TSLA vs. Oil Analysis

By: Jason Muenzen, Max Gregory,
Kanika Sharma & Isaac Iskra

General

Goal: Understanding the impact of the prices of Oil on the prices of Electric vehicle shares like TSLA

- Correlations
- Evaluating Risk and Return: Sharpe Ratio and Beta
- Future Forecasting using MonteCarlo Simulation

Sourcing the Data

- We chose to use TSLA as the proxy for EV manufacturers.
- We also chose to use the oil ETF USO as the proxy for the price of oil.
- We coded the Alpaca API, however, this was not able to bring back the amount of data points we needed (i.e. ~100 data points only).
- TSLA went public on June 29, 2010, so we were looking for ~2800+ daily data points in order to have a robust data set.

Sourcing the Data

- So, we shifted to using Yahoo with Pandas datareader:

```
import pandas as pd
import sqlalchemy as sql
import alpaca_trade_api as tradeapi
import os
from dotenv import load_dotenv
#import hvplot.pandas
from pandas_datareader import data  #remember to pip install pandas-datareader
import pandas_datareader as pdr
import math

%matplotlib inline
```

```
symbol='USO','TSLA', 'SPY'
start='2010-06-29'
end='2021-10-15'

df=data.get_data_yahoo(symbol, start, end)['Close']
df.head()
```

Sourcing the Data

- With this new data source, we were then able to incorporate 2,846 stock prices creating a robust data set.

Symbols	USO	TSLA	SPY	USO_pct_change	TSLA_pct_change	SPY_pct_change
count	2846.000000	2846.000000	2846.000000	2845.000000	2845.000000	2845.000000
mean	164.771809	106.112510	226.313131	-0.000287	0.002437	0.000568
std	102.387174	189.260934	82.173761	0.022700	0.035274	0.010644
min	17.040001	3.160000	102.199997	-0.253150	-0.210628	-0.109424
25%	85.120003	10.464000	158.595005	-0.010686	-0.014816	-0.003469
50%	112.760002	45.909000	209.770004	0.000690	0.001255	0.000649
75%	276.460007	65.295502	279.069992	0.011073	0.019081	0.005452
max	361.200012	883.090027	453.190002	0.166667	0.243951	0.090603

Sourcing the Data

- In order to avoid downloading the data from Yahoo everytime, we created an SQLite database along with a table to hold the stock prices for this analysis.

```
# Working with SQL in order to not ping the Yahoo API too much
#Creating SQL connection/engine

database_connection_string = 'sqlite:///'
engine = sql.create_engine(database_connection_string)
engine
```

```
Engine(sqlite:///)
```

```
#shoving closing_prices_df from Yahoo into a SQL Table

df.to_sql('closing_prices', engine, index= True, if_exists='replace' )
```

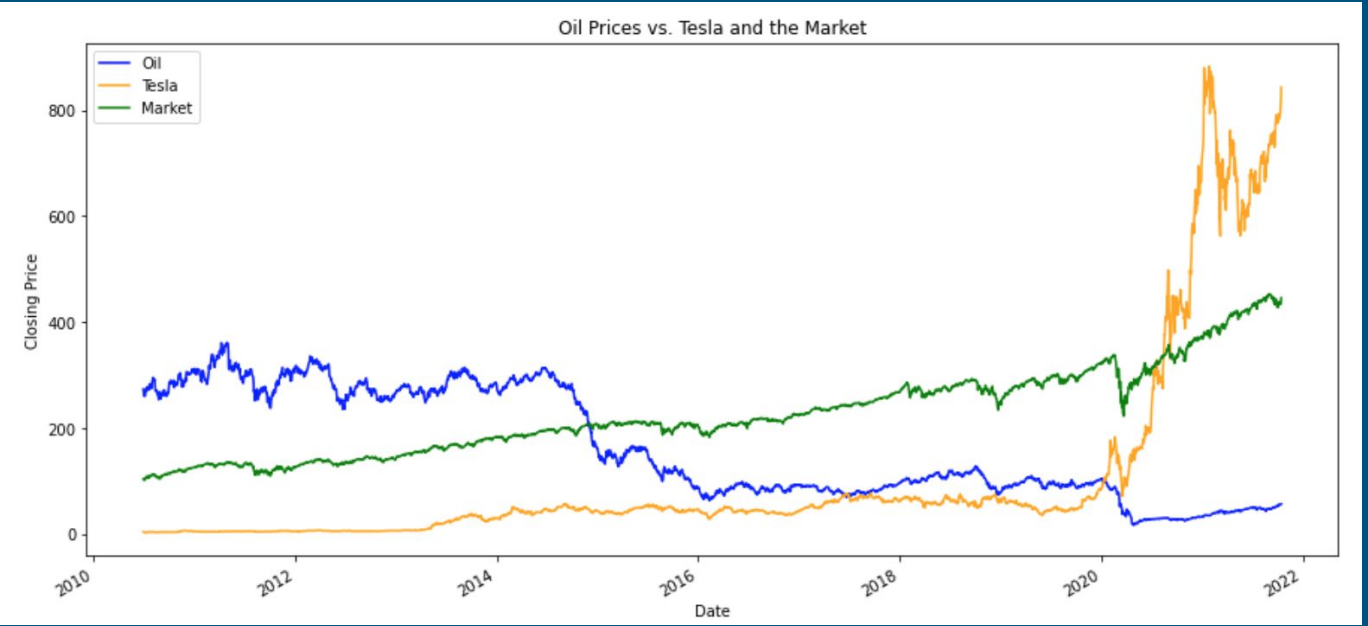
```
#Code to grab the data from the SQL table into a pandas df to analyze further

closing_prices_df = pd.read_sql_table ('closing_prices', con=engine)
```

- Before giving the data over to the analysis piece, we cleaned it/prepared the data by eliminating NaNs, converting dates to DateTime, setting the index Date, etc.

Overview

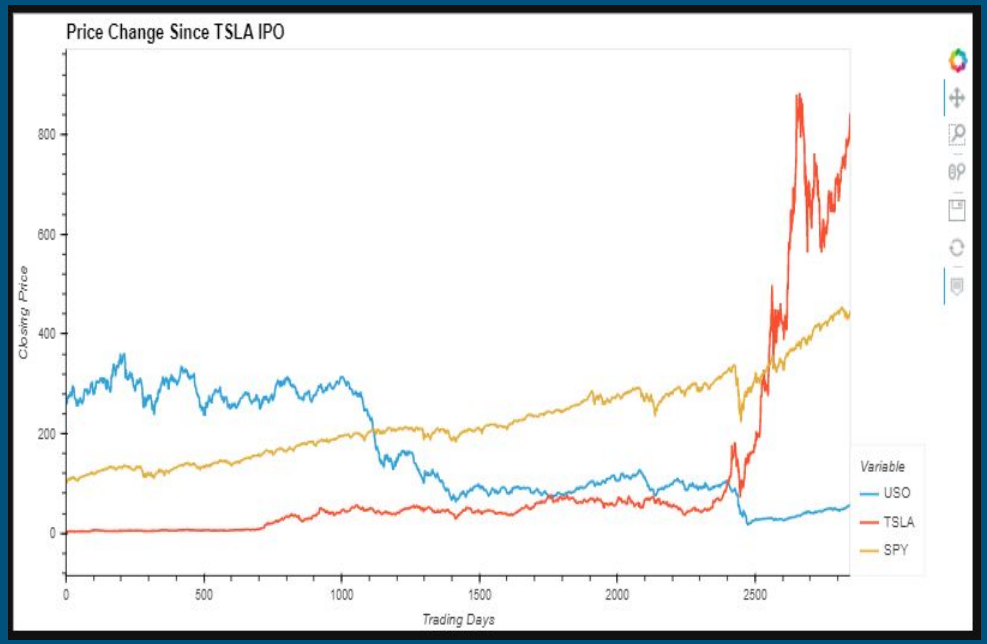
- This overlay plot for the three symbols, “TSLA”, “USO” and “SPY” gives a high level picture of the trend of prices since the IPO of TSLA 11 years ago.



Overview Analysis

TSLA's initial public offering was June 29th, 2010, at a price of $17 per share. Here we see a similar chart as before, utilizing Trading Days.

- During the first 700 trading days TSLA slowly trended upwards, while USO traded in a choppy range and failed to make new highs.
- After 700 trading days, TSLA and USO started to trend up, but TSLA did so on a higher percentage basis.
- Around Trading day 1100, USO begins it's dramatic drop, while TSLA remains relatively flat, except for a collective dip at 1400 days in.
- The most dramatic change can be seen around day 2400, when TSLA begins a sharp move upwards, and USO makes yet another sharp move downwards.
- After day 2500, USO begins to slowly trend upwards, while TSLA continues it's parabolic move higher.



Correlation Analysis

- Although TSLA's correlation with USO fluctuated during those windows, We can see TSLA did not have a correlation with USO greater than the SPY did.

- SPY, our benchmark, has an overall correlation with USO of .3981 over the time frame.

- TSLA, while still correlated to USO, has a significantly lower correlation of .1966 over the same duration.

Correlation for the first 700 days

	USO_pct_change	TSLA_pct_change	SPY_pct_change
USO_pct_change	1.000000	0.265759	0.572316
TSLA_pct_change	0.265759	1.000000	0.388257
SPY_pct_change	0.572316	0.388257	1.000000

Correlation for days 1100 - 1400

	USO_pct_change	TSLA_pct_change	SPY_pct_change
USO_pct_change	1.000000	0.199390	0.324372
TSLA_pct_change	0.199390	1.000000	0.490492
SPY_pct_change	0.324372	0.490492	1.000000

Correlation for days 2400-2500

	USO_pct_change	TSLA_pct_change	SPY_pct_change
USO_pct_change	1.000000	0.318407	0.404437
TSLA_pct_change	0.318407	1.000000	0.521912
SPY_pct_change	0.404437	0.521912	1.000000

Correlation after 2500

	USO_pct_change	TSLA_pct_change	SPY_pct_change
USO_pct_change	1.000000	0.171341	0.402591
TSLA_pct_change	0.171341	1.000000	0.446240
SPY_pct_change	0.402591	0.446240	1.000000

Whole data set

	USO_pct_change	TSLA_pct_change	SPY_pct_change
USO_pct_change	1.000000	0.196624	0.398108
TSLA_pct_change	0.196624	1.000000	0.393186
SPY_pct_change	0.398108	0.393186	1.000000

Volatility and Risk Returns

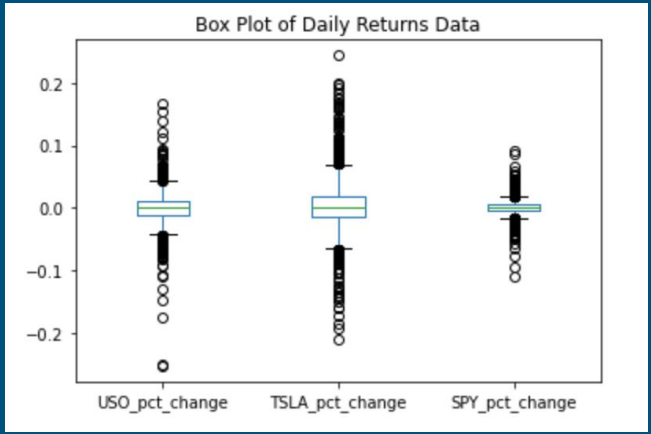
There are several ways to identify if an asset is volatile and will be a greater risk

- Standard Deviation: Indicates how much the returns deviate from the average return. The higher the std dev the riskier and more volatile the asset.
- Sharpe Ratio: Sharpe ratio assesses risk and reward by measuring the excess return (that is, the reward, or profit) for the risk that someone assumes when investing in the asset.
- Beta: measures how much an asset's return value is likely to change relative to changes in the overall market's return value.

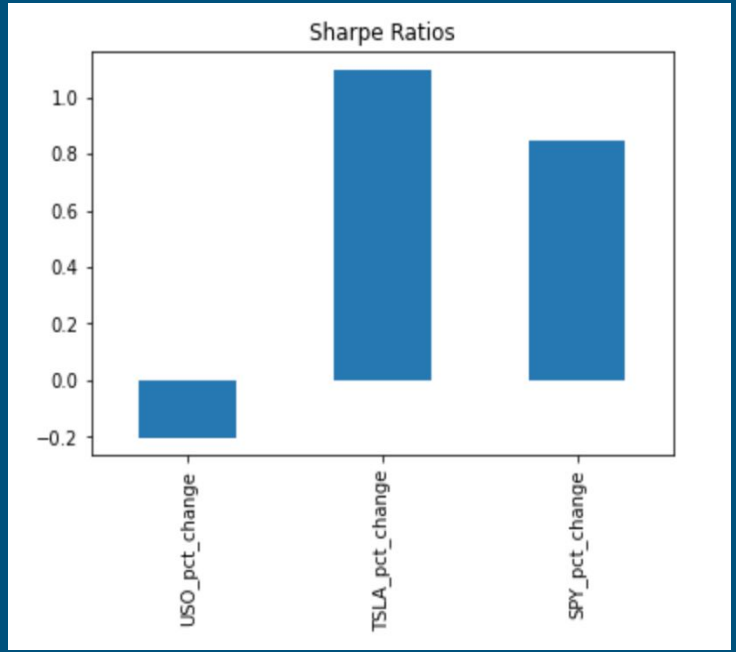
Volatility and Risk Returns Cont.d...

- Standard Deviation

```
SPY_pct_change      0.010644
USO_pct_change      0.022700
TSLA_pct_change     0.035274
dtype: float64
```



-Sharpe Ratio



-Beta

```
5 # Display the USO beta
6 USO_beta
```

```
]: 0.8490111831604799
```

```
5 # Display the TSLA beta
6 TSLA_beta
```

```
]: 1.3030067874364868
```

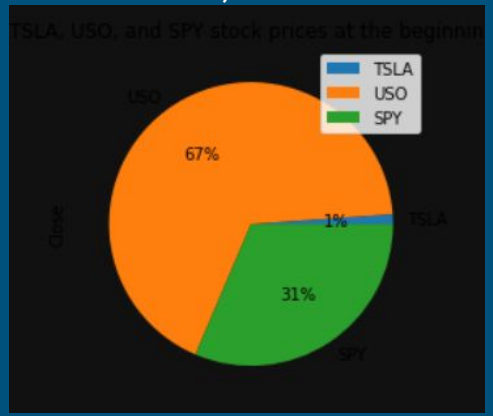
Volatility and Risk Returns Analysis

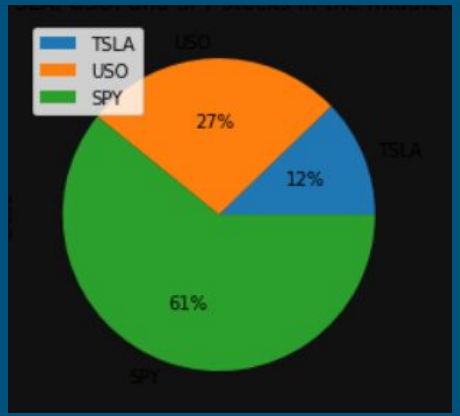
- **Standard Deviation**: You can see the std dev of TSLA is the highest, with SPY being the lowest indicating TSLA is the riskiest stock as it is more volatile than the market and USO.
- **Sharpe Ratio**: As per the bar graph, TSLA's Sharpe ratio is the highest, above the market's and USO's being negative. This shows that TSLA is the more desired asset since the risk-adjusted return for that asset is the highest. The opposite stands for USO, where the risk-adjusted return is negative therefore there is likely to be a loss rather than gain.
- **Beta**: Because the TSLA beta of 1.303 is greater than 1.0, the change in TSLA's return value is likely greater than the change in the market's return value. Since USO's beta is less than 1.0, 0.85, the change in the asset's return value will likely be less than that of the market.

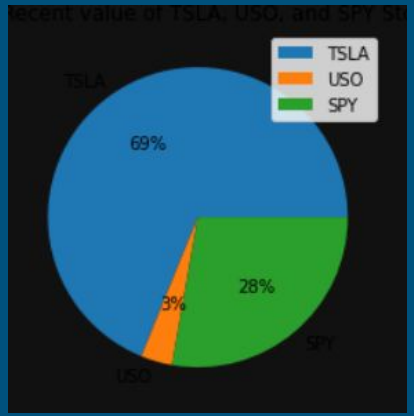
Though these data points like sharpe ratio and beta are not an indication of correlation we can see that TSLA is a more valued asset, though riskier and more volatile than USO, the returns to risk is greater than USO as per the analysis on this dataset.

Shifting Values for TSLA vs. Oil

- With the historical data starting from 2010 and counting up to this year, there has been an immense change for TSLA and USO Oil stock prices. From left to right, this is the development of the value of the stocks per 100 shares of each. If a person were to invest $10,000 at the start of 2010 and split it equally between 100 shares of each, the charts show that the bulk of the value would shift from USO, to SPY, to TSLA in 2021.

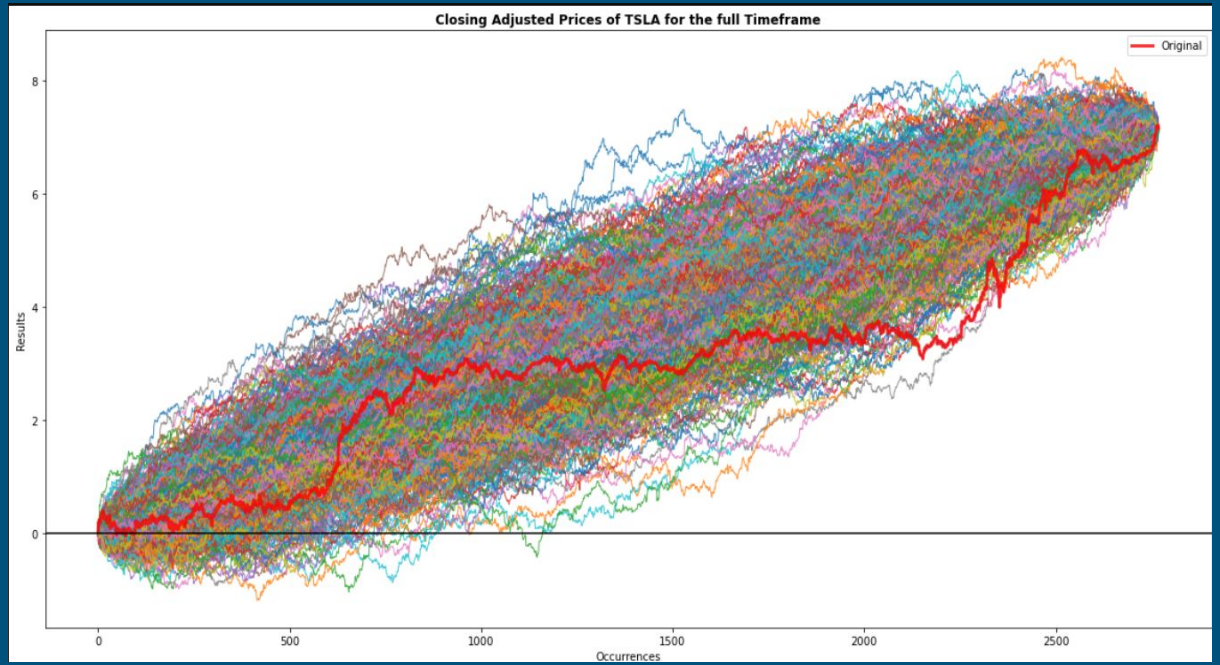






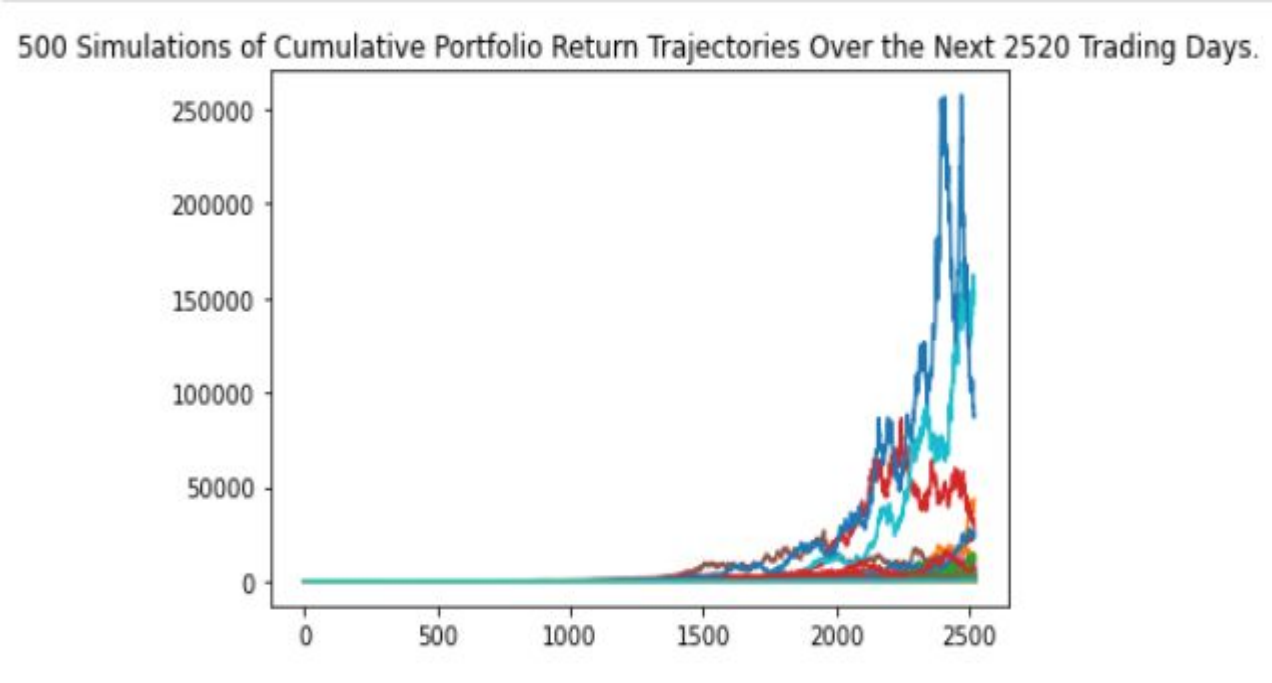
Monte Carlo for TSLA

Looking at the Adjusted closing prices for TSLA stock, we can see that over the past 11 years, there has been a general uptrend of the stocks value.



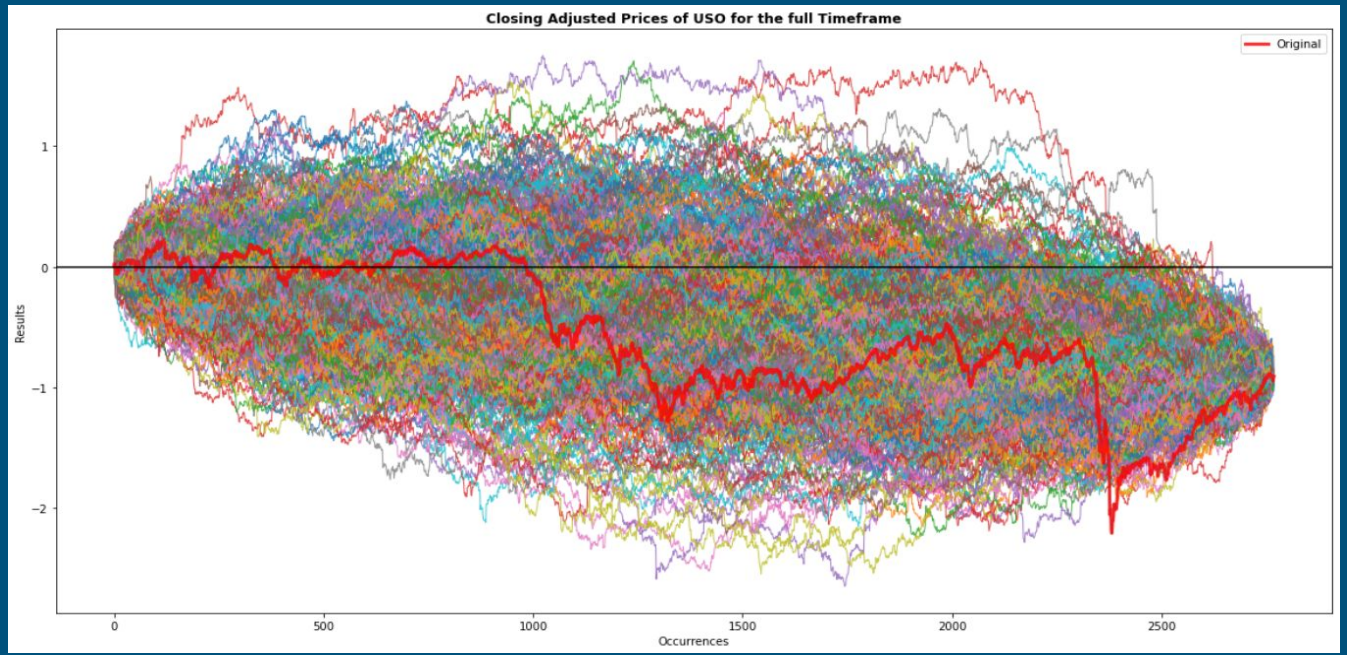
Forecasting prices for TSLA

Looking into the future, the value of TSLA stock is expected to soar exponentially. There is a 95% chance that an interval investment of $10,000 in this stock over the course of 10 years will end within the range of $7,311.59 and $86,143,612.52.



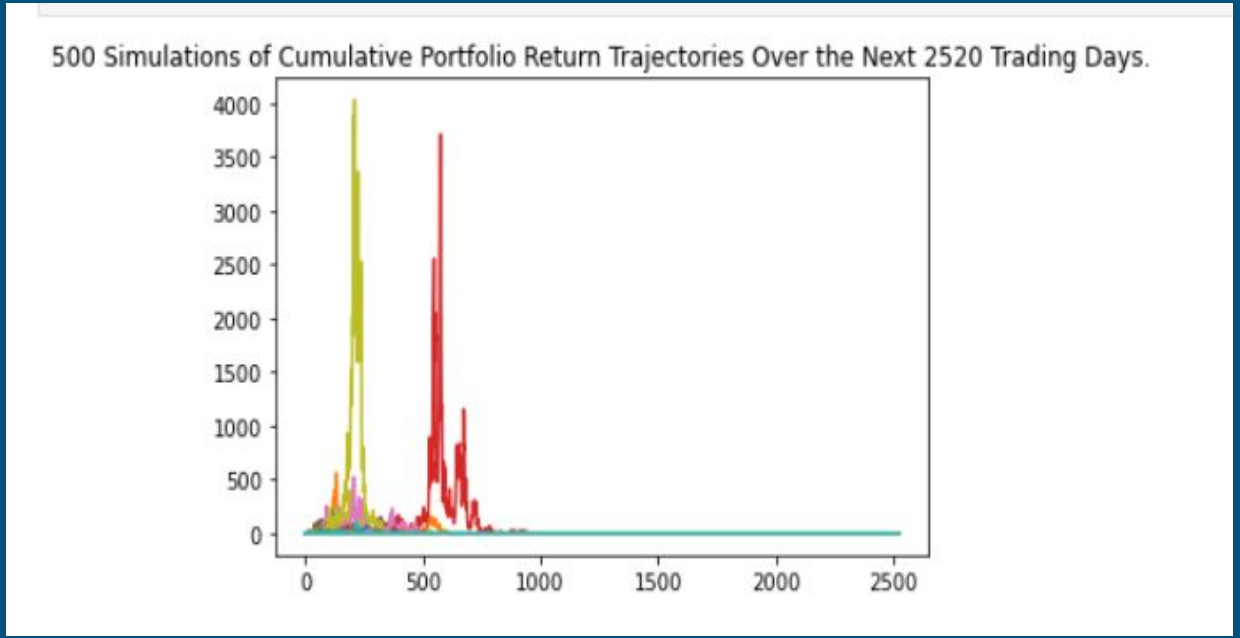
Monte Carlo for USO Oil

Looking at the adjusted closing price for USO Oil stock, we can see there has been a level and eventually a drastic depreciation.



Forecasting prices for USO Oil

Looking into the future, the value of Oil is expected to continue to depreciate. By the numbers, there is a 95% chance that an interval investment of $10,000 in this stock over the course of 10 years will be negative towards $0.



Thank You