

Profitable Intraday Momentum Strategy Using RMS Algorithm

Soorej K R¹ and Dr KC James²

¹Student, M-Tech Engineering Statistics, Dept of Statistics, Cochin University of science and technology.
Kochi-682022, Kerala, India.

²Professor, Dept of Statistics, Cochin University of science and technology.
Kochi-682022, Kerala, India.

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ABSTRACT

Momentum trading strategy aims at going long for the outperforming stocks and shorting the underperforming stocks to generate a decent return percentage. This paper analyses real data and work with historical intraday data of stocks from NSE stock exchange. This paper uses Technical indicators to capture momentum. The momentum-based intraday strategy is analysed in the emerging market conditions, and we generate consistent returns for unique periods. Performance Indicators are measured and is used to compare the stocks chosen for analysis.

Keywords: Momentum Investing, Personal Finance, Portfolio Management
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I. INTRODUCTION

Financial markets are complex, and in the past few decades, the level of complexity has grown with advances in modern technology and the growth of available data. Newton's first law of motion states that an object at rest stays at rest, and an object in motion stays in motion with the same speed and the same direction unless acted upon by an unbalanced force¹. While this may seem to have little to do with the vagaries of the stock market, similar behavior is there in stock prices, rising stock prices seem to continue to rise for some time while falling stock prices continue to fall. This observed phenomenon is popularly known as momentum. However, stocks are not like physical objects. Several factors seem to contribute to the cause of it, including human behavior. People do not want to miss out on an opportunity to make money and tend to follow the herd. People also tend to under-react to the news. New information propagates over time, leading to a prolonged effect on stock prices. There is a branch of trading strategies that attempts to capitalise on such trends. While there is no standard method to quantify momentum signals, a few conventional techniques

include technical indicators such as moving averages, large price movements with volume, and stocks making new highs. The general premise of this trading signal is that outperforming stocks tend to keep their momentum and continue to remain outperformers for some more time in a particular market and vice versa for under-performers. If we believe in momentum being a repeating market phenomenon, it may be an excellent opportunity to buy outperformers and sell under-performers, capitalising on the continuation of their movement.

Once we have found a signal that seems to indicate the future performance of a stock, it is time to put it to action. For instance, if we think that a stock has upward momentum, we might want to buy some shares and hold onto it for a fixed period or until we start seeing the stock fall, which is known as taking a long position on the stock. When we sell our stock, hopefully, at a higher price than we bought it, that is known as closing our position. The momentum investment strategy has found real-world applications. Many Corporations have succeeded in exploiting the momentum investment strategy to their gain by launching momentum-based fund schemes. Many mutual funds also work based on momentum-based strategies.

II. LITERATURE REVIEW

The existing body of literature shows mostly congruent results on momentum-based strategies. (Fama & French, 1992), paper expands upon the capital asset pricing model by adding up size risk and value risk factors to the relevant market risk factor in CAPM. This model takes into consideration the fact that value and small-cap stocks outperform markets regularly. In their paper (Jegadeesh & Titman, 1993), pointed that longing or shorting the 10% best and worst-performing stocks from the previous 3, 6, 9, and 12 months can result in abnormal profits of approximately 1% per month after holding each portfolio for 3, 6, 9, or 12 months. Similar research finds positive returns for momentum trading in

different stock exchanges,(Rouwenhorst, 2002)found that stock return momentum in a sample of 12 European countries over the 1980–95 period. While there has been considerable evidence in support of momentum in stock returns. (Rey & Schmid, 2007),Found that Investors can earn up to 44% per year by buying the best performing SMI and selling the worst performing over the same training period. (Asness, Moskowitz, & Pedersen, 2013), in their paper found consistent value and momentum return premia across eight diverse markets and asset classes.

(Frank, J.Fabozzib, & SinanTana, 2013), pointed out strong evidence for the value effect in all emerging markets and the momentum effect for all but Eastern Europe. (Risk, 2020), found evidence that the returns to the time-series momentum (TSM) strategy are connected to the business cycle, and returns are positive in both recessions and expansions, but profitability is higher in expansions. This paper attempts to capitalise on a strategy developed to work in intraday trading conditions in the emerging market scenario.

III. DATA AND METHODOLOGY

3.1 DATA

Data is the lifeblood of any algorithmic trading strategies. Financial data comes in many shapes, forms, and diversity. Trading opportunities are primarily a function of the data that identifies them. The higher the data frequency, the more the arbitrage opportunities appearing. Inter-trade durations may signal changes in market volatility liquidity and other variables. To apply machine learning algorithms to understand unstructured data, we need to parse it, extract valuable information from it, and store extractions in a regular form. Most ML algorithms are assuming a tabular representation of extracted data. Finance practitioners often refer to those table rows as bars.

3.1.3 DATA VISUALISATION

Date	STOCK A	STOCK B	STOCK C
19/06/2015	31.3616	5.55	8277.15
22/06/2015	30.45602	5.8	8420.3
23/06/2015	30.36069	6.05	8522
24/06/2015	30.74199	6.35	8407.95
25/06/2015	30.45602	6.05	8309.75
26/06/2015	30.12239	5.75	8298.85
29/06/2015	30.12239	5.5	8276.5

Table 1 Stock price data

Some bar construction methods are prevalent in the financial industry, to the extent that most data vendors APIs offer several of them. The analysis mentioned in thispaper uses market data from exchanges. Market data includes all trading activity which takes place in exchange. Market data is sampled in fixed time intervals and is used for our analysis. Strategies are developed through observing patterns and characteristic footprint in the trading records. Through data, we identify original patterns, do the analysis, backtest our strategies, and make sure our models respond in real-time. We have considered all equities traded on NSE as our stock universe. Both active delisted and suspended NSE stocks were included in this sample to avoid any survivorship bias and stock data collected.

3.1.1 DATA COLLECTION

Stock data is collected using the yfinance library in python. The head part of the data frame is given below in the figure. Data consists of Open, High, Low, Close, Adj Close and volume information for the stock. Stock data is collected for the past five years. Adjusted daily closing prices of the stocks considered were obtained for the past five years. Any stock whose data is missing or not available because the stock is delisted or suspended during the period for some reason is not considered for portfolio formation.

3.1.2 DATA WRANGLING

Stock Data collected can comes with missing values in the data frame. These missing values can cause issues in our analysis. These values are backfilled using python pandas backfill function. Any stock whose data is not available during the entire testing period, excluded from stock portfolio formation

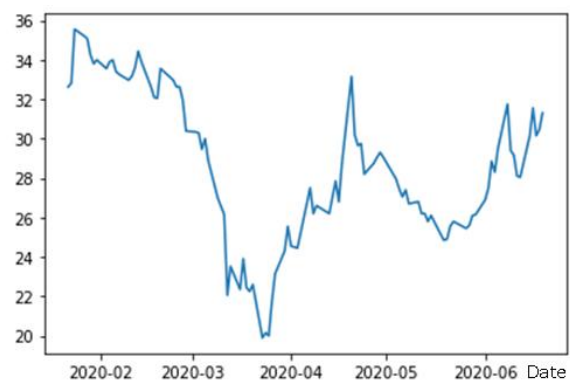


Figure 1 Price Chart for the stock A

Table1 represents stock price data collected in daily time intervals, and the figure 1 represents the price chart for the Stock A

3.2 METHODOLOGY

Rising stock prices seem to continue to rise for some time while falling stock prices

continue to fall. This observed phenomenon is popularly known as momentum. The general premise of this trading signal is that outperforming stocks tend to keep their momentum and continue to remain outperformers for some more time in a particular market and vice versa for underperformers.

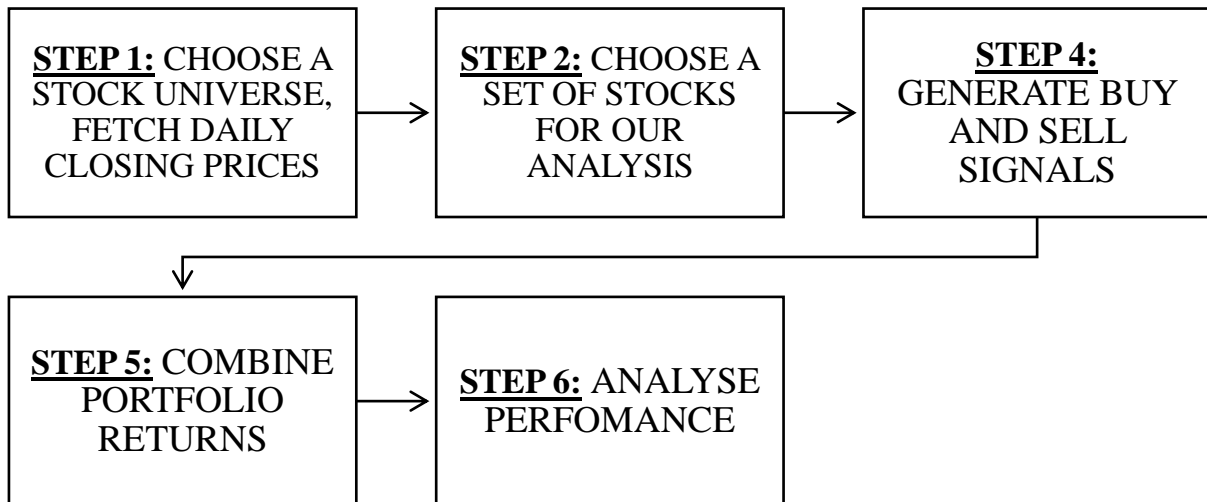


Figure 2 Steps Involved in developing a trading strategy

Our goal is to construct a stock portfolio of long and short positions, and the selection process for stocks to go into the portfolio is based on the stock's trading activity relative to other stocks. First, we fetch the daily closing prices of each stock. We use adjusted closing prices for analysis purposes. The composition of stock universes selection can be changed over time. Our strategy requires high volume and high activity stocks. Selection is made by averaging out the volumes times the average closing prices of all stocks, and we rank the stocks from the highest to the lowest based on activity. High activity stocks are taken into our portfolio. We assume every stock gets an equal dollar amount of investment. This makes it easier to compute the portfolios monthly returns performance as the simple arithmetic average of the stock returns. Now we perform our analysis by generating buy and sell signals. The momentum of the stock is captured using technical indicators such as RENKO charts, MACD indicator and slope of the MACD line is used. Performance is evaluated using performance indicators such as CAGR, Sharpe Ratio, Maximum drawdown RMS(Renko Momentum Slope)Algorithm for determination of trend is developed by a combination of RENKO charts and MACD indicator and the slope of MACD line as well as the Signal line.

Buy signal is generated as follows:

- Renko bar greater than or equal to 2
- MACD line is above the signal line
- MACD line's slope (over last five periods) is more significant than signal line's slope (over last five periods)
- Exit when MACD line goes below the signal line and the MACD line's slope is lower than the signal line's slope

Sell signal is generated as follows:

- Renko bar greater than or equal to 2
- MACD line is above the signal line
- MACD line's slope (over last five periods) is more significant than signal line's slope (over last five periods)
- Exit when MACD line goes above the signal line and MACD line's slope is greater than the signal line's slope

The resulting returns time series is the performance of our long-short portfolio. Our next goal is to see if the CAGR is more significant than zero for the stocks in our portfolio. For this, we perform a statistical test on our hypothesis. A t-test is a way of testing the probability of getting as more significant mean as we did, assuming all the

assumptions we made to build our model of strategy returns were correct. In our case, we can compute the t-statistic by dividing the mean return \bar{x} by the standard error of the mean $SE_{\bar{x}}$.

IV. RESULT AND ANALYSIS

4.1 SAMPLE SELECTION AND CREATION OF BUY/SELL SIGNALS.

Stock data is collected for five years, and stocks are ranked based on high activity and high volume. We start by assuming every stock gets an equal amount of investment. Therefore, the

portfolio's returns can be calculated as the simple arithmetic average of the individual stock returns. The annualised rate of return calculated, which helps us in comparing the rate of return from our strategy to other quoted rates of return that are on an annual basis. Testing period for our analysis is from 20/04/2020 to 19/06/2020. Market data is obtained for every 5 minutes during this testing period. Buy and Sell signals are generated for the following stocks and Buy, Hold, Sell positions are created. The table below represents the buy signal created for a stock used in our analysis.

Date	Adj Close	Barnum	macd	Macdsig	Macdslope	Macdsig_slope	Return
17/04/2020 13:55	444.05	3	1.3172	0.9323	44.8168	44.3365	0
17/04/2020 14:00	443.9	3	1.4608	1.0380	47.0100	45.4673	-0.0003
17/04/2020 14:05	445.9	3	1.7162	1.1736	44.3181	45.00624	0.0045
17/04/2020 14:10	445.8	3	1.8888	1.3167	45.06319	45.0249	-0.0002
17/04/2020 14:15	446.3	4	2.0424	1.4618	46.015	45.2996	0.0011
17/04/2020 14:20	448.1	5	2.2830	1.6261	43.7912	44.8856	0.0040
17/04/2020 14:25	447.15	5	2.3697	1.7748	46.1586	45.1673	-0.0021
17/04/2020 14:30	447.4	5	2.4306	1.9060	46.1693	45.3543	0.0005
17/04/2020 14:35	446.8	5	2.4028	2.0053	41.8181	45.1713	-0.0013
17/04/2020 14:40	449.15	5	2.5410	2.1125	40.4044	44.6998	0.0052
17/04/2020 14:45	455.7	8	3.1429	2.3185	40.6003	43.5886	0.0145
17/04/2020 14:50	457.95	9	3.7581	2.6064	45.0568	44.3878	0.0049
17/04/2020 14:55	464.8	13	4.7437	3.0339	45.2272	44.7729	0.0149
17/04/2020 15:00	464.8	13	5.4618	3.5195	45.5456	45.0963	0
17/04/2020 15:05	464.8	13	5.9622	4.0080	46.1706	45.4594	0
17/04/2020 15:10	482.8	22	7.7222	4.7509	42.7056	44.4710	0.0387
17/04/2020 15:15	485.9	23	9.2604	5.6528	45.0051	44.6564	0.0064
17/04/2020 15:20	485.9	23	10.360	6.5942	46.9191	45.3973	0
17/04/2020 15:25	481	23	10.712	7.4179	45.6265	45.4614	-0.0100
20/04/2020	466.4	-7	9.7020	7.8747	35.9011	45.7357	-0.0303

09:15							
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Table 2 Buy/Sell signal for momentum trading for the ticker AXISBANK.NS

From the table, we can see that our algorithm is working as expected, and a buy signal is created according to our algorithm, and the exit condition is also satisfied.

4.2 COMBINE PORTFOLIO RETURNS AND ANALYSE PERFORMANCE

After generating the buy and sell signals, we are testing our algorithm. Testing is done by taking

historical data on stock prices. Back testing of our strategy is done for the periods of 30 trading days and 60 trading days. The figure below shows the returns obtained from back testing the strategies. Results for our strategy testing shows congruent results as per our research

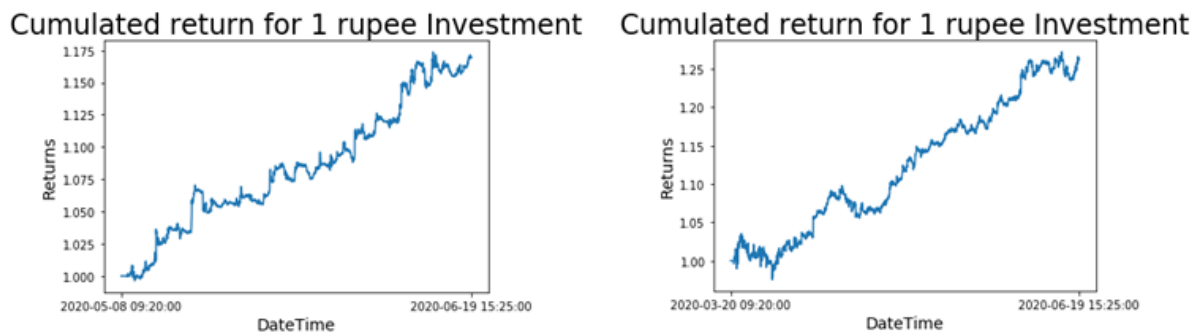


Figure 3 Returns Plot for 30-day and 60-day momentum trading

From the figure, we can see that more than 16.9 % of profit is obtained by running our momentum trading strategy for 30 trading days, and more than 29.22% profit is obtained by running our momentum trading strategy for 60 trading

days. The strategy yielded consistent returns for 30 days as well as 60 days trading. The tables shown below in this section shows the individual return Sharpe ratio for each of the stocks in the portfolio that we analysed.

Ticker	Return	Sharpe Ratio
Stock 1	-0.83167444	-3.3398913
Stock 2	-0.31806527	-1.51644128
Stock 3	1.959152702	5.66448164
Stock 4	16.60658944	39.8203038
Stock 5	19.38656057	45.3953925
Stock 6	3.632447612	7.227715796
Stock 7	20.52351679	33.23446132
Stock 8	2.963156693	8.312728905
Stock 9	-0.51747914	-2.74695611
Stock 10	7.121348557	20.40720151

Table 3 Performance matrix for 30-day momentum trading

Ticker	Return	Sharpe Ratio
Stock 1	-0.47322973	-0.64101514
Stock 2	-0.7569686	-1.69612155
Stock 3	4.243526543	8.718187915
Stock 4	11.41752737	23.06062455
Stock 5	27.19156439	32.83889553
Stock 6	1.613044192	2.878752436
Stock 7	59.18239319	60.58367035
Stock 8	1.23244895	2.627853478
Stock 9	-0.79464099	-2.48880245
Stock10	-0.36467121	-0.65137442

Table 4 Performance matrix for 60-day momentum trading

Table 3 represents the individual performance of stocks taken for our analysis for a 30-day trading period of the momentum strategy, and Table 4 represents the individual performance of stocks taken for our analysis for a 60-day trading period of momentum strategy. Both periods show consistent returns and strategy captured momentum in the market and was able to generate good returns. The overall gain of the strategy for the 30-day trading period is 16.39 percentage, and for the 60-day trading period, it is 29.2 percentage. The strategy yielded negative returns for the stocks 1, 2 and 9 in the 30-day trading period. The stock 10 gave a positive return for the 30-day trading period whereas, in the 60-day trading period, we can see there is reversal and losses are incurred in the portfolio. However, all the other stocks yielded positive returns. In that stock 7 is showing a high return in both the periods. Similarly, 4 and 5 contributed good positive returns, apart from stock 3, 6, and 8 shows positive returns.

The momentum trading generates positive results in our testing. By checking the price chart for the stocks in our analysis, we can see that the algorithm was able to capture the momentum that was present in the market, in addition to that there were some false signals as well. Sharpe ratios of 16 is obtained for momentum trading indicates that the portfolio will give a good return in the long run.

4.3 TEST FOR SIGNIFICANCE

Our null hypothesis (H_0) is that the actual mean return from the signal is zero. We will perform a one-sample, one-sided t-test on the observed mean return, to see if we can reject H_0 . We compute t-statistic and then find its corresponding p-value. This p-value indicates the probability of observing a mean return equally or more extreme than the one we observed if the null hypothesis were correct.

we use $\alpha=0.05$

Sample	P-value	T- value
30-day Trading Period	0.003363	2.713
60-day Trading Period	0.000214	3.525

Table 5 Hypothesis Testing Results

We observed a p-value of 0.003363 for 30-day trading of momentum strategy. Since this is very less than our α of 0.05, there is more persuasive evidence that the null hypothesis is false. (that the actual mean return from the signal is zero), and we can reject this null hypothesis. In other words, because the p-value is smaller than our α

value, we can confidently state that the annualised return we observed was not due to random chance. Similarly, for a 60-day trading period, the p-value is 0.000214. we can reject this null hypothesis and can confidently state that the annualised return we observed was not due to random chance.

V. CONCLUSION

This paper offered an analysis of momentum trading strategy in the emerging market conditions and comparison of momentum strategies performed under different samples. We observed good returns in both our testing period. In this study, we have just predicted the buy/hold signal for stocks and based on momentum with the help of different technical indicators. We have tested the significance of our results and concluded that returns obtained were not due to any random chance. We believe that more work is to be done on this topic, particularly by making stop losses to get the more significant performance or by combining winner portfolios such as incorporating fundamental analysis while selecting the top 10 stocks which can make momentum trading even more rewarding.

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