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Profiting from Technical Analysis in Indian Equity Markets: Using Moving Averages

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Abstract

This study employs the Simple Moving Average (SMA) and the Displaced Moving Average (DMA) trading rules to test the weak form efficiency of the Indian equity markets. The indicators were applied on the S&P CNX Nifty, BSE Sensex as well as multiple individual stocks for a time period spanning 15 years (1991-2005). Our results provide sufficient evidence that the DMA indicator is a highly successful trading rule that generated profitable signals even after adjusting for transaction and other costs.

Key Words:
Market Efficiency, India, Stock Market, Technical Analysis, Moving Average, Displaced, SMA, DMA, Weak Form Efficiency, and Trading

1. INTRODUCTION

Weak form efficiency is one of the different degrees of efficient market hypothesis (EMH) as proposed by Fama (1965). In its weak form, EMH states that the stock returns are serially un-correlated and have a constant mean. In other words, a market is considered weak form efficient if current prices fully reflect all information contained in historical prices. This implies that no investor can devise a trading rule based solely on past price patterns to earn abnormal returns. In essence stating that technical analysis cannot be used to predict and beat the market consistently.

Technical analysis is a method of evaluating financial instruments by analyzing statistics generated by market activity, past prices and volume. Technical analysts do not perform fundamental analysis[1]; instead, they look at stock charts for patterns and indicators that will determine a stock's future performance. Traders who prefer technical analysis usually agree that the fundamental value will eventually be attained. However, they contend that funds can remain unproductive for the intermediate term (from days to months) while awaiting the long-term process of reaching the equilibrium or fundamental value which may take years.

The motivation for the study is primarily due to the huge demand amongst investing community for such speculative 'technical tips and guidelines'. This popularity can be gauged from the fact that technical analysts[2] appear often on business news channels and write regularly in the business print media[3] airing their opinions as well as the numerous websites[4] that offer technical calls.

The objective of this study is firstly to comprehend the simplest and the most popular of all technical analysis methodologies: Moving Averages (MA) and secondly to explore the possibility whether gains can be made in a stock market based on such trading rules, in effect scrutinizing the weak form efficiency of the markets. This study would be an assessment of the beliefs and benefits of trading based on moving averages-based technical analysis alone.

The remainder of this paper is organized as follows – Section 2 takes us through an overview of the existing literature. Section 3 discusses the study framework and gives us the research methodology. Section 4 details the empirical results using SMA. While, Section 5 details the empirical results using DMA. Finally we sum up our discussion in Section 6.

2. LITERATURE REVIEW

Weak form efficiency of the markets can be tested using various methods. The most common method is the correlation test. Empirical literature also makes use of measuring returns based on various filter rules such as trading rules based on such as new peaks, over-reaction, and moving averages. Studies have also looked at the market anomalies

such as day-of-the week effect, holiday effect, P/E effect, small-firm effect, and January effect.

The issue of weak form efficiency has been researched in India for over three decades. Sharma and Kennedy (1977) compared stock price behavior across three exchanges: Mumbai, London and New York during 1963-73. The runs test and spectral analysis that were employed both confirmed the random movement of stock indices for all three stock exchanges. Sharma (1983) tested the random character of stock prices for the developing economy, supporting the independence assumption of the random walk model. This study also suggested that markets are weak form efficient and trading rules cannot lead to extra-normal returns.

Kulkarni (1978) analyzed the weak form efficiency hypothesis using a spectral analysis of prices and he concluded that there is a repeated cycle of four weeks for weekly prices and there also exists seasonality in monthly prices. Poshakwale (1996) provided evidence of the day of the week effect on the BSE. Mitra (2002) utilized complex non-linear processes to explain stock behavior. Seghal & Garhyan (2002) suggested various technical indicators that help in formulating extra-normal return strategy. Evidence from these studies indicates that trading based on technical analysis could result in profiteering.

We summarize some of studies based on technical analysis as follows:

Table 1: Literature Summary

Literature	Period under study	Are markets Weak Form Efficient?
Sharma & Kennedy(1977)	1963-1973	Yes
Kulkarni (1978)	Pre 1978	No
Sharma (1983)	Pre 1983	Yes
Poshakwale (1996)	1987-1994	No
Mitra (2002)	1990s	No
Seghal & Garhyan (2002)	April 96 to March 98	No

There seems to no convincing evidence, which explains with certainty that markets are weak form efficient or not. Secondly, all these studies were done over historical stock returns in a period before 2000. Thirdly, the periods under examination were quite limited not covering entire economic/business cycles (usually sectoral), and controlling for temporal factors.

3. RESEARCH FRAMEWORK AND METHODOLOGY

Having found that there have been not many recent studies testing the weak form hypothesis, we decided to undertake one. This study would also address some of the other gaps by considering the post liberalization era of 1991-2005 (a 15 year period), a

period documented[5] to have economic cycles. Further a well diversified portfolio of stocks would be regressed upon.

We decided on the following steps to undertake our study:

A. Data Collection and Validation:

Stock price data on market indices and a diversified portfolio of stocks over a long time period was needed. Hence, we picked Indian stock market data comprising of daily prices of actively traded and large capitalization stocks over a fifteen-year period: July 1990 to December 2005 approximating to around 3700 data points.

The National Stock Exchange (NSE) website[6] is a good repository for historical share price data which has been adjusted for splits and bonus announcements. Hence we made use of it. The retrieved data was verified for consistency and any discrepancies observed, will be ironed out.

B. Criteria for Stock Selection:

The selected stocks were part of NSE's CNX Nifty[7], the popular market proxy. Additionally, the S&P CNX Nifty and BSE Sensex data was also collected for the corresponding period to serve as an indicator of performance of the overall economy of that time.

Considering that our study consisted of a period of stock market bullishness[8], we also decided to include some stocks whose value fell during our study period to verify the effectiveness of the moving average trading rules short listed.

Table 2: Selected Stocks

Company	*Industry*
Associated Cement Co. (ACC)	Cement
Himachal Futuristic (HFCL)	Telecom
Hindustan Lever Limited (HLL)	FMCG
Moser Baer	IT Hardware
Oil & Natural Gas Corp. (ONGC)	Oil Production
Ranbaxy India	Pharmaceuticals
Reliance Industries Limited (RIL)	Refineries
Satyam Computers	IT Software
State Bank of India (SBI)	Banks
Shipping Corporation of India (SCI)	Shipping
SPIC	Chemicals
Tata Motors (TELCO)	Automobiles
Tata Steel (TISCO)	Steel
Zee Telefilms	Media

C. Hypothesis Testing:

Next, the Weak form efficiency hypothesis will be tested using the selected moving average tools on the validated data obtained from the previous step. The null hypothesis is that prices on Indian stock markets follow a *random walk*[9].

Random Walk[10] is an investment theory which claims that market prices follow a random path up and down, without any influence by past price movements, making it impossible to predict with any accuracy which direction the market will move at any point.

D. Analysis and Evaluation:

Once the empirical tests are performed, we would go on to analyze the results obtained from the testing using metrics that capture profitability, success rates, risk appetite etc.

Finally, we would also evaluate the efficacy of the tools that were used for the data regression and ascertain whether trading using the rules is yielding extra-normal returns or not.

4. EMPIRICAL RESULTS FOR SMA TRADING RULE

Simple Moving Average (SMA) Trading Rule

The SMA trading rule involves comparison of the current market price with an 'n' day moving average. Buy (sell) signals are emitted when the stock prices exceeds (is less than) the moving average. A detailed illustration of the SMA trading rule is outlined in the Appendix.

Empirical Results

Signal Sensitivity:

Shorter SMAs are more sensitive to price changes due to their smaller window of references and hence they produce more signals than longer SMAs, a trend that is clearly established in the figure 1.

Figure 1: SMA Signals and Success Ratio[11] on Nifty 1991-2005

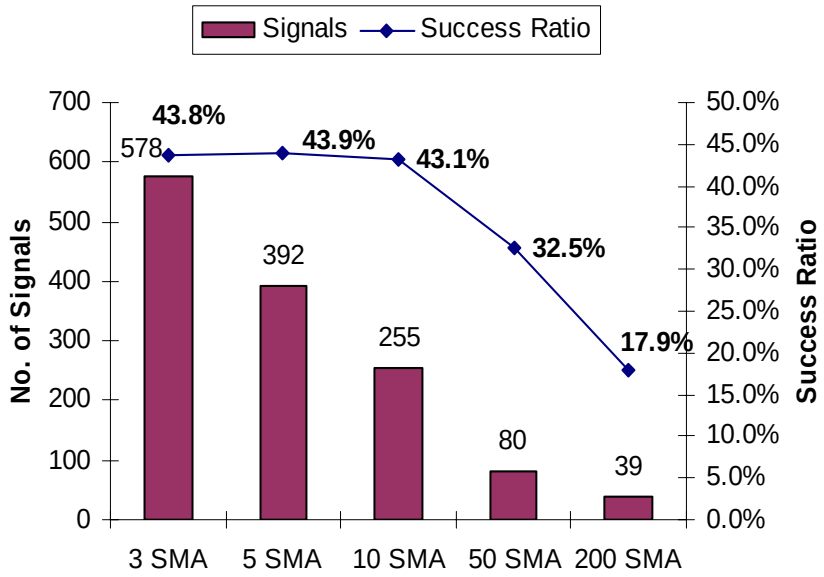


Table 3: SMA Indicator Call Durations on Nifty 1991-2005

Duration	3 SMA	5 SMA	10 SMA	50 SMA	200 SMA
Days	3.30	5.06	7.71	23.98	48.56

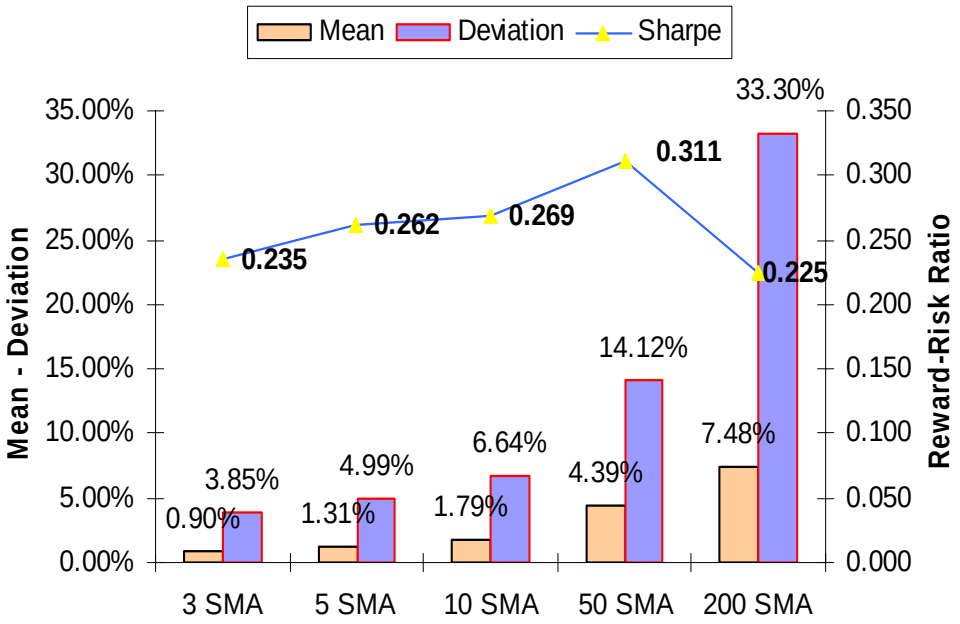
Table 3 captures the mean duration of calls generated by the trading rule, a trend that is directly proportional to the size of the window being captured.

Signal Reliability:
The above results indicate that shorter SMAs are also more successful in yielding profitable transactions. A profitable transaction means returns in excess of an assumed transaction cost[12] of 0.1% each way. However, no SMA trading rule is able to achieve a success ratio of above 50%. The 50-day SMA and the 200-day SMA perform poorly on the reliability front, reiterating the fact that shorter SMAs are more consistent.

Signal Returns:
The means of all SMAs are positive which ratifies the fact that SMAs can be used as a technical analysis tool to trade profitably on stock markets. The returns captured are for a per signal basis and comparison can only be performed by considering the duration of the technical call.

The risk-reward ratio[13] i.e. the ratio of the mean and the standard deviation captures the efficiency of the indicator in maximizing returns while minimizing the risk. The ratio indicates that the 50-day SMA has the best risk-reward ratio with 10-day SMA being the next.

Figure 2: Mean, Deviation and Risk-Reward Ratio for SMAs on Nifty 1991-2005



Statistics of Returns Distributions:

Figure 3 sketches the approximated probability distribution of the different SMA returns for the entire data set under test. Most of the returns are clumped around the 0% mark, which suggests a kind of zero sum game. The 3-day SMA gives the best results.

Figure 3: Probability Distribution Function of SMA returns on Nifty 1991-2005

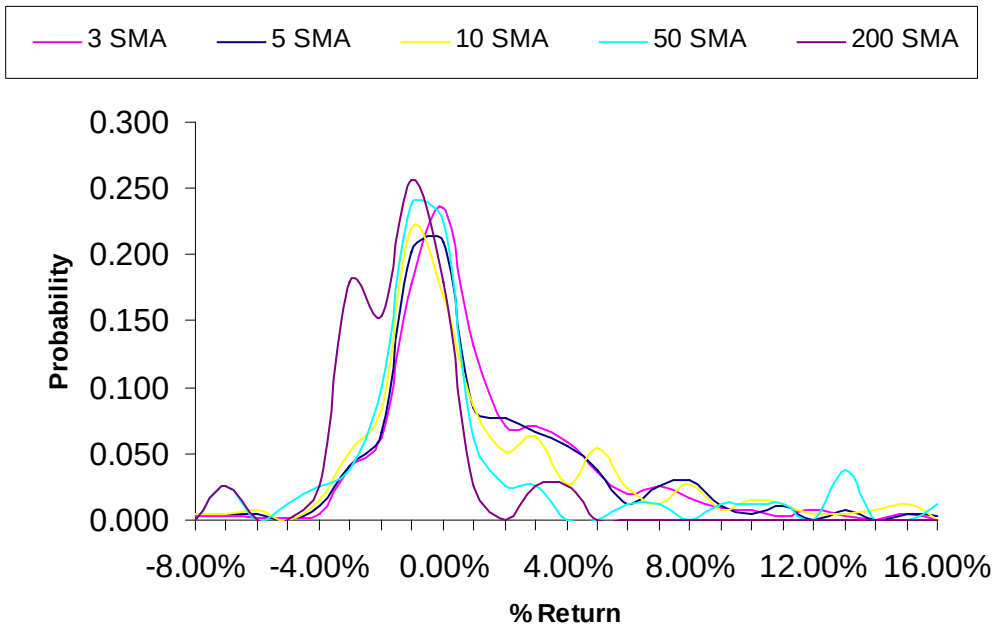


Table 4: Skewness[14] & Kurtosis[15] of SMA Returns on Nifty 1991-2005

	3 SMA	5 SMA	10 SMA	50 SMA	200 SMA
Skewness	2.73	2.74	3.08	3.49	2.90
Kurtosis	15.2	12.7	15.2	12.2	22.1

Positive values of Skewness for all the SMAs are corroborative of the fact that profitability can be achieved by using the SMA trading rule, as the distribution has an asymmetric tail that is extending toward values that are more positive. Kurtosis values are high for all rules, indicating that the returns are relatively more peaked as compared to a normal curve. The results for the individual stocks evaluated were no different from the above results.

Appendix D provides our best results for each stock using a portfolio investment strategy of investing using one of the DMA trading rules vis-à-vis a buy and hold strategy in the same stock. The results show the high success achieved in using DMA trading rule.

Managerial Implications

The study brings to light the following implications

1. Profiteering using simple moving average trading rule is feasible
2. The simple moving average indicator is not very reliable as success percentages are below 50%. So trading must be done with at most caution. Usage of trailing stop losses should be mandated.
3. The trading rule is also very sensitive to price movements, i.e. it is prone to the 'whipsaw effect'[16], and hence must be avoided when markets are volatile in nature.

From the empirical analysis that has been done on SMA trading rule, it can be said quite reasonably that equity markets are not weak form efficient i.e. technical analysis on historical stock data can be used to make predictions about future stock prices resulting in profitable financial returns.

5. EMPIRICAL RUSULTS FOR THE DMA TRADING RULE

Displaced Moving Average (DMA) Trading Rule

The SMA is a lag indicator and the signals that break out from the rule, lag the trend. The DMA rule overcomes this issue by displacing today moving averages forward in time by say't' days. An illustration of the DMA is given in Appendix B. The simplistic assumption behind displacing today's actual moving average value forward in time is that the future period's actual moving average value that has not yet occurred will, in fact, be equal to today's moving average value.

Empirical Results

Signal Sensitivity:

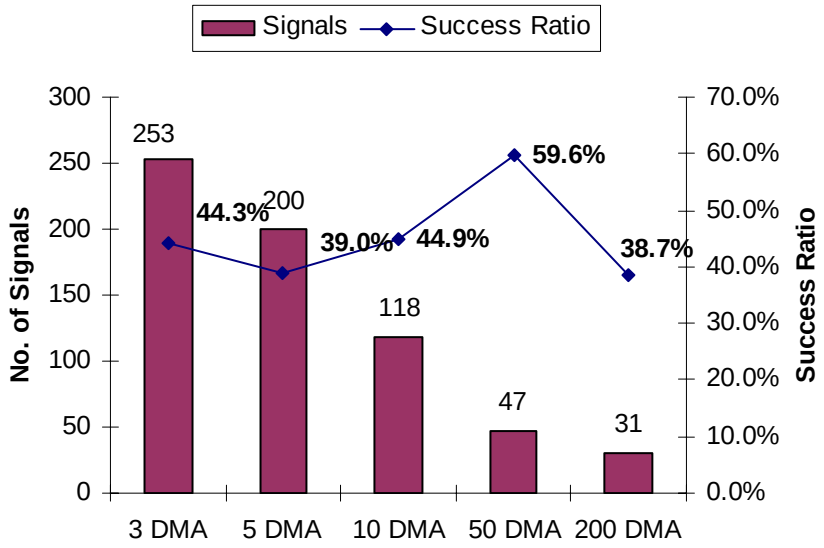
The DMA are less sensitive when compared to the SMAs. DMAs produced lesser signals on the same dataset with the duration of the calls being longer.

Table 5: DMA Indicator Duration on Nifty 1991-2005

Duration	3 DMA	5 DMA	10 DMA	50 DMA	200 DMA
Days	7.82	9.95	16.89	42.77	56.35

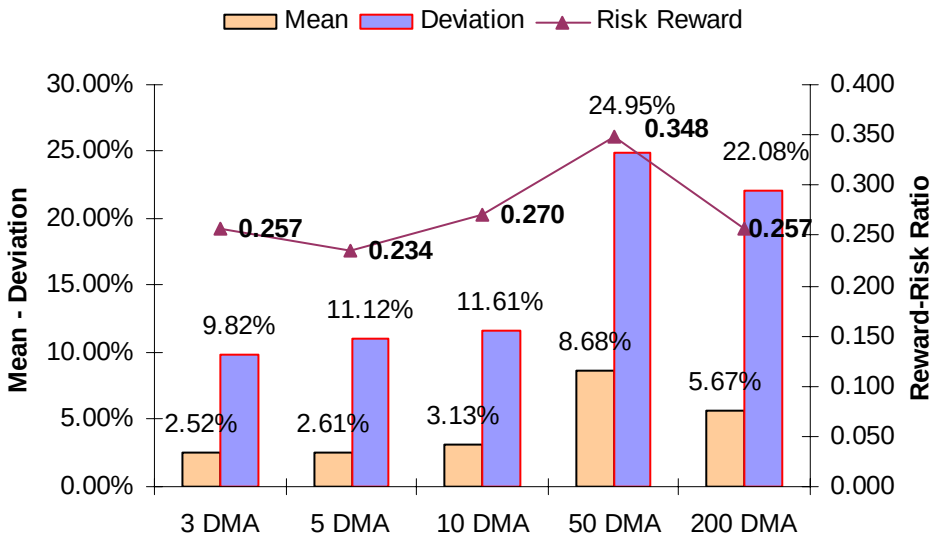
Signal Reliability:
The success ratio of the DMA trading rules is far higher when compared to the SMA trading rules with the 50X11 DMA rule[17] hitting a high of almost 60% extra-normal returns excess of the transaction cost.

Figure 4: DMA Signal, Success Percentage of Signals on Nifty 1991-2005



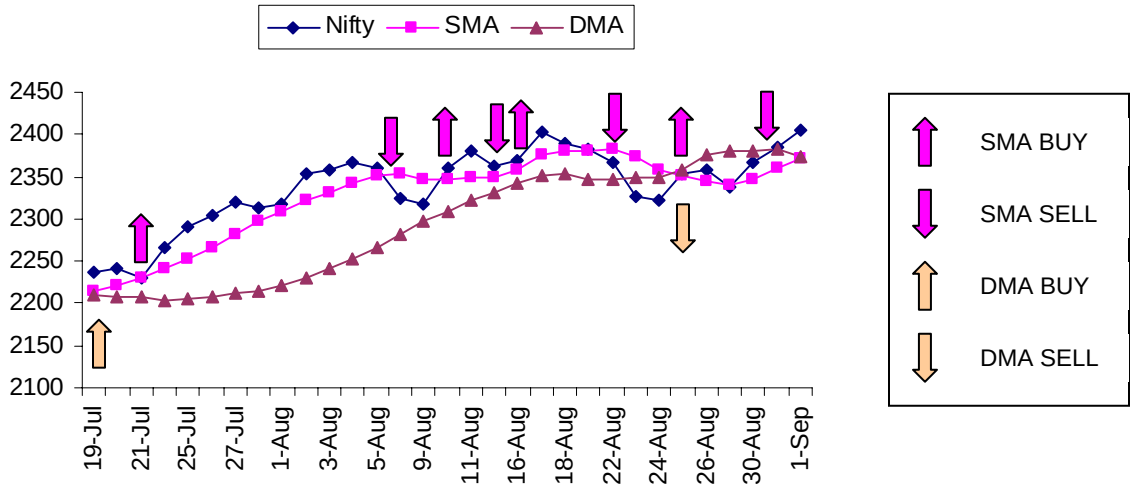
Signal Returns:
The DMA beats the SMA in terms of mean returns for the Nifty data generating returns in excess of 0.2% transaction cost that is assumed for both legs of trading. The risk-reward ratio is also significantly higher with the 50-day DMA having the best risk-reward ratio with the 10-day DMA being the next, indicating the fact that variability of returns has reduced.

Figure 5: Mean, Deviation and Risk-Reward Ratio for DMAs on Nifty 1991-2005



On a per risk basis, the DMA squeezes out more returns from the trend that exists than the SMA does. The evidence is clearly captured in the graph shown below. In the 40 day time period under comparison, the SMA trading rule generates 4 signals while the DMA trading rule generates a single profitable signal indicative of the fact that DMA has lesser whipsaws.

Figure 6: Whipsaw Effect: SMA vs. DMA Trading rule on Nifty Jul-Sep 2005



Statistics of Returns Distribution:

The chart below illustrates the probability distribution of the DMA returns for the Nifty data under test. The distribution is predictably positively skewed with roughly 75% of the returns in the positive zone.

Figure 7: Probability Distribution Function of DMA returns on Nifty 1991-2005

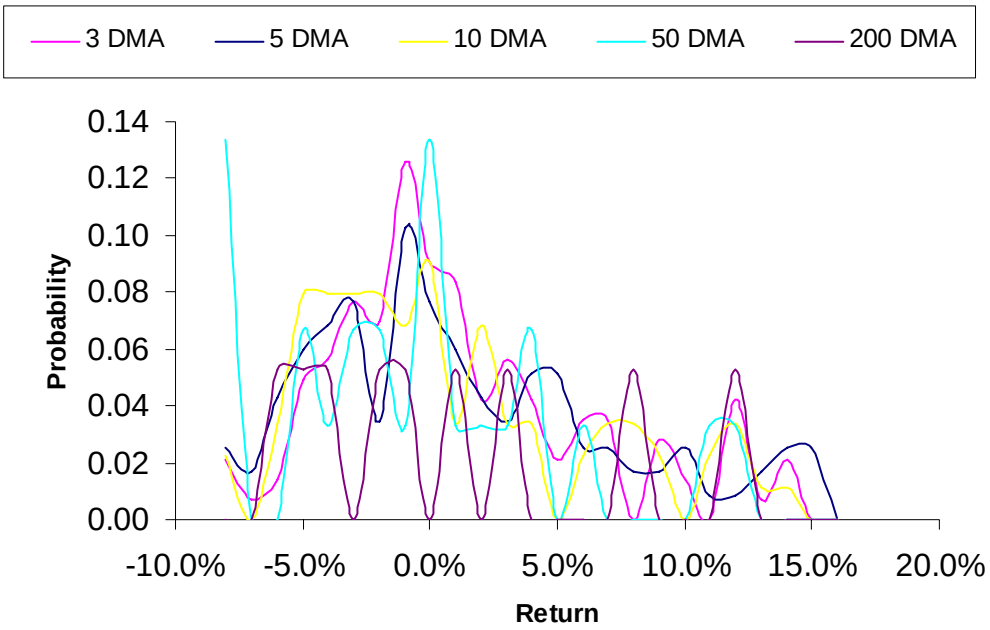


Table 6: Skewness & Kurtosis of DMA Returns on Nifty 1991-2005

	3 DMA	5 DMA	10 DMA	50 DMA	200 DMA
Skewness	1.72	2.03	4.19	2.42	2.18
Kurtosis	5.20	7.65	27.05	6.14	4.31

Positive values of Skewness for all the DMAs in table 6 are corroborative of the fact that the distribution has an asymmetric tail that is extending toward values that are more positive. As in the case of SMAs, the Kurtosis values indicate that curve is peaked much more than a normal curve.

Statistical Tests of Significance:

Test statistics are introduced to test whether the DMA is able to generate superior returns when compared with the daily returns as well as the SMA for the Nifty daily data ranging from 1991-2005. Let μ_{dma}, μ_d and μ_{sma} be the means of the returns, n_{dma}, n_d and n_{sma} be the sample sizes and let σ_{dma}, σ_d and σ_{sma} be the standard deviation of the returns generated by DMA signals, daily returns and SMA signals respectively. Since we are to test the superiority of the DMA over the SMA, it is expected that the difference in means would be positive, so we test the hypothesis $H_{01} : \mu_{dma} - \mu_{sma} = 0$ vs $H_{11} : \mu_{dma} - \mu_{sma} > 0$ using the test statistic:

$$Z = (\mu_{dma} - \mu_{sma}) / ((\sigma_{dma}/ n_{dma})^2 + (\sigma_{sma}/ n_{sma})^2)^{(1/2)}$$

Hence, for an α level of significance, if Z > zα, we will reject H_{01} : μ_{dma} - μ_{sma} = 0 and conclude that the difference in return between DMA and SMA is significantly larger than zero. A similar comparison is made between the DMA and the daily returns over the same period.

A summary of the above is given in Table 7. In this table, statistics that are significant at the 1% level are marked 'a', those significant between 1% to 5% level are marked 'b'.

Table 7: Summary Scheme of Tests

Significance Level	Critical Value Z	Markings
1%	Z > 2.3263	a
1% to 5%	2.3263 > Z > 1.6449	b

Table 8: Z test: Two sample for Means

3 X 9 DMA (μ = 2.42%)	Z Value	Significance Level
Vs Daily (μ = 0.05%)	2.8665	1% (a)
Vs 3 SMA (μ =0.9%)	1.8033	5% (b)

For purposes of test we used the 3 X 9 DMA with the daily returns and the 3 SMA. Table 8 captures the outcome of the statistical tests, indicating how the DMA provides superior return over daily returns and the SMA. The test statistic was of the right sign and was statistically significant at the levels indicated. One can compare the SMA and DMA results and state that the displaced moving average indicator scores over the simple moving average indicator on all statistics. We also observe that the displaced moving average indicator is a very reliable trading rule generating excess returns often reaching success rates of 60% for significant periods. Appendix C gives the descriptive statistics comparing both the trading rules over Nifty.

Managerial Implications

1. The appropriate 'n' day displaced moving average can be short-listed based on either the investment horizon or the risk profile of the client. Data as shown from Table 5 can be used to decide the time frame of investment and risk reward ratios as demonstrated in Figure 6 can be for different degrees of risk aversion among investors.
2. The DMA technique promotes speculation as it neglects all aspects which are fundamental to the stock (and that organization) and focuses only on the stock price.
3. Returns being generated can cover the various costs involved during the trade: impact cost, transaction cost, brokerage and the capital gains tax.
4. Given the above findings we can state that technical calls, analysts and studies will be popular with all section of traders in the market. Equity research firms should

dedicate resources to technical analysis of the stocks due to their popularity amongst the investing clientele and of course their reliability.

6. CONCLUSION

Corporate finance text books state that if markets are weak-form efficient then technically analysis may be a waste of time. On the other hand, we also find that existing business media gives a lot of importance to technical analysis. Consequently, we decided to probe this puzzle further using two popular trading rules based on moving averages.

In this paper, we used two moving averages, namely, SMA and DMA to test for their performance as a trading rule to beat the markets. We used a 15 year time period and data from National Stock Exchange to do the study. We not only applied these trading rules on the broad market indices but also tested these rules on a portfolio of stocks.

We found that both the moving averages were successful and hence reinforce the fact that markets are weak form inefficient at least to the extent of our sample data. This study also reveals the fact that extra-normal returns can be earned by using the DMA trading rule which can more than account for the trading costs that are involved in the transaction.

The above results contradict the existing work on Indian stock markets supporting weak form efficiency. The possible explanations for the same could be: (a) Moving average based trading rules were not tested in these studies; (b) Most of these studies were performed in a different time periods; and (c) Most of these studies had some limitations such as smaller time frames and limited set of stocks for analysis.

However, an important question that arises due to these result is: Why is trading out of a Moving Average rule so successful given high trading volumes and efficient market monitoring mechanisms? The answer possibly lies in the behavioral pattern of the investors. Detry and Gregoire (2001) rightly state that the cause of the predictive power of simple forms of technical analysis has to be found in the areas of behavioral finance, market psychology, and all branches of social science that do not assume the perfect rationality of markets.

In our view, investors seem to jump onto a stock the moment it has hit a new high (or low) or a stock with high volumes or a stock that has a big jump (or fall). The intuition is that the trend that was set in motion is going to continue for a reasonable period of time (Caginalp and Balenovich, 2003). It is this notion that brings in more investors into the stock and pushes the price up, often described in psychological theory as 'Herd Mentality'[18]. A moving average trading rule is best set to capture this psychological frame of mind as it is a trend following approach.

Limitations of the Study

Like all empirical studies, this study also has some limitations. Focusing on those rules that are ex-post most successful would amount to a form of data snooping bias. Buckle et. al. (1999) rightly point out that trading rule based researches must build ex-ante models of securities which can be traded so that the models can be used to develop realistic trading strategies. Hence, ideally we need to find an appropriate DMA using a test data and apply the same on the new data.

Secondly, the study assumes that all dividend payments that were doled out during the period were re-invested into the market. The study also assumes that a trader can buy and sell instantaneously at the closing prices of the stock. For example during the crash of May 2004 of Indian markets, large number of investors could not exit their positions as trading had been abruptly stopped. Finally, the study being exploratory in nature is not robust, as it has a small sample size and ignores the time value of money for investing cash in a less risky asset.

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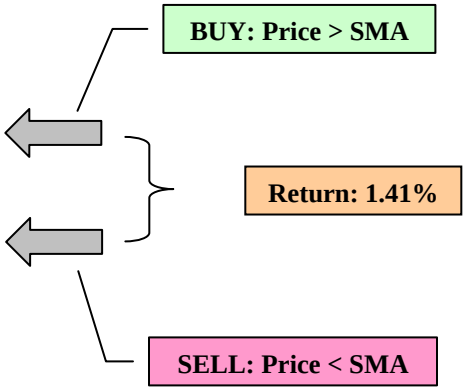
Appendix A: Simple Moving Averages (SMA)

Simple Moving Average (SMA) is an indicator that shows the average value of a security's price over a period. By using an average of prices, moving averages smooth a data series and make it easier to spot trends. Typical daily moving averages are the 3-day, 5-day, 10-day, 50-day and the 200-day moving averages to capture the entire range of periods encompassing short, medium and the long-term cycles. Shorter moving averages are more sensitive to change and they produce more signals than the longer moving averages, which are less sensitive but more robust in signal generation.

A **BUY** signal is generated whenever the stock price crosses an SMA from below and a **SELL** signal is indicated when the stock price falls below its SMA. A typical trade would involve the Buy – Hold – Sell pattern. Gains are made if the exit price is higher than the entry price. The trading rule is designed to keep the trader in line with the stock price's trend by buying shortly after the price bottoms and selling shortly after the price tops.

Figure 8: 3-Day Simple Moving Average on Reliance Industries

Date	Price	3 SMA
1-Nov-05	766.20	
2-Nov-05	777.70	
7-Nov-05	779.10	774.30
8-Nov-05	790.45	782.38
9-Nov-05	791.15	786.87
10-Nov-05	790.00	790.53
11-Nov-05	795.40	792.18
14-Nov-05	798.45	794.62



Appendix B: Displaced Moving Averages (DMA)

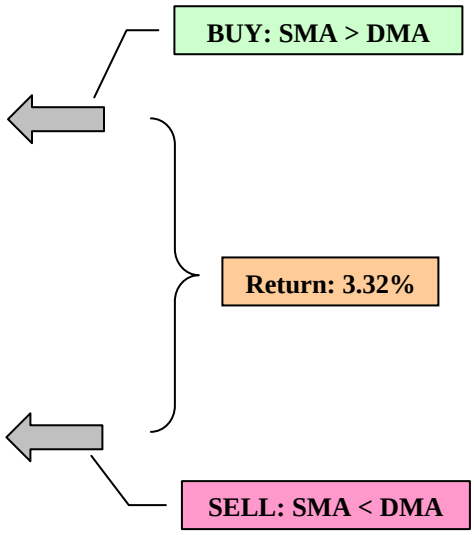
The Simple Moving Average indicator lags behind the market and therefore will usually be late in forecasting a trend change. This would mean buy and sell signals based on moving averages would occur after the trend has already changed direction leading to sub optimal profits.

The DiNapoli's Displaced Moving Average (DMA) attempts to eliminate this lag by displacing or shifting the moving average value forward in time (DiNapoli et. al., 1997). In other words, For a 3X4 DMA, a 3-day moving average value calculated on day't', might be shifted forward to be compared with day t+4. A **BUY** signal is generated when the current SMA is greater than the predicted moving average. Conversely, when the SMA falls below the predicted value a **SELL** signal is closed.

The rationale behind the offsetting is that there are fewer whipsaws as the DMA is able to enclose the trend better than SMAs.

Figure 9: 3 X 4 DMA on Reliance Industries
(i.e., A 3 Day Displaced Moving Average with 4 days Offset)

Date	Price	3 SMA	3 DMA
24-Sep-04	498.85	500.8	
27-Sep-04	495.40	498.1	
28-Sep-04	496.30	496.9	
29-Sep-04	514.30	502.0	
30-Sep-04	517.90	509.5	500.8
1-Oct-04	533.25	521.8	498.1
4-Oct-04	546.20	532.5	496.9
5-Oct-04	539.90	539.8	502.0
6-Oct-04	546.35	544.2	509.5
7-Oct-04	558.80	548.4	521.8
8-Oct-04	554.45	553.2	532.5
9-Oct-04	553.75	555.7	539.8
11-Oct-04	546.90	551.7	544.2
12-Oct-04	535.10	545.3	548.4



Appendix C: Comparison of 10 SMA vs. 10X9 DMA

The table enumerates the statistics of two trading rules: 10 SMA and 10X9 DMA on the Nifty data from 1991-2005.

Table 7: SMA-DMA Descriptive Statistics

	10 SMA	10X9 DMA
Mean Return	1.79%	3.13%
Deviation	6.64%	10.61%
No. of Signals	255	88
Good Calls	43.1%	54.6%
Bad Calls	56.9%	46.4%
Risk Reward Ratio	0.269	0.360
Sensitivity	7.08%	2.40%
Max Return	45.45%	76.65%
Min Return	-11.58%	-11.35%
Median Return	-0.44%	0.51%
Duration (days)	7.71	22.17
Skewness	3.26	3.50
Kurtosis	15.2	18.4

From the table, it is apparent that the DMA rule engenders the following: (a) Higher mean returns; (b) Lesser signals resulting in minimized whipsaw effect; (c) More reliable signals in terms of success ratio; (d) Higher returns, indicative of effective trend capture; and (d) Improved risk reward ratios. So, we can state that overall, the DMA is a far superior trend identifier tool than the SMA a fact that is corroborated from the table above.

The impact of brokerage rates on the success ratios of the DMA rules was also studied wherein transactions costs were assumed to be between 0.1 to 0.2% of the trade size. The change observed in terms of the change in the number of profitable signals was marginal. This implies that the rules generate returns which are in excess of the existing brokerage rates.

Appendix D: Portfolio Investment Strategy

The DMA rules were applied on the stocks mentioned in Table 2 for a period of 5 years starting from Jan 1, 2001 till Dec 31, 2005. An amount of Rs 100,000 was invested on the first day in the stock. Then, based on the signal from the DMA trading rule, a BUY or a SELL was affected. The summary of the evaluation for the stocks is captured in the table below.

Table 8: DMA results based on Success Ratio

Stock	Best DMA Rule	Success %	Average Return	Max Loss	Max Gain	Stock Returns	Corpus Position
ACC	50 X 11	64.3%	5.1%	-10.36%	35.94%	232.57%	**179345**
Himachal Fut	50 X 14	57.1%	13.2%	-22.29%	86.98%	-97.99%	**183876**
HLL	50 X 43	57.1%	-3.8%	-23.48%	7.81%	-1.20%	**73243**
Moser Baer	50 X 16	62.5%	4.1%	-24.47%	60.66%	-15.95%	**113899**
ONGC	50 X 24	87.5%	24.2%	-1.47%	108.41%	857.4%	**437133**
Ranbaxy	50 X 11	62.5%	9.5%	-16.55%	49.85%	7.63%	**173807**
Reliance	50 X 21	71.4%	11.1%	-4.22%	62.48%	160.22%	**219340**
Satyam	50 X 41	70.0%	17.5%	-13.84%	68.66%	134.52%	**196532**
SBI	50 X 14	77.8%	18.1%	-21.95%	85.41%	365.7%	**345478**
SCI	50 X 27	75.0%	21.9%	-25.55%	143.06%	500.18%	**279520**
Tata Motor	50 X 31	87.5%	41.0%	-11.36%	207.40%	633.75%	**779380**
Tisco	50 X 14	71.4%	19.9%	-34.38%	146.46%	186.80%	**202318**
Zee	50 X 19	57.1%	3.1%	-20.66%	45.09%	-40.79%	**110837**

Table 9: DMA results based on Corpus Position

Stock	Best Rule	Success %	Average Return	Max Loss	Max Gain	Stock Returns	Corpus Position
ACC	3 X 8	37.5%	2.7%	-6.05%	31.86%	232.57%	**370550**
Himachal Fut	5 X 1	40.9%	4.0%	-12.87%	153.80%	-97.99%	**1152549**
HLL	5 X 6	44.1%	0.6%	-8.43%	15.42%	-1.20%	**133891**
Moser Baer	10 X 14	37.0%	1.7%	-11.69%	52.77%	-15.95%	**129367**
ONGC	5 X 4	48.6%	3.0%	-14.54%	55.21%	857.40%	**583877**
Ranbaxy	50 X 13	50.0%	11.1%	-15.57%	67.16%	7.63%	**184505**
Reliance	3 X 1	43.9%	56.1%	-5.08%	16.59%	160.22%	**379195**
Satyam	3 X 41	42.9%	7.4%	-9.85%	80.01%	134.52%	**300152**
SBI	10 X 10	53.1%	4.7%	-9.75%	29.55%	365.70%	**382489**
SCI	3 X 14	48.5%	9.0%	-11.36%	66.75%	500.18%	**1124139**
Tata Motor	50 X 31	87.5%	41.0%	-11.36%	207.40%	633.75%	**779380**
Tisco	3 X 13	51.6%	6.3%	-15.41%	56.17%	186.80%	**526128**
Zee	10 X 7	50.0%	2.6%	-13.33%	37.01%	-40.79%	**229390**

From table 9, it is evident that smaller DMAs are clearly able to beat the corresponding stock returns for the time period in most cases[19].

[1] the attempt to measure a security's intrinsic value.
[2] Anil Manghanani, Ashwani Gujral, Devangshu Datta, E Mathew, Mehraboon Irani, Prakash Gaba, Rajat Bose, Rajesh Jain, Salil Sharma, Vijay Bhambhawani, and Venugopal, to name a few technical analysts
[3] For example *Business Today, CNBC India, NDTV Profit, and The Hindu Business Line* have uniform features on Technical analysis (and analyst calls/recommendations based on the same).
[4] www.moneycontrol.com, www.ways2gain.com, www.valuenotes.com, www.stocktips.in
[5] Please refer to the report by Economic Cycle Research Institute: Indian Economic Outlook (http://www.businesscycle.com/showstory.php?storyID=748)
[6] Visit http://www.nseindia.com
[7] The criteria for stock selections were based on the following parameters of: (a) *Liquidity*: This captures the interest levels in the stock; (b) *Market Capitalization*: This is a measure of the size of the company; (c) *Floating Stock*: This ensures that the stock is held by larger non-promoter shareholders; and (d) *Diversified Industry Portfolio*: This parameter makes sure that a varied set of sectors representing the general economy are present.
[8] For example, the two popular indices BSE Sensex and NSE Nifty have gone up by over 3 times during the period.
[9] See http://www.investorwords.com/4029/random_walk_theory.html for more details.
[10] In other words, the theory claims that path a stock's price follows is a random walk that cannot be determined from historical price information, especially in the short term. Investors who believe in the random walk theory feel that it is impossible to outperform the market without taking on additional risk, and believe that neither fundamental analysis nor technical analysis have any validity. However, some proponents of this theory do acknowledge that markets move gradually upward in the long run.
[11] Success Ratio: Ratio of the number of profitable signals (returns that cover transactions costs) obtained to the total number of signals generated
[12] We believe, a 0.1% one-side transaction cost is appropriate in Indian markets (say, NSE) for a trader having a regular big broker and giving good business (for example, see rates offered by www.5paisa.com for big traders).
[13] The risk reward ratio is a measure of risk-adjusted performance of an investment asset, or a trading strategy. It is defined as: $S = R / \sigma$
Where R is the expected value of asset return, and σ is the standard deviation of the asset returns. The risk reward ratio is used to characterize how well the return of an asset compensates the investor for the risk taken. Investors are often advised to pick investments with high risk reward ratios.
[14] Skewness is a measure of the asymmetry of the probability distribution of a real-valued random variable. Roughly speaking, a distribution has positive skew (right-skewed) if the higher tail is longer, implying a larger proportion of positive returns and negative skew (left-skewed) if the lower tail is longer.
[15] In probability theory and statistics, kurtosis is a measure of the "peakedness" of the probability distribution of a real-valued random variable. Higher kurtosis means more of the variance is due to infrequent extreme deviations, as opposed to frequent modestly-sized deviations.
[16] Whipsaw Effect occurs when the moving average generates a false signal i.e. when the average makes a new upward move, a buy signal is triggered, and then suddenly the underlying security reverses direction causing a loss.
[17] 50X11 DMA – 50 DMA offset by 11 days in the future
[18] 'Herd mentality' is a term that refers to an irrational sentiment that hits the market, due to which people tend to behave the way others do. In relation to the stock markets, it could be a rally, which is uncalled for or a panic sell-off, which defies logic.
[19] In 11/13 cases, the DMA trading rule outperformed the Buy-Hold Strategy