Apple Inc Stock Analysis

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Introduction

Recently, Apple's stock (AAPL) has been outperforming the market in comparison to the top-performing tech companies "FAANG". With its increase in performance it is intriguing to find out if the stock will continue to rise. Due to this activity, I recently invested money into Apple' stock. The main motivation I have for this project is to give myself insight on whether it is a safe investment for the long-term, specifically over 12 years. The other stakeholders of this project can include other current/potential Apple shareholders. It could also hold importance to shareholders of Apple's competitors such as Microsoft, Samsung, and Google. This project will also provide insight on AAPL's historical and current performance and it will provide predictions on its future performance. Ultimately, it can help the stakeholder's make a more comfortable decision in their investments.

Problem Statement

The main query I want to solve with this project is if AAPL is a safe long-term investment. To help determine this answer I will be addressing many different metrics in terms of its historical and current performance. First I will analyze and examine the performance of AAPL based on its adjusted closing price. The approach I intend to take with this is descriptive analytics. I will also address the performances of Apple's competitor's stocks to give an inference of how well Apple is performing against its respective market, this will also be implemented with descriptive analysis tools. And lastly, based on the historical data, I will predict its potential future value (open stock price) with a linear machine learning model. All questions will be in respect to the past 12 years since I am questioning the performance on long term investments.

Analytical Questions and Approaches

Question 1. The first question I am addressing is how well AAPL has performed in the last 12 years. This question is significant to start with because it provides the stakeholder the necessary information to understand how well Apple has performed with more specificity. The metrics I will find to provide sufficient information to this question will include AAPL's adjusted closing prices, trade volumes, return on investments, and dividend yields.

To analyze the metrics previously mentioned, I will be using descriptive analytical techniques. For finding the adjusted closing prices, I will find the line of best fit to understand the relationship between the stock's price throughout the past 12 years. This will give a general idea of how well the price of the stock has performed. I will also use the same method for the volume trades AAPL has had. This will give an indicator of how well the demand for the stock is appreciating and its overall value to the market. According to Investopedia a stock is more likely to be a sustainable move if it has a high trading volume (Moskowitz).. To find insight on AAP's performance in regards to the return on investment I will calculate the average rate of its daily return. This will provide sufficient information on the stocks profitability in the long run. Lastly, I will include a rate calculation using the "pct_change" method to find the rate of growth/decline of the dividend yields. Since dividend yields are an indication of how much money a company will provide to its shareholders for investing, It will be an important metric to analyze to see its profitability in the long run.

Question 2. The second question I need to analyze to determine if AAPL is a good stock to invest in the long run, is to see how well their competitors are performing. This question holds value because without knowing how the rest of the market is doing, the numbers for AAPL can

hold less meaning. This can also be useful because it can provide the stakeholders examples of other stocks to see if other companies are better long term investments then apple.

The companies that I will be additionally analyzing to represent Apple's competitors include Microsoft, Google, and Sony. To analyze the competitors, I will address basic stock price performances by visualizing all of their adjusted closing prices. This will give an overview of how all of the stocks have performed in the market. I will then calculate and visualize the daily returns to each company. This provides an idea of which company has the safest long term profitability. Lastly, I will compare the average daily returns of all the companies per year. This is an addition to the previous method, however it adds more specificity. By calculating the average stock returns by year it can be an insightful projection to see if it will continue to increase.

Question 3. The last question I want to answer is to see if I can predict AAPL's opening stock price. This is important because we can slightly predict the future value of AAPL. It can give an inference if it will grow in the short-run/long-run.

The method I will be using for this will include a Linear Regression Model using machine learning. There reason why a simple linear regression model would work efficiently for this objective is because it can help identify relationships between the dependent variable (the stock open price) and the independent variables ("High, Low, Close, Adjusted Close, and Volume"). I will then evaluate the machine learning model with performance metrics including the mean absolute error, coefficient of determination (R^2), mean squared error, and root-mean squared error. These are the most common and effective performance metrics used for linear regression models (Brownlee, 2021). I will then further evaluate the model using the feature

importance method, specifically using recursive elimination (RFE). RFE identifies and removes insignificant features to the dataset to help add greater specificity and simplicity to the model.

Data

The data that I intend to use for this project includes the financial stock data from Yahoo Finance. The dataset that I will use for AAPL includes the historical data on the stock from the past 12 years (April 16 2010 - April 14 2022). in an excel file type. The attributes in the dataset include the “Date”, “Open-Price”, “High- Price”, “Low-Price”, “Closing-Price”, “Adjusted-Price”, and the “Traded Volume”. I will also include a dataset on AAPL’s dividend historical data. The attributes in this dataset contain “Date”, and the “Dividend Yield”. The datasets for the competitor stocks will also be from Yahoo Finance. These datasets will contain the same information and attributes as AAPL. The datasets used will be for Microsoft, Google, and Samsung. The total number of rows in the data set is 3022 with a total of 8 columns (attributes). The total number of instances for all the data sets is 24,176. To keep the analysis consistent, I will only be using data from April 2010 to April 2022 for all datasets.

Since the data sets are all in the same format from Yahoo Finance, they obtain all of the same attributes and datatypes. The attribute types for the datasets, besides the date column, are quantitative, continuous, and float64 data types. This is sufficient for my analysis methods since I will be only analyzing numerical information. Unlike the rest of the attributes, the “Date” column included objects, this made it difficult to perform quantitative analysis. Therefore, To use the “Date” column for my analysis I needed to index my Date column by using the “DatetimeIndex” pandas method.

The target variables for my analysis were dependent on each question. For analysis in regards to the stock's general performance, the target variable would be the variable of concern. For instance, for the average daily return analysis, the target variable would be the adjusted closing price. Another example would be the analysis for the best-fit for the adjusted closing price, the target variable would be the adjusted closing price, in relation to the date. The target variable for the regression analysis would also be the adjusted close price. The reason why this project mainly analyzes the adjusted closing price over the regular closing price is because the adjusted closing price "considers other factors like dividends, stock splits, and new stock offerings" (One, 2020) . This allows the results to be more accurate relative to the real stock market.

Data Analytics & Results

After performing several analysis methods I found insightful data on how Apple and their respective competitors have performed. When initially looking at the summary statistics and the general overview of the stock, AAPL has been performing well (*Figure 1)*. By creating a best-fit line along with the line graph that shows the relationship between the adjusted closing price and the data, I found that AAPL has had an average +4% adjusted closing price growth throughout the past 12 years (*Figure 2*). However, after analyzing the amount of trades, I found that the volume of trades has been decreasing (*Figure 3*). I found this by using the same method for finding the adjusted closing price growth. By calculating the percent changes of the adjusted closing prices using the "pct_change" method, I found that the mean daily return for AAPL has been about +0.0012% and the median being around +0.0009% increase. After analyzing the dividend yields, I found that it has an average 15.6% yield, with an increasing average growth of 2% (*Figure 4*).

To provide an overview of how well the competing stocks have been performing a created a simple line graph comparing the differences in growth (*Figure 5*). Based off of this chart you can see a large difference between Apple's stock and Google's. With Apple having an average adjusted closing cost of 44 and Google having over 900. However, the price of a stock isn't a definite factor of its success. Therefore, similarly to how I analyzed Apple, I computed the daily returns on each company's stock. I found that the average daily return for Google is 0.008%, Microsoft is 0.00092%, and Sony is 0.00056%. Based on this, Apple has the highest return. The last analysis I performed on Apple's competitors is comparing the average daily return per year (*Figure 6*). I did this by grouping the average daily returns with the given years (2010-2022). From this method I found that Apple has had the highest average daily return per year, being at 0.011%. The second highest was Microsoft sitting around 0.0077%. Then Google was just behind at 0.0071.

The simple linear machine learning model performed well in accordance with the metrics tested on it. The first analysis I performed on the model was to test and plot the residuals of the dataset. From the visual in *Figure 7*, we can see a pattern between the predicted values and the residuals. This can indicate that there is a linearity within the dataset.

In terms of the performance metrics, the model has an absolute error of 0.22. This is good since this measures the difference between the expected and actual values, the lower the score the better. It had a coefficient determination (R^2) of 1. This score is considered 100%, as it indicates that the predictions were identical to the observed values. A mean squared error (MSE) of 0.15. This is a good score because this measures the distance of the data points in comparison to the fitted line. And lastly, it had a root-mean squared error of 0.38. The RMSE measures the spread of the data residuals, or the concentration of the data in comparison to the fitted line

(similar to MSE). The lower the value of RMSE translates to a greater accuracy of the model's prediction, therefore, my score is adequate. After performing recursive elimination (for feature importance) I found that all features were considered beneficial to the model. However, this can be due to the small amount of features included in the dataset already. Therefore, after running the performance metrics again, it resulted in the same values.

Based on the results of analyzing Apple's general performance, AAPL is a profitable stock. To summarize, I found that AAPL has been increasing for the majority of the metrics calculated. These metrics included the stock price growth rate, average daily return, and the dividend yields. The metric that is decreasing, includes the trading volume. However this can be a good indicator for growth. According to Investopedia, " [Lower volume] may suggest that the market's upward trend could continue" (Mitchell, 2022). I also found that AAPL is the second highest in terms of average daily returns, first being google. However, in terms of average daily returns per year, AAPL is the highest. Additionally, the simple linear regression model created for the stock predictions performed well against its metrics.

Conclusion

Apple is performing above average in terms of their respective market. From the findings, it can be a safe assumption that Apple's stock will continue to grow in the future. I also found that Google's stock (GOOG) is performing the second best in the competitive market. This can suggest that it can also be a safe stock to invest in besides Apple. For Apple's general stock performance the analysis could have resulted due to the amount of financial success they have been having over the year. For instance, Apple was reportedly the first company to reach a value of $3 trillion dollars. Apple's market share of smartphones is also reportedly higher than all of

their competitors. This can help explain its performance against Google, Microsoft, and Sony in the report. As mentioned previously, the machine learning model performed well and predicted the stock prices from 2010-2022. However the results of the feature importance selection method did not find any unnecessary features. This can be due to the small amount of features in the dataset itself. Nonetheless, the results of this project can suggest that AAPL has and is a successful and safe stock to invest in for the future.

Figures Mentioned

Figure 1 | AAPL Adjusted Closing Price by Year 2010-2022

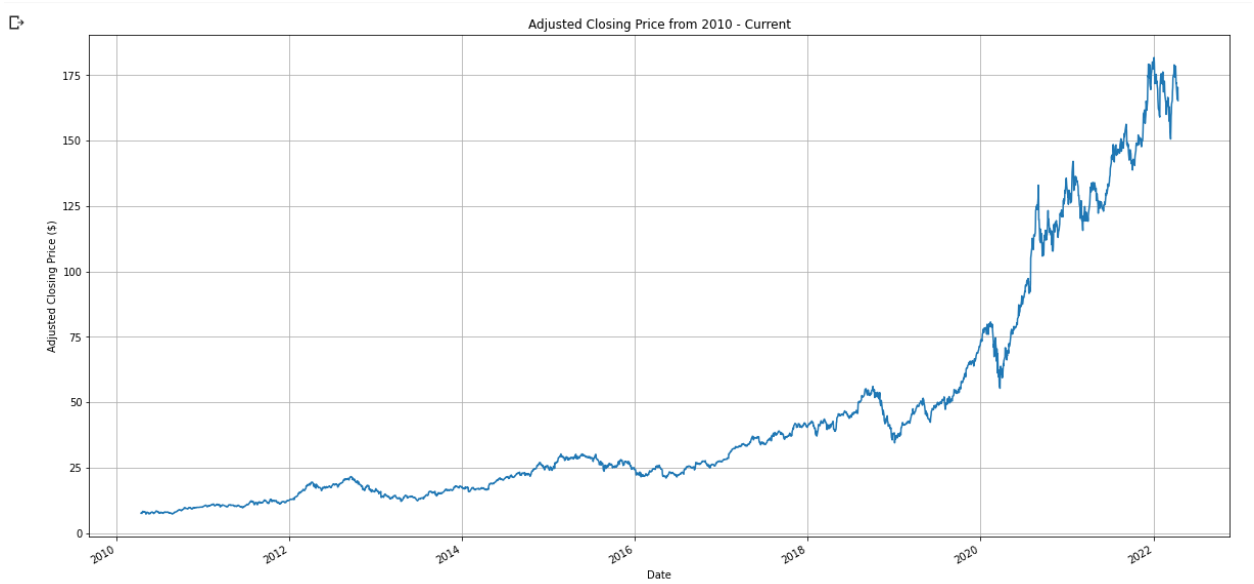


Figure 2 | APPL Adjusted Closing Price Implemented with Best-Fit Line

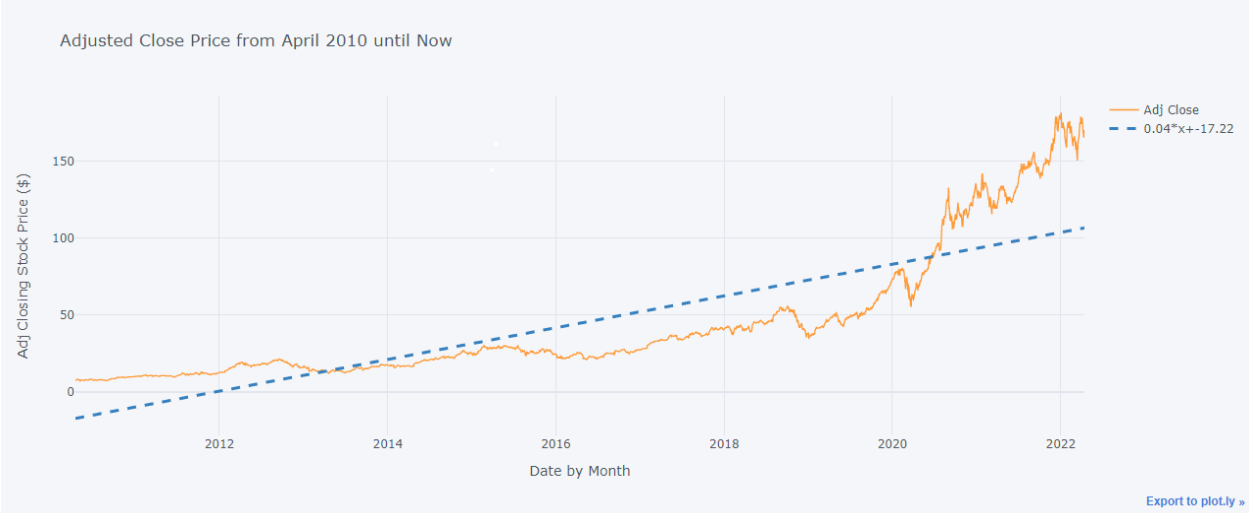


Figure 3 | AAPL Trading Volume Implemented with Best-Fit Line

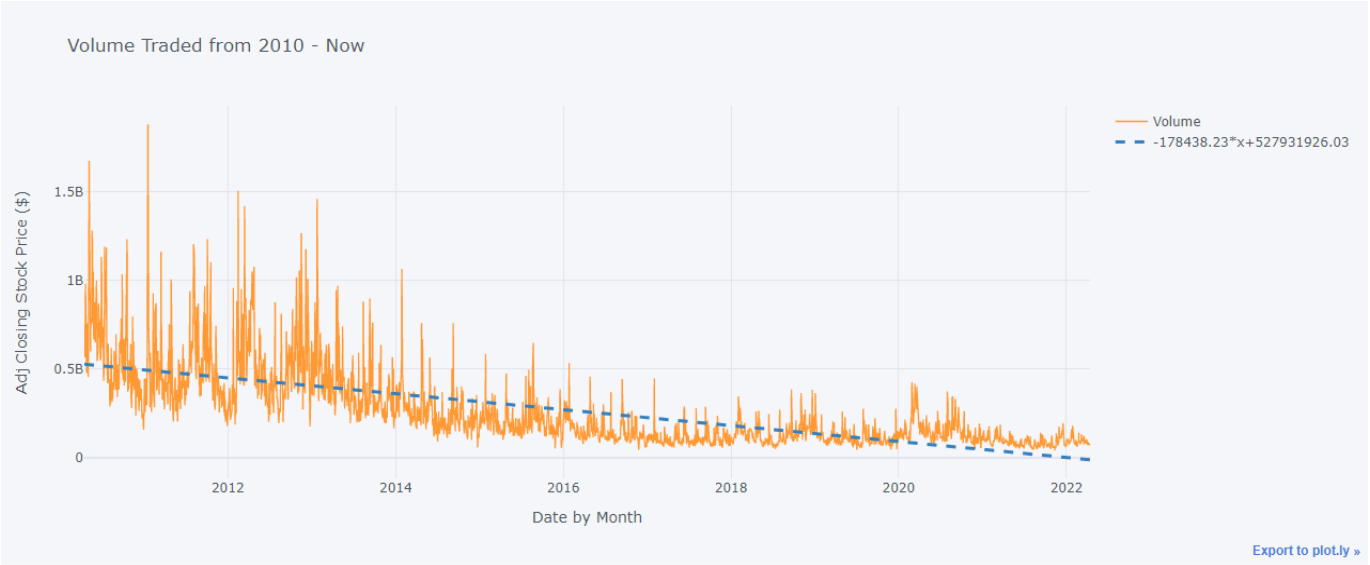


Figure 4 | AAPL Dividend Yield Growth 2013-2022

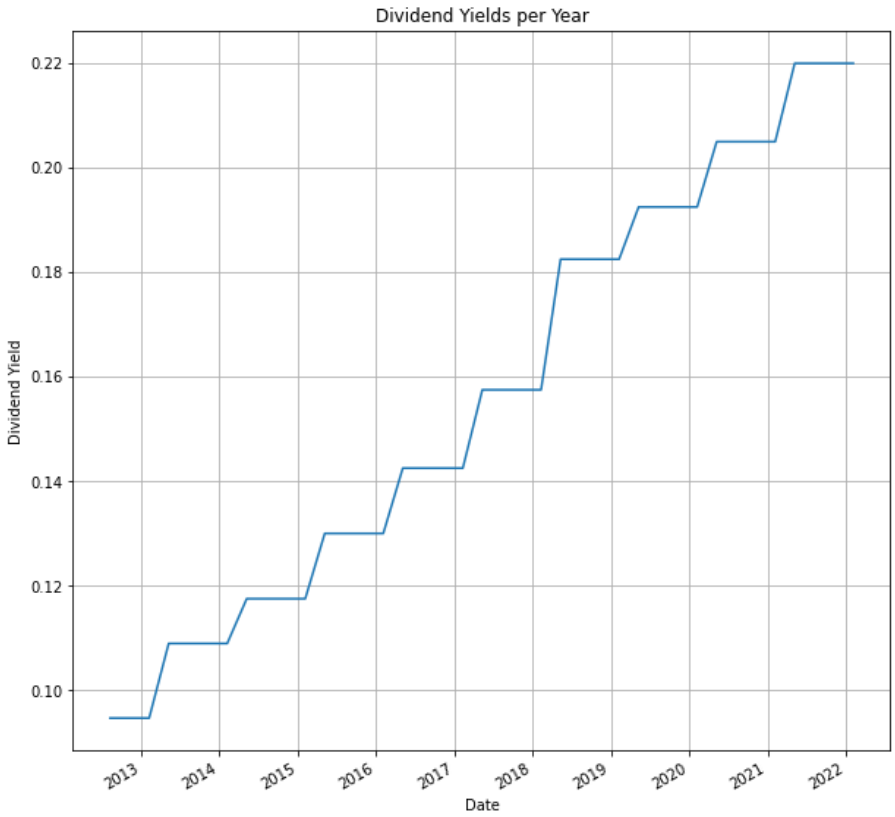


Figure 5 | Competing Tech Companies Adjusted Closing Price from 2010-2022

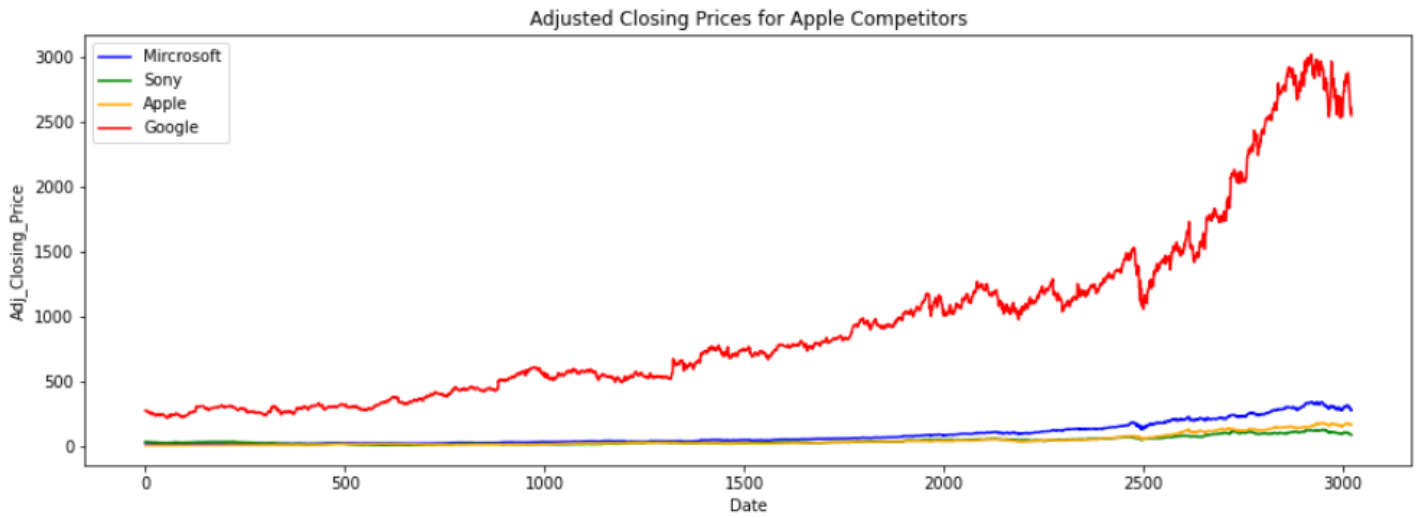


Figure 6 | Competition Average Daily Stock Return Pay Year

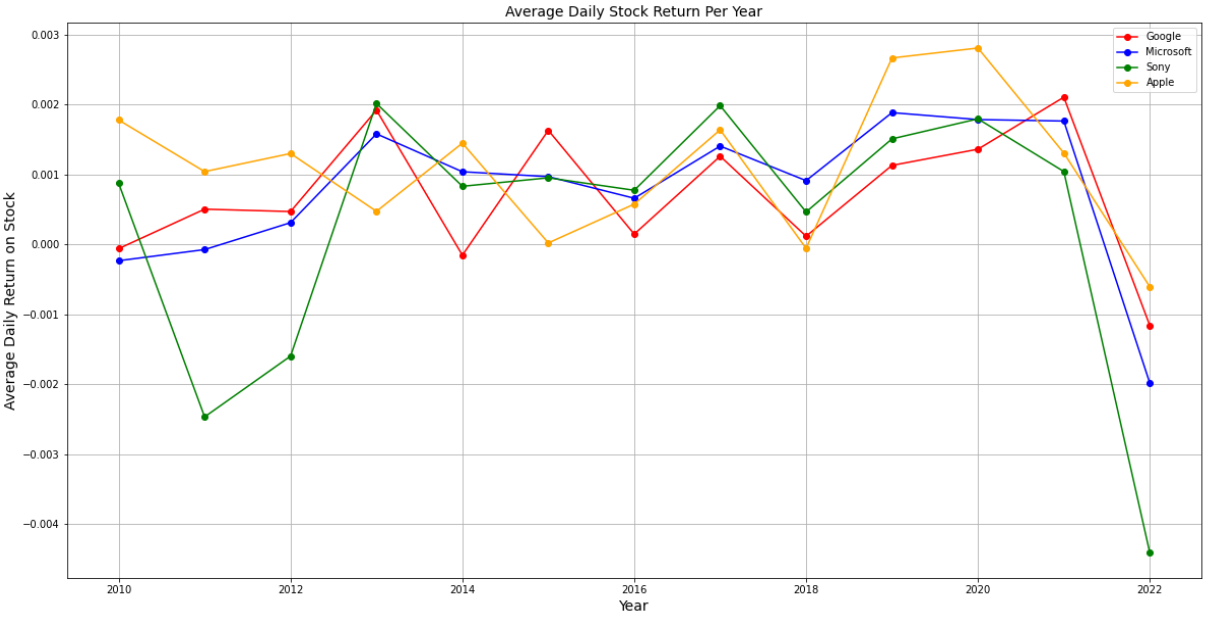
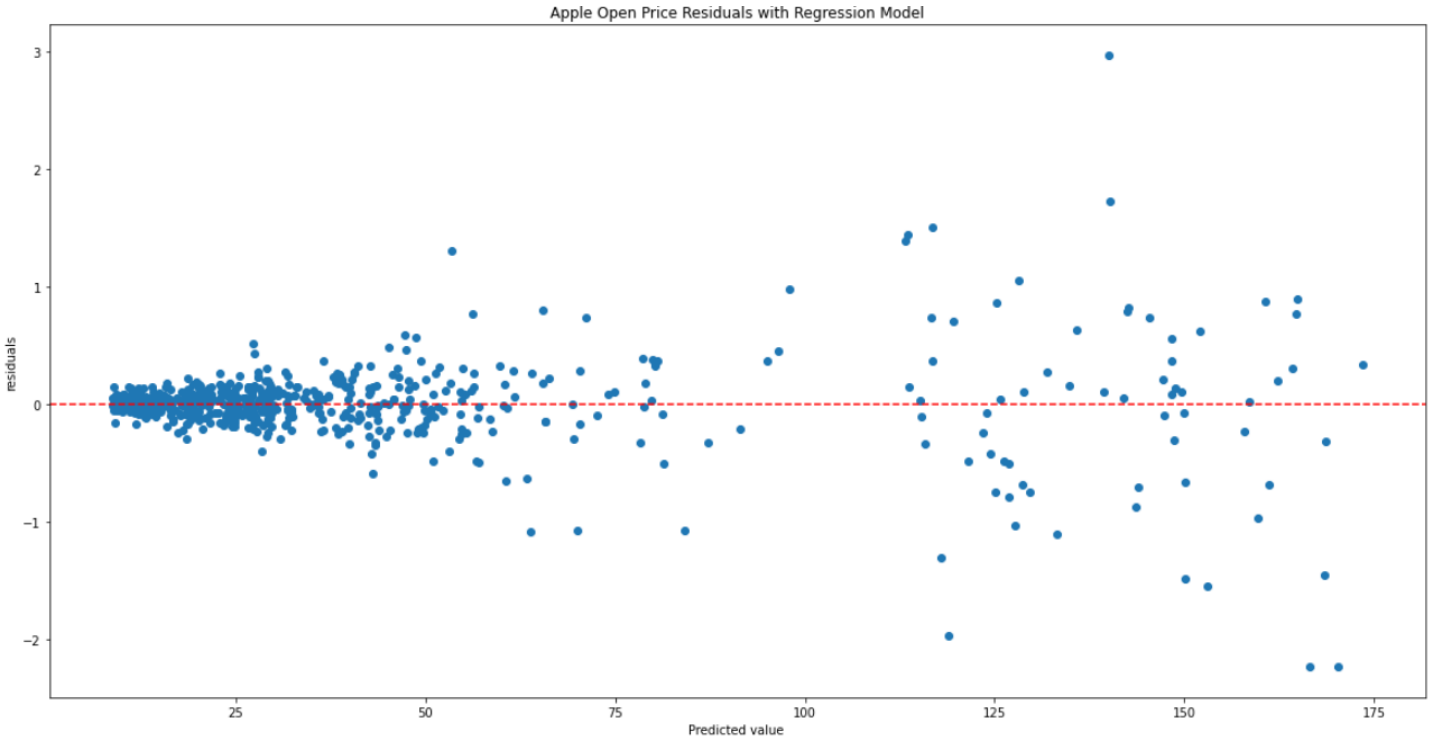


Figure 7 | Linear Regression Model Residuals for AAPL Closing Price



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