

Stevens Institute of Technology

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# **Tesla Stock Price Analysis and comparison with S&P 500**

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## **Abstract**

Tesla's stock has increased dramatically in the last two years. Tesla's market capital was 117 billion dollars in 2020, and it has since grown to 800 billion dollars in 2022, in the course of its expansion, it has also passed the trillion-dollar mark. Tesla's stock is considered to be extremely volatile. I used machine learning model Linear Regression to study and understand the predictability of Tesla stock price utilizing Open, High, Low, Close, and Volumes as features of last 2 years data. Also compared it with one of the most reliable market index S&P 500 by calculating the Beta value.

## **Tesla Description**

Tesla Inc. designs, manufactures, and sells high-performance electric vehicles and electric vehicle power train components. The Company owns its sales and service network and sells electric power train components to other automobile manufacturers. Tesla serves customers worldwide.

Tesla is not just an automotive manufacturer but a technology company. Home energy, solar, the power grid, and the Gigafactory are among the company's other divisions. Automation and robotics are also helping to alter manufacturing processes.

**Prominent Factors:**

- The combined market capital of the top ten automakers is equivalent to Tesla's alone.
- Tesla has 30% profit gross margin on each vehicle.
- Car sales account for 80% of Tesla's revenue.
- Advertising spending of Tesla is 0 dollars whereas it's leading in the Research and Development spending is almost 3 times more when compared to other top automakers.
- Tesla's business approach is direct-to-consumer where they have total control from start to end.

## **S&P 500 Description**

**S&P 500**, abbreviation of **Standard and Poor's 500**, in the United States, a stock market index that tracks 500 publicly traded domestic companies. It is considered by many investors to be the best overall measurement of American stock market performance. As of December 31, 2020, more than \$5.4 trillion was invested in assets tied to the performance of the index.

As of September 30, 2021, the nine largest companies on the list of S&P 500 companies accounted for 28.1% of the market capitalization of the index and were, in order of weighting, Apple, Microsoft, Alphabet (including both class A & C shares), Amazon.com, Meta Platforms, Tesla, Nvidia, Berkshire Hathaway and JPMorgan Chase. The components that have increased their dividends in 25 consecutive years are known as the S&P 500 Dividend Aristocrats.

In 2017, companies in the index derived on average 72% of their revenue in the United States. The index is one of the factors in computation of the Conference Board Leading Economic Index, used to forecast the direction of the economy.

The index is associated with many ticker symbols, including ^GSPC, INX, and \$SPX, depending on market or website. The S&P 500 is maintained by S&P Dow Jones Indices, a joint venture majority-owned by S&P Global, and its components are selected by a committee.

# Data Retrieval

The data was collected from Bloomberg Terminal using excel add-in. The securities SPX Index and TSLA US Equity was used. To view the line chart, the GP function was utilized.

Retrieved the last two years data starting from 5/12/2020 to 5/13/2022

Tesla Data contains columns: -

Date	Last Price	Open Price	High Price	Low Price	Volume
------	------------	------------	------------	-----------	--------

S&P 500 Index Data contains columns: -

Date	Last Price	Volume
------	------------	--------

## Tesla GP



## S&P 500 GP



# Linear Regression on Tesla Stock Price

Passed Open Price, High Price, Low Price, Volume in the dependent Variable X and Last price in the independent variable Y.

```
In [11]: x = df[['Open Price', 'High Price', 'Low Price', 'Volume']].values
         y = df['Last Price'].values

In [12]: x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, random_state = 0)

In [13]: regressor = LinearRegression()

In [31]: regressor.fit(x_train, y_train)

Out[31]: LinearRegression()

In [15]: print(regressor.coef_)
         [-4.01974450e-01  3.56249716e-01  1.06601734e+00  1.87853994e-07]

In [16]: print(regressor.intercept_)
         -9.472412207246975

In [17]: predicted = regressor.predict(x_test)

In [18]: compare = pd.DataFrame({'Original': y_test.flatten(), 'Predicted': predicted.flatten()})

In [20]: compare.head(5)
```

After applying Linear Regression model on the given data, compared the predicted value with the Original Value. Where it can be seen that the model has done an excellent job at forecasting.

	Original	Predicted
0	735.720	737.959458
1	1114.000	1102.616190
2	640.390	631.182556
3	975.990	950.278476
4	475.050	486.193169
5	176.592	178.212522
6	1028.150	1019.371310
7	756.990	757.851424
8	710.920	721.894862
9	413.980	415.016252

Liner Regression has predicted the values with the accuracy of 99.76%.

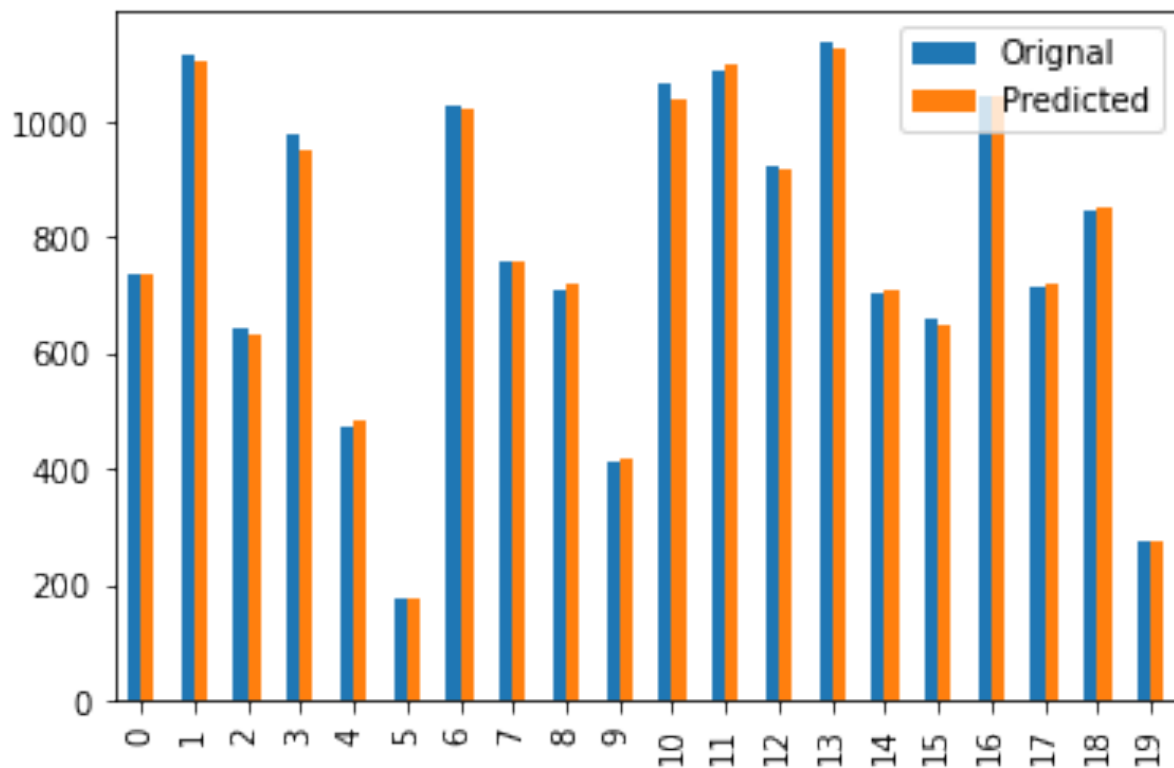
```
In [32]: print('Mean Absolute Error:', metrics.mean_absolute_error(y_test, predicted))
Mean Absolute Error: 9.58185750635081

In [22]: print('Mean Squared Error:', metrics.mean_squared_error(y_test, predicted))
Mean Squared Error: 184.0609342320926

In [23]: print('Root Mean Squared Error:', math.sqrt(metrics.mean_squared_error(y_test, predicted)))
Root Mean Squared Error: 13.566905845921266

In [24]: r2_score = regressor.score(x_test,y_test)
print(r2_score*100,'%')
99.7606822829674 %
```

Comparison between top 20 values of the original and predicted value using bar graph.





# S&P 500 vs Tesla Stock Visualization and Analysis

Compared the Tesla stock price and S&P 500 using matplotlib with the existing data of past two years.

It can be observed that except for a few instances, the Tesla stock price moves in lockstep with the S&P 500.

## Tesla Stock Price VS S&P 500 Index






# Beta Value of Tesla Stock

What is Beta Value?

- The volatility of a stock in relation to the overall market is measured by its beta.
- The beta of the S&P 500 Index is 1.0.
- Stocks with a high beta are seen to be riskier yet have a larger return potential.
- Low-beta equities have a lower risk profile, but they also have lower returns.

Formula:


$$\text{Beta Formula} = \frac{\text{Covariance (Re, Rm)}}{\text{Variance (Rm)}}$$


# Tesla's Beta Value Calculation

Calculated the Beta value of Tesla of last two years, where got the beta value of 1.8845.

```
In [60]: for col in cov.columns:  
         print(col)
```

```
Tesla Last Price  
S&P Last Price
```

```
In [58]: var = log_returns['S&P Last Price'].var()  
         var
```

```
Out[58]: 0.00012146120984058772
```

```
In [61]: cov.loc['Tesla Last Price', 'S&P Last Price']/var
```

```
Out[61]: 1.8845501600926464
```

```
In [62]: cov.loc['S&P Last Price']/var
```

```
Out[62]: Tesla Last Price    1.88455  
         S&P Last Price      1.00000  
         Name: S&P Last Price, dtype: float64
```

```
In [63]: X = log_returns['S&P Last Price'].iloc[1:].to_numpy().reshape(-1, 1)  
         Y = log_returns['Tesla Last Price'].iloc[1:].to_numpy().reshape(-1, 1)  
  
         lin_regr = LinearRegression()  
         lin_regr.fit(X, Y)  
  
         lin_regr.coef_[0, 0]
```

```
Out[63]: 1.8845501600926462
```

When compared the value with Linear Regression Coefficient where was able to obtain the exact same value of 1.8845.

## References:

- [https://english.hani.co.kr/arti/english\\_edition/e\\_business/1016533.html](https://english.hani.co.kr/arti/english_edition/e_business/1016533.html)
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