**TESLA - Predictive analysis of stocks.**

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**Abstract**

The research aims to provide insights onto the evolution of the company Tesla between 2021 and 2022, by analyzing the stock's prices in the specified timeframe and predicting the future ones. The reason for choosing this topic lies in the research of the company's evolution, which determines if it is worth investing in, or not. Why is it important to have an answer on that? Because global pollution and global warming are big problems of the society, the idea of investing in a company that is trying to solve this could be very useful to us. Analyzing the opening and closing prices, volatility, return of stocks, the volume of trading and the predicting prices, as well as the sentiment analysis based on one of Elon Musk’s press conferences about sustainability. The analysis was done in Python using various methods.

**Introduction**

Tesla, Inc. is an American multinational automotive and energy company. Tesla designs and manufactures electric vehicles (electric cars and trucks), home-to-grid battery storage, solar panels and solar roof tiles, and related products and services. Tesla is one of the most valuable companies in the world and remains the world's most valuable automaker with a market capitalization of over $840 billion.

Since its 2010 IPO, the auto manufacturer has enjoyed stratospheric highs, cratered to purgatorial lows, and rumbled over everything in-between. Through its ups and downs, the company has broken records and brought electric vehicles into the mainstream. A few months after the founders left the company, Elon Musk was named CEO of the company and helped the company avoid bankruptcy.

In July 2009, ***TESLA*** announced that it had achieved corporate profitability for the first time, [claiming $1 million out of $20 million](https://www.wired.com/2009/08/tesla-profit/) in revenues. The turnaround occurred thanks to higher gross margins on the record 109 2010 Roadsters shipped in July.

In June 2010 the first stock price was listed at 1,59$.

March 31, 2016 was the day [Elon Musk teased](https://www.youtube.com/watch?v=Q4VGQPk2Dl8) the long-awaited Model 3. He announced that the car would see 215 miles per charge and could accelerate from 0-60mph in under six seconds. ***TESLA*** planned an affordable starting price of $35,000 to bring the vehicle within reach of a broader swath of consumers. The Model 3 was slated to enter high-volume production in early 2017.

In August 2018, ***TESLA*** reported its biggest-ever loss as a company, of $717 million. Still, shares rose as Musk hyped up investors, claiming that the second half of 2018 would see positive cash flows and bigger profits. He also promised that Model 3 production would become more consistent, putting the company on track to regularly meeting its output goals.

In July 2020, after years of production mishaps and cash burn, ***TESLA*** finally announced that it had [turned a profit for four consecutive quarters](https://www.cnbc.com/2020/07/22/tesla-tsla-earnings-q2-2020.html), its first run of sustained profitability ever. The feat teed its stock price to reach a $206 billion valuation, yet again surpassing Toyota to become the world’s most valuable automaker by market cap.

This paper analyzes and confirms the current situation between the stocks and the owner of ***TESLA***, using analytical techniques to quantify if investing in ***TESLA*** would be for a better future. This research has significant implications for the forecasting of stock returns and the linearity of it.

**Methods and Results**

Two main approaches were used to correctly analyze the current situation of TESLA stocks: (1) data analysis and (2) sentiment analysis, both executed in Python. The main purpose of this paper is to observe the relationship between the owner of the company (his impact) and the stocks of the company, if what he is saying can be observed in the performance of the company on the stock market. ***TESLA’s*** marketing strategy is mostly based on human-centric customer experience, including human-centric marketing, marketing aligned with the company’s goals, and world-of-mouth marketing.

1. Data analysis.

To conduct this analysis several libraries from python where used:

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One year period of data has been analyzed to observe the current situation. The data has been downloaded from yahoo finance in an excel file and analyzed in Python.

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When it comes to stocks, everything is analyzed on the closing and opening price, high and low, volume and adjusted price for a period. To be more precise with the results, the difference of adj close price and the closing price has been calculated:

Graphical user interface

Description automatically generated with medium confidence

Result:

Table

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For the current data of ***TESLA’s*** stocks, the difference between adjusted closing price and closing price is equal to 0.0, still the variable ‘adj\_close’ has been used for further calculations.

When it comes to stocks one thing that matter is the volatility of the stocks. A high volatile stock is inherently riskier, a stock that maintains a relatively stable price has low volatility. The volatility was verified in two ways: by calculating the Beta value and by calculating the volatility for 3 periods of time: daily, monthly, and annually.

*Beta measurement*.

1. Beta = Covariance / Variance: Where covariance is the stock’s return relative to the market's return. Variance shows how the stock moves in relation to the market.
2. Beta: y= a + (b\*x): Another way to calculate beta is to use a linear regression formula. Where beta is the coefficient of the independent variable (x in the equation), y is the dependent variable, a is the y-intercept or constant, and b is the slope of the line.

*Load the data*. In python the following libraries where imported:

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Following, symbols and dataframe were created to have the necessary data to work with. The stocks from Ferrari we used to have the dependent variable as the other market for the beta value. The adjusted close price was used to increase the accuracy and decreasing the time required to make calculations. The python function pct\_change() was used to convert the daily adjusted closing prices to a percent change variable as a standardized measure of fluctuation.

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The Beta for ***TESLA*** was:



Having a **Beta** less than 1 indicates a stock with lower volatility. For the time being, ***TESLA*** has good results for a one-year period.

*Daily, monthly, and annually volatility.*

Having a negative Beta is a good indicator for the current situation, but to have a better view a daily, monthly, and annually volatility was calculated using the following method:

*Daily*: calculate the standard deviation of the daily returns.

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*Monthly*: assuming there are 21 trading days in a month, multiply the volatility by the square root of 21.



*Annually*: assuming there are 252 trading days in a calendar year, multiply the daily volatility by the square root of 252



Result:

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Chart, bar chart, waterfall chart

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Calculating the volatility using this method, we can observe the fact that the volatility is extremely low each period. The daily volatility is 0%, monthly is 0.02% and annually is 0.08%. This low volatility demonstrates the security of TESLA’s values which does not fluctuate dramatically, being steadier.

*Volume of stocks,* the total number of shares traded in a specified time frame. This would include every share that is bought and sold during one year in review.

Chart, line chart

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For the last year, ***TESLA’s*** stock volume has never been equal to zero.

*Return of stock*.

A return of stock is calculated by subtracting the initial value of the investment from its current value, and then dividing it by the initial value. To report it as a %, the result is multiplied by 100.

Text

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Obtaining a stock return of:

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Plotted values:

Chart, line chart

Description automatically generated

We can observe here that there were periods of time when the return was negative, but after that it immediately went up.

Having the return of stock as a variable we can plot it per date to better observe how it was over the year.

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Chart, scatter chart

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We can clearly observe that ***TESLA*** had its period of loss a few times for the last year, but it does not overcome the amount of positive return.

To clearly observe on a small scale the situation, first 10 days and last 10 days were extracted for visibility of the adjusted closing price on volume.



Chart, scatter chart

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At the beginning of this one year in the first 10 days, the adjusted closing price was $405, and it ended the period with a price of $385, the first adjusted price having the highest volume of the period.



Chart, scatter chart

Description automatically generated

At the end of the year, the adjusted closing price is between $175 and $180 with a volume of 1.50. Meanwhile the last price of this period is between $180 and $185 with a volume of 0.50.

*Max and min of each open, close, high, and low.*

The charts of open, close, high, and low are used to analyze the price changes over the time for securities. Extracting the max and min of each, we can observe if there are any negative or huge values. The dataframe df\_tesla (df\_tesla = tesla\_data # in python created) and the python functions max() and min() were used for this extraction.

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Result:

Graphical user interface, text, chat or text message

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*Trained the model*.

To predict the evolution of the prices for ***TESLA***, new columns were added to train the model, a target feature which is a signal whether to buy or not we will train our model to predict this only.

A screenshot of a computer

Description automatically generated with medium confidenceNew columns:

But before proceeding let’s check whether the target is balanced or not using a pie chart.

Text

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Having the plot:

Chart, pie chart

Description automatically generatedThe target is quite balanced.

To further train the model, data splitting and normalization were made:

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After selecting the features to train the model on we the normalization of data leads to a stable and fast training of the model. After that whole data has been split into two parts with a 90/10 ratio so, that we can evaluate the performance of our model on unseen data.

After normalization, we used some state-of-the-art machine learning to train the model (Logistic Regression, Support Vector Machine, XGBClassifier), and then based on their performance on the training and validation data we will choose which ML model is serving the purpose at hand better.

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Result:

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All the accuracy rates are high. Among the 3 models, XGBClassifier has an accuracy rate of almost 99%. Also, the confusion matrix is plotted to validate the data.



Chart, treemap chart

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*Price prediction.*

We tried to build the best MRL model for the price prediction using Linear Regression method from our course, even if the XGBClassifier gave us a much higher rate of predictability, we consider that LinearRegression is mostly used for cases like this one.

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In Python a new variable was created: ‘new\_open’ being the prediction price. We took all the values from the data and added in the model.

The plotted prediction of the new price is:

Chart, scatter chart

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*Normality. Residual Errors*:

The residual is the difference between the observed value and the estimated value of the quantity of interest. In our case, the residual standard error is small as it fits the regression model.

Chart, histogram

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(2) Sentiment Analysis

Our second method is based on sentiment analysis where we took Elon Musk’s speech from the conference which took place at Université de Paris Panthéon Sorbonne where he talked about Sustainability.

His speech was read from a txt file in Python.

Logo

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For a better result we conducted data cleaning of the text:

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The words were counted, and a dictionary was created:

Text

Description automatically generated

Further, the words were filtered into an English dictionary and then counted the most used words by Elon Musk in his speech.

Text

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The most used words in the speech were:



With a frequency of:

Chart, bar chart

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After all the words were arranged, the word cloud was possible to be created:

Text

Description automatically generated

Text

Description automatically generated

The word cloud resulted.

Having all the words filtered and sorted, the sentiment analysis is possible to be calculated.

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Result: Score: 0.10657329232009413

Also, the mask with the words was possible to be created:

A screenshot of a computer

Description automatically generated with medium confidence

Result:

A picture containing text

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**Discussion**

The data which was analysed is for a one year period, nevertheless the situation found based on this analysis shows the fact that investing in TESLA’s stocks is for the better. We found a negative value for beta, having a low (and even a negative one which is extremly rare) volatility means the price is stable and the investor is going to have a good return over the years. The volume for his period was never negative. Even if there where negative return of stocks, the negative value did not conquered. For the first and last 10 days we can observe the fact that the prices ranged from $185 to $405.

In the printed mask we can observe the most used words in his speech. He is concerned about the amount of carbon globally, and tries to find a way to a more sustainable situation. Elon Musk created a business which is profitable in several plans: for the market, environmental, and for the future.

The conclusion is as predictable as possible: the investment in Tesla is profitable as well as durable.

Works Cited

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