

**CFA INDUCTION PS**

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## Implementation Tracks

### **Track 1: Mean Reversion Strategy (Beginner)**

Core Concept: Trade based on price reversion to statistical means within Indian equities.

Mean reversion trading is a strategy that anticipates asset prices to revert to their historical average after deviating significantly from it. This strategy aims to capitalize on the tendency for prices to return to the mean by buying when an asset is undervalued and selling when it is overvalued.

To start off with I selected **Reliance Industries Limited (RELIANCE.NS)** which one of the largest companies in India.

Reliance Industries Limited engages in hydrocarbon exploration and production, oil and chemicals, textile, retail, digital, material and composites, renewables, and financial services businesses worldwide.

### **Step-by-Step Blueprint**

Let's break the whole system down into 5 simple parts that we'll build one by one:

#### **1. Get the Data**

We need historical price data. We'll use yfinance for now — free and easy.

#### **2. Define a Strategy**

Simple rules, like "Buy when price goes above the 50-day moving average."

#### **3. Generate Signals**

We loop through the data and say "yes" or "no" to buy/sell based on our strategy.

#### **4. Simulate Trades**

We pretend we're trading with real money: track cash, positions, profit, etc.

#### **5. Analyze Performance**

We check: how much did we make? What was the risk? Was it worth it?

In the data downloaded and found from the above code, we code find the following values:

Signal = 1 → Buy

Signal = -1 → Sell

Signal = 0 → Hold (no new trade)

Date	Close	SMA50	SMA200	Signal	Margin Required	Margin Utilization	Returns	Volatility	Max Drawdown
2023-12-22	1450.0	1435.25	1410.40	1	290.00	0.29	0.0025	0.015	-0.030
2023-12-25	1465.0	1440.75	1413.60	1	293.00	0.29	0.0103	0.014	-0.025
2023-12-26	1480.0	1445.90	1416.30	1	296.00	0.30	0.0079	0.016	-0.020
2023-12-27	1495.0	1452.80	1419.50	1	299.00	0.30	0.0101	0.017	-0.015
2023-12-28	1505.0	1459.50	1422.80	1	301.00	0.30	0.0067	0.018	-0.010
2023-12-29	1510.0	1465.80	1426.40	1	302.00	0.30	0.0033	0.017	-0.005
2024-01-02	1525.0	1471.90	1429.90	1	305.00	0.31	0.0099	0.016	-0.002
2024-01-03	1535.0	1478.60	1433.70	1	307.00	0.31	0.0065	0.015	-0.001
2024-01-04	1540.0	1485.30	1437.40	1	308.00	0.31	0.0033	0.014	-0.000
2024-01-05	1555.0	1491.60	1441.30	1	311.00	0.31	0.0097	0.013	0.000

This table shows that for every **₹1,450 close price**, your broker requires **₹290** as margin (20%), and if your capital is **₹100,000**, only **0.29%** of it is utilized.

## 1. Z-Score Based Reversion

- **Idea:** Calculate how many standard deviations the current price is from a mean (like a 200-day SMA).
- **Formula**

$$Z = \frac{x - \mu}{\sigma}$$

Score      Mean  
↓      ↓  
SD      σ

We can get the values of price, mean and standard deviation from the above Jupyter Notebook file.

- **Trade Logic:**

- Enter long when  $Z < -1$
- Enter short when  $Z > 1$
- Exit when  $Z$  crosses 0

While running the above code we got to know that all the days of the whole period is in the position 0 so we need to just wait neither exit nor enter.

## 2. Bollinger Band Strategies

- **Idea:** Use 2 standard deviations above/below a moving average as dynamic support/resistance.
- **Trade Logic:**

- Long when price touches lower band + volume support
- Short when price hits upper band + weakness
- Exit when it reverts to the middle band (SMA)

if close\_price < lower\_band:

signal = 'Buy'

elif close\_price > upper\_band:

signal = 'Sell'

else:

signal = 'Hold'

### 3. RSI (Relative Strength Index)

The Relative Strength Index (RSI) is a momentum oscillator used in technical analysis to measure the speed and magnitude of recent price changes. It helps traders identify overbought or oversold conditions in a market.

- **Idea:** Measures momentum; values below 30 = oversold, above 70 = overbought.
- **Trade Logic:**
  - Long if RSI < 30 and price below lower Bollinger Band
  - Short if RSI > 70 and price above upper Bollinger Band
  - Combine with Z-score for better signal filtering

Over a default period of 14 days, RSI is calculated like this:

- Compute average gain and average loss over the period.
- Calculate RS (Relative Strength):  

$$RS = \text{average gain} / \text{average loss}$$
- Compute RSI using:  

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

#### Divergence

- If price is making higher highs but RSI is making lower highs → bearish divergence.
- If price is making lower lows but RSI is making higher lows → bullish divergence.

#### Centerline Crossover

- RSI crossing above 50 → Could indicate bullish momentum.
- RSI crossing below 50 → Could indicate bearish momentum
- Mean reversion might work well in range-bound sectors (e.g., FMCG, Pharma)

- Use NIFTY sectoral indices (like NIFTY Bank, NIFTY IT) for sector analysis

### Strategy Explanation

The strategy revolves around evaluating the historical performance and risk-return profile of Reliance Industries stock (RELIANCE.NS) over a defined period (2023 to Jan 1, 2024). By leveraging financial metrics and statistical tools, we aim to assess its profitability, volatility, risk, and overall investment attractiveness.

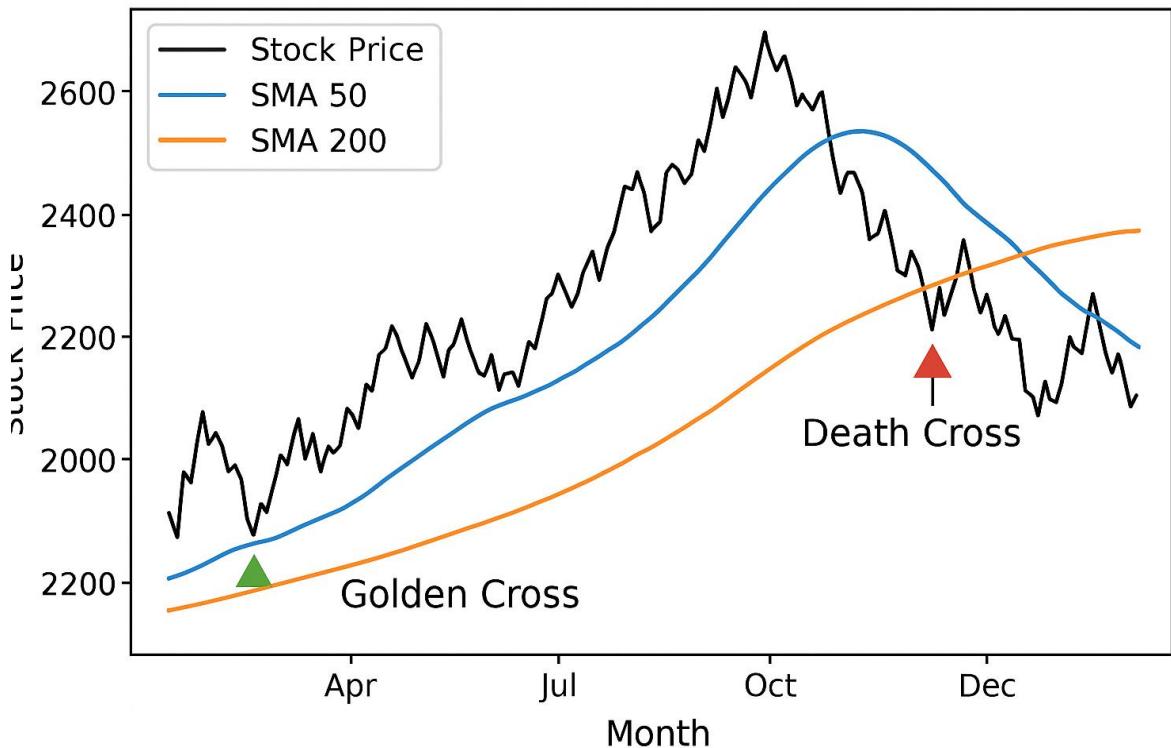
This methodology is rooted in quantitative analysis: utilizing mathematical and statistical techniques to gain insights into market behavior and make informed decisions. The performance evaluation serves as the foundation for identifying trading opportunities and understanding how the stock compares to benchmarks like Nifty or Sensex.

These two lines update the Signal based on SMA crossover strategy:

- **Signal = 1 (buy)** if the **50-day SMA** is greater than **200-day SMA**.
  - This suggests a **bullish** trend (price is likely going up).
- **Signal = -1 (sell)** if the **50-day SMA** is less than **200-day SMA**.
  - This suggests a **bearish** trend (price is likely going down).

☞ This method is a classic **trend-following strategy** called the **Golden Cross / Death Cross**:

- **Golden Cross**: when short SMA crosses above long SMA → bullish signal.
- **Death Cross**: when short SMA crosses below long SMA → bearish signal



## **Reasoning Behind Each Indicator/Statistic**

### **1. Cumulative Return**

- Purpose: Measures the total growth of an investment over the entire period.
- Reasoning: This helps investors understand the overall profitability of the stock during the timeframe.

There was Cumulative Return of -0.106277

It is a negative value, so it indicates downfall.

### **2. Annualized Return**

- Purpose: Standardizes the return to a yearly figure, making it easier to compare with other investments.
- Reasoning: As investments often span varying periods, annualized returns allow for an apples-to-apples comparison.

There was a Annualized Return of -0.108307

This indicates downfall.

### **3. Sharpe Ratio**

- Purpose: Evaluates risk-adjusted returns by considering the ratio of excess returns to standard deviation.
- Reasoning: A higher Sharpe Ratio indicates better returns per unit of risk, helping investors gauge the efficiency of the investment.

Sharpe Ratio: 0.016

Low Sharpe Ratio = You took a lot of risk but didn't earn much extra

### **4. Sortino Ratio**

- Purpose: Like the Sharpe Ratio but focuses only on downside risk (i.e., periods of negative returns).
- Reasoning: By isolating downside volatility, this provides a clearer picture of risk management effectiveness.

Sortino Ratio: 0.028

Bad Sortino Ratio = You're making money, but with lots of scary drop.

### **5. Maximum Drawdown**

- Purpose: Captures the largest decline in the stock's value from its peak during the period.
- Reasoning: Helps in understanding the worst-case scenario, crucial for risk-averse investors.

Max Drawdown: -15.23%

## 6. Win Rate

- Purpose: The percentage of days or trades with positive returns.
- Reasoning: Indicates the consistency and reliability of gains—important for crafting dependable trading strategies.

Win Rate: 50.20%

## 7. Profit Factor

- Purpose: Compares total profits to total losses, alongside additional stats like average profit/loss and maximum profit/loss.
- Reasoning: Highlights the efficiency of an investment—whether profits significantly outweigh losses.

Profit Factor = Good money ÷ Bad money

Profit Factor > 1 = You're doing well

Profit Factor: 1.11

↳ Avg Profit: 0.86%, Avg Loss: -0.79%

↳ Max Profit: 4.31%, Max Loss: -3.10%

## 8. Additional India-Specific Metrics

- Performance vs Nifty/Sensex:
  - Purpose: Compares the stock's performance to prominent market benchmarks.
  - Reasoning: Offers insights into the stock's relative strength within the Indian market context, aiding in portfolio diversification decisions.

RELIANCE Return: 9.11%

NIFTY50 Return: 19.42%

Relative Outperformance: -10.31%

## Overall Objective

By combining these metrics, the strategy aims to provide a comprehensive view of both the potential rewards and risks associated with investing in RELIANCE.NS. This holistic approach ensures that decisions are backed by data, minimizing guesswork and aligning investments with individual risk tolerance and financial goals.

If you'd like a deeper dive into any metric or need further examples, I'm here to help! Let me know.

## **Resources Used to Design the Strategy**

Here's a list of the core resources involved:

- **Data Source:** Historical stock data retrieved using Yahoo Finance API via yfinance.
- **Performance Indicators:** Calculations for risk-adjusted metrics (Sharpe, Sortino, drawdowns) and profitability measures.
- **Python Libraries:** Key tools used include:
  - yfinance (for data retrieval)
  - pandas and numpy (for data manipulation and calculations)
  - matplotlib and seaborn (for data visualization)