

COVID Case Impact on Vaccine Stock Prices

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Project Overview

Goal

As COVID-19 cases have fluctuated within the past years due to various variants, vaccination rates in the US have been steadily increasing. Our main goal of the project was to determine if the price of vaccine stocks such as Pfizer (PFE) and Moderna (MRNA) were correlated with the daily COVID-19 case rates in the U.S.

Project Overview *continued*

Strategies

The COVID case data came from the COVID ActNow API, and the vaccination stock data came from the Alpha Vantage API. From the COVID data, we extracted the 100 most recent days of case data. From the vaccination stock data, we extracted the 100 most recent days of stock data for Pfizer and then Moderna. The reason for extracting stock data for more than one vaccine was to ensure the correlation was generally consistent regardless of vaccine. We also were interested in exploring if different types of vaccines had higher stock prices than others.

Project Overview *continued*

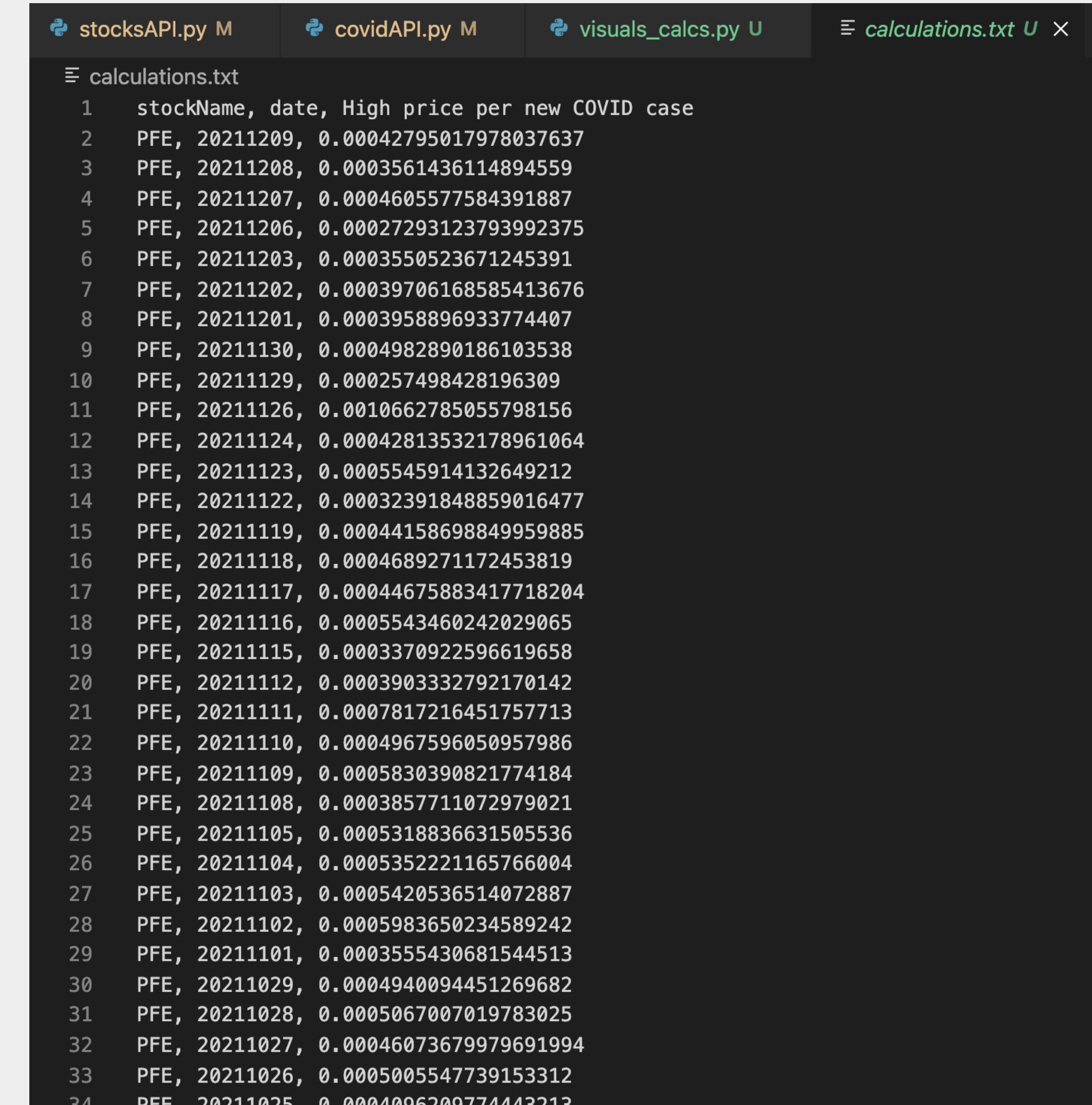
Problems Faced

- Had to change the scope of the project multiple times because initially the goal was to look at flight prices - not only were the travel APIs not free
- Many weather APIs only provided current data rather than historical data
- Can only query the stocks API 5 times per minute
- COVID data was cumulative, so that required further calculations once the data was extracted
- Some of the values for days were missing from both APIs, so it would return None - we fixed this by using the integer 0 as a “null” value without string repetition

Calculations

Between Tables

- To join the COVID case data with the stock data, we used the dates as the shared key
- We calculated stock high price per new cases by dividing the stock high value by the new case value for each value, then we added those to a file called ‘calculations.txt’
- Within the file, there are three values for each row: stock name, date, and stock high price per new COVID cases



```
calculations.txt
1 stockName, date, High price per new COVID case
2 PFE, 20211209, 0.00042795017978037637
3 PFE, 20211208, 0.0003561436114894559
4 PFE, 20211207, 0.0004605577584391887
5 PFE, 20211206, 0.00027293123793992375
6 PFE, 20211203, 0.0003550523671245391
7 PFE, 20211202, 0.00039706168585413676
8 PFE, 20211201, 0.0003958896933774407
9 PFE, 20211130, 0.0004982890186103538
10 PFE, 20211129, 0.000257498428196309
11 PFE, 20211126, 0.0010662785055798156
12 PFE, 20211124, 0.00042813532178961064
13 PFE, 20211123, 0.0005545914132649212
14 PFE, 20211122, 0.00032391848859016477
15 PFE, 20211119, 0.00044158698849959885
16 PFE, 20211118, 0.0004689271172453819
17 PFE, 20211117, 0.00044675883417718204
18 PFE, 20211116, 0.0005543460242029065
19 PFE, 20211115, 0.0003370922596619658
20 PFE, 20211112, 0.0003903332792170142
21 PFE, 20211111, 0.0007817216451757713
22 PFE, 20211110, 0.0004967596050957986
23 PFE, 20211109, 0.0005830390821774184
24 PFE, 20211108, 0.0003857711072979021
25 PFE, 20211105, 0.0005318836631505536
26 PFE, 20211104, 0.0005352221165766004
27 PFE, 20211103, 0.0005420536514072887
28 PFE, 20211102, 0.0005983650234589242
29 PFE, 20211101, 0.0003555430681544513
30 PFE, 20211029, 0.0004940094451269682
31 PFE, 20211028, 0.0005067007019783025
32 PFE, 20211027, 0.00046073679979691994
33 PFE, 20211026, 0.0005005547739153312
34 PFE, 20211025, 0.000409620977443213
```

Creating our content

Instructions for running our code

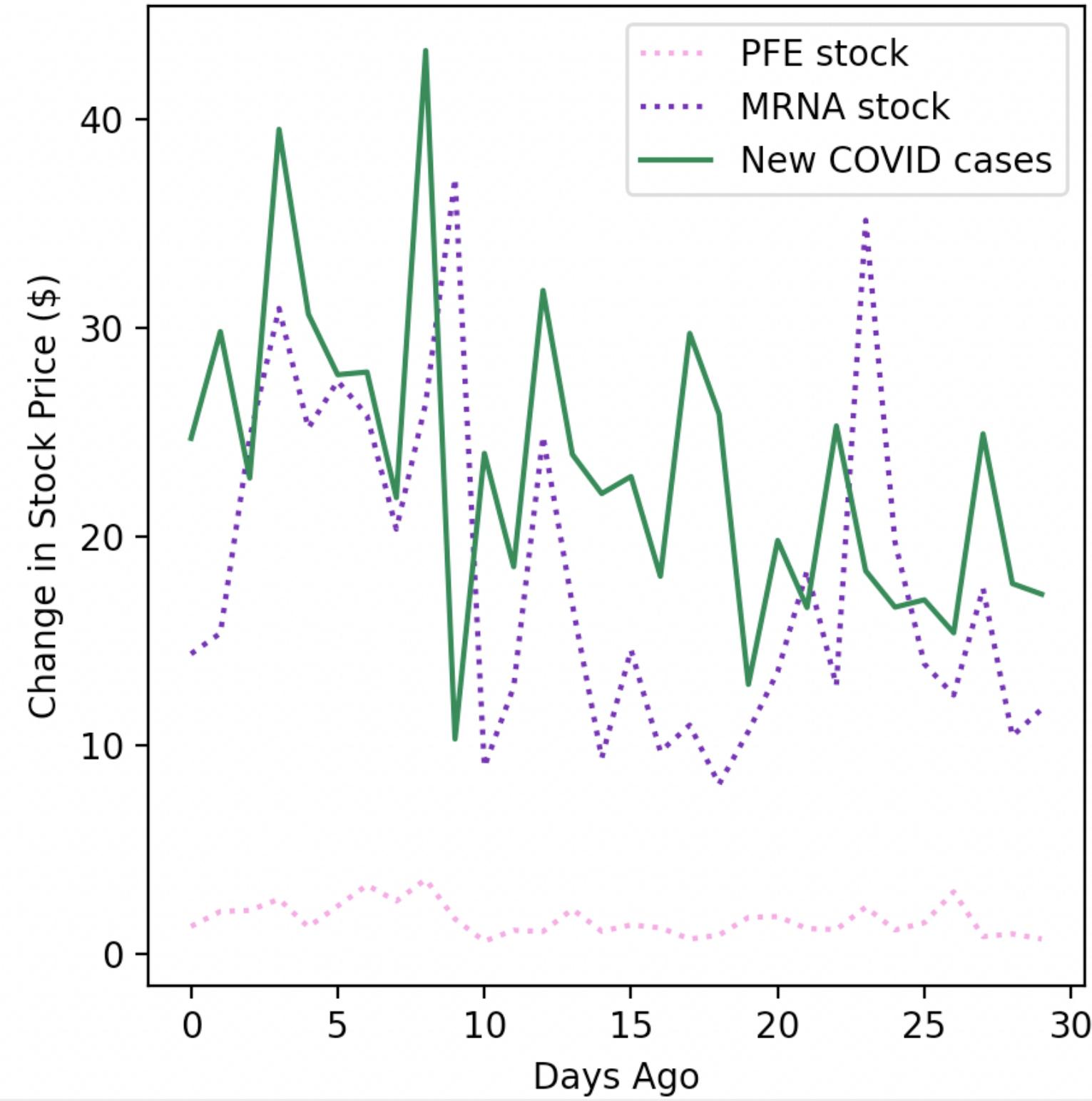
1. Start on stocksAPI.py. Run this code four times, and then wait a minute. This API only allows for 5 calls per minute. Then, run the code four more times. The table should add 25 items each time for a total of 200 rows. The database is the same (covid.db), and you can find the stock names with their correlating ID in the table Stocks whereas you can find more daily information in the table StocksInfo.
2. Switch to covidAPI.py. Run this code four times, and the table should add 25 items each time for a total of 100 rows. The database is called covid.db, and the table is called covidData.
3. To see the visualizations, run the file visuals_calcs.py. There are three visualizations. Additionally, there should be a calculations file that was created called ‘calculations.txt.’

Visualizations

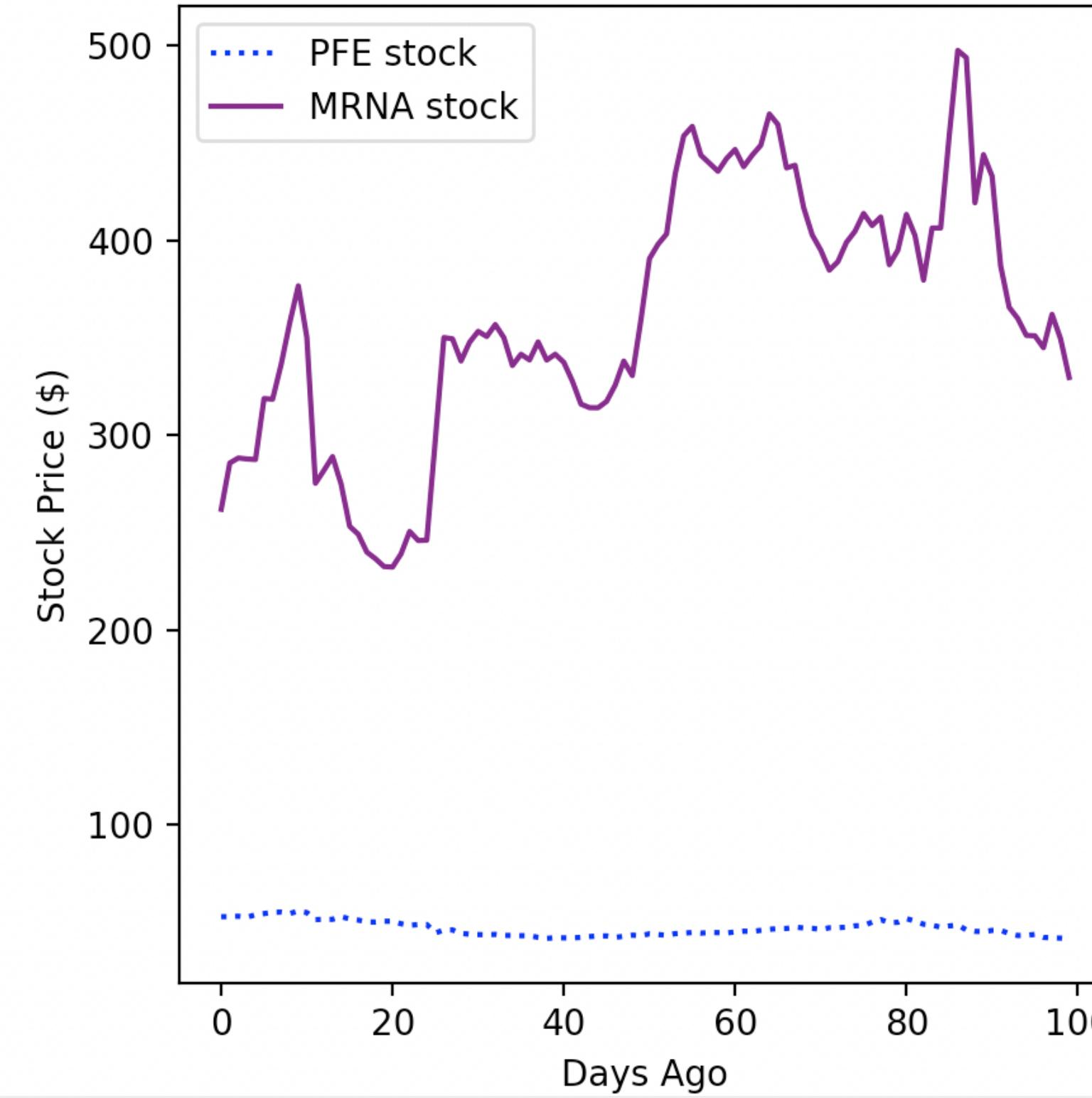
visuals_calcs.py

In our file ‘visuals.py,’ we created three visualizations to demonstrate our understanding of the data. First, there is a graph of daily average stock prices for each vaccine, and a line showing COVID cases per 5000 Americans. Second, there is a graph of the data in the calculations.txt file. Third, there is a line graph for PFE and mRNA high stock price for past 100 days

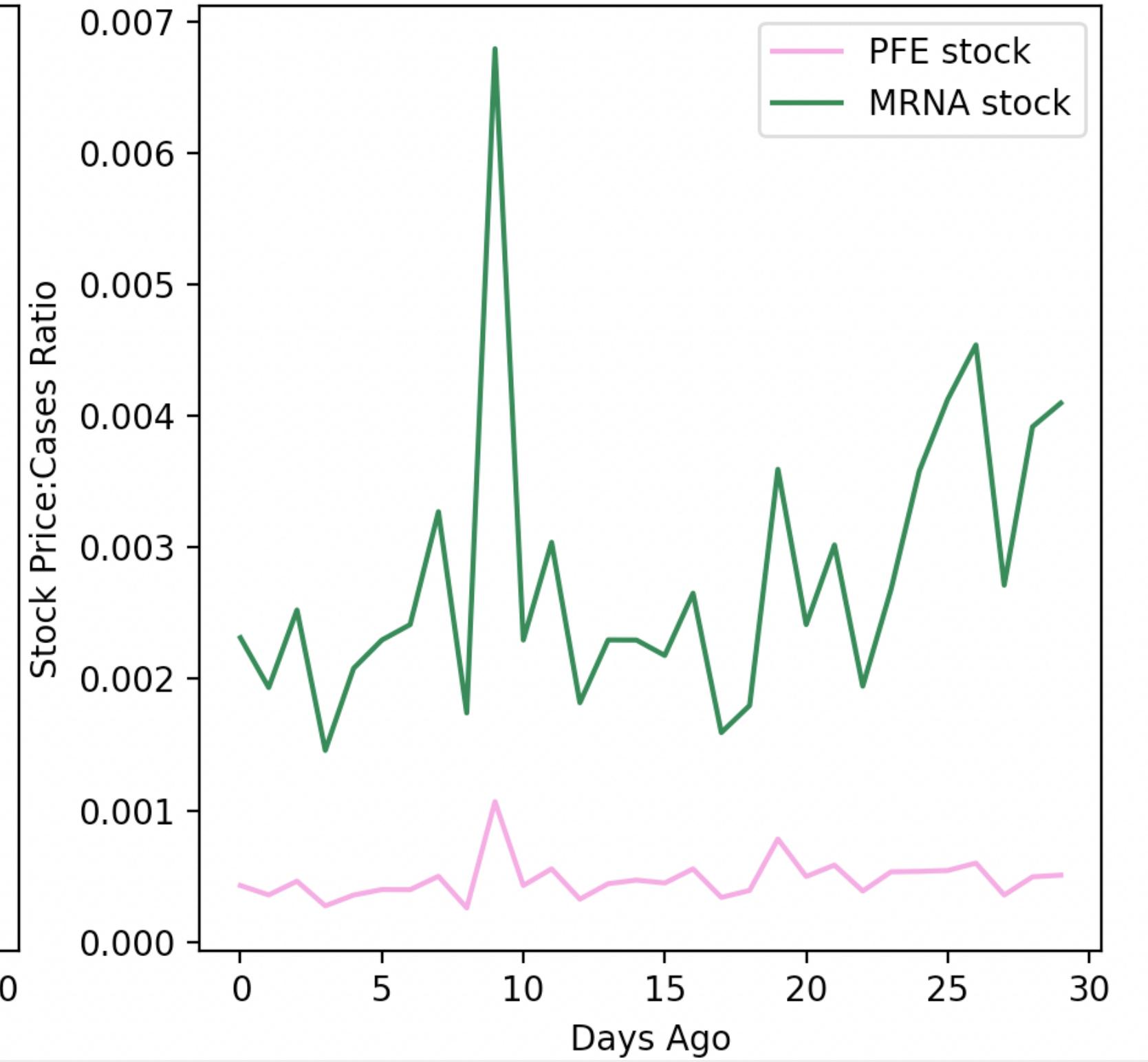
Daily Change in Stock Price
by new COVID Case (per 5000 Americans)



PFE & mRNA High Price for Past 100 Days



Stock Price:COVID Cases
for the past 30 days



COVID Functions

getDataFromCOVID

Overview: Gets 100 days of data from the COVID API related to cases, deaths, initiated vaccinations, and completed vaccinations.

Input: None

Output: A list of counter variables (integer, used for the index for adding to the database), list of dates (integer), list of new cases, list of new deaths, list of initiated vaccinations per day, list of completed vaccinations per day

CalcStocktoCase

Overview: Creates a file with the calculations, each row containing the date, vaccine name, and high stock price per new COVID cases

Input: Cursor, connection, file name

Output: No return statement, but the file 'calculations.txt' is created

COVID Functions *continued*

main

Overview: Creates a table of the data from `getDataFromCOVID`, parsing the rows only 25 at a time

Input: None

Output: No return statement, but a table ‘covidData’ is created

Visualization Functions

visualizationJoint

Overview: Creates a graph of daily average stock prices for each vaccine, and a line showing COVID cases per 5000 Americans

Input: Cursor, connection

Output: A graph with three lines, two were the daily average stock prices and the other was COVID cases

visualizationRatio

Overview: Creates a graph of the data in the calculations.txt file

Input: Cursor, connection

Output: A graph with a Pfizer ratio line and Moderna ratio line

Visualization Functions *continued*

visualizationLine

Overview: Creates a line graph for PFE and MRNA high stock price for past 100 days

Input: Cursor, connection

Output: A graph with a Pfizer line and Moderna line

main

Overview: Creates all visuals, as well as performs calculations

Input: None

Output: Produces the 3 graphs and ‘calculations.txt’ file

Stocks Functions

getStockInfo

Overview: Gathers stock information from the Alpha Vantage API for PFE and MRNA stock for past 100 days; cleans data for desired info

Input: Nothing

Output: Returns list with 200 dictionary items (both vaccine brands for past 100 days), each item containing stock name, date, daily high, daily low, and stock volume

setUpDatabase

Overview: Sets up database with desired file name

Input: Desired db name

Output: cur, conn

Stocks Functions continued

createStocksTable

Overview: Create table ‘Stocks’ with stock name and an id to avoid duplicate string data

Input: cur, conn

Output: No return statement, but the table ‘Stocks’ is created

setUpStocks

Overview: Create table that details daily info for each of the 2 stocks for past 100 days

Input: stocks_info, cur, conn, startIndex

Output: No return statement, but the table ‘StocksInfo’ is created

Stocks Functions *continued*

main

Overview: Sets up database ‘covid.db’ with tables
‘Stocks’ and ‘StocksInfo’

Input: None

Output: No return statement but database is set up

Project Summary

Goals Achieved

- Were able to see how relatively volatile stocks prices are within a short window of time, especially considering real-world events, like new COVID cases
- For the most part, vaccine stock prices followed COVID vaccination trends in direction and magnitude (spike in cases, spike in vaccine stock prices)
- mRNA stock seemed to fluctuate more than PFE stock
- Found a positive correlation between COVID cases and vaccine stock prices

Resources

Date	Issue Description	Location of Resource	Result
12/6/21	Accessing stocks data	https://www.alphavantage.co/documentation/	Was able to successfully extract stocks data
12/6/21	Accessing COVID-19 case/vaccination data	https://apidocs.covidactnow.org/migration	Was able to successfully extract COVID-19 data
12/9/21	Creating multiple axes on same figure	https://matplotlib.org/	Was able to put all 3 visualizations on same figure