In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib as mlb
import matplotlib.pyplot as plt
```

In [2]:
```
stock_data = pd.read_csv("Stock Market Data.csv")
```

In [3]:
```
stock_data.head()
```

Out[3]:

	Date	Name	Open	High	Low	Close	Volume
0	02-01-2022	01.Bank	22.83	23.20	22.59	22.93	1842350.41
1	03-01-2022	01.Bank	23.03	23.29	22.74	22.90	1664989.63
2	04-01-2022	01.Bank	22.85	23.13	22.64	22.84	1354510.97
3	05-01-2022	01.Bank	22.91	23.20	22.70	22.98	1564334.81
4	06-01-2022	01.Bank	23.12	23.65	23.00	23.37	2586344.19

In [ ]:

In [4]:
```
stock_data["Date"]= pd.to_datetime(stock_data["Date"],dayfirst=True)
```

In [5]:
```
stock_data.set_index('Date', inplace=True)
```

In [ ]:

In [6]:
```
specific_company_name = "GP"
specific_company = stock_data[stock_data["Name"]==specific_company_name]
```

In [ ]:

In [7]:
```
specific_banks_list = ["ABBANK","BRACBANK","CITYBANK","ISLAMIBANK","RUPALIBANK"]
specific_banks = stock_data[stock_data["Name"].isin(specific_banks_list)]
```

In [ ]:

In [ ]:

In [ ]:

Part 1: Data Cleaning and Exploration:

1. Calculate basic summary statistics for each column (mean, median, standard deviation, etc.).

****basic summary statistics**

In [8]:
```
stock_data.describe()
```

Out[8]:

	Open	High	Low	Close	Volume
count	49158.000000	49158.000000	49158.000000	49158.000000	4.915800e+04
mean	157.869018	159.588214	155.906364	157.351462	5.619999e+05
std	520.191624	523.348078	517.136149	519.711667	1.276909e+06
min	3.900000	3.900000	3.000000	3.800000	1.000000e+00
25%	19.000000	19.300000	18.700000	19.000000	5.109475e+04
50%	40.300000	41.000000	39.535000	40.100000	1.824160e+05
75%	89.400000	90.500000	87.700000	88.700000	5.401398e+05
max	6000.000000	6050.000000	5975.000000	6000.500000	6.593180e+07

In [ ]:

*****extra**

In [9]:
```
stock_data[["Open","High","Low","Close","Volume"]].mean()
```

Out[9]:
```
Open          157.869018
High          159.588214
Low           155.906364
Close         157.351462
Volume    561999.931974
dtype: float64
```

In [10]:
```
stock_data[["Open","High","Low","Close","Volume"]].median()
```

Out[10]:
```
Open          40.300
High          41.000
Low           39.535
Close         40.100
Volume    182416.000
dtype: float64
```

In [11]:
```
stock_data[["Open","High","Low","Close","Volume"]].std()
```

Out[11]:
```
Open      5.201916e+02
High      5.233481e+02
Low       5.171361e+02
Close     5.197117e+02
Volume    1.276909e+06
dtype: float64
```

In [ ]:

In [ ]:

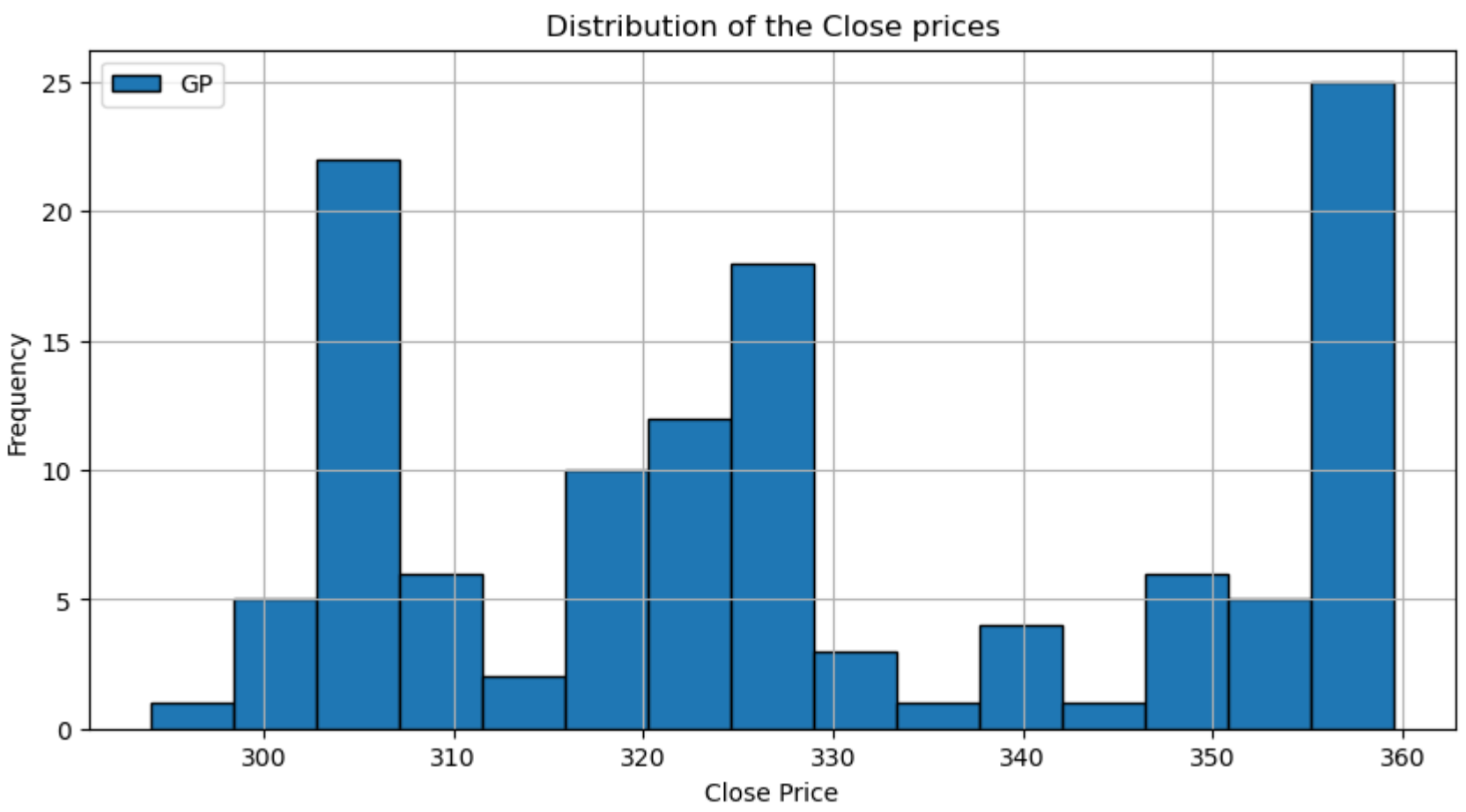
In [ ]:

2. Explore the distribution of the 'Close' prices over time.

In [12]:
```
plt.figure(figsize=(10,5))

plt.hist(specific_company["Close"], bins=15, edgecolor='black', label=f"{specific_company_name}")

plt.title("Distribution of the Close prices")
plt.xlabel("Close Price")
plt.ylabel("Frequency")
plt.legend()
plt.grid()
plt.show()
```



In [ ]:

In [ ]:

In [ ]:

3. Identify and analyze any outliers (if any) in the dataset.

**calculation

In [13]:
```
sd_price_columns = stock_data[["Open","High","Low","Close","Volume"]]

sd_std = sd_price_columns.std()
sd_avg = sd_price_columns.mean()

higher_limit = sd_avg + 3*sd_std #3 standard deviations method
lower_limit = sd_avg - 3*sd_std  ##Although not required for this dataset*
```

In [ ]:

**outliers in each column using 3 standard deviations method

In [14]:
```
outliers_column = ( (sd_price_columns > higher_limit) | (sd_price_columns < lower_limit)  )
outliers_column.sum()
```

Out[14]:
```
Open      943
High      947
Low       941
Close     941
Volume    906
dtype: int64
```

In [ ]:

**total outliers in the dataset

In [15]:
```
total_outliers = stock_data[(sd_price_columns > higher_limit).any(axis=1)]
total_outliers
```

Out[15]:

Date	Name	Open	High	Low	Close	Volume
2022-01-17	15.Services_&_Real_Estate	60.18	61.83	59.28	61.15	6056375.75
2022-01-18	15.Services_&_Real_Estate	63.03	66.15	59.05	64.75	5141492.75
2022-01-12	17.Telecommunication	209.87	213.37	204.67	207.20	4952772.33
2022-01-02	20.Bond	3634.00	3634.00	3609.00	3617.83	12.00
2022-01-03	20.Bond	4033.88	4040.13	4033.75	4034.50	4.75
...	...	...	...	...	...	...
2022-06-01	UNIONBANK	10.80	11.00	10.80	10.90	7746766.00
2022-06-06	UNIONBANK	10.80	11.20	10.70	11.00	6885189.00
2022-06-30	UNIONBANK	10.30	10.30	10.10	10.30	6726621.00
2022-06-28	YPL	22.80	23.60	21.90	23.60	6145142.00
2022-06-29	YPL	24.30	24.60	23.30	23.40	4463125.00

1855 rows × 6 columns

In [16]:
```
#total outliers in the dataset
total_outliers.shape
```

Out[16]:
```
(1855, 6)
```

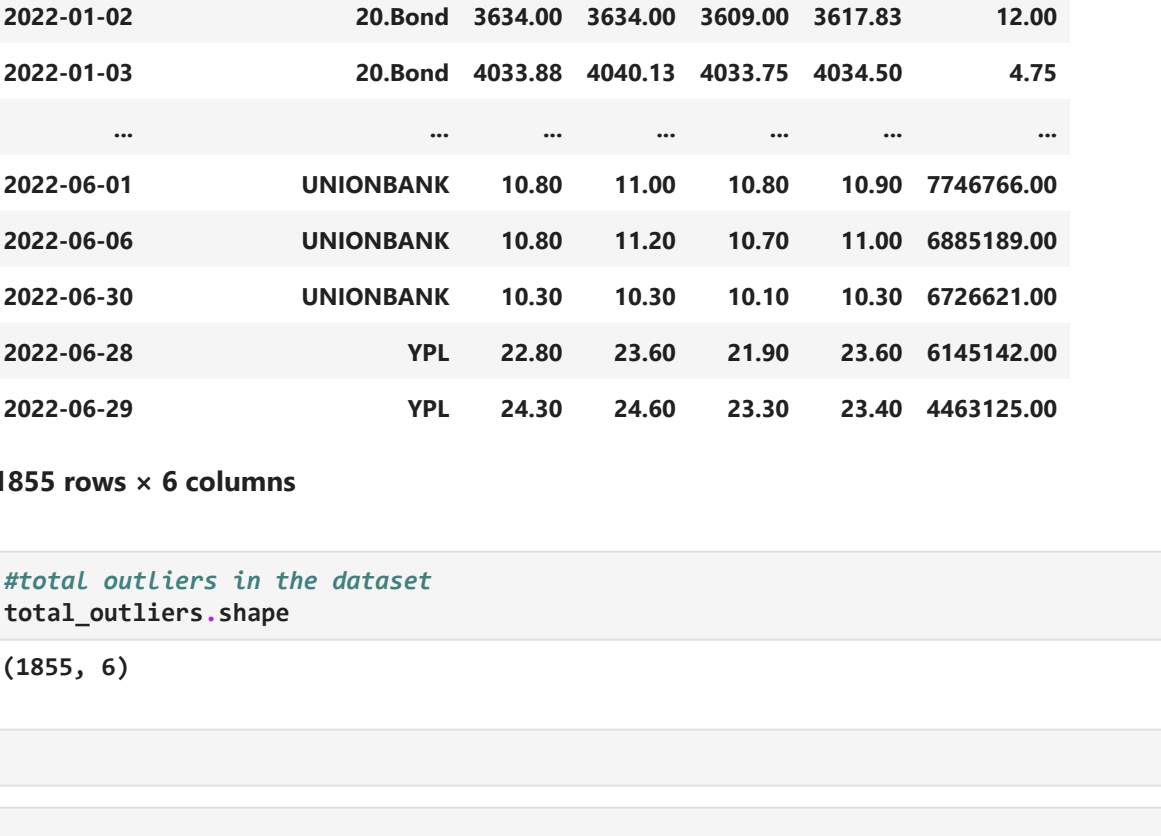
In [ ]:

In [ ]:

***extra

In [17]:
```
stock_data.plot(kind="hist",bins=100)
```

Out[17]:
```
<Axes: ylabel='Frequency'>
```



In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Part 2: Time Series Analysis / Rolling Window / Moving Averages :

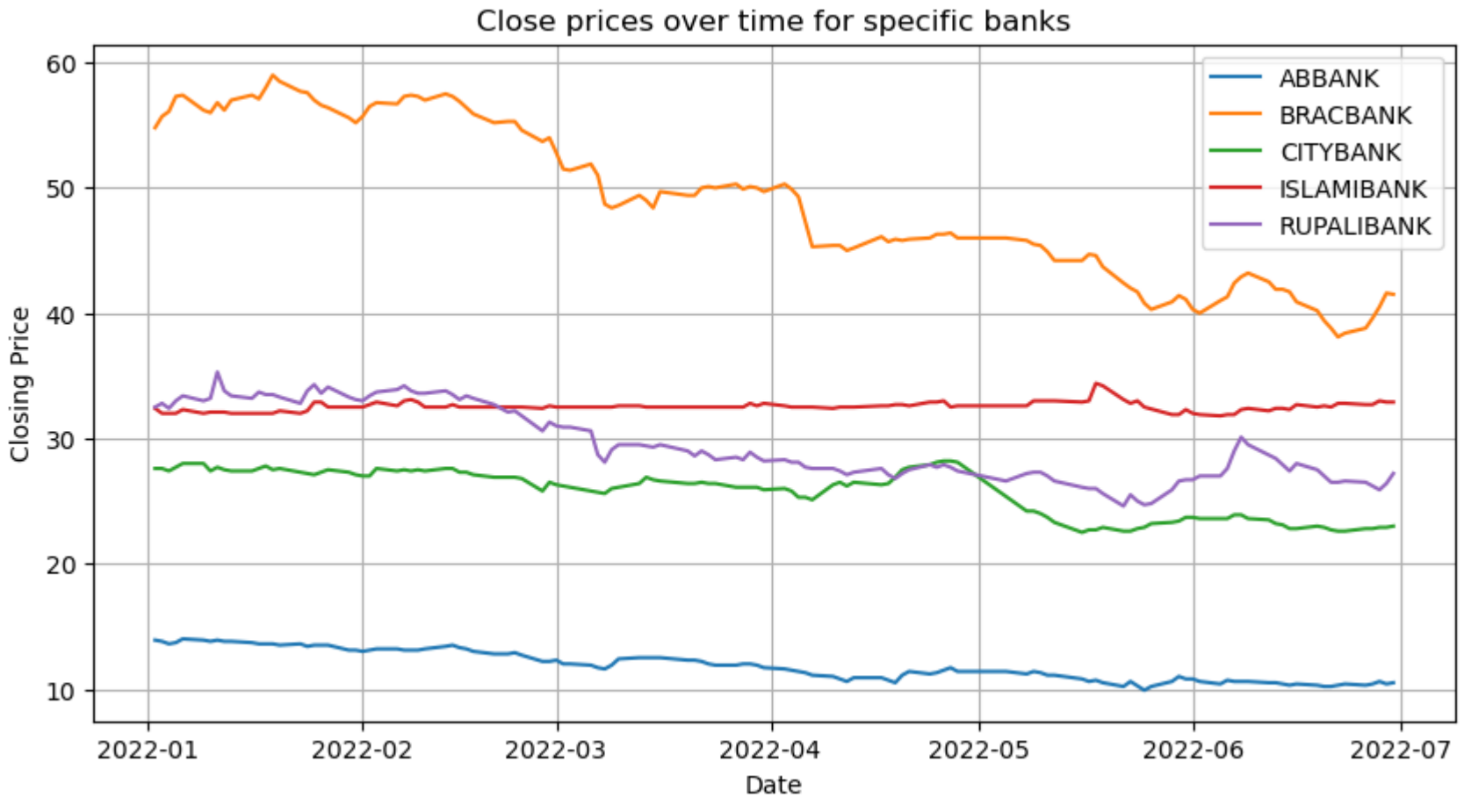
1. Create a line chart to visualize the 'Close' prices over time.

**specific banks

In [18]:
```
plt.figure(figsize=(10,5))

for x in specific_banks_list:
    x_data = specific_banks[specific_banks["Name"]==x]
    plt.plot(x_data["Close"] , label=x )

plt.title("Close prices over time for specific banks")
plt.xlabel("Date")
plt.ylabel("Closing Price")
plt.legend()
plt.grid()
plt.show()
```



In [ ]:

**specific single company

In [19]:
```
plt.figure(figsize=(10,5))

plt.plot(specific_company["Close"] , label=f"{specific_company_name}" )

plt.title(f"Close prices over time for {specific_company_name}'s stock")
plt.xlabel("Date")
plt.ylabel("Closing Price")
plt.legend()
plt.grid()
plt.show()
```

In [ ]:

In [ ]:

2. Calculate and plot the daily percentage change in closing prices.

****calculation**

In [20]:
```
daily_pct_change = specific_company["Close"].pct_change() #specific_company [GP]
daily_pct_change
```

Out[20]:
```
Date
2022-01-02         NaN
2022-01-03   -0.005149
2022-01-04    0.004025
2022-01-05   -0.008018
2022-01-06    0.005485
                 ...
2022-06-26    0.006256
2022-06-27   -0.008835
2022-06-28   -0.000330
2022-06-29   -0.008917
2022-06-30   -0.019993
Name: Close, Length: 121, dtype: float64
```

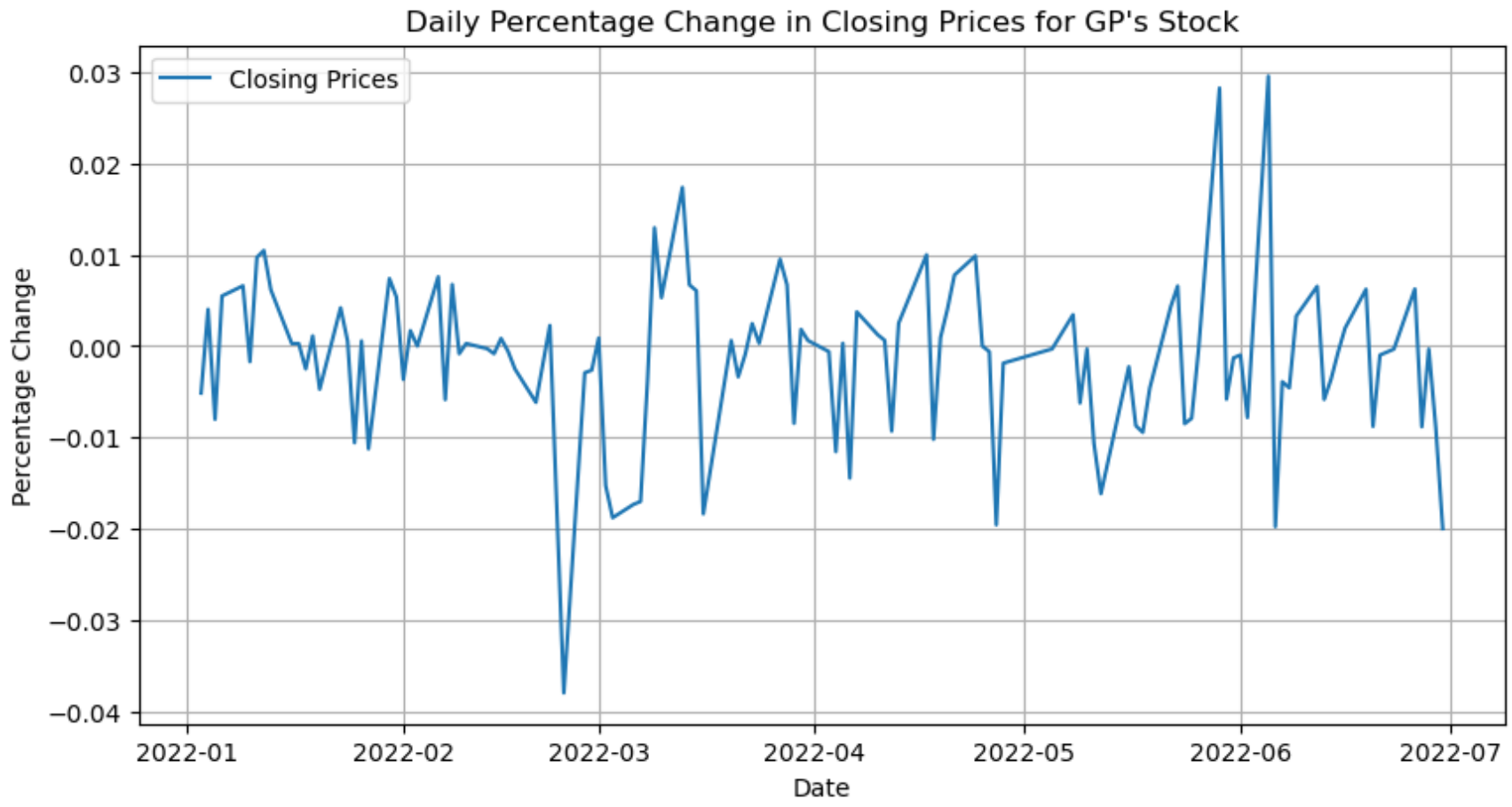
In [ ]:

****plot**

In [21]:
```
plt.figure(figsize=(10, 5))

plt.plot(daily_pct_change, label="Closing Prices")

plt.title(f"Daily Percentage Change in Closing Prices for {specific_company_name}'s Stock")
plt.xlabel("Date")
plt.ylabel("Percentage Change")
plt.legend()
plt.grid()
plt.show()
```



In [ ]:

In [ ]:

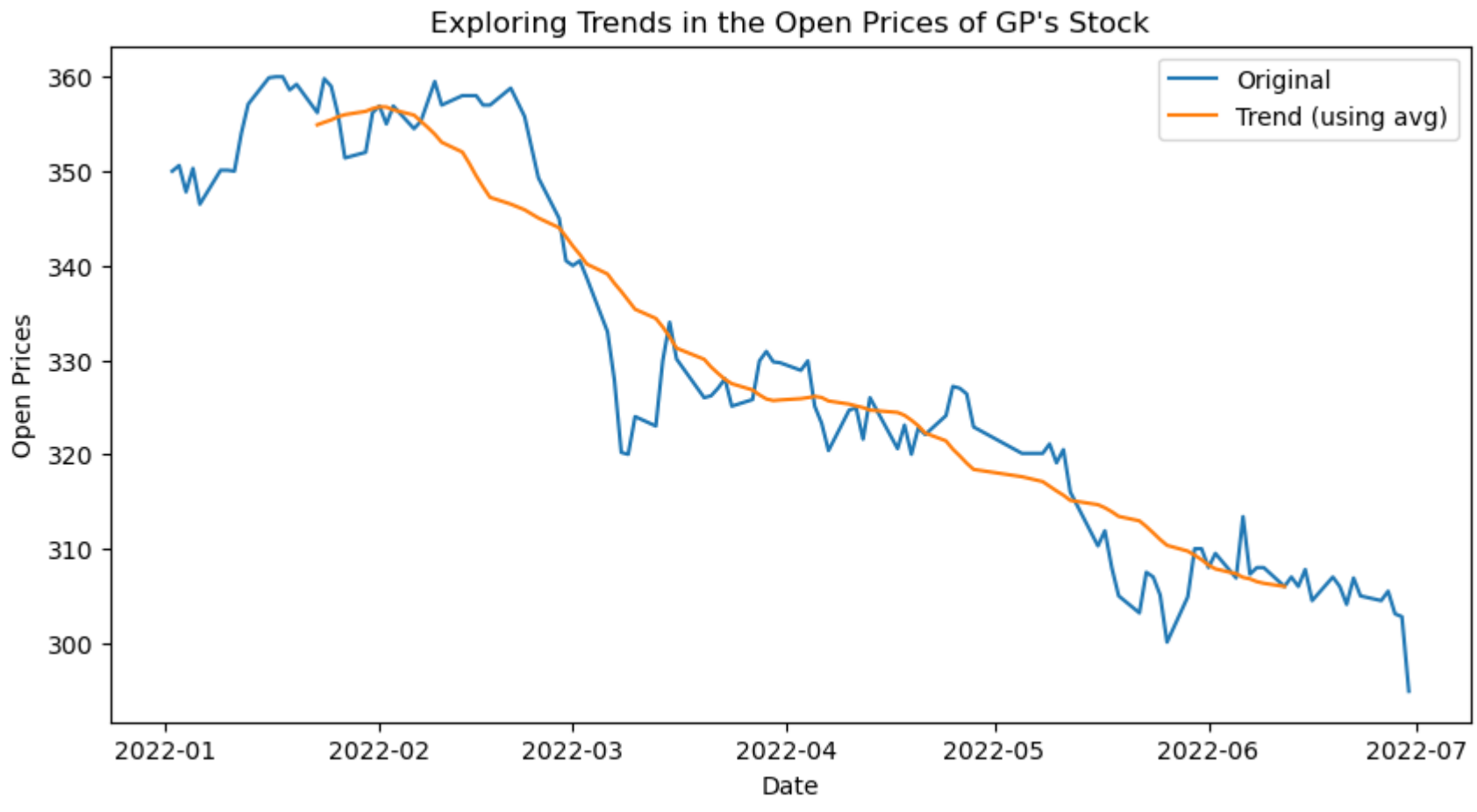
3. Investigate the presence of any trends or seasonality in the stock prices.

**trends > using rolling window average

In [22]:
```
plt.figure(figsize=(10,5))

plt.plot( specific_company["Open"], label="Original")
plt.plot( specific_company["Open"].rolling(window=30,center=True).mean(), label="Trend (using avg)")

plt.title(f"Exploring Trends in the Open Prices of {specific_company_name}'s Stock")
plt.xlabel("Date")
plt.ylabel("Open Prices")
plt.legend()
plt.show()
```



In [ ]:

**seasonal_decompose

In [23]:
```
from statsmodels.tsa.seasonal import seasonal_decompose

result = seasonal_decompose(specific_company["Open"], period=30)


plt.figure(figsize=(10, 12))
```

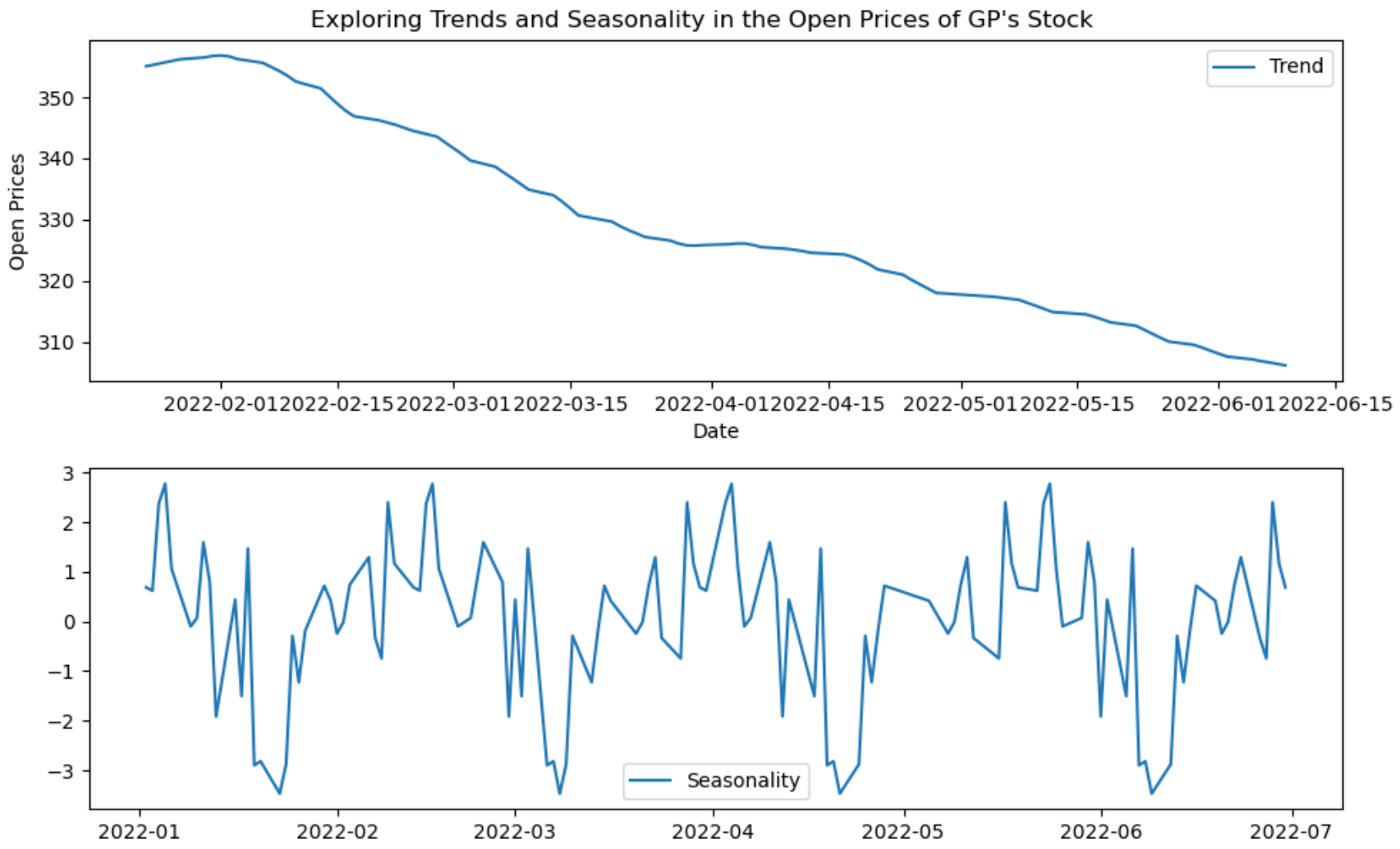
```
plt.subplot(4,1,1)

#plt.plot(specific_company["Close"], label="Original")

plt.plot(result.trend, label="Trend")
plt.xlabel("Date")
plt.ylabel("Open Prices")
plt.legend()

plt.subplot(4,1,2)
plt.plot(result.seasonal, label="Seasonality")
plt.legend()


plt.suptitle(f"Exploring Trends and Seasonality in the Open Prices of {specific_company_name}'s Stock")
plt.tight_layout()
plt.show()
```



In [ ]:

In [ ]:

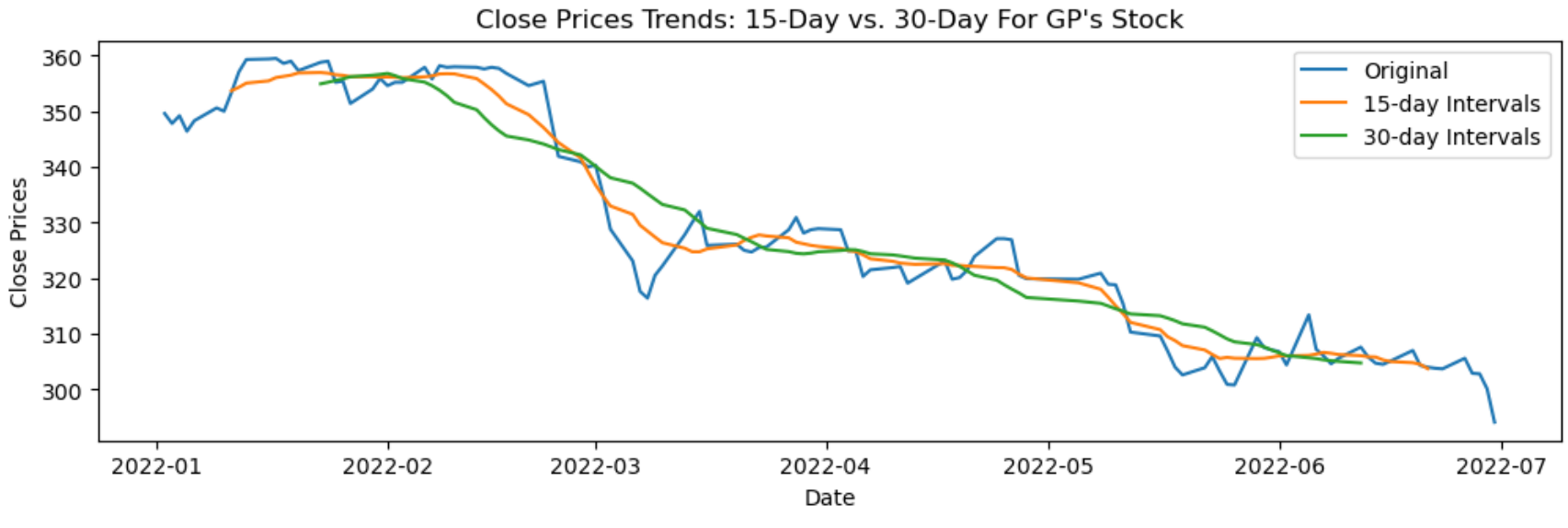
In [ ]:

4. Apply moving averages to smooth the time series data in 15/30 day intervals against the original graph.

In [24]:
```
plt.figure(figsize=(12,3.3))

plt.plot( specific_company["Close"], label="Original")
plt.plot( specific_company["Close"].rolling(window=15,center=True).mean(), label="15-day Intervals")
plt.plot( specific_company["Close"].rolling(window=30,center=True).mean(), label="30-day Intervals")

plt.title(f"Close Prices Trends: 15-Day vs. 30-Day For {specific_company_name}'s Stock")
plt.xlabel("Date")
plt.ylabel("Close Prices")
plt.legend()
plt.show()
```



In [ ]:

In [ ]:

In [ ]:

5. Calculate the average closing price for each stock.

**Calculation

In [25]:
```
average_closing_price = stock_data.groupby("Name")["Close"].mean()
average_closing_price
```

Out[25]:
```
Name
01.Bank                       21.260902
02.Cement                     96.600820
03.Ceramics_Sector            71.225164
04.Engineering               132.352459
05.Financial_Institutions     29.253525
                                ...
WMSHIPYARD                    12.370492
YPL                           21.339344
ZAHEENSPIN                     9.964754
ZAHINTEX                       7.858197
ZEALBANGLA                   150.338525
Name: Close, Length: 412, dtype: float64
```

In [ ]:

**new dataframe

In [26]:
```
average_closing_price_df = average_closing_price.reset_index(name="Average_Close")
average_closing_price_df
```

Out[26]:

	Name	Average_Close
0	01.Bank	21.260902
1	02.Cement	96.600820
2	03.Ceramics_Sector	71.225164
3	04.Engineering	132.352459
4	05.Financial_Institutions	29.253525
...	...	...
407	WMSHIPYARD	12.370492
408	YPL	21.339344
409	ZAHEENSPIN	9.964754
410	ZAHINTEX	7.858197
411	ZEALBANGLA	150.338525

412 rows × 2 columns

In [ ]:

In [ ]:

In [ ]:

6. Identify the top 5 and bottom 5 stocks based on average closing price.

** Top 5 stocks based on average closing price

In [27]:
```
top_5 = average_closing_price_df.sort_values(by="Average_Close", ascending=False).head(5)
top_5
```

Out[27]:

	Name	Average_Close
56	APSCLBOND	5413.238636
320	RECKITTBEN	5342.024793
298	PREBPBOND	4918.357143
178	IBBL2PBOND	4851.330357
283	PBLPBOND	4836.195652

In [ ]:

** Bottom 5 stocks based on average closing price

In [28]:
```
bottom_5 = average_closing_price_df.sort_values(by="Average_Close", ascending=True).head(5)
bottom_5
```

Out[28]:

	Name	Average_Close
144	FAMILYTEX	4.698361
187	ICBIBANK	4.725620
149	FBFIF	5.289344
293	POPULAR1MF	5.368033
291	PHPMF1	5.417213

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Part 3: Volatility Analysis:

1. Calculate and plot the rolling standard deviation of the 'Close' prices.

**calculation

In [29]:
```
sd_volatility = specific_company["Close"].rolling(window=15).std()  #15 days Intervals
sd_volatility
```

Out[29]:
```
Date
2022-01-02         NaN
2022-01-03         NaN
2022-01-04         NaN
2022-01-05         NaN
2022-01-06         NaN
                  ...
2022-06-26    1.246137
2022-06-27    1.272156
2022-06-28    1.360147
2022-06-29    1.824437
2022-06-30    3.215291
Name: Close, Length: 121, dtype: float64
```

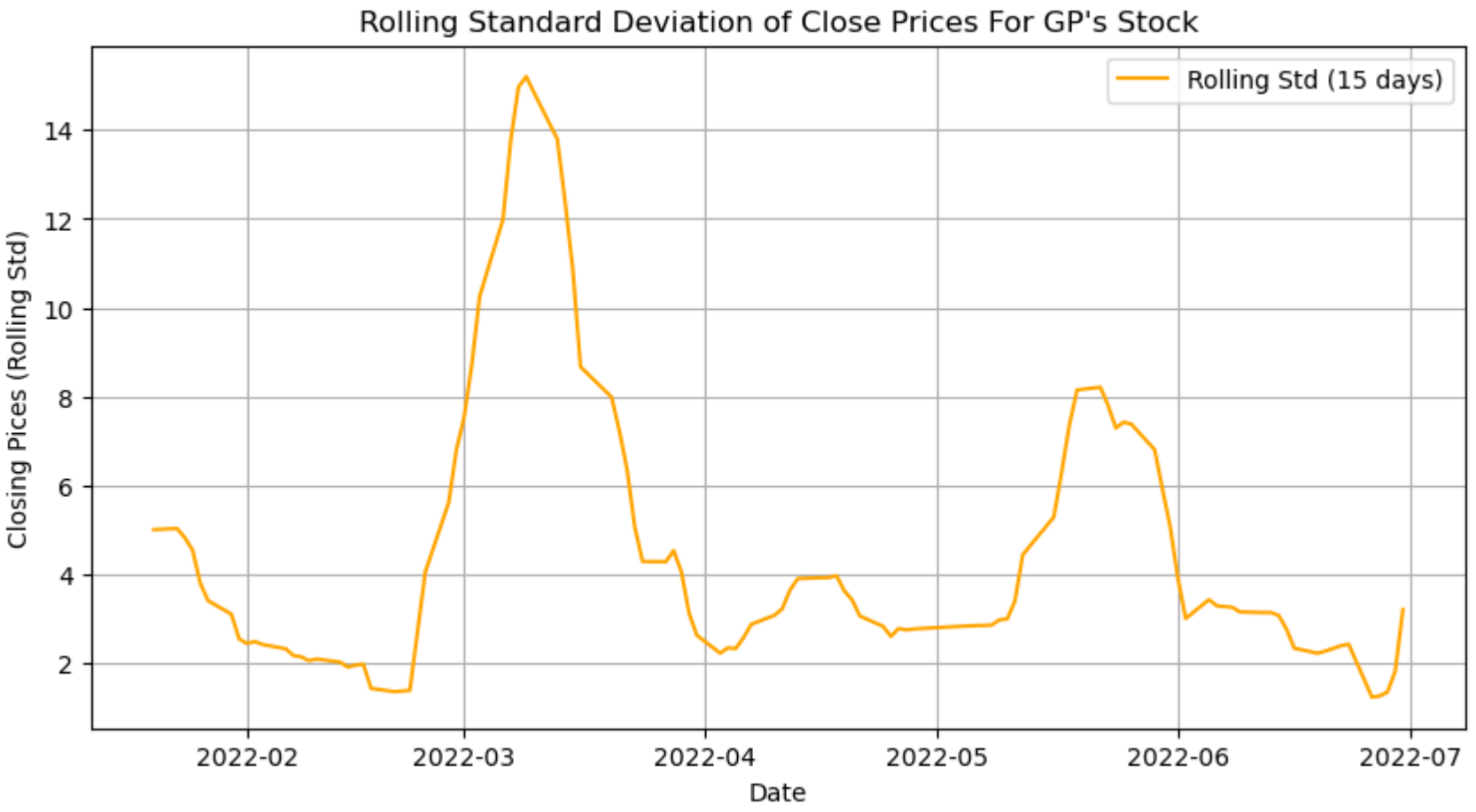
In [ ]:

**plot

In [30]:
```
plt.figure(figsize=(10, 5))

plt.plot(sd_volatility, label="Rolling Std (15 days)", color="orange")

plt.title(f"Rolling Standard Deviation of Close Prices For {specific_company_name}'s Stock")
plt.xlabel("Date")
plt.ylabel("Closing Pices (Rolling Std)")
plt.legend()
plt.grid()
plt.show()
```

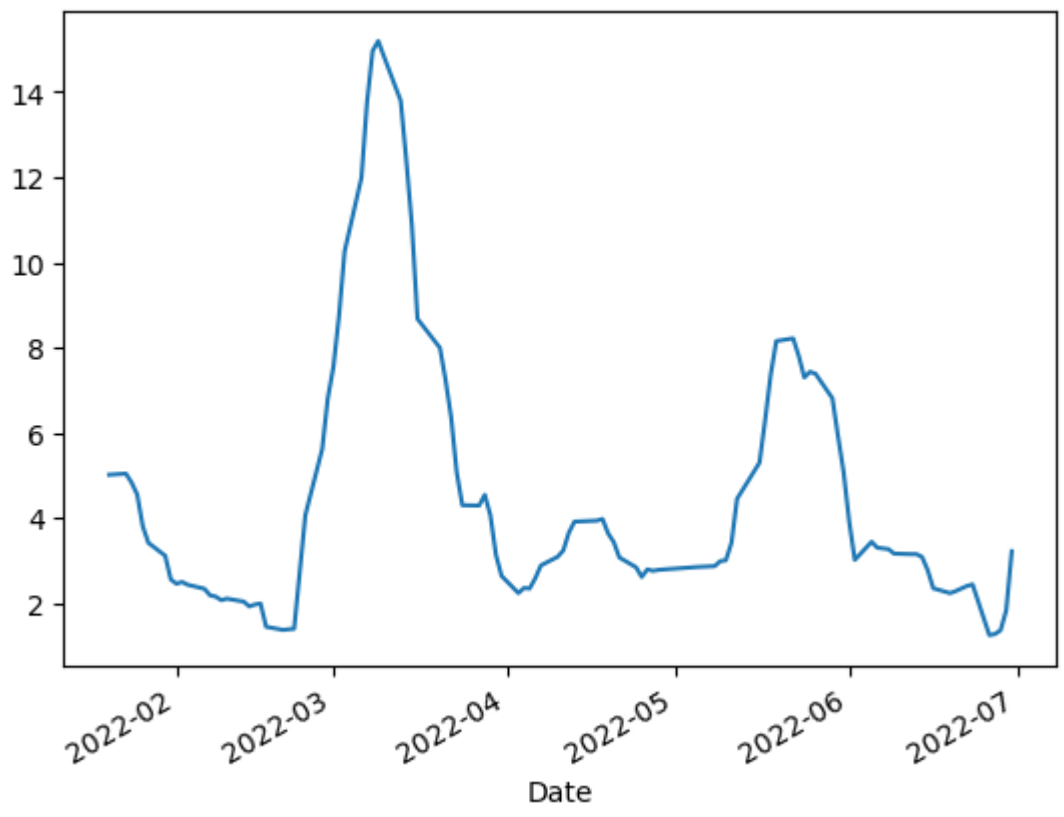


In [ ]:

***extra

In [31]:
```
specific_company["Close"].rolling(window=15).std().plot() #GP
```

Out[31]: <Axes: xlabel='Date'>



In [ ]:

In [ ]:

In [ ]:

2. Create a new column for daily price change (Close - Open).

In [32]:
```
stock_data["Daily Price Change"] = stock_data["Close"] - stock_data["Open"]
stock_data
```

Out[32]:

Date	Name	Open	High	Low	Close	Volume	Daily Price Change
2022-01-02	01.Bank	22.83	23.20	22.59	22.93	1842350.41	0.10
2022-01-03	01.Bank	23.03	23.29	22.74	22.90	1664989.63	-0.13
2022-01-04	01.Bank	22.85	23.13	22.64	22.84	1354510.97	-0.01
2022-01-05	01.Bank	22.91	23.20	22.70	22.98	1564334.81	0.07
2022-01-06	01.Bank	23.12	23.65	23.00	23.37	2586344.19	0.25
...	...	...	...	...	...	...	...
2022-06-26	ZEALBANGLA	169.00	174.90	169.00	170.30	10480.00	1.30
2022-06-27	ZEALBANGLA	174.10	176.00	166.90	167.50	13817.00	-6.60
2022-06-28	ZEALBANGLA	170.00	170.90	167.00	168.10	5214.00	-1.90
2022-06-29	ZEALBANGLA	167.10	169.00	164.90	165.10	6678.00	-2.00
2022-06-30	ZEALBANGLA	165.10	174.00	164.00	172.20	5883.00	7.10

49158 rows × 7 columns

In [ ]:

In [ ]:

In [ ]:

for update

In [33]:
```
specific_company_name = "GP"
specific_company = stock_data[stock_data["Name"]==specific_company_name]
specific_banks_list = ["ABBANK","BRACBANK","CITYBANK","ISLAMIBANK","RUPALIBANK"]
specific_banks = stock_data[stock_data["Name"].isin(specific_banks_list)]
```

In [ ]:

In [ ]:

In [ ]:

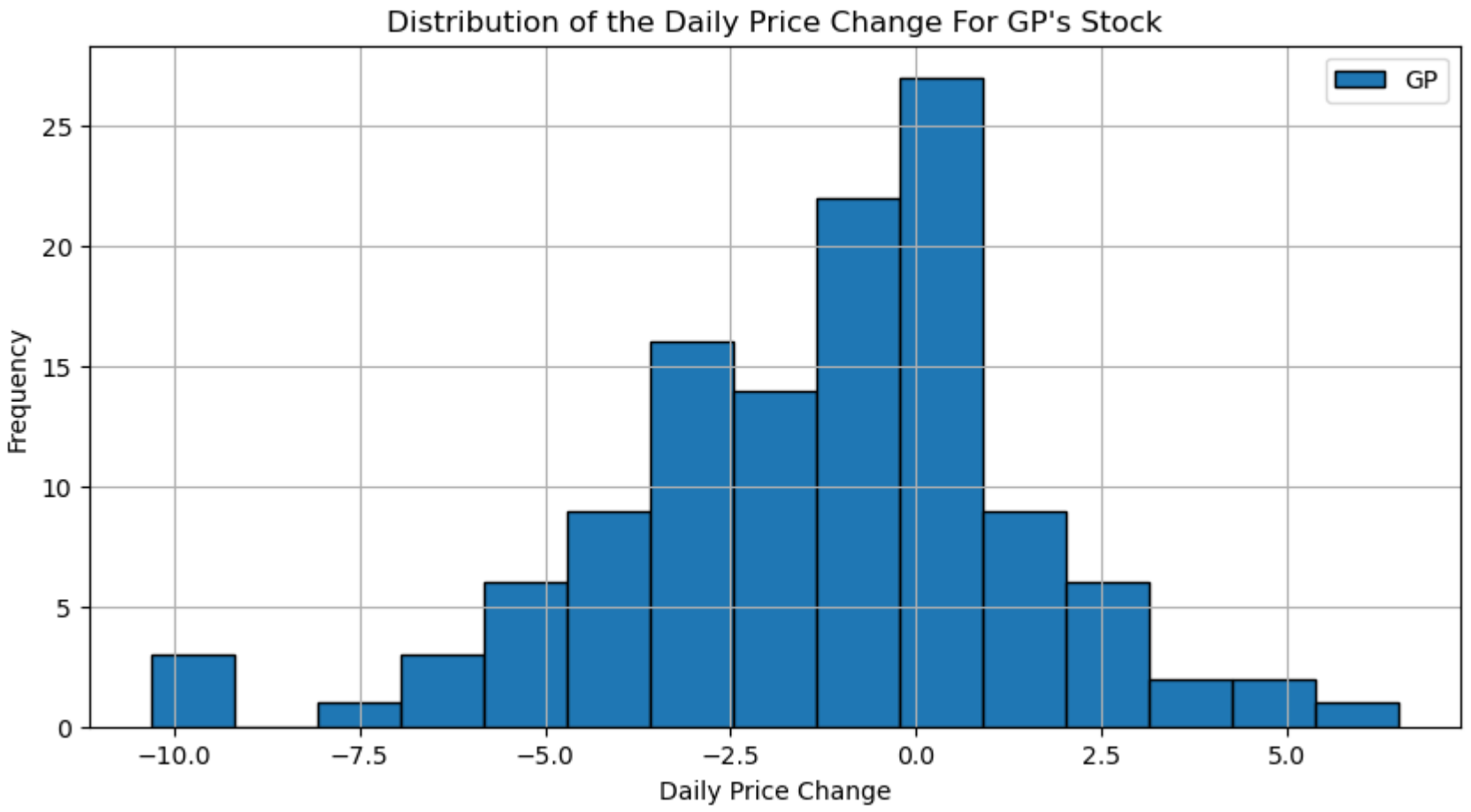
3. Analyze the distribution of daily price changes.

***** for a specific company's stock***

In [34]:
```
plt.figure(figsize=(10,5))

plt.hist(specific_company["Daily Price Change"], bins=15, edgecolor="black", label=f"{specific_company_name}")

plt.title(f"Distribution of the Daily Price Change For {specific_company_name}'s Stock")
plt.xlabel("Daily Price Change")
plt.ylabel("Frequency")
plt.legend()
plt.grid()
plt.show()
```



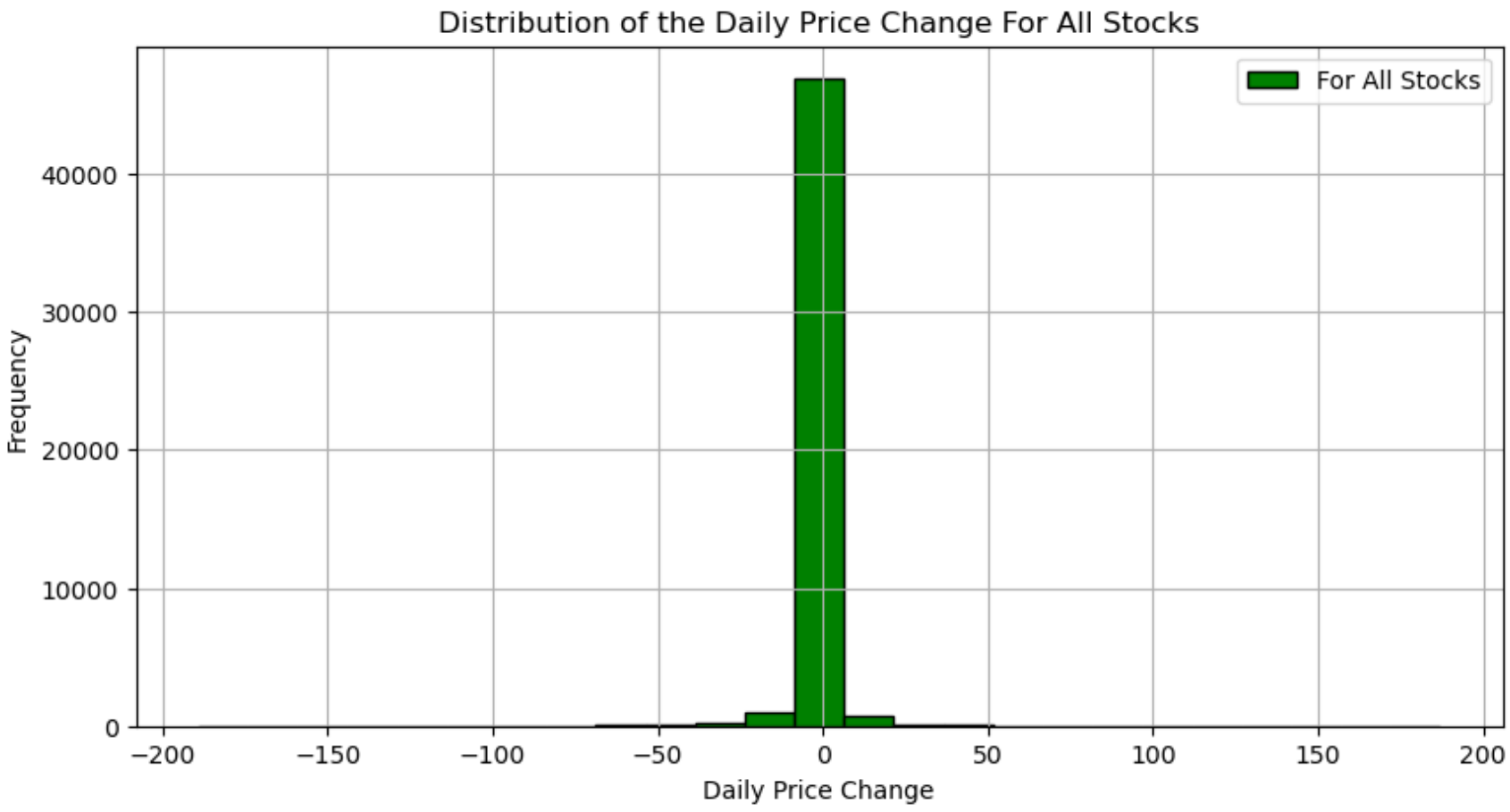
In [ ]:

for all the company's stock

In [35]:
```
plt.figure(figsize=(10,5))

plt.hist(stock_data["Daily Price Change"], bins=25,color="green", edgecolor="black", label="For All Stocks")

plt.title("Distribution of the Daily Price Change For All Stocks")
plt.xlabel("Daily Price Change")
plt.ylabel("Frequency")
plt.legend()
plt.grid()
plt.show()
```



In [ ]:

In [ ]:

In [ ]:

4. Identify days with the largest price increases and decreases.

largest price increases

In [36]:
```
largest_increase_day = stock_data[stock_data["Daily Price Change"] == stock_data["Daily Price Change"].max()]
largest_increase_day.sort_values(by="Daily Price Change", ascending=False)
```

Out[36]:

Date	Name	Open	High	Low	Close	Volume	Daily Price Change
2022-06-29	SJIBLPBOND	4710.0	4899.0	4710.0	4897.0	101.0	187.0

In [ ]:

**largest price increases each day

In [37]:
```
increase = stock_data.groupby("Date")["Daily Price Change"].max()
increase.sort_values(ascending=False)
```

Out[37]:
```
Date
2022-06-29    187.0
2022-06-27    145.5
2022-06-21    141.5
2022-01-05    125.6
2022-06-30    124.5
              ...
2022-04-12      7.0
2022-06-14      6.1
2022-04-03      5.7
2022-03-10      4.5
2022-02-24      3.2
Name: Daily Price Change, Length: 122, dtype: float64
```

In [ ]:

**largest price decreases

In [38]:
```
largest_decrease_day = stock_data[stock_data["Daily Price Change"] == stock_data["Daily Price Change"].min()]
largest_decrease_day.sort_values(by="Daily Price Change", ascending=True)
```

Out[38]:

Date	Name	Open	High	Low	Close	Volume	Daily Price Change
2022-03-07	RECKITTBEN	5753.0	5753.0	5550.0	5563.8	1876.0	-189.2

In [ ]:

**largest price decreases each day

In [39]:
```
decrease = stock_data.groupby("Date")["Daily Price Change"].min()
decrease.sort_values(ascending=True)
```

Out[39]:
```
Date
2022-03-07   -189.2
2022-01-03   -182.5
2022-04-28   -178.7
2022-01-20   -166.6
2022-01-31   -154.9
              ...
2022-03-03    -16.2
2022-05-05    -16.0
2022-05-09    -14.3
2022-06-12    -10.1
2022-04-19     -9.8
Name: Daily Price Change, Length: 122, dtype: float64
```

In [ ]:

In [ ]:

In [ ]:

5. Identify stocks with unusually high trading volume on certain days.

**using the 3 standard deviations method

In [40]:
```
volume_limit = sd_avg["Volume"] + 3 * sd_std["Volume"]  #3 standard deviations method

unusually_high_volume = (stock_data[stock_data["Volume"] > volume_limit])

unusually_high_volume.sort_values(by="Volume",ascending=False)
```

Out[40]:

Date	Name	Open	High	Low	Close	Volume	Daily Price Change
2022-01-31	UNIONBANK	14.6	14.6	13.0	13.2	65931798.0	-1.4
2022-05-22	SOUTHEASTB	14.1	14.9	14.0	14.8	47588963.0	0.7
2022-02-03	UNIONBANK	12.8	14.0	12.6	14.0	30513155.0	1.2
2022-01-06	ONEBANKLTD	14.1	14.8	14.0	14.4	26013201.0	0.3
2022-01-17	SAIFPOWER	43.4	46.8	43.0	46.3	22441452.0	2.9
...	...	...	...	...	...	...	...
2022-05-29	RINGSHINE	9.0	9.7	9.0	9.5	4406585.0	0.5
2022-06-29	BDFINANCE	49.9	50.2	48.9	49.1	4406287.0	-0.8
2022-02-14	APOLOISPAT	10.1	10.2	9.6	9.9	4404704.0	-0.2
2022-01-06	SAIFPOWER	42.9	43.8	42.5	43.0	4404538.0	0.1
2022-05-08	PENINSULA	34.3	37.6	34.2	37.6	4399405.0	3.3

906 rows × 7 columns

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Part 4: Correlation and Heatmaps:

1. Explore the relationship between trading volume and volatility.

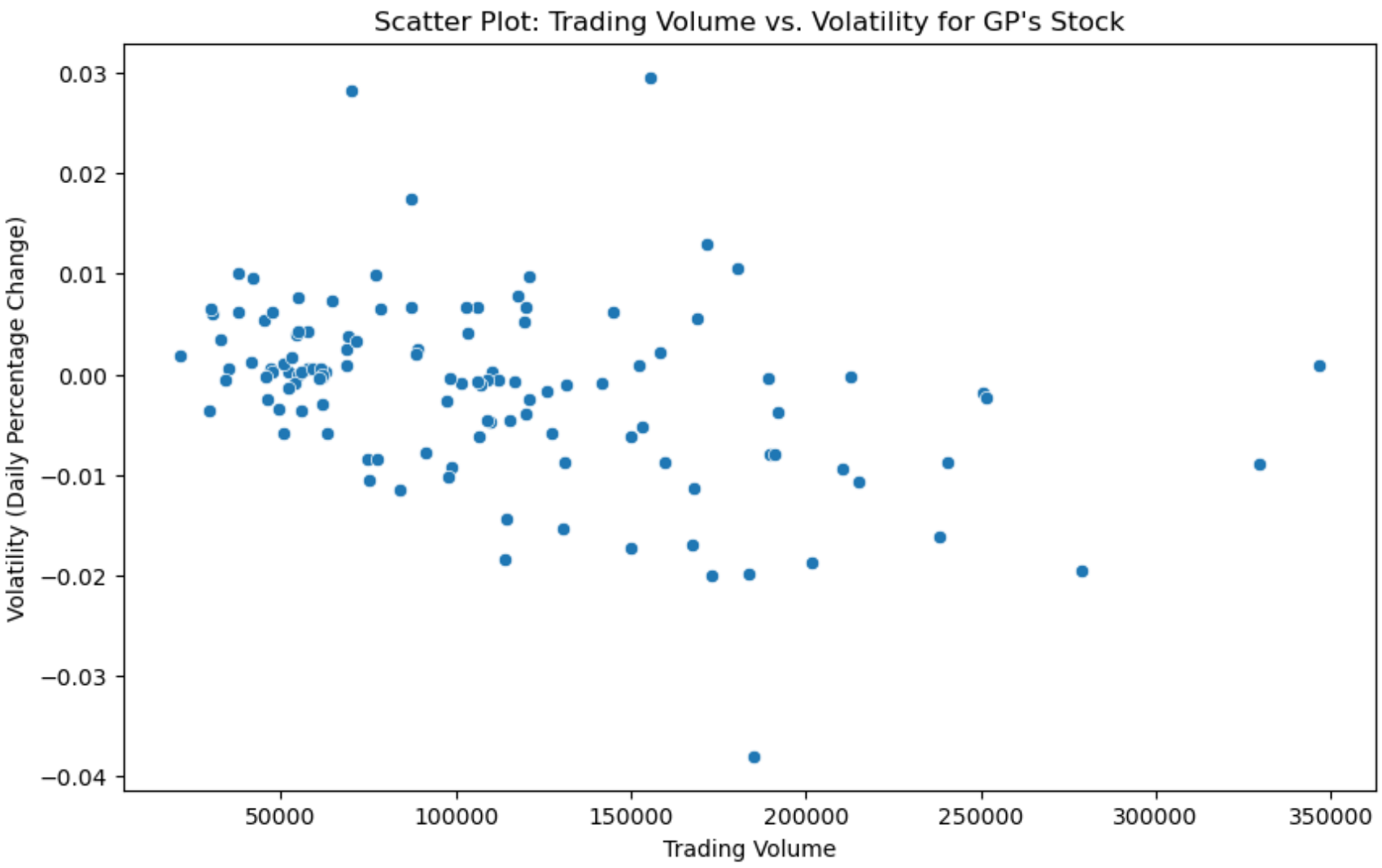
*** volatility using daily percentage change*

In [41]:
```
volatility_1 = daily_pct_change  ### From>> Part:2 Question:2 (Daily Percentage Change)

plt.figure(figsize=(10, 6))

sns.scatterplot(x=specific_company["Volume"], y=volatility_1)

plt.title(f"Scatter Plot: Trading Volume vs. Volatility for {specific_company_name}'s Stock")
plt.xlabel("Trading Volume")
plt.ylabel("Volatility (Daily Percentage Change)")
plt.show()
```



In [ ]:

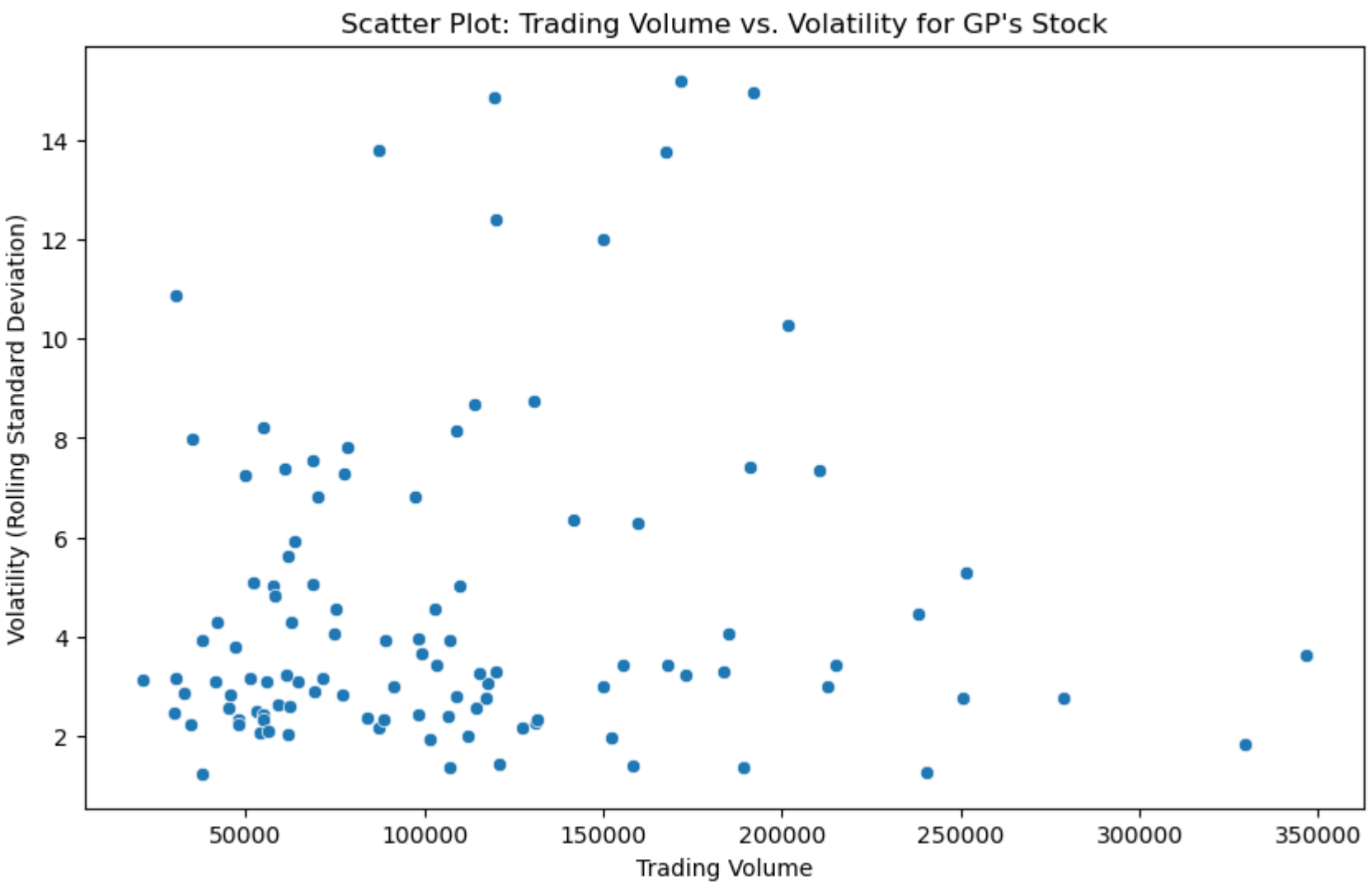
using rolling standard deviation 15 days intervals

In [42]:
```
volatility_2 = sd_volatility ### From>> Part:3 Question:1 [Rolling Standard Deviation 15 days Intervals]

plt.figure(figsize=(10, 6))

sns.scatterplot(x=specific_company["Volume"], y=volatility_2)


plt.title(f"Scatter Plot: Trading Volume vs. Volatility for {specific_company_name}'s Stock")
plt.xlabel("Trading Volume")
plt.ylabel("Volatility (Rolling Standard Deviation)")
plt.show()
```



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2. Calculate the correlation matrix between the 'Open' & 'High', 'Low' &'Close' prices.

In [43]:
```
correlation_matrix = stock_data[["Open", "High", "Low", "Close"]].corr()
correlation_matrix
```

Out[43]:

	Open	High	Low	Close
Open	1.000000	0.999940	0.999939	0.999925
High	0.999940	1.000000	0.999887	0.999942
Low	0.999939	0.999887	1.000000	0.999961
Close	0.999925	0.999942	0.999961	1.000000

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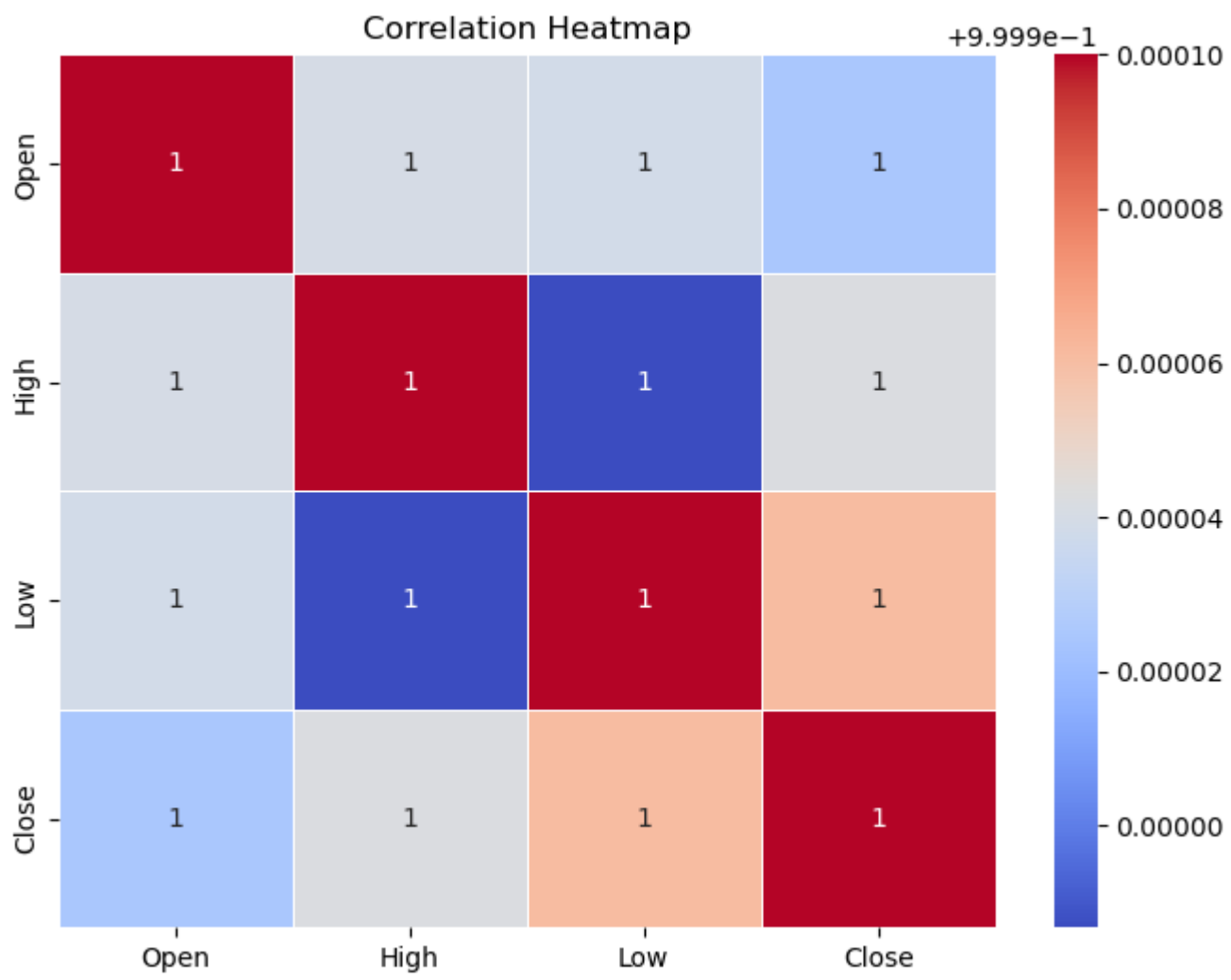
3. Create a heatmap to visualize the correlations using the seaborn package.

In [44]:
```
plt.figure(figsize=(8, 6))

sns.heatmap(correlation_matrix, annot=True, cmap="coolwarm", linewidths=.6)

plt.title("Correlation Heatmap")
plt.show()
```



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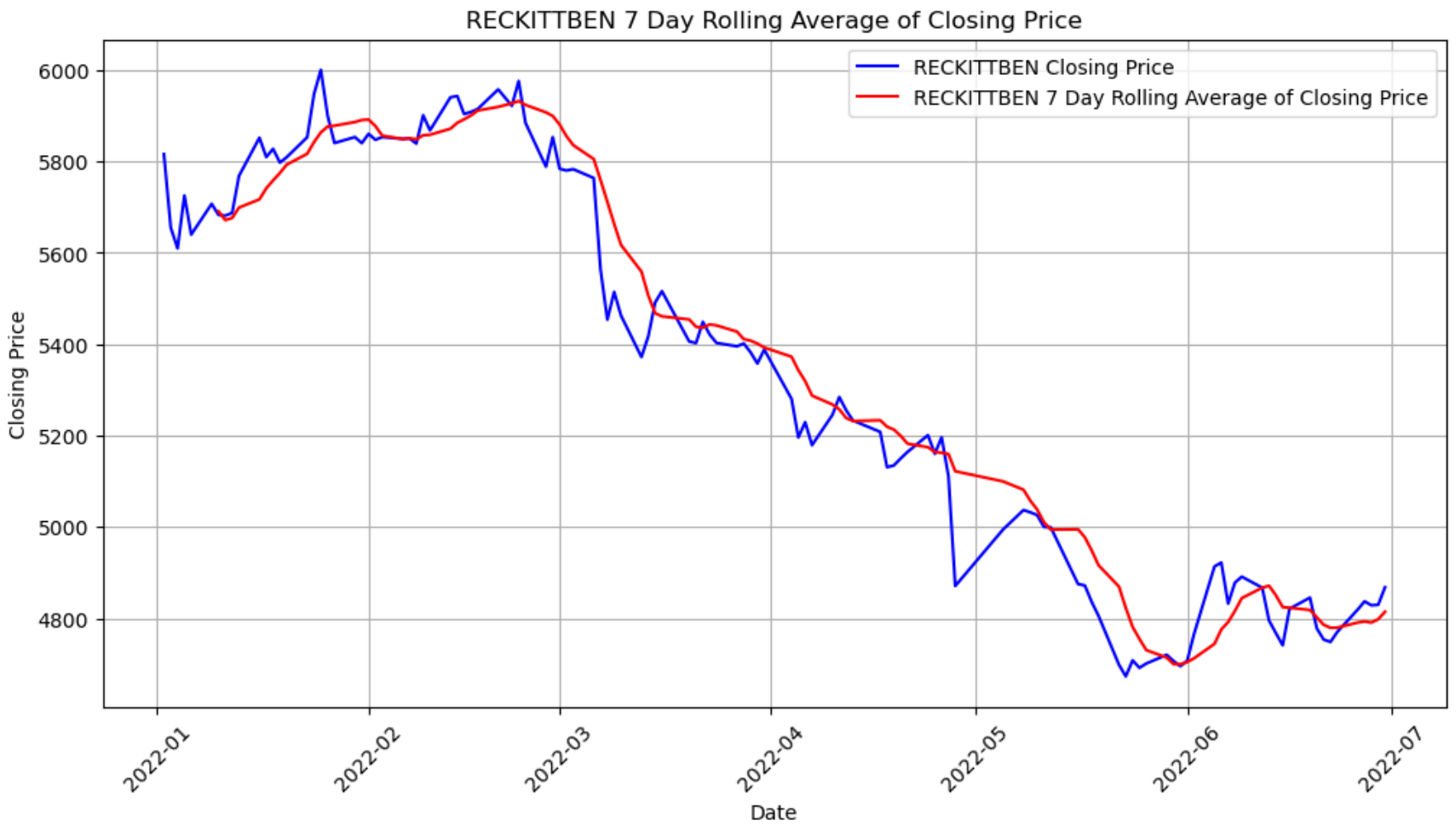
Bonus Task:

***resolved rolling window warning**

In [45]:
```
bonus_specific_company='RECKITTBEN'

specific_data=stock_data[stock_data['Name']==bonus_specific_company].copy() #>>>>>>>>>>  .copy()

specific_data['7_Day_Rolling_Avg']=specific_data['Close'].rolling(window=7).mean()

plt.figure(figsize=(12,6))
```

```
plt.plot(specific_data['Close'], label=f'{bonus_specific_company} Closing Price',color='blue')
plt.plot(specific_data['7_Day_Rolling_Avg'], label=f'{bonus_specific_company} 7 Day Rolling Average of Closing Price', 

plt.xlabel('Date')
plt.ylabel('Closing Price')
plt.title(f'{bonus_specific_company} 7 Day Rolling Average of Closing Price')
plt.grid()
plt.legend()
plt.xticks(rotation=45)
plt.show()
```



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ABU SAEYD