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# PGP-DSBA PROJECT REPORT

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FRA – Guided Project  
PART B

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# INTRODUCTION

Investors face market risk, arising from asset price fluctuations due to economic events, geopolitical developments, and investor sentiment changes. Understanding and analyzing this risk is crucial for informed decision-making and optimizing investment strategies.

## 1.1 Objective

The objective of this analysis is to conduct Market Risk Analysis on a portfolio of Indian stocks using Python. It uses historical stock price data to understand market volatility and riskiness. Using statistical measures like mean and standard deviation, investors gain a deeper understanding of individual stocks' performance and portfolio variability.

Through this analysis, investors can aim to achieve the following objectives:

- **Risk Assessment:** Analyze the historical volatility of individual stocks and the overall portfolio.
- **Portfolio Optimization:** Use Market Risk Analysis insights to enhance risk-adjusted returns.
- **Performance Evaluation:** Assess portfolio management strategies' effectiveness in mitigating market risk.
- **Portfolio Performance Monitoring:** Monitor portfolio performance over time and adjust as market conditions and risk preferences change.

# EXPLORATORY DATA ANALYSIS

## 2.1 Problem Definition

The problem revolves around the uncertainty and volatility in the Indian stock market, influenced by economic events, geopolitical shifts, and investor sentiment. Investors need a systematic approach to assess market risk, optimize portfolio returns, and monitor performance over time. By leveraging historical stock price data and statistical measures like mean and standard deviation, the analysis aims to quantify risk levels and enhance investment decision-making. The key challenges include identifying risk factors, measuring individual stock volatility, evaluating overall portfolio stability, and adapting strategies based on evolving market conditions. A robust market risk analysis framework can help investors mitigate risk, refine portfolio strategies, and improve long-term financial outcomes.

## 2.2 Data Contents

The dataset (Market\_Risk\_Data.csv) consists of weekly stock price data for 5 Indian stocks over an 8-year period. The dataset enables us to analyze the historical performance of individual stocks and the overall market dynamics.

- There are 418 observations in the dataset.
- There are 6 columns in the dataset.
- The columns consist of 5 numerical variables and 1 object variable.
- All numerical variables are integer type data.
- There are no duplicate entries in the dataset.
- There are no null values in the dataset.

## 2.3 Statistical Summary

Figure 1 - Statistical Summary of the Dataset

	count	mean	std	min	25%	50%	75%	max
<b>Dish TV</b>	418.0	38.648325	31.944620	4.0	14.00	19.5	73.0	108.0
<b>Infosys</b>	418.0	1007.210526	455.089501	445.0	591.25	777.5	1454.0	1939.0
<b>Hindustan Unilever</b>	418.0	1906.344498	597.800173	788.0	1368.50	2083.0	2419.0	2798.0
<b>Vodafone Idea</b>	418.0	23.234450	20.264854	3.0	9.00	12.0	43.0	71.0
<b>Cipla</b>	418.0	756.614833	252.969619	370.0	556.00	637.0	946.0	1493.0

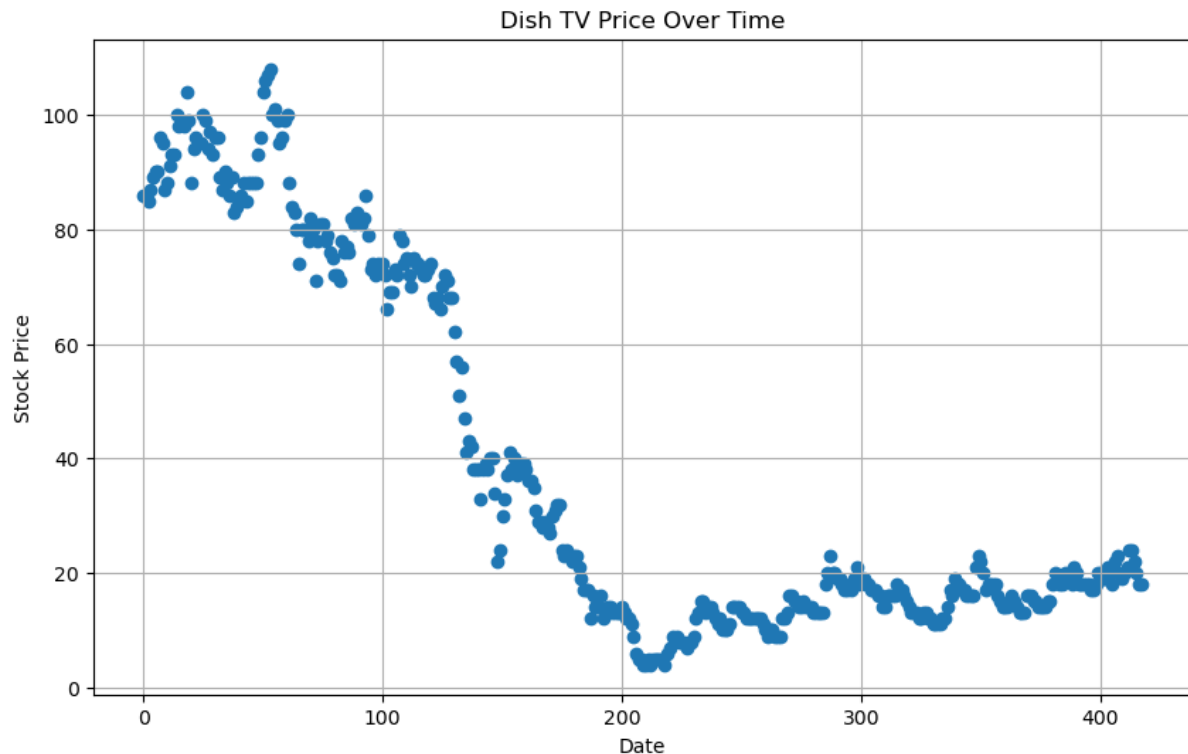
### Observations:

- Dish TV has the lowest mean stock price of 38.65, with significant fluctuations, as seen in its high standard deviation of 31.94.
- Infosys shows a high mean of 1007.21 and a large range between the minimum of 445 and maximum of 1939.
- Hindustan Unilever shows stability with a relatively high average price of 1906.34 and standard deviation of 597.80.
- Vodafone Idea has the lowest stock price among the five, with a mean of 23.23 and high standard deviation of 20.26.
- Cipla shows moderate stability, with a mean of 756.61 and lower standard deviations compared to Infosys and Hindustan Unilever.

# STOCK PRICE GRAPH ANALYSIS

## 3.1 Dish TV

*Figure 2 - Dish TV Stock Price Graph*

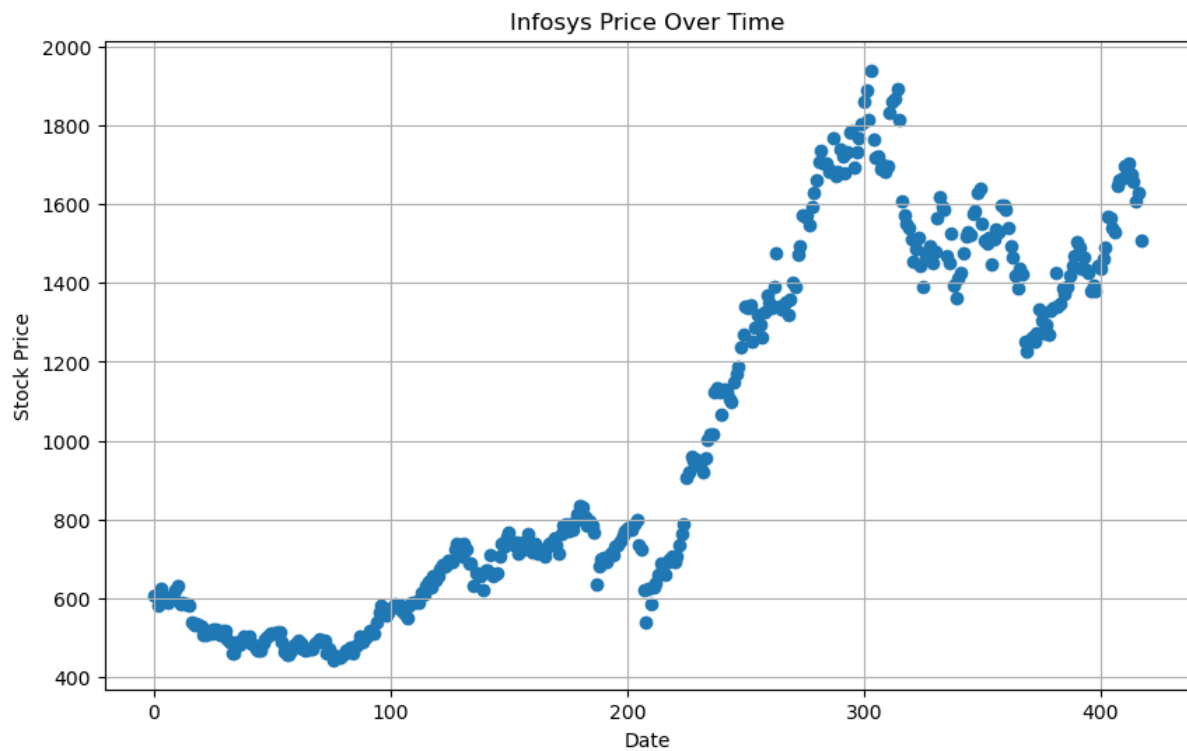


### Observations:

- The Dish TV stock price starts relatively high, peaking around 100 in the early part of the period.
- There's a notable downward trend from approximate date points 100 to 200, where the price drops significantly.
- The stock price reaches a low point and fluctuates in a range between roughly 5 and 20 for a considerable portion of the observed period.
- Towards the end of the period, there appears to be a slight recovery and stabilization in the stock price, hovering around 20.

## 3.2 Infosys

Figure 3 - Infosys Stock Price Graph

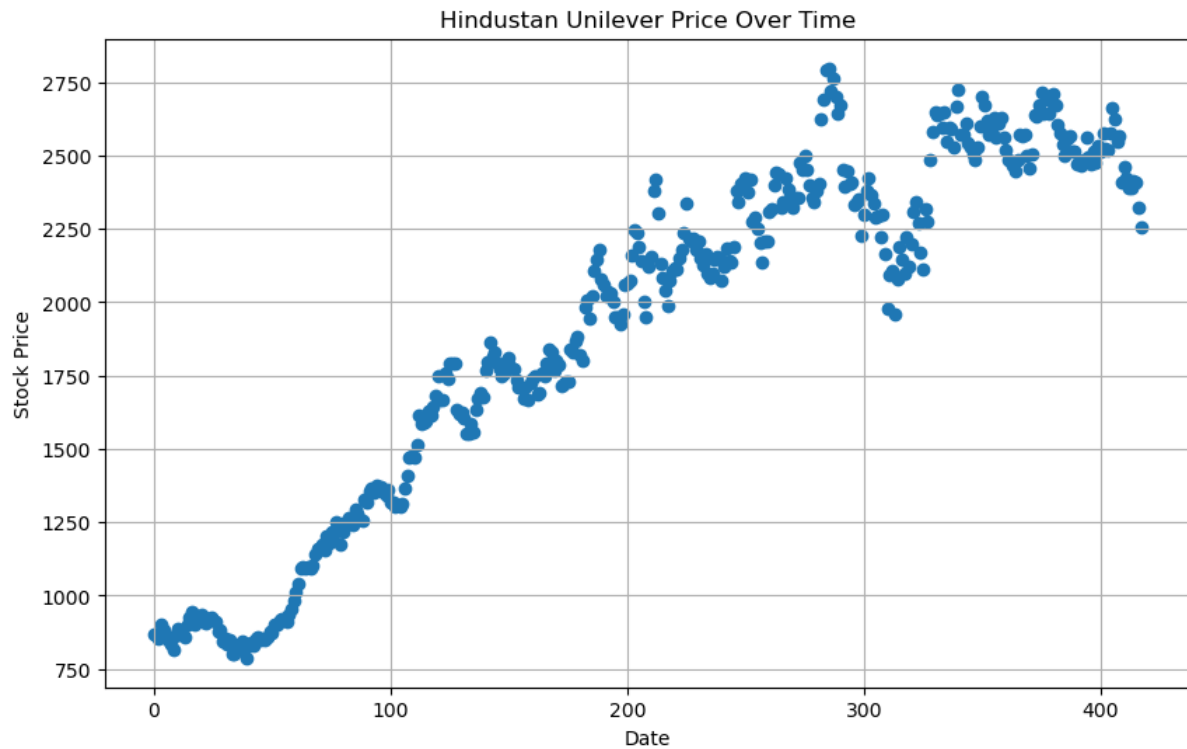


### Observations:

- The Infosys stock exhibits a strong overall upward trajectory throughout the 8-year period.
- The period of rapid price increase occurs in the middle of the timeline around date points 200-300.
- The stock reaches a high point followed by a substantial price correction and subsequent fluctuation.
- Overall, the stock price is higher than it was initially.

### 3.3 Hindustan Unilever

Figure 4 - Hindustan Unilever Stock Price Graph



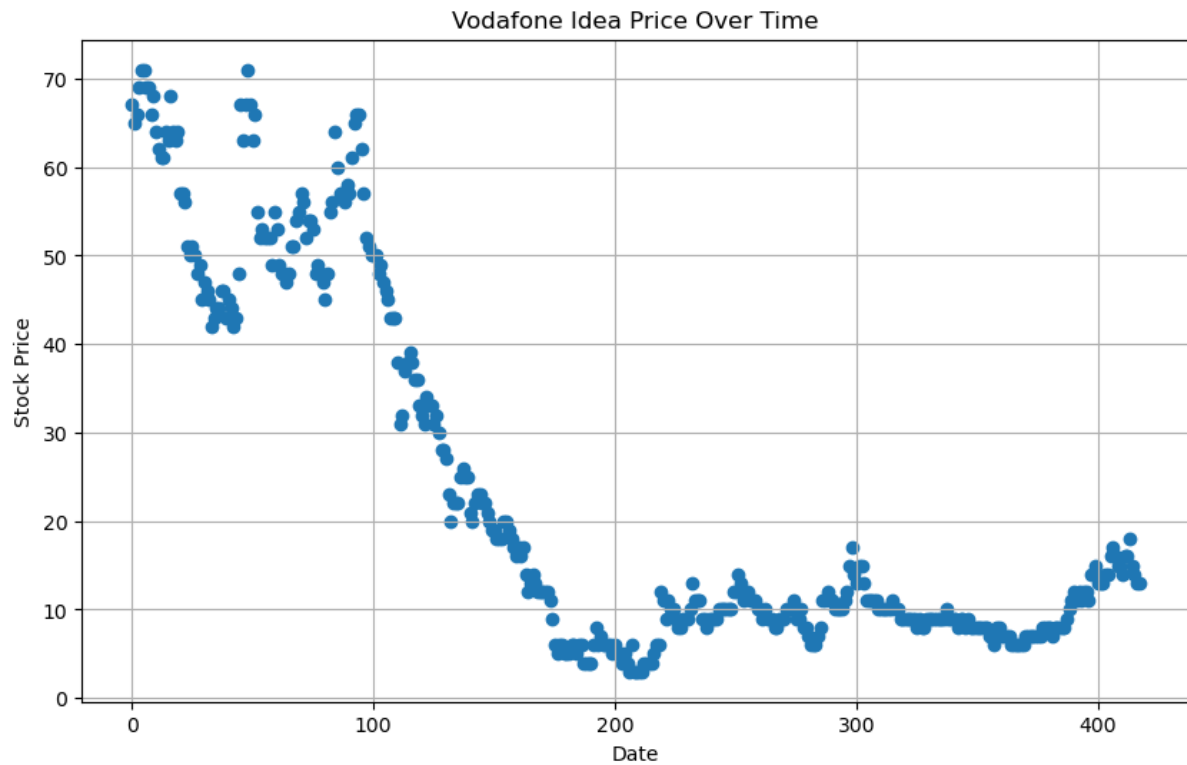
#### Observations:

- The Hindustan Unilever stock price shows a generally consistent upward trend throughout the entire 8-year period.
- There are distinct phases of accelerated growth, particularly between date points 50-100 and again around 200-300.
- After the significant growth, the price decreases to less than around 2000 and then increases after date points around 320 and remains stable.
- Towards the very end of the period, there appears to be a noticeable dip in the stock price.



### 3.4 Vodafone Idea

Figure 5 - Vodafone Idea Stock Price Graph

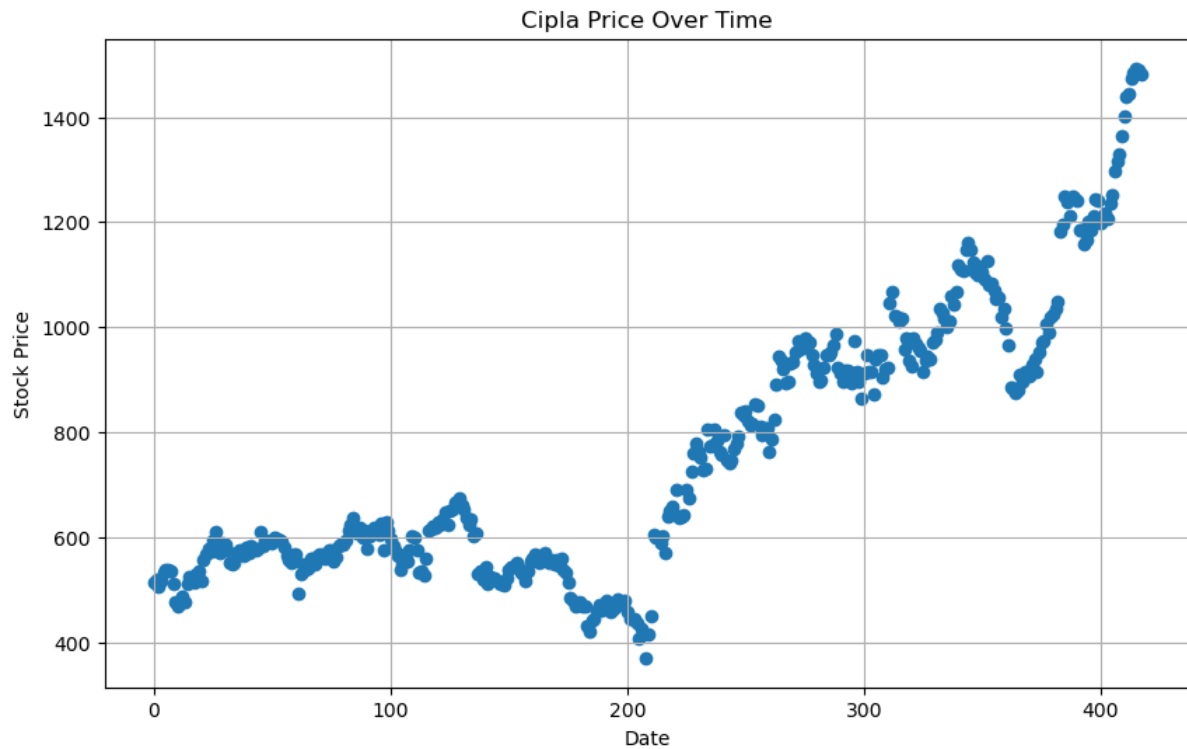


#### Observations:

- The Vodafone stock experienced a substantial drop in price during the initial phase.
- After the significant drop in price, the stock values have stabilized with a price capping at around 20.
- The price has not recovered to the high price it was initially.

### 3.5 Cipla

Figure 6 - Cipla Stock Price Graph



#### Observations:

- The Cipla stock price begins with a period of relative stability, showing some moderate fluctuations within a defined range.
- From approximately the 200 date point onwards, the stock enters a phase of consistent and significant upward growth.
- Towards the very end of the observed timeframe, the rate of price increase appears to accelerate sharply.

# STOCK RETURNS CALCULATIONS AND ANALYSIS

## 4.1 Returns Calculation

Figure 7 - Return of Stock Sample Output

	Dish TV	Infosys	Hindustan Unilever	Vodafone Idea	Cipla
0	NaN	NaN	NaN	NaN	NaN
1	0.000000	-0.001646	-0.004624	-0.030305	0.009681
2	-0.011696	-0.040342	-0.011655	0.015267	-0.025367
3	0.023257	0.069564	0.053635	0.044452	0.017630
4	0.022728	-0.030872	-0.022473	0.028573	0.032477
5	0.011173	-0.001652	-0.014883	0.000000	0.009355
6	0.000000	-0.023412	-0.018627	-0.028573	0.001860
7	0.064539	0.023412	-0.021378	0.000000	-0.007463
8	-0.010471	-0.004971	-0.019395	-0.044452	-0.045985
9	-0.087969	0.031074	0.055934	0.029853	-0.066894
10	0.011429	0.017558	0.027399	-0.060625	-0.016914

Stock return calculation quantifies the change in the price of a stock over a specific period. It represents the gain or loss from investing in that stock. The snippet above shows the log percentage change of all stock prices for each day. Positive log values shows that the price has increased compared to the previous day, a negative log shows that the price has been decreased compared to the previous day. First row display NaN as it has no previous day price to compare it to.

## 4.2 Mean and Standard Deviation Calculation

Figure 8 - Stock Mean Calculation

```
Vodafone Idea      -0.003932
Dish TV            -0.003751
Infosys            0.002180
Hindustan Unilever 0.002294
Cipla              0.002538
dtype: float64
```

Mean return is the average percentage gain or loss of a stock over a period. It's calculated by averaging all the individual returns during that time, giving a simple idea of typical performance.

- Vodafone Idea had a negative mean daily return of -0.003932. This suggests that, on average, the stock price experienced a slight decrease each day during the observed period.
- Dish TV also showed a negative mean daily return of -0.003751, indicating an average daily price decline.
- Infosys shows a positive mean daily return of 0.002180, suggesting an average daily increase in stock price.
- Hindustan Unilever has a positive mean daily return of 0.002294, indicating an average daily price increase slightly higher than Infosys.
- Cipla shows the highest positive mean daily return among the five stocks, at 0.002538, indicating the strongest average daily price increase.

*Figure 9 - Stock Standard Deviation Calculation*

```
Hindustan Unilever    0.028845
Infosys               0.036102
Cipla                 0.036759
Dish TV               0.091333
Vodafone Idea         0.113747
dtype: float64
```

Stock standard deviation is calculated to show the volatility of the returns around their mean. A higher standard deviation indicates greater price fluctuations and thus higher risk.

- Hindustan Unilever shows a mean standard deviation of 0.028845. This indicates a relatively lower level of volatility in its daily returns compared to the other stocks.
- Infosys has a mean standard deviation of 0.036102, suggesting a moderate level of volatility in its daily returns.
- Cipla: exhibits a mean standard deviation of 0.036759, slightly higher than Infosys, indicating a bit more volatility in its daily price movements.
- Dish TV shows a significantly higher mean standard deviation of 0.091333. This points to substantial volatility and larger swings in its daily returns compared to the other three stocks.

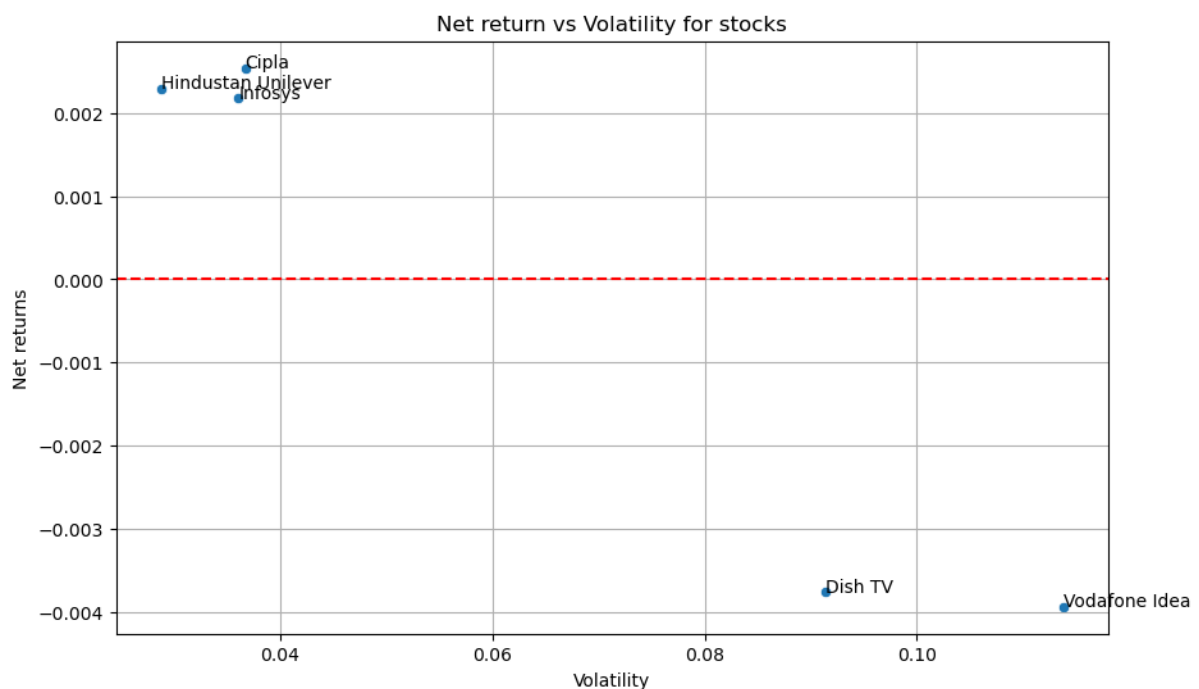
- Vodafone Idea shows the highest mean standard deviation among the group, at 0.113747. This indicates the greatest level of volatility and the most significant fluctuations in its daily stock price.

### 4.3 Visualising Returns and Volatility

Figure 10 - Mean vs Volatility for each stock

	Mean	Volatility
<b>Dish TV</b>	-0.003751	0.091333
<b>Infosys</b>	0.002180	0.036102
<b>Hindustan Unilever</b>	0.002294	0.028845
<b>Vodafone Idea</b>	-0.003932	0.113747
<b>Cipla</b>	0.002538	0.036759

Figure 11 - Scatter Plot - Mean vs Volatility



#### Observations:

- Vodafone Idea and Dish TV show high risk, low return. The stocks exhibit the highest volatility while delivering negative average daily returns, making them less attractive based on this analysis.

- Cipla shows the highest return for moderate risk. It shows the highest average daily return among the five stocks, with a moderate level of volatility, suggesting a relatively favorable risk-reward balance.
- Hindustan Unilever and Infosys has lower Risk, lower Return compared to Cipla. These stocks demonstrate lower volatility but also offer lower positive average daily returns compared to Cipla but still a positive average daily returns.

## ACTIONABLE INSIGHTS AND RECOMMENDATIONS

- Cipla has shown the highest average daily return with a moderate level of volatility compared to the other stocks. This suggests it might be a worthwhile consideration for investors seeking growth without excessive risk. Further fundamental analysis would be needed to validate this potential.
- Both Vodafone Idea and Dish TV have exhibited high volatility and negative average daily returns. This suggests higher risk without reward based on the historical data. Investors should be cautious and potentially avoid or significantly limit exposure to these stocks unless there are strong, well-researched reasons to believe in a future turnaround.
- Hindustan Unilever and Infosys are options for investors prioritizing lower volatility and stability. They have shown positive average returns with relatively lower price fluctuations. These might be suitable for more risk-averse investors or as stable components within a diversified portfolio.