

Quantitative Analysis of Stock Market using Python

Quantitative Analysis in the stock market involves the use of mathematical and statistical techniques to understand, predict, and make decisions about financial investments. If you want to learn how to perform Quantitative Analysis on stock market data, this article is for you. In this article, I'll take you through the task of Quantitative Analysis of the stock market using Python.

Quantitative Analysis of Stock Market: Process We Can Follow

Quantitative Analysis in the stock market is a financial methodology that utilizes mathematical and statistical techniques to analyze stocks and financial markets.

Below is the process we can follow for the task of Quantitative Analysis of the stock market:

- Clearly define the objectives and questions to be answered.
- Identify the key performance indicators (KPIs) relevant to the analysis.
- Gather historical stock market data, including prices, volumes, and other relevant financial indicators.
- Clean and preprocess the data to handle missing values, outliers, and errors.
- Conduct initial analysis to understand data distributions, patterns, and correlations.
- Implement various strategies based on quantitative analysis.

Now, let's get started with the task of Quantitative Analysis of the stock market by importing the necessary Python libraries and the dataset:

```
In [2]: import pandas as pd
import plotly.express as px
import plotly.graph_objects as go
from plotly.subplots import make_subplots
import plotly.io as pio
pio.templates.default = "plotly_white"

# Load the dataset
stocks_data = pd.read_csv(r"C:\Users\shali\OneDrive\Documents\Data analysis project\stocks\stocks.csv")

# Display the first few rows of the dataset
print(stocks_data.head())
```

	Ticker	Date	Open	High	Low	Close	\
0	AAPL	2023-02-07	150.639999	155.229996	150.639999	154.649994	
1	AAPL	2023-02-08	153.880005	154.580002	151.169998	151.919998	
2	AAPL	2023-02-09	153.779999	154.330002	150.419998	150.869995	
3	AAPL	2023-02-10	149.460007	151.339996	149.220001	151.009995	
4	AAPL	2023-02-13	150.949997	154.259995	150.919998	153.850006	

	Adj Close	Volume
0	154.414230	83322600
1	151.688400	64120100
2	150.639999	56007100
3	151.069995	57450700
4	153.850006	62199000

The dataset contains the following columns for stock market data:

- Ticker: The stock ticker symbol.
- Date: The trading date.
- Open: The opening price of the stock for the day.
- High: The highest price of the stock during the day.
- Low: The lowest price of the stock during the day.
- Close: The closing price of the stock for the day.
- Adj Close: The adjusted closing price, which accounts for all corporate actions such as dividends, stock splits, etc.
- Volume: The number of shares traded during the day.

To perform a quantitative analysis, we can explore various statistical concepts like descriptive statistics, time series analysis, correlation analysis, and more. Here are some potential analyses we can perform:

- Descriptive Statistics: Summary statistics (mean, median, standard deviation, etc.) for each stock.
- Time Series Analysis: Trends and patterns over time, especially for closing prices.
- Volatility Analysis: How much the stock price fluctuates over a period.
- Correlation Analysis: How stock prices of different companies are related to each other.
- Comparative Analysis: Comparing the performance of different stocks.
- Risk-Return Trade-off Analysis: Analyzing the balance between the potential risks and rewards of different stocks, aiding in portfolio management.

Let's implement all these concepts of Quantitative Analysis of the stock market one by one.

Descriptive Statistics

Descriptive Statistics will provide summary statistics for each stock in the dataset. We'll look at measures such as mean, median, standard deviation, and more for the Close prices:

```
In [3]: # Descriptive Statistics for each stock
descriptive_stats = stocks_data.groupby('Ticker')['Close'].describe()
print(descriptive_stats)
```

Let's break down the results for each stock:

AAPL (Apple Inc.)

- Count: 62.0 (The number of observations or trading days included in the dataset for AAPL)
- Mean: 158.24 (The average closing price)
- Standard Deviation: 7.36 (Measures the amount of variation or dispersion of closing prices)
- Minimum: 145.31 (The lowest closing price in the dataset)
- 25th Percentile: 152.08 (25% of the closing prices are below this value)
- Median (50%): 158.06 (The middle value of the closing prices)
- 75th Percentile: 165.16 (75% of the closing prices are below this value)
- Maximum: 173.57 (The highest closing price in the dataset)

GOOG (Alphabet Inc.)

Similar statistics as AAPL, but for GOOG. The mean closing price is 100.63, with a standard deviation of 6.28, indicating less variability in closing prices compared to AAPL.

MSFT (Microsoft Corporation)

The dataset includes the same number of observations for MSFT. It has a higher mean closing price of 275.04 and a higher standard deviation of 17.68, suggesting greater price variability than AAPL and GOOG.

NFLX (Netflix Inc.)

NFLX shows the highest mean closing price (327.61) among these stocks and the highest standard deviation (18.55), indicating the most significant price fluctuation.

Time Series Analysis

Next, we'll proceed with the Time Series Analysis to examine trends and patterns over time, focusing on the closing prices:

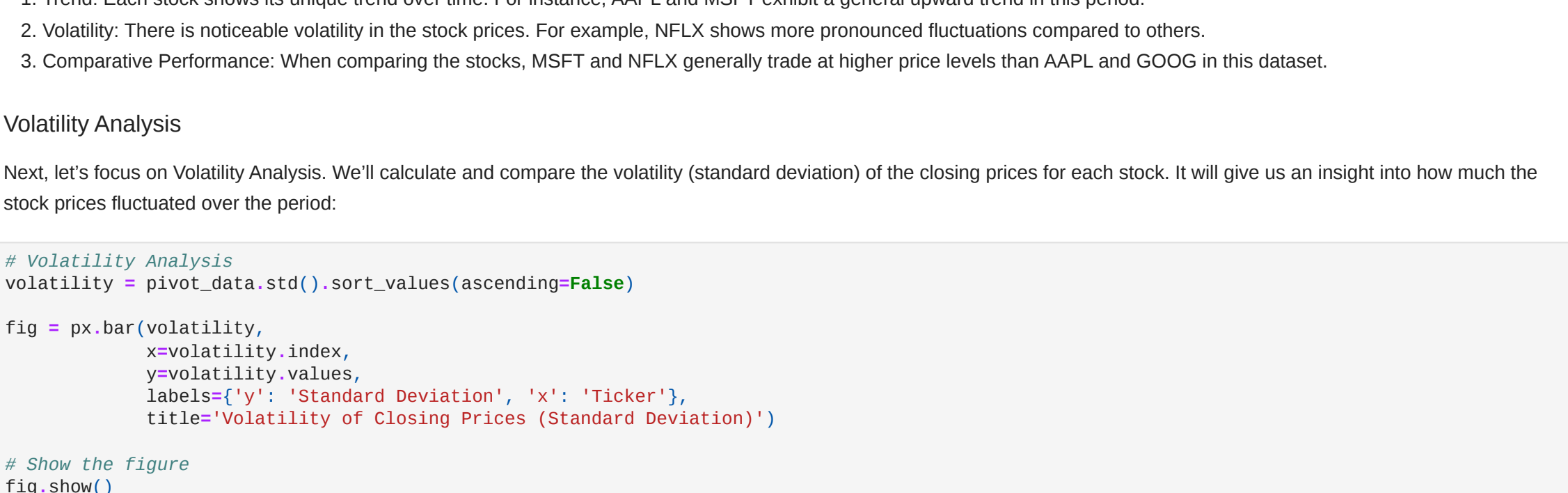


The above plot displays the time series of the closing prices for each stock (AAPL, GOOG, MSFT, NFLX) over the observed period. Here are some key observations:

- Trend: Each stock shows its unique trend over time. For instance, AAPL and MSFT exhibit a general upward trend in this period.
- Volatility: There is noticeable volatility in the stock prices. For example, NFLX shows more pronounced fluctuations compared to others.
- Comparative Performance: When comparing the stocks, MSFT and NFLX generally trade at higher price levels than AAPL and GOOG in this dataset.

Volatility Analysis

Next, let's focus on Volatility Analysis. We'll calculate and compare the volatility (standard deviation) of the closing prices for each stock. It will give us an insight into how much the stock prices fluctuated over the period:



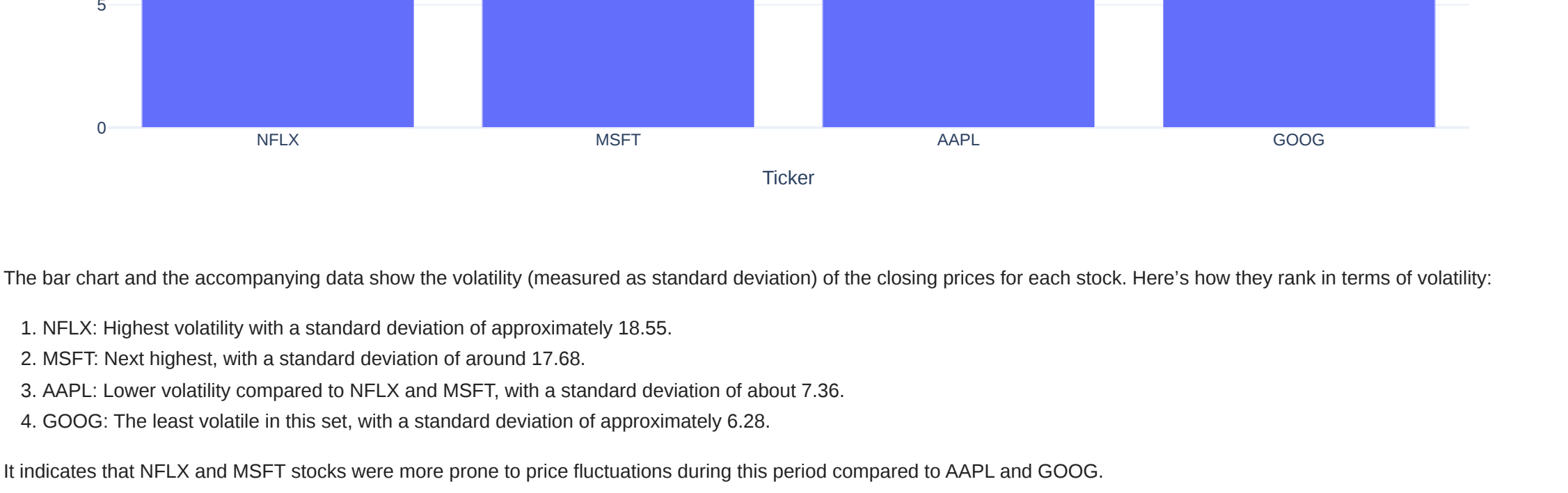
The bar chart and the accompanying data show the volatility (measured as standard deviation) of the closing prices for each stock. Here's how they rank in terms of volatility:

- NFLX: Highest volatility with a standard deviation of approximately 18.55.
- MSFT: Next highest, with a standard deviation of around 17.68.
- GOOG: The least volatile in this set, with a standard deviation of approximately 6.28.

It indicates that NFLX and MSFT stocks were more prone to price fluctuations during this period compared to AAPL and GOOG.

Correlation Analysis

Next, we'll perform a Correlation Analysis to understand how the stock prices of these companies are related to each other:



The heatmap above displays the correlation matrix of the closing prices of the four stocks (AAPL, GOOG, MSFT, NFLX). Here's what the correlation coefficients suggest:

- Values close to +1 indicate a strong positive correlation, meaning that as one stock's price increases, the other tends to increase as well.
- Values close to -1 indicate a strong negative correlation, where one stock's price increase corresponds to a decrease in the other.
- Values around 0 indicate a lack of correlation.

From the heatmap, we can observe that there are varying degrees of positive correlations between the stock prices, with some pairs showing stronger correlations than others. For instance, AAPL and MSFT seem to have a relatively higher positive correlation.

Comparative Analysis

Now, let's move on to Comparative Analysis. In this step, we'll compare the performance of different stocks based on their returns over the period. We'll calculate the percentage change in closing prices from the start to the end of the period for each stock:



The bar chart and the accompanying data show the percentage change in the closing prices of the stocks from the start to the end of the observed period:

- MSFT: The highest positive change of approximately 12.31%.
- AAPL: Exhibited a positive change of approximately 12.23%. It indicates a solid performance, though slightly lower than MSFT's.
- GOOG: Showed a slight negative change of about -1.69%. It indicates a minor decline in its stock price over the observed period.
- NFLX: Experienced the most significant negative change, at approximately -11.07%. It suggests a notable decrease in its stock price during the period.

Daily Risk Vs. Return Analysis

To perform a Risk vs. Return Analysis, we will calculate the average daily return and the standard deviation of daily returns for each stock. The standard deviation will serve as a proxy for risk, while the average daily return represents the expected return.

We will then plot these values to visually assess the risk-return profile of each stock. Stocks with higher average returns and lower risk (standard deviation) are generally more desirable, but investment decisions often depend on the investor's risk tolerance:



So, AAPL shows the lowest risk combined with a positive average daily return, suggesting a more stable investment with consistent returns. GOOG has higher volatility than AAPL and, on average, a slightly negative daily return, indicating a riskier and less rewarding investment during this period.

MSFT shows moderate risk with the highest average daily return, suggesting a potentially more rewarding investment, although with higher volatility compared to AAPL. NFLX exhibits the highest risk and a negative average daily return, indicating it was the most volatile and least rewarding investment among these stocks over the analyzed period.

Summary

So, this is how you can perform a Quantitative Analysis of the Stock Market using Python. Quantitative Analysis in the stock market is a financial methodology that utilizes mathematical and statistical techniques to analyze stocks and financial markets. I hope you liked this article on Quantitative Analysis of Stock Market using Python. Feel free to ask valuable questions in the comments section below.