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The Test of Predictive Power of "Moving Average" Indicator on Indian Stock Market through System Design & Back Testing Strategy

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Abstract
Specialized investigation enables financial specialists in foreseeing future to value patterns dependent on the data like stock value development, advertise situation and exchanging volume. At the point when specialized examination devices are appropriately applied at the hour of exchanging and contributing, a financial specialist can expect an expansion in progress pace of getting great returns. This exploration paper depends on the utilization of specialized examination device for example Exponential Moving Average (EMA) Crossover. The primary point is to assess and approve EMA Crossover on Nifty&Bank nifty Index which is on NSE.

The resulting goal is to plan framework exchanging arrangement and create back testing system. The experimental investigation incorporates backtesting of daily closing price data to Nifty &Bank Nifty Index from Jan 2013 to Jan 2019. To comprehend the effectiveness of market, back testing of Exponential Moving Average Cross Over methodology is finished with the assistance of Amibroker programming AFL language to create contributing and exchanging grid.

Keywords: Technical Analysis, Indicators, Backtest, EMA , Nifty Index,Fundamental analysis ,Technical analysis, Amibroker formula language.

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Introduction:

In every corner of the financial markets, people wants to earns more & more returns by taking minimum risk at a point of time. Moving average is a tool or indicator which is lagging in forecasting trends but effective in identifying trends in most cases. Almost all professional in financial markets uses this tool to identifyingtrends [1].Mass mental examination of purchasing and selling conduct spoke to in statistical structure with the assistance of measurements to gauge the redundancy of economic incidents is essentially named as Technical Analysis.

It depends on the idea that future value developments rely upon past exchanging movement and value changes of security. The interest for specialized examination has expanded among financial specialists especially in light of the fact that value information data can be gotten from IT empower advances productively and successfully.

This research paper is focused on the use of technical analysis & its indicator i.e. Exponential Moving Average Crossover align with system design backtesting . The main aim is to evaluate & Validate EMA Crossover on BankNifty Index which is traded on NSE Plateform.The subsequent objective is to design system trading setup & develop back testing strategy, the objective of achieving higher revenue during trading & investing on the stock markets. The empirical analysis includes the back testing of optimized indicator, representing BankNifty Index.

Literature Review:

To reveals that for smoothing the effect of end of price data, we need to use lagging indicator, practitioners know how to play with noise in the market tounderstand the new wave oftrends. [2]

In another view point in research that lagging indicator reduce the facet of price noising & identify To report that index fund is very helpful to increase its performance significantly with the proposed Genetic algorithm portfolio scheme,Korea Stock Price Index will be demonstrated for index fund identified [4].

To recognized that the most exact value for value N to calculate the appropriate RSI is 14 because it was half of the lunar cycle. However, depending on the market, the company and other factors, the value 14 is not the best suited value to calculate the RSI [5]

ToObserve technical trading rules finds very good presence on stock market of Malaysia, Thiland, Indonesia.[6]

Technical indicators disclose significant economic value for financial investors, in terms of superior oil risk premium forecasts and sizable utility gains. The technical indicators have a capability to predict the oil prices, it can determine the ability to identify sentiment in advance [7]

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To observe that even thoughmoving Average(MA) is the total of current stock prices which is divided by the number of days,due to lagging factor that is mechanise as a catalyst to minimises the impact of noise in setting the price trends.[8]Further it was studied that momentum does not continue after n-day lows. Returns reverse, and because the momentum factor looks at these as short opportunities, the risk reward tradeoff is excellent.[9]

Trading rules can outperform statistical models in predicting exchange rates and stock prices.[10]

Different kinds of moving averages identified in practice during their research work, like Simple moving average, Weight moving average, exponential moving average. Technical analyst adopts various standard values for the trading & investing purposes like ten days, forty days or two hundred days. The value of observationis dependent on type of time frame which is prefocoused by a trader & investor based on long, short, and intermediate period. [11]

The most suitable value to compute the best result for RSI value N is 14 as this is half of the lunar cycle. Though the value 14 is not provide best results alwaysor not the only value to calculate the RSI as it depends and varies with respect to market, company and many other variables based on market circumstance.[12]Tested two trading rules in their research work that comprises Trading Range Break and Moving Average based on the price data from 1897 to 1986, data is taken from Dow Jones Index. They found a very strong support for strategies of Technical Analysis and decided that the return achieved from technical

analysis strategies are not regular with four popular the random walk; null models the AR (1); the GARCH M and the exponential GARCH and buy signal regularly gives better return than sell signal and the return following sell signal are more fluctuating than return following buy signal.[13]

The exciting issues about prediction of real world stock market like share prices, volatility and mixture of stocks for portfolios. Technical indicators are used to understand trends in share market to take informed decisions related to investments. With the help of suitable parameter technical indicator works well only.[14]

Investigate volume and its applicability and acceptability for technical analysis is very high in financial practices. They observed that volume provides necessary information about financialmarkets that cannot be reveals only from end of price data. They observed that the role of volume, information precision, and price movements are very relate, and demonstrate volume and prices can be enlightening trading &investment decision. [15]

In this research work state that, we can use the SMA and the EMA, simultaneously, SMA with k periods superior and EMA with k periods inferior or vice versa. At the time in which the shorter moving average value is cross upward to the longer moving average A there will be a buy order, whereas atthe time in which the shorter moving average value is cross downward to the longer moving average there will be a sell order. [16]

Three moving average technical analysis rules have great influence to identify trends. Their result isaligning with inefficient market for the period 1954 to1984 & efficient market from 1984 to 2004. Technical trading rules areinefficient to find patterns of recurring-prices. Their results are in line with inefficient market for the period 1954 to 1984 and efficient market from 1984 till 2004. [17]
The chances of long term stock market may fall more than 50 %& investors needto be mentally strong to face this challenge.[18]

The significance of the application of technical analysis to decide time of entry and exit with respect to financial markets. Trend following is the most important indicator to test the position of moving average & relative strength index on Singapore Stock Exchange data and found that the indicators can be create positive impact on returns on investment. It was originating that member firms of Singapore Stock Exchange had received a good return by using moving average technical indicators.[19]

1. Research Objectives

- To evaluate EMA Crossover on Nifty&Banknifty Index.
- To find out the validity of EMA in Indian Stock Market (Nifty Index).
- To design system trading & back testing strategy.
- To optimise greater revenue from Stock market

This research paper is based on the application of technical analysis & its indicator i.e. Exponential Moving Average Crossover. The main aim is to evaluate & Validate EMA Crossover on Nifty Index &Bankniftywhich is traded on NSE. The subsequent objective is to design system trading setup & develop back testing strategy, the objective of getting greater revenue from trading & investing in the share market. The empirical analysis contains the back testing of optimized indicator, representing Nifty&BankniftyIndex from Jan 2013 to Nov 2019.

Hypothesis

Null Hypothesis (H01): There is no significant difference between the return calculated from Exponential Moving Average and Index Return. (REMA<RINDEX)
Null Hypothesis (H02): There is no significant difference between the returns calculated from
the system design trading and the manual trading.

Research Design for Computational Experiments Specifications

The System design for Moving Average commendations are:
Buy: System identify when the short Moving Average crosses the long Moving average from lower side

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Sell: System identify when the short Moving Average crosses the long Moving Average from uppers.

Amibroker&Trading/Investment System Application

The TS identifies in this study was constructed using Amibroker for application oriented trading system and for developing a model Amibroker plays avery vital role.The idea behind this trading system is to identify & execute buy & sell recommendation passes by trading system backed by Amibroker.Starting capital used was 1,00,000 Rs for both Nifty &Banknifty.Whenever buy signal generate by moving average crossover, trading system buys most appropriate positions, whereas when sell signal generates its closes the position own their own with utmost perfection.
The present study involves exploratory research design which includes Exponential Moving Average Crossover system to generate buy & sell signal along with 6 years back testing of Nifty &Banknifty Index closing data prices.
This system is a trend following system to identify a buy signal & sell signal. Buy condition if **3 EMA > 13 EMA > 34 EMA** and shows a sell condition if **3 EMA < 13 EMA < 34 EMA**.

Sample Size and Source of data

In the present study data is taken only for Indian market from January 2013 to Nov 2019. The whole data of daily trade and prices of the markets is taken from the website: www.finance.yahoo.com.

Tools used

- Exponential Moving Average Crossover
- Amibroker Software
- AFL language

Table I
Analysis and Interpretation: -

Table I: Results of Technical Trading Rules for Whole Period	
Initial capital	1,00,000
Ending capital	1,80051
Net Profit	80051
Net Profit %	80.05%
Annual Return %	9.86%
Total Profit	180051
All trades	57
Winners trade	24(43%)
Loose trade	33(57%)
Largest win	21563
Max. trade % drawdown	-7.10%
Profit Factor	1.96
Sharpe Ratio of trades	0.64

This table represents the backtesting result of EMA crossover for the whole period of study. The table shows that EMA Crossover is found to have very good presence in Nifty &Banknifty for the whole period of data. EMA shows the significant presence in case of long strategy at 10% and 5% level of significance. The EMA crossovers have their prediction power in Indian market and also more than 80% net profit achieved.

Table 2: BankNifty Chart
Total fifty-seven (57) trade were executed within specified time period & more than 43% winning trade executed & managed to get more than 9% annual return. The analysis of EMA crossover for the whole period of study for risk and return attached with the strategy. When observed for the Sharpe ratio in cases of EMA crossover have given the positive ratio. Net profit percentage is managed to get 80

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Fig :IBanknifty Chart

Fig:IINifty Chart

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Fig III: Portfolio Equity

Overall portfolio increased by 150% from 2013 to 2015 & gradually it increased by more than 180% by Jan 2019.furthermore This system helps to remove human emotions in investment decisions.

which shows strategic balance between risk & reward ratio with the help of EMA crossover strategy. In 2016 portfolio reached to 1,20,000,then start moving towards new high in 2019.

Fig:IV Underwater Nifty

With the decent performance of EMA crossover strategy we managed to maximum trade percentage draw down – 24%. Maximum draw down touch -24% in 2016 & average drawdown approx. -3%. During the specified time frame largest loss was 5062 & maximum profit is 21562.77, which show a good pay off financial system design.

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Table II: Profit Table

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr%
2013	N/A	N/A	N/A	N/A	0.0%	0.0%	-2.4%	0.0%	1.3%	9.8%	-3.5%	-0.4%	4.4%
2014	-4.2%	1.8%	18.4%	0.9%	7.6%	2.1%	-3.9%	1.9%	0.6%	7.0%	8.6%	-1.2%	44.8%
2015	0.3%	-4.5%	-2.7%	-3.1%	-1.2%	-3.1%	-0.1%	-2.2%	2.8%	0.8%	-0.8%	-0.7%	-13.5%
2016	-4.8%	-5.1%	7.1%	1.4%	-0.7%	-0.9%	4.2%	-1.1%	-0.9%	0.0%	-2.7%	-2.5%	-6.4%
2017	4.6%	3.7%	-0.8%	1.1%	2.1%	0.2%	3.1%	-1.7%	-1.2%	2.4%	-1.1%	1.4%	14.5%
2018	4.7%	-3.3%	-0.7%	5.2%	5.6%	-2.0%	4.6%	2.9%	-1.4%	-1.5%	6.8%	1.1%	23.6%
2019	0.3%	-2.1%	10.4%	-2.4%	2.0%	-1.3%	-2.4%	0.0%	N/A	N/A	N/A	N/A	4.0%
Avg	0.2%	-1.6%	5.3%	0.5%	2.2%	-0.7%	0.4%	-0.0%	0.2%	3.1%	1.2%	-0.4%	

This table shows month wise & yearly profit percentage till Jan 2013 to Jan 2019. Maximum 44.8 % achieved in 214& minimum profit percentage was -13.5% in 2015. Still we are managed to get average more than 10% return per year.

Table III: Nifty & Bank Nifty Buy/Sell Positions

Ticker	Trade	Entry	Exit	% change	Profit	Cum. profit
^NSEI	Long	03-01-2013	10-01-2013	-0.68%	-679.76	-679.76
		6009.5	5968.65		-0.68%	
^NSEI	Long	21-01-2013	24-01-2013	-1.03%	-1027.94	-1707.69
		6082.3	6019.35		-1.03%	
^N225	Long	25-02-2013	26-02-2013	-2.26%	-2222.56	-3930.25
		11662.52	11398.81		-2.26%	
^N225	Long	06-03-2013	28-03-2013	3.38%	3250.21	-680.04
		11932.27	12335.96		3.38%	
^N225	Long	08-04-2013	27-05-2013	7.20%	7152.49	6472.45
		13192.59	14142.65		7.20%	
^N225	Long	28-06-2013	29-07-2013	-0.12%	-126.03	6346.42
		13677.32	13661.13		-0.12%	
^NSEI	Long	02-09-2013	03-09-2013	-3.77%	-4009.96	2336.46
		5550.75	5341.45		-3.77%	
^N225	Long	03-09-2013	04-10-2013	0.33%	335.82	2672.27
		13978.44	14024.31		0.33%	
DJI	Long	16-10-2013	05-12-2013	2.91%	2989.92	5662.19
		15373.8	15821.5		2.91%	
^N225	Long	20-12-2013	14-01-2014	-2.82%	-2982.83	2679.36
		15870.42	15422.4		-2.82%	
^NSEI	Long	15-01-2014	27-01-2014	-2.93%	-3006.03	-326.67
		6320.9	6135.85		-2.93%	
DJI	Long	13-02-2014	27-03-2014	1.48%	1471.38	1144.71
		16027.6	16264.2		1.48%	

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^N225	Long	28-03-2014	10-04-2014	-2.69%	-2724.83	-1580.12
		14696.03	14300.12		-2.69%	
DJI	Long	22-04-2014	19-05-2014	-0.02%	-14.9	-1595.02
		16514.4	16511.9		-0.02%	
^N225	Long	22-05-2014	11-07-2014	5.76%	5670.83	4075.8
		14337.79	15164.04		5.76%	
DJI	Long	16-07-2014	25-07-2014	-1.04%	-1078.52	2997.28
		17138.2	16960.6		-1.04%	
^N225	Long	28-07-2014	05-08-2014	-1.35%	-1386.77	1610.52
		15529.4	15320.31		-1.35%	
^NSEI	Long	18-08-2014	16-09-2014	0.74%	756.83	2367.34
		7874.25	7932.9		0.74%	
DJI	Long	24-10-2014	10-12-2014	4.33%	4433.27	6800.62
		16805.4	17533.2		4.33%	
DJI	Long	24-12-2014	05-01-2015	-2.93%	-3130.53	3670.09
		18030.2	17501.7		-2.93%	
^NSEI	Long	15-01-2015	09-02-2015	0.38%	393	4063.08
		8494.15	8526.35		0.38%	
^NSEI	Long	18-02-2015	23-02-2015	-1.29%	-1339.35	2723.74
		8869.1	8754.95		-1.29%	
^NSEI	Long	03-03-2015	09-03-2015	-2.66%	-2734.73	-11
		8996.25	8756.75		-2.66%	
^NSEI	Long	08-04-2015	20-04-2015	-3.06%	-3055.53	-3066.52
		8714.4	8448.1		-3.06%	
^N225	Long	22-04-2015	27-04-2015	-0.75%	-724.96	-3791.48
		20133.9	19983.32		-0.75%	
DJI	Long	11-05-2015	29-05-2015	-0.52%	-502.16	-4293.64
		18105.2	18010.7		-0.52%	
^NSEI	Long	19-06-2015	29-07-2015	1.82%	1746.58	-2547.06
		8224.95	8375.05		1.82%	
^N225	Long	31-07-2015	03-08-2015	-0.18%	-175.78	-2722.84
		20585.24	20548.11		-0.18%	
^N225	Long	03-08-2015	04-08-2015	-0.14%	-131.37	-2854.21
		20548.11	20520.36		-0.14%	
^N225	Long	04-08-2015	12-08-2015	-0.62%	-604.03	-3458.24
		20520.36	20392.77		-0.62%	
DJI	Long	11-09-2015	16-11-2015	6.39%	6167.99	2709.75
		16433.1	17483		6.39%	
^NSEI	Long	30-11-2015	04-12-2015	-1.93%	-1984.88	724.87
		7935.25	7781.9		-1.93%	
^NSEI	Long	17-12-2015	07-01-2016	-3.52%	-3544.6	-2819.73
		7844.35	7568.3		-3.52%	
^N225	Long	29-01-2016	09-02-2016	-8.18%	-7948.59	-10768.32
		17518.3	16085.44		-8.18%	
DJI	Long	16-02-2016	28-04-2016	10.09%	9004.49	-1763.83

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		16196.4	17830.8		10.09%	
^NSEI	Long	26-05-2016	24-06-2016	0.23%	230.69	-1533.14
		8069.65	8088.6		0.23%	
^NSEI	Long	30-06-2016	03-08-2016	3.10%	3054.61	1521.47
		8287.75	8544.85		3.10%	
^N225	Long	01-09-2016	14-09-2016	-1.85%	-1874.87	-353.4
		16926.84	16614.24		-1.85%	
DJI	Long	30-09-2016	03-10-2016	-0.30%	-296.08	-649.49
		18308.2	18253.8		-0.30%	
DJI	Long	03-10-2016	04-10-2016	-0.47%	-464.81	-1114.3
		18253.8	18168.4		-0.47%	
^N225	Long	04-10-2016	09-11-2016	-2.89%	-2860.45	-3974.75
		16735.65	16251.54		-2.89%	
^NSEI	Long	10-11-2016	11-11-2016	-2.69%	-2584.29	-6559.04
		8525.75	8296.3		-2.69%	
^N225	Long	15-11-2016	10-01-2017	9.24%	8637.93	2078.89
		17668.15	19301.44		9.24%	
DJI	Long	10-02-2017	13-03-2017	3.02%	3082.6	5161.49
		20269.4	20881.5		3.02%	
^NSEI	Long	16-03-2017	24-03-2017	-0.50%	-525.02	4636.47
		9153.7	9108		-0.50%	
^NSEI	Long	03-04-2017	10-04-2017	-0.61%	-638.84	3997.63
		9237.85	9181.45		-0.61%	
^N225	Long	25-04-2017	15-06-2017	3.94%	4101.67	8099.3
		19079.33	19831.82		3.94%	
^NSEI	Long	10-07-2017	09-08-2017	1.40%	1515.66	9614.96
		9771.05	9908.05		1.40%	
^N225	Long	01-09-2017	04-09-2017	-0.93%	-1019.92	8595.05
		19691.47	19508.25		-0.93%	
^N225	Long	11-09-2017	17-11-2017	14.59%	15840.14	24435.19
		19545.77	22396.8		14.59%	
DJI	Long	29-11-2017	02-02-2018	6.60%	8213.83	32649.02
		23940.7	25521		6.60%	
DJI	Long	26-02-2018	28-02-2018	-2.65%	-3509.03	29140
		25709.3	25029.2		-2.65%	
DJI	Long	09-03-2018	13-03-2018	-1.30%	-1675.44	27464.56
		25335.7	25007		-1.30%	
^N225	Long	13-03-2018	20-03-2018	-2.67%	-3406.68	24057.88
		21968.1	21380.97		-2.67%	
^N225	Long	22-03-2018	23-03-2018	-4.51%	-5596.91	18460.97
		21591.99	20617.86		-4.51%	
^N225	Long	29-03-2018	29-05-2018	5.67%	6714.67	25175.64
		21159.08	22358.43		5.67%	
^NSEI	Long	08-06-2018	21-06-2018	-0.25%	-308.65	24866.99
		10767.65	10741.1		-0.25%	

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^NSEI	Long	09-07-2018	04-09-2018	6.15%	7678.71	32545.69
		10852.9	11520.3		6.15%	
^N225	Long	13-09-2018	11-10-2018	-1.01%	-1338.51	31207.19
		22821.32	22590.86		-1.01%	
^NSEI	Long	31-10-2018	07-01-2019	3.71%	4865.98	36073.17
		10386.6	10771.8		3.71%	
^N225	Long	15-01-2019	25-03-2019	2.05%	2792.39	38865.56
		20555.29	20977.11		2.05%	
DJI	Long	04-04-2019	01-05-2019	0.17%	239.47	39105.03
		26384.6	26430.1		0.17%	
^NSEI	Long	22-05-2019	14-06-2019	0.73%	1012.07	40117.1
		11737.9	11823.3		0.73%	
^NSEI	Long	04-07-2019	05-07-2019	-1.14%	-1590.38	38526.72
		11946.75	11811.15		-1.14%	
^NSEI	Long	20-08-2019	21-08-2019	-0.89%	-1236.01	37290.71
		11017	10918.7		-0.89%	
^N225	Long	23-08-2019	26-08-2019	-2.17%	-2982.15	34308.56
		20710.91	20261.04		-2.17%	
^NSEI	Long	26-08-2019	03-09-2019	-2.35%	-3157.35	31151.21
		11057.85	10797.9		-2.35%	
^NSEI	Long	06-09-2019	19-09-2019	-2.21%	-2892.32	28258.89
		10946.2	10704.8		-2.21%	
^NSEI	Open Long	20-09-2019	12-11-2019	5.47%	7012.36	35271.25
		11274.2	11890.6		5.47%	

Conclusion& Result

It can be concluded from the above study that Exponential Moving Average Crossover (EMA) technique can help the investors in getting positive returns from the market. More than 43% of investment decision were successful & managed to get good returns as well. EMA plays very vital role, when it comes to predict Nifty &BankNifty index future movement with good amount of returns as well. It also well defines risk management system & portfolio management system. In future we can direct our research work A potential direction is understanding new dimensionsof optimization on Multi time frame analysis or Wave Theory. In future we can further develop this strategy to get best results with defined market conditions & enhance prediction ability with a zeal to buy & sell at right time & at right price with right stop loss.

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