NVIDIA STOCK TRENDS AND VOLATILITY ANALYSIS

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1. INTRODUCTION

Founded in 1993, NVIDIA is the world leader in accelerated computing. Our invention of the GPU in 1999 sparked the growth of the PC gaming market, redefined computer graphics, revolutionized accelerated computing, ignited the era of modern AI, and is fueling industrial digitalization across markets. NVIDIA is now a full-stack computing infrastructure company with data-center-scale offerings that are reshaping the industry.

Objective

The main objective is to conduct a **comprehensive data analysis** of historical stock price data to uncover key patterns, trends, and metrics. Specifically, you aim to:

1. **Analyze historical stock price data** (open, high, low, close, volume) to identify trends, patterns, and anomalies.
2. **Quantify and understand stock price volatility** using metrics like standard deviation, Bollinger Bands, and Average True Range (ATR).
3. **Identify key stock market trends** using technical indicators (e.g., moving averages, volume analysis).
4. **Assess stock performance** through various statistical measures and visualizations, helping investors gain insights into historical stock behavior.

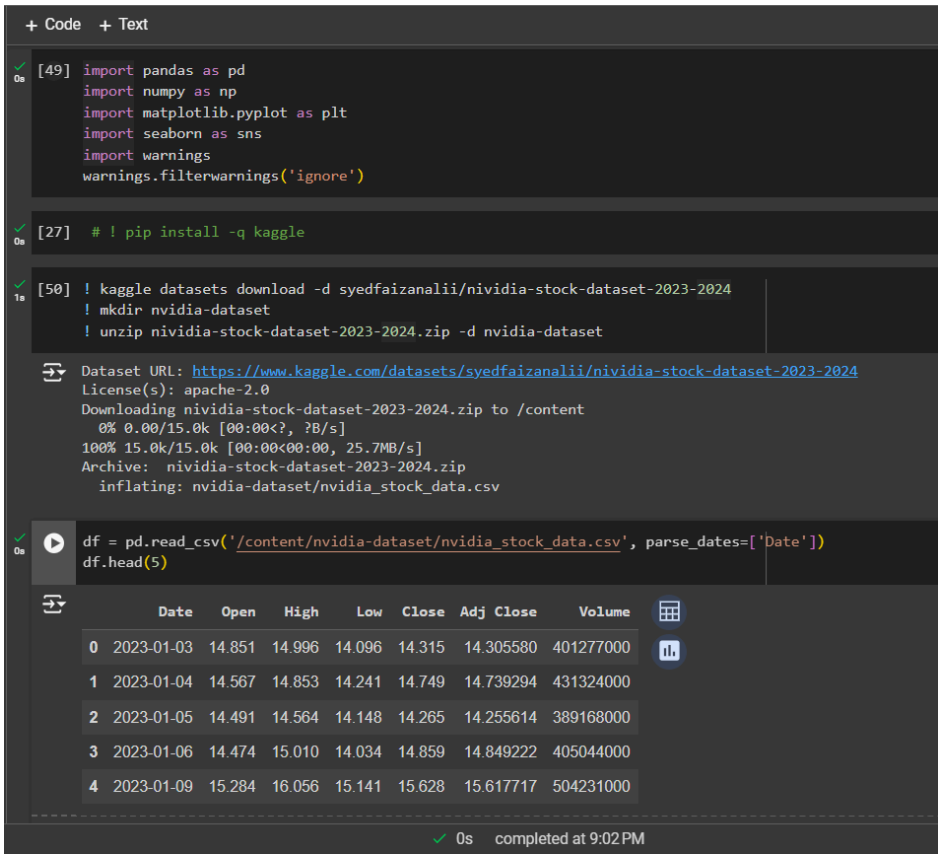
2. DATA EXPLORATION

How the data was collected

The NVIDIA Stock Dataset (2023-24) was collected from Kaggle Datasets. This dataset contains historical stock market data, with each row representing a trading day. The dataset was called into my colab notebook with the help of kaggle api. This makes it easy, as we don't have to manually download the dataset again and again.

Features in this dataset

This dataset consists of 7 columns; Date, Open, High, Low, Close, Adj Close (Adjusted Close), Volume. These features are essential for a detailed analysis and also to gather meaningful insights about the stock price trends and the volatility of the stock, as well as help us to decide what should be done next.



3. METHODOLOGY

For this analysis, the programming language of choice was Python. This is because python is a very intuitive language to work with. It also supports a huge number of packages which can be used together in order to get the most out of the data.

Packages like pandas and numpy help in working with large datasets and also aid in working with numbers. Matplotlib and Seaborn are data visualization packages which help us to plot detailed graphs which helps us to visualize complex datasets in an easy to understand form.

Google Colab, short for Google Colaboratory, is a powerful and user-friendly cloud service that enables users to write and execute Python code directly in their web browsers. Designed primarily for data analysis, machine learning, and deep learning, Colab provides an interactive environment that integrates seamlessly with Google Drive for easy file management and sharing.

Colab notebooks are saved in the .ipynb format, which is compatible with Jupyter notebooks. This allows users to create and share documents that contain live code, equations and visualizations. Google Colab comes pre-installed with many popular Python libraries, such as TensorFlow, PyTorch, NumPy, and Pandas.

4. ABOUT NVIDIA’S STOCKS

Nvidia is one of the leading technology companies, particularly renowned for its graphics processing units (GPUs) and innovations in AI, gaming, and data center technologies. Nvidia's stock (NVDA) is highly regarded due to the company's significant role in driving advancements in artificial intelligence (AI), machine learning, and data-intensive applications.

Key factors that influence Nvidia's stock include:

1. **Leadership in AI:** Nvidia's GPUs are essential for AI workloads, particularly in training deep learning models. This makes Nvidia a critical player in industries ranging from autonomous vehicles to healthcare and cloud computing.
2. **Gaming Market:** Nvidia dominates the high-end gaming GPU market with its GeForce product line, which is popular among gamers and content creators. This consumer base provides a steady revenue stream for the company.
3. **Data Center Growth:** The company is expanding into data centers, providing powerful chips for cloud computing and high-performance computing environments. Nvidia's GPUs are used by major tech companies for AI processing in their data centers.
4. **Volatility and Growth Potential:** Nvidia's stock tends to be highly volatile due to the rapidly changing tech landscape, but it also shows strong long-term growth potential. Analysts frequently rate it as a "Buy" due to its market dominance and potential for growth in AI and gaming.

Investors in Nvidia often focus on its innovation pipeline, demand for GPUs in AI and gaming, and the overall health of the semiconductor industry.

5. DESCRIPTIVE ANALYSIS

Summary Statistics

1. Check Data Types

```
df.describe()
```

	Date	Open	High	Low	Close	Adj Close	Volume
count	437	437.000000	437.000000	437.000000	437.000000	437.000000	4.370000e+02
mean	2023-11-15 17:11:23.752860672	62.618792	63.795366	61.340346	62.635151	62.621695	4.554760e+08
min	2023-01-03 00:00:00	14.474000	14.564000	14.034000	14.265000	14.255614	1.739110e+08
25%	2023-06-09 00:00:00	40.097000	40.500000	39.057999	39.770000	39.750576	3.610260e+08
50%	2023-11-14 00:00:00	47.500000	48.230000	46.742001	47.506001	47.495808	4.277170e+08
75%	2024-04-23 00:00:00	90.000000	91.300003	88.400002	90.356003	90.340851	5.136480e+08
max	2024-09-27 00:00:00	139.800003	140.759995	132.419998	135.580002	135.568405	1.543911e+09
std	NaN	34.893995	35.606990	33.951698	34.782847	34.783928	1.582334e+08

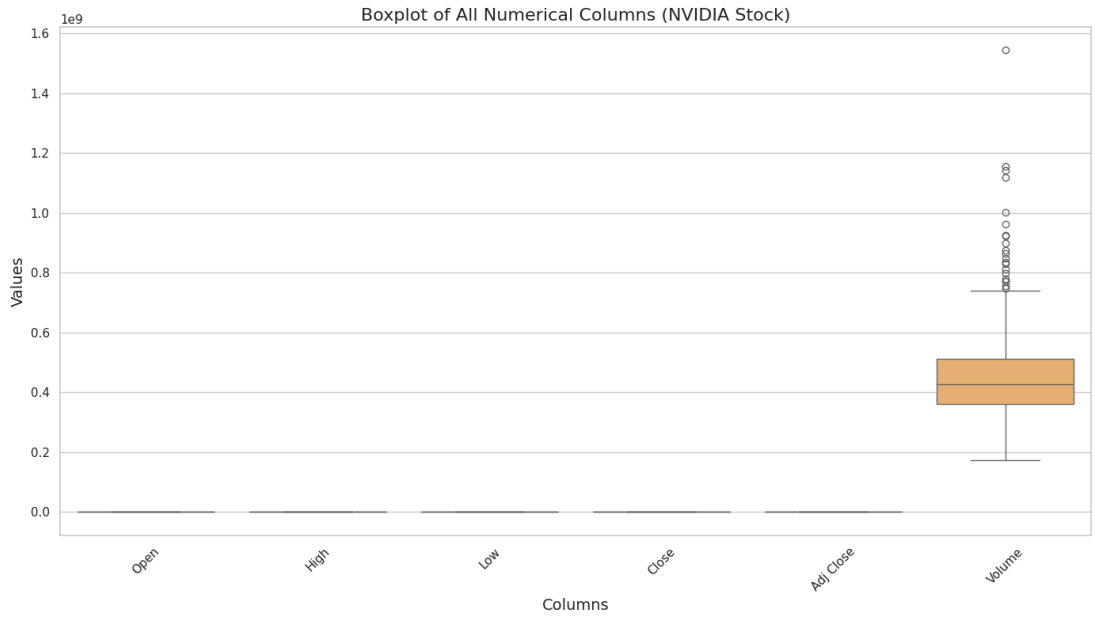
2. Check for Null Values

```
[ ] df.isnull().sum()
```

	0
Date	0
Open	0
High	0
Low	0
Close	0
Adj Close	0
Volume	0

dtype: int64

3. Check for Outliers



4. Handling Outliers

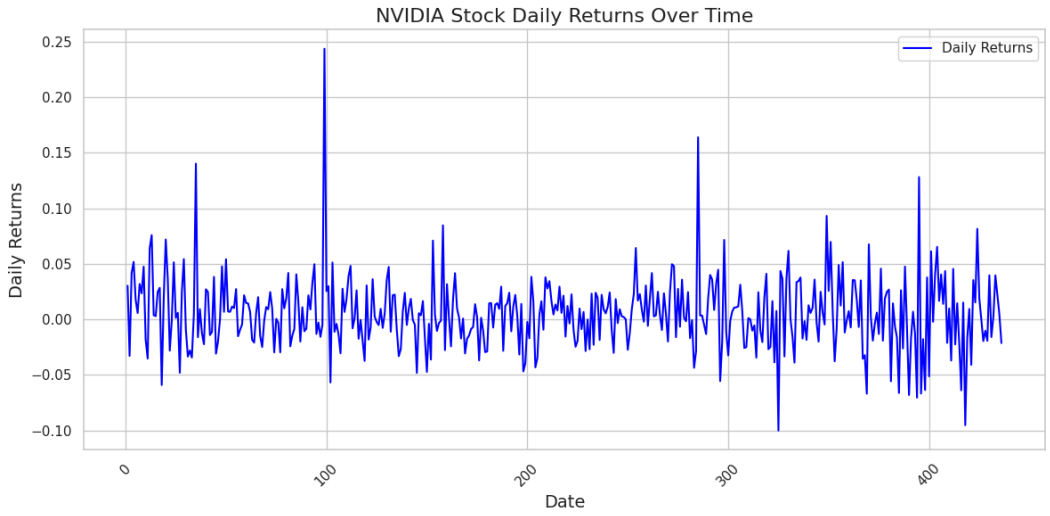
For this analysis, as the number of outliers in the Volume column is only 21 out of 437 records, which constitutes to 4.58% of the dataset, I have chosen to leave the outliers as it is.

Feature Engineering

Even though the dataset consists of all the necessary features, not all kinds of insights and conclusions can be made only using them. Feature Engineering is an important step which is required to add new and more meaningful features to the dataset. These new features provide us with much hidden information, helping us better understand the data and also solve the business problem with more evidence.

1. Daily Returns

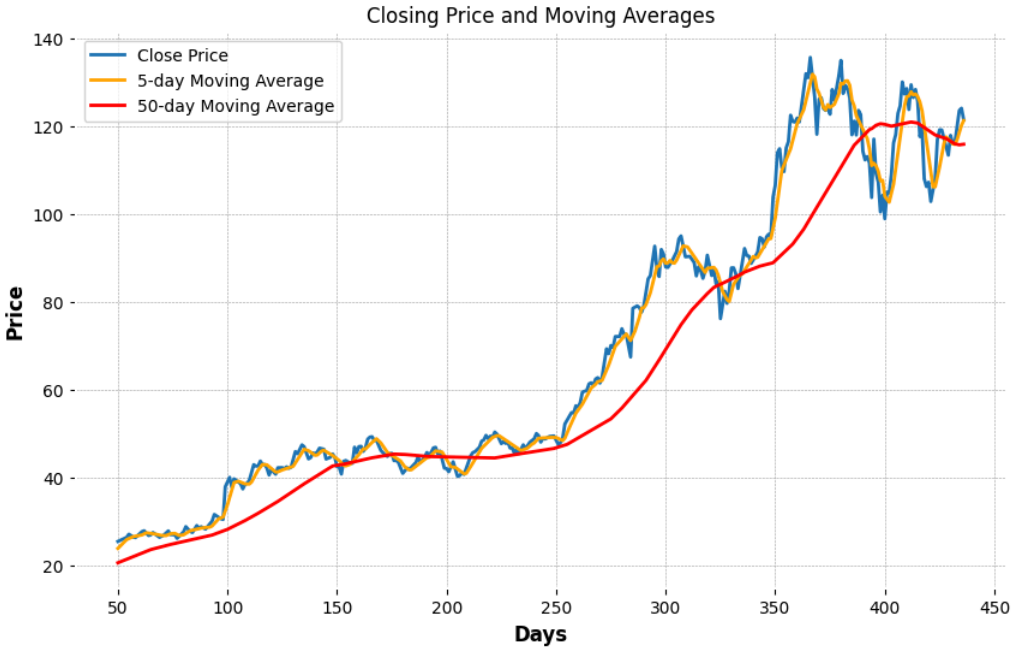
Daily returns in simple terms, is the percentage change in closing prices between today and yesterday. This can be easily done with the help of pct_change() function from pandas library.



The daily returns fluctuate significantly, with frequent swings between positive and negative values. Most daily returns appear to fall within a range of approximately -5% to +5%. There are several extreme outliers, including a notable positive return of about 25% and negative returns reaching around -10%. Small to moderate daily returns are common, while large returns (both positive and negative) occur less frequently but are still notable.

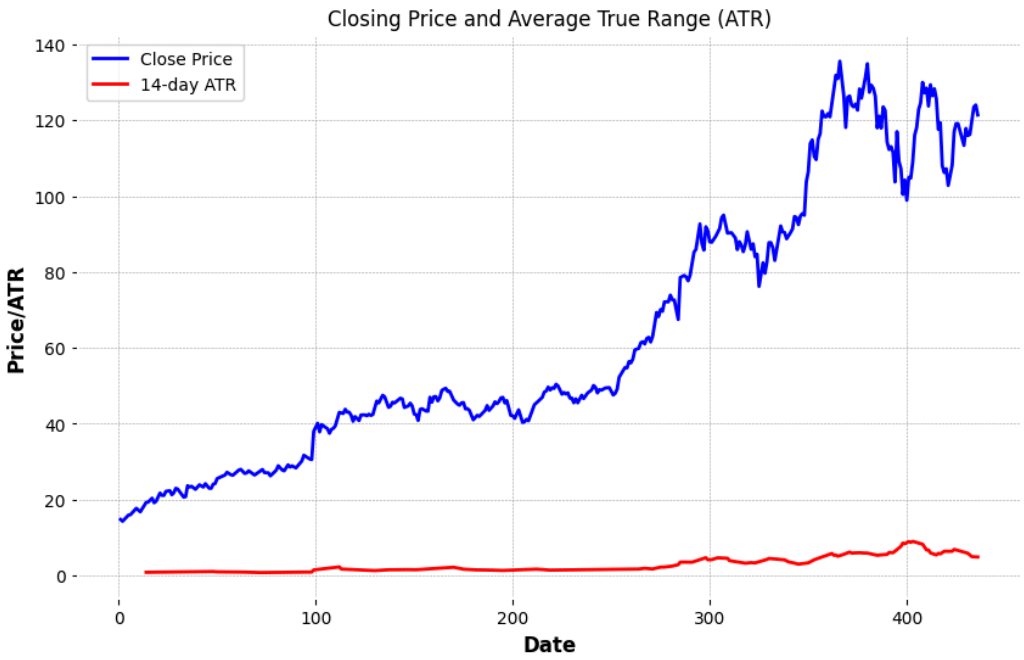
2. Moving Averages column

A moving average in stock analysis smooths out price data by calculating the average of a stock's price over a specific number of periods, like 5 or 50 days. It helps identify trends by filtering out short-term fluctuations. Traders use it to assess the stock's direction and potential buy/sell signals.



3. Add TR and ATR

The ATR helps traders assess the volatility of a stock. When the ATR is rising, the stock tends to experience higher volatility, and when the ATR is falling, the stock shows lower volatility. High ATR values indicate large price movements, while low ATR values suggest smaller price movements or low volatility.



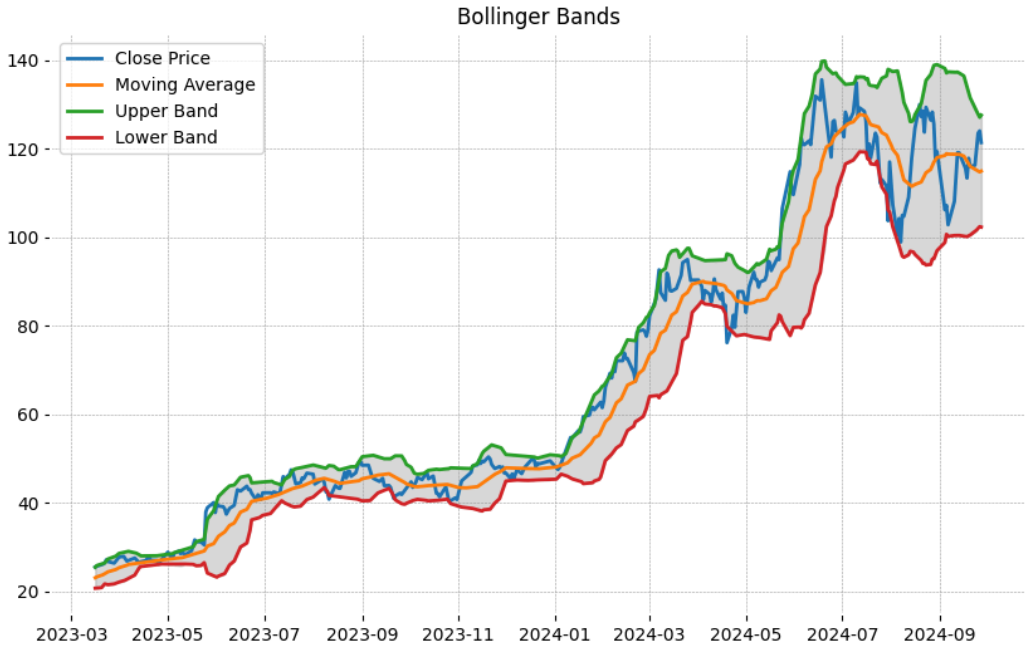
4. Add Bollinger Bands columns

Bollinger Bands are a technical analysis tool used to measure stock price volatility. These bands help identify potential buy and sell signals based on price movement relative to the bands. They consist of three lines:

Upper Band: The middle band plus 2 standard deviations, indicating overbought conditions,

Middle Band: A simple moving average (typically 20 days) of the stock's closing price.

Lower Band: The middle band minus 2 standard deviations, indicating oversold conditions.


Bollinger Bands
Close Price
Moving Average
Upper Band
Lower Band
140
120
100
80
60
40
20
2023-03
2023-05
2023-07
2023-09
2023-11
2024-01
2024-03
2024-05
2024-07
2024-09

6. EXPLORATORY DATA ANALYSIS

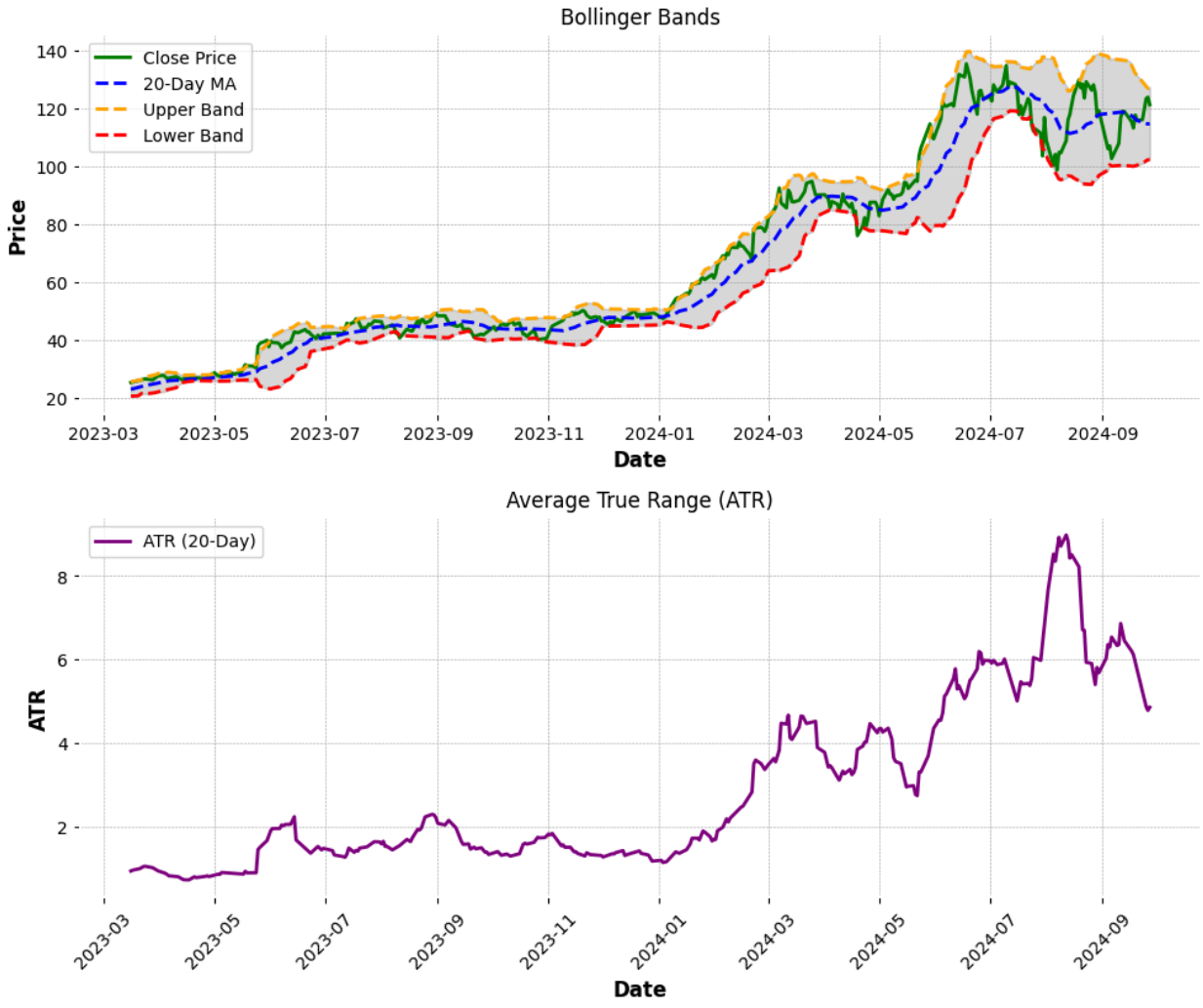
Exploratory Data Analysis (EDA) in the context of stocks involves examining stock market data to uncover patterns, trends, and anomalies. It uses visual tools like line charts, histograms, and scatter plots to help investors understand stock price movements, detect outliers, and analyze relationships between different stocks or market variables. EDA provides a foundational understanding that informs more advanced financial analysis and decision-making.

Stock Price Trends

The observations you've made about NVIDIA's stock prices are insightful. Volatility in the stock market is often a reflection of investor sentiment and external factors influencing the market. The peaks and troughs you've noticed could indeed be the result of specific events or announcements that affect investor confidence and decision-making.

An overall upward trend suggests that, despite short-term fluctuations, the company's market value is growing over time, which can be a positive sign for investors looking for long-term growth.

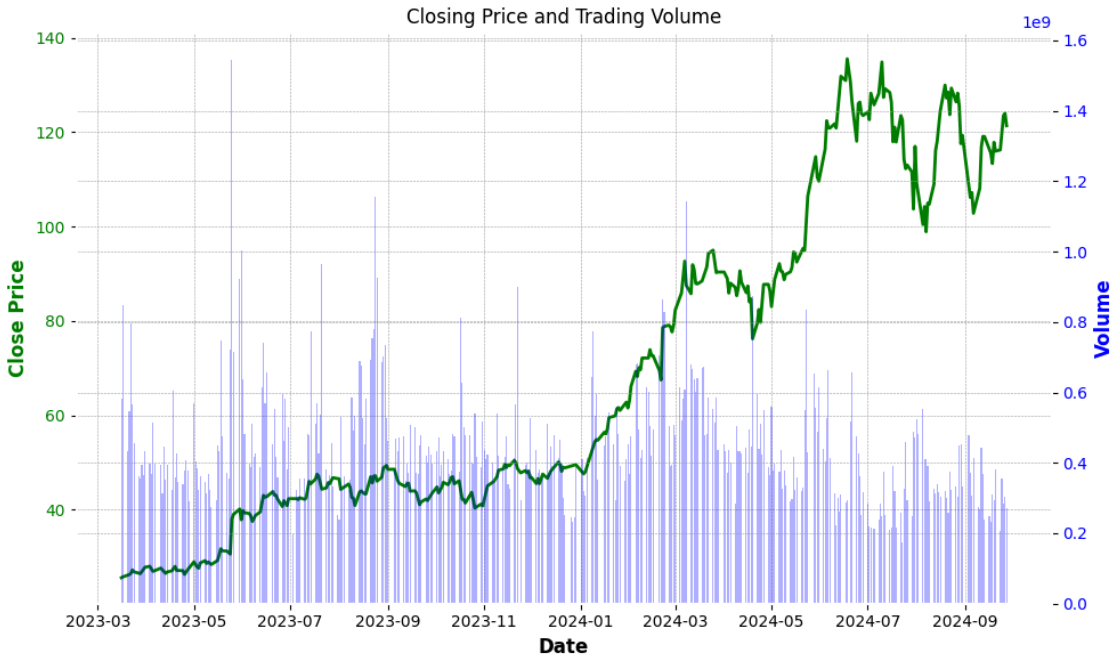
Volatility Analysis



Strong upward trend from March 2023 to September 2024, with prices rising from about $25 to over $120. Significant increase in volatility starting from early 2024, as evidenced by the widening Bollinger Bands and rising ATR. Strong bullish momentum from January 2024 to May 2024, with price consistently near or above the upper Bollinger Band.

Significant expansion in trading ranges since early 2024, as indicated by the widening Bollinger Bands and increased ATR. Slight downward trend in volatility since July 2024, as shown by the decreasing ATR. The high ATR values in recent months indicate increased risk and potential for larger price swings.

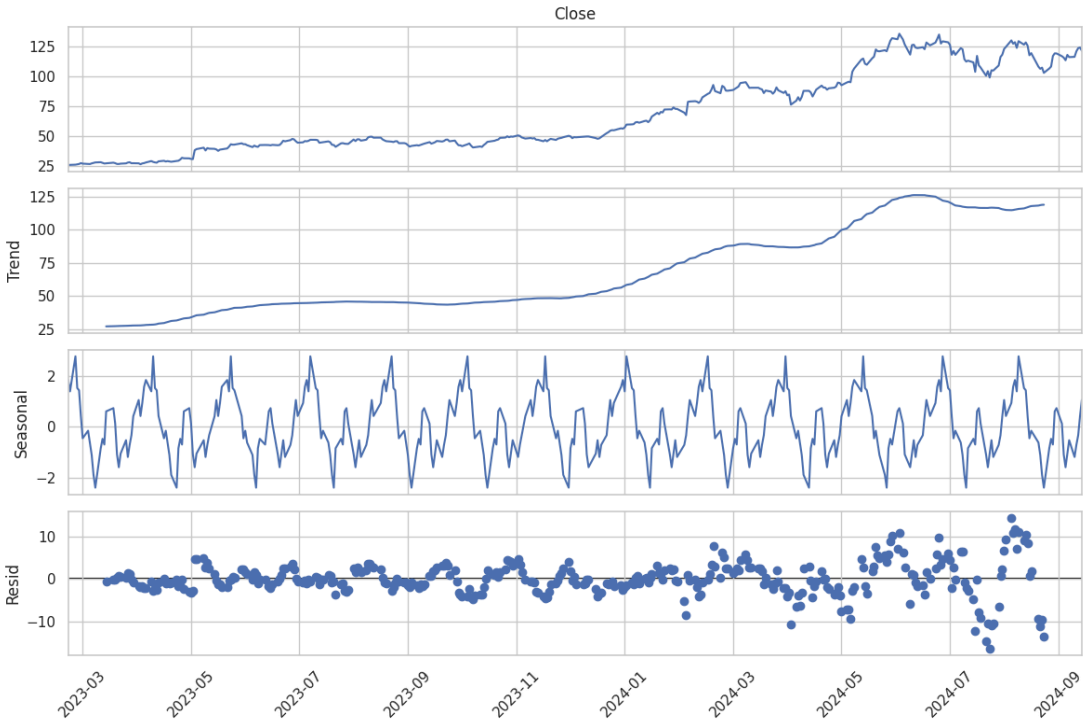
Volume vs Price Movements



The stock has experienced a significant upward trend, escalating from approximately $25 in March 2023 to surpassing $120 by September 2024. This growth was particularly pronounced from late 2023 through mid-2024. The latter half of 2024 saw increased volatility, with the price fluctuating between $100 and $140.

Trading volumes remained high, indicating sustained investor interest, with spikes in volume often correlating with notable price changes. Recent months have shown increased volatility, suggesting differing investor expectations about the stock's future direction, with support around $100 and resistance near the $130-$140 range.

Trend Identification



Seasonal patterns in stock prices can be attributed to various factors, including economic cycles, weather phenomena, and consumer behavior, which can affect supply and demand for related assets. Additionally, residual volatility in the stock market may increase due to economic data releases, political events, changes in interest rates, and unexpected news or events, which can also be influenced by investor sentiment and market manipulation. Understanding these underlying causes can help traders and investors make more informed decisions when considering market timing and risk management strategies.

7. CONCLUSION

In this analysis of NVIDIA's stock trends and volatility from 2023 to 2024, several key insights have been uncovered, reflecting the company's position in the rapidly evolving tech industry:

1. Strong Growth Trend: NVIDIA's stock price exhibited a strong upward trend, especially from March 2023 to September 2024, with prices surging from $25 to over $120. This remarkable growth highlights investor confidence in the company's leadership in AI, gaming, and data centers. The significant rise in stock price also underscores NVIDIA's ability to capitalize on its strategic initiatives, including AI workloads, GPUs for data centers, and growth in the gaming market.

2. High Volatility: The analysis shows that NVIDIA's stock experienced increased volatility, particularly in 2024. The use of **Bollinger Bands** and **ATR** (Average True Range) indicates rising volatility and wider trading ranges during this period. This volatility may have been triggered by industry shifts, economic conditions, or company-specific events, such as earnings reports or product announcements.

3. Daily Returns and Price Swings: Daily returns fluctuated between -5% and +5%, with a few extreme outliers showing significant positive and negative swings. This suggests that while NVIDIA has been a strong growth stock, it is also prone to sharp short-term fluctuations that can impact short-term traders and investors.

4. Moving Averages and Momentum: The strong bullish momentum between January 2024 and May 2024, when the price remained near or above the upper Bollinger Band, highlights NVIDIA's dominance in key markets like AI and gaming. The use of moving averages during this period reveals clear upward momentum, confirming a sustained bullish trend.

5. Volume vs. Price Movements: There was a strong correlation between volume spikes and significant price changes, indicating active trading interest in response to market events. High trading volumes and sharp price increases typically signal investor optimism, while volume spikes accompanied by price drops can indicate market anxiety.

6. Seasonal and Residual Volatility: The observed seasonal patterns and residual volatility indicate that NVIDIA’s stock is sensitive to external factors such as economic data, investor sentiment, and global events. These factors drive short-term market movements, adding complexity to NVIDIA's stock behavior.

Final Thoughts:

Overall, NVIDIA's stock has demonstrated **impressive long-term growth** despite heightened volatility. The company's leadership in **AI, gaming, and data center technologies** has positioned it as a key player in the tech industry, drawing sustained investor interest. However, the stock’s **volatile nature** necessitates careful risk management, especially for short-term investors. For long-term investors, NVIDIA remains an attractive proposition due to its growth potential in **AI and accelerated computing**, provided they can withstand periodic market fluctuations.