the literature discusses the possible reasons for momentum profits, some attributing it to investor behavior, while others attributing it to risk factors not captured by CAPM or the Fama-French three-factor model.

III. Data and Methodology

Sampling

The sample for the study consists of the constituent stocks from CNX 100 index. It is a diversified 100-stock index accounting for 38 sectors of the economy. CNX 100 is computed using free-float market capitalization method. CNX 100 is owned and managed by India Index

[6] Both are well known behavioral bias. Self-attribution bias occurs when people attribute successful outcomes to their own skill but blame unsuccessful outcomes on bad luck.

Services and Products Ltd. (IISL), which is a joint venture between the NSE and CRISIL. The CNX 100 Index has a base date of Jan 1, 2003 and a base value of 1000 (Source: NSE website). The reason behind selecting S&P CNX 100 constituents stocks as sample is that in addition to the index representing almost the entire market, it also helps avoiding issues associated with small and illiquid stocks influencing the results.

Data Collection

Adjusted monthly closing prices of the stocks on NSE for the period starting January 2003 and ending August 2011 were obtained from the *Capitaline* database. [7] This study is for the period from January 2003 to August 2011, which includes the stock market rally from 2004 to 2008, the global financial meltdown of 2008-2009, and the subsequent recovery and the consolidation period beginning soon after. Thus, this period signifies all the major ups and downs in the Indian equity markets over the last decade.

Selection of scrips [8]

All stocks, which have been a part of the index at any point of time between January 2003 and August 2011, have been considered for the study. Any stock where the previous six months stock data is available (though it could be excluded from the index but continues to list on the NSE during the period of portfolio testing) is considered for **portfolio formation**. Any stock whose either last six months data is not available due to the stock being (a) unlisted during the portfolio formation or (b) getting delisted during the testing period, is not considered for portfolio formation. The number of CNX 100 stocks that qualify for 6 x 12 strategy according to the above mentioned criteria for each month of the selected period are shown in Annexure 1.

[7] Stock price is adjusted for stock splits, dividends/distributions, etc. which facilitates calculation of return without any difficulty i.e. if current price of a stock is Rs. 100, the company has just gone ex bonus with bonus of 1:1, which means price before the bonus may be say Rs.200. Now if we go by absolute price, then the last month's closing price may be somewhere around Rs. 200, while this month's closing price is around Rs.100, which means negative returns. However, that is not true as the stock has gone ex-bonus and therefore the price should be adjusted to half of the price prevailing before the bonus of 1:1 to make it comparable to the price now.

[8] Selection of scrips is done during the formation period.

Measurements of returns

Stock returns are measured monthly on adjusted monthly price of the companies by using the formula *ln(Pn/Pn-1)* where *Pn* and *Pn-1* are the adjusted closing prices of the last trading day of the two relevant months. [9] The main advantage of using logarithmic returns is that it is not affected by the base effect problem. For example, an investment of Rs.100 that yields an arithmetic return of 20 percent followed by an arithmetic return of (-20) percent results in a final value of Rs. 96; while an investment of Rs. 100 that yields a logarithmic return of 20 percent followed by a logarithmic return of (-20) percent results in Rs. 100.

MxN strategy

Here, we specifically use a strategy that selects stocks on the basis of returns over the past M months (i.e. formation period) and holds them for N months (holding period). This is called as the M x N strategy. At the beginning of each month t, the candidate stocks are ranked in descending order on the basis of their returns in the past M months. The top decile portfolio is called the "winners" portfolio and the bottom decile is called the "losers" portfolio. This strategy involves, simultaneously **buying the winner portfolio and selling the loser portfolio and then holding this position for N months (total number of months).**

The strategies we consider in this paper involve selecting stocks based on their 3-month and 6-month returns (for formation period). We then consider holding periods of 3, 6 and 12 months for stocks selected on the basis of returns in 3-month formation period--thus generating trading strategies: 3x3, 3x6, 3x12. On the basis of returns in 6-month formation period, however, we consider a holding period of only 12 months, thus generating the 6x12 trading strategy.

Methodology

To test the momentum trading strategy for Indian market, we have followed the methodology used by Debondt and Thaler (1985, 1987) and Jegadeesh and Titman (1993) with a slight modification i.e. instead of using abnormal returns, we use actual returns for the analysis, so that it serves two purposes. First, it does not have any adverse impact on robustness of analysis and

[9] For e.g. The return of a stock for the period of January 2003 to March 2003 will be calculated as [ln(*P1/P0*) + ln(*P2/P1*)] where P0, P1 and P2 are the adjusted closing prices for the last trading days for the months of January, February and March.

second, it simplifies understanding and makes implementation easier. Another important aspect to be noted about this strategy is that it uses overlapping portfolios. Jegadeesh and Titman (1993, 2001) suggest that using overlapping portfolios [10] helps reduce the effects of bid-ask bounce [11] and provides more robust results. Hence, we have considered overlapping portfolios for the four trading strategies. Therefore, in any given month, the strategies hold a series of portfolios that are selected in the current month as well as in the previous N-1 months, where N is the holding period.

In this paper, we explain the methodology for 6 x 12 strategy for illustration purpose, although similar methodology has been used in other strategies as well. The analysis is performed using first six months data for portfolio formation and next twelve months for portfolio testing period i.e. 6x12 strategy. As the study uses 104 months data (from January 2003 to August 2011), there are 86 winner and loser portfolios each for the testing period. [12]

The methodology for 6x12 strategy is explained below in various steps which are followed in the formation period and the holding period.

A. Formation Period

In case of a 6x12 strategy, if the portfolio has to be formed for the month of August 2003, then the cumulative returns of the selected stocks for last 6 months are calculated and then arranged in a descending order. The six months *CR* (Cumulative Returns) of the CNX 100 constituents is defined in equation (1). [13] For every stock *i* in the sample (CNX 100), the cumulative returns (CR) for the prior 6 months will be calculated as:

[10] Consider the 3 x 6 strategy. The portfolio formed at the end of June based on April – June returns would be held till December. Similarly portfolios formed at the end of July, August, September, October, November, would be held till the end of January, February, March, April and May respectively. Thus, in any given month t, the strategies hold a series of portfolios that are selected in the current month as well as in the previous n – 1 months where n is the holding period.

[11] Suppose a stock trades at bid 950 and ask 1000. Suppose no news appears for ten minutes. But, over this period, suppose that a buy order first comes in (at Rs.1000) followed by a sell order (at Rs. 950). This sequence of events makes it seem that the stock price has dropped by Rs.50. Even when no news is breaking, when a stock price is not changing, the `bid-ask bounce' is about prices bouncing up and down between bid and ask. These changes are spurious. This problem is the greatest with illiquid stocks where the bid-ask spread is wide.

[12] Number of winner or loser portfolios for the m x n strategy for a sample period of t months = t – m - n

[13] Cumulative returns help in identifying the month-on-month pattern in return of the portfolio especially in studies on momentum based strategies where there is reversal in the returns of the winner and loser portfolios over a period of time.

$$CR = \sum_{t=-5}^{0} Rit \qquad (1)$$

where R_{it} is the return of the i^{th} stock for the t^{th} month. In simple words, cumulative returns are the sum total of the logarithmic month-on- month returns of the stock prices in the past six months.

i.e. $CR_i = \ln(P_1/P_0) + \ln (P_2/P_1) + \ln(P_3/P_2) + \ln(P_4/P_3) + \ln(P_5/P_4) + \ln(P_6/P_5)$

where P_0, P_1, P_2, P_3, P_4, P_5 , P_6 and P_7 are adjusted monthly closing prices for January, February, March, April, May ,June and July respectively.

Based on the cumulative returns (CR_i), the stocks are arranged in descending order. Based on these rankings, ten decile portfolios are formed. Each decile portfolio consists of stocks weighed equally in that decile. **Top decile portfolio forms winner portfolio and bottom decile portfolio forms loser portfolio.**

It is to be noted that a portfolio is constructed by going long on the winner portfolio and short on the loser portfolio. This is done on a monthly basis and the step is repeated 86 times for the period starting August 2003 and ending on August, 2011 as mentioned above.

B. Holding Period

After the winner and loser portfolios are identified in a given month for a given formation period, the following calculations are to be done for the holding period.

Step 1: Calculating month-on-month stock returns for all stocks selected in winner and loser portfolio

The first step involves calculating month-on-month returns for all candidate stocks in the winner and loser portfolio for each of the 12 months holding period (i.e. 1st month return, 2nd month return, 3rd month…and 12th month returns). [14] This is illustrated below with the help of Matrix 1.

[14] As mentioned above, these returns are calculated using the logarithmic returns of adjusted monthly closing prices during the month i.e. $R_{(1,1)} = \ln(P_6/P_5)$…. $R_{(12,10)} = \ln(P_{11}/P_{10})$ and so on.

Matrix 1: Illustration of returns (month-on-month) during the holding period (12 months) for one sample winner portfolio formed during August 2003

Returns during the holding month									
Stock No.	**Name of Stocks**	**1st month**	**2nd month**	**3rd month**	**……**	**9th month**	**10th month**	**11th month**	**12th month**
1	Oriental	$R_{(1,1)}$	$R_{(2,1)}$	$R_{(3,1)}$	……	$R_{(9,1)}$	$R_{(10,1)}$	$R_{(11,1)}$	$R_{(12,1)}$
2	CPCL	$R_{(1,2)}$	$R_{(2,2)}$	$R_{(3,2)}$	……	$R_{(9,2)}$	$R_{(10,2)}$	$R_{(11,2)}$	$R_{(12,2)}$
3	Flextronics	$R_{(1,3)}$	$R_{(2,3)}$	$R_{(3,3)}$	……	$R_{(9,3)}$	$R_{(10,3)}$	$R_{(11,3)}$	$R_{(12,3)}$
4	LIC Housing Fin	$R_{(1,4)}$	$R_{(2,4)}$	$R_{(3,4)}$	……	$R_{(9,4)}$	$R_{(10,4)}$	$R_{(11,4)}$	$R_{(12,4)}$
5	M&M	$R_{(1,5)}$	$R_{(2,5)}$	$R_{(3,5)}$	……	$R_{(9,5)}$	$R_{(10,5)}$	$R_{(11,5)}$	$R_{(12,5)}$
6	Bank of Baroda	$R_{(1,6)}$	$R_{(2,6)}$	$R_{(3,6)}$	……	$R_{(9,6)}$	$R_{(10,6)}$	$R_{(11,6)}$	$R_{(12,6)}$
7	Bharat Electron	$R_{(1,7)}$	$R_{(2,7)}$	$R_{(3,7)}$	……	$R_{(9,7)}$	$R_{(10,7)}$	$R_{(11,7)}$	$R_{(12,7)}$
8	ING Vyasa Bank	$R_{(1,8)}$	$R_{(2,8)}$	$R_{(3,8)}$	……	$R_{(9,8)}$	$R_{(10,8)}$	$R_{(11,8)}$	$R_{(12,8)}$
9	Grasim Inds	$R_{(1,9)}$	$R_{(2,9)}$	$R_{(3,9)}$	……	$R_{(9,9)}$	$R_{(10,9)}$	$R_{(11,9)}$	$R_{(12,9)}$
10	India Cement	$R_{(1,10)}$	$R_{(2,10)}$	$R_{(3,10)}$	……	$R_{(9,10)}$	$R_{(10,10)}$	$R_{(11,10)}$	$R_{(12,10)}$
	Average Returns =	AR_1 = avg ($R_{(1,1)}$… $R_{(1,10)}$).	AR_2 = avg($R_{(2,1)}$… $R_{(2,10)}$)	AR_3= avg ($R_{(3,1)}$… $R_{(3,10)}$).		AR_9 = avg ($R_{(9,1)}$… $R_{(9,10)}$).	$AR_{10=avg}$ ($R_{(10,1)}$… $R_{(10,10)}$).	AR_{11} =avg($R_{(11,1)}$… $R_{(11,10)}$).	AR_{12} =avg ($R_{(12,1)}$… $R_{(12,10)}$)

where:

$R_{(1,1)}$ is the month-on-month return of stock 1 for the month of August 2003;

$R_{(12,10)}$ is the month-on-month return of stock 10 for July 2004 and so on.

Step 2: Calculating Average Return of Stocks

After Step 1, average of the stock returns are calculated for each month of the 12-month holding period for each winner and loser portfolio. This is illustrated in Matrix 1 where:

AR_1 = Average($R_{(1,1)}$,$R_{(1,2)}$,$R_{(1,3)}$,$R_{(1,4)}$,$R_{(1,5)}$,$R_{(1,6)}$,$R_{(1,7)}$,$R_{(1,8)}$,$R_{(1,9)}$,$R_{(1,10)}$) i.e. average of the return of all stocks during the first month in the winner portfolio for the particular month.

…

AR_{12} = Average($R_{(12,1)}$,$R_{(12,2)}$,$R_{(12,3)}$,$R_{(12,4)}$,$R_{(12,5)}$,$R_{(12,6)}$,$R_{(12,7)}$,$R_{(12,8)}$,$R_{(12,9)}$,$R_{(12,10)}$) i.e. average of return of all stocks during the twelfth month in the winner portfolio for the particular month

Likewise, average returns are calculated for the winner and loser portfolios separately for each of the 86 iterations. Matrix 2 illustrates the average returns of all the winner portfolios. Similar matrix needs to be constructed for the loser portfolio.

Matrix: 2 Calculation of average returns of the 86 winner portfolios

	Portfolios								
Average Returns	**1** **(Aug 03)**	**2** **(Sep 03)**	**3** **(Oct 03)**	**4** **(Nov 03)**		**83** **(Jun 10)**	**84** **(Jul 10)**	**85** **(Aug 10)**	**86** **(Sep 10)**
$AR_{W,1\ (1st\ month\ return)}$	$AR_{1,1}$	$AR_{1,2}$	$AR_{1,3}$	$AR_{1,4}$		$AR_{1,83}$	$AR_{1,84}$	$AR_{1,85}$	$AR_{1,86}$
$AR_{(W,2)}$	$AR_{2,1}$	$AR_{2,2}$	$AR_{2,3}$	$AR_{2,4}$	.....	$AR_{2,83}$	$AR_{2,84}$	$AR_{2,85}$	$AR_{2,86}$
$AR_{(W,3)}$	$AR_{3,1}$	$AR_{3,2}$	$AR_{3,3}$	$AR_{3,4}$		$AR_{3,83}$	$AR_{3,84}$	$AR_{3,85}$	$AR_{3,86}$
$AR_{(W),4)}$	$AR_{4,1}$	$AR_{4,2}$	$AR_{4,3}$	$AR_{4,4}$	.....	$AR_{4,83}$	$AR_{4,84}$	$AR_{4,85}$	$AR_{4,86}$
$AR_{(W,5)}$	$AR_{5,1}$	$AR_{5,2}$	$AR_{5,3}$	$AR_{5,4}$		$AR_{5,83}$	$AR_{5,84}$	$AR_{5,85}$	$AR_{5,86}$
$AR_{(W,6)}$	$AR_{6,1}$	$AR_{6,2}$	$AR_{6,3}$	$AR_{6,4}$	.....	$AR_{6,83}$	$AR_{6,84}$	$AR_{6,85}$	$AR_{6,86}$
$AR_{(W,7)}$	$AR_{7,1}$	$AR_{7,2}$	$AR_{7,3}$	$AR_{7,4}$		$AR_{7,83}$	$AR_{7,84}$	$AR_{7,85}$	$AR_{7,86}$
$AR_{(W,8)}$	$AR_{8,1}$	$AR_{8,2}$	$AR_{8,3}$	$AR_{8,4}$	.....	$AR_{8,83}$	$AR_{8,84}$	$AR_{8,85}$	$AR_{8,86}$
$AR_{(W,9)}$	$AR_{9,1}$	$AR_{9,2}$	$AR_{9,3}$	$AR_{9,4}$		$AR_{9,83}$	$AR_{9,84}$	$AR_{9,85}$	$AR_{9,86}$
$AR_{(W,10)}$	$AR_{10,1}$	$AR_{10,2}$	$AR_{10,3}$	$AR_{10,4}$	.....	$AR_{10,83}$	$AR_{10,84}$	$AR_{10,85}$	$AR_{10,86}$
$AR_{(W,11)}$	$AR_{11,1}$	$AR_{11,2}$	$AR_{11,3}$	$AR_{11,4}$		$AR_{11,83}$	$AR_{11,84}$	$AR_{11,85}$	$AR_{11,86}$
$AR_{(W,12)}$ (12th month return)	$AR_{12,1}$	$AR_{12,2}$	$AR_{12,3}$	$AR_{12,4}$	.....	$AR_{12,83}$	$AR_{12,84}$	$AR_{12,85}$	$AR_{12,86}$

Step 3: Calculating Cumulative Average Returns

The monthly ARs (in Matrix 2) are used to calculate the Cumulative Average Returns (*CAR*s) in each month (t*)*, where *t*=1,…, 12 during holding period, this step is repeated 86 times each i.e. for 86 winner and 86 loser portfolios for 6x12 strategy as shown in the Matrix 3.

Matrix 3: Calculating Month wise cumulative average returns for 86 winner and loser portfolios

Cumulative Average Returns Month wise	Portfolios									Mean Cumulative Average returns of all 86 Portfolios where K=86
	1	2	3	4		83	84	85	86	
	(Aug 03)	(Sep 03)	(Oct 03)	(Nov 03)		(Jun '10)	(Jul 10)	(Aug 10)	(Sep 10)	
$CAR_{(W,1)}$	$CAR_{1,1} = AR_1$	$CAR_{1,2}$	$CAR_{1,3}$	$CAR_{1,4}$	…..	$CAR_{1,83}$	$CAR_{1,84}$	$CAR_{1,85}$	$CAR_{1,86}$	$\mathbf{MCAR_1} = (CAR_{(1,1)} + CAR_{(1,2)} + \ldots.. + CAR_{(1,86)})/K$
$CAR_{(W,2)}$	$CAR_{2,1}=CAR_1 + AR_2$	$CAR_{2,2}$	$CAR_{2,3}$	$CAR_{2,4}$	…..	$CAR_{2,83}$	$CAR_{2,84}$	$CAR_{2,85}$	$CAR_{2,86}$	$MCAR_2$
$CAR_{(W,3)}$	$CAR_{3,1}=CAR_2 + AR_3$	$CAR_{3,2}$	$CAR_{3,3}$	$CAR_{3,4}$	…..	$CAR_{3,83}$	$CAR_{3,84}$	$CAR_{3,85}$	$CAR_{3,86}$	$MCAR_3$
$CAR_{(W,4)}$	$CAR_{4,1}=CAR_3 + AR_4$	$CAR_{4,2}$	$CAR_{4,3}$	$CAR_{4,4}$	…..	$CAR_{4,83}$	$CAR_{4,84}$	$CAR_{4,85}$	$CAR_{4,86}$	$MCAR_4$
$CAR_{(W,5)}$	$CAR_{5,1}=CAR_4 + AR_5$	$CAR_{5,2}$	$CAR_{5,3}$	$CAR_{5,4}$	…..	$CAR_{5,83}$	$CAR_{5,84}$	$CAR_{5,85}$	$CAR_{5,86}$	MCAR5
$CAR_{(W,6)}$	$CAR_{6,1}=CAR_5+ AR_6$	$CAR_{6,2}$	$CAR_{6,3}$	$CAR_{6,4}$	…..	$CAR_{6,83}$	$CAR_{6,84}$	$CAR_{6,85}$	$CAR_{6,86}$	$MCAR_6$
$CAR_{(W,7)}$	$CAR_{7,1}=CAR_6 + AR_7$	$CAR_{7,2}$	$CAR_{7,3}$	$CAR_{7,4}$	…..	$CAR_{7,83}$	$CAR_{7,84}$	$CAR_{7,85}$	$CAR_{7,86}$	MCAR7
$CAR_{(W,8)}$	$CAR_{8,1}=CAR_7+ AR_8$	$CAR_{8,2}$	$CAR_{8,2}$	$CAR_{8,2}$	…..	$CAR_{8,83}$	$CAR_{8,84}$	$CAR_{8,85}$	$CAR_{8,86}$	$MCAR_8$
$CAR_{(W,9)}$	$CAR_{9,1}=CAR_8 + AR_9$	$CAR_{9,2}$	$CAR_{9,3}$	$CAR_{9,4}$	…..	$CAR_{9,83}$	$CAR_{9,84}$	$CAR_{9,85}$	$CAR_{9,86}$	MCAR9
$CAR_{(W,10)}$	$CAR_{10,1}=CAR_9 + AR_{10}$	$CAR_{10,2}$	$CAR_{10,3}$	$CAR_{10,4}$	…..	$CAR_{10,83}$	$CAR_{10,84}$	$CAR_{10,85}$	$CAR_{10,86}$	$MCAR_{10}$
$CAR_{(W,11)}$	$CAR_{11,1}CAR_{10} + AR_{11}$	$CAR_{11,2}$	$CAR_{11,3}$	$CAR_{11,4}$	…..	$CAR_{11,83}$	$CAR_{11,84}$	$CAR_{11,85}$	$CAR_{11,86}$	$MCAR_{11}$
$CAR_{(W,12)}$	$CAR_{12,1}=CAR_{11} + AR_{12}$	$CAR_{12,2}$	$CAR_{12,3}$	$CAR_{12,4}$	…..	$CAR_{12,83}$	$CAR_{12,84}$	$CAR_{12,85}$	$CAR_{12,86}$	$\mathbf{MCAR_{12}}=(CAR_{(12,1)} + CAR_{(12,2)} + \ldots..+ CAR_{(1,86)})/K$

where:

$CAR_{W,1}$ denotes the Cumulative average returns for the winner portfolio for the one month and $CAR_{w,12}$ denotes the cumulative average returns for the winner portfolio for two months and so on. Similarly, cumulative average returns are calculated for loser portfolio.

Step 4: Mean Cumulative Average Returns

Then average the *CARs* for these 86 portfolios are used to get Mean Cumulative Average Returns (*MCARs*). [15] (see Matrix 3)

[15] Since MCAR gives the average of the CAR of all the 86 portfolios, it removes any seasonality or cyclical bias from CAR.

where:

$MCAR_1 = (CAR_{(1,1)} + CAR_{(1,2)} + \ldots.. + CAR_{(1,86)})/K$

…

$MCAR_{12} = (CAR_{(12,1)} + CAR_{(12,2)} + \ldots.. + CAR_{(1,86)})/K$

where K = 86 (Number of iterations)

$CAR_{(1,1)}$ and $CAR_{(1,86)}$ are the Cumulative Average Returns for the 1st month of the holding period for the 1st and 86th portfolios respectively.

$CAR_{(12,1)}$ and $CAR_{(12,86)}$ are the Cumulative Average Returns for the 12st month of the holding period for the 1st and 86th portfolios respectively.

Step 4: Mean Average Returns

The mean average returns (MARs) are calculated by averaging the *ARs* for the 86 portfolios for the 86 months. [16]

Matrix 4: Mean average returns (MAR) for 86 winner and loser portfolios

Average Returns	Portfolio 1 (Aug 03)	Portfolio 2 (Sep 04)	Portfolio 3 (Oct 04)	Portfolio 5 (Dec 04)	……	Portfolio 84 (Jul 10)	Portfolio 85 (Aug 10)	Portfolio 86 (Sep 10)	Mean Average returns of all 86 Portfolios where K=86
$AR_{(W),1)}$	$AR_{1,1}$	$AR_{1,2}$	$AR_{1,3}$	$AR_{1,5}$		$AR_{1,84}$	$AR_{1,85}$	$AR_{1,86}$	**MAR_1 =** $(AR_{(1,1)} + AR_{(1,2)} + \ldots.. + AR_{(1,86)})/K$
$AR_{(W,2)}$	$AR_{2,1}$	$AR_{2,2}$	$AR_{2,3}$	$AR_{2,5}$	……	$AR_{2,84}$	$AR_{2,85}$	$AR_{2,86}$	**MAR_2**
$AR_{(W,3)}$	$AR_{3,1}$	$AR_{3,2}$	$AR_{3,3}$	$AR_{3,5}$		$AR_{3,84}$	$AR_{3,85}$	$AR_{3,86}$	**MAR_3**
$AR_{(W,4)}$	$AR_{4,1}$	$AR_{4,2}$	$AR_{4,3}$	$AR_{4,5}$	……	$AR_{4,84}$	$AR_{4,85}$	$AR_{4,86}$	**MAR_4**
$AR_{(W,5)}$	$AR_{5,1}$	$AR_{5,2}$	$AR_{5,3}$	$AR_{5,5}$		$AR_{5,84}$	$AR_{5,85}$	$AR_{5,86}$	**MAR_5**
$AR_{(W,6)}$	$AR_{6,1}$	$AR_{6,2}$	$AR_{6,3}$	$AR_{6,5}$	……	$AR_{6,84}$	$AR_{6,85}$	$AR_{6,86}$	**MAR_6**
$AR_{(W,7)}$	$AR_{7,1}$	$AR_{7,2}$	$AR_{7,3}$	$AR_{7,5}$		$AR_{7,84}$	$AR_{7,85}$	$AR_{7,86}$	**MAR_7**
$AR_{(W,8)}$	$AR_{8,1}$	$AR_{8,2}$	$AR_{8,3}$	$AR_{8,5}$	……	$AR_{8,84}$	$AR_{8,85}$	$AR_{8,86}$	**MAR_8**

[16] Since MAR gives the average of the AR of all the 86 portfolios it removes any seasonality or cyclical bias from AR.

Average Returns	Portfolio 1 (Aug 03)	Portfolio 2 (Sep 04)	Portfolio 3 (Oct 04)	Portfolio 5 (Dec 04)	……	Portfolio 84 (Jul 10)	Portfolio 85 (Aug 10)	Portfolio 86 (Sep 10)	Mean Average returns of all 86 Portfolios where K=86
$AR_{(W(L),9)}$	$AR_{9,1}$	$AR_{9,2}$	$AR_{9,3}$	$AR_{9,5}$		$AR_{9,84}$	$AR_{9,85}$	$AR_{9,86}$	**MAR_9**
$AR_{(W(L),10)}$	$AR_{10,1}$	$AR_{10,2}$	$AR_{10,3}$	$AR_{10,5}$	……	$AR_{10,84}$	$AR_{10,85}$	$AR_{10,86}$	**MAR_{10}**
$AR_{(W(L),11)}$	$AR_{11,1}$	$AR_{11,2}$	$AR_{11,3}$	$AR_{11,5}$		$AR_{11,84}$	$AR_{11,85}$	$AR_{11,86}$	**MAR_{11}**
$AR_{(W(L),12)}$	$AR_{12,1}$	$AR_{12,2}$	$AR_{12,3}$	$AR_{12,5}$	……	$AR_{12,84}$	$AR_{12,85}$	$AR_{12,86}$	**MAR12** = $(AR_{(12,1)} + AR_{(12,2)} + \ldots.+ AR_{(1,86)})/K$

where:

$MAR_1 = (AR_{(1,1)} + AR_{(1,2)} + \ldots.+ AR_{(1,86)})/K$

…

$MAR_{12} = (AR_{(12,1)} + AR_{(12,2)} + \ldots.+ AR_{(12,86)})/K$

K = 86 (Number of iterations)

$AR_{(1,1)}$ and $AR_{(1,86)}$ are the Average Returns for the 1st month of the holding period for the 1st and 86th portfolios respectively.

$AR_{(12,1)}$ and $AR_{(12,86)}$ are the Average Returns for the 12st month of the holding period for the 1st and 86th portfolios respectively.

Box 1 gives the definition of AR, CAR, MCAR and MAR to test the momentum strategy**.**

Box 1: Definitions of AR, CAR, MCAR and MAR

$$\mathrm{AR(W,t)} = \left(\frac{1}{\mathrm{N}}\right) * \sum_{\mathrm{i=1}}^{\mathrm{N}} ARit \qquad \mathrm{AR(L,t)} = \left(\frac{1}{\mathrm{N}}\right) * \sum_{\mathrm{i=1}}^{\mathrm{N}} ARit \qquad (2)$$

$$\mathrm{CAR(W,t)} = \sum_{\mathrm{t=1}}^{12} AR(W,t) \qquad \mathrm{CAR(L,t)} = \sum_{\mathrm{t=1}}^{12} AR(L,t) \qquad (3)$$

$$\mathrm{MCAR(W,t)} = \left(\frac{1}{\mathrm{K}}\right) * \sum_{\mathrm{i=1}}^{\mathrm{K}} CARt(W,i) \qquad \mathrm{MCAR(L,t)} = \left(\frac{1}{\mathrm{K}}\right) * \sum_{\mathrm{i=1}}^{\mathrm{K}} CARt(L,i) \qquad (4)$$

$$\mathrm{MAR(W,t)} = \left(\frac{1}{\mathrm{K}}\right) * \sum_{\mathrm{i=1}}^{\mathrm{K}} ARt(W,i) \qquad \mathrm{MAR}(L,t) = \left(\frac{1}{\mathrm{K}}\right) * \sum_{i=1}^{K} ARt(L,i) \qquad (5)$$

Where n=number of stocks in each portfolio t= 1 to 12 k = no of times test repetition (86 in our case)

Test of Significance

$MCAR_W$ ($MCAR_L$) indicates how much cumulated returns stocks in the winner (loser) portfolio earn on an average during 12 months in test period.

If markets are efficient but weak then $MCAR_W$ minus $MCAR_L$ must be equal to zero.

The momentum hypothesis implies that $MCARw$ minus $MCAR_L > 0$.

The two tests -- MCAR and MAR are used to test the hypothesis. The test of MCAR verifies significance of momentum returns and show if the returns grow stronger or are reversed at some stage during holding period on a cumulative basis. The test of MAR helps one to identify on a monthly basis whether the momentum returns are getting built up or reversed. Before analyzing the results of momentum hypothesis from MCAR test and MAR test, it is to be noted that one has to look at the returns of the momentum portfolio i.e. the return of the winner portfolio (W) minus the return of the loser portfolio (L). [17] Therefore, if the momentum profits exist then winners should always outperform losers irrespective of the direction of the market movement and thereby generate absolute positive returns. Let us understand this by following two possible scenarios.

Scenario 1: Market Goes Up

If the entire market goes up significantly say by 10 percent, both the winner as well as loser portfolios would generate positive returns. The only difference being that winner portfolio would outperform the market and may earn 12 percent returns whereas the loser portfolio would underperform the market and may earn only 8 percent. Therefore, the momentum portfolio i.e. W minus L would yield a return of 12 percent – 8 percent = 4 percent.

Scenario-2: Market Goes Down

If the entire market goes down by 10 percent, both the winner as well loser portfolios would expectedly generate negative returns. The only difference being that the winner portfolio would

[17] As mentioned earlier, in the momentum investment strategy one has to simultaneously buy the winner portfolio(W) and sell the loser portfolio (L).

lose percent while the loser portfolio would underperform and may go down by 12 percent. Therefore the momentum portfolio i.e. W minus L would yield a return of -8 percent -(-12 percent) = 4 percent.

Thus, an important point to be noted is that irrespective of direction of market movement, the momentum portfolio (W minus L) would generate absolute positive return of 4 percent. This is also known as a zero beta or non-directional strategy.

IV. Results and Analysis

In this section, we analyze the results of the 6 x 12 strategy using MCAR and MAR tests explained in section IVA and IV B.

IVA. Mean Cumulative Average Returns Test

$MCAR_t$ of a portfolio shows the cumulated returns of the portfolio till the t^{th} month (for example $MCAR_3$ denotes mean cumulative average returns of 86 winner and loser portfolios in the third month).

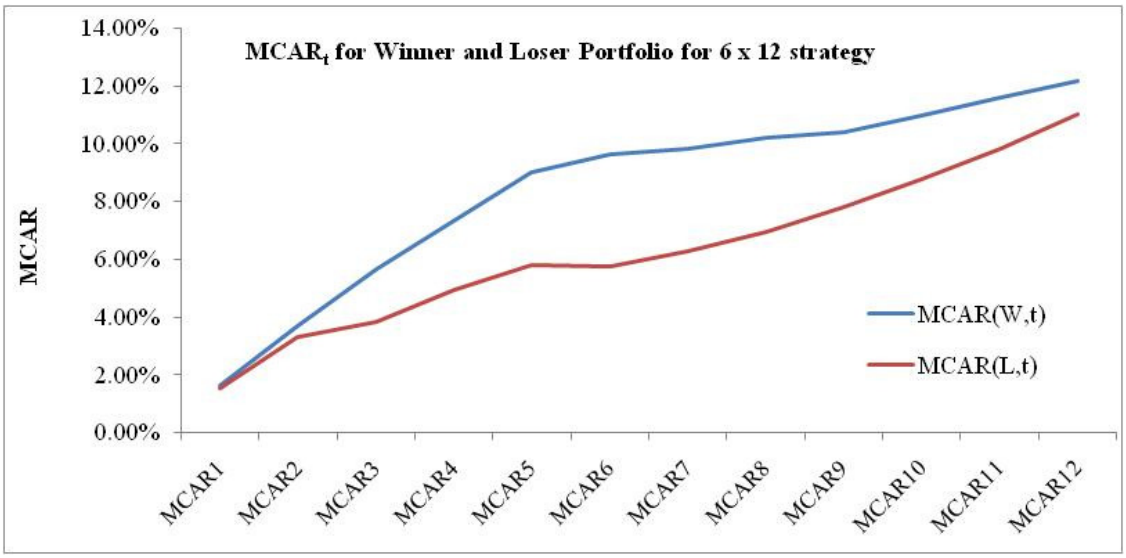
As shown in Table 1, the winner portfolio delivers a 1.64 percent return in the first month of testing period that goes on increasing to 12.14 percent in the 12^{th} month of the testing period. Similarly, the MCAR of loser portfolio in the 1^{st} month of the testing period is 1.53 percent, which increases to 11.03 percent at the end of the 12^{th} month of the testing period. Column 3 of table 1 gives the mean cumulated average return of the long winner and short loser portfolio. The return on the momentum portfolio i.e. the difference between $MCAR_W$ and $MCAR_{L,}$ becomes 3.88 percent in the 6^{th} month, which is the highest in the 12 months testing period and reduces to 1.11 percent at the end of the 12 month testing period. Interestingly in this 12 month testing period, the MCAR of loser portfolio remains positive. This can be contributed to the fact that in the test period of January 2003 to August 2011, the CNX 100 saw a huge rally during which it climbed to a peak of 6204 on 4^{th} January 2008, fell to a low of 2456 on October 24, 2008 and rose again to close at 4921 on 30^{th} August 2011.

***Table 1**: MCAR of winner and loser portfolio for the testing period for 6x12 trading strategy*

MCAR	$MCAR_{(W,t)}$ (A)	$MCAR_{(L,t)}$ (B)	MCAR of Momentum Portfolio (A-B)
$MCAR_1$	1.64%	1.53%	0.11%
$MCAR_2$	3.69%	3.31%	0.38%
$MCAR_3$	5.66%	3.85%	1.80%
$MCAR_4$	7.32%	4.92%	2.39%
$MCAR_5$	9.00%	5.82%	3.17%
$MCAR_6$	9.64%	5.76%	3.88%
$MCAR_7$	9.81%	6.27%	3.54%
$MCAR_8$	10.16%	6.93%	3.23%
$MCAR_9$	10.38%	7.82%	2.56%
$MCAR_{10}$	10.93%	8.80%	2.14%
$MCAR_{11}$	11.57%	9.85%	1.72%
$MCAR_{12}$	12.15%	11.03%	1.11%

Data in Table 1 are put in the form of a Chart (see Chart 1).

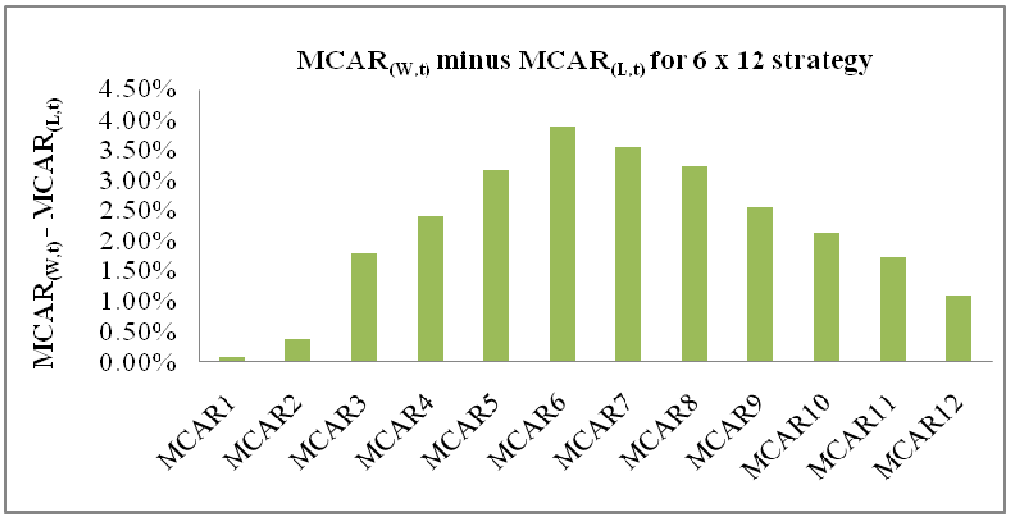
Chart 1: MCAR of winner and loser portfolios over the testing period for 6 x12 trading strategy



It may be observed from Chart 1, that although the returns of both the loser and the winner portfolio rise throughout the 12-month period, the pace of increase slows down for both portfolios after the 6th month. It may also be observed that the MCAR of winner portfolio continues to diverge from the loser portfolio till the 6th month and after remaining widely divergent till the 8th month, the gap narrows rapidly in the subsequent months.

Thus, from MCAR test, it becomes clear that irrespective of the market direction, the difference $MCAR_W$ minus $MCAR_L$ remains positive indicating that the strategy is market neutral (i.e. non-directional market strategy).

Chart 2: $MCAR_{(W,t)}$ minus $MCAR_{(L,t)}$ over the testing period for 6 x12 trading strategy



IV. B. Mean Average Test (MAR)

The MAR_t[18] of a portfolio denotes the mean of the average return of the portfolio in the t^{th} month of the testing period. If we look at the MAR of the winner portfolio (see table 2) then in the initial 5 months there is significantly high MAR. While results for MCAR are presented on differential of winner and loser portfolio, to gauge whether winner or loser or both the portfolios contributed significantly to a particular months' momentum returns we have presented results for MAR for winner as well as loser portfolio independently. The MAR test helps to identify: a)

[18] Mean Average Absolute Return is calculated by averaging the Average Return of the K iterations

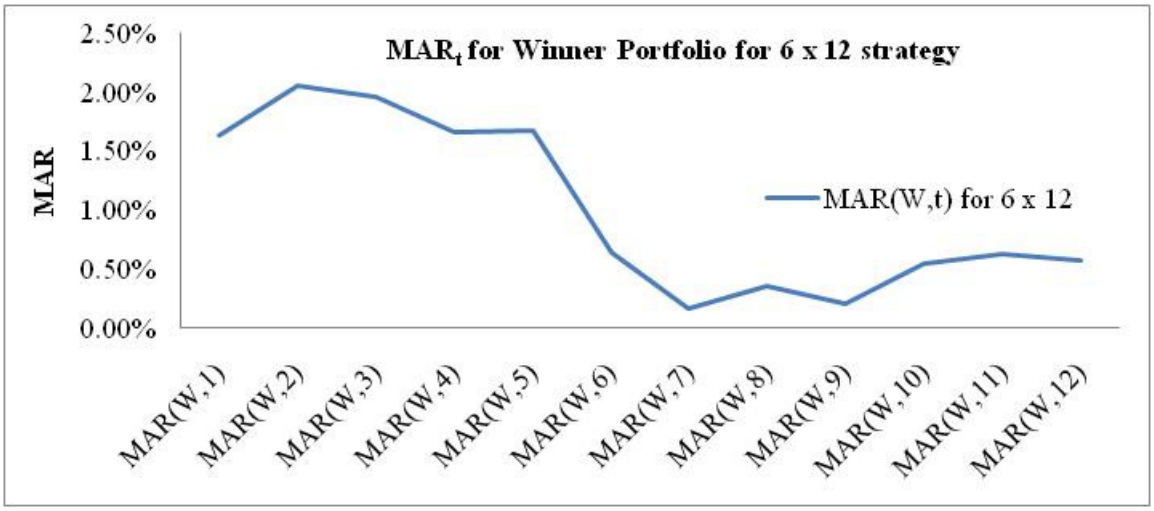
whether it is the winner portfolio or loser portfolio that runs out of momentum and b) returns of which portfolio (winner or loser) are reversed in the first instance.

Table 2: MAR of winner and loser portfolio for the testing period for 6x12 trading strategy

	$MAR_{(W,t)}$	$MAR_{(L,t)}$
MAR 1	1.64%	1.53%
MAR 2	2.05%	1.78%
MAR 3	1.96%	0.54%
MAR 4	1.66%	1.07%
MAR 5	1.68%	0.90%
MAR 6	0.64%	**-0.07%**
MAR 7	0.17%	0.51%
MAR 8	0.36%	0.66%
MAR 9	0.21%	0.88%
MAR 10	0.55%	0.98%
MAR 11	0.64%	1.05%
MAR 12	0.57%	1.18%

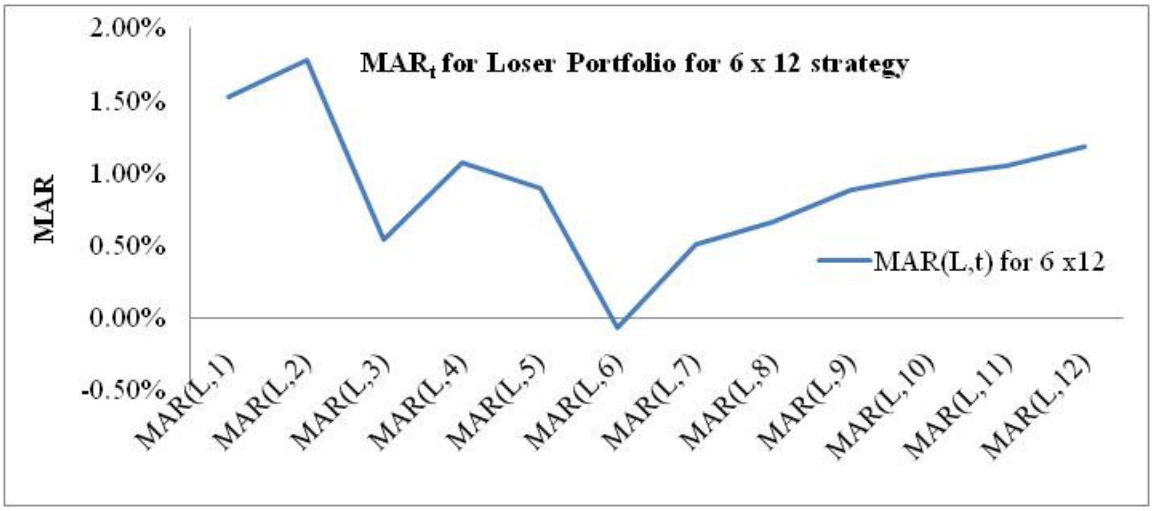
In the first month, the MAR for the first 5 months is 1.64 percent, 2.05 percent, 1.96 percent, 1.66 percent, and 1.68 percent respectively, which drops to 0.64 percent in the 6th month and to 0.17 percent in the fifth month of the test period. Thus, we can see a strong reversal in the momentum returns for the winner portfolio in the sixth month of the test period (Chart 3).

Chart 3: MAR_t for the winner portfolio over the testing period for 6 x12 trading strategy



Interestingly MAR of the loser portfolio (see table 2) shows an increase in the 2nd month to 1.78 percent from 1.53 percent in the 1st month. In the third month there is a strong fall in the MAR which becomes 0.54 percent and thereafter a small upsurge to become 1.07 percent and 0.89 percent in the 4th and 5th month respectively before dropping to -0.07 percent in the sixth month of the testing period. After the sixth month there is a reversal and loser portfolio starts to rally (see chart 4). Sixth month onwards the MAR of the portfolio increases to 1.18 percent in the twelfth month.

Chart 4: MAR_t for the loser portfolio over the testing period for 6 x12 trading strategy



Thus, overall we can see from the MAR figures that the winner portfolio shows a reversal in momentum in the fifth month while the loser portfolio shows a reversal in momentum in the fourth and seventh month of the holding period.

To answer the question as to whether the superior returns derived by investing in loser portfolio are just the compensation of higher risk or there is presence of genuine momentum profits, we calculate the average betas of the winner and loser portfolios during the test period. The average beta of 86 loser portfolios is 1.0364 and that of the winner portfolio is 0.9502 and the two are not significantly different from each other. Hence, the superior returns observed in momentum portfolio cannot be attributed only to compensation for higher risk.

To test whether the momentum profits do exist in shorter formation and holding period, the study is done for shorter duration formation and holding periods. The results for 3x3, 3x6 and 3x12 strategies are explained with the help of tables and charts in Annexure 2 and Annexure 3.

Clearly, the momentum returns do exist for almost all the combinations of formation and holding periods. It is also evident from the discussion of 6x12 strategy that though MCAR remains positive for the entire holding period, from seventh month onwards loser portfolio shows superior MAR to the winner portfolio, implying that the trend of winner portfolio outperforming loser portfolio is completely getting reversed. It shows that going by the results of this study, for a momentum portfolio formed using six months returns, it is better to have a holding period for six months rather than of 12 months. Because one can see, that momentum loses steam from seventh month onwards. Having said that, it is worth mentioning here that this conclusion is based on the result of current study only.

V. Implementation issues

Most studies on momentum investment strategies assume zero-cost portfolios, zero transaction costs, ability to short-sale the desired stocks and ignores the impact of block deals on prices and the constraints imposed by regulations. However, these factors affect implementation of momentum-based investment strategies and have been classified as avoidable and unavoidable factors and examined in some detail. [19]

Unavoidable Factors

Explicit trading costs and price pressures

Scalability of momentum investment strategies is limited by explicit trading costs[20] and price pressures due to large trade blocks. Large funds trading on momentum strategy execute block

[19] Bushee and Raedy (2005) divided these factors into two main categories—unavoidable, and avoidable.Though many researcher before them have researched solely on one or the other factor affecting the strategy, have been explained in this section.

[20] Explicit trading costs include commissions, fees and taxes.

trades; however, the implicit price pressure costs of such trades reduce the expected returns from this strategy. [21]

Short Sale

In short sale, the stock to be shorted is borrowed by the short seller from a lender. In case a stock is recalled by the lender, the portfolio manager has to take up additional transaction costs to maintain his short position in the security, which reduces the return of the portfolio. The longer the period of short position the greater is the probability of the stock being recalled. Thus, the cost of borrowing stocks and the possibility of the borrowed stock being recalled by the lender makes it difficult for funds to exploit the short-selling possibilities.

Futures market

Futures market provides another mechanism to short an individual stock. Advantages of futures market include low transaction costs and high liquidity and therefore low impact costs. Roll-over costs come into picture when a short position has to be maintained beyond three months since the maturity period for futures contracts is three months.

Avoidable factors

Maximum portfolio weight constraint

Under Indian regulations, a mutual fund scheme cannot invest more than 10 percent of its NAV in the equity shares/equity-related instruments of any company except in the case of an index fund or an industry-specific scheme.[22] Therefore, this constraint does not allow mutual funds to build such portfolios where one needs to put more than 10 percent in a particular stock. This point can be explained with the help of an example. In the strategy explained in this paper if during a month we have 90 stocks which have to be divided into ten deciles, it means that we will have nine stocks each in the winner and a loser portfolio. In such a case, if we have to create equally weighted winner or loser portfolio (as required by this strategy) we need to put more

[21] Many studies have documented significant price impact of large block trades. These studies done by Holthausen (1987), Chan and Lakonishok (1993/1995), Keim and Madhavan (1997) found that price impact increases with increasing transaction size and decreases with increasing stock price and market capitalization of the stock.
[22] KPMG India Funds and Fund Management 2010

than ten percent in each stock and that may not be allowed under current set of regulations. This constraint can however be avoided by creating portfolios of more than 10 stocks.

Fund management characteristics

Mutual funds can manage their portfolios using equally weighted investments or market capitalization-weighted investments. While equally weighted portfolios tend to be biased in favour of smaller firms as compared to larger (as it does not differentiate stocks based on their relative size), market-cap weighted portfolios tend to be dominated by larger stocks. However, portfolio managers can avoid such limitations by choosing an appropriate screening process. For instance in this study, where we have used equally weighted portfolios, we have eliminated the potential bias (exerted by small cap stocks) by using only the constitutes of CNX 100 (which are the top 100 stocks).

VI. Conclusion

There is strong evidence of momentum profit for the short-term formation-test period. For each of the trading strategies 3x3, 3x6, 3x12 and 6x12, we found presence of momentum profits. After a period of 6 to 8 months, reversal in momentum takes place, as the winner and loser portfolio returns start to converge. Further, it was found that the average risk of the winner portfolios was not significantly different to loser portfolio, thus proving evidence that the superior momentum returns are not only due to compensation for higher risk. In other words, there is empirical evidence against weak form of market efficiency in the Indian market. These results are consistent with those of the seminal studies by *Jegadeesh and Titman* (1993, 2001) and *De Bondt & Thaler* (1985, 1987 and 1990) in the US markets. To conclude, the study provides a strong evidence of short-term profits through the use of momentum strategy.

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Annexure 1: Number of CNX 100 listed companies eligible for portfolio formation for 6x12 strategy for the given month.

Month – Year	Number of stocks	Month – Year	Number of stocks	Month – Year	Number of stocks	Month – Year	Number of stocks
Jan-03	--	**Mar-05**	93	**May-07**	97	**Jul-09**	95
Feb-03	--	**Apr-05**	93	**Jun-07**	96	**Aug-09**	95
Mar-03	--	**May-05**	93	**Jul-07**	96	**Sep-09**	99
Apr-03	--	**Jun-05**	97	**Aug-07**	96	**Oct-09**	92
May-03	--	**Jul-05**	97	**Sep-07**	95	**Nov-09**	92
Jun-03	--	**Aug-05**	99	**Oct-07**	96	**Dec-09**	93
Jul-03	--	**Sep-05**	98	**Nov-07**	96	**Jan-10**	93
Aug-03	83	**Oct-05**	98	**Dec-07**	92	**Feb-10**	93
Sep-03	84	**Nov-05**	98	**Jan-08**	92	**Mar-10**	93
Oct-03	90	**Dec-05**	98	**Feb-08**	91	**Apr-10**	98
Nov-03	95	**Jan-06**	98	**Mar-08**	90	**May-10**	98
Dec-03	95	**Feb-06**	97	**Apr-08**	91	**Jun-10**	98
Jan-04	95	**Mar-06**	97	**May-08**	91	**Jul-10**	98
Feb-04	98	**Apr-06**	97	**Jun-08**	94	**Aug-10**	98
Mar-04	85	**May-06**	97	**Jul-08**	94	**Sep-10**	98
Apr-04	84	**Jun-06**	95	**Aug-08**	95	**Oct-10**	94
May-04	83	**Jul-06**	95	**Sep-08**	96	**Nov-10**	94
Jun-04	83	**Aug-06**	96	**Oct-08**	96	**Dec-10**	94
Jul-04	83	**Sep-06**	95	**Nov-08**	96	**Jan-11**	94
Aug-04	83	**Oct-06**	95	**Dec-08**	97	**Feb-11**	94
Sep-04	96	**Nov-06**	94	**Jan-09**	96	**Mar-11**	91
Oct-04	97	**Dec-06**	96	**Feb-09**	96	**Apr-11**	96
Nov-04	98	**Jan-07**	96	**Mar-09**	94	**May-11**	96
Dec-04	94	**Feb-07**	96	**Apr-09**	94	**Jun-11**	96
Jan-05	95	**Mar-07**	98	**May-09**	94	**Jul-11**	96
Feb-05	93	**Apr-07**	96	**Jun-09**	94	**Aug-11**	96

Annexure 2: MCAR of Winner and Loser Portfolio for the testing period for different trading strategies

MCAR 3x3 trading strategy

	$MCAR_{(W,t)}$	$MCAR_{(L,t)}$	MCAR(W,t) - MCAR(L,t)
$MCAR_1$	1.79%	1.10%	0.69%
$MCAR_2$	3.40%	1.90%	1.50%
$MCAR_3$	4.92%	2.54%	2.38%

MCAR 3x6 trading strategy

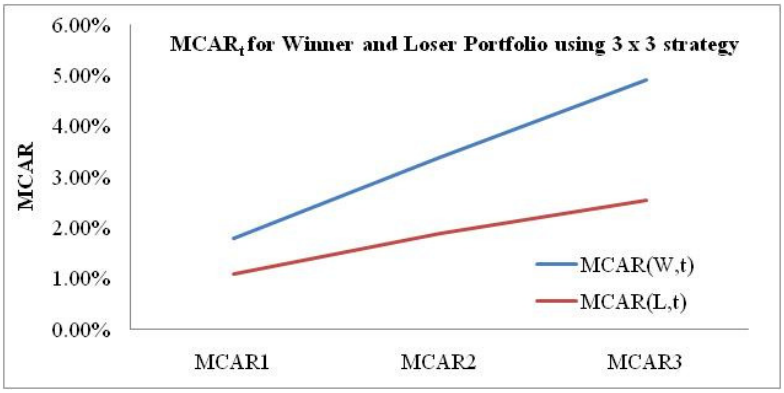
	$MCAR_{(W,t)}$	$MCAR_{(L,t)}$	MCAR(W,t) - MCAR(L,t)
$MCAR_1$	1.88%	1.17%	0.71%
$MCAR_2$	3.55%	2.05%	1.50%
$MCAR_3$	5.23%	2.95%	2.28%
$MCAR_4$	6.64%	3.67%	2.97%
$MCAR_5$	7.78%	4.55%	3.23%
$MCAR_6$	8.44%	4.99%	3.45%

MCAR 3x12 trading strategy

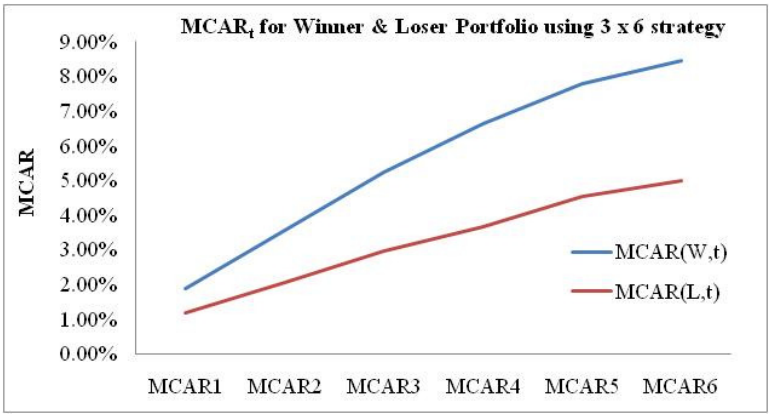
	$MCAR_{(W,t)}$	$MCAR_{(L,t)}$	$MCAR_{(W,t)}$ - $MCAR_{(L,t)}$
MCAR1	2.27%	1.35%	0.92%
MCAR2	4.26%	2.37%	1.89%
MCAR3	6.15%	3.44%	2.72%
MCAR4	7.70%	4.51%	3.19%
MCAR5	8.93%	5.77%	3.16%
MCAR6	9.74%	6.04%	3.70%
MCAR7	10.47%	7.21%	3.26%
MCAR8	11.99%	8.27%	3.72%
MCAR9	12.15%	8.69%	3.45%
MCAR10	12.66%	9.09%	3.57%
MCAR11	13.14%	9.64%	3.49%
MCAR12	13.90%	10.68%	3.22%

Annexure:3 $MCAR_t$ for winner and loser portfolio for the testing period for different strategies

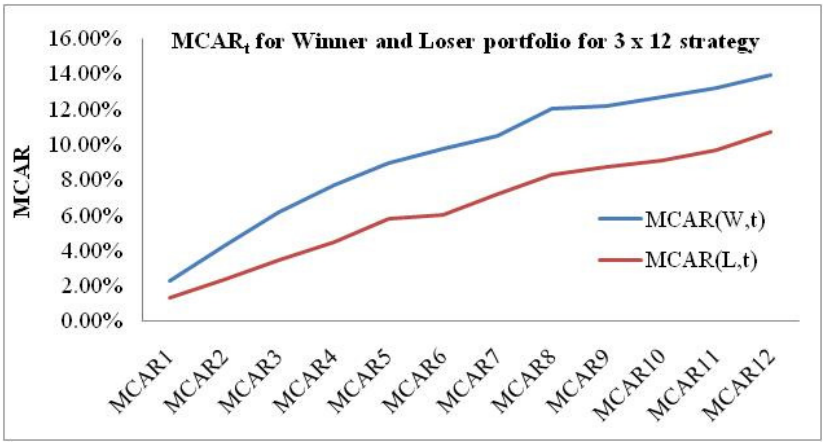
MCAR for 3 x 3 strategy



MCAR 3 x 6 strategy



MCAR 3 x 12 strategy



Annexure 3: 86 winner portfolios for the 6x12 trading strategy

Aug-03	Sep-03	Oct-03	Nov-03	Dec-03							
Oriental Bank	S A I L	S A I L	S A I L	S A I L							
C P C L	IFCI	IFCI	IFCI	Tata Teleservices							
Flextronics	Oriental Bank	Oriental Bank	M & M	GE Shipping Co							
LIC Housing Fin.	C P C L	Aurobindo Pharma	IDBI Bank	M & M							
M & M	Bharat Electron	Bharat Electron	Oriental Bank	Flextronics							
Bank of Baroda	India Cements	IDBI Bank	Aurobindo Pharma	Tata Motors							
Bharat Electron	Aurobindo Pharma	M & M	Tata Steel	Grasim Inds							
ING Vysya Bank	Flextronics	India Cements	Tata Teleservices	IFCI							
Grasim Inds	LIC Housing Fin.	C P C L	Tata Motors	Tata Steel							
India Cements	GE Shipping Co	Flextronics	Kotak Mah. Bank	Kotak Mah. Bank							
Jan-04	**Feb-04**	**Mar-04**	**Apr-04**	**May-04**	**Jun-04**	**Jul-04**	**Aug-04**	**Sep-04**	**Oct-04**	**Nov-04**	**Dec-04**
GE Shipping Co	Bharti Airtel	Siemens	Siemens	C P C L	Bharti Airtel	Bharti Airtel	C P C L	C P C L	IDBI Bank	C P C L	IDBI Bank
S A I L	GE Shipping Co	M & M	Axis Bank	Axis Bank	C P C L	Sun Pharma.Inds.	Union Bank (I)	Union Bank (I)	S A I L	Infosys	C P C L
Siemens	Tata Power Co.	Moser Baer (I)	C P C L	Wockhardt	Punjab Natl.Bank	C P C L	Tata Global	CMC	HCL Technologies	CMC	S C I
Tata Teleservices	Siemens	Reliance Infra.	Tata Power Co.	Bharti Airtel	Aventis Pharma	Punjab Natl.Bank	Infosys	Infosys	JSW Steel	S C I	S A I L
Axis Bank	Tata Motors	Bharti Airtel	Reliance Infra.	Siemens	Wockhardt	M & M	Aventis Pharma	Wipro	CMC	IDBI Bank	Union Bank (I)
M & M	Moser Baer (I)	GE Shipping Co	Bharti Airtel	Punjab Natl.Bank	Sun Pharma.Inds.	Union Bank (I)	Sun Pharma.Inds.	Sun Pharma.Inds.	Union Bank (I)	S A I L	I O B
Tata Steel	Thomas Cook (I)	Larsen & Toubro	M & M	Piramal Health	Axis Bank	Hero Motocorp	Bharti Airtel	Raymond	Infosys	GE Shipping Co	Raymond
Flextronics	Piramal Health	Piramal Health	Piramal Health	Corporation Bank	Piramal Health	Reliance Infra.	M & M	Tata Global	Wockhardt	HCL Technologies	JSW Steel
S C I	IFCI	Axis Bank	Punjab Natl.Bank	Union Bank (I)	Tata Global	Tata Comm	Piramal Health	Wockhardt	Raymond	JSW Steel	Andhra Bank
Kotak Mah. Bank	Axis Bank	Flextronics	Larsen & Toubro	Tata Power Co.	Glaxosmit Pharma	Aventis Pharma	HDFC Bank	IDBI Bank	Wipro	Wipro	Infosys
Jan-05	**Feb-05**	**Mar-05**	**Apr-05**	**May-05**	**Jun-05**	**Jul-05**	**Aug-05**	**Sep-05**	**Oct-05**	**Nov-05**	**Dec-05**
IDBI Bank	Bharat Forge	Andhra Bank	Andhra Bank	Andhra Bank	Siemens	Siemens	Tata Comm	Tata Comm	Tata Comm	M & M	M & M
S A I L	ING Vysya Bank	Axis Bank	Bank of India	LIC Housing Fin.	Bharat Forge	Dabur India	Bank of India	Oracle Fin.Serv.	Bharti Airtel	Bharti Airtel	JP Associates
Andhra Bank	Andhra Bank	Bank of India	Kotak Mah. Bank	Kotak Mah. Bank	A B B	Kotak Mah. Bank	Siemens	Kotak Mah. Bank	Oracle Fin.Serv.	Syndicate Bank	Tata Comm
C P C L	Union Bank (I)	ING Vysya Bank	Axis Bank	ING Vysya Bank	Dabur India	A B B	A B B	Tata Global	Syndicate Bank	JP Associates	B H E L
Piramal Health	Bank of India	Kotak Mah. Bank	Bharat Forge	Bank of India	Axis Bank	Colgate-Palm.	ICICI Bank	Wockhardt	Tata Global	St Bk of India	Siemens
Bank of India	JP Associates	IFCI	LIC Housing Fin.	Siemens	Kotak Mah. Bank	O N G C	Kotak Mah. Bank	JP Associates	B H E L	Oracle Fin.Serv.	Larsen & Toubro
Syndicate Bank	Piramal Health	Bharat Forge	ING Vysya Bank	A B B	Andhra Bank	Axis Bank	Dabur India	Nirma	ICICI Bank	Tata Global	Bharti Airtel
Tata Steel	Canara Bank	Union Bank (I)	A B B	Axis Bank	B H E L	Tata Global	Corporation Bank	Bharti Airtel	JP Associates	Larsen & Toubro	Syndicate Bank
JSW Steel	IDBI Bank	Punjab Natl.Bank	Union Bank (I)	Bharat Forge	LIC Housing Fin.	Asian Paints	Tata Global	Siemens	Siemens	Reliance Inds.	Reliance Inds.
IFCI	Tata Teleservices	LIC Housing Fin.	Dabur India	I O B	ING Vysya Bank	ITC	Oracle Fin.Serv.	Ingersoll-Rand	ITC	Dabur India	Tata Global
Jan-06	**Feb-06**	**Mar-06**	**Apr-06**	**May-06**	**Jun-06**	**Jul-06**	**Aug-06**	**Sep-06**	**Oct-06**	**Nov-06**	**Dec-06**
JP Associates	Siemens	Siemens	Siemens	Sterlite Inds.	Sterlite Inds.	Sterlite Inds.	Zee Entertainmen	Reliance Inds.	Reliance Inds.	Bank of India	Bank of India
Siemens	Sterlite Inds.	B H E L	Sterlite Inds.	Aurobindo Pharma	S A I L	Zee Entertainmen	ACC	Zee Entertainmen	Zee Entertainmen	Infosys	Bharti Airtel
M & M	B H E L	Larsen & Toubro	Aurobindo Pharma	Siemens	Dabur India	S A I L	Grasim Inds	Sterlite Inds.	ACC	ICICI Bank	Axis Bank
GE Shipping Co	Natl. Aluminium	Sterlite Inds.	B H E L	ACC	Aurobindo Pharma	ACC	Sterlite Inds.	ACC	Bank of Baroda	Bharti Airtel	ICICI Bank
Sterlite Inds.	A B B	Tata Motors	Tata Motors	Grasim Inds	Siemens	Reliance Inds.	Reliance Inds.	Kotak Mah. Bank	Sterlite Inds.	Axis Bank	Zee Entertainmen
Larsen & Toubro	Larsen & Toubro	Maruti Suzuki	Cipla	B H E L	Zee Entertainmen	Aurobindo Pharma	Cipla	Oracle Fin.Serv.	Infosys	Oracle Fin.Serv.	St Bk of India
Dabur India	JP Associates	Natl. Aluminium	A B B	Hindalco Inds.	ACC	B H E L	S A I L	Grasim Inds	Grasim Inds	M & M	Grasim Inds
B H E L	M & M	Dr Reddy's Labs	Natl. Aluminium	JP Associates	Dr Reddy's Labs	Tata Steel	Dr Reddy's Labs	Infosys	Bank of India	HDFC Bank	Ambuja Cem.
Natl. Aluminium	Dabur India	M & M	Dr Reddy's Labs	Natl. Aluminium	Tata Steel	Grasim Inds	Container Corpn.	Ambuja Cem.	HDFC Bank	Bank of Baroda	JP Associates
Tata Comm	Maruti Suzuki	Cipla	MphasiS	Tata Motors	Cipla	Dabur India	Tata Steel	Cadila Health.	Kotak Mah. Bank	St Bk of India	HDFC Bank
Jan-07	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Polaris Soft.	IFCI	IFCI	IFCI	IFCI	IFCI	IFCI	IFCI	IFCI	IFCI	Reliance Infra.	Reliance Infra.
Bank of India	Polaris Soft.	Bharti Airtel	Bharti Airtel	Oracle Fin.Serv.	Moser Baer (I)	Reliance Capital	Reliance Capital	Reliance Capital	Reliance Infra.	Reliance Petro.	JP Associates
MphasiS	Moser Baer (I)	Moser Baer (I)	Polaris Soft.	Kotak Mah. Bank	Reliance Capital	Reliance Petro.	Reliance Petro.	Larsen & Toubro	Reliance Capital	Reliance Capital	GMR Infra.
JP Associates	JP Associates	Polaris Soft.	MphasiS	Bharat Electron	S A I L	I D F C	Larsen & Toubro	B H E L	Reliance Petro.	Larsen & Toubro	Reliance Capital
ICICI Bank	I D F C	I D F C	S A I L	Tata Teleservices	ING Vysya Bank	Kotak Mah. Bank	Kotak Mah. Bank	Reliance Petro.	Tata Teleservices	JP Associates	Reliance Petro.
Axis Bank	Bharti Airtel	S A I L	Oracle Fin.Serv.	Bharti Airtel	Larsen & Toubro	ING Vysya Bank	A B B	JP Associates	JP Associates	LIC Housing Fin.	Kotak Mah. Bank
Oracle Fin.Serv.	MphasiS	MphasiS	Kotak Mah. Bank	Moser Baer (I)	Tata Teleservices	IDBI Bank	Reliance Infra.	Kotak Mah. Bank	IDBI Bank	B H E L	Larsen & Toubro
St Bk of India	Axis Bank	Punjab Tractors	Moser Baer (I)	S A I L	Reliance Petro.	Larsen & Toubro	Cummins India	Reliance Infra.	St Bk of India	Tata Power Co.	LIC Housing Fin.
Bharti Airtel	IDBI Bank	ICICI Bank	Lupin	MphasiS	Kotak Mah. Bank	Moser Baer (I)	St Bk of India	A B B	Kotak Mah. Bank	I D F C	IFCI
ING Vysya Bank	Bank of India	Rel. Comm.	Bharat Electron	Lupin	I D F C	Tata Teleservices	Tata Steel	Tata Steel	Tata Steel	S A I L	Tata Power Co.
Jan-08	**Feb-08**	**Mar-08**	**Apr-08**	**May-08**	**Jun-08**	**Jul-08**	**Aug-08**	**Sep-08**	**Oct-08**	**Nov-08**	**Dec-08**
Reliance Infra.	Reliance Infra.	Tata Power Co.	Natl. Aluminium	Natl. Aluminium	Natl. Aluminium	Ranbaxy Labs.	Oracle Fin.Serv.	Lupin	Lupin	Lupin	Union Bank (I)
JP Associates	JP Associates	Reliance Infra.	Tata Power Co.	Sun Pharma.Inds.	Lupin	Sun Pharma.Inds.	Ranbaxy Labs.	Cadila Health.	Hero Motocorp	Tata Comm	Hero Motocorp
Reliance Capital	Axis Bank	Natl. Aluminium	ING Vysya Bank	Asian Paints	Ranbaxy Labs.	Cairn India	Lupin	Sun Pharma.Inds.	Cadila Health.	Cadila Health.	Aventis Pharma
Tata Teleservices	Tata Power Co.	LIC Housing Fin.	Sun Pharma.Inds.	ITC	Cairn India	Lupin	Cadila Health.	Ranbaxy Labs.	Sun Pharma.Inds.	Hind. Unilever	Hind. Unilever
Tata Power Co.	Natl. Aluminium	Axis Bank	Asian Paints	Hind. Unilever	Asian Paints	Asian Paints	Sun Pharma.Inds.	Cipla	Bank of India	Hero Motocorp	B P C L
S A I L	Reliance Capital	I D F C	Cipla	B P C L	Sun Pharma.Inds.	Hero Motocorp	Cairn India	Infosys	Hind. Unilever	Aventis Pharma	Bank of Baroda
Reliance Petro.	LIC Housing Fin.	Reliance Capital	LIC Housing Fin.	Cipla	Infosys	Cipla	Hero Motocorp	Oracle Fin.Serv.	O N G C	Cipla	Cipla
Kotak Mah. Bank	I D F C	Reliance Petro.	Tata Comm	Apollo Tyres	Satyam Computer	Infosys	Cipla	Asian Paints	Bank of Baroda	Infosys	NTPC
Larsen & Toubro	S A I L	S A I L	B P C L	Hero Motocorp	Tata Power Co.	Hind. Unilever	LIC Housing Fin.	Hero Motocorp	Aventis Pharma	Union Bank (I)	Punjab Natl.Bank
LIC Housing Fin.	Reliance Petro.	B P C L	GAIL (India)	Tata Power Co.	Cipla	Satyam Computer	Hind. Unilever	Cairn India	Cipla	Sun Pharma.Inds.	Bank of India
Jan-09	**Feb-09**	**Mar-09**	**Apr-09**	**May-09**	**Jun-09**	**Jul-09**	**Aug-09**	**Sep-09**	**Oct-09**	**Nov-09**	**Dec-09**
B P C L	B P C L	B P C L	Hero Motocorp	GMR Infra.	JP Associates	Tech Mahindra	Tech Mahindra	Patni Computer	H D I L	MphasiS	Sesa Goa
Union Bank (I)	Syndicate Bank	Hero Motocorp	Power Fin.Corpn.	Jindal Steel	H D I L	Jindal Steel	JSW Steel	H D I L	JSW Steel	Tech Mahindra	HCL Technologies
Punjab Natl.Bank	Union Bank (I)	Power Fin.Corpn.	Maruti Suzuki	JP Associates	Unitech	Oracle Fin.Serv.	MphasiS	Tech Mahindra	Patni Computer	Patni Computer	MphasiS
Bank of Baroda	NTPC	NTPC	Power Grid Corpn	LIC Housing Fin.	LIC Housing Fin.	JSW Steel	JP Associates	Unitech	Tech Mahindra	Sesa Goa	Patni Computer
Tata Comm	Aventis Pharma	Maruti Suzuki	Tata Comm	Tata Teleservices	GMR Infra.	LIC Housing Fin.	Patni Computer	JSW Steel	LIC Housing Fin.	Oracle Fin.Serv.	Jindal Steel
Bank of India	Hind. Unilever	Power Grid Corpn	MphasiS	Grasim Inds	JSW Steel	M & M	H D I L	JP Associates	HCL Technologies	Jindal Steel	Tata Motors
Power Fin.Corpn.	Hero Motocorp	Hind. Unilever	GMR Infra.	UltraTech Cem.	Jindal Steel	MphasiS	Jindal Steel	MphasiS	MphasiS	HCL Technologies	Tech Mahindra
Aventis Pharma	Andhra Bank	Tata Comm	Tata Teleservices	Hero Motocorp	IFCI	JP Associates	M & M	Tata Motors	Tata Motors	Ranbaxy Labs.	TCS
Syndicate Bank	Power Fin.Corpn.	ITC	NTPC	Bharat Electron	Tata Steel	IFCI	Tata Motors	LIC Housing Fin.	Unitech	Tata Motors	Oracle Fin.Serv.
Hind. Unilever	Tata Comm	ACC	B P C L	Reliance Infra.	UltraTech Cem.	Sterlite Inds.	Unitech	IFCI	IFCI	Hindalco Inds.	JSW Steel
Jan-10	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**	**Jun-10**	**Jul-10**	**Aug-10**	**Sep-10**			
Tata Motors	Tata Motors	Sesa Goa	Sesa Goa	JSW Steel	Federal Bank	Bajaj Auto	Bajaj Auto	Cummins India			
Sesa Goa	Cummins India	JSW Steel	Mundra Port	Adani Enterp.	Cummins India	Cummins India	LIC Housing Fin.	LIC Housing Fin.			
Ranbaxy Labs.	Ranbaxy Labs.	Hindalco Inds.	JSW Steel	Tata Motors	Bajaj Auto	Bank of Baroda	Cummins India	Andhra Bank			
HCL Technologies	Lupin	Lupin	S A I L	Cummins India	Bank of Baroda	Glaxosmit Pharma	Ashok Leyland	Asian Paints			
TCS	Hindalco Inds.	Canara Bank	Cummins India	Bajaj Auto	Lupin	Federal Bank	Asian Paints	H P C L			
Bharat Forge	HCL Technologies	Tata Motors	Crompton Greaves	Mundra Port	Adani Enterp.	Lupin	Federal Bank	Bajaj Auto			
MphasiS	Sesa Goa	TCS	Asian Paints	Indian Hotels	Siemens	Mundra Port	Andhra Bank	Ashok Leyland			
Patni Computer	MphasiS	Dr Reddy's Labs	United Spirits	Hindalco Inds.	Mundra Port	Ashok Leyland	Corporation Bank	Bharat Forge			
Hindalco Inds.	JSW Steel	Ranbaxy Labs.	UltraTech Cem.	Sesa Goa	Glaxosmit Pharma	Asian Paints	Glaxosmit Pharma	Tata Motors			
Oracle Fin.Serv.	Oracle Fin.Serv.	United Spirits	Bharat Electron	Axis Bank	Patni Computer	Colgate-Palm.	Lupin	I O B			

Annexure 4: 86 loser portfolios for the 6x12 trading strategy

Aug-03	Sep-03	Oct-03	Nov-03	Dec-03							
Punjab Tractors	NIIT	Thomas Cook (I)	Hind. Unilever	Pfizer							
NIIT	Satyam Computer	Polaris Soft.	M T N L	Hind. Unilever							
Satyam Computer	Rolta India	Dr Reddy's Labs	H P C L	Colgate-Palm.							
CMC	Polaris Soft.	HCL Technologies	Britannia Inds.	Punjab Natl.Bank							
Wockhardt	Infosys	Infosys	Colgate-Palm.	Bank of India							
Infosys	CMC	Britannia Inds.	Polaris Soft.	Britannia Inds.							
M T N L	GTL	CMC	GTL	Ingersoll-Rand							
Polaris Soft.	Thomas Cook (I)	Wipro	CMC	GTL							
Wipro	Wipro	Morepen Labs.	Morepen Labs.	Morepen Labs.							
Morepen Labs.	Morepen Labs.	Colgate-Palm.	H F C L	H F C L							
Jan-04	**Feb-04**	**Mar-04**	**Apr-04**	**May-04**	**Jun-04**	**Jul-04**	**Aug-04**	**Sep-04**	**Oct-04**	**Nov-04**	**Dec-04**
Bank of India	Union Bank (I)	Andhra Bank	Ranbaxy Labs.	Colgate-Palm.	Polaris Soft.	TVS Motor Co.	H P C L	TVS Motor Co.	Punjab Natl.Bank	Syndicate Bank	Maruti Suzuki
H P C L	M T N L	S A I L	CMC	Zee Entertainmen	Apollo Tyres	LIC Housing Fin.	Tata Power Co.	Tata Power Co.	St Bk of India	Vijaya Bank	Grasim Inds
M T N L	Pfizer	Union Bank (I)	Colgate-Palm.	Nirma	S A I L	Hind. Unilever	LIC Housing Fin.	Bank of India	Dr Reddy's Labs	Corporation Bank	Hind. Unilever
GlaxoSmith C H L	Hind. Unilever	Asian Paints	Dr Reddy's Labs	MphasiS	IDBI Bank	Nirma	Nirma	Bank of Baroda	Ashok Leyland	Ashok Leyland	Asian Paints
Tata Comm	GlaxoSmith C H L	Colgate-Palm.	S A I L	Ingersoll-Rand	TVS Motor Co.	Polaris Soft.	Hind. Unilever	Ashok Leyland	B P C L	St Bk of India	Dr Reddy's Labs
Colgate-Palm.	Oracle Fin.Serv.	Ranbaxy Labs.	Nirma	Hind. Unilever	I P C L	S C I	TVS Motor Co.	H P C L	Maruti Suzuki	Maruti Suzuki	Aurobindo Pharma
Hind. Unilever	Ingersoll-Rand	Hind. Unilever	Hind. Unilever	S A I L	Oracle Fin.Serv.	S A I L	Moser Baer (I)	Hind. Unilever	Moser Baer (I)	Bank of Baroda	Ashok Leyland
Ingersoll-Rand	Colgate-Palm.	Nirma	Ingersoll-Rand	Oracle Fin.Serv.	Dr Reddy's Labs	Moser Baer (I)	Dr Reddy's Labs	Moser Baer (I)	Bank of Baroda	H P C L	Tata Teleservices
Morepen Labs.	Morepen Labs.	Ingersoll-Rand	Oracle Fin.Serv.	IFCI	S C I	Dr Reddy's Labs	IFCI	Dr Reddy's Labs	ING Vysya Bank	Punjab Natl.Bank	ING Vysya Bank
H F C L	H F C L	IFCI	IFCI	Dr Reddy's Labs	IFCI	IFCI	ING Vysya Bank	ING Vysya Bank	H P C L	ING Vysya Bank	Punjab Tractors
Jan-05	**Feb-05**	**Mar-05**	**Apr-05**	**May-05**	**Jun-05**	**Jul-05**	**Aug-05**	**Sep-05**	**Oct-05**	**Nov-05**	**Dec-05**
Hero Motocorp	HCL Technologies	Kochi Refineries	Punjab Tractors	Dr Reddy's Labs	C P C L	GE Shipping Co	C P C L	M T N L	Moser Baer (I)	Apollo Tyres	Oriental Bank
Hind. Unilever	IBP Co.	CMC	Cipla	M T N L	Biocon	S A I L	Ranbaxy Labs.	Tata Steel	Natl. Aluminium	M T N L	CMC
Flextronics	Punjab Tractors	TVS Motor Co.	Reliance Infra.	S C I	S C I	H P C L	Oriental Bank	Punjab Natl.Bank	Vijaya Bank	Vijaya Bank	S A I L
Oracle Fin.Serv.	Flextronics	Flextronics	Cadila Health.	Ranbaxy Labs.	GE Shipping Co	IBP Co.	B P C L	Kochi Refineries	Ranbaxy Labs.	Andhra Bank	Moser Baer (I)
MphasiS	I P C L	Zee Entertainmen	TVS Motor Co.	MphasiS	TVS Motor Co.	Oriental Bank	ING Vysya Bank	B P C L	Andhra Bank	IBP Co.	Andhra Bank
Ashok Leyland	Dr Reddy's Labs	MphasiS	M T N L	Kochi Refineries	Natl. Aluminium	M T N L	S A I L	H P C L	IBP Co.	Moser Baer (I)	Vijaya Bank
Asian Paints	Reliance Infra.	Polaris Soft.	I P C L	Reliance Infra.	Kochi Refineries	Natl. Aluminium	Kochi Refineries	LIC Housing Fin.	Bongaigaon Ref	Oriental Bank	LIC Housing Fin.
Aurobindo Pharma	MphasiS	I P C L	Aurobindo Pharma	Aurobindo Pharma	M T N L	Kochi Refineries	H P C L	Oriental Bank	Oriental Bank	LIC Housing Fin.	Bongaigaon Ref
Punjab Tractors	Polaris Soft.	Reliance Infra.	MphasiS	Polaris Soft.	CMC	CMC	IBP Co.	CMC	LIC Housing Fin.	Ranbaxy Labs.	IFCI
Reliance Infra.	Aurobindo Pharma	Aurobindo Pharma	Polaris Soft.	CMC	Polaris Soft.	Polaris Soft.	CMC	IBP Co.	CMC	Bongaigaon Ref	Ranbaxy Labs.
Jan-06	**Feb-06**	**Mar-06**	**Apr-06**	**May-06**	**Jun-06**	**Jul-06**	**Aug-06**	**Sep-06**	**Oct-06**	**Nov-06**	**Dec-06**
Corporation Bank	Oriental Bank	Piramal Health	Oriental Bank	Piramal Health	IBP Co.	IBP Co.	Reliance Infra.	Bharat Forge	GAIL (India)	Reliance Infra.	Tata Steel
Andhra Bank	Polaris Soft.	Corporation Bank	Polaris Soft.	Bongaigaon Ref	Vijaya Bank	Bongaigaon Ref	Tata Teleservices	Biocon	Tata Teleservices	Aventis Pharma	Ranbaxy Labs.
CMC	Zee Entertainmen	Jet Airways	C P C L	IFCI	Andhra Bank	Vijaya Bank	Wockhardt	TVS Motor Co.	Bharat Forge	Nirma	Pfizer
Reliance Infra.	Tata Teleservices	Bongaigaon Ref	Vijaya Bank	IDBI Bank	Tata Teleservices	Oriental Bank	Oriental Bank	Canara Bank	Pfizer	Raymond	Aventis Pharma
IDBI Bank	Andhra Bank	ING Vysya Bank	Bongaigaon Ref	Oriental Bank	IDBI Bank	Corporation Bank	Syndicate Bank	Tata Teleservices	Wockhardt	Tata Steel	B P C L
LIC Housing Fin.	Ranbaxy Labs.	Tata Teleservices	Andhra Bank	Jet Airways	Bongaigaon Ref	Syndicate Bank	Vijaya Bank	Natl. Aluminium	Reliance Infra.	Biocon	Tata Teleservices
Moser Baer (I)	IDBI Bank	Ranbaxy Labs.	Tata Teleservices	Andhra Bank	ING Vysya Bank	IDBI Bank	Pfizer	Wockhardt	Nirma	Natl. Aluminium	Bongaigaon Ref
Bongaigaon Ref	Bongaigaon Ref	IDBI Bank	ING Vysya Bank	Tata Teleservices	Piramal Health	ING Vysya Bank	IDBI Bank	Reliance Infra.	Natl. Aluminium	TVS Motor Co.	M T N L
IFCI	Corporation Bank	Polaris Soft.	IFCI	Patni Computer	Polaris Soft.	Polaris Soft.	Patni Computer	Ingersoll-Rand	Ingersoll-Rand	M T N L	Nirma
Ranbaxy Labs.	IFCI	IFCI	IDBI Bank	ING Vysya Bank	Jet Airways	Jet Airways	Jet Airways	Jet Airways	Jet Airways	Jet Airways	TVS Motor Co.
Jan-07	**Feb-07**	**Mar-07**	**Apr-07**	**May-07**	**Jun-07**	**Jul-07**	**Aug-07**	**Sep-07**	**Oct-07**	**Nov-07**	**Dec-07**
Hero Motocorp	Cipla	M T N L	Union Bank (I)	H P C L	Dr Reddy's Labs	Wipro	Dr Reddy's Labs	TCS	Oracle Fin.Serv.	Aurobindo Pharma	Container Corpn.
Hind. Unilever	ITC	Union Bank (I)	Hindalco Inds.	B P C L	Cipla	Bharat Forge	H P C L	Indian Hotels	Bharat Forge	Cipla	Pfizer
Natl. Aluminium	Aventis Pharma	Ranbaxy Labs.	Vijaya Bank	Union Bank (I)	Zee Entertainmen	Ashok Leyland	Wipro	M & M	Pfizer	Lupin	Aventis Pharma
Tata Teleservices	Wockhardt	Corporation Bank	Bank of Baroda	LIC Housing Fin.	Corporation Bank	Cipla	M & M	H P C L	Dr Reddy's Labs	TCS	Glaxosmit Pharma
Aventis Pharma	Hero Motocorp	Hindalco Inds.	ACC	Corporation Bank	Canara Bank	Dr Reddy's Labs	Tata Motors	Wipro	Aurobindo Pharma	Pfizer	Lupin
M T N L	Bongaigaon Ref	Raymond	Bongaigaon Ref	Cipla	Hindalco Inds.	Maruti Suzuki	TVS Motor Co.	Bharat Forge	TCS	Aventis Pharma	Aurobindo Pharma
Wockhardt	Nirma	Hind. Unilever	Syndicate Bank	Hindalco Inds.	Ambuja Cem.	M & M	Cipla	Raymond	Wipro	Tech Mahindra	Tech Mahindra
Tata Steel	Tata Steel	Aventis Pharma	Corporation Bank	Raymond	ACC	Raymond	Ashok Leyland	Punjab Tractors	Punjab Tractors	Punjab Tractors	Oracle Fin.Serv.
Nirma	Hind. Unilever	Bongaigaon Ref	Canara Bank	Canara Bank	Raymond	Tata Motors	Raymond	Cipla	Cipla	Polaris Soft.	Punjab Tractors
TVS Motor Co.	TVS Motor Co.	TVS Motor Co.	TVS Motor Co.	TVS Motor Co.	TVS Motor Co.	TVS Motor Co.	Polaris Soft.	Polaris Soft.	Polaris Soft.	Oracle Fin.Serv.	Patni Computer
Jan-08	**Feb-08**	**Mar-08**	**Apr-08**	**May-08**	**Jun-08**	**Jul-08**	**Aug-08**	**Sep-08**	**Oct-08**	**Nov-08**	**Dec-08**
Infosys	ACC	MphasiS	Wockhardt	ICICI Bank	Unitech	IFCI	Vijaya Bank	Indian Hotels	GMR Infra.	I D F C	IFCI
Lupin	Glaxosmit Pharma	Zee Entertainmen	Bharat Electron	Maruti Suzuki	Vijaya Bank	IDBI Bank	GMR Infra.	Syndicate Bank	Wockhardt	Reliance Infra.	JP Associates
Cadila Health.	Cadila Health.	Aventis Pharma	IDBI Bank	Patni Computer	ACC	Power Fin.Corpn.	Wockhardt	Wockhardt	Suzlon Energy	GMR Infra.	Tech Mahindra
Container Corpn.	Aventis Pharma	ACC	Tech Mahindra	IDBI Bank	JP Associates	Tata Teleservices	I O B	GMR Infra.	Tata Motors	DLF	Sterlite Inds.
Tech Mahindra	TVS Motor Co.	TVS Motor Co.	TVS Motor Co.	Grasim Inds	Grasim Inds	Reliance Infra.	Kotak Mah. Bank	Moser Baer (I)	Ranbaxy Labs.	Raymond	Tata Motors
Glaxosmit Pharma	Moser Baer (I)	Moser Baer (I)	Oracle Fin.Serv.	Zee Entertainmen	Power Fin.Corpn.	Kotak Mah. Bank	Reliance Infra.	Raymond	DLF	JP Associates	Tata Steel
Aventis Pharma	Patni Computer	Aurobindo Pharma	Aurobindo Pharma	IFCI	Kotak Mah. Bank	Unitech	I D F C	Vijaya Bank	JP Associates	Tata Motors	JSW Steel
Aurobindo Pharma	Tech Mahindra	Tech Mahindra	Moser Baer (I)	Moser Baer (I)	IDBI Bank	Reliance Capital	Moser Baer (I)	I O B	I D F C	Tata Steel	Suzlon Energy
Patni Computer	Aurobindo Pharma	Oracle Fin.Serv.	Patni Computer	Siemens	GMR Infra.	JP Associates	JP Associates	I D F C	Raymond	Unitech	H D I L
Oracle Fin.Serv.	Oracle Fin.Serv.	Patni Computer	IFCI	Aurobindo Pharma	Reliance Capital	GMR Infra.	Unitech	Unitech	Unitech	Suzlon Energy	Unitech
Jan-09	**Feb-09**	**Mar-09**	**Apr-09**	**May-09**	**Jun-09**	**Jul-09**	**Aug-09**	**Sep-09**	**Oct-09**	**Nov-09**	**Dec-09**
Hindalco Inds.	DLF	Aditya Bir. Nuv.	JSW Steel	Asian Paints	TCS	Bharti Airtel	Syndicate Bank	Cipla	Glaxosmit Pharma	NTPC	Moser Baer (I)
Tata Motors	Rel. Comm.	Hindalco Inds.	Tata Steel	Unitech	Bharti Airtel	ITC	Power Grid Corpn	Bharti Airtel	Ambuja Cem.	Ambuja Cem.	Reliance Infra.
Sterlite Inds.	Bharat Forge	Ranbaxy Labs.	H D I L	A B B	Asian Paints	DLF	Bank of India	B P C L	United Spirits	Tata Teleservices	Rel.Nat.Resour.
Bharat Forge	Reliance Capital	DLF	Aditya Bir. Nuv.	Hindalco Inds.	HCL Technologies	NTPC	Ranbaxy Labs.	ITC	Bharti Airtel	GMR Infra.	Suzlon Energy
Tech Mahindra	Tech Mahindra	Tata Steel	DLF	I O B	Tata Comm	Hind. Unilever	Bharti Airtel	Tata Comm	Cipla	Sun Pharma.Inds.	GMR Infra.
Oracle Fin.Serv.	JSW Steel	Reliance Capital	C P C L	Moser Baer (I)	Sun Pharma.Inds.	Sun Pharma.Inds.	B P C L	Glaxosmit Pharma	Sun Pharma.Inds.	Reliance Inds.	Reliance Power
Tata Steel	Tata Steel	H D I L	Tech Mahindra	Wockhardt	Cipla	United Spirits	NTPC	Sun Pharma.Inds.	ITC	Suzlon Energy	Tata Teleservices
Suzlon Energy	H D I L	JSW Steel	Reliance Capital	Reliance Capital	ITC	Ranbaxy Labs.	Tata Comm	NTPC	NTPC	Idea Cellular	Bharti Airtel
JSW Steel	Suzlon Energy	Suzlon Energy	Unitech	United Spirits	United Spirits	Tata Comm	Hind. Unilever	Power Grid Corpn	Power Grid Corpn	Rel. Comm.	Idea Cellular
Unitech	Unitech	Unitech	Suzlon Energy	HCL Technologies	Hind. Unilever	Glenmark Pharma.	Sun Pharma.Inds.	Hind. Unilever	Hind. Unilever	Bharti Airtel	Rel. Comm.
Jan-10	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**	**Jun-10**	**Jul-10**	**Aug-10**	**Sep-10**			
M R P L	DLF	Moser Baer (I)	H P C L	O N G C	DLF	DLF	DLF	Maruti Suzuki			
GMR Infra.	GMR Infra.	Suzlon Energy	Suzlon Energy	Rel. Comm.	Reliance Capital	S A I L	Power Grid Corpn	S A I L			
Reliance Power	Hind. Unilever	GMR Infra.	Bharti Airtel	Maruti Suzuki	I O B	Bharti Airtel	Tata Teleservices	H D I L			
Mundra Port	Unitech	Idea Cellular	I O B	H P C L	Sterlite Inds.	Sterlite Inds.	MphasiS	Bharat Electron			
Suzlon Energy	Suzlon Energy	Aditya Bir. Nuv.	Reliance Infra.	Tata Teleservices	Maruti Suzuki	Tata Steel	Maruti Suzuki	JP Associates			
Reliance Capital	Reliance Infra.	DLF	DLF	H D I L	Tata Teleservices	MphasiS	JP Associates	Sesa Goa			
Bharti Airtel	Bharti Airtel	Tata Teleservices	Unitech	Hind. Unilever	Indbull.RealEst.	Tech Mahindra	H D I L	Sterlite Inds.			
Idea Cellular	Idea Cellular	Unitech	Tata Teleservices	DLF	Suzlon Energy	H D I L	Tech Mahindra	Tech Mahindra			
Tata Teleservices	Tata Teleservices	Bharti Airtel	Indbull.RealEst.	Tech Mahindra	H D I L	Indbull.RealEst.	Suzlon Energy	Suzlon Energy			
Rel. Comm.	Rel. Comm.	Rel. Comm.	Rel. Comm.	Indbull.RealEst.	Tech Mahindra	Suzlon Energy	Aditya Bir. Nuv.	UltraTech Cem.			