Stock Price Prediction Report

1. Introduction

This report presents the results of the stock price forecasting project using **AAPL stock data**. The objective of the study was to analyze historical stock price trends, compute key financial indicators, and develop predictive models using **ARIMA and STLF forecasting techniques**.

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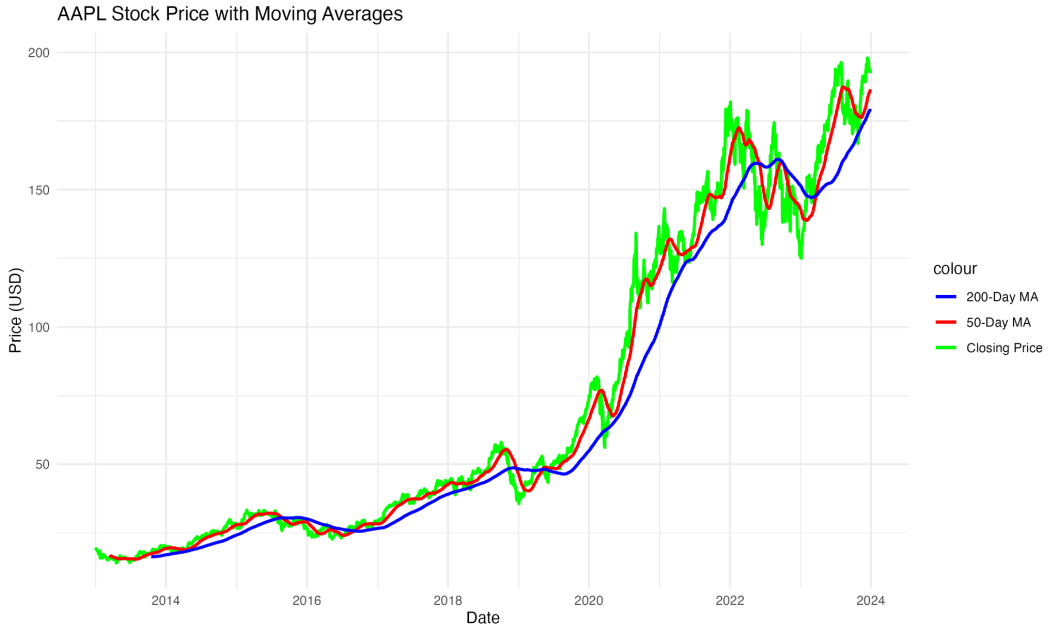
2. Exploratory Data Analysis (EDA)

2.1 AAPL Closing Price Over Time

The following visualization represents the historical closing price of AAPL stock.

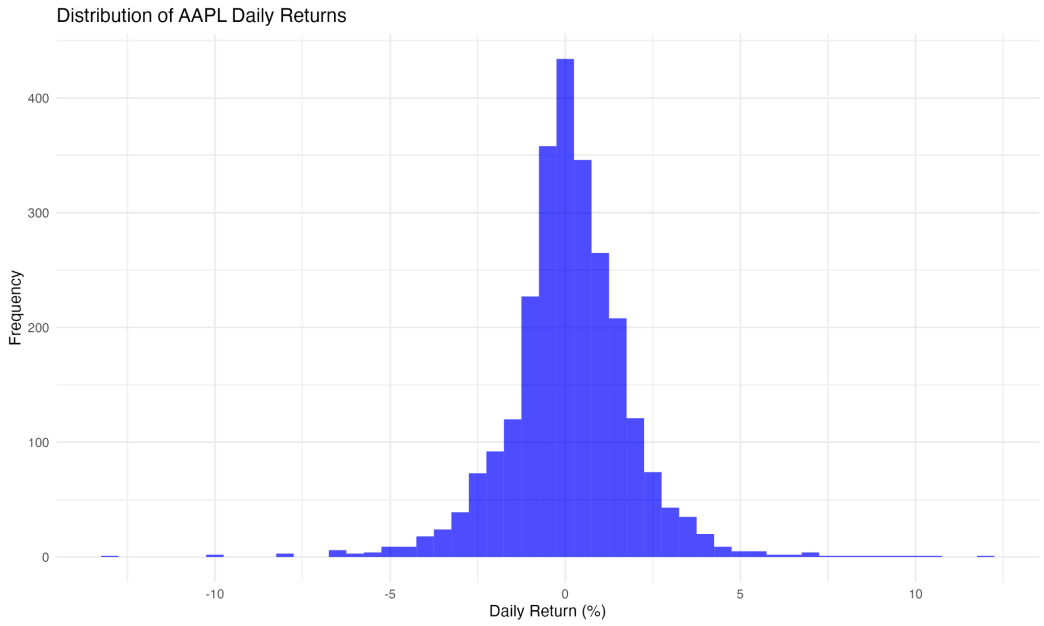
2.2 Moving Averages Analysis

To identify trends, we computed the **50-day and 200-day moving averages**.



2.3 Daily Returns Distribution

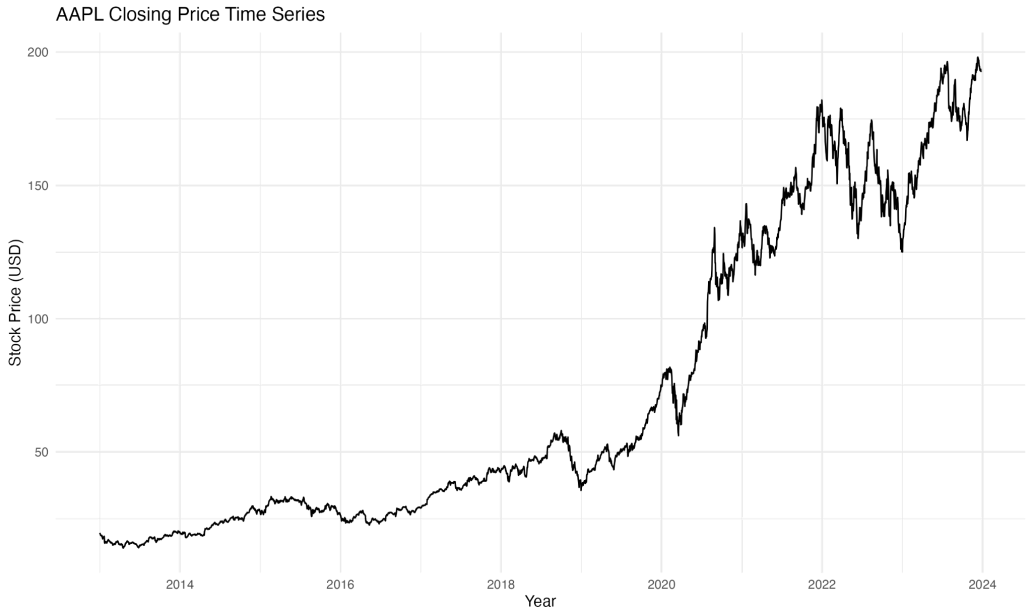
To assess the volatility of AAPL stock, we calculated **daily percentage returns**.



3. Time Series Modeling & Forecasting

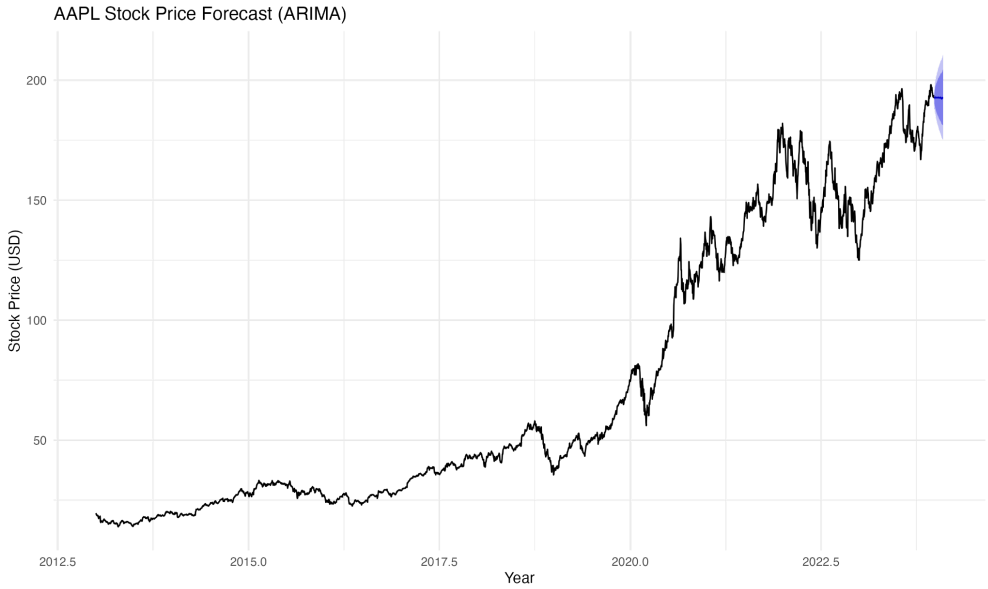
3.1 Time-Series Representation of AAPL Closing Prices

To prepare the data for forecasting, we converted the closing prices into a time-series object.



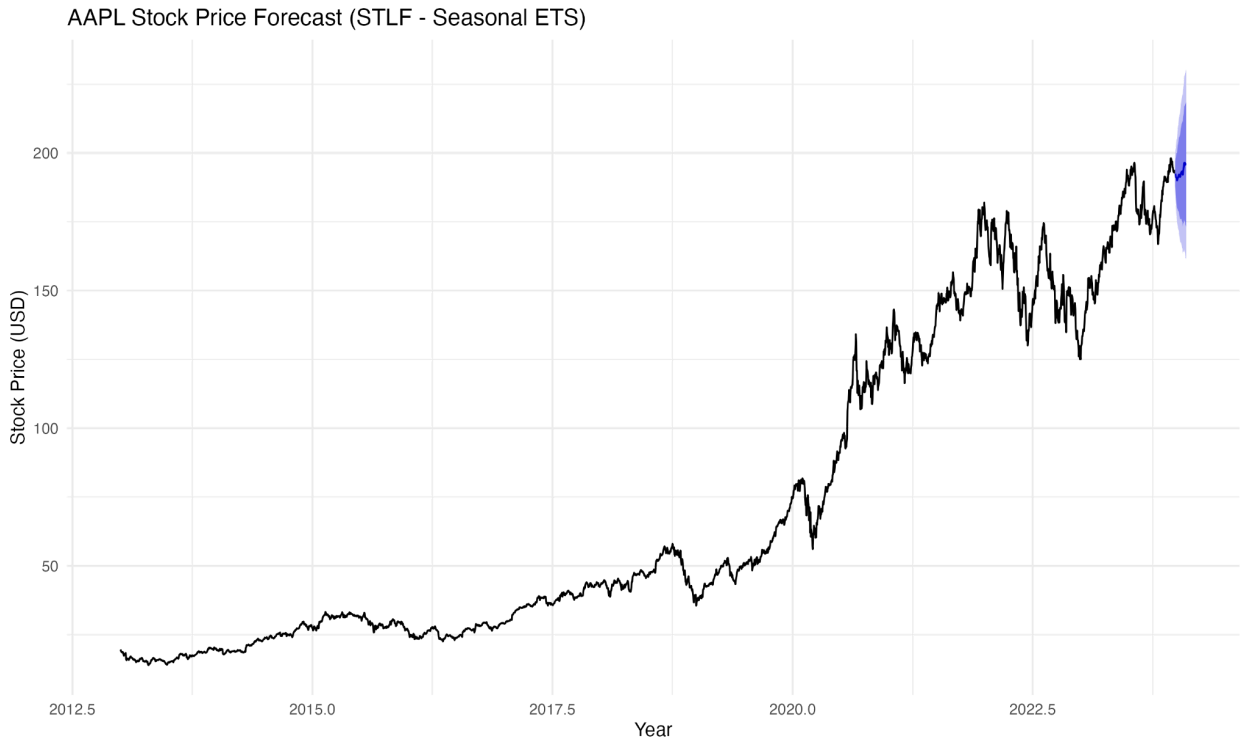
3.2 ARIMA Forecasting Results

The **AutoRegressive Integrated Moving Average (ARIMA)** model was used for forecasting the stock prices over the next 30 days.



3.3 STLF Forecasting Results

The **Seasonal and Trend decomposition using Loess Forecasting (STLF)** model was also applied to predict future prices while accounting for seasonality.



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4. Model Performance Comparison

The following table presents the evaluation metrics of both models based on **Root Mean Squared Error (RMSE), Mean Absolute Percentage Error (MAPE), and Mean Absolute Error (MAE)**.

Model	RMSE	MAPE (%)	MAE
ARIMA	2.68	1.18	2.28
STLF	2.47	1.05	2.04

🔹 **Observation:** The STLF model performed slightly better than ARIMA in all three metrics, suggesting it captured seasonal trends more effectively.

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5. Conclusion & Next Steps

✅ **The STLF model showed superior predictive performance over ARIMA**. ✅ The forecasts provide a reasonable estimate of future price movements. ✅ No further fine-tuning is planned at this stage.

🔹 **Potential Future Work:**

- Incorporating external financial indicators to improve predictions.
- Trying deep learning approaches like **LSTMs** or **Facebook Prophet**.
- Evaluating forecast performance on different stock datasets.

📌 **Final Notes:** The project successfully demonstrated how time-series forecasting techniques can be applied to stock market analysis. The results suggest that STLF is a viable model for stock price forecasting.

📂 **Files Available:**

- **Forecast Performance Metrics**: table above
- **Generated Plots**: Included in the report.