Forecasting Stock Trend Using Technical Indicators with R

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Abstract- **Technical analysis is a well proven method in monitoring the price action of free markets that have broad participation in order to gain insight into the future price trend. This paper attempts to study on the effectiveness of several technical indicators on share trading to assess the company financial performance over period of time. The major technical indicators in Technical analysis includes Moving Averages, Moving Average Convergence/Divergence, Average Directional Index, Trend Detection Index, Aroon Indicator, Vertical Horizontal Filter, Relative Strength Index, Stochastic, Stochastic Momentum Index, Williams %R, Commodity Channel Index, Chande's Momentum Oscillator, Bollinger Bands, Average True Range, Donchain Channel, Chaikin Money Flow, On balance Volume and Money Flow Index. This study will help the investors to gain knowledge about the usage of these technical indicators so as to increase their proportion of profitable trading and improve investment returns.**

Keywords - technical indicators, trend, momentum, volatility, volume, charts, price trend

1. INTRODUCTION

Forecasting the trend of future stock prices is most widely studied topic in many fields including stock trading, finance, statistics and computer science. The motivation behind the forecasting is naturally to predict the direction of future prices such that stocks can be bought and sold at profitable positions. The methods used to analyze securities and make investment decisions fall into two very broad categories: fundamental analysis and technical analysis (Larsen, 2007). The fundamental analysis is traditional approach that attempts to determine a security's value by focusing on underlying factors that affect a company's actual business and its future prospects. The technical analysis, on the other hand, is the evaluation of securities/assets by means of studying statistics generated by market activity, such as past prices and volume. Therefore, technical analysis is the analysis of human mass psychology and it is also called behavioral finance. Experts of technical analysis study price charts for price patterns and use price data in different technical indicators assessment to forecast future price movements. The technical analysis paradigm is thus that there is an inherent correlation between price and company that can be used to determine when to enter and exit the market.

Despite all kind of exotic tools in stock market, technical analysis really studies supply and demand in a market in an attempt to determine what direction, or trend, will continue in the future (Dahlquist, 2011). Furthermore, technical analysis attempts to understand the emotions in the market by studying the market itself. If we are able to understand the benefits and limitations of technical analysis, it can give a direction or skills that will enable us to be a better trader or investor in stock market.

Also, technical analysis is all about studying stock price graphs and a few momentum oscillators derived thereof. It must be understood that technical studies are based entirely on prices and do not include balance sheets, P&L accounts, the assumption being that the markets are efficient and all possible price sensitive information is built into the price graph of a security/index (Larsen, 2007). In this paper, we are discussing major technical indicators which are using most predominately and study its performances in trend analysis.

2. REVIEW OF LITERATURE

The Dow Theory laid the foundations for the modern technical analysis (Theory, 2015). Of the many theorems put forth by Dow, three stand out: Price Discounts Everything (www.ifcmarkets.com, 2013), Price movements are not totally random and "What" is important than "Why". Technical analysts believe that the current price fully reflects all information. Because all information is already reflected in the price, it represents

the fair value, and should form the basis for analysis. Most of earlier research studies on technical analysis focused on selective indicators and limits themselves with five/six indicators in their study.

The applicability of certain computational measures like Beta calculation, Relative Strength Index and Simple Moving average (R, 2011) were discussed in stock analysis and also suggested various factors like Government of India budget, company performance, political and social events, climatic conditions etc., are to be considered before any decision is made in stock trading.

The effectiveness of technical tools like Relative Stock Index (RSI) and chart patterns (Dhutti, 2014) were discussed elaborately in taking the investment decisions whether to buy or sell the stocks of five IT companies viz: Tata Consultancy Services (TCS), Infosys Limited, Wipro, Hindustan Computers Technologies Limited (HCL), Satyam Computers Limited (now Mahindra Satyam) of IT sector during the period of Jan-Dec 2012. Further the author illustrated how statistical methods like coefficient of variation and beta are used to analyze the risk and return relationship of security with the market. Four enriched technical indicators- Relative Strength Index, Bollinger Bands, Moving Average Convergence/Divergence and Simple Moving Average (Vasantha S, 2012) used to take a decision on whether to buy or sell the stocks of the IT sector. Also it was observed that Moving Average Convergence Divergence (MACD) value helps to identify the scripts that are technically strong or not (V, 2015)and also showed that how MACD facilitates investors to recognize the current trend and risks associated with the script at par with the market. He also confirmed that technical analysis can be used neither the bull side nor the bear side of the stock market, but it is only the right side of the stock market when to buy/sell the script.

In recent study on major technical indicators conducted by (C, 2014) revealed that Candlestick chart, Exponential Moving average, RSI, MACD indictors are very helpful in making decisions to earn profit while selling/buying stocks of five companies Wipro, SBIN, Gail, ONGC and ITC. The authors (Zhu, 2014)explained the effectiveness of the derived technical indicator called volume weighted moving average (VWMA) against Moving average value. Further he endorsed that need for inclusion of volume information to technical indicators and its advantages over various matters like issuing of more trading signals, increasing the proportion of profitable trading, reduction in the average draw down, and improving investment returns etc., A study was conducted on selected stocks from Thai stock market data and performed clustering analysis on that data and identified that a group of stocks that has the best trend and further the study highlighted that momentum characteristics of these stocks indicates the outperformance of the market will be more during a short time period (Peachavanish, 2016).

Based on the survey of research work done by various authors , we observed that limited technical indicators alone used in their study and the role of other reliable stock market technical indicators are not discussed so for. As a result, the following objected are framed.

- To study the effectiveness of major technical indicators in Indian stock market.
- To analyze the TVS Motor stock of NSE Mid Cap using technical indicators.
- To make clear picture of market behavior by using Technical indicators so as to increase their profit.

3. METHODOLOGY

Technical analysis refers to a broad field and the list of technical market indicators is almost infinite. Hence it is grouped under four categories such as Trend indicators, Momentum indicators, Volatility indicators and Volume indicators (mwlibtoolkit, 2011). Each indicator dominates the other in predicting the trend of different types of stocks. For example, RSI may lead WPR in predicting trend of TVS Motor Stock and WPR may lead RSI in predicting trend of Tata Motors Stock. This study aims at analyzing the impact of major 22 technical indicators altogether on NSE Mid Cap Stock TVS Motor. Six months daily data of TVS Motor of NSE Mid Cap index from January 2010 to June 2010 is used in this study. TVS Motor OHLCV (Open, High, Low, Close, Volume) is retrieved from NSE websites and yahoo finance (TradingGeek, 2014). Twenty two technical indicators are derived from OHLCV (Ulrich, 2016) are used in our case study. The gorgeous effect of 22 technical indicators which are available in TTR package is explained in an unsophisticated manner in predicting trend of the market. As the study describes about each indicators and its uses, investors can use this as

a reference in making decisions whether to buy or sell stocks, thereby increase their profit in their investment. They can also observe combination of these indicators such as Trend, Momentum, Volatility indicators to make accurate decisions.

Fast and flexible technical analysis can be done with TTR package in R (TradingGeek, 2014). Performance of all technical indicators against data set is depicted in 2-D plot. R is a language and environment for statistical computing and graphics. R provides a wide variety of statistical and graphical techniques, and is highly extensible. R Packages is also easy to learn and have all dependencies being installed automatically. The graphical capabilities of R are outstanding, providing a fully programmable graphics language that surpasses most other statistical and graphical packages. Because R is open source, unlike closed source software, it has been reviewed by many internationally renowned statisticians and computational scientists. The brief details of all technical indicators in each group are explained below.

3.1. Trend Indicators

Trend indicators are used to measure the direction and strength of a trend using some form of price averaging to establish a baseline. As price moves above the average, it is a buy signal. If it moves below the average, it is a sell signal.

3.1.1. Moving Averages

Moving Averages are very popular indicators of technical analysis *(Larsen, 2007)*. These measures are used to eliminate noise and identify trends by smoothing the data. It is broadly used because of its simplicity and possibility to combine several moving averages together. There are different types of moving averages - Simple moving average, Exponential moving average, Weighted moving average, Double Exponential Moving Average and Volume Adjusted Moving Average *(TradingGeek, 2014)*.

Simple Moving Average(SMA):Simple moving average gives all the days equal weight. It is the main disadvantage of Simple moving average.

$$SMA = \frac{\sum_1^n price}{n} \tag{1}$$

Exponential Moving Average (EMA): Exponential moving average, unlike SMA gives higher priority to the actual data. The current values get higher importance in the EMA calculation compared to the furthest ones.

$$EMA = EMA_{(-1)} + K x \left(input - EMA_{(-1)}\right) \text{ where } K = \frac{2}{(n+1)} \tag{2}$$

Weighted Moving Average (WMA): Weighted Moving average gives higher importance to actual days and lower importance to the furthest days usually. But the trader has to take decision which day should be more or less significant.

$$WMA = \frac{price \times n + price_{(-1)} \times (n-1) + price_{(-2)} \times (n-2) + \cdots price_{(-(n-1))} \times (1)}{n!} \tag{3}$$

Double Exponential Moving Average: Double Exponential Moving Average follows the price graph closer than most of other moving averages, so the lag is lower and the curve is not so choppy.

$$DEMA = 2 \times EMA(n) - EMA\left(EMA(n)\right) \tag{4}$$

Volume Adjusted Moving Average(VAMA): The Volume Weighted Moving Average is a weighted moving average that uses the volume as the weighting factor, so that higher volume days have more weight. It is a non-cumulative moving average, in that only data within the time period is used in the calculation.

$$VAMA = \frac{\sum_1^n price \times volume}{\sum_1^n volume} \tag{5}$$

In all moving averages, when close price is above its moving average then it indicates buy signal, when it is below its moving average it signals to sell. The price and moving average will be frequent so the moving average curve can be followed, if it is rising, it is a buy signal else it is a sell signal.

3.1.2. Moving Average Convergence/Divergence (MACD) Indicator:

MACD was proposed by Gerald Appel. MACD is a momentum oscillator that indicates the dynamics and strength of the current trend and oscillates around the zero line in both directions. MACD consists of three moving averages. Their normal settings are 9, 12 and 26 *(V, 2015)*.Zero Line Crossover - The strategy is to buy when the MACD crosses above the zero line, and sell when the MACD line crosses below the zero line. Signal Line Crossover – The strategy is to buy when the MACD line crosses above the signal line else sell.

$$\text{MACD line} = 12 \text{ day EMA} - 26 \text{ day EMA} \tag{6}$$
$$\text{Signal line} = 9 \text{ day EMA of MACD line}$$
$$\text{Where EMA} = \text{Exponential Moving Average}$$

3.1.3. Average Directional Movement Index (ADX)

The Average Directional Index (ADX) was developed by Welles Wilder *(Labs, 2016)*. TheADX is used to measure the strength or weakness of a trend, not the actual direction. Directional movement is defined by +DI and -DI. The indicators, Plus Directional Indicator (+DI) and Minus Directional Indicator (-DI), complement ADX by defining trend direction. The +DI is the percentage of the true range that is up. The -DI is the percentage of the true range that is down.Used together, chartists can determine both the direction and strength of the trend. The strategy is to buy when +DI is greater than –DI and the strategy is to sell when -DI is greater. Crosses of these directional indicators can be combined with ADX form a complete trading system. The trend is strong when ADX is above 25 and no trend is present when below 20. There appears to be a gray zone between 20 and 25. The values range from 0 to 100, but rarely get above 60. High value of ADX indicates a strong trend and low value indicates a weak trend.

$$\text{ADX} = \frac{\text{ADX}_{(-1)} \times (n-1) + DX}{n} \qquad DX = \frac{(+DI) - (-DI)}{(+DI) + (-DI)} \tag{7}$$

3.1.4. Trend Detection Index(TDI)

The trend detection index (TDI) is used to detect when a trend has begun and when it has come to an end. The TDI can be used as a stand-alone indicator or combined with others; it will perform well in detecting the beginning of trends *(Labs, 2016)*. An uptrend is signaled by a positive direction indicator value, whereas a downtrend is signaled by a negative value. If both TDI and direction indicator are positive it is a buy signal and if the TDI is positive and the direction indicator is negative, it is a sell signal.

$$20 - \text{day Trend Detection Index(TDI)} = (\text{AV20}) - \{(\Sigma \text{ AM40}) - (\Sigma \text{ AM20})\} \tag{8}$$
$$\text{where, AV20} = \text{absolute value of the sum of } 20 - \text{day momenta of the last 20 days}$$
$$\Sigma \text{ AM40} = \text{Sum of } 20 - \text{day absolute momenta of the last 40 days}$$
$$\Sigma \text{ AM20} = \text{Sum of } 20 - \text{day absolute momenta of the last 20 days}$$

3.1.5. Aroon Indicator(Aroon)

The Aroon indicator, developed by technician Tushar Chande *(Labs, 2016)*and the word aroon in Sanskrit means "dawn's early light."The Aroon indicator attempts to show when a new trend is dawning. The indicator consists of two lines (Up and Down) that measure how long it has been since the highest high/lowest low has occurred within an *n* period range.When the Aroon Up is staying between 70 and 100 then it indicates an upward trend. When the Aroon Down is staying between 70 and 100 then it indicates a downward trend. A strong upward trend is indicated when the Aroon Up is above 70 while the Aroon Down is below 30. Likewise, a strong downward trend is indicated when the Aroon Down is above 70 while the Aroon Up is below 30. Also look for crossovers. When the Aroon Down crosses above the Aroon Up, it indicates a weakening of the upward trend.

$$\text{AroonUP} = 100 \times \left(\frac{n - PeriodSinceHighestHigh}{n}\right) \qquad \text{AroonDown} = 100 \times \left(\frac{n - PeriodSinceLowestLow}{n}\right) \tag{9}$$

3.1.6. Vertical Horizontal Filter (VHF)

The Vertical Horizontal Filter was developed by Adam White *(Labs, 2016)* and it determines whether prices are trending. When the VHF is rising, it indicates the formation of a trend.Higher VHF values indicate a stronger trend. When the VHF is falling, it indicates the trend is ending and price is becoming congested.

$$\text{VHF} = \frac{\text{HighestHigh} - \text{LowestLow}}{\sum_1^n \frac{\text{close}_i - \text{close}_{i-1}}{\text{close}_{i-1}}} \tag{10}$$

3.2. Momentum Indicators

Momentum indicators help traders to identify the speed of price movement by comparing prices over time. This type of indicator is typically applied to price and it is used to analyze volume.

3.2.1. Relative Strength Index (RSI)

The Relative Strength Index (RSI) was developed by J. Welles Wilder *(TradingGeek, 2014)* and it calculates a ratio of the recent upward price movements to the absolute price movement. The RSI ranges from 0 to 100. If RSI value is above 70 it indicates overbought and if it is below 30 it indicates oversold. If the price is making new highs/lows, and the RSI is not, it indicates a reversal.

$$RSI = 100 \times \frac{upavg}{upavg + dnavg} \tag{11}$$

$$\text{where } upavg = \frac{\text{upavg} \times (n-1) + \text{up}}{n} \text{ and } downavg = \frac{\text{downavg} \times (n-1) + \text{dn}}{n}$$

3.2.2. Stochastic Oscillator(stoch)

The Stochastic Indicator was developed by George C. Lane. *(Dahlquist, 2011)*. It measures relation between close and the recent trading range. The values range from 0 to 100. %D values over 75 indicate an overbought condition; values under 25 indicate an oversold condition. When the Fast %D crosses above the Slow %D, it is a buy signal; when it crosses below, it is a sell signal. The Raw %K is generally considered too erratic to use for crossover signals.

$$\%\text{K} = 100 \times \frac{\text{Close} - \text{LowestLow (last n periods)}}{\text{HighestHigh (last n periods)} - \text{LowestLow (last n periods)}} \tag{12}$$

$$\%\text{D} = \text{Moving Average}(\%\text{K})$$

3.2.3. Stochastic Momentum Index(SMI)

Stochastic Momentum Index was developed by William Blau *(Labs, 2016)*. The SMI is considered a refinement of the stochastic oscillator. It is a more reliable indicator, less subject to false swings. It calculates the distance of the current closing price as it relates to the median of the high/low range of price.The SMI has a normal range of values between +100 and -100. Like the stochastic oscillator, the SMI is primarily used by traders or analysts to indicate overbought or oversold conditions in a market. Traders also use the SMI as a general trend indicator, interpreting values above 40 as bullish trend and negative values greater than -40 as bearish trend.

$$\text{SMI} = 100 \times \frac{cm}{\frac{hl}{2}}, \quad \text{Signal} = \text{EMA(SMI)} \tag{13}$$

$$\text{where } \text{hl} = \text{HighestHigh} - \text{LowestLow, and } cm = close - \frac{hl}{2}$$

3.2.4. William%R– Williams Percentage Range(WPR)

Williams Percentage Range was developed by Larry Williams *(Dahlquist, 2011)*. It is very similar to RSI and Stochastic so it shouldn't be used in conjunction with them. It is used to identify the oversold and overbought levels and the proper entry points. The default setting for Williams%R is 14 periods which can be days, weeks, months or an intraday timeframe. Indicator value move in the range of 0 to -100. Values below -80 means that the asset is oversold and its value will probably rise. Values above -20 mean that the asset is overbought and its value will probably fall. Some of the technical analysis prefer to use W%R with the settings to -50 points upwards/downwards instead of -80/-20 values.

$$\%R = 100 \times \frac{\text{HighestHigh}_{(\text{last n periods})} - \text{close}}{\text{HighestHigh}_{(\text{last n periods})} - \text{LowestLow}_{(\text{last n periods})}} \tag{14}$$

3.2.5. Chande's Momentum Oscillator (CMO)

The Chande's Momentum Oscillator was developed by Tushar S. Chande *(Labs, 2016)*. The Chande Momentum Oscillator is a modified RSI. Where the RSI divides the upward movement by the net movement (up / (up + down)), the CMO divides the total movement by the net movement ((up - down) / (up + down)).Values over 50 indicates a buy signal and values below 50 indicatesa sell signal.

$$\text{CMO} = 100 \times \frac{\text{ups}_i - \text{downs}_i}{\text{ups}_i + \text{downs}_i} \text{ where } \quad \text{ups}_i = \sum_{i-n}^{i} \text{up} \text{ and downs}_i = \sum_{i-n}^{i} \text{down} \tag{15}$$

3.2.6. Commodity Channel Index(CCI)

Commodity Channel was created by Donald Lambert *(Dahlquist, 2011)*.It shows Trading Cyclic Trends and detect beginning and ending market trends. The range is 100 to -100 and the values outside this range indicate overbought or oversold conditions. If the price is making new highs, and the CCI is not, then reversal of trend may occur.

$$\text{CCI} = \frac{\text{TP} - \text{ATP}}{0.015 \times \text{MD}}, \text{Typical Price(TP)} = \frac{\text{close} + \text{high}_n + \text{low}_n}{3} \tag{16}$$
$$\text{MD} = \text{Mean Deviation of ATP(Average Typical Price)}$$

3.3. Volatility Indicators

Volatility indicators provide useful information about the range of buying and selling that take place in a given market information that can help the traders determine potential points where the market may change direction. The following are the volatility indicators:

3.3.1. Bollinger Bands(BBands)

Bollinger Bands were developed by John Bollinger. Bollinger Bands consist of three lines *(TradingGeek, 2014)*. The middle band is a simple moving average (generally 20 periods) of the typical price (TP). The upper and lower bands are F standard deviations (generally 2) above and below the middle band. The bands widen and narrow when the volatility of the price is higher or lower respectively.Bollinger Bands do not generate buy or sell signals; they are an indicator of overbought or oversold conditions. When the price is near the upper or lower band it indicates there may be trend reversal. The middle band becomes a support or resistance level. The upper and lower bands can also be interpreted as price targets. When the price bounces off of the lower band and crosses the middle band, then the upper band becomes the price target.

$$\text{MidBand} = \text{SimpleMovingAverage(TP)} \tag{17}$$
$$\text{UpperBand} = \text{MidBand} + \text{Price} \times \sigma(\text{TP})$$
$$\text{LowerBand} = \text{MidBand} + \text{Price} \times \sigma(\text{TP})$$

3.3.2. Donchian channel

It is an indicator used in market trading developed by Richard Donchian *(Labs, 2016)*. The Donchian channel is a useful indicator for seeing the volatility of a market price. If a price is stable the Donchian channel will be relatively narrow. If the price fluctuates a lot the Donchian channel will be wider. If a security trades above its highest n day high, then a long is established. If it trades below its lowest n day low, then a short is established.Enter long when price crosses above 20-day upper donchain channel and exit when price reaches 10-day lower donchain channel. Enter short when price crosses below lower donchain channel and exit when price reaches 10-day upper donchain channel. To do safe trading 25 day/350-day can be used as a trend filter. Enter long only When 25-day EMA is above 350 day EMA, enter short only 25-day EMA is below 350-day EMA.

$$\text{Upper Channel Line}: n - \text{days high}; \text{ Lower Channel Line}: n - \text{days low}; \text{ and}$$
$$\text{Center Line}: (n - \text{days high} + n - \text{days low})/2 \tag{18}$$

3.3.3. Average True Range (ATR)

The ATR was developed by J. Welles Wilder *(Labs, 2016)*. It is the moving average of the TrueRange. The ATR is a measure of volatility. High ATR values indicate high volatility, and low values indicate low volatility, and the price is flat.

$$ATR = \frac{TR_{(-1)} \times (n-1) + TR}{n} \; where \; TR = TrueHigh - TrueLow \tag{19}$$

3.4. Volume Indicators

Volume represents the amount of trading activity that occurs during a given interval, independent of price. As volume levels move above their average, it indicates the strengthening of a trend or confirmation of a trading direction. The strongest trends often occur while volume increases which leads to large movement in price.

3.4.1. Chaikin Money Flow(CMF)

The Chaikin Money Flow indicator was developed by Marc Chaikin *(Labs, 2016)* and it compares the total volume over the last n time periods to the total of volume times the Closing Location Value (CLV) over the last n time periods. The CLV calculates where the issue closes within its trading range.When the Chaikin Money Flow is above 0.25 it is a bullish signal, when it is below -0.25, it is a bearish signal. But rarely it reaches extremes. Buying and selling pressure can be measured using CMF. A move into positive territory indicates buying pressure, while a move into negative territory indicates selling pressure. The indicator oscillates above/below zero. Zero-line cross ends up with whipsaws. To reduce whipsaws the bullish/bullish threshold can be set to +0.05/-0.05 instead of 0. This may reduce whipsaws.

$$CLV = \frac{(close - low) - (high - close)}{(high - low)} \quad CMF_i = \frac{\sum_{i-n}^{i}(CLV \times volume)}{\sum_{i-n}^{i} volume} \tag{20}$$

3.4.2. On Balance Volume (OBV)

The On Balance Volume was developed by Joseph Granville and OBV is a cumulative total of the up and down volume *(mwlibtoolkit, 2011)*. When the close is higher than the previous close, the volume is added to the running total, and when the close is lower than the previous close, the volume is subtracted from the running total. If the price moves before the OBV, then it is a non-confirmed move. A series of rising peaks, or falling troughs, in the OBV indicates a strong trend. If the OBV is flat, then the market is not trending.

$$IF \; Close > Close_{[-1]} then OBV = OBV_{[-1]} + Volume$$
$$Else \; If \; Close < Close_{[-1]} then OBV = OBV_{[-1]} - Volume$$
$$Else OBV = OBV_{[-1]}$$

3.4.3. Money Flow Index(MFI)

The Money Flow Index calculates the ratio of money flowing into and out of a security *(mwlibtoolkit, 2011)* and its values range from 0 to 100. Values above 80/below 20 indicate market tops/bottoms.

$$MoneyRatio_i = \frac{\sum_{i-n}^{i} PositiveMoneyFlow}{\sum_{i-n}^{i} NegativeMoneyFlow} \; and$$
$$MoneyFlowIndex = 100 - \left(\frac{100}{1+MoneyRatio}\right) \tag{21}$$

4. RESULTS AND DISCUSSIONS

We have conducted preliminary study of 22 technical indicators which are classified into four major groups such as Trend Indicators, Momentum indicators, Volatility indicators and Volume indicators. To get clear view about all these 22 technicalindicators, a 2-D chart is plotted against each indicator andsignificance of each indicator is analyzed. For our complete study, we have taken TVSMOTOR security data for 6 months from January 2016 to June 2016 and 2-D plots are drawn with appropriate package that supports technical

analysis in R. R provides thousands of free open-source statistical, mathematical libraries and algorithms.Traders can significantly cut down the time required to prototype and backtest trading strategies using R. All indicators are explained with the help TTR package in R.

The Moving average indicator advised that when the price is above the moving average indicator value then themarket is in uptrend otherwise the market is in downtrend. Figure1 shows that 2-D plot of Exponential Moving average (EMA) of TVSMOTOR security and that indicates that the market is in uptrend in March 2016 and in May 2016 it is in downtrend. The behaviors of other trend indicators such as SMA, WMA, VWMA, and DEMA are same as EMA.
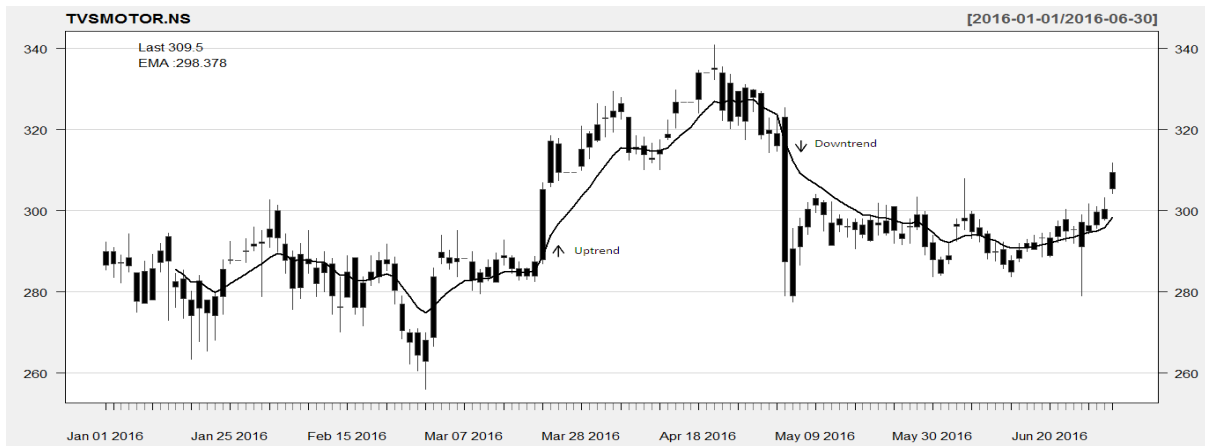
Figure 1. Trend Indicator – Exponential Moving Average

The Moving Average Convergence Divergence (MACD) indicator highlights that the market is in uptrend when MACD line crosses above the zero line or the MACD line crosses above the signal line. On the other hand, the market is in downtrend when MACD line crosses below the zero line or the MACD line crossed below the signal line. Figure 2reveals that the MACD line crosses above 0 during the month ofMarch 2016 and indicates the market is in uptrend and during the month of May MACD crosses below 0 indicating a downtrend. And also, the MACD line crosses above the signal line by the end of February indicating uptrend and it occurs before the Zero crossover of MACD. Similarly the downtrend is also indicated earlier by signal line crossover before the zero crossovers.
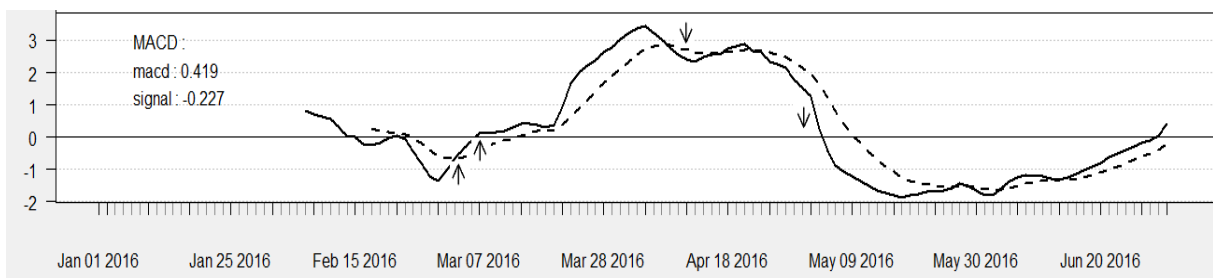
Figure 2. Trend Indicator –Moving Average Convergence/Divergence(MACD)

The Average Directional Movement Index (ADX) indicator signal a strong trend if ADX value is above 25 points along with the direction of the trend +DI and –DI on either side. That is, when +DI crosses above –DI it indicates buy signal and when +DI crosses below –DI it indicates sell signal. In Figure3 ADX indicator chart of TVSMOTOR security, ADX value is above 25 in March and indicates strong trend and also +DI crosses above -DI indicates bearish market. In February, ADX value is less than 20 indicating the price is flat. So, if the trend is strong, buy/sell direction can be decided using +DI and –DI.
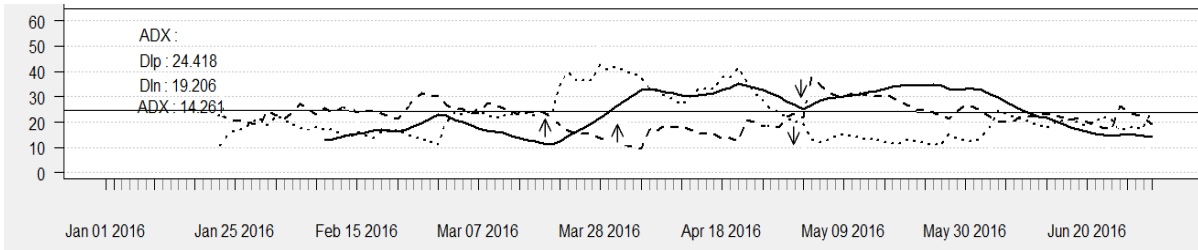
Figure 3. Trend Indicator –Average Directional Movement Index (ADX)

The trend detection index (TDI) is used to detect when a trend has begun and when it has come to an end. If the values of TDI and direction of indicator is positive it signals that there is a bullish market and if TDI is positive and the direction indicator is negative then there will be a bearish market. In Figure 4TDI chart of TVSMOTOR security indicates that in-betweenlast week of March and first week of May, both TDI and DI is positive indicating uptrend, whereas in middle of May TDI is negative and DI is positive indicating a down trend.
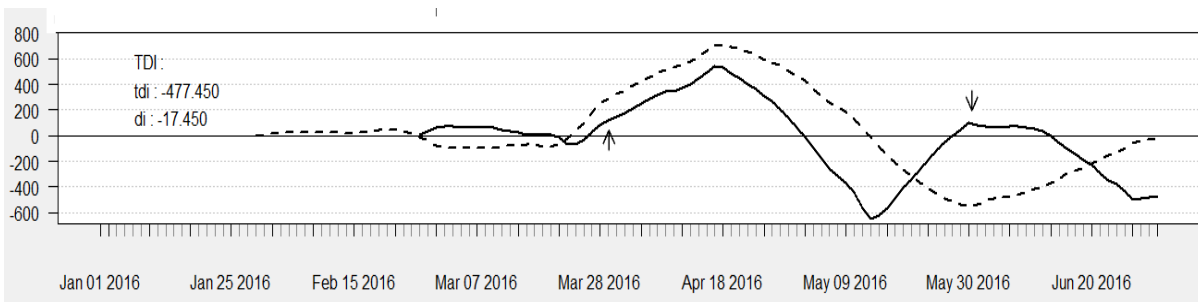
Figure 4. Trend Indicator –Trend Detection index (TDI)

The strategy followed in Aroon indicator is, the Aroon up value between 70 and 100 indicates uptrend and Aroon down value between 70 and 100 indicates downtrend. If Aroon up is above 70 and Aroon down is below 30 it indicates strong uptrend and if Aroon down is above 70 and Aroon up is below30 indicates strong downtrend. In Figure5 Aroon indicator chart of TVSMOTOR security, the Aroon up indicator value is above 70 and Aroon up crosses above Aroon down value in March showing the market is in uptrend. Similarly, during the month of May Aroon down value is above 70 and the Aroon up crosses below the Aroon down, indicating a downtrend.
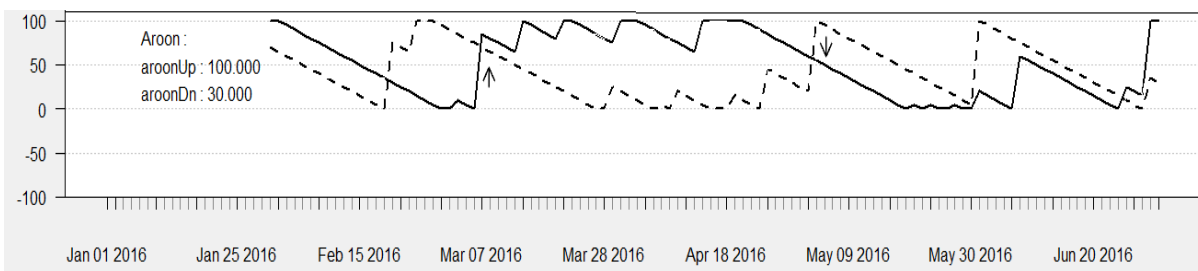
Figure 5. Trend Indicator–Aroon Indicator (Aroon)

Vertical Horizontal Filter(VHF) indictor quantify that when the value is rising it shows prices are trending, if it falls then it indicates trend is ending. Figure 6 shows that VHF chart of TVSMOTOR security, during the month of March. VHF value is rising indicating an uptrend, during the end of the April, VHF value is falling indicating downtrend.
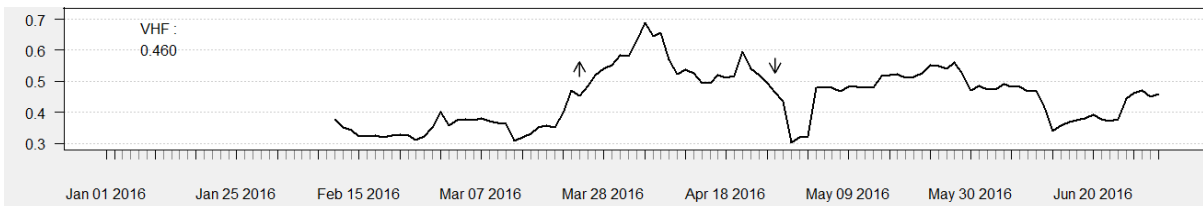
Figure 6. Trend Indicator-Vertical Horizontal Filter (VHF)

In Relative Strength Index (RSI) indicator, if RSI value above 70 indicates stocks are overbought and it is below 30 it indicates oversold condition of a security. If RSI reaches overbought/oversold condition then the trend reversal occurs. Figure 7 reveals that the stocks are overbought twice during the month of March and once in April 2016. During March there is gradual downtrend whereas in April there is a drastic downtrend. And by the end of April, RSI value reaches nearer to 30 indicating oversold and there is an uptrend in the market.
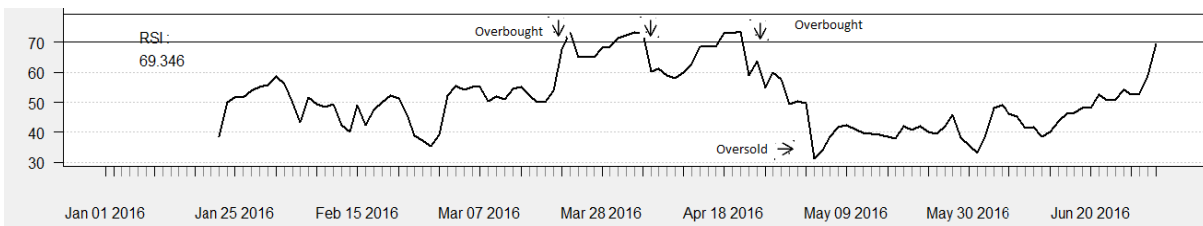
Figure 7. Momentum Indicator – Relative Strength Index (RSI)

In Stochastic Oscillator indicator (Stoch), when stochastic value above 80 indicates overbought level and below 20 indicates oversold level. If %K line crosses above %D buy signal is indicated else sell signal is indicated. In Figure 8, we observed that, the %K line crosses below the slow %D line indicating sell signal during the end of January, March and in the middle of April 2016. Stochastic value goes below 20 in the February, March and May 2016 indicates oversold and %K line crosses above slow %D line and buy signal is generated. False signals can be reduced when using slow %D instead of Fast %D.
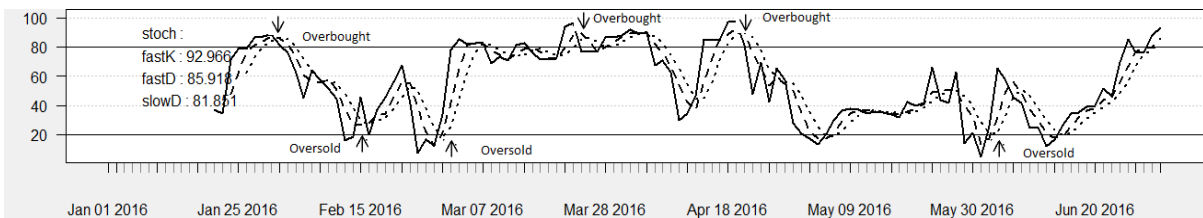

Figure 8. Momentum Indicator–Stochastic Oscillators (Stoch)

The value of Stochastic Momentum Index (SMI) above 40 indicates overbought and below 40 indicates oversold condition. If it reaches overbought/oversold levels then there will be trend reversal. Figure 9 gives SMI chart of TVSMOTOR security and it divulges that during the month of March & April 2016, the SMI value is above 40 indicating that the stocks are overbought and the start of downtrend can be visualized. During the month of February SMI crosses above signal line and there bullish trend can be visualized, whereas during the month of April SMI crosses below the signal line showing a bearish trend.
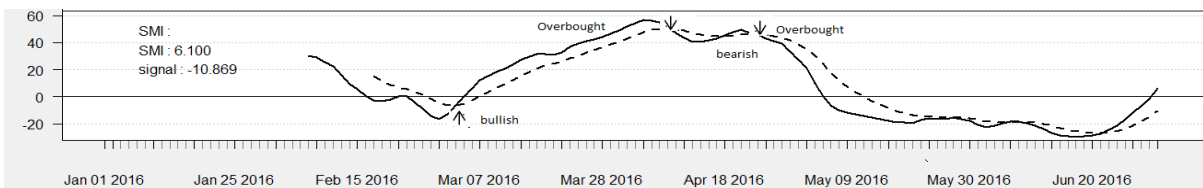

Figure 9. Momentum Indicator–Stochastic Momentum Index(SMI)

Williams %R (WPR) indicator values above -20 indicates overbought level and values below -80 indicates oversold level. Mostly crossover above or below -50 is used to detect the trend. The WPR value of

TVSMOTOR security lies between 0 and 20 during February, March and April months indicating overbought condition and also it indicates the beginning of downtrend. WPR value reaches the range80 to 100 six times between January to June indicating oversold condition and also indicates the beginning of uptrend. Some signals may be a filtered by looking at other technical indicators to do safe trading.WPR value crosses above and below -50 during January and February indicates uptrend and downtrend (Figure 10).
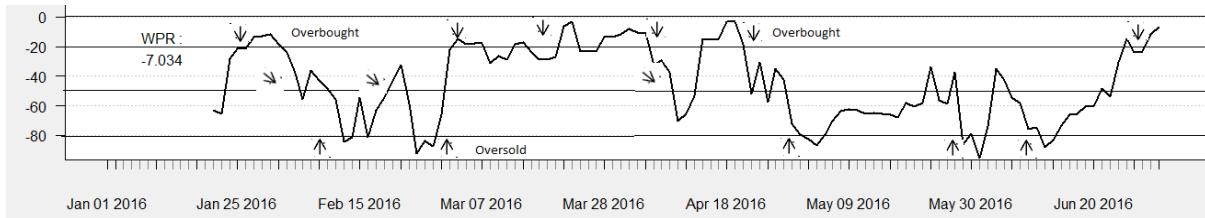
Figure 10. Momentum Indicator–Williams Percent Range (WPR)

The value of Chande's Momentum Oscillator (CMO) indicator crosses above 50 indicates overbought and if it crosses below -50 it indicates oversold. A trend reversal may occur after it reaches overbought/oversold levels. Figure 11 envisaged the gesture of CMO of TVSMOTOR security and the value of CMO is above 50 during the end of March and June indicating uptrend. In the month of June the CMO value is more than in March indicating the uptrend is stronger than March. And if the CMO value is below -50 then there will be downtrend. If CMO crosses a moving average above, it indicates buy signal.
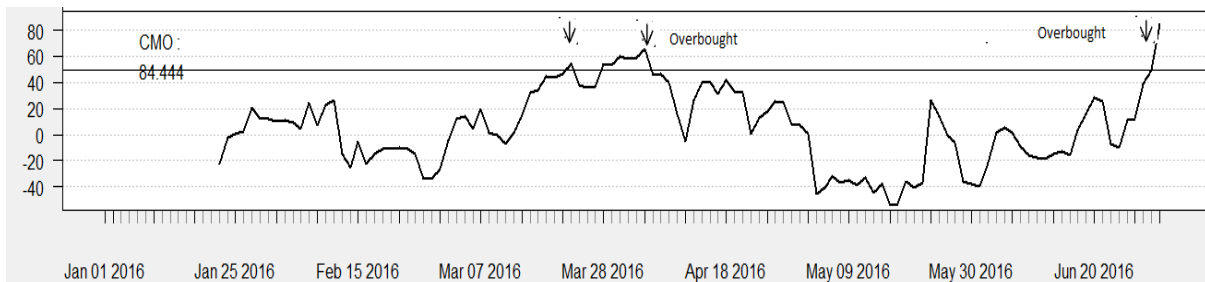

Figure 11. Momentum Indicator–Chande Momentum Oscillator (CMO)

The Commodity Channel Index (CCI) of Momentum Indicator recommends that if the value crosses above/below 100 it indicates overbought/oversold levels of stocks. After it reaches this level trend reversal occurs. The value of CCI is above 100 and shows overbought condition and it also indicates uptrend during early month of February and last week of March, April and June 2016. The CCI value is below -100 and indicates oversold condition and also shows the beginning and ending of downtrend (Figure 12).
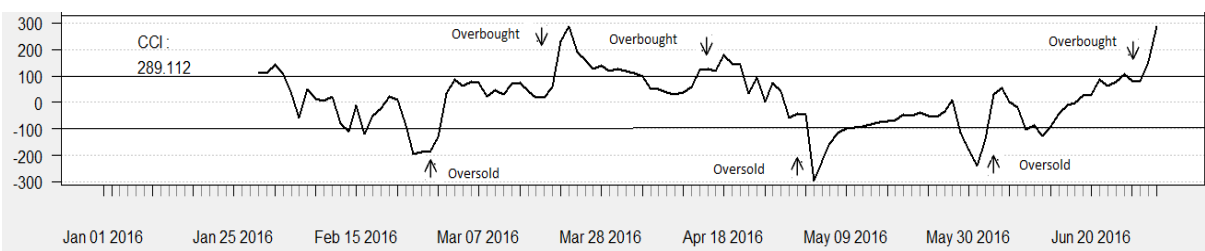

Figure 12. Momentum Indicator–Commodity Channel Index (CCI)

Bollinger Bandsare used to measure the volatility and indicates overbought and oversold conditions. The upper and lower band acts as price targets, whereas the middle band acts as a support or resistance level. Bollinger Bands of 2-D plot in Figure 13 highlights that, in the last week of February 2016, price touches the lower band and bounce above the middle band so buy signal is generated. The price move above the middle band at price Rs.280/- and we may expect a target of upper band at Rs.300/-. But in the middle of March it reaches to price Rs.320/- . In April end the stock price goes below the middle band (Rs.325/-) and sell is initiated and the target of lower band is Rs.315/ but actually it moves down to Rs.280/-. It also measures

volatility, stock is less volatile from end of May to June and stock is more volatile between middle of March and middle of May.
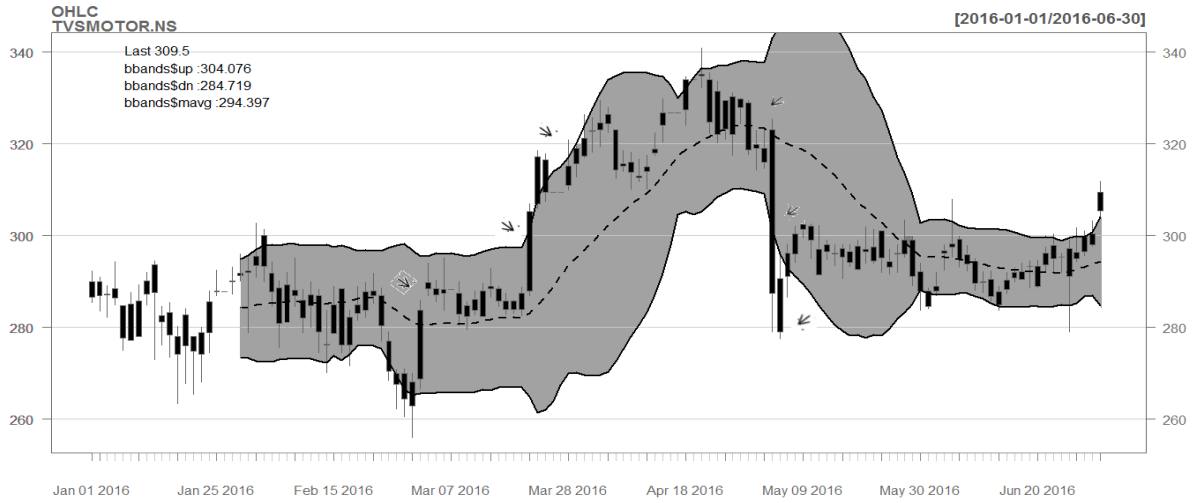

Figure 13. Volatility Indicator–Bollinger Bands(BBands)

The Average True Range (ATR) indicator value is high then it indicates high volatility and if the ATR value is low, then it indicates the price is less volatile and the price is flat(Figure 14). The ATR value is so high during the end of February and in the beginning of May. A bullish reversal with an increase in ATR would show strong buying pressure and reinforce the reversal. ATR is low in middle of March and May indicates less volatility. A bearish support break with an increase in ATR would show strong selling pressure and reinforce the support break.
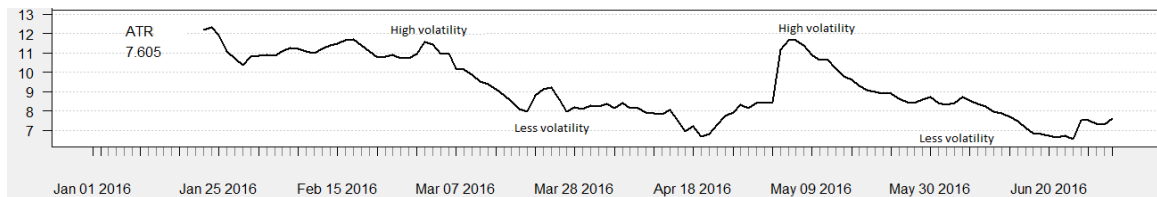

Figure 14. Volatility Indicator–Average True Range(ATR)

In Donchain Channel (DC) indicator, long is entered when price goes above upper channel and it is exited from long when it penetrates lower channel. And short is entered when price goes below lower channel and it is exit when it penetrates upper channel. Figure 15 articulate that, in the middle of March long can be entered around level 290 and exit level is 310, but the stock moves to 330. During month of May and June, short can be entered around price 310 and exit level is 285.
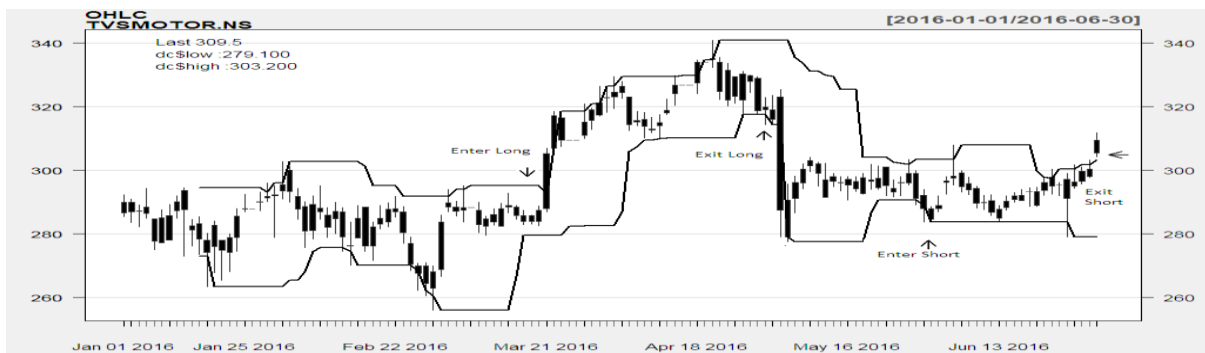

Figure 15. Volatility Indicator–Donchain Channel

On Balance Volume (OBV) indicator exposes that OBV value increases in the middle of April and foreshadow the rise in price. Falling OBV values in the beginning of May foreshadow fall in price. Volume is less volatile in June and foreshadow that the price is flat (Figure 16).
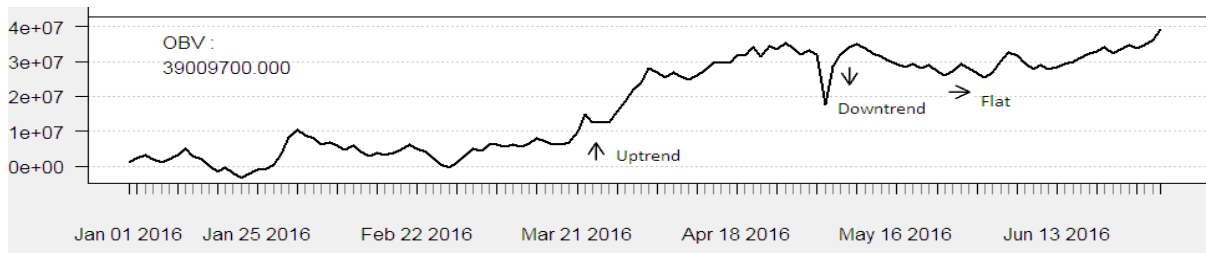
Figure 16. Volume Indicator–On Balance Volume (OBV)

Chaikin Money Flow (CMF) indicator is used to measure buying and selling pressure. In Figure 17, CMF value crosses above/below 0 then there are many bullish/bearish signals. To reduce whipsaws threshold is set at +0.05/-0.05 and numbers of whipsaws are reduced. In the months of January, March and June 2016, buying pressure is more as it crosses the threshold +0.05. In February, March and June the value crosses the threshold -0.05 indicating selling pressure.
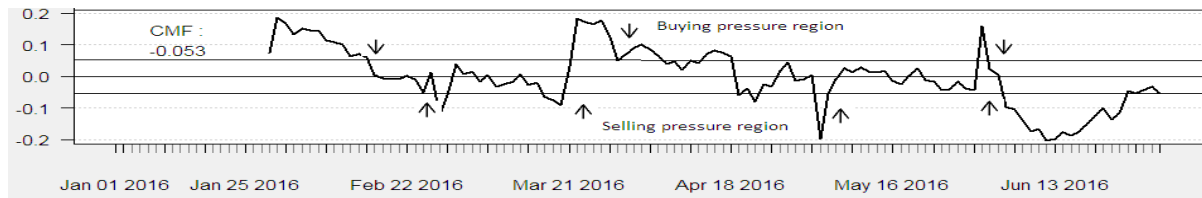
Figure 17. Volume Indicator–Chaikin Money Flow(CMF)

Money Flow Index indicator indicates market tops/bottoms when its value is above 80/below 20. The Money Flow Index value (Figure 18) indicate market top in the month of March, April and June and market bottom in February and May 2016. Trend reversal occurs when market tops reaches above 80 and market bottom reaches nearer to 30.
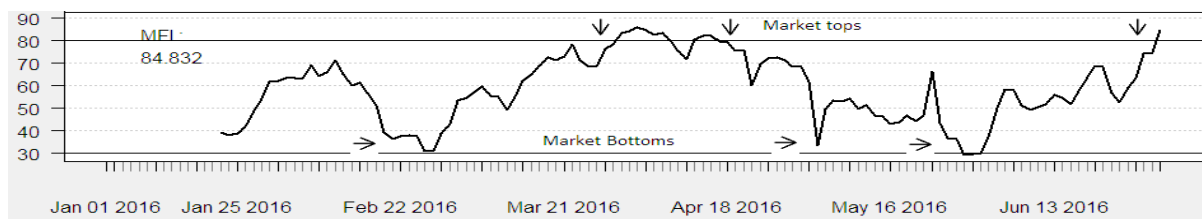
Figure 18. Volume Indicator–Money Flow Index(MFI)

5. CONCLUSION

Most of the trading types can be easily identified with just one or four chart indicators. Once we know how to use trend indicators, momentum indicators, volatility indicators and volume indicators, we can find a way to execute the trading plan. Moreover findings of this study will help the investors to gain knowledge about the usage of these technical indicators so as to increase their proportion of profitable trading and improve investment returns.The purpose of this preliminary study is to understand basis of share trading through technical analysis and we extend our work towards forecasting of share prices by means of developing AI based prediction models and explore how technical indicators contributing in prediction models.

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