Tesla & Twitter stock prediction and comparison

Kosyk Daryna
Lilia Mudryk

1. Introduction

On Thursday, April 14th, Elon Musk announced an offer to buy Twitter for $54.20 a share. On April 25th, Twitter accepted the deal. On May 13th, Elon Musk said that his deal to buy Twitter is currently on hold. These days the whole world watches after the process of this deal, so we got interested in whether the stock prices of Twitter and Tesla are connected and whether Elon Musk's decision to buy Twitter has affected any (or both) of these companies' stock prices. As the deal is still on hold, we decided to do research and decide whether it will be profitable for Elon Musk to buy Twitter and predict the stock prices for both companies. This research can be useful for both Twitter and Tesla, and possibly they could buy our results. Also, anyone who thinks about investing in Tesla and/or Twitter will be interested in our research.
Our project aims to make two models to predict the stock prices of Twitter and Tesla and compare the stock prices of these companies, define how much they are correlated and how they impact each other.

2. Literature review

We made some research to better understand some methods to explain and predict time series. Here is the literature that we used:

ARIMA model : Introduction to ARIMA models (duke.edu)

ACF and PACF:
https://towardsdatascience.com/significance-of-acf-and-pacf-plots-in-time-series-analysis-2fa11a5d10a8

Random walk: Notes on the random walk model (duke.edu)

We also used lecture and seminar materials about the time series and the main course book 'Introductory Econometrics: A Modern Approach' by Jeffrey M. Wooldridge

3. Data description and analysis

The variables in Twitter data and Tesla data are the same. They describe the stock's dynamics during some period and basically represent just one variable - price.
Every dataset has 6 columns:
Date - date of price change
Open - the price at which a stock started trading during some period.
High - the highest price of the period.
Low - the lowest price of the period
Close - the price at which a stock ended trading during some period.
Adj close - the closing price adjusted for corporate actions such as dividend payouts, stock splits, or the issuance of more shares.
Volume - is the total number of shares traded in a corresponding period.
After plotting data we saw that Twitter's data does not have an obvious trend and is fluctuating a lot. Telsa's stock prices has been growing up almost all the time since 2013, especially after 2020. We saw a trend close to exponential. So we assumed that both datasets are not stationary.

We decided to decompose data to see trend and seasonality separately and then performed ADF test to make our assumptions clear. It showed that data is not stationary as it had both trend and seasonality, so we performed differencing on both datasets. We differenced Tesla's data twice as differencing once was not enough to make data stationary.

5. Methodology

We supposed that we can use ARIMA model to predict the stock prices of Tesla and Twitter. So after making the data stationary we plotted ACF(Auto correlation function) and PACF (partial correlation function) to determine parameters of our ARIMA model.

From ACF and PACF plots for Twitter we saw that it is neither AR process nor MA process. The plot of the first-order difference of a time series results is white noise, so it is a random walk.

We constructed ARIMA(0,1,0) model for Twitter and predicted some confidence intervals for the nearest future, as random walk is hard to predict and lots of possible realizations may happen.

For Tesla AR process has order 5 which means that 5 lags can be used as predictors. We believe that this is because of exponential trend, as data is steadily growing up, more lags can influence predictions. The MA has order 1.

For Tesla we constructed ARIMA(5,0,1) which gave us better predictions then one for Twitter.

6. Results

We have conveyed a research on two types of data: monthly historical prices of

Tesla’s and Twitter’s stock for 2013-2022 period, and daily stock prices of both companies for 14.04.2022-13.05.2022 to observe data’s dynamics during a long period of time and short period of latest data. We concluded that:

1. Tesla’s and Twitter’s stock prices have not been correlated neither during 2013-2022, nor after Elon Musk’s announcement that he is going to buy Twitter, which is after 14.04.2022
2. Tesla’s stock prices have a tendency to grow in the long-time perspective. They have been almost constantly increasing after 2013, when Tesla gained 350%. It can be explained by the popularity boom of Tesla Model S, which Tesla has delivered in the quantity 21,500 vehicles comparing to selling a few hundred sports cars in the previous years. Also Tesla's expansion into China contributed to this succes. After 2020 Tesla's value has grown enourmously and continues to rise. It was caused by a stock split in summer 2020 and addition to the S&P 500 later that year.
3. Tesla's stock prices are much higher than Twitter's: for the past month Twitter’s mean was 47.85285742857144, while Tesla’s 896.912862095238.
4. After performing ACF and PACF plots, we have concluded that Twitter's data is a random walk and cannot be well predicted, while Tesla's data does not represent a random walk, therefore it can be predicted with ARIMA model better than Twitter.
5. Constructing ARIMA model for Twitter was not very effective because of the nature of Twitter’s data. As it represents a random walk, ARIMA model can only predict a wide range in which the future stock prices will be fluctuating with some confidence interval. On the contrary, Tesla’s data is not a random walk and can be predicted better with ARIMA model.

Surprisingly, we found out that in the nearest future Tesla's stock prices are going to drop according to our model.

7. Conclusions

Our main aim was to compare and predict stock prices of Tesla and Twitter, investigate their correlation and answer the question: is it profitable for Elon Musk to buy Twitter? After conducting our research and considering available data, we came with the conclusion that 15.05.2022 was a good time for Elon Musk to buy Twitter but for the smaller price than he proposed. After a drop in Twitter's prices after the beginning of May and a tendency of Twitter's stock prices to decrease, it would be wise to buy Twitter for a smaller price than Elon Musk and Twitter has agreed on - $54.20 per share. Though Tesla's stock prices are decreasing and are likely to decrease in the short-term future according to ARIMA model, we should not pay great attention to this. Because of the nature of stocks, that cannot be predicted in the log-run, we cannot say what will happen in the future, but logically it is clear that Tesla's stock prices are likely to increase in the long-term perspective, as it has been for the past 9 years. Therefore Elon Musk as CEO of Tesla can afford to buy Twitter and his company will have no negative consequences from this.

8. Next steps

As predicting stock prices is not an easy task and Twitter stock price data is a random walk, we can`t construct a trustable model to predict stock prices, especially for the long-term. Maybe further research of factors that may influence Twitter stock prices to build a model that depends on these factors would be an

option to make a more precise and trustable model. The same can be done for Tesla stock prices to improve the existing ARIMA model.

Appendix

Twitter data source:
https://finance.yahoo.com/quote/TWTR/history?period1=1383782400&period2=1652572800&interval=1d&filter=history&frequency=1d&includeAdjustedClose=true

Tesla data source:
https://finance.yahoo.com/quote/TSLA/history?period1=1277769600&period2=1652572800&interval=1d&filter=history&frequency=1d&includeAdjustedClose=true

Project code source**:**
https://colab.research.google.com/drive/1B4bqUo9q7x3k0g8yPvQE8p0SxQexatyG#scrollTo=osTsDkcn1sVP