

Machine Learning & Mechanics of “Investment Matrix”: “Performance Optimisation & Risk Measurement of Bank Nifty”



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Abstract: Purpose: The zeal and reason to write this research paper are to evaluate the performance & risk measurement of Bank Nifty based on Machine learning, Technical Analysis & Monte Carlo Simulation.

Design /Methodologies/Approach: To achieve our desired results for this study, we use moving average (auto-optimization method) as a technical analysis return optimization tool & Monte Carlo Simulation as a risk analysis tool, & at the end harmonize both of the results, & compare with buy hold strategy. We use Bank Nifty end of day historical closing data of past five years i.e.1 Jan 2015 – 31 Dec 2019, For this study using Amibroker software.

Originality & Value: This research paper is beneficial for anyone who wants understand Bank Nifty on the ground of technical analysis & risk measurement technique (MCs), & also to synergies the strength of two studies.

Research Limitations: In appropriate input can lead to creating wrong simulation result, there are no. of unknown factors that simulation cannot truly understand or account during the process.

Practical implication: Understanding stock market results is essential to make further decisions related to risk & reward ratio. The results imply that Moving average give outstanding returns on Bank Nifty in medium to long run, & Monte Carlo Simulation having functional judgemental abilities on probabilities basis towards risk & returns. Furthermore, by apply both the technique for risk analysis, simultaneously give outstanding risk & return optimization of Bank Nifty.

Key Words: Technical Analysis, Moving Average, Indicators, National Stock Exchange, Expert system, Bank Nifty

I. INTRODUCTION:

Technical Analysis is one of the very important analysis tools to investigate price behaviour & the mood of financial markets. In the study of Murphy (1999) reveals about the use of technical analysis for predicting future price movement & market actions, here market action means three important parameters i.e., Price, volume & open interest. Historically, many practitioners & academicians ignored art & science of technical analysis because it opposes the most fundamental basis of hypothesis i.e. market efficiency.

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But several studies give us a conclusion about the positive returns of technical analysis. Lo at all (2000) shows that chart patterns in technical analysis information affects good future stock returns. Moreover, Fiess & MacDonald (2002) depict the results about high & low prices carryout very insightful details on exchange rate.

The logic behind technical analysis belief that price has specific patterns, they are not random at all, because history repeats itself underlying assumption applied.

This Experimental study include forecast buy–sell behaviour of stock price & maximize returns of presented stock for an experiment, we apply Monte Carlo Simulation for risk analysis. For this purpose, we choose Bank Nifty on the fundamental basis of the free float stock market index. Any financial market has to deal with this fundamental usefulness before making investment decision i.e.

- 1) Forecasting
- 2) Optimizing
- 3) Risk measurement

II. LITERATURE REVIEW:

Monte Carlo simulation technique uses the random numbers to solve the problem. it can be dealing with any issue be it probabilistic or statistical, James (1980); furthermore, the logic behind this method is to create a sequence of random numbers & develop new mathematical simulation over a long period. (Rollett & Manohar, 2004)

Atmeh & Dobbs (2006) shows positive results by applying 14 moving average trading rule on an index from the period approx. Ten years (1992-2001).

Dempster & Jones (1998), Chang & Osler (1999) studied about technical analysis, & conclude less profitability & minimal information content available for satisfying trading rules.

According to Cheung & Wong (1999), technical analysis very famous among foreign exchange dealers; they use trading signal up to 25% to 30%. Allen & Taylor (1992) with the help of a questionnaire, more than 90% of the dealer in foreign exchange, use technical analysis as a primary or secondary source of information; furthermore charts are as crucial as fundamentals analysis, mostly consider both the analysis (fundamental & technical analysis) mostly complementary.

Bechu & Bertrand (1999) divide technical analyst into three categories which include a) Analyst which is depend on the study of chart patterns, second one is more interested in to use technical indicators, & last one behaves like philosophical, to understand this Wave theory is one of the best example for such kind of technical analyst.



Prost & Precher (1985) shows the results every price movement divided & subdivided into eight different phases. i.e., five impulse waves & three corrective waves.

Besides MenKhoff(1988), their result shows maximum foreign exchange participants give more importance to Non-fundamental like Technical analysis & order flow information.

Broke at all (1992) studies focused on the two simplest & popular tools of technical analysis. i.e., moving average & support/resistance break up. By applying these rules on Dow jones, they show these rules can create a positive return on Dow Jones.

Further, these simple rules studied by others Doolely & Shafer (1984); Levich and Thomas (1993); by taking a sample from the foreign exchange rate. Osler (2000) examines that with the help of support /resistance techniques, one can enhance the success rate in the share market. Jenson (1970) focus on Relative strength as a technical tool, but results were not significantly better as compared to buy –hold strategy.

Tsao Pan (2010) pieces of advice to use a hybrid model to enhance the predictive ability. The sample includes Taiwanese & Chinese companies from 3 August 2004 to 26 March 2008.

(Earl & Deem ,2008) says that MCs free from any restrictions while solving newton's equations of motions. With the help of MCs can solve many problems in value estimations like pricing deviation of securities, price sensitivity, & quantitative measurement of a portfolio. It includes three main steps:

- 1) Generating sample path
- 2) Evaluating the payoff
- 3) Calculating an average

III. RESEARCH OBJECTIVE:

- 1)To analyze the performance & returns of Bank Nifty after applying the moving average.
- 2)To find out the validity of the Moving average on Bank nifty.
- 3)Does both Technical analysis & Monte Carlo simulation can work together for measuring risk in a quantitative term.

IV. HYPOTHESIS:

Null Hypothesis (H01): There is no significant difference between the performance of Bank Nifty on moving average & Buy Hold Sell strategy

Null Hypothesis (H02): There is no significant difference between moving average & Bank Nifty

Null Hypothesis (H03): There is no significant difference between Technical analysis & Monte Carlo simulation.

V. RESEARCH DESIGN:

The Mechanics of the "Investment" Matrix helps to understand the following points.

1.**Fundamental Analysis:** Various selected ratios help choose investment alternatives.

2.**Risk Analysis:** After choosing investment options, one needs to understand the risk-reward ratio with the help of Monte Carlo Simulation.

3. **Technical Analysis:** It helps to optimize selected investment options through various indicators & patterns.

4.**Machine Learning:** To automate multiple functions, one needs to take the help of an expert system & AI.

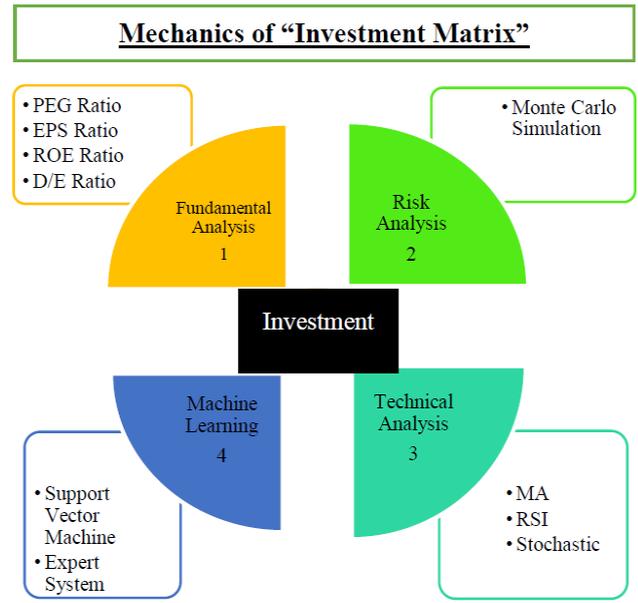
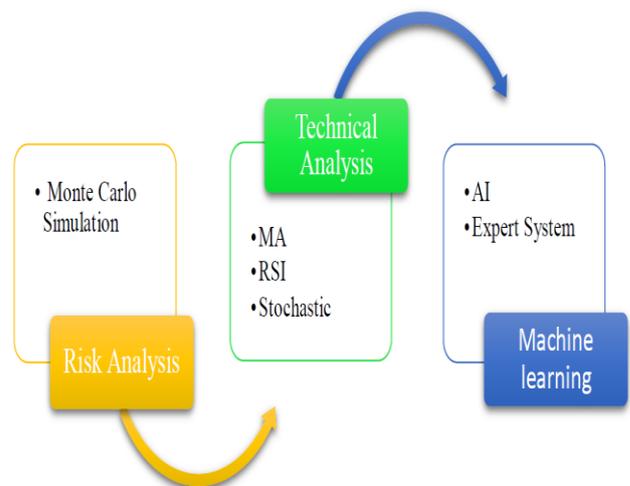


Fig:1

Since, for this research, we already selected Bank nifty as an investment option, so we only test three dimensions of the "Investment Matrix." i.e., Risk Analysis, Technical Analysis & Machine Learning.

In this Research paper, we use a moving average Technical analysis tool on Banknifty, five years of EOD closing price historical data, for performance analysis return optimization. Afterward, we use Monte Carlo Simulations for the quantification of risk measurement. Align the results of Technical analysis & MCs. With the help of Amibroker professional software.

Fig:2 Process of Mordren Investment Mechanism



VI. ANALYSIS & INTERPRETATION OF RESULT -

Table 1 represents the Summary descriptive of the Monte Carlo simulation of the daily market Bank Nifty index value, probable returns which include the following:



1. Percentage
2. Equity
3. Annual returns
4. Max Drawdown in value & percentage
5. Lowest equity

In between 50 percentiles to 75 percentiles, MCs show the expected returns after applying the Moving average in between 208534-235635. At the 99 percentile Bank Nifty may raise to Rs.305415 at the end of a given period. Maximum drawdown could be up to 10% & annual return maximizes up to 25.03%. One Percentile tells us that 1% of the test had a yearly profit of less than negative 4.15 %. Less than 1% of cases one can experience drawdown – 27%

Fig. 3 represents Bank Nifty can reach the maximum value at 305414 & minimum value can be reached at 122548. Here, Fig: 2 Represent Cumulative distribution function of final equity, we can see less than 5% our system would not breakeven, more than 50% chances are there to get a 10 % return. Profits above 20% per year only occur in the top 10 %

Table 2 shows the comparative results of Technical analysis & Buy Hold Sell strategy on Bank Nifty. Both the strategy positively managed to get more than 10 % of the annual return within a selected time frame. Total 186 trade were there; overall, winner trader was 94 & loose trade were 92 still we manage to get net profit 110%. Whereas Buy hold sells strategy net profit is 68% & annual return is 11 %, which is quite low as compared with TA 16% & annual return is 110%.

Application of Amibroker expert system based Technical analysis on Bank Nifty provide us significantly good return

along with quantitative risk measurement through MC Simulation.

By analysing Both the result (Technical analysis & Monte Carlo Simulation), we can conclude, on the one hand Technical analysis tool (Moving average) able to give significant positive return, on the other hand, MCs gives us insight to understand about Max & min. The drawdown of funds provides us various percentile to judge final equity along with functional risk analysis within give a time frame. One can simultaneously use both the analysis to get the best returns & able to understand the risk within the opportunity. One % chance of maximum drawdown 19% approx. To get 22.67 % annual returns, which has a 90% chance. Once you have risk in your hand in quantitative terms, it's been easy to judge the future course of action as per the choice of risk & rewards.

Future research could be on the basis of wave theory or Neural network based on technical analysis of various tools & techniques & fusion studies of different financial toolkits.

VII. CONCLUSION;

This research paper proposes systematic approach to invest through Fundamental Analysis, Risk Analysis, Technical Analysis & Machine learning. Our benchmark is FD rate, & result shows 11% annual returns which is far better than our benchmark.

Future research may be towards neuro finance & fuzzy logic with reference to mechanics of “Investment Metrix”

Very soon Bank Nifty is going to touch their lower –lows in near future March –April 2020

Table:1 Monte Carlo Simulation

Percentile	Final Equity	Annual Return	Max. Drawdown \$	Max. Drawdown %	Lowest Eq.
1%	122548	4.15%	-36583	-27.71%	77326
5%	147919	8.15%	-28025	-21.10%	85434
10%	160364	9.91%	-24508	-18.10%	88814
25%	182863	12.84%	-19696	-13.93%	93606
50%	208534	15.84%	-15542	-10.62%	97371
75%	235635	18.71%	-12508	-8.17%	99744
90%	261024	21.17%	-10370	-6.46%	100000
95%	276024	22.53%	-9389	-5.70%	100000
99%	305415	25.03%	-7796	-4.55%	100000

Table: 2 Comparative Results of Technical Analysis & Buy Hold Sell Strategy- “Bank Nifty”

Index/Factors	Bank Nifty	Buy-Hold-Sells Strategy
Initial Capital	100000	100000
Ending Capital	210546	168758
Net Profit/loss	110546	68758
Net Profit %	110.55	68.76



Annual Return %	16.07	11.04
Total Profit	235914	68758
All trades	186	1
Winners trade	94	1
Loose trade	92	0
Largest win	16879	68758
Max. trade % drawdown	10	34
Profit Factor	1.88	NA
Sharpe Ratio of Trades	1.17	NA

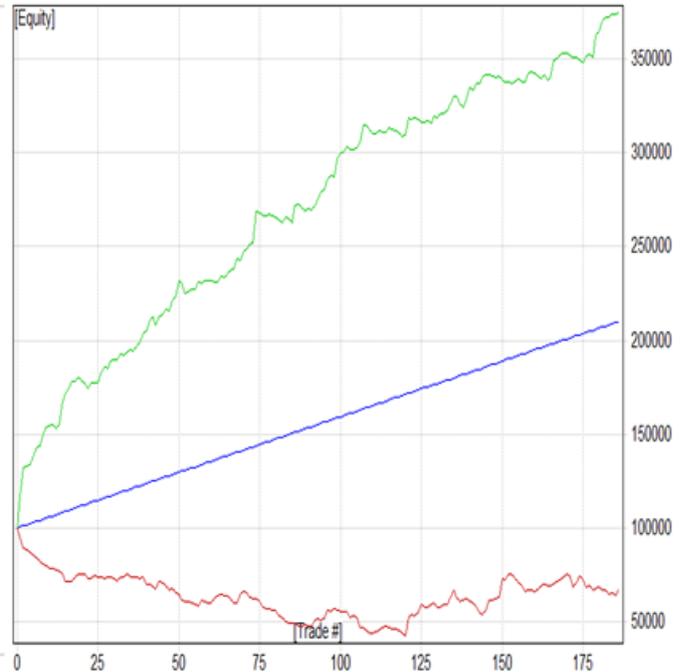
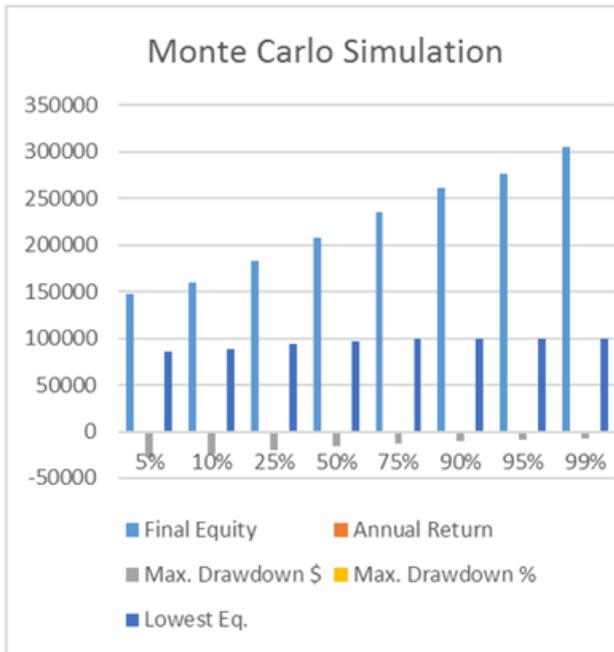


Fig: 3 Monte Carlo Simulation

Fig: 4 Overview of Monte Carlo Simulation

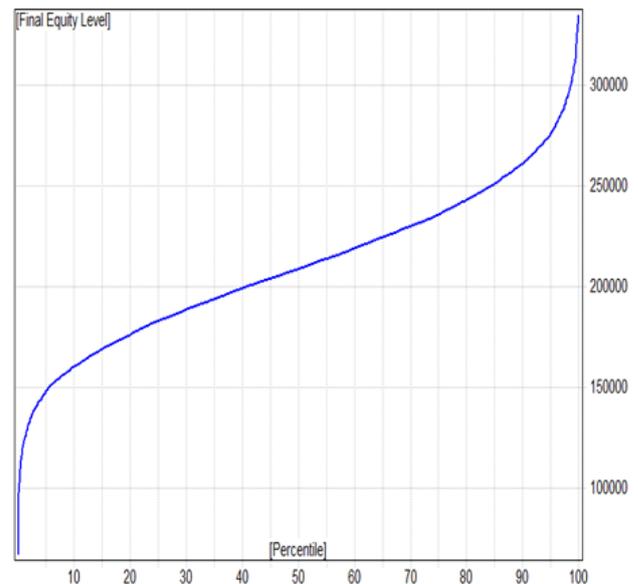
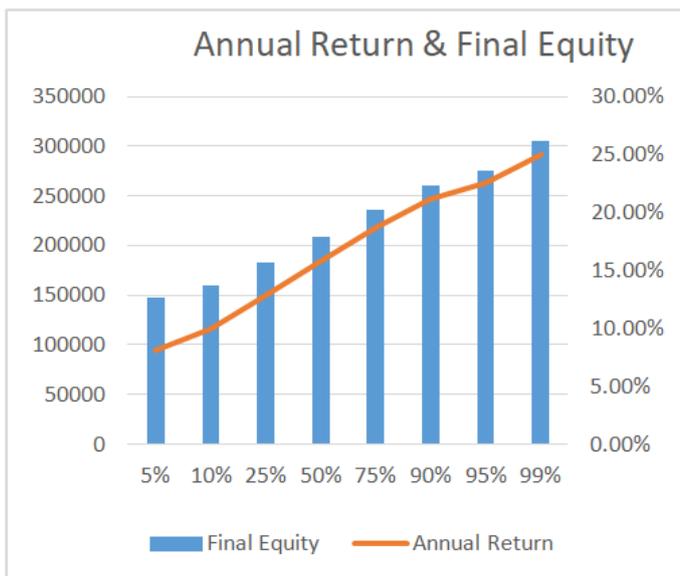


Fig 5: MCs Annual Returns (Percentile Based)

Fig 6: Cumulative Distribution Functions

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