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PICKING BUY-SELL SIGNALS: A PRACTITIONER'S PERSPECTIVE ON KEY TECHNICAL INDICATORS FOR SELECTED INDIAN FIRMS

TALWAR SHALINI
K J Somaiya Institute of Management Studies and Research, Vidyanagar, India

SHAH PRANAV
K J Somaiya Institute of Management Studies and Research, Vidyanagar, India

SHAH UTKARSH
K J Somaiya Institute of Management Studies and Research, Vidyanagar, India

Abstract:
The purpose of this study is to undertake technical analysis of selected companies included in the S&P CNX Nifty 50, a leading stock market index in India. We have used the stock price data of twenty leading listed firms in India for a period from January 1, 2012 through December 31, 2017. We have applied Guppy Multiple Moving Average (GMMA), Moving Average Convergence Divergence (MACD), Stochastic Relative Strength Index (Stoch RSI) and Average Directional Index (ADX) to Heikin Ashi charts to back test and provide entry and exit points for the players in the stock market. Analysis of the price information has revealed that the GMMA and ADX are effective indicators for most of the stocks under the study but they give late signals as compared to RSI and MACD. Further, the study has shown that though RSI and MACD give early signals, yet they are risky as the number of false signals generated by them is also found out to be quite high. The study is important as the findings can be used by investors, option traders and portfolio managers to get generate profitable trading signals and obtain good risk to reward ratios.

Key words: *ADX, GMMA, Heikin Ashi, MACD, S&P CNX Nifty 50, RSI*

1. Introduction

In the recent years, retail investors are more attracted towards share market as it requires small capital and has easy access. To make sound decision about which stocks to select in their portfolio, investors need to carry out analysis of stocks they are interested to invest in using formal techniques of security analysis. The two key methods of security analysis are fundamental and technical analysis. Fundamental analysis can be applied by

investors to help them identify potential multibaggers, but it does not give any clue about timing the entry in the market. Technical analysis, which includes a number of charts, indicators and oscillators is more useful in helping investors in identifying the right time to entry the market so as to increase their profits.

Many research analysts have come up with various technical tools and indicators like Moving Average Covergence and Divergence (MACD), Relative Strength Index (RSI), Bollinger bands and Average Directional Index (ADX) etc. to identify the entry and exit points to increase the profits from investing in stocks. However, all these tools do not give accurate results for all the stocks. It has been observed that some tools and indicators are quite accurate for certain stocks whereas they are quite ineffective for others. That's why, it is essential to identify which indicator works best for a particular stock. Further, indicators give false signal quite often so understanding conformational signals or indicators is also very important. Therefore, instead of only one, a pair of indicators and oscillators which match a particular stock's momentum should be used.

In this paper, we plan to apply selected technical analysis tools to the chosen stocks that are part of Nifty 50 with a view to identify the techniques that work best for trading in the identified stocks. We have applied four techniques, namely, Guppy Multiple Moving Average (GMMA), Moving Average Convergence and Divergence (MACD), Relative Strength Index (RSI) & Average Directional Index (ADX) indicators on Heikin Ashi Charts. These techniques have been short-listed on the basis of their popularity amongst traders. We have back-tested these indicators on the stock price data spanning a period from January 1, 2012 to 31st December 2017. The period from 2012 to 2017 is considered for the study because the markets had stable during this time. They had been extremely choppy since the onset of the subprime mortgage crisis of 2007–2008, popularly known as the global financial crisis and took time to recover and stabilize. The markets recovered fully only after 2011.

The findings of the study reveal that the GMMA and ADX are accurate for most of the stocks in generating the buy sell signals but they give late signals as compared to RSI and MACD. However, RSI and MACD have been found to give false signals more frequently, nullifying their accuracy and the reliability of the early signals given by them.

To the best of our knowledge, this kind of extensive back testing of key technical indicators for listed Indian stocks has not been undertaken before. The study is extremely important from the perspective of its practical orientation. It truly bridges the gap between theory and practice and provides valuable insights to investors, option traders and portfolio managers trading in the stock market to generate profit and enhance their wealth. It is a known fact that stocks comprising Nifty 50 are amongst the highest traded stocks in the country. The reason is that Nifty 50 stocks are considered to be the most liquid stocks and comparatively safe to invest in. The knowledge of the suitable tools to apply can help investors multiply their profits. Further, the selected stocks represent sectorial leaders from their respective sectors. Therefore, the study not only identifies the best suited tools for the chosen stocks but also provides a bird's eye view into the potential stocks that can be held in a well diversifies portfolio spread across wide range of sectors.

Rest of the paper is arranged as follows: section 2 provides a summary of research papers which are used to create a base for this study, followed by section 3

outlining the details of all the indicators and data used for the study. Data analysis and summary of results are given in section 4, discussion in section 5, implications of the study in section 6 and limitations of the study and the direction for future research in section 7.

2. Literature review

Many research papers have been published with respect to technical analysis. A large part of the existing studies are focused on usefulness of technical indicators and their accuracy. Most analysts and researchers have identified technical analysis as a key tool for traders to trade effectively in stock markets. The profitability of technical trading rules and indicators has continued to be thoroughly explored in the literature in the recent past.

Many existing studies have documented the success of technical analysis in profitable trading in financial markets, including those by Fama and Blume (1966), Gencay (1998), and Kestner (2003). Studies by Loh (2005) and Lento (2009) have argued that technical analysis can be more effective in benefitting from recurrent price patterns when indicators are combined together. Mohd. Nor et al. (2017) investigated the profitability of a very commonly used technical indicator, namely, moving average (MA) rules in the Bursa Malaysia around the global financial crisis (GFC) of 2008-2009 and found that MA rules performed differently before, during and after the crisis.

Pandya (2013) studied the use of technical analysis for trading in listed Indian IT (information technology firms. The indicators he used were EMA (exponential moving average), MACD, ROC(rate of change) and RSI. Nithya and Thamizhchelvan (2014) also studied MACD and RSI with respect to the banking sector stocks. Subramanian and Balakrishnan (2014) used refined MACD indicators to challenge the Efficient Market Hypothesis, which argues that it is not possible to beat the market all the time. Chong and Ng (2008) revealed through their study that MACD and RSI rules were effective in generating excess return in the London Stock Exchange. Metghalchi et al. (2012) investigated the profitability of some technical trading rules for 16 European stock markets with price data extracted from 1990 to 2006 period. They found that increasing moving average rules had good predictive power leading to profitable trading.

Rosillo et al.(2013) tested the RSI, MACD, momentum and stochastic rules on price data of listed Spanish companies with a view to give purchase and sale recommendations to small investors. In addition, the findings of the study solve the problems in case of ambiguity, in the indicators, for the traders. Gold (2015) used MACD, AROON, RSI, SO, OBV, and ADL to identify effective buy and sell signals. He concluded that the measures of performance of a stock were multi-dimensional and beyond return efficiency only. Bhargavi (2017) studied the effectiveness of RSI in Indian markets and found that RSI worked in Indian stock markets. Roy (2013) compared fundamental and technical analysis and discussed why market participants tend to prefer one over the other during different times. C. Boobalan (2014) also studied technical indicators of the securities of the selected companies to understand the price behavior of the shares, the signals given by them and the major turning points of the market price. Subramanian and Vikneswaran (2016) used three technical indicators, namely, MACD, RSI and the Stochastic Oscillator, to reveal that none of the indicator was reliable in giving out reliable

trading signal using the standard pre-set rules. They also found that RSI was better than the other two.

A review of literature shows that research related to efficacy of technical indicators is extensive but limited to a few indicators and/or companies. Identifying this gap in research, in the current study we propose to test a more comprehensive set of technical indicators on firms listed across various sectors over a time period which is more relevant from the perspective of future decision making.

3. Methods and data

3.1 Methods

Indian economy is currently one of the fastest growing economies of the world. The same is reflected in the Indian Stock Market. National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) are currently trading at their all-time highs. In order to capitalize on this growth investors, traders and portfolio managers should have the ability to time their entry in and exit from market effectively, that is, they should be able to identify signals indicating when to buy and sell a security. There are two main approaches that are used to analyze stocks from the perspective of buying or selling them. One is called fundamental analysis and the other is called technical analysis. Fundamental analysis involves the quantitative analysis of historical performance data to estimate the future earnings of stocks under consideration. Technical analysis relates to the study of price movements of stocks using charts and mathematical techniques to predict price trends. It includes a broad spectrum of tools like moving averages, support and resistance, rate of change indicators, Bollinger bands etc. The basic premise of technical analysis lies in the tenets of Dow's theory, which is a compilation of the collective market wisdom of Charles Dow and William Peter Hamilton. Though highly criticized, technical analysis is of great importance to both traders and investors as the value of assets is not fully expressed in prices. This means that the asset is yet to realize its intrinsic value giving an opportunity to gain profits.

In the current paper, we are back testing a combination of indicators to check whether they provide perfect signals with least false alarms. The basic underlying assumption of our analysis is to proceed only when two or more indicators confirm the signal. That combination of indicators has been considered most favorable for a particular stock which has given more uniform signals. False signals have also been critically analyzed to downgrade the concerned indicators accordingly. The period of analysis is divided into 2 parts, namely, 2012 to 2014 and 2015 to 2017 for performing detailed analysis of all indicators. The charts have been plotted using Heikien Ashi candles and four technical indicators, namely, Guppy Multiple Moving Average (GMMA), Moving Average Convergence Divergence (MACD), Stochastic Relative Strength Index (Stoch RSI) and Average Directional Index (ADX) have been used to generate and test buy and sell signals. All these are described below.

Moving Average Convergence Divergence (MACD)

The moving average convergence divergence (MACD) indicator is both momentum indicator and price based oscillator. MACD was developed by a legendary technician Gerald Appel in 1979 (Appel, 2005). It is a lagging indicator but works well in all stocks and futures. MACD actually consists of two lines that comprise three moving averages, namely, MACD line and 'the signal line'. The MACD and signal lines are derived as given below:

$$MACD\ line = 12day\ Exponential\ Price\ average - 26day\ Exponential\ Price\ average$$

$$SIGNAL\ line = 9day\ exponential\ average\ of\ MACD\ line$$

We have interpreted MACD indicator using following three methods:

1. Crossovers: A bearish signal is shown when the MACD falls below the signal line that shows that it is the time to sell. Also when the MACD goes above the signal line it shows a bullish signal and it is a time to buy the stock.

2. Divergence: When the price of the stock diverges from the MACD, it signals the end of the current trend. For example a rising stock price and a MACD is falling could mean that the rally is about to end. Conversely, if stock price is falling and the MACD is rising, it could mean that a bullish reversal could occur in the short-term.

3. D*ramatic rise*: When the MACD rises intensely, that is, the shorter moving average pulls away from the longer-term moving average, it is a signal that the security is overbought and will soon return to average levels.

Guppy Multiple Moving Average (GMMA)

This indicator developed by Daryl Guppy (Guppy, 2003) is based on relationship between two sets of moving averages, one with a shorter time frame and the other with a longer time frame. The set with a brief time frame determines the activity of short-term traders. The number of days used in determining the moving averages are usually 3,5,8,10,12 or 15. The other set with an extended time frame is used to gauge the activity of long-term investors. Generally 30, 35, 40, 45, 50 or 60 days moving averages are used for this set. A bullish trend is identified when short term moving averages are above long term moving averages). A bearish trend is identified when short term moving averages are below long term moving averages

Relative Strength Index (RSI)

RSI is momentum oscillator developed by Welles Wilder (Wilder, 1978) that measures the speed and change of price movements. This indicator is primarily used to identify the overbought and oversold conditions. The value of RSI oscillates between 0 and 100. RSI above 70 is considered to be overbought whereas RSI below 30 is considered to be oversold. RSI is calculated using the following formula

$$RSI = 100 - 100/(1 + RS)$$

Where

RS is Average Gain / Average Loss

Average Gain = Sum of Gains over period of past n days / n

Average Loss = Sum of Losses over period of past n days / n

The default number of periods suggested by Wilder is 14. Generally for short and medium term trades a 9 day RSI and 14 day RSI is used.

Average Directional Index (ADX)

ADX measures the strength of a trend, whether it is up or down, thus quantifies the trend strength. ADX was developed by J. Welles Wilder (Wilder, 1978). Its calculations are based on a moving average of price range expansion over a given period of time. This indicator has two directional movement indicators, one for upward movement (+DMI) and the other for downward movement (-DMI). ADX represents the average difference between the two DMIs. Rising values suggest that the trend's strength is increasing. An ADX value crossing above 25 is in a strong trend. As long as the price is trending, ADX should remain above 25. The default setting is 14 bars, although other time periods can be used. ADX is plotted as a single line with values ranging from 0 to 100. In general, the following rules (table 1) may be followed with regard to the ADX:

Table 1: Rules for ADX

ADX Value	Trend Strength
0-25	Absent or Weak trend
25-50	Strong trend
50-75	Very Strong trend
75-10	Extremely strong trend

ADX rising from 15 to 25 from lower levels means the trend is strengthening, while ADX above 30 indicates a strong trend. ADX at an extremely high level of 45 or above indicates a market in a strong trend with a consolidation expected anytime. After this if we see ADX declining below 30, it indicates a consolidation after a trending move. (Gujral, 2005)

3.2 Data

For carrying out back testing of technical indicators, we started with stocks that are components of Nifty 50 index in India. Nifty 50 is key index of National stock exchange (NSE). We decided to focus on stocks comprising Nifty 50 because index stocks have a highest market capitalization and they are major players in their respective sectors. Further, we obtained data related to the daily traded values of all Nifty 50 component stocks and filtered the top 20 stocks based on yearly weighted average and compared them to sectorial leaders It was found that using both these approaches, there were 15 common stocks, that is, there were about 15 stocks that had highest market capitalization in their respective sectors and were also Nifty 50 components. We have focused on sectorial leaders so that we are able to understand the efficacy of all indicators in the context of all key sectors. The list of sectors and stocks used for the study is given in table 2.

Table 2: Stocks and sectors selected for the study

Sr. No.	Sector	Company Name
1	Refineries	Reliance Industries Ltd.
2	Public Sector Unit Bank	State Bank of India
3	Commercial Pvt. Bank	ICICI Bank Ltd.
4	Information and Technology	Infosys Ltd.

5	Consumer Goods	Hindustan Unilever Ltd.
6	Housing Finance	Housing Development Finance Corporation Ltd.
7	Exploration	Oil & Natural Gas Corporation Ltd.
8	Power	NTPC Ltd.
9	Tobacco	ITC Ltd.
10	Automobile	Maruti Suzuki India Ltd.
11	Information and Technology	Tata Consultancy Services Ltd.
12	Pharma	Sun Pharmaceutical Industries Ltd.
13	Engineering & Construction	Larsen & Toubro Ltd.
14	Metal	Tata Steel Ltd.
15	Retail Pvt. Bank	HDFC Bank Ltd.
16	Non Ferrous Metals	Vedanta Ltd.
17	Cement & Cement Products	UltraTech Cement Ltd.
18	Telecom	Bharti Airtel Ltd.
19	Agricultural Products	UPL Ltd.
20	Coal	Coal India Ltd.

Our choice of study period from 2012 to 2017 is guided by the thought of incorporating data that represents genuine market movements and is not the outcome of outliers generated due to extraordinary events like the global financial crisis of 2008. Usually, in the wake of a crisis, the markets take 3-4 years for complete stabilization and for the new business cycle to begin. The impact of the crisis reverberated till about 2010 and then commodity bubble crisis and sovereign debt crisis of Europe also impacted the markets just before 2012. Thereafter, things began to settle down. So we have started our analysis from a stable phase of 2012 and ended it to the recent period of 2017. We have obtained all our data from the website of national stock exchange (https://www.nseindia.com/)

The chosen stocks have been analyzed using weekly charts as the trades are for medium to long term perspective. The charts used for the analysis are obtained from paid account of Zerodha Securities Pvt. Ltd. for the purpose of this study.

4. Data Analysis and Summary of Results

4.1 Reliance Industries Limited (RIL)

We have first analyzed all four indicators for RIL. When long term moving averages (red lines) and short term moving averages (green lines) in GMMA are very close to each other, it indicates a choppy stock and it is not advisable to trade in these conditions. This is clearly seen in RIL from July 2012 to March 2014. In April 2014, we can see a clear uptrend as indicated by GMMA, MACD and ADX. MACD shows early reversal signals that are followed by GMMA and ADX. For the second period of the study, the choppy movements in RIL continued till early 2017. In Feb 2017, we can see a huge break-out. GMMA, MACD and ADX, all confirmed the breakout at almost the same time. Directional strength grew from 16 to 47 during this period confirming very strong uptrend. Long term investors are still holding their positions showing no early signs of reversals.

Chart 1: Reliance Industries Limited: 2015-2017

Source: Zeroddha Securities Pvt. Ltd.

4.2 State Bank of India

SBI was in consolidation phase from early 2012 to mid-2013. In May 2013, MACD and ADX both gave a sell signal, confirmed by GMMA and the stock went down. After this it went into consolidation phase from October 2013 to March 2014. In March 2014, MACD and ADX gave a strong buy signal. This rally continued but had few minor corrections which were show by RSI. For the second period of the study, the rally continued till February, 2015 after which MACD gave a sell signal confirmed by ADX and GMMA too. The stock actually went into bear run thereafter. In April 2016, MACD gave a strong buy signal and it was confirmed by ADX and GMMA again. The rally stopped in July 2016 and the stock went down. This was indicated by all indicators. Further, in the next 2 months every indicator again gave a buy signal and the stock also actually went up thereafter.

Chart 2: State Bank of India: 2015-2017

Source: Zeroddha Securities Pvt. Ltd.

4.3 ICICI Bank

In July 2012, ICICI started an uptrend which continued till July 2013. It went into consolidation phase later. In September 2013, RSI weakened to a level of 20 which gave a good buy signal. This was later confirmed by MACD, ADX and GMMA respectively. The uptrend continued till early 2015 after which MACD and ADX gave a sell signal. For the second period of the study, GMMA gave a very late sell signal. The downtrend continued for almost a year and a half following which RSI and MACD simultaneously gave a strong buy signal which was later confirmed by ADX. GMMA was a lagging indicator here. As indicated, the stock continued to be in uptrend with minor corrections.

4.4 Infosys

From early 2012 to early 2013, Infosys was a range bound stock. In July 2013, MACD and ADX gave a buy signal which was later confirmed by GMMA. From that point till late 2014 the stock was in uptrend as indicated by technical analysis. MACD and RSI gave a false reversal signal in late 2014 but the reversal trend was short-lived. The stock continued its uptrend with minor corrections till mid-2016. In July 2016, MACD followed by ADX and GMMA gave sell signal for the stock. RSI also showed weakening trend. The stock behaved as expected. The downtrend continued till end 2017 and again reversal signal was shown for the stock, firstly through MACD followed by ADX and GMMA. The stock continued to be in uptrend.

4.5 Hindustan Unilever

We can see that HUL was in uptrend which continued till early 2013. There were minor corrections and the stock went down after that. In May 2013, all the indicators gave a buy signal and RSI also showed strength. As soon as RSI was overbought, the stock started its downtrend. In May 2014, the stock again showed uptrend through all the indicators.

The uptrend continued till October 2015, after which the stock went into a consolidation phase till early 2017. In January 2017, MACD showed a buy signal which was later confirmed by ADX and GMMA simultaneously, after which the stock continued to be in uptrend. Though RSI gave some good indications for the stock, it also gave many false alarms.

4.6 HDFC Limited

Since July 2012, the stock was in continuous uptrend. All the indicators gave a buy signal in July 2012. With minor corrections in the uptrend, the stock behaved as confirmed by the technical indicators and reached new highs. After uptrend for 2 years, the stock was in a consolidation phase in late 2015 to early 2016. In April 2016 all the indicators again gave a buy signal. The stock rose as expected. In October 2016, MACD showed a trend reversal which was later confirmed by ADX and GMMA in November 2016. The reversal trend did not last long and the stock continued its uptrend.

4.7 HDFC Bank

There were no signals generated in the stock by any of the indicators during the first period of the study.

As HDFC and HDFC Bank are twin stocks, they normally move in tandem. This is also confirmed through their charts. Here RSI has shown a false overbought signal from April to October 2017.

4.8 ONGC

ONGC in 2012 to 2013 was range bound between 170 and 200. In early 2013 MACD and GMMA showed breakout. RSI as well as ADX confirmed the uptrend. The trend continued till August 2013 and GMMA as well as MACD gave reversal signals. Again after being range bound, there was a break out in March 2014. All the indicators confirmed the trend. In late 2014, MACD gave early reversal signal which was later followed by ADX and GMMA. In the second period of study too MACD showed early reversal signals in late September 2014, which was confirmed by GMMA in early 2015. RSI also showed overbought condition along with MACD. ADX showed reversal signals in tandem with GMMA. Long-term investors were having sell positions as clearly indicated by GMMA. MACD showed early reversal signal in October 2015 but it was only the secondary trend and the primary downtrend continued till October 2017.

4.9 NTPC

In April 2012, MACD, ADX and GMMA simultaneously gave a sell signal and the stock continued to plunge till April 2013 with frequent minor corrections. In April 2014, all indicators gave a reversal signal but the reversal was short-lived and the stock went into a consolidation phase. In late 2014, all the indicators gave a buy signal but the uptrend was short-lived. Then in June 2016, all indicators again gave a buy signal and the stock went into uptrend till 2017 end, with few minor corrections.

4.10 ITC

From 2012 onward, the stock has been uptrend as confrimed by ADX and MACD. GMMA showed that the long-term investors were holding their positions while the short-term investors had started to enter. There were few minor corrections in October 2013, but the uptrend was held firm by the long-term investors. The stock broke out of its range boundedness of 200-250 in early 2017. This was first confirmed by MACD followed by GMMA. ADX did not give any signals for ITC. Also, since the stock was range bound for 3 years, RSI was not of great help. However, MACD and GMMA gave good signals for ITC.

4.11 Maruti

Since the long-term and the short-term moving averages of GMMA were very close to each other from early 2012 to September 2013, Maruti was in a choppy phase during that period. In September 2013, RSI first showed a buy signal which was confirmed by MACD, GMMA and ADX later. The stock remained in uptrend since then. RSI gave some false sell signals in late 2014. The stock again went into a consolidation phase after the previous uptrend till early 2016. In February 2016, RSI weakened and gave a buy signal which was then confirmed by MACD and later by ADX and GMMA simultaneously. It again went into an uptrend from that period onwards till the end of 2017, with some minor corrections occurring at frequent intervals of time. These minor corrections were confirmed by RSI.

4.12 TCS

TCS was in slight uptrend from 2012 to 2013. After that it picked up but was not able to continue its rise. MACD and ADX gave a sell signal. GMMA always had a buy signal. In July 2013, ADX gave a buy signal, confirmed by MACD too. The uptrend with minor corrections continued till October 2014, after which both ADX and MACD gave a sell signal. Since 2015, the stock was in a consolidation phase and range bound quite

noticeably. The secondary trends governed the stock movement. MACD and ADX gave a sell signal in October 2015 which was confirmed by GMMA too. Then in April 2016, MACD and ADX gave a buy signal which was confirmed by GMMA later. That trend continued till October and then the stock was range bound again. In July 2017, it started showing strength and reached new highs.

4.13 Sun Pharmaceutical

There was a beautiful bull rally of all pharma sector stocks which started from 2012 and continued beyond 2014. GMMA persistently signaled that the bulls were in control, with no longer moving average getting crossed by short-term average. There were minor corrections, which were clearly indicated by RSI going into overbought region. Other than that, there were no major signal by MACD and ADX. The rally of Sun pharma stock came to an end in April 2015. RSI gave the first sell signal, followed by MACD and ADX. GMMA also confirmed the same. This started the bear run for the stock. Till October 2017, there was no buy signal. After that, MACD gave the first buy signal and later ADX gave the same signal. If GMMA short-term averages cross the long-term ones, a clear buy signal would be generated.

4.14 Larsen & Toubro

L&T was in choppy phase from early 2012 to late 2014, with some major movements in late 2013. In September 2013, RSI showed a weakening strength and gave a buy signal which was later confirmed by MACD, ADX and GMMA respectively. MACD then gave reversal signal but the downtrend was temporary and the reversal signal was not confirmed through GMMA. The stock maintained its uptrend till late 2014. The uptrend in the stock continued till September 2015 when MACD, GMMA and ADX showed reversal signals together. The stock price behaved as indicated. The downtrend continued till April 2016, when MACD first indicated a buy signal which was confirmed by GMMA and ADX much later. Another buy signal was indicated by all the 3 indicators simultaneously in March 2017 and the stock conformed by going into an uptrend that continued till the end of 2017.

4.15 Tata Steel

Tata Steel was in primary downtrend that went on till August 2013. RSI showed that the stock was oversold. This was also confirmed by MACD and ADX. After this, as anticipated, the stock started moving up. In October 2014, MACD showed the first reversal signal followed by ADX and GMMA. The stock price fell as indicated and the downtrend continued even in 2015.Till 2016, the stock was facing a downward pressure and it continued to go down. In March 2016, MACD and ADX gave a strong buy signal. Even GMMA gave a similar buy signal. The signals were accurate and the stock rose. After a breakout, there was no looking back and the stock did not give any reversal signal till the end of 2017. Though RSI went into overbought zone for some time, yet it cool down quite soon.

4.16 Vedanta Ltd.

The stock was in a downtrend since 2012, with no signs of reversals. In August 2013, MACD gave a buy signal which was confirmed by ADX. Even GMMA gave a buy signal later. The stock went into consolidation phase and again started its uptrend in May, 2014. MACD gave a sell signal in September 2014, which was followed by ADX. GMMA

gave a late signal. RSI gave a sell signal too, but after the stock shoot up. The downtrend in the stock continued till October, 2015. After that, the stock went into a consolidation phase. RSI and MACD both gave a reversal signal. The stock started rising in April 2016, which was signaled by ADX and MACD. GMMA confirmed the same in August 2016. After that there was no looking back and the stock started scaling new highs.

4.17 Ultra tech Cement

Ultratech Cement was in uptrend since 2012. In early 2013, it went through a consolidation phase which was clearly pointed out by MACD and later by ADX. RSI also showed that the stock was in overbought region. It went into reversal cycle in July 2013 and then started consolidating again. In late 2013, there was a buy signal on MACD and then ADX, which was confirmed by GMMA. As indicated by these indicators, the stock rose and reached new highs in 2014. In mid-2015, the stock showed a loss of strength and it started coming down. It consolidated with a few secondary trends. In March 2016, MACD and ADX gave a good buy signal. This was confirmed by GMMA too. The stock rose as anticipated and the uptrend continued till November 2016, after which the downtrend started. By early 2017, the stock bottomed-out and gave a buy signal on each indicator. As indicated jointly by all indicators, the stock rose and it continued its uptrend in 2017.

4.18. Bharti Airtel

In January 2012, ADX gave a buy signal while MACD and GMMA did not show any similar signals. So if someone bought just using ADX, he would have hit the stop loss as the stock actually fell. After the downfall, Airtel was in consolidation phase from early 2013 to March 2014. In April 2014, MACD and ADX gave a buy signal which was later confirmed by GMMA. The trend continued till October 2014 which can be seen from the confirmation of ADX and MACD. GMMA was yet to give any signals. RSI gave a very early overbought signal. In July 2015, MACD and ADX gave a sell signal, GMMA confirmed the same later. RSI also showed lesser strength in the stock. The trend actually continued till early 2017 after which MACD was the first one to show a buy signal followed by ADX and GMMA respectively and the uptrend continued till the end of 2017. We observe that only one indicator did not give true indications for Airtel. Combinations gave the best of the results.

4.19. United Phosphorous Ltd.

The stock was range bound for around one and half year since 2012. In April, 2013, MACD, GMMA and ADX gave a strong buy signal. After this the stock actually skyrocketed and tripled its value. There were few healthy corrections and RSI came in overbought zone but the stock then cooled down and continued its uptrend. The uptrend continued till July, 2015 after which MACD gave a sell signal. This was confirmed by ADX too. But it was just a minor correction in long uptrend. The stock again started picking up in May 2016. The rally continued till Aug 2017 and the reversal signals came up. MACD and ADX both gave a sell signal. But it looks like it was just the correction and not a reversal in trend.

4.20. Coal India

Coal India was mainly in range bound state till December 2012. In early 2013 it gave a sell signal through MACD followed by ADX and GMMA. There were few false signals provided by MACD but the trend reversal started in April 2014. ADX as well as GMMA gave a buy signal. After that, the stock hit it high for the period. Again a false sell

signal was given by MACD. RSI also showed the same. The previous uptrend continued till July 2015 after which it gave a sell signal through all the indicators. With minor fluctuation and false alarms by all the indicators, the downtrend continued till October, 2017. MACD and ADX then gave a buy signal. So we can see that for from period of 2016 to 2017, Coal India's price did not conform to any of the technical indicators tested here.
We have not shared all graphs to save space. They are readily available, in case readers want to refer to them.

5. Discussion

In the current study, we have attempted to test whether a combination of all or few of the four most popular technical indicators, namely, ADX, RSI, MACD and GMMA are accurate, time and again, in predicting price behavior of stocks. It has been observed in the past, somewhat inexplicably, that some indicators are very efficient in predicting trend for certain stocks but they give false alarms for other stocks, more frequently than not. It would be very useful to know how reliable these indicators are for few of the most traded stocks in India. We have tested the accuracy of the indicators both, individually and in combination, for post-facto price data of shares of 20 leading firms in the country for a period from 2012 till 2017. Each instance of cross-over, divergence and concurrence has been documented to form a view on the reliability of these indicators for taking trading positions in the selected stocks. On the basis of our extensive analysis, we have rated each indicator on its efficiency in correct buy-sell signals. We have used a 5-point Likert-like scale to rate the indicators based on their accuracy. 5 being the most accurate and 1 being the least accurate indicator which is prone to give frequent false alarms for the given stock. The outcome is documented in table 3.

Table 3: Accuracy of technical indicators on 5-point rating scale

STOCK	GMMA	MACD	ADX	RSI
RIL	4	4	4	2
SBI	3	4	4	3
ICICI BANK	4	4	4	4
INFOSYS	3	3	4	2
HUL	3	3	4	4
HDFC	4	3	3	1
ONGC	5	4	4	3
NTPC	3	3	3	1
ITC	4	3	4	3
MARUTI SUZUKI	3	3	3	4
TCS	3	3	3	3
SUNPHARMA	3	2	2	4
L&T	4	4	4	3
TATA STEEL	4	4	4	3
HDFC BANK	4	3	3	1
VEDANTA	3	3	3	2
ULTRATECH	4	5	5	3
AIRTEL	4	4	3	2
UPL	3	4	3	2
COAL INDIA	3	2	3	2

6. Implications of the study

The study is focused on technical analysis, which is very popular among traders, investors and portfolio managers trading in equity market with a view to earn profit and create wealth. Technical analysis involves use of charts, trends and mathematical indicators generated on past price data to draw clues about future price movement. As profit from any trade depends on the difference between the prices at which a stock is bought and then sold, timing the entry and exit is the key. Technical analysis, though quite appealing is very challenging to apply. There is a plethora of indicators and even the most experienced traders can become quite confused. We have tried to resolve this confusion through our study by extensively analyzing and documenting the efficacy of ADX, MACD, RSI and GMMA in accurate indicating the upcoming trend. The findings of the study confirm that various players in the stock market need not worry about using to many indicators to determine profitable entry and exit points. They can rely on a combination of GMMA, MACD and ADX for RIL, MACD and ADX for SBI, all four for ICICI Bank and so on for rest of the stocks selected for the study. The basis is to go with indicators that have 4 and 5 ratings. These implications are extremely valuable and can strengthen the hands of practioners seeking to trade successfully in stock markets in India.

7. Limitations of the study and the direction for future research

The study offers deep insights into tools for trading successfully in stock markets in India. However, the study has certain limitations. First limitation is that the very premise of the study makes it extremely specific and it cannot be generalized for all stocks. Though we have identified sectorial leaders in terms of market capitalization, no sector related conclusions can be drawn. The other limitation is that the scope of study is limited to 20 stocks only. Adding more stocks would further increase the utility of the study. Yet another limitation is that we have used a practitioners' perspective and based our analysis solely on testing signals generated by the indicators. No econometric tool is applied. Only technical indicators are calculated and evaluated.

The study can be taken further by future researchers by testing it for other stocks and trying to draw some sector-specific conclusions. They can also go deeper in the history to make their analysis more robust. Further, periods of crisis can be identified and the researchers can analyze if the accuracy of indicators stands the stress of fluctuations or it is valid only during the periods of stability.

8. References:

Appel, G. (2005): *Technical analysis power tools for active investors*, F T Press: Upper Saddle River, New Jersey, pp.166.

Bhargavi, R. Gumparthi, S., Anith, R., (2017), *Relative strength index for developing effective trading strategies in constructing optimal portfolio*, International Journal of Applied Engineering Research, Vol.12, no.19, pp. 8926-8936.

Boobalan, C., (2014), *Technical analysis in select stocks of Indian companies*, International Journal of Business and Administration Research Review, Vol. 2, no.4,pp. 26-36.

Chong, T.T.L, Ng, W. K., (2008), *Technical analysis and the London stock exchange: Testing the MACD and RSI rules using the FT30*, Applied Economies Letters, Vol. 1, no. 15, pp. 1111–1114.

Fama, E. F., Blume, M. E., (1966), *Filter Rules and Stock-Market Trading*, The Journal of Business, Vol.39, no.S1, pp. 226. doi:10.1086/294849.

Gençay, R., (1998), *Optimization of technical trading strategies and the profitability in security markets,* Economics Letters, Vol.59, no.2, pp. 249–254. doi:10.1016/s0165-1765(98)00051-2.

Gold, S.,(2015), *The Viability of six popular technical analysis trading rules in determining effective buy and sell signals: MACD, AROON, RSI, SO, OBV, and ADL,* Journal of Applied Financial Research, Vol.1, no.1, pp. 8-27.

Gujral, A., (2005), *ADX: the key to market trends,* Futures, Vol. 34 , no.6, pp. 34-36.

Guppy, D,(2003). *Trading with Guppy Multiple Moving Average*, available online at https://www.forexfactory.com/attachment.php/57918?attachmentid=57918&d=1184830389

https://doi.org/10.1080/00036846.2010.543084.

Kestner,L.,(2003): *Quantitative trading strategies: harnessing the power of quantitative techniques to create a winning trading program*, McGraw-Hill Trader(TM)s Edge Series, United States.

Lento, C.,(2009), *The combined signal approach to technical analysis: A review & commentary*, available online at SSRN: https://ssrn.com/abstract=1410899

or http://dx.doi.org/10.2139/ssrn.1410899

Loh, E. Y. L, (2005), *A comparative study of technical trading rules, time–series trading rules and combined technical and time–series trading strategies in the Australian Stock Exchange*, The University of Western Australia, Doctoral thesis, available online at http:// repository.uwa.edu.au/dtl_pub-lish/Theses/44/6762.html

Metghalchi, M., Marcucci, J., Chang, Y. H., (2012), *Are moving average trading rules profitable? Evidence from the European stock markets*, Applied Economics, Vol.44, no.12, pp.1539-1559.

Mohd. Nor, S., Wickremasinghe, G., (2017), *Market efficiency and technical analysis during different market phases: Further evidence from Malaysia*, *Investment Management and Financial Innovations*, Vol.14, no.2,pp. 359-366. 10.21511/imfi.14(2-2).2017.07.

Nithya, J., Thamizhchelvan, G.,(2014), *Effectiveness of technical analysis in banking sector of equity market*, IOSR Journal of Business and Management, Vol.16, no.7, pp. 20-28.

Pandya, H., (2013), *Technical analysis for selected companies of Indian IT sector*, International Journal of Advanced Research, Vol.1, no.4, pp. 430-446.

Rosillo, R., de la Fuente, D., Brugos, J. L., (2013), *Technical analysis and the Spanish stock exchange: Testing the RSI, MACD, momentum and stochastic rules using Spanish market companies*, Applied Economics, Vol. 45, no. 12, pp. 1541-1550. doi:10.1080/00036846.2011.631894.

Roy,S., (2013), *Equity research: Fundamental and technical analysis*, International Journal of Science and Research, Vol.4, no.9,pp. 272-275.

Subramaniam, P., Vikneswaran, M., (2016), *A study of financial indicators' reliability in technical analysis*, European Academic Research, Vol.4, no.8, pp. 6805-6834.

Subramanian, V., Balakrishnan, K. P., (2014), *Efficacy of refined MACD Indicators: Evidence from Indian Stock Markets,* IUP Journal of Applied Finance, Vol. 20, no. 1, pp. 76-91.

Wilder, J. W. Jr., (1978): *New concepts in technical trading systems*, Trend Research, Greensboro, N.C.