# Stock analysis and prediction

*Project by Clarissa Lo (GitHub profile)*

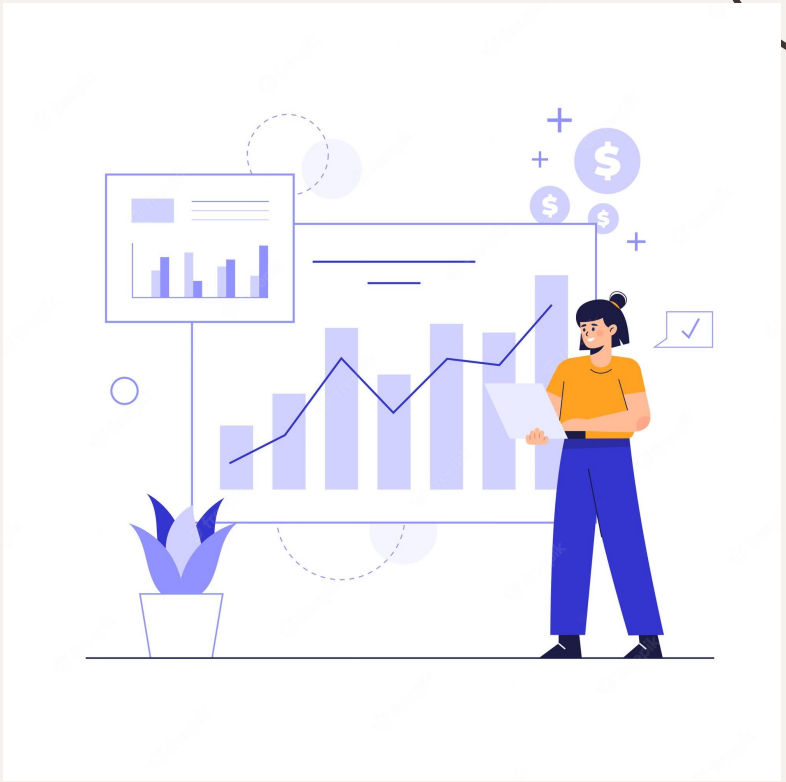
https://github.com/clarissa-lo/stock-prediction

# Aims and objectives

Technology stocks have experienced huge fluctuations in recent years, especially between 2020 Q1 to 2022 Q1. During this period of time between 1 Jan 2020 to 31 Mar 2022, we witnessed different world events, including the outbreak of COVID-19 and Russia-Ukraine war. I am interested to focus on the stocks of some of the largest technology companies (including Alphabet, Amazon, Meta and Apple) to analyse their stock price data during time period, to explore whether these world events would impact their stock prices and to predict future stock closing prices.

Therefore, the main objectives of the project are:

- to analyse the daily percentage changes of the technology stock closing prices,
- to explore the factors affecting the closing prices,
- to test the relationship of the closing prices between technology stocks,
- to predict the closing prices 25 days into the future.



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# 01 Daily percentage changes of stock closing prices

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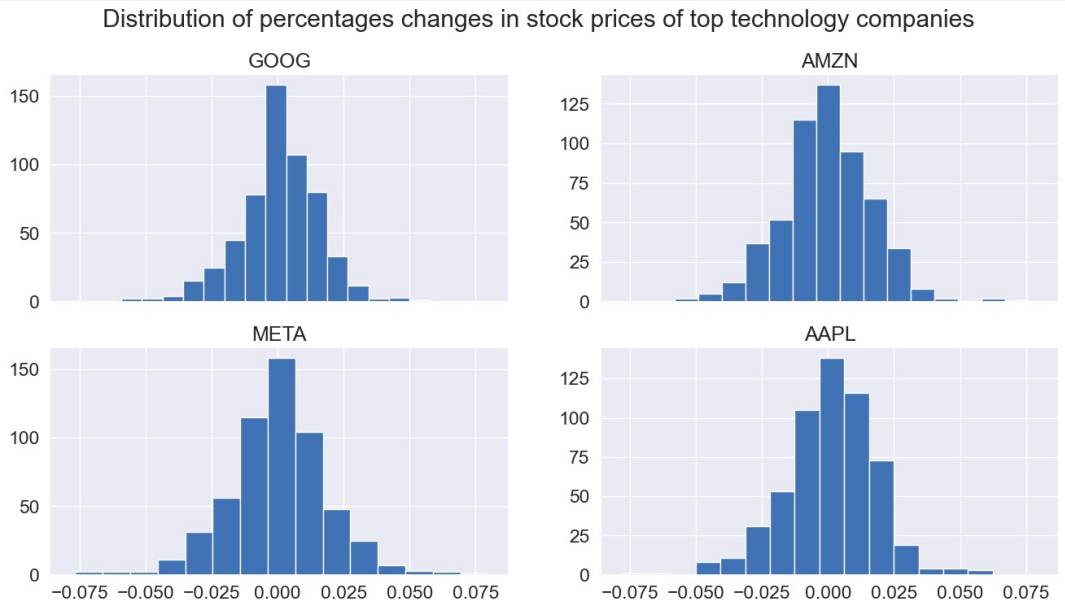
# Daily percentage changes of all 4 technology companies analysed are generally normally distributed, but showed slight skewness.




All percentage changes are generally normally distributed.

However, the distribution of META and AMZN show a slight negative skew suggesting that the stock prices were more likely to decrease than increase in a daily basis.

Contrastingly, there was a positive skew for AAPL and GOOG which implied that the stock prices were more likely to show daily increases.

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# 02 Factors affecting stock closing prices

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# The closing prices of majority of the analysed technology companies increased from 2020 Q1 to 2022 Q1.

GOOG (104.3% increase) had the highest growth while AAPL (41.9% decrease) showed the greatest decline.

Percentage change of the stock closing prices from 2020 Q1 to 2022 Q1:

| | |
|---|---|
| Alphabet (GOOG) | 104.3% |
| amazon (AMZN) | 71.8% |
| Meta (META) | 6% |
| Apple (AAPL) | -41.9% |
| Average of the 4 selected companies: | 35% |

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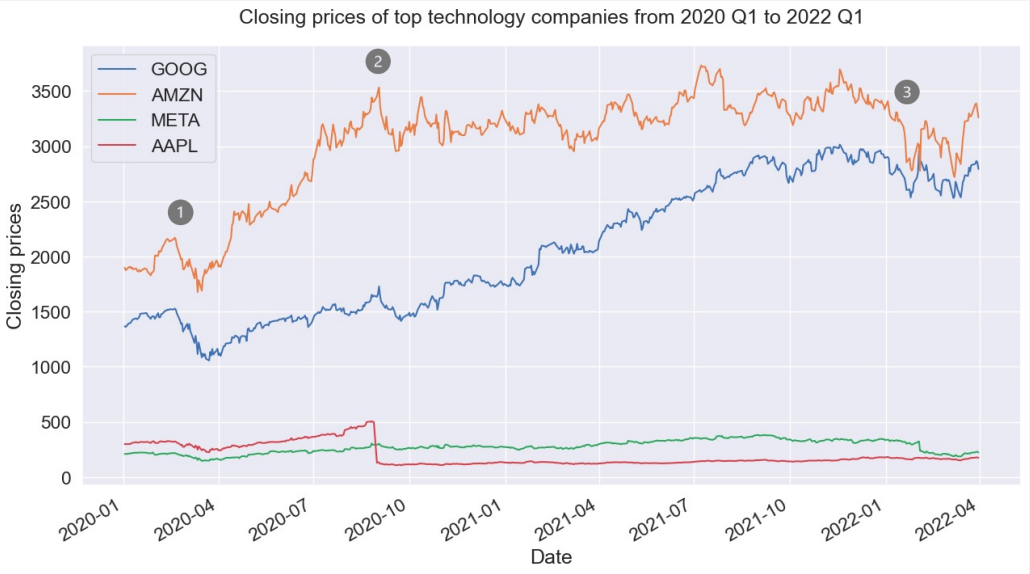
# The closing stock prices were negatively impacted by world events including the COVID-19 pandemic, economic recession, Russian-Ukraine war.




Common trends observed:

1. Mar 2020: All 4 companies showed a fall in stock prices which was possibly driven by the outbreak of COVID-19 worldwide.

2. Apr 2020 – Sep 2020: The stock prices of the companies slowly recovered since Apr 2020 but again dropped in Sep 2020. The reason financial markets continue to struggle was the concern about a possible recession, as interest rates rise to combat the world's high inflation.

3. Feb 2022: There was also a major decline of stock closing prices, which was resulted by the Russian and Ukraine war.

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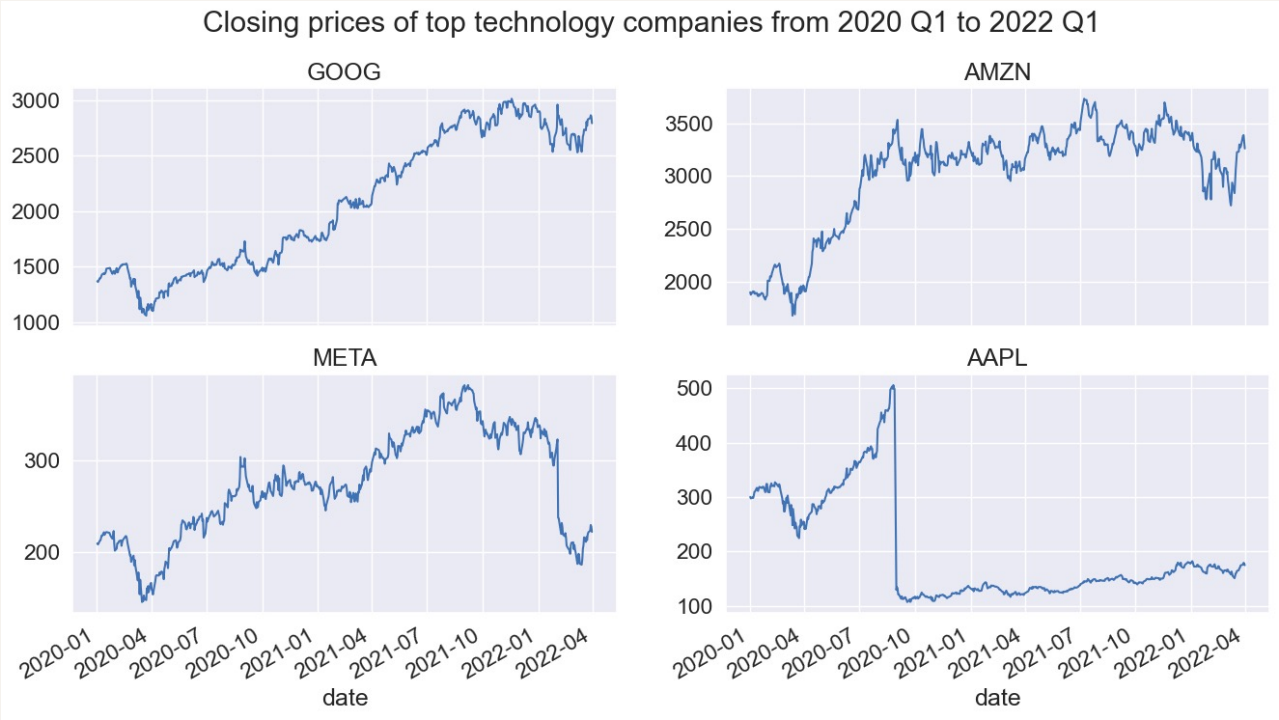
# We can separate the lines by companies for clearer analysis of their stock prices in an individual level...

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Alphabet

# The closing prices of Alphabet was impacted by reports of their financial performance.


Alphabet's stock prices showed a steady increase after the outbreak of pandemic in Mar 2020, but fluctuated from Oct 2021 to the end of Mar 2022.

1. Oct 2021: Alphabet's closing prices dipped as they reported that their earnings were below expectations.

2. Feb 2022: Closing prices jumped in Feb 2022 after Alphabet announced that their profit increased 36 percent which was above analysts' expectations.

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# Increasing demand of online shopping and company policies drove Amazon's closing prices.


Differed to the other technology companies, Amazon's stock prices surged after the outbreak of COVID-19 in Mar 2020.

1. Mar 2020 to Sep 2020: Though the closing prices of all the technology companies slowly recovered after the outbreak of COVID-19 in Mar 2020, the closing prices of Amazon seemed to show a larger growth during this period of time. This was due to Amazon's profit soared brought by customers' increasing demand of online shopping due to lockdowns and health concerns during COVID-19.

2. Mar 2022: Amazon's closing prices increased as they announced their 20-for-1 split plans.

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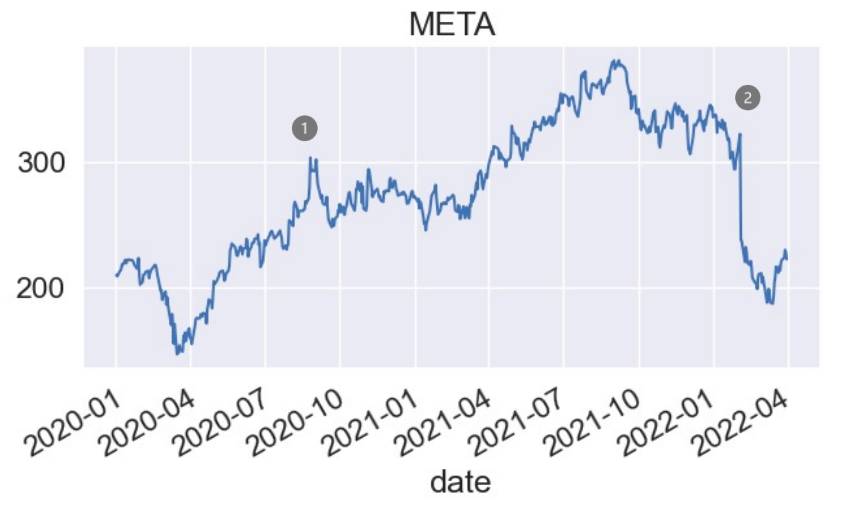
# Meta's stock prices were undermined by major rebranding and lower popularity of the platform.




Meta's stock prices generally increased from Jan 2020 to Sep 2021, but dropped from Sep 2021 to the end of 2022 Q1.

1. Sep 2021: The drop of prices might be related to the announcement of the change of company name from Facebook to Meta and the metaverse project, making investors lose confidence in the company.

2. Feb 2022: There was also a crash of closing prices in Feb 2022 after Meta reported its first ever drop in daily user numbers.

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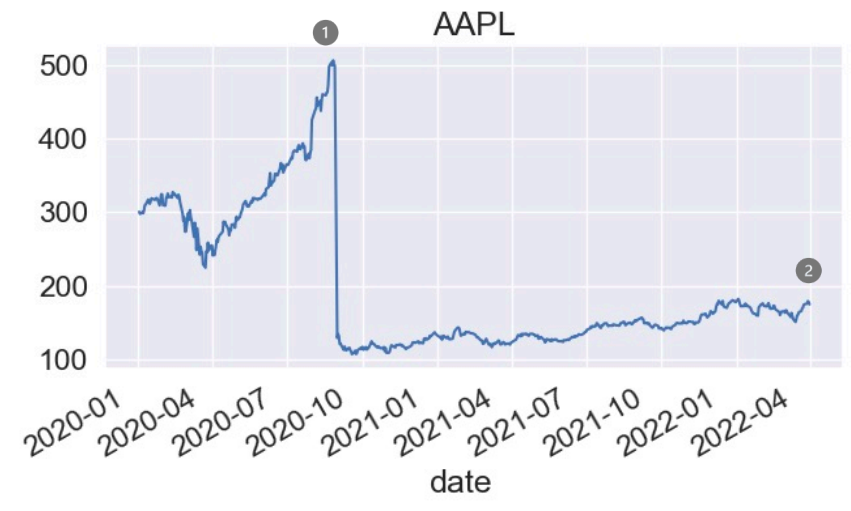
# Apple's closing prices were significantly influenced by their product launch events.




Similar to Meta, Apple's stock prices grew from Jan 2020 to Sep 2021, but fell significantly in Sep 2021.

1. Sep 2020: There was a major decline of stock prices in Sep 2020. This is believed to be due to be the combined effects of people's fear of recession and Apple's relatively underwhelming product launch event on 15 Sep 2020, when they announced new hardware and some updated software, but did not announce any new iPhones.
2. Mar 2022: Apple's stock prices grew in March 2022 which was driven by their product launch event, announcing a range of new iPhone and iPad products.

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# 03 Relationship of closing prices between stocks

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# Apple's closing prices were least correlated with the other technology companies.


The closing prices of META and AMZN were most closely and positively correlated ($r$ = 0.81), followed by the closing prices between META and GOOG ($r$ = 0.75), then AMZN and GOOG ($r$ = 0.7).

AAPL appeared to be least correlated with the other technology stocks, implying that AAPL might be more independent to the fluctuations of the other technology companies.

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# Amazon's closing prices were positively related to Meta's prices.


When the closing prices of AMZN increased, that of META also increased.

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# 04 Predicting future stock closing prices

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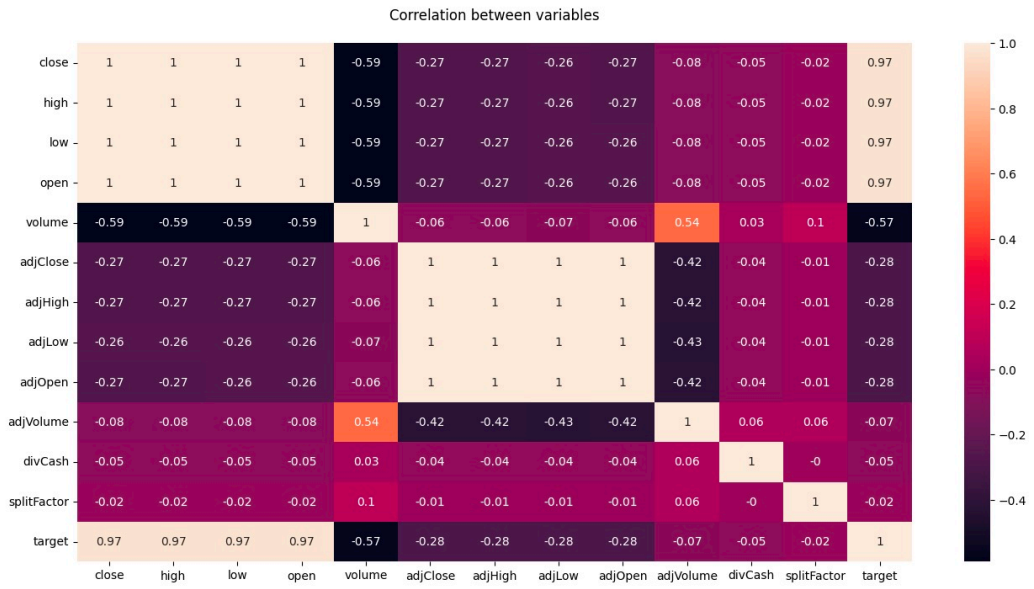
# Future 25 day closing prices correlates the most with current day closing prices, highest trading prices, lowest trading prices and opening prices.




The *target* variable (i.e., future 25 day closing prices) correlated the most with current day closing prices (*close*), highest trading price (*high*), lowest trading price (*low*) and opening price (*open*).

Therefore, these variables were included in the linear regression models to predict closing prices 25 days into the future.

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# The linear regression model of GOOG accounts for the most variance and AAPL for the least.

The linear regression model of GOOG accounted for the most variance in the company's future closing prices; 94.92 % of variance in future closing prices of GOOG were accounted by the company's current closing, highest trading, lowest trading and opening prices.

AAPL had the lowest R squared ($r^2$ = 46.3 %), suggesting that the predictor variables did not significantly predict the Apple's future closing prices.

R squared of the linear regression models predicting companies' closing prices 25 days into the future:

| | |
|---|---|
| Alphabet (GOOG) | 94.92% |
| amazon (AMZN) | 72.9% |
| Meta (META) | 64.3% |
| Apple (AAPL) | 46.3% |

****Visualisations of each linear regression model are included in the appendix.*

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# 05 Summary of findings

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# Summary of findings

I analysed the stock price data of some of the top technology companies (including Alphabet, Amazon, Meta and Apple) from 1 Jan 2020 to 31 Mar 2022.

1. The stock prices of Meta and Amazon tended to drop in a daily basis, whereas that of Apple tended to grow daily.
2. The closing prices of Alphabet had the highest growth between the start of 2020 Q1 to end of 2022 Q1, and Apple showed the greatest decline during this period of time.
3. The closing prices of the 4 companies analysed were negatively impacted by the COVID-19 pandemic, customers' fear of recession as well as the Russian and Ukraine war.
4. The closing prices of Amazon and Meta correlated the most, while Apple was least correlated with the other 3 companies.
5. Compared to other companies analysed, Alphabet's current closing, highest trading, lowest trading and opening prices most reliably predicted the company's closing prices 25 days into the future.

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# 06 Appendix

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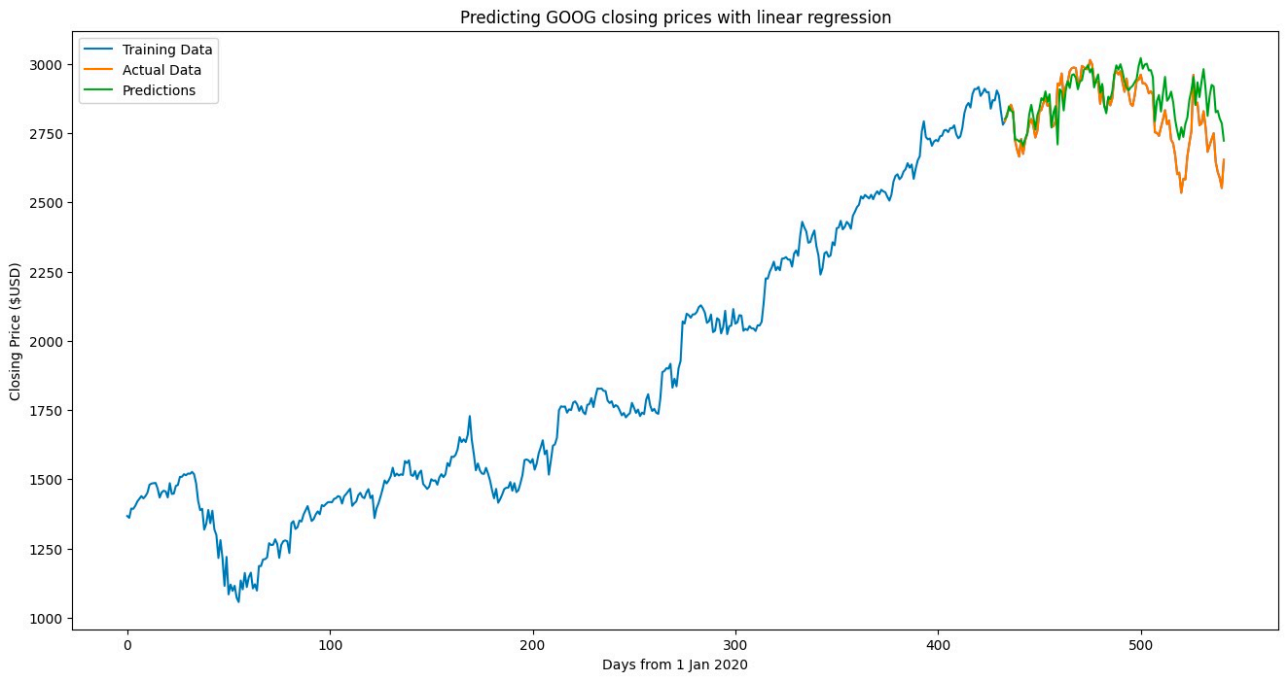
Alphabet

# GOOG linear regression model




Linear regression was used to predict GOOG closing prices 25 days into the future according to its current closing, highest trading, lowest trading and opening prices.

The predicters account for 94.92% of the variance in GOOG closing prices 25 days into the future.

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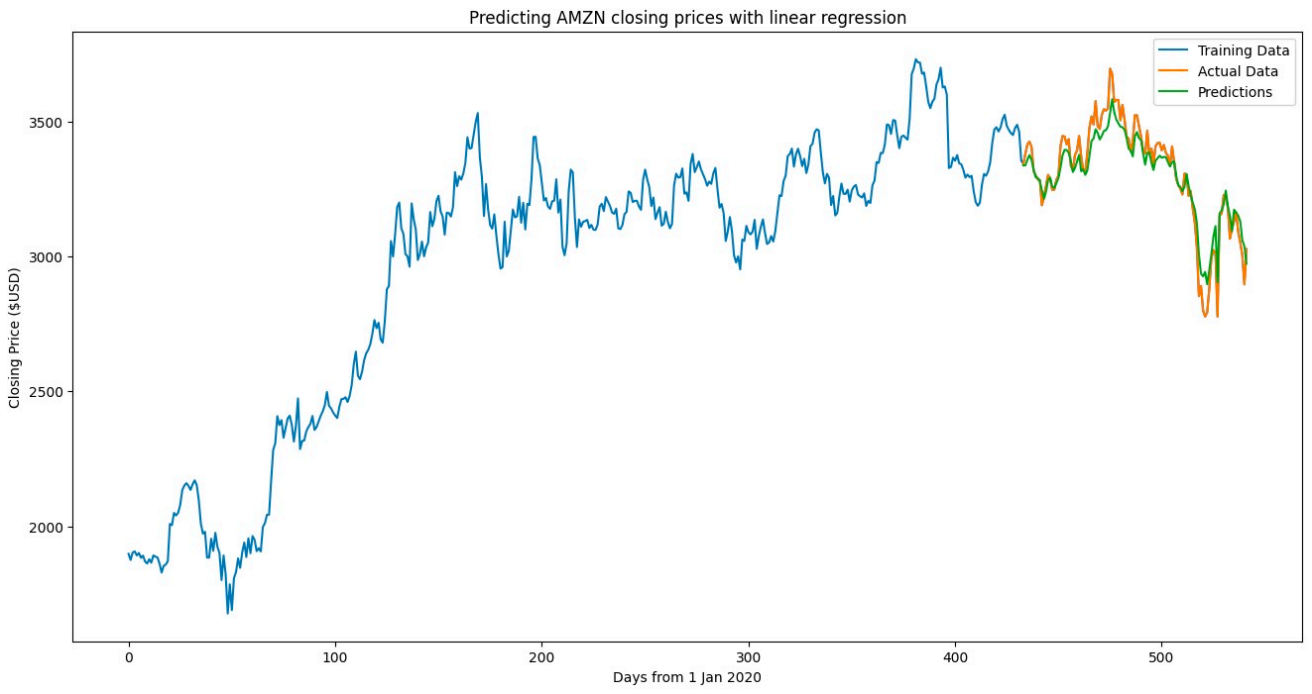
# AMZN linear regression model




Linear regression was used to predict GOOG closing prices 25 days into the future according to its current closing, highest trading, lowest trading and opening prices.

The predicters account for 72.9% of the variance in AMZN closing prices 25 days into the future.

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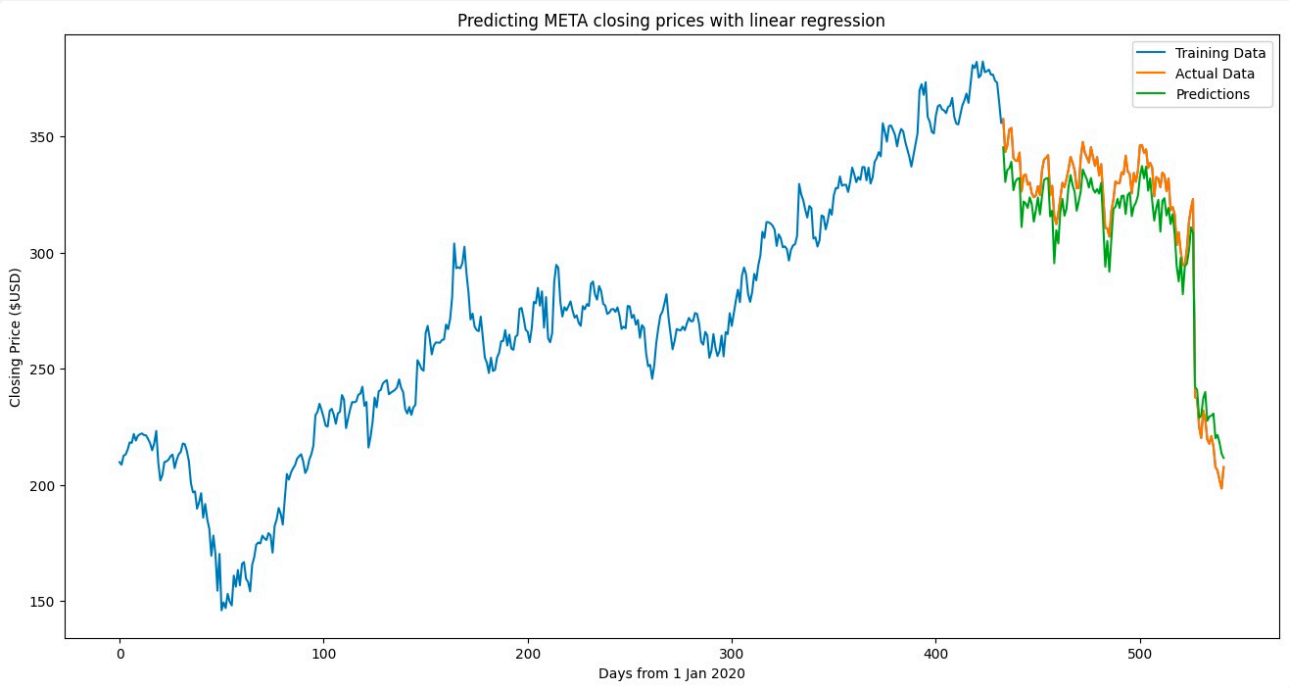
# META linear regression model




Linear regression was used to predict AAPL closing prices 25 days into the future according to its current closing, highest trading, lowest trading and opening prices.

The predicters account for 64.3% META the variance in AAPL closing prices 25 days into the future.

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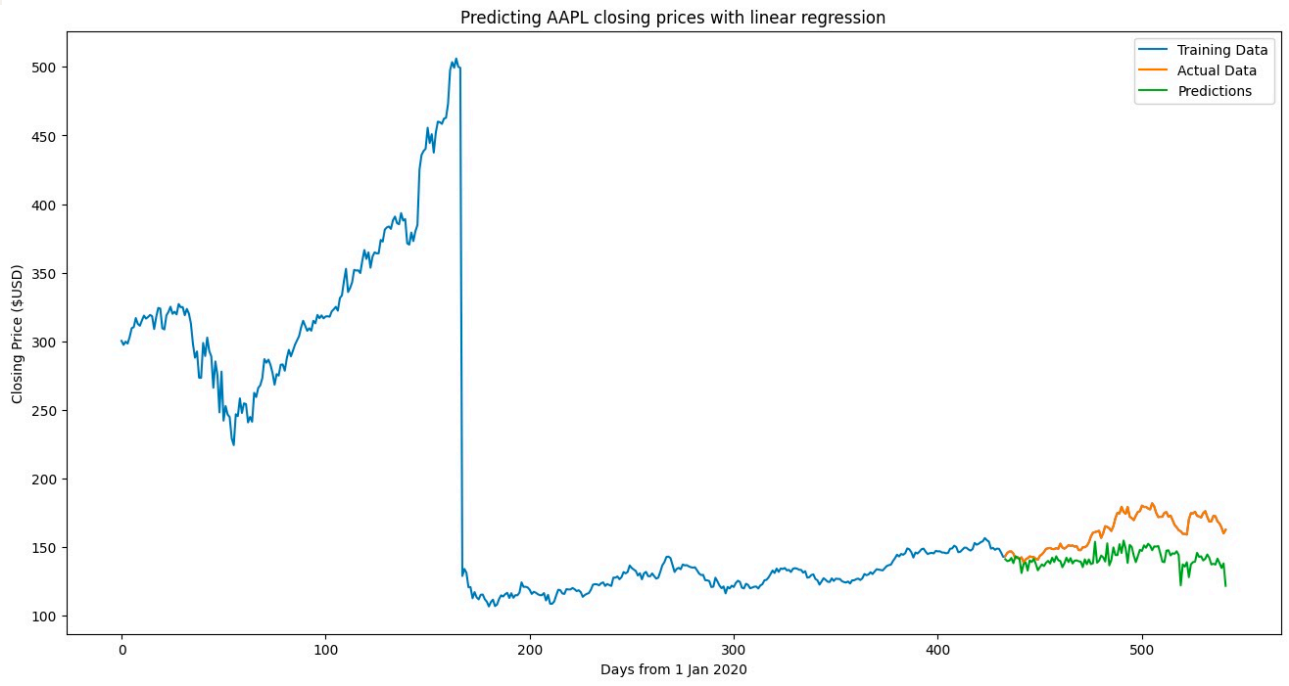
# Apple AAPL linear regression model




Linear regression was used to predict AAPL closing prices 25 days into the future according to its current closing, highest trading, lowest trading and opening prices.

The predicters account for 46.3% of the variance in AAPL closing prices 25 days into the future.

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