Risk and Return on Bank Equity Index by Using Technical Indicators

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Abstract

The present study has been conducted to examine the risk and return on Bank Equity Index by using technical indicators that is Exponential Moving Average (EMA), Relative Strength Index (RSI) and Moving Average Convergence/Divergence (MACD). The study is based on the daily closing prices of S&P BSE BANKEX and the period of study is ten years commencing from 1st April 2007 to 31st March 2017. To examine the performance of technical rules effectively the period of study is divided into five sub period of two years each. The study found that MACD rule generates highest average abnormal returns in all periods and t-value for buy (sell) 4.052 (-3.905) and for (buy-sell) is 6.911 respectively during the period of study. All computed returns were found significant at 1% level of significance, which reject the null hypothesis that MACD technical indicator cannot better perform than buy and hold strategy during the study period. It was interesting to know that EMA (5,20) and EMA (20,50) do not show significant returns in any of sub period and whole period while EMA (50,200) in 16.67% cases (i.e. 3 out of 18) at 5% level of significance in different periods. RSI show significant return in 0.18% case (i.e. 1 out of 18) at 10% level of significance. EMA and RSI accept the null hypothesis that technical indicators cannot outperform than buy and hold strategy. The study also found that Compound Annual Growth Rate (CAGR) based on aggregate gross return was 22.75% per annum and CAGR based on net aggregate return that means after adjusting the transaction cost was 22.43% per annum for the whole period in the study under consideration on the basis of MACD. On the basis of CAGR based on technical indicators the returns of MACD has given first ranking during the whole period and all sub periods of study under consideration but the ranking of EMA (5, 20), EMA(20, 50), EMA(50, 200) and RSI(50, 50) were fluctuating during the different sub periods of study. On the basis of CAGR, Sharpe Ratio and Alpha it may be concluded that MACD is more effective than EMA (5, 20), EMA (20, 50), EMA (50,200) and RSI (50, 50).

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Introduction

Technical analysis is a method of predicting future price movements on the basis of past prices and volumes (Gorgula et al. 2011; Lin et al. 2011; Oliveria et al. 2013). "Can Stock Market Forecaster Forecast?" was the initial study matter of technical analysis which is written by Alfered Cowles 3rd and published in Econometrica, July 1933. Technical indicator recognizes the prospective direction of price as early as possible for a period of time. Indicators generate signals for the entry and exit position and also indicate about the reversal of price movement. Technical traders increase their trading activities when price breaks the support and resistant level because it gives almost clear indication of price direction. Technical analysis are successful in generating abnormal returns as observed by Gencay (1998), Lebaron (1999) , Lento (2007), Metghalchi et al.(2007), Kamath (2008), Yen-Hsu (2010), Cialenco and Protopapadakir (2011), Zapranis and Tsinaslanidis (2012), Ulku and Prodon (2013), Narayan et al. (2014), Boobalan (2014), Royo et al. (2015), Kresta and Franek (2015), Arevalo et al. (2017), Weng et. al. (2017) and Zarrabi et al. (2017) while Fong and Yong (2005), Zapranis and Tsinaslanidis (2012), and Zakamulin (2014) do not observe the efficiency of technical trading. The reason behind the inefficiency of technical trading was the complexity of stock market and micro and macro factors of economy as observed by Ticknor (2013). Zhang et al. (2016), Zarrabi et al. (2017) used the econometric models with technical indicators for measuring the volatility level and minimizing the risk. In this paper the most popular technical

indicators has been used for analyzing the risk and return of the Banking sectors (S&P BSE Bank Index) to maximize the significant returns with transaction cost. Sharpe ratio and Alpha has been used to measure the risk involved in trading of banking sector. To check the robustness of performance of technical indicators the whole period is divided into five sub periods.

Review of Literature

Numerous articles have been published on technical analysis in which various studies support the efficiency of technical analysis and others are not. Some of which are as under:

Gencay (1998) observed technical indicators generate significantly higher returns for Dow Jones Industrial Average. The moving average strategy showed 10% more return than buy and hold strategy. The GARCH-M (1,1) model forecast average 2.95% improved results over the standard model. Lebaron (1999) observed simple moving average produce significantly abnormal returns for the foreign exchange series with high Sharpe ratio and frequent trading reduce the transactional cost. Rodriguez et al. (2000) deduced that Artificial Neural Network (ANN) Model perform better after eliminating the transaction cost than buy and hold strategy in down trend and stable market of Madrid stock exchange. The model outperforms in 54%-58% cases in first period and 19%-27% in the second period. Fong and Yong (2005) deduced that simple moving average strategy in up and down market do not produce abnormal return after considering the transactional cost for 30 internet stocks in the trend market. The average cumulative return for large companies is 63.2% and -44.6%,-109.3% for the small and mid companies. Lento et al. (2007) observed Moving average crossover (MACO), Trading range breakout (TRB) rules generates excess return for the Toronto Stock exchange index, NASDAQ index and CANDA/US spot exchange rate. Filter rule produce significant abnormal return for CANDA/US market. Technical trading rules produce 8.7% to 14.4% more returns and combined technical trading strategies can be enhanced the profitability. Metghalchi et al. (2007) stated that Standard MA and Increasing MA produce abnormal return for Austrian stock market in the presence of transaction cost. Kamath (2008) found significant positive relation between daily price–volume behaviors of Santiago stock exchange. The price volume strategy produced 237% returns every year. GRANGER Causality test show volume play a major role in minimizing or maximizing the returns of stock trading. Yen and HSU (2010) observed significantly abnormal returns for forex market by using the Superior Predictive Ability test (SPA) with different technical tools such as (MFI-RSI), Filter rule (FR), MA, OBV, MSV in down trend market. Cialenco and Protopapadakis (2011) deduced that Filter and Moving Average rules generate significant returns even after considering the transaction cost for foreign exchange series of developed nation. Wang et al. (2012) observed traders behavior around the technical indictor's signals regarding order submission by examining the information about the stock trading, market return, and performance of individual companies stock provided by Taiwan economic journal and data related to trades, limit orders and quotes from Taiwan stock exchange. The result showed that foreign institutional investors try to place order on the technical signals while individual supply liquidity by submitting limit orders. Zapranis and Tsinaslanidis (2012) observed that saucer and resistant level are useful in recognizing trading points but significant returns cannot be produced for the entire sample period. Ulku and Prodon (2013) deduced that MA show significant return in 30 countries out of 44 stock market indexes of different countries. The MA (22 days) generates 9.33% more return and MACD 0.26% p.a. than buy and hold strategy. Zakamulin (2014) deduced that market timing strategy and SMA did not show significant returns for S&P, DJIA indices and US bond indices. Narayan et al. (2014) studied the 82 stocks of six sectors from NSE India with the use of range of technical and momentum trading strategy. The result states that momentum portfolio generates 2.97% and 2.57% more average return at industry level except banking sectors. Boobalan (2014) observed that candlestick chart; MA, RSI and MACD generate significant returns for companies listed on National stock exchange. Kresta and Franek (2015) used the different combination of moving average on Czech Stock Market found that moving average crossover delivers significant return even after accounting the transactional cost. Royo et al. (2015) studied the daily data of DJIA index, DAX and FTS with Flag chart pattern, stop loss & take profit with new parameters found that technical indicators generate average return of 180.2% annually. Chen et al. (2016) found that MA generates abnormal returns for the stocks in the cash market not for option of Taiwan stock market after considering the transaction cost. MA generates 37% more annual average daily return on no option issue portfolio than buy and hold strategy. Zhang et al. (2016) studied the index values of S&P 500 American Stock market and CSI 300. The result showed that American stock markets returns are less than Chinese market. Chinese stock market change trend very frequently. Arevalo et al. (2017) observed that dynamic window scheme with updated stop loss and take profit produce 134.34% average return in long trade and 151.69% in short trade for DJIA. The exponential moving average generates 157% average return. Macedo et al. (2017) analyzed multi objective evolutionary algorithms and technical indicators for the stocks of Argentina, Belgium, UK, Brazil, South Africa, Greece, Portugal, Australia, Netherland and US. The result showed that the performance of MOEA'S (NSGA-2) and (SPE-2) are different and Bollinger Band generates significant returns for all most market. Weng et al. (2017) observed that combined use of online data source from financial expert system, Wikipedia, Google news and technical indicators can improve the trading return for AAPL (NASDAC). Zarrabi et al. (2017) examined the foreign exchange series with technical tools. Data snooping bias and transaction cost is also considered for the analysis. The study found that FDR (False discovery

rate) presents the series of best performing technical trading rules for all markets of foreign exchange. The annual results of Sharpe ratio are volatile.

Research Methodology

The main objective of the study under consideration is to analyze the Risk and Return of Bank equity index by using technical indicators. The macro and micro factor of economy directly affect the banking sector like GDP, Inflation, monitory policy, political activities, global market scenario etc. Indian economy is considered as fastest growing economy of the world because estimated growth rate of GDP 7.5% in next three years and growth rate of economy is 7%. Indian economy is flexible and there are many opportunities of growth of industrialization, employment. The banking sector is the backbone of any economy. Numerous decisions have been taken in the Indian economy which affect the banking sector like demonetization, recapitalization of banking sector, rules regarding NPA, scams and bank credit policy which makes this sector more risky and volatile. Due to risk the job of prediction becomes more tedious. So there is a need of study the banking index form trading and investing point of view. Bank equity index are actively traded in stock market.

Objective of the Study

Main objective of the present study is to examine the risk and return on Bank equity index by using technical indicators. To achieve the main objective the following sub-objectives have been framed:

1. To examine the risk and return on Bank Equity Index by using Exponential Moving Average.
2. To examine risk and return on Bank Equity Index by using the Relative Strength Index.
3. To examine risk and return on Bank Equity Indices by using Moving Average Convergence and Divergence.
4. To compare the risk and return on Bank Equity Indices of different techniques used in the study.

Research Hypotheses

Following research hypotheses are formulated to achieve the research objectives:

H_{01}

It is not possible to earn higher return on Bank Equity Index by using EMA technique in comparison to buy and hold strategy.

H_{02}

It is not possible to earn higher return on Bank Equity Index by using RSI technique in comparison to buy and hold strategy.

H_{03}

It is not possible to earn higher return on Bank Equity Indices by using MACD technique in comparison to buy and hold strategy

H_{04}

There is no difference in the returns generated by use of EMA, RSI and MACD.

Research Design

The research design of the present study on the topic entitled "Risk and Return on Bank Equity Index by using Technical Indicators" will be of empirical nature. In the study the empirical results of Bank equity Index will be calculated by using EMA, RSI, MACD tools.

Source of Data

The daily closing price of S&P BSE BANKEX will be collected from the official website of Bombay Stock Exchange (www.bseindia.com)

Periods of Study

The period of the present study is 10 years commencing from 1st April 2007.

Tools for Analysis

Statistical Tools

The statistical tools used for the study are Geometric Mean, Standard Deviation, T-Test. The details of statistical tools are as follows:

Geometrics Mean

Geometric mean is a compound average measure of periodic returns. It measures the periodic growth rate. This is the most appropriate measure of return for gauging historical performance and comparative performance among different investments. Geometric mean is calculated as follows.

$$GM = \{Return\ 1 \times Return\ 2 \times \dots .. Return\ n\}^{1/n}$$

Standard Deviation

Standard deviation measure the risk involved in investment. Standard Deviation is calculated as follows:

$$S = \sqrt{\frac{\sum (X - \overline{X})^2}{n-1}}$$

Where X is a value of return, $\overline{X}$ is mean return, and n is the number of items.

T-Test

T-test is used for examining the returns from any technical tool. It measure the difference between the mean buy (sell) returns from buy and hold strategy and compare the mean buy returns and mean sell return. T-Test is calculated as follows:

$$t = \frac{x(b) - x(h)}{\sqrt{Var(b)/N_b + Var(h)/N_h}}$$

Where X (b) is the mean buy return and X (h) is the average return of the buy and hold strategy. Var(b) is the variance of buy return and variance of buy-and-hold returns is Var(h) respectively.

Tools of Technical Analysis

To analyse the risk and return the application of technical tools is concerned, the proposed study uses the EMA (5, 20, 50 and 200), MACD (9, 12, and 26), and RSI (50, 50). Technical Tools are as follows:

Exponential Moving Average

The Study use the EMA (5, 20), (20, 50), (50, 200) days strategy. In EMA (5,20), (20,50), (50,200) 5, 20, 50 days EMA is considered as short exponential moving average and 20, 50, 200 days long exponential moving average. Exponential moving averages are calculated as follows:

$$EMA_t = P_t * K + EMA_{t-1}\ (1-K)$$
$$K = 2/\ (N+1)$$

Where, P_t is current price, N is the time period selected for the exponential moving average and K is weighting multiplier. Exponential moving average is most frequently used because it gives more weight to recent price because current price is more important for the trading.

Signals: Long Position: If $EMA_S > EMA_L$
Short Position: If $EMA_S < EMA_L$

Relative Strength Index

The Relative Strength Index (RSI) is a momentum oscillator developed by J. Welles Wilder. RSI oscillates between 0 and 100. RSI determine the overbought and oversold level of securities. RSI is calculated as follows:

RSI = 100-[100 / (1+RS)]
RS = Average Gain / Average Loss
AVERAGE GAIN = [(previous Average Gain) × 13 + current Gain] / 14
AVERAGE LOSS = [(previous Average Loss) × 13 + current Loss] / 14

Traditionally, RSI (70, 30) and RSI (80, 20) have been used from many years. According to Wilder, RSI considered overbought when above 70 and oversold when below 30. A trader will take short position when RSI above 70 and 80 and long position when RSI below 30 and 20. In this study RSI 50, 50 will be used.

Signals: Long Position: if RSI < 50
Short Position: if RSI > 50

Moving Average Convergence/Divergence

MACD is developed by Gerald Appel. It is a momentum indicator. MACD (12,26,9) is most probably used by traders. It is best strategy of trend market. MACD is calculated as follows:

$MACD_t = EMA(s)_t - EMA(l)_t$

Where,

$EMA(n)_t = 2/(n+1) [P_t - EMA_{t-1}] + EMA_{t-1}$

EMA denotes the exponential moving average. MACD is calculated by subtracting the 26 day EMA from 12 day EMA. Further, a trigger line or signal line is also created by calculating the 9 day EMA of MACD. If trigger line is above the MACD line then it gives sell signal and in reverse situation it indicate buy signal.

Signals: Buy: if MACD > trigger Line
Sell: if MACD < trigger Line

Measuring Profitability of Technical Indicators

Technical indicators profitability is measured by the average returns generated by buy and sell signals than these returns are compared with the average returns of buy and hold strategy. The significance and robustness of returns are checked through sub period data analyses. Ten year data set has been divided into five sub-periods. The returns are measured before and after considering the transaction cost. Sharpe ratio is also calculated to examine the robustness of the results.

Empirical Results

The average returns generated by buy and hold strategy is 0.00053 (13% annually) with a standard deviation of 0.0198 and the t-value is 1.33(0.00053 divided by 0.0198/ $(2459)^{1/2}$ for the whole study period of 2459 observation. The calculated value of 't' is compared with the critical value of 1.28, 1.64, and 2.58 at 10%, 5% and 1%. Here results are interpreted in three sections:

Section1: Statistical results for Technical Tools

Table summarizes the result of Exponential Moving Average, Relative Strength Index and Moving Average Convergence/Divergence rules. For every trading tool we show average returns and standard deviation (S_b, S_s) of buy (sell) signals with buy/sell days (N_b, N_s). The t-value is also present here to show the difference between the returns of mean buy (sell) and buy and hold strategy which is shown in brackets.

The results of Table 1 reports that mean buy return of all technical indicators are positive and mean sell return are negative for RSI and MACD while mean return of buy-sell difference are positive in 4 cases. MACD are the most profitable tool in comparison other technical tools. T-values of MACD signal are 4.052(3.905) and 6.911 for buy (sell) and (buy–sell) that is highly significant at 1% level of significance and rejects the null hypothesis. The t-values are not significant at EMA (5, 20), EMA (20, 50) and EMA (50, 200) in case of mean buy/sell returns and buy-sell difference which accept the null hypothesis. RSI show significant return in only 1 case. Returns are insignificant in 80% cases i.e. 4 indicator out of 5 indicators. Standard deviation of sell returns are more than buy returns. The technical tools show 41.15% more buy signals than sell signals.

Table 1: Standard test Results for Technical Trading Rules (Panel I: Whole Period)

Rules	Mean Buy Return	Mean Sell Return	(Buy-Sell) Mean	SD_b	SD_s	N_b	N_s
EMA(5,20)	0.00086 (0.53)	0.00164 (-1.146)	0.00078 (0.928)	0.01772	0.02255	1449	1030
EMA(20,50)	0.0008 (0.525)	0.0001 (-0.550)	0.00078 (0.898)	0.01704	0.02343	1480	999
EMA(50,200)	0.0005 (-0.071)	0.0006 (0.09)	-0.00012 (-0.13)	0.01609	0.02652	1720	759
RSI(50,50)	0.00112 (0.936)	-0.0002 (-0.668)	0.00132 (1.605***)	0.01793	0.02203	1374	1105
MACD	0.00328 (4.052*)	-0.00219 (-3.905*)	0.00546 (6.911*)	0.01921	0.02014	1234	1245

Statistical results on The Basis of Sub Periods for Checking The Robustness

The results of Table 2 report the positive mean return of buy-sell difference with highly significant t-values for MACD signal. The t-values are not significant at EMA (5, 20), EMA (20, 50), EMA (50,200), RSI (50, 50) in any case of mean buy/sell returns and buy-sell difference. Returns are insignificant in 80% cases that mean nobody can earn abnormal returns and stock market is efficient. But MACD indicator shows significant return 1.747(1.631) and 2.914 for buy (sell) and (buy-sell) at 5%, 10% and 1% which reject the null hypothesis. There is more variability in the sell returns in comparison to buy returns. The average buy (sell) days are equal (247).

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Table 2: Standard test Results for Technical Trading Rules (Panel II: April 2007 -March 2009)

Rules	Mean Buy Return	Mean Sell Return	(Buy-Sell) Mean	SD_b	SD_s	N_b	N_s
EMA (5, 20)	0.00017 (0.437)	-0.00172 (-0.367)	0.00188 (0.685)	0.02574	0.03459	251	243
EMA (20,50)	-0.0002 (0.263)	-0.0012 (-0.165)	0.0010 (0.370)	0.02391	0.03430	205	289
EMA (50, 200)	0.0006 (0.674)	-0.0022 (-0.54)	0.0028 (1.02)	0.02411	0.03579	252	242
RSI (50, 50)	0.00072 (0.690)	-0.00225 (-0.578)	0.00296 (1.086)	0.02610	0.03415	247	247
MACD	0.00309 (1.747**)	-0.00487 (-1.631***)	0.00796 (2.914*)	0.02759	0.03269	279	216

The result of Table 3 reports that mean return of buy-sell difference are positive in 2 cases and the t-values are highly significant at MACD and EMA (50,200) signal. The t-values are not significant at EMA (5, 20), EMA (20, 50), RSI (50, 50) in case of mean buy (sell) returns and buy-sell difference. MACD indicator show significant returns 1.600, 1.965, 3.100 for buy (sell) and (buy-sell). EMA (50,200) show significant returns at 5% significance level. Returns are insignificant in 60% cases i.e. 3 indicator out of 5 indicators. Null hypotheses are accepted in case of EMA (5, 20), EMA (20, 50), and RSI. So the conclusion is here that technical indicator does not show significant returns than buy and hold strategy. But EMA (50, 200) and MACD reject the null hypothesis. Average number of buy days 160.87% more than sell days

Table 3: Standard test Results for Technical Trading Rules (Panel III: April 2009 -March 2011)

Rules	Mean Buy Return	Mean Sell Return	(Buy-Sell) Mean	SD_b	SD_s	N_b	N_s
EMA(5,20)	0.00197 (-0.154)	0.00267 (0.275)	-0.00071 (-0.373)	0.02574	0.01916	348	150
EMA(20,50)	0.0021 (-0.031)	0.0023 (0.079)	-0.0002 (-0.098)	0.02017	0.01759	389	109
EMA(50, 200)	0.0011 (-0.90)	0.0174 (1.98**)	-0.0162 (-2.12**)	0.01643	0.04317	466	32
RSI(50,50)	0.00238 (0.136)	0.00185 (-0.201)	0.00053 (0.293)	0.02008	0.01886	313	185
MACD	0.00452 (1.600***)	-0.00091 (-1.965**)	0.00543 (3.100*)	0.01972	0.01909	283	215

The result of Table 4 reports that mean return of buy-sell difference are positive in 3 cases and the t-values are highly significant at MACD. The t-values are not significant at EMA (5, 20), EMA (20, 50), RSI (50, 50) in case of mean buy/sell returns and buy-sell difference. EMA (50,200) show significant returns at 10% significance level in 1 case. Returns are significant in 26.67% cases i.e. (4 out of 15). So the conclusion is here that technical indicators do not show significant returns except MACD. In average number of buy days (265) are more than sell days (233).

Table 4: Standard test Results for Technical Trading Rules (Panel IV: April 2011 -March 2013)

Rules	Mean Buy Return	Mean Sell Return	(Buy-Sell) Mean	SD_b	SD_s	N_b	N_s
EMA(5,20)	0.00031 (0.328)	-0.00043 (-0.308)	0.00074 (0.547)	0.01364	0.01628	259	239
EMA(20,50)	-0.0001 (-0.061)	0.0000 (0.059)	-0.0001 (-0.102)	0.01292	0.01722	278	220
EMA(50,200)	-0.0007 (-0.73)	0.0013 (0.85)	-0.0020 (-1.29***)	0.01269	0.01839	323	175
RSI(50,50)	0.00027 (0.285)	-0.00035 (-0.255)	0.00063 (0.466)	0.01373	0.01611	248	250
MACD	0.00285 (2.371**)	-0.00229 (-2.048**)	0.00514 (3.839*)	0.01501	0.01455	218	280

The results of Table 5 reports that combined mean return of buy and sell difference are positive and the t-values are significant at MACD signal. The t-values are not significant at EMA (5, 20), EMA (20, 50), EMA (50, 200) RSI (50, 50). MACD rule show significant return in all cases. Returns are significant in 20% cases i.e. (4 out of 5). MACD shows significant more returns than buy and hold strategy. Technical indicators generate 65.59% more buy signals.

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Table 5: Standard test Results for Technical Trading Rules (Panel V: April 2013 -March 2015)

Rules	Mean Buy Return	Mean Sell Return	(Buy-Sell) Mean	SD_b	SD_s	N_b	N_s
EMA (5,20)	0.00115 (0.171)	0.00064 (-0.205)	0.00051 (0.320)	0.01519	0.01825	303	191
EMA (20,50)	0.0010 (0.004)	0.0009 (-0.006)	0.0001 (0.008)	0.01397	0.02180	361	133
EMA (50,200)	0.0009 (-0.08)	0.0012 (0.11)	-0.0003 (-0.15)	0.01380	0.02214	362	132
RSI (50,50)	0.00176 (0.685)	-0.00016 (0.778)	0.00192 (1.255)	0.01545	0.01766	287	207
MACD	0.00414 (2.347**)	-0.00173 (-2.247**)	0.00587 (3.980*)	0.01709	0.01536	226	268

The results of Table 6 reports that MACD indicator show significant returns 1.398(1.292) and 2.322 for buy (sell) and (buy-sell) at 10% and 5%. Returns are insignificant in 80% cases i.e. (4 out of 5) indicators. Null hypotheses are accepted in case of EMA (5, 20), EMA (20, 50), EMA (50,200) and RSI which shows technical indicator does not produce significant returns. The results of MACD prove that stock market is inefficient.

Table 6: Standard test Results for Technical Trading Rules (Panel VI: April 2015-March 2017)

Rules	Mean Buy Return	Mean Sell Return	(Buy-Sell) Mean	SD_b	SD_s	N_b	N_s
EMA (5,20)	0.0003 (-0.025)	0.00035 (0.024)	-0.00005 (-0.041)	0.01090	0.0157	288	207
EMA (20,50)	0.0006 (0.256)	0.0001 (-0.237)	0.0005 (0.427)	0.01237	0.01382	247	248
EMA (50,200)	0.0003 (-0.05)	0.0004 (0.06)	-0.0001 (-0.09)	0.01284	0.01361	317	178
RSI (50,50)	0.00015 (-0.188)	0.00053 (0.175)	-0.00038 (-0.116)	0.01078	0.01563	279	216
MACD	0.00166 (1.398***)	-0.00107 (-1.292***)	0.00273 (2.322**)	0.01201	0.01404	252	243

Section 2: Risk-Return Analysis

In this section risk and return has been analyzed by calculating the gross return, net return and cumulative annual growth rate (CAGR) of technical tools. Ranking has been given on the basis of gross CAGR and net CAGR.

In the table 7, CAGR ranges between 22.75% (MACD) to 3.23% EMA (50, 200). Net CAGR of MACD signals is maximum and minimum for EMA (50, 200). The net CAGR is more than passive approach of buy and hold strategy. Transaction cost is highest in case of RSI and lowest in case of EMA (50, 200). MACD performance has given 1st rank because it produces highest returns and EMA (50, 200) are on 5th rank because it gives minimum return in comparison to other strategy. The Sharpe ratio is highest in case of MACD and lowest in EMA (50, 200). Alpha is positive in all cases in ten years. The Sharpe ratio is highest in case of MACD and lowest (negative) in EMA (50, 200).

Table 7: Risk-Return Analysis of Technical Trading Rules (Panel I: Whole Period)

Rules	No of Trades	Trade Repetition Time (in days)	Gross Return (%)			Transaction cost ((0.01%) of average trade value*number of trade)	Net Return (%) (Gross return – transaction cost)			Sharpe Ratio (%)	Alpha (Index Return)
			Aggregate	CAGR	Rank	Aggregate	Aggregate	CAGR	Rank		
EMA (5,20)	298	8.32	116.46	8.03	4	15.42	101.04	7.23	4	317.44	99.73
EMA (20,50)	83	29.87	118.12	8.11	3	4.17	113.95	7.90	3	358.54	112.64
EMA (50,200)	29	85.48	37.38	3.23	5	1.40	35.98	3.12	5	110.35	34.67
RSI (50,50)	556	4.46	175.64	10.67	2	28.30	147.34	9.48	2	464.82	146.03
MACD	373	6.65	676.58	22.75	1	18.69	657.73	22.43	1	2089.46	656.42

In the table 8, CAGR ranges between 71.80% (MACD) to 13.86% (EMA, 20, 50). Net compound annual growth rate of MACD signals is maximum and minimum for EMA (20, 50). The net CAGR is more than passive approach of buy and hold strategy. Transaction cost is higher in case of RSI because numbers of trades are more in this strategy. MACD performance has given 1st rank because it produces highest returns and EMA (20, 50) are on 5th rank because it gives minimum return in comparison to other strategy. Alpha is positive in all cases in two

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years. The Sharpe ratio is highest in case of MACD and lowest in EMA (20, 50).

Table 8: Risk-Return Analysis of Technical Trading Rules (Panel II: April 2007 -March 2009)

Rules	No of Trades	Trade Repetition Time (in days)	Gross Return (%)			Transaction cost ((0.01%) of average trade value*number of trade)	Net Return (%) (Gross return – transaction cost)			Sharpe Ratio (%)	Alpha (Index Return)
			Aggregate	CAGR	Rank	Aggregate	Aggregate	CAGR	Rank		
EMA (5, 20)	58	8.53	45.93	20.80	4	2.9	43.03	19.60	4	90.31	43.41
EMA (20, 50)	21	23.52	29.63	13.86	5	1.00	28.63	13.42	5	60.35	29.01
EMA (50, 200)	3	164.67	68.74	29.90	3	0.10	68.64	29.86	3	143.59	69.02
RSI (50,50)	92	5.37	73.33	31.65	2	4.60	68.73	29.90	2	143.78	69.11
MACD	65	7.6	195.16	71.80	1	3.20	191.96	70.87	1	400.16	192.34

In the table 9 CAGR of MACD are 57.33% and -1.28% of EMA (50, 200). Net compound annual growth rate (CAGR) of MACD signals is maximum and minimum for EMA (50, 200). The net CAGR is more than passive approach of buy and hold strategy. Transaction cost is higher in case of RSI and lowest in EMA (50,200). MACD performance has given 1st rank because it produces highest returns and Sharpe ratio is highest. EMA (50, 200) are on 5th rank because it gives negative return in comparison to other strategy and lowest Sharpe ratio. Alpha is positive in all cases in two years.

Table 9: Risk-Return Analysis of Technical Trading Rules (Panel III: April 2009 -March 2011)

Rules	No of Trades	Trade Repetition Time (in days)	Gross Return (%)			Transaction cost ((0.01%) of average trade value*number of trade)	Net Return (%) (Gross return – transaction cost)			Sharp Ratio (%)	Alpha (Index Return)
			Aggregate	CAGR	Rank	Aggregate	Aggregate	CAGR	Rank		
EMA (5,20)	64	7.78	28.39	13.30	4	3.41	19.40	11.79	4	59.05	18.31
EMA (20, 50)	18	27.67	57.76	25.60	2	1.00	56.76	25.20	2	179.50	55.67
EMA (50, 200)	2	249	-2.55	-1.28	5	0.10	2.65	-1.18	5	5.04	1.56
RSI (50,50)	122	4.08	40.14	18.38	3	6.30	33.84	15.69	3	105.60	32.75
MACD	80	6.23	147.54	57.33	1	4.11	143.43	56.02	1	458.92	142.34

In the table 10, CAGR of MACD is 50.39% and -26.79% of EMA 50, 200. The net CAGR is more than passive approach of buy and hold strategy. Transaction cost is higher in case of RSI because numbers of trades are more in this strategy and lowest in case of EMA (50,200). MACD performance has given 1st rank because it produces highest returns and Sharpe ratio is highest and EMA (50, 200) are on 5th rank because it gives negative return and negative Sharpe ratio. Alpha is positive in all cases in two years except EMA (20, 50). The Sharpe ratio is highest in case of MACD and lowest (negative) in EMA (20, 50).

Table 10: Risk-Return Analysis of Technical Trading Rules (Panel IV: April 2011 -March 2013)

Rules	No of Trades	Trade Repetition Time (in days)	Gross Return (%)			Transaction cost ((0.01%) of average trade value*number of trade)	Net Return (%) (Gross return –transaction cost)			Sharpe Ratio (%)	Alpha (Index Return)
			Aggregate	CAGR	Rank	Aggregate	Aggregate	CAGR	Rank		
EMA (5,20)	66	7.55	18	8.63	2	3.38	14.62	7.06	2	61.73	14.60
EMA (20,50)	18	27.67	-3.72	-1.88	4	0.88	-4.6	-2.33	4	-19.54	-4.62
EMA (50, 200)	12	41.5	-46.41	-26.79	5	0.60	-47.01	-27.21	5	198.68	46.99

| RSI (50,50) | 126 | 3.95 | 15.58 | 7.51 | 3 | 6.38 | 9.2 | 4.50 | 3 | 38.81 | 9.18 |
| MACD | 62 | 8.03 | 126.16 | 50.39 | 1 | 3.08 | 122.92 | 49.31 | 1 | 519.64 | 122.90 |

In the table 11, CAGR ranges between 54.87% (MACD) to 7.62% (EMA 50, 200). Net CAGR of MACD signals is highest and lowest for EMA (50, 200). The net CAGR is more than passive approach of buy and hold strategy. Transaction cost is higher in case of RSI and lower in case of EMA (50,200). MACD performance has given 1st rank because it produces highest returns and EMA (50, 200) are on 5th rank because it gives minimum return in comparison to other strategy. Alpha is positive in all cases in two years. The Sharpe ratio is highest in case of MACD and lowest in EMA (50, 200). Alpha is positive in all cases in two years. The Sharpe ratio is highest in case of MACD and lowest in EMA (50, 200).

Table 11: Risk-Return Analysis of Technical Trading Rules (Panel V: April 2013 -March 2015)

Rules	No of Trades	Trade Repetition Time (in days)	Gross Return (%)			Transaction cost ((0.01%) of average trade value*number of trade)	Net Return (%) (Gross return – transaction cost)			Sharp Ratio (%)	Alpha (Index Return)
			Aggregate	CAGR	Rank	Aggregate	Aggregate	CAGR	Rank		
EMA (5,20)	60	8.23	22.53	10.69	3	3.13	19.40	9.27	4	72.91	18.93
EMA (20, 50)	12	41.17	22.04	10.47	4	0.61	21.43	10.20	3	80.73	20.96
EMA (50, 200)	8	61.75	15.83	7.62	5	0.40	15.43	7.44	5	57.62	14.96
RSI (50, 50)	96	5.15	53.76	24.00	2	4.94	48.82	21.99	2	186.22	48.35
MACD	72	6.86	139.86	54.87	1	3.60	136.26	53.71	1	522.99	135.79

In the table 12, CAGR ranges between 29.56% (MACD) to -3.65% (RSI 50, 50). Net CAGR of MACD signals is maximum and minimum for RSI (50, 50). Transaction cost is higher in case of RSI and lower in case of EMA (50, 200). MACD performance has given 1st rank because it produces highest returns and RSI (50, 50) are on 5th rank because it gives negative return in comparison to other strategy. The Sharpe ratio is highest in case of MACD and lowest in EMA (50, 200). Alpha is positive in all cases except EMA (5, 20) in two years. The Sharpe ratio is highest in case of MACD and lowest (negative) in EMA (5, 20).

Table 12: Risk-Return Analysis of Technical Trading Rules (Panel VI: April 2015 -March 2017)

Rules	No of Trades	Trade Repetition Time (in days)	Gross Return (%)			Transaction cost ((0.01%) of average trade value*number of trade)	Net Return (%) (Gross return – transaction cost)			Sharpe Ratio (%)	Alpha (Index Return)
			Aggregate	CAGR	Rank	Aggregate	Aggregate	CAGR	Rank		
EMA (5,20)	50	9.9	1.32	0.66	4	2.6	-1.28	-0.64	5	-6.94	-1.44
EMA (20,50)	14	35.36	12.41	6.02	2	0.68	11.73	5.70	2	55.85	11.57
EMA (50,200)	4	123.75	1.77	0.88	3	0.20	1.57	0.78	3	6.81	1.41
RSI (50,50)	120	4.13	-7.17	-3.65	5	6.08	-13.25	-6.86	4	4.50	0.93
MACD	94	5.27	67.86	29.56	1	4.70	63.16	27.73	1	304.05	63.01

In the table 13, CAGR ranges between 22.75% (MACD) to 3.23% EMA (50, 200). Net CAGR of MACD signals is maximum and minimum for EMA (50, 200). The net CAGR is more than passive approach of buy and hold strategy. Transaction cost is highest in case of RSI and lowest in case of EMA (50, 200). MACD performance has given 1st rank because it produces highest returns and EMA (50, 200) are on 5th rank because it gives minimum return in comparison to other strategy. The Sharpe ratio is highest in case of MACD and lowest in EMA (50, 200). Alpha is positive in all cases in ten years. The Sharpe ratio is highest in case of MACD and lowest (negative) in EMA (50, 200).

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Table 13: Risk-Return Analysis of Technical Trading Rules (Panel VII: Whole Period)

Rules	No of Trades	Trade Repetition Time (in days)	Gross Return (%)			Transaction cost ((0.01%) of average trade value*number of trade)	Net Return (%) (Gross return – transaction cost)			Sharpe Ratio (%)	Alpha (Index Return)
			Aggregate	CAGR	Rank	Aggregate	Aggregate	CAGR	Rank		
EMA (5,20)	298	8.32	116.46	8.03	4	15.42	101.04	7.23	4	317.44	99.73
EMA (20,50)	83	29.87	118.12	8.11	3	4.17	113.95	7.90	3	358.54	112.64
EMA (50,200)	29	85.48	37.38	3.23	5	1.40	35.98	3.12	5	110.35	34.67
RSI (50,50)	556	4.46	175.64	10.67	2	28.30	147.34	9.48	2	464.82	146.03
MACD	373	6.65	676.58	22.75	1	18.69	657.73	22.43	1	2089.46	656.42

Section 3: Descriptive Statistical Analysis

Table 14 shows a summary of descriptive statistics of return series from 2007-2017 with sub periods of Bank index. Descriptive of returns includes mean, median, standard error, standard deviation, sample variance, kurtosis, skewness, range, minimum, maximum, range and count.

The mean returns are positive in 67% cases i.e. 4 out of 6. Mean return rate show that minimum average return during 2007-2009 and maximum in 2009-2011. Higher values of average based on median indicate the presence of extreme negative values in the data. Standard deviation lies between 0.01311 and 0.03040 which show considerable variability. All return distributions are right skewed except 2007 to 2009 and 2015 to 2017. It means there is persistency in the returns. Kurtosis of all return distribution is less than three except period (2007-2017). It means the returns series has minor tail than the standard normal distribution.

Table 14: Descriptive statistical Analysis of Technical Trading Rules

Statistical Measure	(April 2007 - March 2009)	(April 2009 - March 2011)	(April 2011 - March 2013)	(April 2013 - March 2015)	(April 2015 - March 2017)	(April 2007 - March 2017)
Mean	-0.00076	0.00218	-0.00004	0.00095	0.00032	0.00053
Standard Error	0.00137	0.00088	0.00067	0.00074	0.00059	0.00040
Median	0.00068	0.00209	-0.00006	0.00088	0.00025	0.00070
Standard Deviation	0.03040	0.01962	0.01496	0.01642	0.01311	0.01987
Sample Variance	0.00092	0.00038	0.00022	0.00027	0.00017	0.00040
Kurtosis	1.27101	12.7635	0.59983	2.77596	2.33417	5.70841
Skewness	-0.16662	1.35325	0.18514	0.22054	-0.32895	0.11758
Range	0.25086	0.2607	0.08866	0.14609	0.12043	0.31033
Minimum	-0.13485	-0.08522	-0.04065	-0.05712	-0.07245	-0.13485
Maximum	0.11601	0.17548	0.04801	0.088968	0.04798	0.17548
Count	494	498	498	494	495	2479

Conclusion

Numerous studies have supported the effectiveness of technical trading tools for predicting the stock market returns. The present study examines the EMA, RSI and MACD for analyzing the risk and return of Bank equity index from S&P BSE over the period from 1st April 2007 to 31st March 2017. The result of the study showed highly significant returns from MACD technical indicators which reject the null hypothesis that returns of MACD are lesser or equal the buy and hold strategy. Which show that stock market is inefficient. The performance of MACD has given 1st ranking on the basis of compound annual growth rate and the ranking of other tools are fluctuating in different periods. EMA (5, 20), EMA (20, 50), EMA (50, 200) and RSI (50, 50) do not show significant returns which accept the null hypothesis that return of technical indicators cannot more than buy and hold strategy. The average buy returns are more than the sell returns. Transaction cost does not eliminate the returns of technical indicators. Transaction cost of RSI is higher because of more number of trades and transaction cost of EMA (50,200) is minimum during all periods. Alpha is positive in all most all cases. Sharpe ratio is highest in case of MACD every year. Thus we conclude that Majority of technical tools show insignificant returns except MACD.

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