

Moving Fibonacci Strategy using Bollinger Bands

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Abstract — Financial market forecasting is one of the most substantial aspects of financial studies. It requires adequate knowledge of both fundamental and technical analysis of financial markets. In this study, we work on two different indicators namely Bollinger Band and Fibonacci Retracement to construct a new investing strategy. We try to combine these two indicators and attempt to develop the concept of Moving Fibonacci Strategy. In this proposed strategy, we try to eliminate the shortcomings of individual indicator strategy and calculate the return obtained from the strategy through R programming. We examine this strategy on NSE data.

Keywords — Bollinger Bands, Fibonacci Retracement, Moving Fibonacci Strategy, Return Mapping, Programming

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I. Introduction

In the stock market analysis, there are two different types of studies: one is fundamental, and another is technical. Technical analysis provides you a discipline in stock market investing rather than believing on individuals instinct or sentiments. Technical analysis helps us to identify the investing opportunities by examining and predicting price movements using chart pattern, indicators, oscillators, price trends etc. Sometimes the result of technical analysis and fundamental analysis may be different or contradicting with each other because technical analysis works with historical data of securities while fundamental analysis works with company's fundamental conditions. On the other hand, we can say that any one of fundamental or technical analysis alone cannot help you to identify better opportunities in the market. We must use both the studies while performing investing activities. Using fundamental analysis, we can select the stock for investments and after that using technical analysis we can identify the better entry and exit points of that stock.

The behavior of financial market in longer time horizon is always same. There is one concept called mean reversion in financial study which provides a better justification for the above phenomenon. The concept of mean reversion is based on security's prices reversion in the direction of its long term mean. In technical analysis most of the indicators are based and developed by using this core concept of the financial study. In the study we mainly focus on combining two different types of indicators and provide a better investing strategy in the financial market. For that, we use one volatility indicator namely Bollinger Bands and one support and resistance indicator namely Fibonacci Retracement. Bollinger Band is volatility band and used as a trend indicator and volatility indicator and Fibonacci retracement is support and resistance level used as an upcoming trend prediction for long time horizon. The Bollinger Band was originally developed in 1992 by John Bollinger. It is one of the popular indicators of technical analysis and has more than six trading and investing strategy. It is also used in conjunction with many indicators such as RSI, ADX, Moving Average, Parabolic SAR, ATR etc. But in the study, we combine Bollinger Band with Fibonacci Retracement and make a hybrid investing strategy.

- **Bollinger Bands:**

Bollinger Bands is the most popular technical indicator. Its construction is simply volatility bands which are placed across the moving average. In 1992, John Bollinger published his article "Using Bollinger Bands" in the traders' magazine namely Stocks & Commodities. In that article, he introduced Bollinger Bands for the first time. Bollinger Bands evolved from Trading Bands (Envelops). The Trading Bands or Envelops was used as a technical indicator in the mid-to late 1970s. It is the concept of shifting moving average up and down by a fixed amount or weight to obtain an envelope around price. [1] John Bollinger standardized Trading Bands using standard deviation for envelopes. Mainly Bollinger Bands are plotted two standard deviations above and below a simple moving average. [1]

Calculations: [1]

Middle Bollinger Band (MB) = Simple Moving Average (N – Period)

Upper Bollinger Band (UB) = MB + 2σ

Lower Bollinger Band (LB) = MB – 2σ

where, *Standard Deviation* (σ) = $\sqrt{\frac{\sum_{j=1}^N (x_j - \bar{x})^2}{N}}$ and $\bar{x} = \frac{\sum_{j=1}^N x_j}{N}$

The Envelops is simply based on statistical standard deviation in Bollinger Bands. So that, Bollinger Bands can be considered as volatility bands or volatility indicator. The Bollinger Bands measures market volatility too. Market Volatility is a complex concept to understand. Instant market volatility, known as applied volatility, is difficult to predict or calculate.

- **Fibonacci Retracement [8]:**

The support and resistance level in financial market are defined by Pivot Point, Highest High and Lowest Low of timeframe, Fibonacci sequence and Golden Ratio etc. The Support and resistance are considered as lowest and highest point of stock over a timeframe respectively. The Support levels provide a floor to security's prices that is price of security retracing from that certain/specific level and changing in the current trend. And in the same way resistance levels provide a roof to security's prices that is price of security retracing from that certain/specific level and changing the current trend. According to Princeton economist Burton Malkiel in his book "A Random Walk Down Wall Street", the behavior of the price retracement may be due to price volatility.

Fibonacci Retracement is a method of technical analysis to identify potential trend reversal. Fibonacci Retracement levels are described using Fibonacci sequence and golden ratio. Fibonacci sequence: - 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, ... The first ratio of 61.8% which is the inverse of "Golden Ratio", is found by dividing a number in sequence by the number that follows it. $8 \div 13 = 0.6153$, $34 \div 55 = 0.6182$, $55 \div 89 = 0.6179 \approx 61.8\%$. The 38.2% ratio is found by dividing a number that appears two places to the right of it. $8 \div 21 = 0.3809$, $21 \div 55 = 0.3818$, $55 \div 144 = 0.3819 \approx 38.2\%$. The 23.6% ratio is found by dividing a number in the sequence by the number that appears three places right of it. $8 \div 34 = 0.2352$, $21 \div 89 = 0.2352$, $34 \div 144 = 0.2361 \approx 23.6\%$. The 78.6% ratio is found by finding the square root of 61.8%. $\sqrt{0.618} = 0.786 \approx 78.6\%$. The 76.4% ratio is found by subtracting 0.236 from 1.00. $1.00 - 0.236 = 0.764 \approx 76.4\%$.

Calculations:

There are 5 retracement level in 0% and 100%

MAX = retracement level 100% = maximum of (50 Day High price) [Gray Line]

5th Level = Retracement level 78.6% [Blue Line]

4th Level = Retracement level 61.8% [Sky-Blue Line]

3rd Level = Retracement level 50% [Green Line]

2nd Level = Retracement level 32.8% [Yellow Line]

1st Level = Retracement level 23.6% [Red Line]

MIN = retracement level 0% = minimum of (50 Day Low price) [Gray Line]

II. Literature review

Bollinger J. (1992) was the first one to describe Bollinger bands. He focused on the volatility as a trading band and found that Bollinger bands were quick to react to large moves in the market. [1]

Leung and Chong (2003) compared the Moving Average Envelopes and Bollinger Bands and revealed that Bollinger Bands do not outperform the Moving Average Envelopes. [3]

Bhattacharya and Kumar (2006) reviewed some popular technical analysis methodologies based on Fibonacci sequences. Their obtained result does appear to corroborate the claim of technical analysts that there is some predictive utility associated with Fibonacci sequences used as filters in automated trading systems. They obtained evidence into the topological and statistical interrelationship of Fibonacci sequences with the prices of securities being actively traded in financial markets. [4]

Lento et al. (2007) tested the profitability of Bollinger bands. After adjusting for transaction costs, Bollinger bands underperform relative to Buy and Hold trading strategy. But Bollinger bands was greatly improved when a contrarian's approach was utilized. [5]

Gaucan et al. (2011) explained how Fibonacci Retracement can be used as an important tool to predict forex market. Also, they used some graphic formats like Fibonacci arcs, channel, expansion with Fibonacci Retracement. They combined Fibonacci Retracement with other technical analysis tools such as stochastics, RSI, MACD, Moving averages and candlestick patterns. [6]

Leeds (2012) explained the relationship between Bollinger bands and rolling regression time series model. He studied the statistical concepts of the Bollinger bands. Also, he illustrated the use of Bollinger band pair trading and developed a pair trading variant; fixed forecast maximum duration band (FFMDPT). [7]

Otake and Fallou (2013) attempted to apply Fibonacci trading in the African market similar to the western or Japanese market. They considered different turning points and calculated the retracement and

projection ratios and concluded that Fibonacci retracement proved that the stock prices almost reversed around the Fibonacci ratios and Fibonacci trading could be very useful for traders in the African stock market. [8]

Kumar (2014) attempted the prediction of resistance and support levels with the help of Fibonacci Series and combined with RSI and MFI. They gave proposed model with Fibonacci retracement as a dependent variable and RSI and MFI (different indicators) as an independent variable and concluded that RSI is more important in the proposed model for formation of rules. [9]

Martin et al. (2015) studied the performance of Golden ratios in Fibonacci Retracements and Fibonacci Fans in one of the most active stocks of the Philippine Stock Exchange. Also, they concluded that Fibonacci fan lines along with the retracement levels is more effective than only retracement levels. [10]

Tabar S. et al. (2016) proposed a new algorithm using Fibonacci summation series to better control the number of losses in trading. The research results showed that the proposed algorithm is more beneficial compared to traditional algorithms such as Simple Moving Average with Average True Range Stop-Loss and Exponential Moving Average with Average True Range Stop-Loss. [11]

Shaker R. Z. et al. (2018) studied Fibonacci series analysis to predict the future stock prices trend of four randomly selected companies in the Cement sector listed in Karachi stocks. The findings of this study accept the hypothesis that the trend reversals in the Cement sector listed in PSX follow Fibonacci retracements to some extent. Using Fibonacci retracements (support and resistance levels) the investor can make good investment decisions by selling on resistance and buying on support. [12]

Panchal and Gor (2020) converted the chart pattern of technical indicators which followed mean reversion into numeric form and determined buy and sell signals of investment without having to test the chart pattern. They tried to describe the hold phenomenon in the stock market. [13]

Panchal and Gor (2020) attempted to construct a hybrid strategy of Exponential Moving Average and Parabolic Stop and Reversal which follows the Mean Reversion process. They concluded that the hybrid strategy provides better long and short positions in the market and good strength of trend rather than individual indicator. [14]

Panchal and Gor (2021) applied Mean Reverting Theory on the Donchian Channel. To reduce the drawback of the Donchian Channel they combined it with RSI indicator which is useful in volatile and normal markets. They also combined it with fundamental factors which give better buy and sell signals. [15]

III. Hybrid Strategy & Programming

- **Hybrid Strategy:**

Bollinger Bands is calculated using number of periods and closing price of security while Fibonacci Retracement Level is calculated on range of highest high and lowest low price of security. Bollinger Band is helpful to identify current trend and volatility of security and determine the entry and exit points through Band break-out. Fibonacci Retracement is support and resistance indicator. It is helpful to identify different support and resistance level using Golden Ratio and Fibonacci sequence. The entry and exit signals determine by Bollinger Band's break-out strategy is accurate only in strong market trend. But some problems occur in weak market or security price closer to middle bands (moving average). That is, if the security price lies in between bands or is closer to moving average than determining the signal and trend prediction is difficult. With different support and resistance levels scenarios, it is difficult to predict from which support or resistance the prices revert back.

Due to these types of pros and cons, we construct a strategy combining both the indicators. We construct Fibonacci Retracement Level in between Bollinger Band. That can help us to identify proper support or resistance level and easy upcoming trend prediction if price is closer to moving average. In this paper, the combined strategy used is named as Hybrid strategy of Bollinger Band and Fibonacci Retracement / Moving Fibonacci Strategy. This Hybrid strategy works better than single indicator strategy. We apply this Hybrid Strategy on 50 stocks of Nifty50 and Nifty50 index.

Stepwise Procedure followed:

- Select some stocks using fundamental factors.
- Apply Bollinger Band break out strategy on stock.
- Place Fibonacci Retracement Level in Bollinger Bands
- To take position in market either long or short through Hybrid Strategy's signal.
- Identify reversal market by Hybrid Strategy to book profit on previous position.
- **Programming in R Language:**
 - Step 1: Take data from NSE website and clean the data.
 - Step 2: Find the Moving Average for n-period.
 - Step 3: Find the Bollinger Bands with 1.8 and 2.2 standard deviation.
 - Step 4: Find the range using high and low point from Bollinger Bands.

- Step 5: Find the retracement level 0%, 23.6%, 32.8%, 50%, 61.8%, 78.6% and 100%.
- Step 6: Make a plot of Bollinger Band and Fibonacci Retracement.
- Step 7: Find the return using this Hybrid Strategy / Moving Fibonacci Strategy.

IV. Research Methodology

1. Objective

In this study, we construct a combined strategy using Bollinger Bands and Fibonacci Retracement. With the help of this study, we show how to take advantage of price fluctuations in stock market investing and identify upcoming future market directions.

2. Data Collection

- In this work, we have taken data from NSE website.
- We have arbitrarily selected the data of Reliance Industry, Aarti Industry, Dr. Reddy’s Laboratory, Graphite India from 29th October 2010 to 29th October 2021 for explaining the illustration.
- Particularly we use Open price, Low price, High price and Closing price.

3. Computation

Bollinger Bands through tools [13]:

- Find 20-day simple moving average.
- Find standard deviation:

Step 1: Find difference between 20-day simple moving average and closing price.

Step 2: Find 20-day moving standard deviation.

- By using formula of Bollinger Bands find lower band and upper band.
- Identify buy and sell signal: (selection of Standard Deviation of 2 and 2.2 are based on the Bollinger article [1],[2])

Step 1: Find lower band at 1.8 standard deviation, 2 standard deviation, 2.2 standard deviation.

Step 2: Similarly, find upper band at 1.8 standard deviation, 2 standard deviation, 2.2 standard deviation.

Step 3: Buy signal when current price fall-down between lower band at 1.8 standard deviation and lower band at 2 standard deviations.

Step 4: Sell signal when current price fall-down between upper band at 1.8 standard deviation and upper band at 2 standard deviations.

Step 5: When current price fall-down between lower band at 2 standard deviation and lower band at 2.2 standard deviation then there is risky buy signal.

Step 6: When current price fall-down between upper band at 2 standard deviation and upper band at 2.2 standard deviation then there is risky sell signal.

- Next, using buy and sell signal identify return of the security over a period of time. The return mapping process performed by R-Programming.

- In Figure 2, Bollinger Bands are plot on the security price. Both of the plot made by R-Programming.

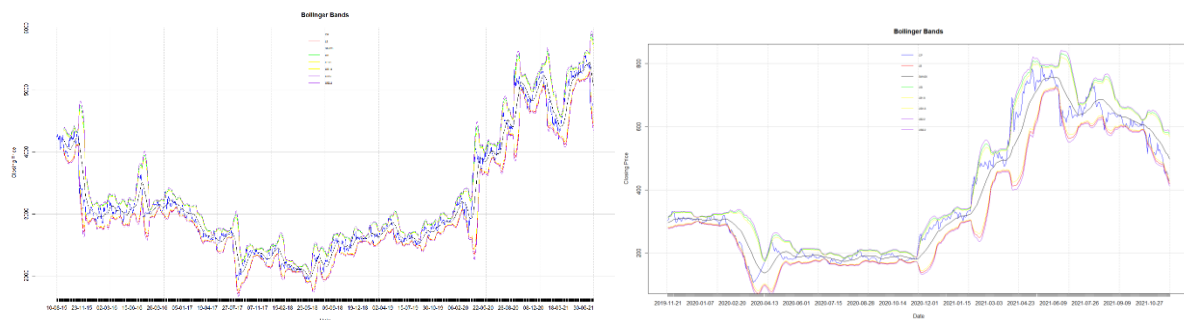


Figure 2

Fibonacci Retracement in Bollinger Bands through tools [13]:

- For Fibonacci Retracement, the retracement levels are 0%, 23.60%, 32.80%, 50%, 61.80%, 76.40%, 78.60% and 100%.
- To find retracement level into Bollinger Bands form:

Step 1: find range.

$$\text{Range} = 50 \text{ day previous high price in Upper Band}(\mu + 2.2\sigma) - 50 \text{ day previous low price in Lower Band}(\mu - 2.2\sigma)$$

Step 2: By using range convert retracement percentage into daily price form.

- To identify current trend:
- If High price of previous 50-days appear before the low price of pervious 50-daysthen current trend is down-trend.
- If High price of previous 50-days appear after the low price of pervious 50-days then current trend is up-trend.
- If current trend is up-trend and the price retracement is between 0% and 23.60% or 23.60% and 32.80% or 32.80% and 50% than trend goes further in continuous manner which means, future trend will be up-trend.
- If current trend is up-trend and the price retracement is between 100% or 78.60% or 61.80% and 78.60% than trend goes further in change manner which means, future trend will be down-trend.
- If current trend is down-trend and the price retracement is between 0% and 23.60% or 23.60% and 32.80% than trend goes further in change manner which means, future trend will be up-trend.
- If current trend is down-trend and the price retracement is between 100% or 78.60% or 61.80% and 78.60% than trend goes further in continuous manner which means, future trend will be down-trend.
- We can observe above 4 points form the following Figure 3.

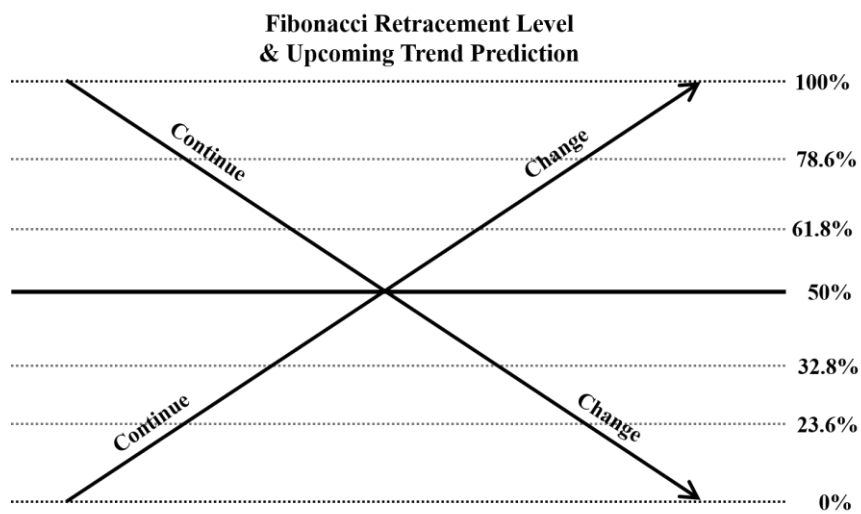


Figure 3

- Next, we plot Fibonacci Retracement in Bollinger Band for upcoming trend prediction.
- In following Figure 4, plot of Fibonacci Retracement in Bollinger Bands through R-Programming.

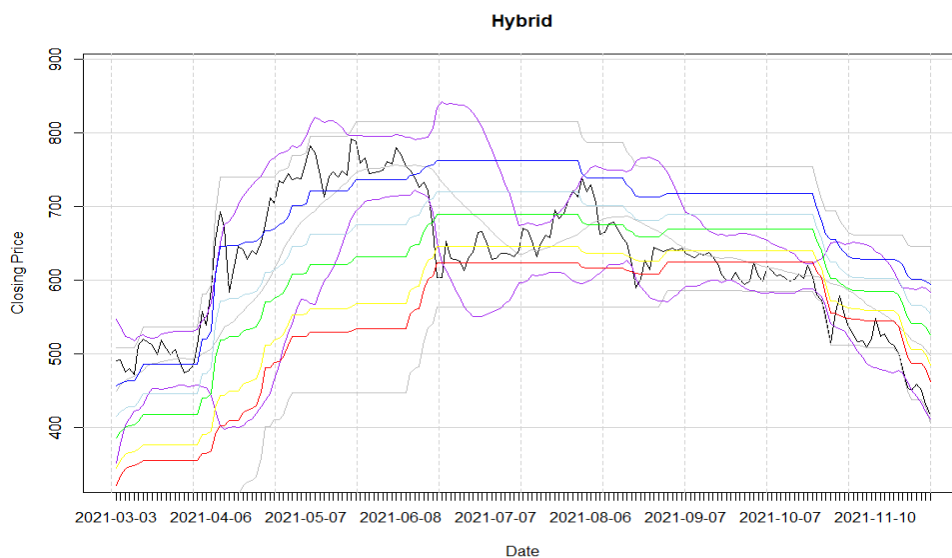


Figure 4

V. Conclusion

In this study, the Moving Fibonacci Strategy is applied on index Nifty50 and top 50 securities of NSE. In the new strategy, we manipulate the Fibonacci Retracement Strategy and place it inside the Bollinger Band. The Bollinger Bands do not perform well when the price of securities is around the moving average. And in Fibonacci retracement, it is difficult to understand which level of retracement is accurate to predict. These are shortfall of individual indicator strategy which is successfully overcome with the help of Moving Fibonacci Strategy. We find the return of this strategy through R-Programming. We conclude that the return is high compared to individual indicator strategy and if this strategy is used in proper discipline there is a potential for increased returns.

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