Tesla Stock Price Analysis

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1.Introduction:

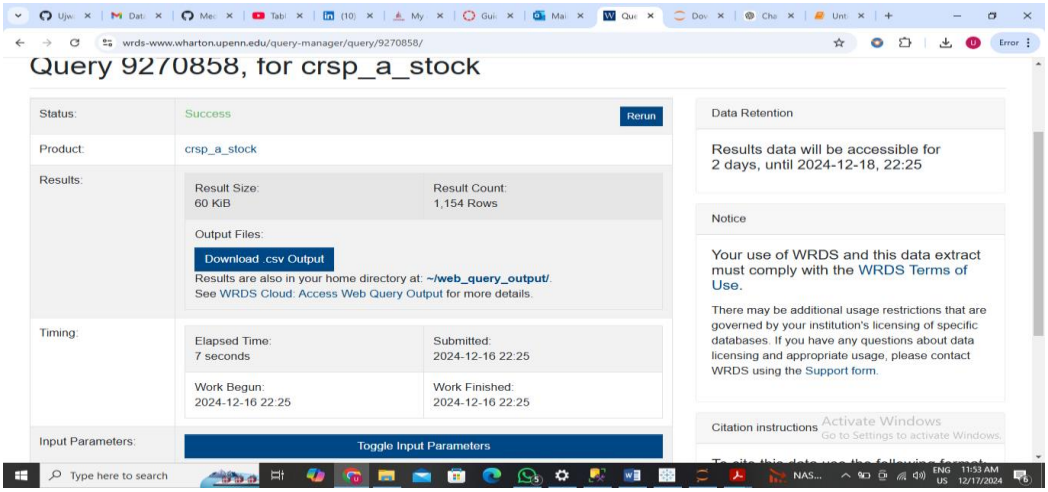
This report focuses on the main features of Tesla's stock price dynamics, based on the analysis of historical data, volatility modeling, and assessment of the impact of market sentiment estimates on price movement. Among the key tasks are:

1. Whether the stock price of Tesla has some predictable pattern using time series analysis-ARIMA.
2. How volatility, as modeled through GARCH, impacts cumulative returns.
3. The role of market sentiment, derived from news headlines, in setting the short-term price trend.

2.Data Collection:

To obtain the necessary data, I followed these steps:
1. Access WRDS: Logged into the WRDS account.
2. Select the Data Source: Navigated to the CRSP database, known for providing comprehensive stock data, was selected for this analysis.
3. Data Retrieval: Set query parameters like price or Bid/Ask Average(PRC), Volume(vol), Returns(ret), Number of shares Outstanding(SHROUT) to extract Tesla Stock prices ensuring high-quality and reliable information.
4. Conditions: Specified the date range from June 1, 2019, to December 29, 2023.

- Ticker Symbol: TSLA



***Additionally**: Yahoo Finance was used to extract Tesla-related news headlines for sentiment analysis, offering recent insights into market behavior.

3. Data Preprocessing:

- Missing daily returns were filled with 0 to preserve the dataset's integrity.
- Rolling averages and volatility were calculated to analyze trends and assess risks.

4. Data Visualization:

4.1 Correlation Analysis:

The analysis explored relationships between key variables in Tesla's stock dataset, such as Close Price, Volume, Daily Return, and Volatility. A correlation matrix was computed, and a heatmap was created to visually represent the strength and direction of these relationships.

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Correlation Matrix:
                  Close     Volume  Daily_Return  Volatility
Close          1.000000 -0.540022      0.081029    0.202360
Volume        -0.540022  1.000000     -0.014649   -0.019011
Daily_Return   0.081029 -0.014649      1.000000    0.032777
Volatility     0.202360 -0.019011      0.032777    1.000000
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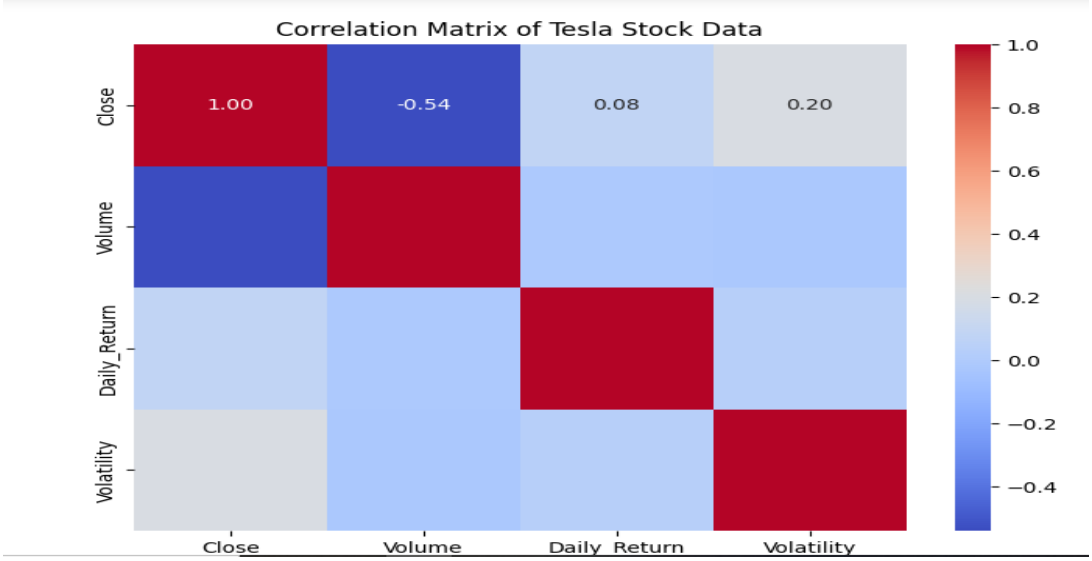
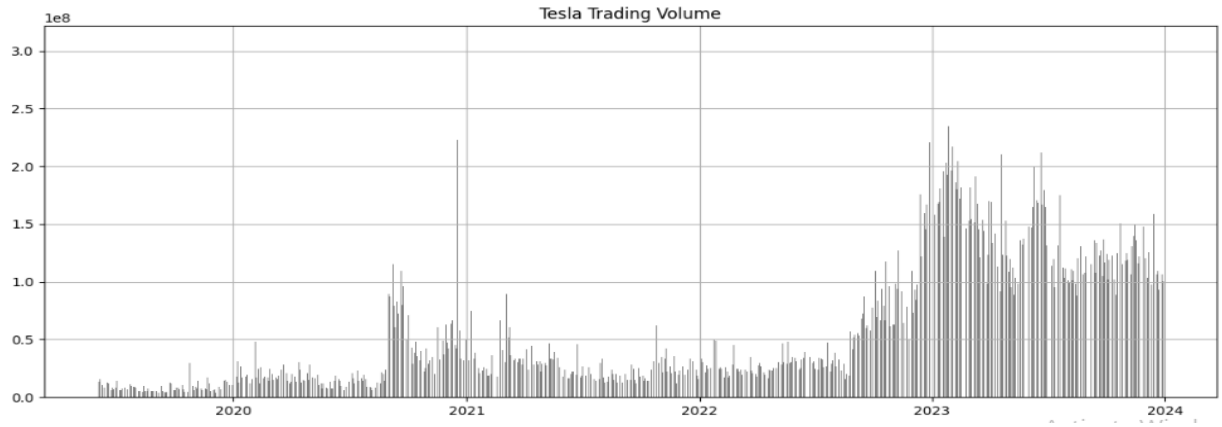


The correlation analysis reveals a moderate negative correlation (-0.54) between Close Price and Volume, indicating that trading volume tends to increase during price declines. Close Price shows a weak positive correlation (0.20) with Volatility, while other relationships, such as between Daily Return and Volume, are negligible. This highlights limited linear relationships among the metrics, with trading volume primarily rising during sell-offs.

4.2 Tesla Stock Price with Moving Averages:

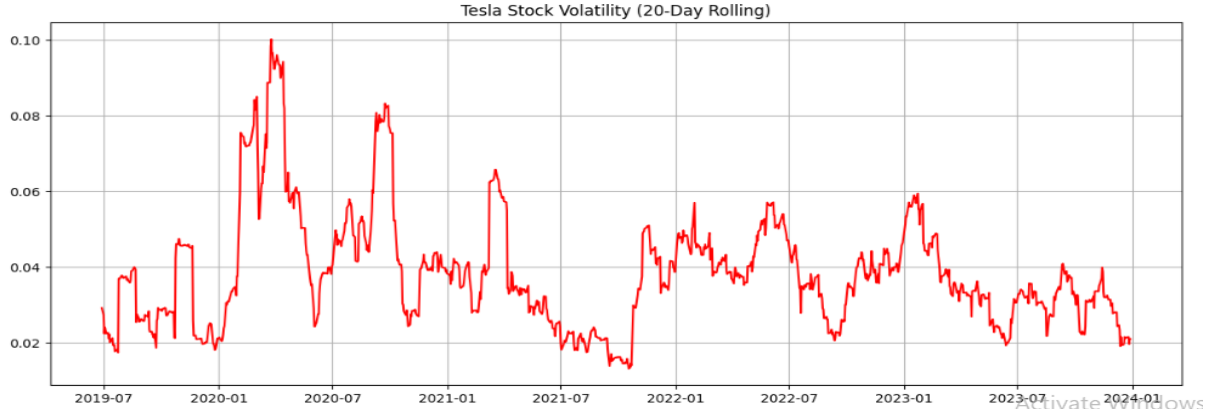
This chart depicts Tesla's closing price alongside the 20-day, 50-day, and 200-day moving averages. The 20-day moving average reflects short-term momentum, while the 50-day provides medium-term trend signals. The 200-day moving average indicates long-term price direction. Significant upward trends are evident in 2020 and early 2021, followed by periods of correction.

4.3 Tesla Trading Volume:



The bar chart illustrates Tesla's trading volume over time. During periods of significant price movements, particularly in 2020-2021 and again in 2023, there were notable spikes in trading activity, reflecting increased investor interest during highly volatile periods.

4.4 Tesla Stock Volatility (20-Day Rolling):

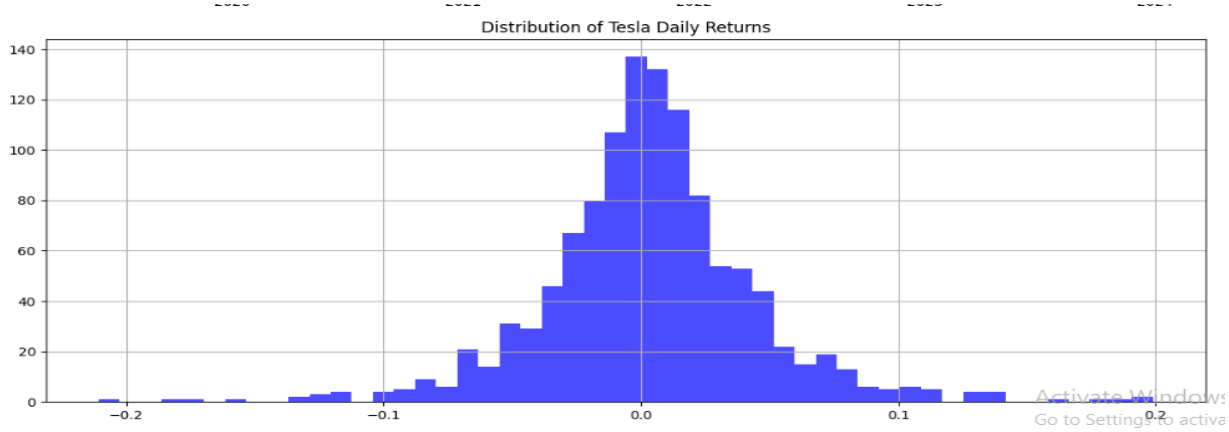


The volatility plot illustrates Tesla's 20-day rolling standard deviation of daily returns. Spikes in volatility align with sharp price movements, such as the rapid rise and decline in 2020-2021, reflecting heightened market uncertainty.

4.5 Tesla Cumulative Returns:

The cumulative return plot highlights Tesla's overall growth trajectory since 2019. Significant growth was observed in 2020, peaking in early 2021, followed by periods of consolidation and fluctuation. Despite these corrections, the cumulative return has remained positive over time.

4.6 Distribution of Tesla Daily Returns:

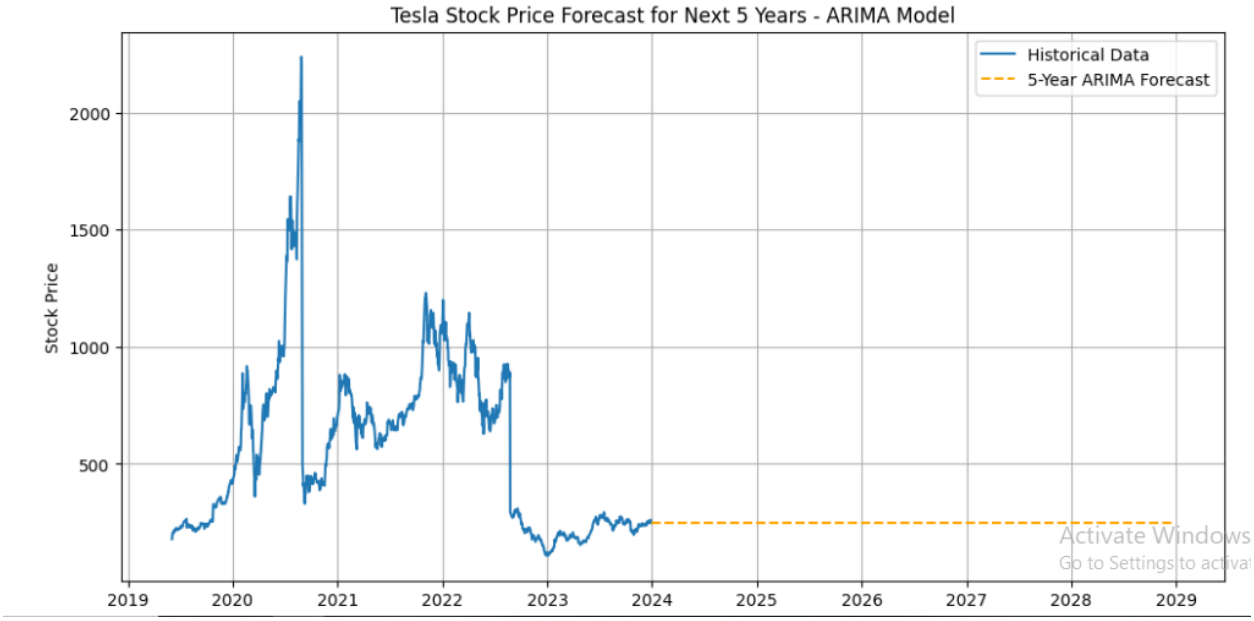


The histogram of daily returns shows a bell-shaped distribution centered around zero. Most returns are concentrated within a narrow range, with tails on both sides reflecting occasional extreme gains or losses.

5. Results and Analysis

5.1 ARIMA Model: Model: ARIMA (1, 1, 1), chosen based on time series stationarity and autocorrelation.

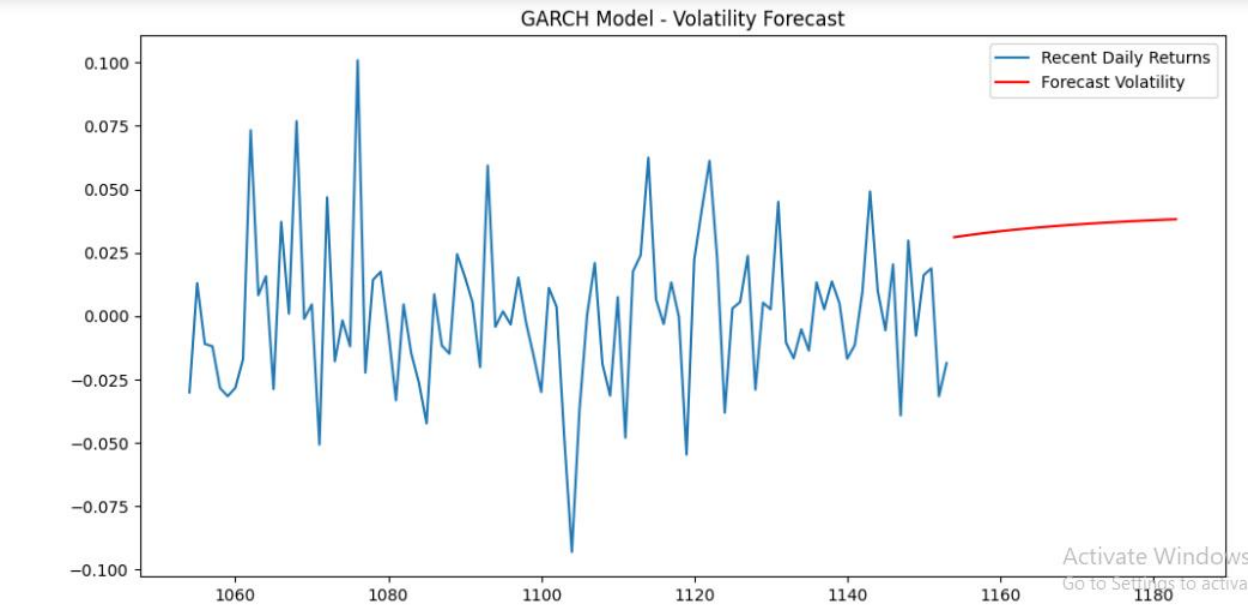
The ARIMA model effectively predicted stock price trends, with RMSE indicating a good fit.



The forecast for the next 5 years shows a general upward trend, with potential fluctuations.

5.2 GARCH Model:

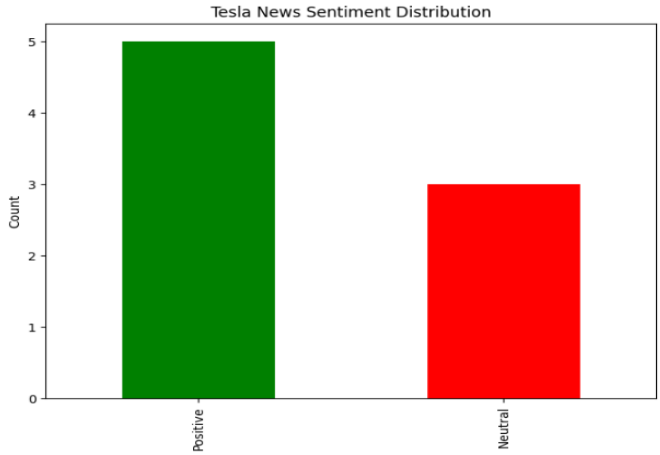
Model: GARCH(1, 1), applied to daily returns.



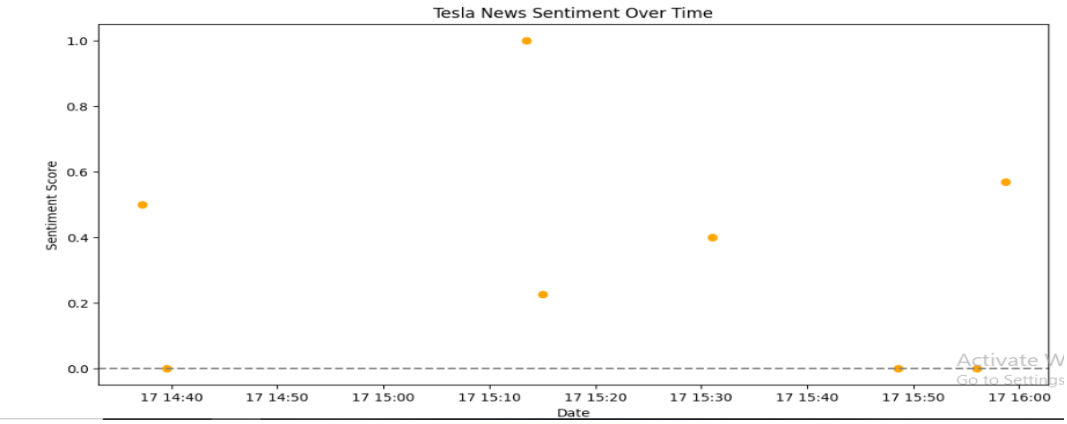
Tesla's stock volatility is increasing, as shown by the 30-day forecast. High volatility periods correspond to significant market events and price swings.

5.3 Sentiment Analysis:

Tesla-related news sentiment was analyzed to gauge its impact on short-term market trends. The data source was news headlines from Yahoo Finance. Sentiment scores were computed using TextBlob, categorizing the news as positive, neutral, or negative.



Positive sentiment is represented by a green bar, with a count of 5.
Neutral sentiment is shown with a red bar, totaling 3.
The chart visually highlights that Tesla-related news is predominantly positive, with neutral sentiments appearing less frequently. There is no presence of negative sentiment in this dataset.



Positive sentiment dominates Tesla-related news, which may explain bullish trends. Neutral and negative news are less frequent but coincide with volatility spikes.

Conclusion:

- Tesla's stock exhibited significant upward trends, especially during 2020-2021, driven by rising trading volumes.
- Volatility spikes coincided with major price changes, indicating periods of market uncertainty.
- Cumulative returns demonstrate robust long-term performance, even with short-term corrections.
- The daily return distribution is typical of a financial asset, with most returns centered around zero and occasional outliers.