

EDA and stock price forecasting of Adidas Stock Prices

1. Introduction

This report presents an Exploratory Data Analysis (EDA) and forecast of the Adidas stock prices using various techniques, including datetime manipulation, plotting, resampling methods, moving averages and Prophet. The analysis also includes stationarity tests to understand the data's properties over time.

2. Data Retrieval

The data for Adidas stock prices was retrieved using the Yahoo Finance API, covering the period from January 1, 2019, to September 30, 2024. The closing prices were the primary focus.

3. Data Overview

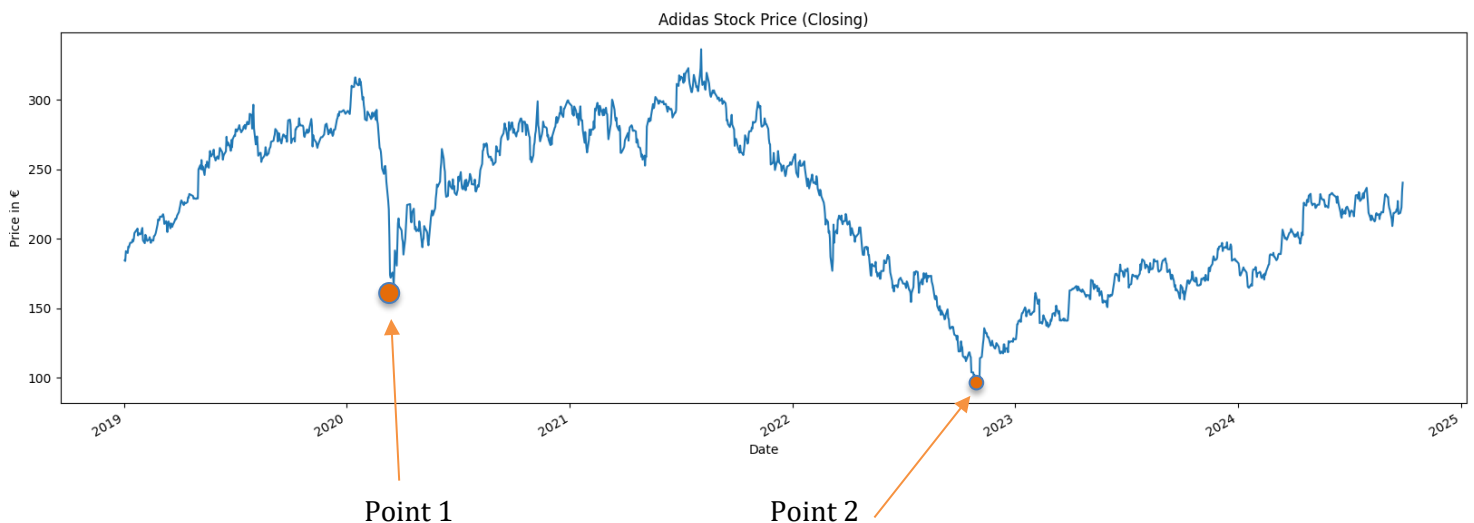
The dataset includes various columns such as Open, High, Low, Close, Volume, and Adjusted Close. We primarily focused on the 'Close' price for analysis. Basic statistical measures were computed to understand the data distribution.

4. Visualizations

The stock prices were visualized to observe trends over time. The following plots were generated:

4.1 Stock Prices Over Time

A line plot of the Adidas stock prices was created to visualize the trends from January 2019 to September 2024. This helped in identifying periods of significant increase or decrease in stock prices.



Insights

1. Significant Dip (January 2020 - April 2020):

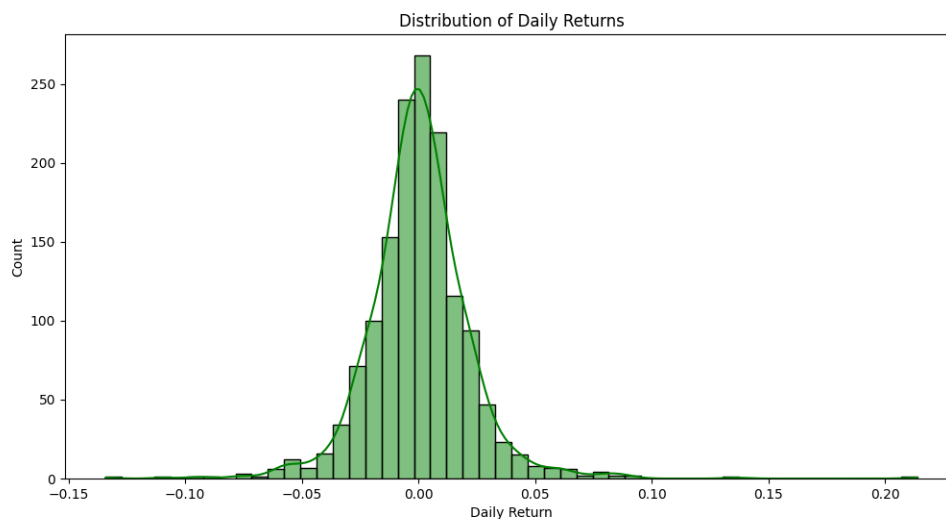
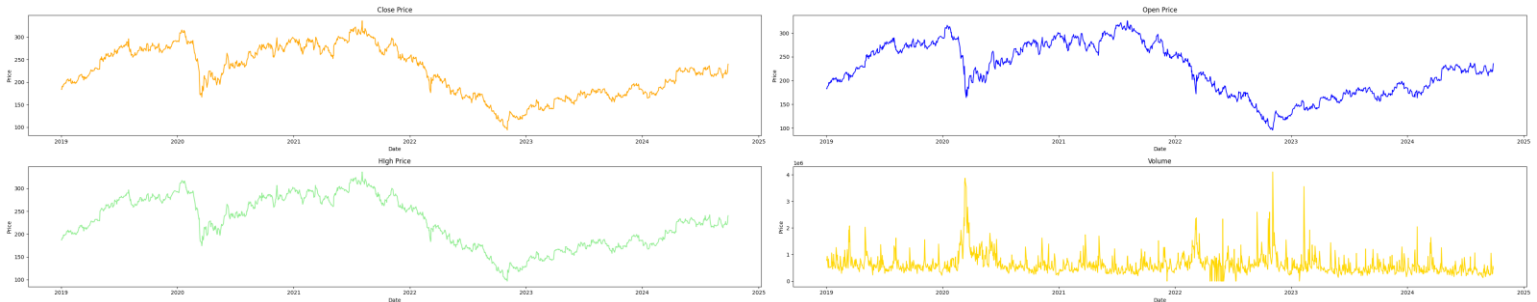
- **Trend:** The closing price saw a considerable decline during this period.
- **Lowest Point:** This period corresponds to the initial outbreak of the COVID-19 pandemic, leading to widespread lockdowns and economic uncertainty.

2. Highest Price (Mid-2021):

- **Trend:** Mid-2021 marked a peak in Adidas' closing price.
- **Recovery Phase:** This could indicate a period of recovery as markets began to stabilize and consumer confidence improved with the rollout of vaccines and easing of restrictions.

3. Lowest Price (October 2022):

- **Trend:** Adidas experienced its lowest closing price in October 2022.
- **Market Context:** After heightened volatility throughout the year, global stock markets were significantly lower at the end of 2022 compared to 2021. The war in Ukraine and the continued negative impact of the covid-19 pandemic as well as their economic consequences severely impacted investor sentiment.



5. Resampling Techniques

Resampling methods were used to aggregate the data for better analysis. We utilized different techniques such as daily, weekly, and monthly resampling to observe price trends over various time frames. Here are some of the resampling offset rules:

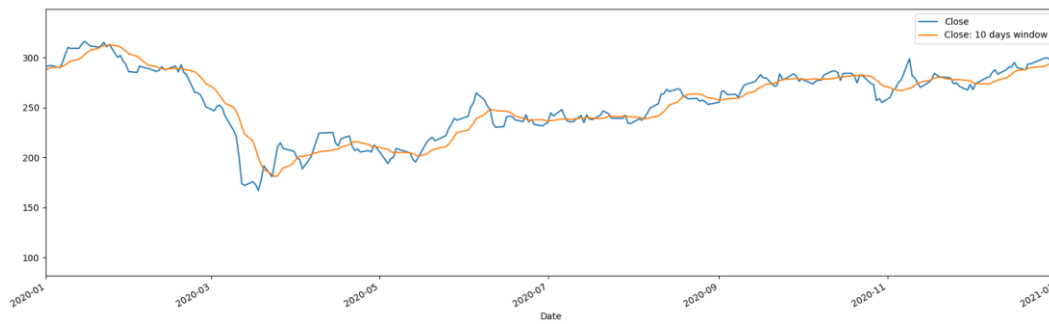
| Date Offset | Frequency String | Description |
|---------------------------|------------------|---|
| DateOffset | None | Generic offset class, defaults to absolute 24 hours |
| BDay Or BusinessDay | 'B' | business day (weekday) |
| CDay Or CustomBusinessDay | 'C' | custom business day |
| Week | 'W' | one week, optionally anchored on a day of the week |
| WeekOfMonth | 'WOM' | the x-th day of the y-th week of each month |
| LastWeekOfMonth | 'LWOM' | the x-th day of the last week of each month |
| MonthEnd | 'M' | calendar month end |
| MonthBegin | 'MS' | calendar month begin |
| BusinessHour | 'BH' | business hour |
| CustomBusinessHour | 'CBH' | custom business hour |
| Day | 'D' | one absolute day |
| Hour | 'H' | one hour |

6. Moving Averages

Moving averages were calculated to smooth out the price data and identify trends more

6.1 Simple Moving Average (SMA)

The Simple Moving Average was calculated over different time windows to analyze short-term and long-term trends in the stock prices.

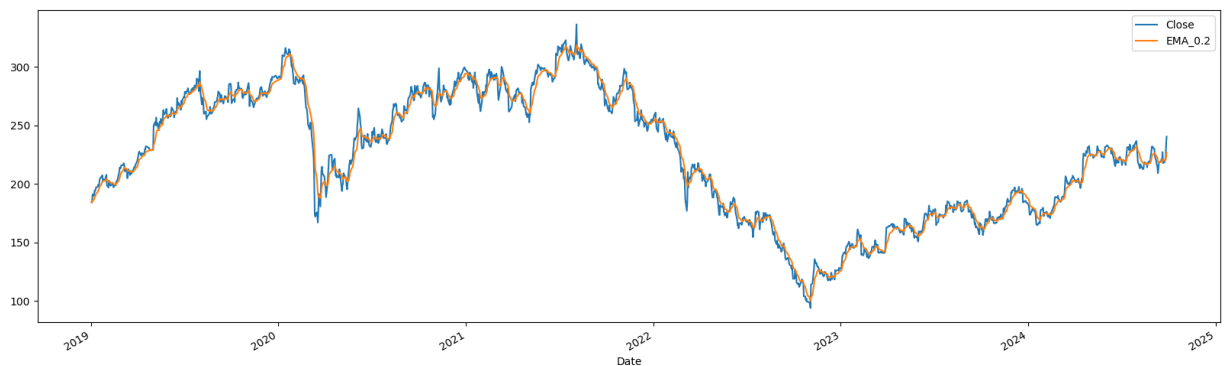


6.2 Cumulative Moving Average (CMA)

The Cumulative Moving Average was used to calculate the average price of the stock over time, providing insights into the overall performance of the stock.

6.3 Exponential Moving Average (EMA)

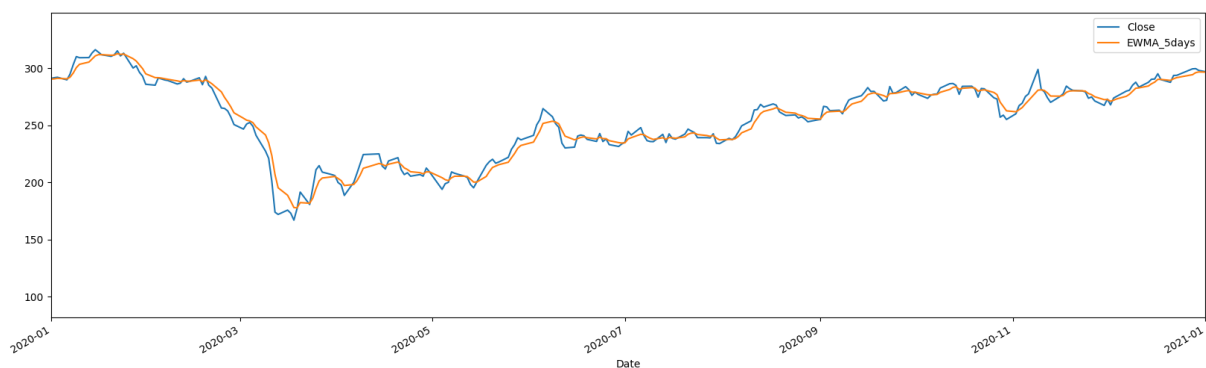
The Exponential Moving Average gives more weight to recent prices, making it more responsive to new information. This helped in identifying recent trends more effectively.



6.4 Exponential Weighted Moving Average (EWMA)

The Exponential Weighted Moving Average was also calculated, allowing for the incorporation of different weights to price observations over time.

All these aggregate methods calculated above have shown a smoothening effect on the trend curve.



7. Stationarity Testing

The stationarity of the time series was tested using the Augmented Dickey-Fuller (ADF) test. This test helped to determine whether the time series data has a unit root, indicating it is non-stationary.

8. Differencing

Differencing was applied to the data to make it stationary. By subtracting the previous observation from the current observation, we can eliminate trends in the data, making it easier to model.

9. Forecasting - Prophet

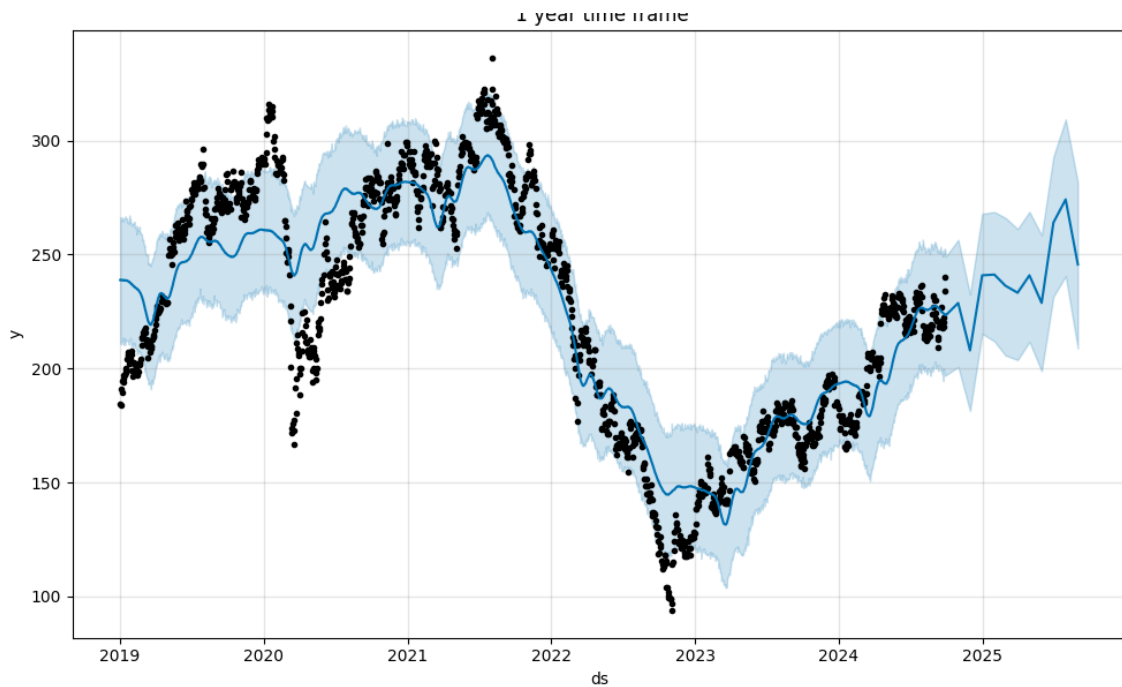
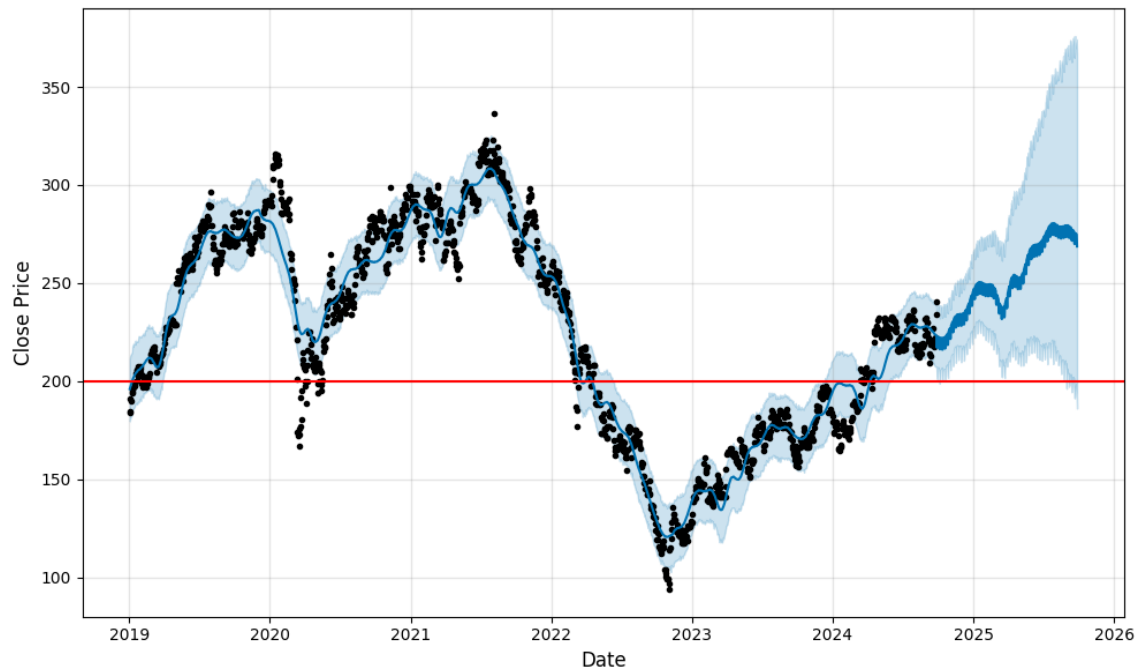
After the Exploratory Data analysis performed on the Adidas, we now move to the forecasting or prediction of future stock prices for Adidas using Prophet.

Facebook's research team has come up with an easier implementation of forecasting through its new library called Prophet. From what I have read, the blog states that an analyst that can produce high quality forecasting data is rarely seen. This is one of the reasons why Facebook's research team came to an easily approachable way for using advanced concepts for time series forecasting.

Before applying the Prophet model, the dataset was preprocessed to ensure compatibility with the forecasting algorithm. The necessary steps included:

- **Datetime Conversion:** The 'Date' column was converted to the datetime format to facilitate time series analysis.
- **Data Cleaning:** Missing values were handled, and the dataset was filtered to ensure it contained relevant information for forecasting.
- **Feature Selection:** The dataset was reduced to essential columns, specifically 'Date' and 'Close Price', which were renamed to 'ds' and 'y', respectively, as required by the Prophet model.

After fitting the model, we generated a forecast for the next twelve months. The results included the predicted stock prices along with uncertainty intervals to account for potential fluctuations.



10. Conclusion

Historical Trend: The plot reveals that Adidas experienced significant fluctuations in stock prices, with noticeable dips during early 2020 and a recovery phase peaking in mid-2021.

Forecasted Trends: The forecasted values indicate a possible upward trend, reflecting market recovery and increased consumer confidence.

Confidence Intervals: The shaded areas represent uncertainty in predictions, highlighting potential volatility in stock prices.

Future Stock Performance: The forecast suggests a gradual increase in stock prices, indicating potential investor confidence as market conditions stabilize.

Seasonal Patterns: The model captures seasonal patterns, which may be influenced by product launches, marketing campaigns, and holiday shopping seasons.

Market Resilience: Despite the challenges faced during the pandemic, the forecast indicates that Adidas may be on a path to recovery, buoyed by brand loyalty and strategic initiatives.

11. Future Plans

Continuous Monitoring: Regular updates to the model with new data will enhance prediction accuracy and provide timely insights.

Incorporate External Factors: Consider integrating additional external factors such as economic indicators, competitive landscape, and consumer behavior trends to refine forecasts.