

Simulation of Technical Indicators for Better Profits in the Indian Stock Market



Krishna Murthy Inumula, Anupama Tadamarla, K.Deepa

ABSTRACT: This article designs models and uses simulation to examine optimization of technical indicators in stock market: the Moving Average Convergence Divergence (MACD) and the Relative Strength Index (RSI). Based on sector-wise Nifty 50 group of companies' daily closing price of the stocks from the year January 2013 to September 2018. This study is to demonstrate how the simulation of technical indicators MACD and RSI helps investor in reducing the trading cycles of investment with better profits in the long run. Results concluded that the experimentation of optimization of technical indicators is one-step forward in making profitable trades as it is evident from the nifty50 stocks. Furthermore, it also proves that both the optimized MACD and RSI outperformed the standard MACD, standard RSI and Buy& Hold strategy.

Key words- Simulation, Technical indicators, Buy and Hold Strategy, Indian Equity Market JEL Classifications- G11, G12, G17

I. INTRODUCTION

A large number of participants come together in the composite system called stock markets, interrelating one another with the objective of profit maximization through trading stocks [Johnson (2003) and Kendall (2003)]. Testing of past data is done by traders to institute specific rules for buying and selling of the securities in order to maximize profit and minimize the risk of loss. Traders undertake their analysis on the principle that the market prices follow a pattern of recurring in the future and hence becoming a base for future prediction. In spite of the fact that the principle seems to be simple, it is complex to take a decision of when and how much to buy and sell. To manage this situation there are a few techniques emerged with technical indicators that helps in the study of the market information that predicts the rise and fall trends. Many technical indicators have been found in literature to experiment over the stock returns. Compared to conventional buy and sell strategy the signals generated by technical indicators proved to be more efficient and give good returns over the investment both short term and long term. In this research study two momentum indicators MACD and RSI were considered for simulation to determine the profitable trading strategies.

This research is supportive to regulate the pertinent use of indicators like MACD and RSI in the decision making of attaining a profitable investment in the Indian Financial Market. Investors in stock market always find ways to beat the market and expect higher returns in short run and long run investments.

As per the EMH (Efficient Market Hypothesis) there is no profitable trading rule available for the investors to make abnormal profits as it says that all the information for decision making in buying and selling stocks is contained in the market that drives the business.

II. REVIEW OF LITERATURE:

The definition of indicators is perfectly done mathematically which leads to the usage of these technical indicators mechanically by certain investors. It is imperative to understand that the best practice to use the indicators is with its combination with other tools of technical analysis. However, return predictability might not infer higher returns after considering transaction costs as the strategy of technical trading involve many transactions. (Bassembinder and Chan, 1998:2).

Gencay (1998) examined through nonparametric models the profitability of simple technical trading rules as the strategy would capitalize on the investment with total returns. The investment strategies for profitability was assessed against the simple strategy of buy & hold on the security and its expanse from the ideal net profit. The indicated results showed that the technical strategy with nonparametric models provided substantial profits when tested against the strategy of buy-and-hold.

Brock et al. (1992) showed improved profits from 1897 to 1986 in the companies of Dow-Jones Index (DJI) with the usage of moving averages and trading tools like the supports and resistances for technical analysis than the strategy of buy-and-hold in the same index. Mills (1997) elucidated a related outcome to the one reflected in the stated article, but for FT30 index of London stock exchange where assessing the significance of the rules statistically through the technique of bootstrap and $AR\pm ARCH$ models, which resulted with greater returns been produced by the trading rules than the strategy of buy-and-hold.

Stephanos, P. and T. Stavros (2001) has appraised earlier research on forecasting exchange rate and recognized few issues in problems in constructing a predictive model and examined the usage of different technical rules for profitability in the USD/DM and USD/BP foreign exchange markets. The data for 1989-1996 were taken, separated into two sub-periods with altered macroeconomic features; and results compared with detailed technical rules and the strategy of buy and hold.

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Kwon and Kish (2002) acknowledged that in New York Stock Exchange (NYSE) the technical rules attained an enhanced profitability than strategy of buy-and-hold.

Eddie, H., et al. (2014) examined the indices of the securitized real estates of 6 Asian economies namely Japan, China, Taiwan, Malaysia, Hong Kong and Thailand if trading strategy could outperform the strategy of “buy-and-hold”. The fallouts showed that in contrary market situations trading strategy is mostly suitable in shielding the investor from huge loss. The effects can be used in various fields like finance/investment where an investor can build a trading strategy related to the same as that of the authors to gain high profits. Mieko Tanaka-Yamawaki and Seiji Tokuoka (2007) studied the intra-day stock price forecast in the New York Stock Exchange with adaptive practice of technical indicators by smearing them on the tick data of various stock prices. The paper examined the technical analyses over a long time period with application of MACD and RVI indicators, especially regarding investment strategy optimization and the afore mentioned trading conditions on the Belgrade Stock Exchange. It showed good forecast of the future price level with ideal combination of some indicators selected from each stock by using evolutionary computation.

Chong and Ng (2008) tested with MACD and RSI on daily data from the London FT30 index from 1935 and 1994 with 10 days period of fixed holding. The sample is separated into sub periods to control for snooping bias and t-test is done to test the significance. The authors do not address non-synchronous trading or any transaction costs and find that all strategies are consistently significant and profitable. Pushpa BV et al in this paper aim at technical analysis of select companies under Nifty 50 based on different sectors for a period from January 2011 to December 2016. The analysis used tools like RSI, moving averages, MACD and Bollinger bands. The paper accomplishes technically strong position for most of the stocks evaluated. Indicators such as RSI & MACD gives strong signals as to the direction in which the company is heading as well as it helps to identify oversold, overbought and trend reversals.

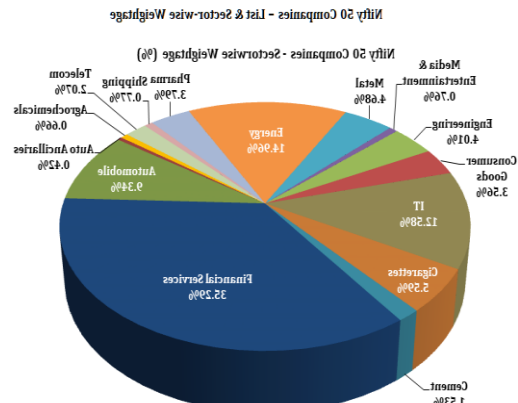
Jelena Stankovic, Ivana Markovic, Milos Stoanovic (2015) in this study examined the optimal strategy for investment in the stock market with efficient use of technical analysis and predictive modeling. The economies of the emerging market are covered in the paper with the usage of technical indicators explicitly such as moving averages, RSI, MACD etc. it is grounded on least squares support vector machines model. The results declared that the profitability maximization on investment model with machine learning techniques capture nonlinear models adequately and perform better than the buy and hold strategy.

Dejan Eric et al (2009) concluded that the application of the technical analysis indicators like optimized MACD and RVI gave substantial impact to maximization of profitability in investments which would help the financial market to take proper decisions on investments.

III. DATA & METHODOLOGY:

In this research study sector-wise Nifty 50 group of companies were analyzed based on the daily closing price of

the stocks. The period of study covers from the year January 2013 to September 2018. The secondary data has been collected from the official NSE web portal. The objective of this study is to demonstrate how the simulation of technical indicators MACD and RSI helps investor in reducing the trading cycles of investment with better profits in the long run. The data was analyzed using Metastock trading simulation software and IBM SPSS. The use of Buy&Hold strategy, standard MACD&RSI indicators and Optimized MACD&RSI indicators were taken as the investment strategy. The paired “t” test is used to test the significant difference between the investment strategies. An equity capital of Rs.10000/- is considered for trading. Rs. 50 per trade is considered as Transaction which include brokerage, taxes etc. which prevailed during the study person in India. The sector-wise distribution of Nifty50 companies categorized based on the weightage, the contribution of 47.87% is done by Financial Services and Information Technology to the overall weight-age. There are five Pharmaceutical companies. India is among the major pharmaceutical exporters in the world. The below graph (Graph-1) shows the sector-wise distribution of Nifty50 companies.



Source: NSE Graph-1

The following table (Table-1) gives the details of stocks along with weightage of Nifty 50 companies.

Sector	Constituents	Weightage (%)
Cigarettes	ITC	5.68
Pharmaceuticals	Cipla	0.73
	Dr. Reddy's Lab	0.6
	Lupin	0.46
	Sun Pharmaceutical	1.38
Information Technology	HCL Technologies	1.39
	Infosys	5.39
	TCS	4.16
	Tech Mahindra	0.99
	Wipro	0.75
Cements	Grasim Industries	1.02
	UltraTech Cement	1.01
Automobile	Bajaj Auto	0.95
	Hero MotoCorp	1.15



	Eicher Motors	0.99
	Mahindra & Mahindra	1.93
	Maruti Suzuki	2.77
	Tata Motors	1.49
Financial Services	Axis Bank	2.1
	HDFC Bank	9.42
	ICICI Bank	4.32
	IndusInd Bank	2.29
	Kotak Mahindra Bank	3.82
	State Bank of India	2.16
	Yes Bank	1.58
	Bajaj Finance	1.07
	Bajaj Finserv	0.78
	HDFC	7.46
Metals	Indiabulls Housing Finance	1
	Coal India	0.88
	Hindalco Industries	0.81
	Tata Steel	1.09
Energy	Vedanta	1.31
	BPCL	0.72
	HPCL	0.54
	GAIL (India)	0.68
	IOC	0.82
	NTPC	1.28
	ONGC	1.21
	Power Grid	1.11
Telecom	Reliance Industries	7.86
	Bharti Airtel	1.28
Consumer Goods	Bharti Infratel	0.63
	Asian Paints	1.28
Construction	Hindustan Unilever	2.55
	Larsen & Toubro	4.09
Media & Entertainment	Zee Entertainment	0.76
Shipping	Adani Ports and Special Economic Zone Ltd.	0.68
Agrochemicals	UPL Limited	0.63

Source:NSE (Table-1)

In this study the following hypothesis are to be tested on Nifty50 companies:

Hypothesis 1- There is no significant difference between the Mean performance of optimized MACD and standard MACD.

Hypothesis 2- There is no significant difference between the Mean performance of optimized MACD and standard RSI.

Hypothesis 3- There is no significant difference between the Mean performance of optimized MACD and optimized RSI.

Hypothesis 4- There is no significant difference between the Mean performance of optimized MACD and Buy&Hold.

Hypothesis 5- There is no significant difference between the Mean performance of standard MACD and standard RSI.

Hypothesis 6- There is no significant difference between the Mean performance of standard MACD and optimized RSI.

Hypothesis 7- There is no significant difference between the Mean performance of standard MACD and Buy&Hold.

Hypothesis 8- There is no significant difference between the Mean performance of standard RSI and optimized RSI.

Hypothesis 9- There is no significant difference between the Mean performance of standard RSI and Buy&Hold.

Hypothesis 10- There is no significant difference between the Mean performance of optimized RSI and Buy&Hold.

Technical Analysis Tools:

The analysis of charts and graphs using the technical indicators give insights in to the price movements, trading volumes, support and resistance price levels for the stock under investigation. It involves indicators of two types namely lagging and leading. The strength and movement of the trend is identified with lagging indicators, while leading indicators identify the level of overbought and oversold of stock prices. MACD is a lagging indicator and RSI is a leading indicator.

Moving Average Convergence/Divergence (MACD):

The Moving Average Convergence/Divergence indicator (MACD) is calculated by subtracting the value of a 0.075 (26-period) exponential moving average from a 0.15 (12-period) exponential moving average. The MACD's trigger (9-period signal line) which is a 9-day exponential moving average of the MACD indicator, selling is done when there is a fall in MACD below its 9-period signal line which is the basic trading rule of MACD. Likewise, when the MACD rises above the signal level the buy signal occurs. Developed by Gerald Appel in the late seventies, the moving averages converge, cross and diverge which makes the MACD fluctuate above and below the zero line. The time to sell is indicated as bearish signal which occurs when the MACD falls below the signal line (MACDS). On the other hand, time to buy is indicated as bullish signal which occurs when MACD rises above the signal line, which recommends that the price of the asset is likely to experience upward momentum.

MACDS = 9 day exponential moving average (EMA) – “Signal line”

MACD = Difference between 26 and 12 day EMA – “MACD line”

Relative Strength Index:

The Relative Strength Index (RSI) is an oscillator used by commodity traders and introduced by J. Welles Wilder in an article in *Commodities* magazine (now known as *Futures*) in June 1978. When RSI was introduced a 14 day RSI usage was recommended. Where the 9 day and 25 day RSIs popularity was gained later.

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The velocity and magnitude of directional price moves is measured with RSI and the data is represented graphically by oscillating between 0 and 100. The default look-back setting for the indicator suggested by Wilder is 14 periods. Lowering the default setting rises the indicator's sensitivity, generating more occasions of overbought and oversold conditions.

Raising the setting declines sensitivity, causing fewer occasions of overbought and oversold conditions. A stock is considered overbought when its RSI is above 70, while it is regarded as oversold when the RSI is below 30.

Calculating the RSI requires the calculation of the RS.

$RS = \frac{EMA(\text{Upwards})}{EMA(\text{Downwards})}$ over some common trading period (14 days).

- $EMA(\text{Upwards})$ and $EMA(\text{Downwards})$ are calculated on the basis of the differences between indices/rates/yields/prices between the closing of trading days.
- $RSI = 100 - 100/(1+RS)$

Optimization of MACD and RSI Indicators:

For MACD optimization, following range of values were taken for 12,26 and 9 lines-

- 1) Short Moving Average (12 line) -2 to 25
- 2) Long Moving Average (26 line)- 2 to 50
- 3) Signal Line (9 line) - 2 to 15

For RSI optimization, following range of values were taken for 14 days period, 30 and 70 lines-

- 1) RSI period- 2 to 20
- 2) RSI low- 5 to 40
- 3) RSI high- 41 to 100

IV. RESULTS AND DISCUSSION:

For the selected time period Buy&Hold strategy, standard MACD&RSI indicators and Optimized MACD&RSI indicators were tested on the Nifty50 companies. The results are presented in tabular form according to different sectors as per Table-1 and as a whole the Nifty index.

Results of Table 2 shows stocks from **Pharmaceuticals** sector, table 3 shows **Information Technology**, table 4 shows **Automobile** sector, table 5 shows **Financial Services**, table 6 shows Metals, table 7 shows **Energy** table 8 shows miscellaneous stocks from **Cigarettes, Cements, Telecom, Consumer Goods, Construction, Media & Entertainment, Shipping, Agrochemicals** sectors and table 9 all stocks representing **Nifty50**.

The performance of standard MACD, RSI indicators vis-à-vis Buy&Hold strategy, the performance of optimized MACD, RSI indicators vis-à-vis Buy&Hold strategy, the performance of optimized MACD, RSI indicators vis-à-vis standard MACD, RSI indicators, are indicated in results table where performance index shows the percentage of the system's profits as compared to a buy and hold strategy's profits. A value of "-50" means that the system's profits were one-half (i.e., 50%) of the buy/hold's. A value of "25" means that the system's profits were 25% greater than the buy/hold's. A value of "0" means they were equal. Ideally

you want your system test to produce higher profits than a buy/hold strategy (i.e., Buy/Hold Index is greater than zero); otherwise the trading may not be worth the time and effort. In total there are four system tester applicable in this study: standard MACD, RSI indicators & optimized MACD, RSI indicators In all this tables column one is name of the stock, column 2 represents trading results of optimized MACD, column3 is the optimized 12 line value, column 4 is optimized 26 line value, column 5 is optimized signal 9 line value. Column 6 is number of trading cycles for optimized MACD. Column 7 represents trading results of standard MACD. Column 8 is number of trading cycles for standard MACD. Column 9 represents trading results for standard RSI indicator. Column 10 represents number of trading cycles for standard RSI indicator. Column 11 represents trading results for optimized RSI indicator, Column 12 represents number of trading cycles for optimized RSI. Column 13 represents optimized RSI period. Column 14 represents lowest value for optimized RSI. . Column 15 represents highest value for optimized RSI. Column 16 represents trading results of buy and hold strategy.

Table 2: Performance of Pharmaceuticals

Stock	OPTMACD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30/70	TC	OPT RSI	TC	period	lo	high	buy& hold
CIPLA	156.78	14	10	21	90	-92.74	121	-45.66	10	85	9	10	30	90	224.6
DRREDDY	1524.46	4	10	3	95	-95.27	117	221.24	11	56	8	14	40	80	344.7
LUPIN	95.5	12	10	15	110	30.01	138	1547.41	22	401	19	10	30	75	12.55
SUNPHA	109.8	12	4	9	98	-77.16	116	-200.91	49	499	33	10	30	85	71.45
Average	471.635	10.5	8.5	12	98	-58.79	123	380.52	23	260	17	11	33	82.5	163.3

From the Table 2 it is found that for the pharmaceuticals the performance of optimized MACD is on average 472% greater than the Buy&Hold strategy, the performance of optimized RSI is on average 260% greater than the Buy&Hold strategy. Compared to Buy&Hold standard MACD performance is negative but standard RSI shows on an average 381% more than Buy&Hold strategy. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 11,9,12 and average RSI period is 11 for Pharmaceuticals.

Table 3: Performance of Information Technology(IT)

Stock	OPTMACD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30/70	TC	OPT RSI	TC	period	lo	high	buy& hold
HCLTECH	2004.9	4	12	3	120	-60.06	130	302.08	17	6774	10	14	40	80	40.85
INFY	368.42	14	6	21	90	100.69	118	145.99	18	282	12	6	30	80	-2379
TCS	1627.86	6	8	9	95	-91.33	111	747.88	47	2949	37	5	20	80	188.2
TECHM	348.81	6	8	6	120	102.81	150	197.37	51	543	25	12	30	90	-581.2
WIPRO	110.1	14	6	6	85	111.2	107	344.13	55	665	31	10	30	80	-145.7
AVERAGE	892.018	8.8	8	9	102	32.662	123.2	347.49	38	2243	23	9.4	30	82	-575.3



For the IT stocks Buy&Hold strategy results in negative profits meaning that the study period has high volatility indicating that holding the stock throughout the study period resulted in loss of the investment. Optimized RSI followed by optimized MACD gave good profits on an average 2243%, 892% respectively over the Buy&Hold. The standard MACD is only 32% greater than the Buy&Hold strategy.

The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 9, 8, 9 and average RSI period is 9 for IT stocks.

Table 4: Performance of Automobile

Stock	OPTM ACD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30/70	TC	OPT RSI	TC	period	lo	high	buy& hold
BAJAJ-AUTO	164.8	4	6	3	68	-97.98	104	217.28	18	10.6	8	10	30	90	806.7
EICHERMOT	329.8	4	14	3	98	-99.93	150	-80.17	15	47.5	11	10	30	80	120
HEROMOTOCO	115.2	14	12	18	87	-98.42	113	-108.11	24	75.5	18	6	45	80	234.6
M&M	10034	14	10	9	84	-71.43	106	297.02	30	58.1	15	10	40	75	57.1
MARUTI	55	14	8	9	88	-99.75	128	-166.12	42	153	28	10	35	75	631.5
TATAMOTORS	120.4	6	10	6	85	116.14	119	-127.05	48	119	23	10	25	80	-101
AVERAGE	1803	9.333	10	8	85	-58.562	120	5.475	29.5	164	17	9.333	34	80	291.5

The Performance of Buy&Hold strategy for Automobile is positive, where standard MACD performance is negative (-58%) compared to Buy&Hold. Both optimized MACD and RSI outperformed Buy&Hold for automotive sector. Optimized MACD followed by optimized RSI gave good profits on an average 1803%, 164% respectively over the Buy&Hold. The standard RSI performed only 5% greater than the Buy&Hold. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 9, 10, 8 and average RSI period is 9 for Automobile stocks.

Table 5: Performance of Financial Services

Stock	OPTM ACD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30/70	TC	OPT RSI	TC	period	lo	high	buy& hold
AXISBANK	604.7	14	4	21	102	103.83	144	356.56	15	632	12	20	40	80	-426
BAJAJFINSV	25.4	14	10	18	92	-99.71	168	-159.4	11	10.8	11	20	40	80	499.4
BAJFINANCE	1242.7	14	12	21	122	-98.56	190	24.28	19	1983	12	10	45	90	1130
HDFC	129.89	14	12	21	86	-98.3	110	-132.1	15	55.5	11	14	35	75	957.9
HDFCBANK	149.8	10	8	9	82	-98.75	104	-148.5	13	89.6	7	10	30	80	309.9
IBULHSGFIN	-110.6	14	8	21	100	-96.87	150	-156.9	24	179	16	6	40	90	712.7
ICICIBANK	338.8	12	10	21	89	102.03	125	192.81	19	320	21	10	50	80	-648
INDUSINDBK	55.5	12	6	21	104	-98.72	123	-144.9	18	122	22	10	45	80	1276
KOTAKBANK	254.93	12	2	3	102	96.51	112	-121.1	32	216	24	8	40	80	468.2
SBIN	341.2	8	10	6	110	100.8	129	211.55	66	285	32	10	30	75	-1429
YESBANK	1904.2	8	6	15	124	130.95	169	900.35	42	1308	22	10	40	60	-86
AVERAGE	448.78	12	8	16	101	-5.1627	139	74.8	25	473	17	11.64	40	79.1	251.5

Out of all the stocks under financial services Indiabulls Housing Finance is the only stock where optimized MACD performed negative (-110%) compared to Buy&Hold, however sector as a whole the performance of optimized MACD is on average 449% greater than the Buy&Hold strategy, the performance of optimized RSI is on average 473% greater than the Buy&Hold strategy. whereas standard MACD performance is negative (-5%) compared to Buy&Hold, standard RSI performed only 75% greater than

the Buy&Hold. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 12, 8, 16 and average RSI period is 12 for Financial Services.

Table 6: Performance of Metals

Stock	OPTM ACD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30/70	TC	OPT RSI	TC	period	lo	high	buy& hold
COALINDIA	121	14	10	18	97	197.41	123	-711.34	14	96	8	14	50	90	-16.8
HINDALCO	35.4	14	10	21	101	-122.55	160	-191.79	28	121	19	4	50	80	128.6
TATASTEEL	100.1	4	10	9	121	-99.25	153	-238.07	52	110	24	4	15	90	287.1
VEDL	1050	10	8	6	95	-85.52	121	-1978.33	47	110	14	4	15	80	12
AVERAGE	326.6	10.5	9.5	14	104	-27.4775	139	-779.8825	35	109	16	6.5	33	85	102.7

The standard MACD and RSI indicators performance is negative compared to Buy&Hold, The Performance of Buy&Hold strategy for Metals is positive, both optimized MACD and RSI outperformed Buy&Hold for Metals. Optimized MACD followed by optimized RSI gave good profits on an average 327%, 109% respectively over the Buy&Hold. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 11, 10, 14 and average RSI period is 7 for Metal stocks.

Table 7: Performance of Energy

Stock	OPTM ACD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30/70	TC	OPT RSI	TC	period	lo	high	buy& hold
BPL	12.78	14	12	15	101	-68.44	132	-85.69	15	59.7	10	10	40	80	51.7
GAIL	602.4	10	4	6	85	-74.31	132	445.43	21	185	7	10	40	90	63.5
HINDPETRO	938.5	10	2	18	89	-84.52	155	-105	35	1171	22	4	35	90	53.1
IOC	277.61	12	10	21	102	153.66	132	451.74	27	899	15	10	40	90	-75.95
NTPC	389.04	8	2	12	85	-162.73	90	295.73	35	125	23	8	30	70	32.8
ONGC	458.35	12	2	9	110	79.44	118	-26.43	41	159	27	6	25	80	-110.5
POWERGRID	125.4	6	4	9	105	-127.72	110	-161.4	45	113	34	8	25	80	93.1
RELIANCE	225.8	10	2	9	95	-95.24	126	206.7	52	385	34	18	40	60	342.6
AVERAGE	378.74	10	4.8	12	97	-47.483	124	127.63	33.9	387	22	9.25	34	80	56.29

From the Table 7 it is found that for the energy sector the performance of optimized MACD is on average 379% greater than the Buy&Hold strategy, the performance of optimized RSI is on average 387% greater than the Buy&Hold strategy.

Compared to Buy&Hold standard MACD performance is negative but standard RSI shows on an average 128% more than Buy&Hold strategy. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 10,5,12 and average RSI period is 9 for energy stocks.



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Table 8: Performance of Miscellaneous Stocks (Cigarettes, Cements, Telecom, Consumer Goods, Construction, Media & Entertainment, Shipping, Agrochemicals sectors).

Stock	OPTM ACD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30 /70	TC	OPT RSI	TC	period	lo	high	buy& hold
ADANI PORTS	156.5	12	8	6	127	-101.6	181	-189.26	18	98	12	18	40	90	209
ASIAN PAINT	185	4	2	3	109	-98.07	252	-205.78	12	10	8	18	40	90	443.4
BHARTIARTL	654.8	4	6	3	66	-24.81	118	407.83	15	152	11	14	50	90	21.7
GRASIM	444.6	8	4	9	79	101.07	110	274.94	18	389	9	18	40	80	-1523
HINDUNILVR	51.1	10	8	9	94	-98.35	108	-161.78	30	120	24	6	40	90	988.9
INFRA TEL	712.9	14	8	9	125	-109.22	155	-185.49	22	186	17	6	40	80	115.4
ITC	1179	12	8	18	94	153.32	109	592.48	29	122	19	6	40	80	-30.6
LT	35.9	14	8	15	95	-96.7	122	-29.37	25	159	12	10	50	90	494.1
ULTRACEMCO	145.1	4	8	9	90	-99.27	114	-54.83	31	112	30	10	25	70	244.7
UPL	258.5	14	12	6	115	-99.87	148	-230.1	29	49	21	10	35	80	505.3
ZEEL	297.9	10	8	6	92	-92.57	119	-76.42	54	115	28	10	30	70	219.7
AVERAGE	374.6	9.64	7.3	8	99	-51.461	140	12.929	26	137	17	11.455	39	83	153.5

From the table 8 of mixed portfolio it is found that Buy&Hold on an average performance is positive (154%). Where standard MACD performance is negative (-51%) compared to Buy&Hold, optimized MACD outperformed Buy&Hold for miscellaneous sector. Optimized MACD followed by optimized RSI gave good profits on an average 375%, 137% respectively over the Buy&Hold. The standard RSI performed only 13% greater than the Buy&Hold. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 10, 7, 8 and average RSI period is 11 for mixed portfolio.

Table 9: Performance of Nifty50

Stock	OPTMA CD	SMA	LMA	SL	TC	12,26,9 (MACD)	TC	RSI (14):30/ 70	TC	OPTRS I	TC	period	lo	high	buy&h old
ADANI PORTS	156.5	12.0	8.0	6.0	127.0	-101.6	181.0	-189.3	18.0	98.0	12.0	18.0	40.0	90.0	209.0
ASIAN PAINT	185.0	4.0	2.0	3.0	109.0	-98.1	252.0	-205.8	12.0	10.0	8.0	18.0	40.0	90.0	443.4
AXIS BANK	604.7	14.0	4.0	21.0	102.0	103.8	144.0	356.6	15.0	632.4	12.0	20.0	40.0	80.0	-425.5
BAJAJ-AUTO	164.8	4.0	6.0	3.0	68.0	-98.0	104.0	217.3	18.0	10.6	8.0	10.0	30.0	90.0	806.7
BAJAJFINSV	25.4	14.0	10.0	18.0	92.0	-99.7	168.0	-159.4	11.0	10.8	11.0	20.0	40.0	80.0	499.4
BAJFINANCE	1242.7	14.0	12.0	21.0	122.0	-98.6	190.0	24.3	19.0	1982.6	12.0	10.0	45.0	90.0	1130.2
BHARTIARTL	654.8	4.0	6.0	3.0	66.0	-24.8	118.0	407.8	15.0	151.8	11.0	14.0	50.0	90.0	21.7
BPCL	12.8	14.0	12.0	15.0	101.0	-68.4	132.0	-85.7	15.0	59.7	10.0	10.0	40.0	80.0	51.7
CIPLA	156.8	14.0	10.0	21.0	90.0	-92.7	121.0	-45.7	10.0	85.2	9.0	10.0	30.0	90.0	224.6
COALINDIA	121.0	14.0	10.0	18.0	97.0	197.4	123.0	-711.3	14.0	95.8	8.0	14.0	50.0	90.0	-16.8
DRREDDY	1524.5	4.0	10.0	3.0	95.0	-95.3	117.0	221.2	11.0	55.9	8.0	14.0	40.0	80.0	344.7
EICHERMOT	329.8	4.0	14.0	3.0	98.0	-99.9	150.0	-80.2	15.0	47.5	11.0	10.0	30.0	80.0	120.0
GAIL	602.4	10.0	4.0	6.0	85.0	-74.3	132.0	445.4	21.0	185.2	7.0	10.0	40.0	90.0	63.5
GRASIM	444.6	8.0	4.0	9.0	79.0	101.1	110.0	274.9	18.0	388.9	9.0	18.0	40.0	80.0	-1522.0
HCLTECH	2004.9	4.0	12.0	3.0	120.0	-60.1	130.0	302.1	17.0	6774.4	10.0	14.0	40.0	80.0	40.9
HDFC	129.9	14.0	12.0	21.0	86.0	-98.3	110.0	-132.1	15.0	55.5	11.0	14.0	35.0	75.0	957.9
HDFCBANK	149.8	10.0	8.0	9.0	82.0	-98.8	104.0	-148.5	13.0	89.6	7.0	10.0	30.0	80.0	309.9
HEROMOTO	115.2	14.0	12.0	18.0	87.0	-98.4	113.0	-108.1	24.0	75.5	18.0	6.0	45.0	80.0	234.6
HINDALCO	35.4	14.0	10.0	21.0	101.0	-122.6	160.0	-191.8	28.0	120.5	19.0	4.0	50.0	80.0	128.6
HINDPETRO	938.5	10.0	2.0	18.0	89.0	-84.5	155.0	-105.0	35.0	1170.6	22.0	4.0	35.0	90.0	53.1
HINDUNILVR	51.1	10.0	8.0	9.0	94.0	-98.4	108.0	-161.8	30.0	120.4	24.0	6.0	40.0	90.0	988.9
IBULHSGFIN	-110.6	14.0	8.0	21.0	100.0	-96.9	150.0	-156.9	24.0	178.5	16.0	6.0	40.0	90.0	712.7
ICICIBANK	338.8	12.0	10.0	21.0	89.0	102.0	125.0	192.8	19.0	320.3	21.0	10.0	50.0	80.0	-647.8
INDUSINDBK	55.5	12.0	6.0	21.0	104.0	-98.7	123.0	-144.9	18.0	121.5	22.0	10.0	45.0	80.0	1276.4
INFRA TEL	712.9	14.0	8.0	9.0	125.0	-109.2	155.0	-185.5	22.0	185.7	17.0	6.0	40.0	80.0	115.4
INFY	368.4	14.0	6.0	21.0	90.0	100.7	118.0	146.0	18.0	282.1	12.0	6.0	30.0	80.0	-2378.8
IOC	277.6	12.0	10.0	21.0	102.0	153.7	132.0	451.7	27.0	898.6	15.0	10.0	40.0	90.0	-76.0
ITC	1178.5	12.0	8.0	18.0	94.0	153.3	109.0	592.5	29.0	121.6	19.0	6.0	40.0	80.0	-30.6
KOTAK BANK	254.9	12.0	2.0	3.0	102.0	96.5	112.0	-121.1	32.0	215.5	24.0	8.0	40.0	80.0	468.2
LT	35.9	14.0	8.0	15.0	95.0	-96.7	122.0	-29.4	25.0	158.7	12.0	10.0	50.0	90.0	494.1
LUPIN	95.5	12.0	10.0	15.0	110.0	30.0	138.0	1547.4	22.0	400.5	19.0	10.0	30.0	75.0	12.6
M&M	10033.8	14.0	10.0	9.0	84.0	-71.4	106.0	297.0	30.0	580.5	15.0	10.0	40.0	75.0	57.1
MARUTI	55.0	14.0	8.0	9.0	88.0	-99.8	128.0	-166.1	42.0	152.8	28.0	10.0	35.0	75.0	631.5
NTPC	389.0	8.0	2.0	12.0	85.0	-162.7	90.0	295.7	35.0	125.4	23.0	8.0	30.0	70.0	32.8
ONGC	458.4	12.0	2.0	9.0	110.0	79.4	118.0	-26.4	41.0	158.9	27.0	6.0	25.0	80.0	-110.5
POWERGRID	125.4	6.0	4.0	9.0	105.0	-127.7	110.0	-161.4	45.0	112.9	34.0	8.0	25.0	80.0	93.1
RELIANCE	225.8	10.0	2.0	9.0	95.0	-95.2	126.0	206.7	52.0	385.2	34.0	18.0	40.0	60.0	342.6
SBIN	341.2	8.0	10.0	6.0	110.0	100.8	129.0	211.6	66.0	284.6	32.0	10.0	30.0	75.0	-1429.1
SUNPHARMA	109.8	12.0	4.0	9.0	98.0	-77.2	116.0	-200.9	49.0	498.5	33.0	10.0	30.0	85.0	71.5
TATAMOTORS	120.4	6.0	10.0	6.0	85.0	116.1	119.0	-127.1	48.0	119.2	23.0	10.0	25.0	80.0	-101.1
TATASTEEL	100.1	4.0	10.0	9.0	121.0	-99.3	153.0	-238.1	52.0	110.4	24.0	4.0	15.0	90.0	287.1
TCS	1627.9	6.0	8.0	9.0	95.0	-91.3	111.0	747.9	47.0	2948.6	37.0	5.0	20.0	80.0	188.2
TECHM	348.8	6.0	8.0	6.0	120.0	102.8	150.0	197.4	51.0	542.6	25.0	12.0	30.0	90.0	-581.2
TITAN	168.5	4.0	10.0	6.0	115.0	-97.1	145.0	-153.6	29.0	35.6	22.0	12.0	40.0	90.0	158.9
ULTRACEMCO	145.1	4.0	8.0	9.0	90.0	-99.3	114.0	-54.8	31.0	112.3	30.0	10.0	25.0	70.0	244.7
UPL	258.5	14.0	12.0	6.0	115.0	-99.9	148.0	-230.1	29.0	48.9	21.0	10.0	35.0	80.0	505.3
VEDL	1049.8	10.0	8.0	6.0	95.0	-85.5	121.0	-1978.3	47.0	110.2	14.0	4.0	15.0	80.0	12.0
WIPRO	110.1	14.0	6.0	6.0	85.0	111.2	107.0	344.1	55.0	665.3	31.0	10.0	30.0	80.0	-145.7
YES BANK	1904.2	8.0	6.0	15.0	124.0	131.0	169.0	900.4	42.0	1307.5	22.0	10.0	40.0	60.0	-86.0
ZEEL	297.9	10.0	8.0	6.0	92.0	-92.6	119.0	-76.4	54.0	115.4	28.0	10.0	30.0	70.0	219.7
AVERAGE	614.6	10.2	7.8	11.4	98.3	-32.7	131.7	40.1	29.1	470.4	18.5	10.3	35.9	81.4	100.0



Results of table 9 shows all the 50 stocks trading under Nifty, on an average the Buy&Hold performed positively over the study period (100%). If investor maintains all the stocks under Nifty it can be seen that the standard MACD performance is negative (-33%) compared to Buy&Hold, standard RSI performed only 40% greater than the Buy&Hold. Both optimized MACD and RSI outperformed Buy&Hold for Nifty 50. Optimized MACD followed by optimized RSI gave good profits on an average 615%, 470% respectively over the Buy&Hold. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 10, 8, 11 and average RSI period is 10 for Nifty50.

Hypothesis Testing:

Table-10: Paired Samples Test for all the stocks Nifty50

Paired Samples Test		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	SD	SE(MEAN)	Confidence Interval (95%)				
					Lower				Upper
Pair 1	OPTMACD - MACD	647.2088	1453.106	205.50029	234.24051	1060.177	3.149	49	0.003
Pair 2	OPTMACD - RSI	574.4442	1449.433	204.98079	162.51988	986.3685	2.802	49	0.007
Pair 3	OPTMACD - OPTRSI	144.1816	1566.162	221.48875	-300.91671	589.2799	0.651	49	0.518
Pair 4	OPTMACD - BUYHOLD	514.5452	1599.65	226.22469	59.92966	969.1607	2.274	49	0.027
Pair 5	MACD - RSI	-72.7646	444.4524	62.85506	-199.07657	53.54737	-1.158	49	0.253
Pair 6	MACD - OPTRSI	-503.027	1053.967	149.05342	-802.56125	-203.493	-3.375	49	0.001
Pair 7	MACD - BUYHOLD	-132.664	682.551	96.52729	-326.64246	61.31526	-1.374	49	0.176
Pair 8	RSI - OPTRSI	-430.263	1036.057	146.52064	-724.70686	-135.818	-2.937	49	0.005
Pair 9	RSI - BUYHOLD	-59.899	840.3753	118.84702	-298.73103	178.933	-0.504	49	0.617
Pair 10	OPTRSI - BUYHOLD	370.3636	1233.617	174.45975	19.7736	720.9536	2.123	49	0.039

The paired t test between optimized MACD and standard MACD shows that there is a significant difference between the mean profitability of optimized MACD and standard MACD (Sig. value 0.003) implies statistical evidence for accepting that optimum MACD strategy is superior to standard MACD for the selected stocks, hence the hypothesis that there is no significant difference between the Mean performance of optimized MACD and standard MACD is rejected. T-test results indicates that there is a significant difference between the mean profitability optimized MACD and standard RSI (Sig. value 0.007), the same is confirmed from the stocks profitability results, hence the hypothesis that there is no significant difference between the Mean performance of optimized MACD and standard RSI is rejected. The paired t test between optimized MACD and optimized RSI shows that there no significant difference between the mean profitability of optimized MACD and standard MACD (Sig. value 0.518) implies both the optimized MACD and optimized RSI indicators yield the same returns, hence any one of the indicator is sufficient to judge the momentum in the stocks, hence the hypothesis that there is no significant difference between the Mean performance of optimized MACD and optimized RSI is accepted. The paired t test between optimized MACD and Buy&Hold shows that there is a significant difference between the mean profitability of optimized MACD and Buy&Hold (Sig. value 0.027) implies statistical evidence for accepting that optimum MACD strategy is superior to Buy&Hold for the selected stocks, hence the hypothesis that there is no significant difference between the Mean

performance of optimized MACD and Buy&Hold is rejected.

From the above hypothesis tests it is concluded that the performance of optimized MACD is greater than that of standard MACD, standard RSI and Buy&Hold strategy.

The paired t test between standard MACD and standard RSI shows that there no significant difference between the mean profitability of optimized MACD and standard MACD (Sig. value 0.253) implies both standard MACD and standard RSI yield the same returns, hence any one of the indicator is sufficient to judge the momentum in the stocks, hence the hypothesis that there is no significant difference between the Mean performance of standard MACD and standard RSI is accepted.

The paired t test between standard MACD and optimized RSI shows that there is a significant difference between the mean profitability of standard MACD and optimized RSI (Sig. value 0.001) implies statistical evidence for accepting that optimized RSI strategy is superior to standard MACD for the selected stocks (Mean difference 503), hence the hypothesis that there is no significant difference between the Mean performance of standard MACD and optimized RSI is rejected.

The paired t test between standard MACD and Buy&Hold shows that there no significant difference between the mean profitability of standard MACD and Buy&Hold (Sig. value 0.176) implies both the standard MACD and Buy&Hold indicators yield the same returns meaning that investor either use the standard MACD or keep holding the stocks both yield the same returns, hence the hypothesis that there is no significant difference between the Mean performance of standard MACD and Buy&Hold is accepted.

The paired t test between standard RSI and optimized RSI shows that there is a significant difference between the mean profitability of standard RSI and optimized RSI (Sig. value 0.005) implies statistical evidence for accepting that optimized RSI strategy is superior to standard RSI for the selected stocks (Mean difference 430), hence the hypothesis that there is no significant difference between the Mean performance of standard RSI and optimized RSI is rejected.

The paired t test between standard RSI and Buy&Hold shows that there no significant difference between the mean profitability of standard RSI and Buy&Hold (Sig. value 0.617) implies both the standard RSI and Buy&Hold yield the same returns, meaning that investor either use the standard RSI or keep holding the stocks both yield the same returns, hence the hypothesis that there is no significant difference between the Mean performance of standard RSI and Buy&Hold is accepted. The paired t test between optimized RSI and Buy&Hold shows that there is a significant difference between the mean profitability of optimized RSI and Buy&Hold (Sig. value 0.039) implies statistical evidence for accepting that optimized RSI strategy is superior to Buy&Hold for the selected stocks (Mean difference 370), hence the hypothesis that there is no significant difference between the Mean performance of optimized RSI and Buy&Hold is rejected.



Simulation of Technical Indicators for Better Profits in the Indian Stock Market

From the above hypothesis tests it is concluded that the performance of optimized RSI is greater than that of standard MACD, standard RSI and Buy&Hold strategy. Both the optimized MACD and optimized RSI indicators performed greater than that of standard MACD, standard RSI and Buy&Hold strategy.

V. CONCLUSION

For the long-term investor the objective of keep buying and holding stocks is not always good as Stock markets are subject to volatile due to various national and international factors. With the help of technical indicators investors always try to beat the market in their own ways. The experimentation of optimization of technical indicators is one-step forward in making profitable trades as it is evident from the nifty50 stocks. Results concluded that both the optimized MACD and RSI outperformed the standard MACD, standard RSI and Buy&Hold strategy. If investor maintains Nifty 50 portfolio it can be seen that the standard MACD performance is negative (-33%) compared to Buy&Hold, standard RSI performed only 40% greater than the Buy&Hold. The number of trading cycles has been reduced in case of optimized MACD and Optimized RSI. The average optimum MACD period is 10, 8, 11 and average RSI period is 10 for Nifty50. Both optimized MACD and RSI outperformed Buy&Hold for Nifty 50. Optimized MACD followed by optimized RSI gave good profits on an average 615%, 470% respectively over the Buy&Hold.

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