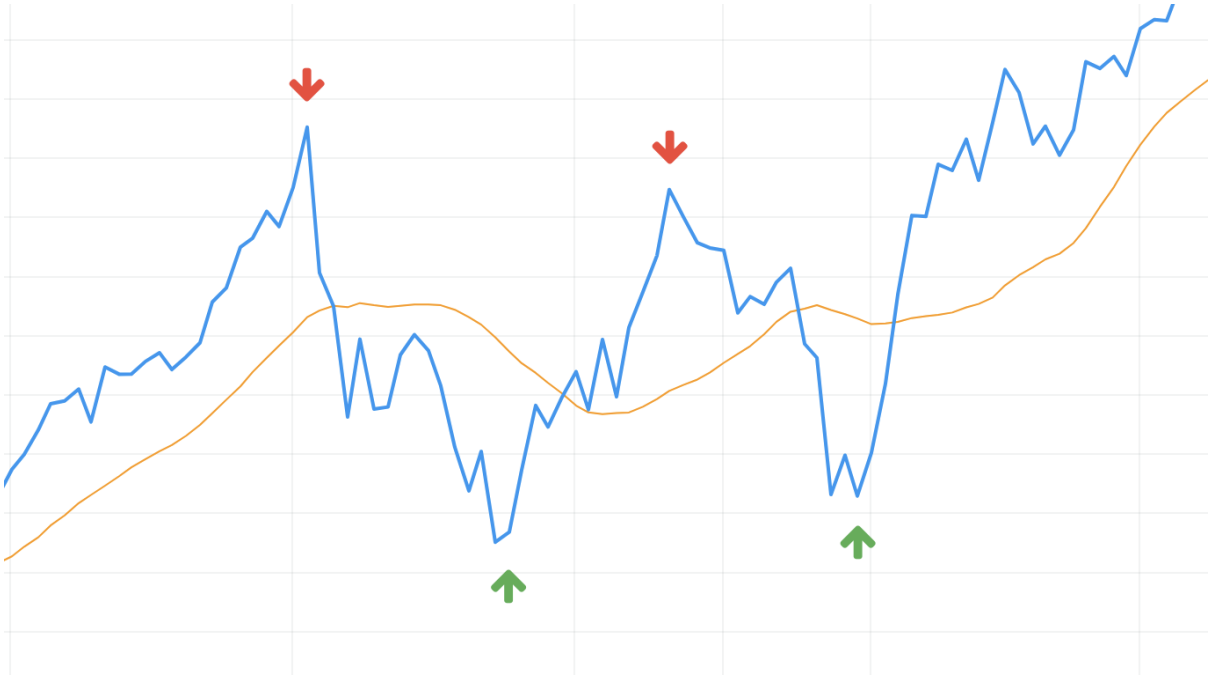
MEAN REVERSION

The Mean Reversion strategy assumes that the price of a stock will eventually revert to their long-term average levels. Similar to the behaviour of a rubber band, stretch too far out and it will snap back.

Because the market is generally mean reverting, A simplistic example of a mean reversion strategy is to buy a stock after it has had a large fall in price. When a stock has seen a big drop, there's usually a good chance that it will bounce back to a more normal level.



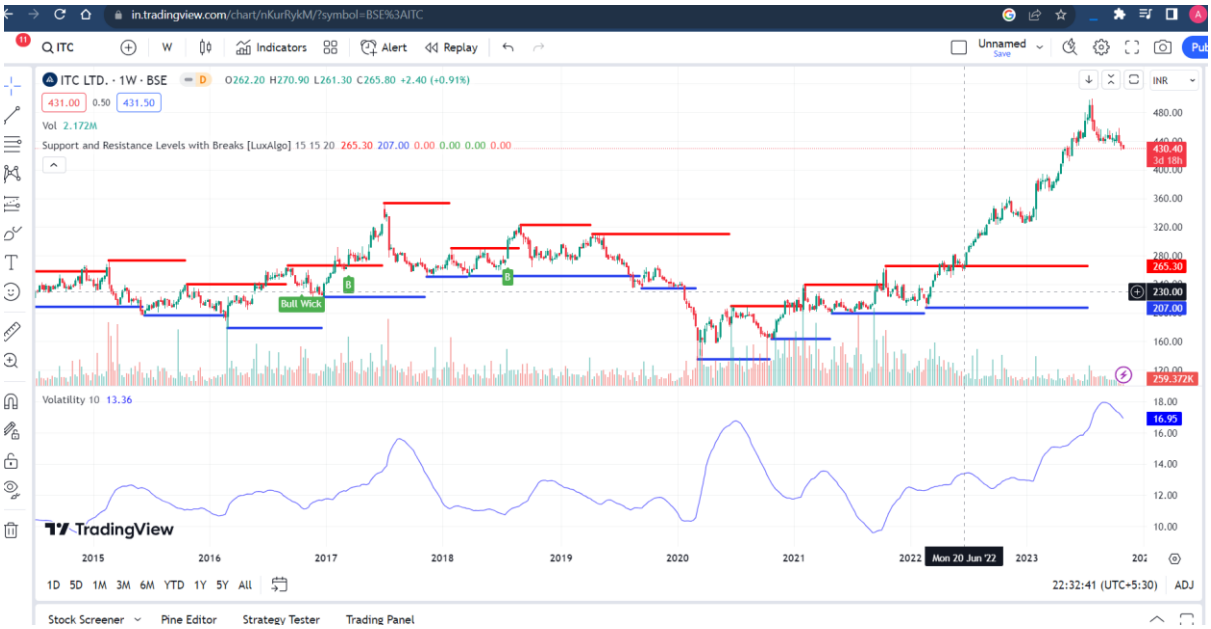
CHOOSING A STOCK

When using mean reversion strategy, our best bet is to go for sideways markets. This strategy generally loses in trending markets, which is also a key flaw of this strategy.

I have mainly used 2 conditions to select a stock.

- Strong support and resistance(S/R): Strong support and resistances imply a sideways trend.
- High Volatility: More volatile stocks have more swings in prices around the mean, so we get more trades

Using the indicators on the TradingView website I chose to test this strategy on **ITC.**

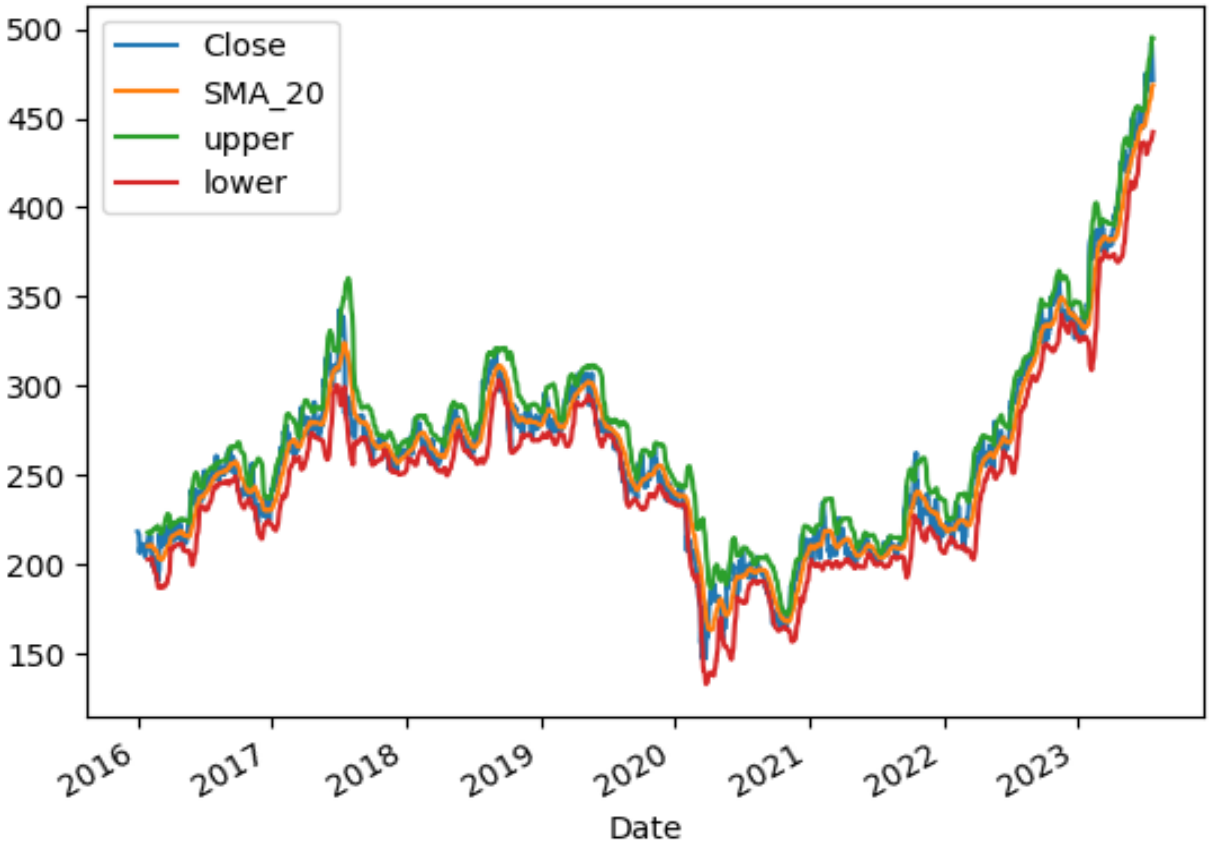


KEY INDICATORS

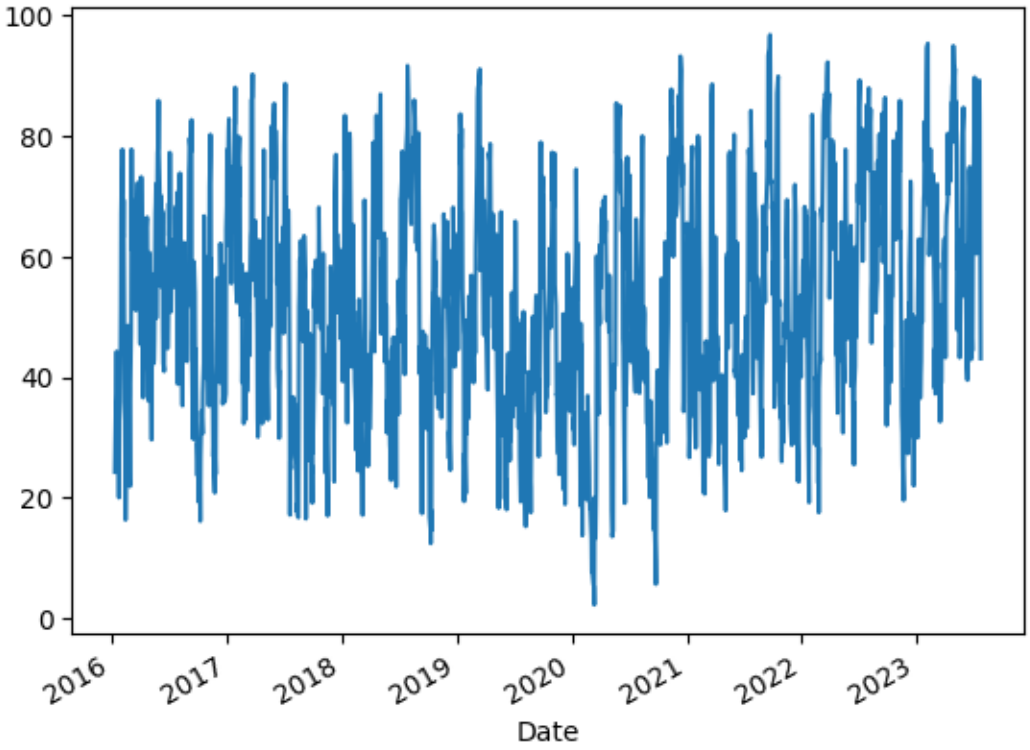
Since the mean reversion strategy relies on accurately betting that prices will revert back to its mean, we will need a combination of statistical factors to measure how far the current price has deviated and signal when the price has extremely high probability of reverting. After searching around, I found 2 popular indicators:

- **Bollinger Bands:** These Bands represent a certain standard deviation above and below the SMA value. I have used the popular parameters for the bands. (20-day SMA and 2 times of the standard deviations).

```
]   1 df['SMA_20']=df.Close.rolling(20).mean() #Simple Moving Avg for 20 days
    2 df['vol'] = df.Close.rolling(20).std() #Volatility
    3 df['upper'] = df.SMA_20 + (2*df.vol) #Upper Bollinger Band
    4 df['lower'] = df.SMA_20 - (2*df.vol) #Lower Bollinger Band
```



- **Relative Strength Index (RSI):** It measures the magnitude of recent price changes and evaluates whether the stock is overbought or oversold. (I have used a 6-day window period as our positions are short term).



BUYING AND SELLING CONDITIONS

Now that we've calculated the indicators, we will need to come up with rules to decide when to buy or sell the stock. I implemented the following 2 rules that were easy to follow:

- **Buy** when the 6-period RSI falls below 30 & Price closes below the lower Bollinger band. Indicates that the price has fallen extremely low and that the stock is being oversold.
- **Sell** when the 6-period RSI rises above 70 & Price closes above the upper Bollinger band. Indicated that the price has come up extremely high and that the stock is being overbought. Moreover, I have also put a stoploss of 5% to avoid risks.

```
conditions = [(df.rsi < 30) & (df.Close < df.lower),(df.rsi>70) & (df.Close>df.upper)]
```

```
choices = ['Buy','Sell']
```

```
df['signal']=np.select(conditions,choices)
```

```
position = False
buydates,selldates = [],[]
buyprice,sellprice = [],[]
df['shiftedclose']=df.Close.shift()
```

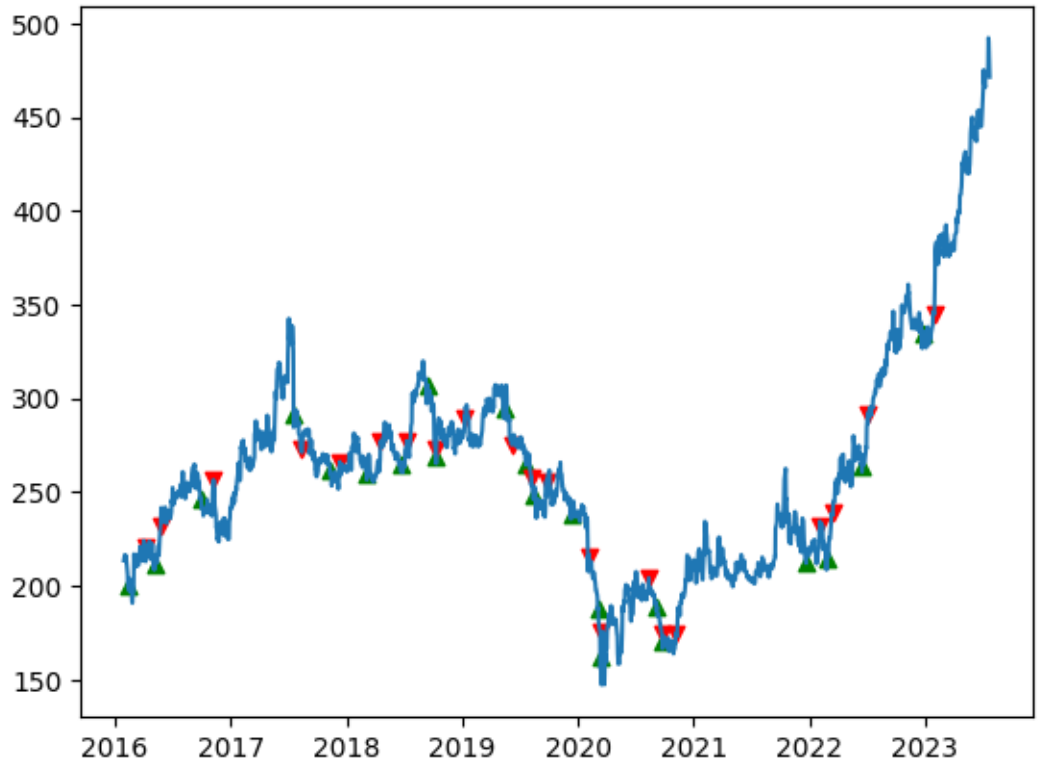
FINDING EXECUTED TRADES

```
for index, row in df.iterrows():

  if not position and row['signal'] == 'Buy':
    buydates.append(index)
    buyprice.append(row.Open)
    position = True
  if position:
     if row['signal'] == 'Sell' or row.shiftedclose < 0.95*buyprice[-1]:
      selldates.append(index)
      sellprice.append(row.Open)
      position = False

```

VISUALIZATION OF TRADES



EXAMPLE TRADE SETUP

In this example we observe a declining trend after the start of mid-February. We get a Buy Signal on 24th of February. As at this time our closing price (211) is below the lower Bollinger band and out RSI is also less than 30.

After holding for a few days, on 14th of March we get a sell signal as the close price rises above our upper Bollinger band and RSI has also become over 70. Thus, we sell at this point. This trade generated a profit of about 11%.

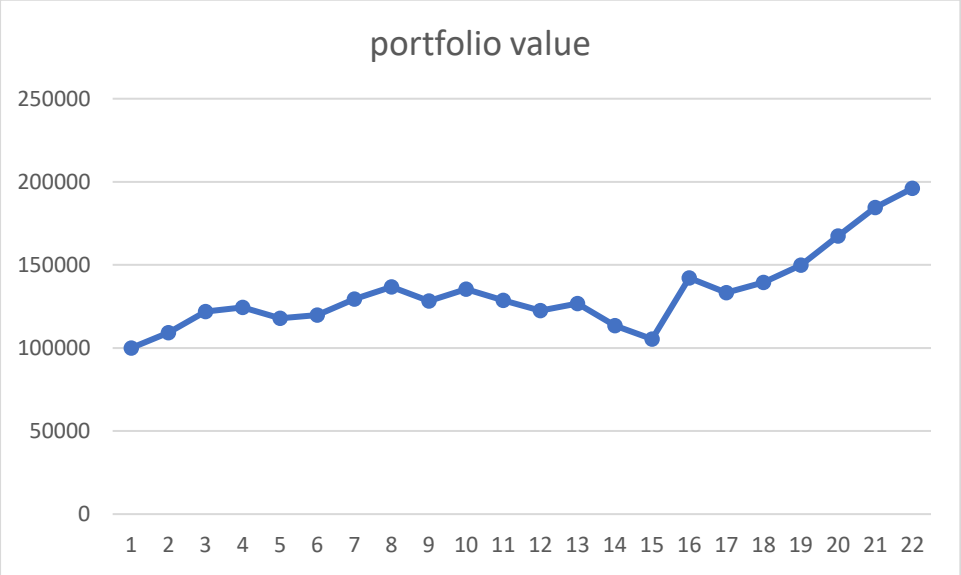
BACKTESTING THE STRATEGY

I have also back tested this strategy over a period of 8 years on ITC. The csv file in the drive consists of all the executed trades and corresponding returns.

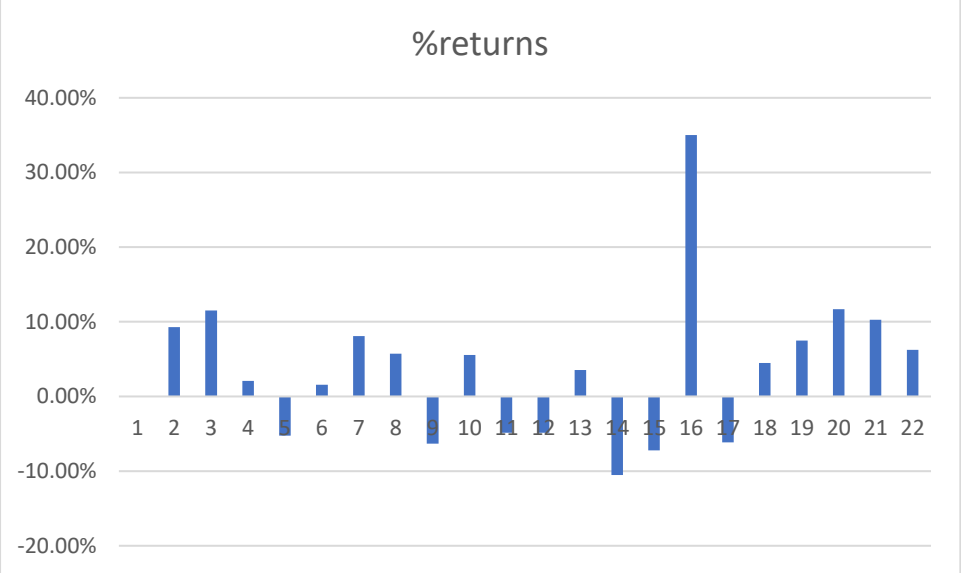
These were the results:

Sharpe Ratio	0.611
Benchmark Returns	170.97%
No. OF Executed trades	21
Win Ratio	66.67%
Cumulative Returns	96.07%
Annualized Returns	8.99%
Maximum Drawdown	-23.08%
Max Returns for a trade	35.00%
Max loss on a trade	-10.53%

PORTFOLIO VALUE FOR TRADES



RETURNS OF THE TRADES



LIMITATIONS

One limitation of our strategy was its inability to navigate through a black swan event, which happened in our back test on Nov 2019. At the start of any black swan event, prices always fall extremely low, which theoretically presents a perfect mean reversion opportunity. However, our indicators can never predict when or how deep the crash may be, and we might end up catching a falling knife. One way to prevent this may be to include stop losses into our algorithm, but this may decrease the overall performance of the wider mean reversion strategy.

Another limitation was that it was unable to find trades in a trending market, as seen from Feb 2023 to July 2020. Despite producing many Sell signals, the algorithm failed to initiate a single Buy signal. Instead, a trend following strategy could perform better here. Because markets are forever moving in and out of phases of consolidation (mean reversion) and breakouts, it's possible to construct an algorithm that implement both strategies.

CONCLUSION

In conclusion, this mean reversion strategy has the potential to deliver consistent returns in range-bound and volatile environments. However, it might not be the best strategy to implement in trending markets. It is also highly vulnerable to a stock market crash.

In reality, proper risk-management would be required to cut losses if the price does not move in the expected direction, for example implementing stop losses and or factoring fundamental analysis into the strategy. Using a combination of mean reversion in periods of consolidation and trend following to capture profitable trades from the momentum of prices could maximise returns as well.

Common sense tells us that diversification reduces risk. It is possible to do so by creating and trading on a stationary portfolio that consists of cointegrated stocks.

Apart from back testing, it is also better to evaluate the strategy by performing walk-forward optimisation. For example, we could improve the strategy over 8 months of train data, then project the parameters onto 4 months of test data. Alternatively, we could also test the algorithm with live paper trades, but this would be very time consuming. Ultimately, there is no one-size-fits-all approach. While this strategy forms a good base, it should evolve and change depending on market conditions.

SUMMARY

- The Mean Reversion strategy assumes that the price of a stock will eventually revert to their long-term average levels.
- To apply mean reversion on a stock it should had a strong support and resistance and High volatility. (A sideways trend)
- Popular indicators like Bollinger Bands and RSI can be used for this implementation.
- Buying Condition: RSI<30 and Close price< Lower Band.
- Selling Condition: RSI>70 and Close price> Upper Band.
- Limitations: Not a good strategy for trending or highly declining markets. (Stoploss can be added to reduce the risks.)

RESOURCES

- https://blog.quantinsti.com/mean-reversion-strategies-introduction-building-blocks/
- https://decodingmarkets.com/mean-reversion-trading-strategy/
- https://youtube.com/@Algovibes?si=yl0KWOOgR_1aokoa
- https://in.tradingview.com/