This project works on analyzing the sentiment of the News Data given a dataset of news articles with their headlines for a set of companies. In the following code, I have worked on analyzing the sentiment for companies such as, Apple Inc, Amazon Inc, Bank of America, Best Buy, Citigroup Inc, The Boeing Company

In [247]:
```
# pip install yahoo_fin
```

In [248]:
```
# pip install yfinance
```

In [ ]:
```
from nltk.sentiment.vader import SentimentIntensityAnalyzer
import nltk
nltk.download('all')
import warnings
warnings.filterwarnings("ignore")
```

In [250]:
```
from google.colab import drive
import pandas as pd
import os
import pickle

drive.mount('/content/drive')
path = '/content/drive/MyDrive/Colab Notebooks/news_data/'
folders = os.listdir(path)
dict_files = {}
word_cloud = []

for folder in folders:
    folder_path = os.path.join(path, folder)
    dict_files[folder] = os.listdir(folder_path)
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount,
call drive.mount("/content/drive", force_remount=True).
```

For Apple Inc Ticker

In [251]:
```
# for Stock Price Estimation and News related to Apple, limiting the c
c_name = ['Apple Inc']
print('\n\nThe news data available for Apple for 30 days, and consolid
```

```
The news data available for Apple for 30 days, and consolidated by news p
er company is 27 in number
```

In [252]:

```
# function to read csvs and perform sentiment analysis on its contents
def myread_csv(c_name):
  df_A = pd.DataFrame()
  df = pd.DataFrame()

  analyzer = SentimentIntensityAnalyzer()
  file_path = os.path.join(path, c_name)
  iter = 0
  for i in dict_files[c_name]:

    csv_path = os.path.join(file_path, i)
    df_temp = pd.read_csv(csv_path, encoding = 'ISO-8859-1',low_memory
    date = i.split('.')[0]
    df_temp["Date"] = date
    df = pd.concat([df, df_temp])
    df['Concat'] = df["Title"] + df["Description"]

    scores = df['Concat'].apply(analyzer.polarity_scores).tolist()
    df_scores = pd.DataFrame(scores)
    if iter==1:
      print("For the following data: \n", df['Concat'])
      print("\nSample values of Polarity Scores: \n",df_scores)
    iter+=1
    mean = round(df_scores['compound'].mean(), 2)

    new_row = {'Date': date, 'Mean': mean}
    df_A = df_A.append(new_row, ignore_index=True)
  return df_A
```

In [253]:

```
# Sentiment Scores for every day data within the directory - 'Apple In

AAPL_Sentiment_Scores = pd.DataFrame()
for i in c_name:
  AAPL_Sentiment_Scores = AAPL_Sentiment_Scores.append(myread_csv(i))
AAPL_Sentiment_Scores = AAPL_Sentiment_Scores.reset_index(drop=True)
AAPL_Sentiment_Scores.index = AAPL_Sentiment_Scores.index + 1

print('\n\nHere are the Mean Sentiment Polarity Scores for News with r
AAPL_Sentiment_Scores
```

```
For the following data:
 0    Consumer Cloud Services Global Market Report 2...
0    Apple to host annual developers' conference fr...
1    Elon Musk, Steve Wozniak sign letter calling f...
2    The best disk clone apps for Mac in 2023A hand...
3    Global Subscription-based Gaming Market to 203...
4    Samsung Display has one less market rival with...
5    BYD Defers US Debut, Alibaba's Split Sparks La...
6    Whatâ??s new for IT in the latest Mac, iPhone,...
7    Apple expected to unveil its $3,000 mixed-real...
8    Are US Sanctions On China Working? China Tech ...
Name: Concat, dtype: object

Sample values of Polarity Scores:
      neg    neu    pos  compound
0  0.000  0.870  0.130    0.6597
1  0.000  1.000  0.000    0.0000
2  0.039  0.904  0.057    0.2500
3  0.000  0.906  0.094    0.6486
4  0.000  0.939  0.061    0.2960
5  0.087  0.913  0.000   -0.5423
6  0.031  0.929  0.040    0.1027
7  0.000  0.955  0.045    0.3818
8  0.000  1.000  0.000    0.0000
9  0.046  0.780  0.173    0.5267


Here are the Mean Sentiment Polarity Scores for News with respect to Appl
e
```

Out[253]:

	Date	Mean
1	2023-03-11	0.66
2	2023-03-29	0.23
3	2023-03-27	0.18
4	2023-03-25	0.20
5	2023-03-17	0.22
6	2023-03-06	0.23
7	2023-03-14	0.19
8	2023-04-02	0.22
9	2023-03-28	0.22
10	2023-03-07	0.20
11	2023-03-16	0.24
12	2023-03-09	0.23
13	2023-03-04	0.22
14	2023-03-13	0.26
15	2023-03-31	0.26
16	2023-04-03	0.25
17	2023-03-21	0.26
18	2023-03-18	0.27
19	2023-03-23	0.30
20	2023-03-15	0.30
21	2023-03-30	0.29
22	2023-03-24	0.29
23	2023-03-10	0.28
24	2023-03-05	0.28
25	2023-03-19	0.28
26	2023-03-08	0.28
27	2023-03-20	0.28

In [254]:

```
# importing stock price data from yahoo finance
from yahoo_fin import stock_info as si
import yfinance as yf
import pandas as pd
import os
import matplotlib.pyplot as plt
from datetime import date, timedelta, datetime

# taking the start and end dates as per the news data
start_date = min(AAPL_Sentiment_Scores['Date'])
end_date = max(AAPL_Sentiment_Scores['Date'])

# getting the stock price data for Apple
ticker = "AAPL"
stock_data_all = si.get_data(ticker, start_date=start_date, end_date=e
```

In [255]:
```
# resetting index
stock_data_all = stock_data_all.reset_index()
stock_data_all.index = stock_data_all.index + 1
stock_data_all
```

Out[255]:

	index	open	high	low	close	adjclose	volume	ticker
1	2023-03-06	153.789993	156.300003	153.460007	153.830002	153.830002	87558000	AAPL
2	2023-03-07	153.699997	154.029999	151.130005	151.600006	151.600006	56182000	AAPL
3	2023-03-08	152.809998	153.470001	151.830002	152.869995	152.869995	47204800	AAPL
4	2023-03-09	153.559998	154.539993	150.229996	150.589996	150.589996	53833600	AAPL
5	2023-03-10	150.210007	150.940002	147.610001	148.500000	148.500000	68572400	AAPL
6	2023-03-13	147.809998	153.139999	147.699997	150.470001	150.470001	84457100	AAPL
7	2023-03-14	151.279999	153.399994	150.100006	152.589996	152.589996	73695900	AAPL
8	2023-03-15	151.190002	153.250000	149.919998	152.990005	152.990005	77167900	AAPL
9	2023-03-16	152.160004	156.460007	151.639999	155.850006	155.850006	76161100	AAPL
10	2023-03-17	156.080002	156.740005	154.279999	155.000000	155.000000	98944600	AAPL
11	2023-03-20	155.070007	157.820007	154.149994	157.399994	157.399994	73641400	AAPL
12	2023-03-21	157.320007	159.399994	156.539993	159.279999	159.279999	73938300	AAPL
13	2023-03-22	159.300003	162.139999	157.809998	157.830002	157.830002	75701800	AAPL
14	2023-03-23	158.830002	161.550003	157.679993	158.929993	158.929993	67622100	AAPL
15	2023-03-24	158.860001	160.339996	157.850006	160.250000	160.250000	59196500	AAPL
16	2023-03-27	159.940002	160.770004	157.869995	158.279999	158.279999	52390300	AAPL
17	2023-03-28	157.970001	158.490005	155.979996	157.649994	157.649994	45992200	AAPL
18	2023-03-29	159.369995	161.050003	159.350006	160.770004	160.770004	51305700	AAPL
19	2023-03-30	161.529999	162.470001	161.270004	162.360001	162.360001	49501700	AAPL
20	2023-03-31	162.440002	165.000000	161.910004	164.899994	164.899994	68749800	AAPL

In [256]:

```
# resetting column names and date format
new_column = {'index':'Date', 'open':'Open','high':'High', 'low':'Low'
stock_data_all = stock_data_all.rename(columns=new_column)
import datetime
for i in stock_data_all['Date']:
  date_obj = i
  date_str = date_obj.strftime('%Y-%m-%d')
  stock_data_all['Date'] = date_str
```

In [257]:

```
for i in AAPL_Sentiment_Scores['Date']:
  for j in stock_data_all['Date']:
    # print(i,j)
    if i == str(j):
      AAPL_Sentiment_Scores['Open'] = stock_data_all['Open']
      AAPL_Sentiment_Scores['Adjclose'] = stock_data_all['Adjclose']
      AAPL_Sentiment_Scores['High'] = stock_data_all['High']
      AAPL_Sentiment_Scores['Low'] = stock_data_all['Low']
      AAPL_Sentiment_Scores['Close'] = stock_data_all['Close']
      AAPL_Sentiment_Scores['Volume'] = stock_data_all['Volume']

print('\n\nThe Sentiment Scores Concatenated with the Stock Price Data
AAPL_Sentiment_Scores = AAPL_Sentiment_Scores.dropna()
AAPL_Sentiment_Scores
```

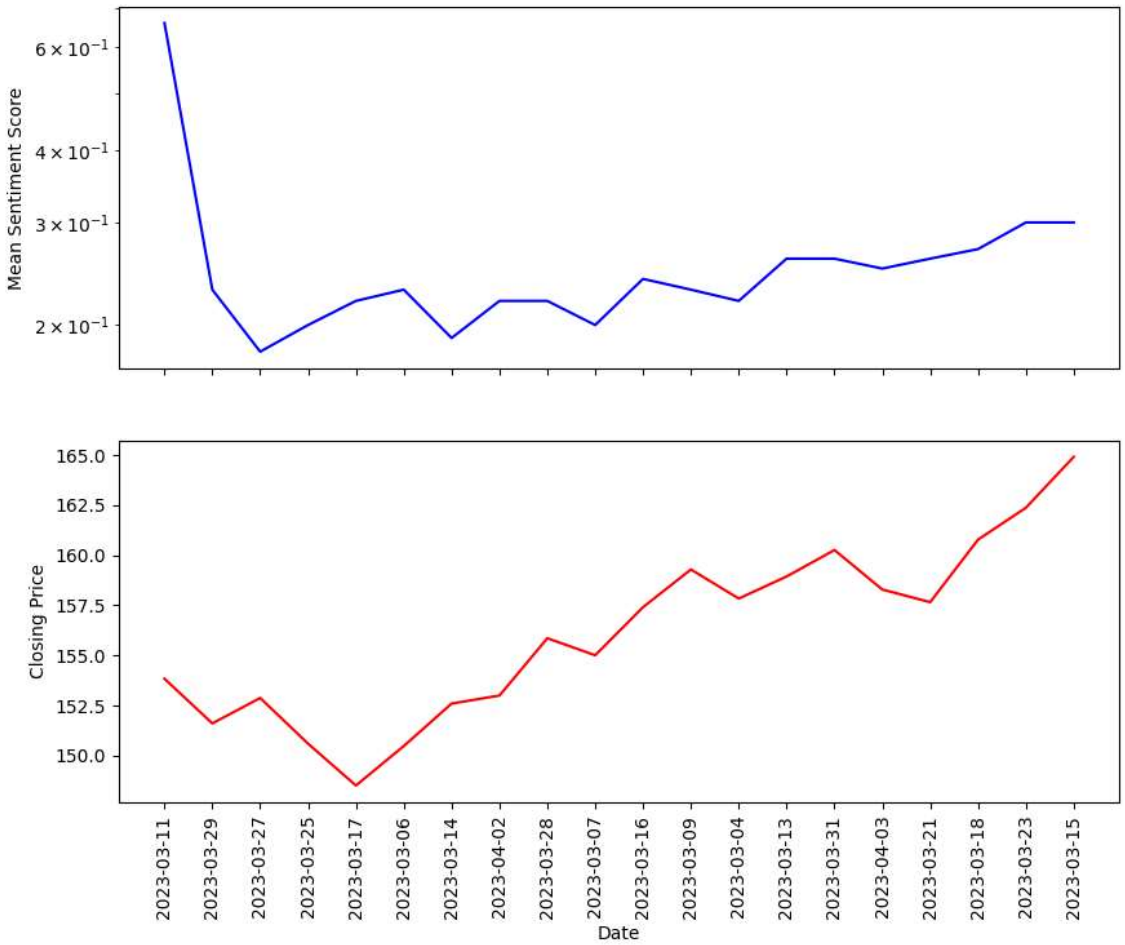
```
The Sentiment Scores Concatenated with the Stock Price Data for Apple
```

Out[257]:

	Date	Mean	Open	Adjclose	High	Low	Close	Volume
1	2023-03-11	0.66	153.789993	153.830002	156.300003	153.460007	153.830002	87558000.0
2	2023-03-29	0.23	153.699997	151.600006	154.029999	151.130005	151.600006	56182000.0
3	2023-03-27	0.18	152.809998	152.869995	153.470001	151.830002	152.869995	47204800.0
4	2023-03-25	0.20	153.559998	150.589996	154.539993	150.229996	150.589996	53833600.0
5	2023-03-17	0.22	150.210007	148.500000	150.940002	147.610001	148.500000	68572400.0
6	2023-03-06	0.23	147.809998	150.470001	153.139999	147.699997	150.470001	84457100.0
7	2023-03-14	0.19	151.279999	152.589996	153.399994	150.100006	152.589996	73695900.0
8	2023-04-02	0.22	151.190002	152.990005	153.250000	149.919998	152.990005	77167900.0
9	2023-03-28	0.22	152.160004	155.850006	156.460007	151.639999	155.850006	76161100.0
10	2023-03-07	0.20	156.080002	155.000000	156.740005	154.279999	155.000000	98944600.0
11	2023-03-16	0.24	155.070007	157.399994	157.820007	154.149994	157.399994	73641400.0
12	2023-03-09	0.23	157.320007	159.279999	159.399994	156.539993	159.279999	73938300.0
13	2023-03-04	0.22	159.300003	157.830002	162.139999	157.809998	157.830002	75701800.0
14	2023-03-13	0.26	158.830002	158.929993	161.550003	157.679993	158.929993	67622100.0
15	2023-03-31	0.26	158.860001	160.250000	160.339996	157.850006	160.250000	59196500.0
16	2023-04-03	0.25	159.940002	158.279999	160.770004	157.869995	158.279999	52390300.0
17	2023-03-21	0.26	157.970001	157.649994	158.490005	155.979996	157.649994	45992200.0
18	2023-03-18	0.27	159.369995	160.770004	161.050003	159.350006	160.770004	51305700.0
19	2023-03-23	0.30	161.529999	162.360001	162.470001	161.270004	162.360001	49501700.0
20	2023-03-15	0.30	162.440002	164.899994	165.000000	161.910004	164.899994	68749800.0

In [258]:

```
import matplotlib.pyplot as plt

fig, (ax1, ax2) = plt.subplots(2, 1, sharex=True, figsize=(10, 8))

ax1.plot(AAPL_Sentiment_Scores['Date'], AAPL_Sentiment_Scores['Mean'],
ax1.set_yscale('log')
ax1.set_ylabel('Mean Sentiment Score')

ax2.plot(AAPL_Sentiment_Scores['Date'], AAPL_Sentiment_Scores['Adjclos
ax2.set_ylabel('Closing Price')

plt.xlabel('Date')

plt.xticks(rotation='vertical')

plt.show()
```



For Amazon Inc Ticker

In [259]:

```
c_name = ['Amazon.com, Inc']
print('\nThe news data available for Amazon for 30 days, and consolida
```

```
The news data available for Amazon for 30 days, and consolidated by news
per day is 24 in number
```

In [260]:

```
# Sentiment Scores for every day data within the directory - 'Amazon I

AMZN_Sentiment_Scores = pd.DataFrame()
for i in c_name:
  AMZN_Sentiment_Scores = AMZN_Sentiment_Scores.append(myread_csv(i))
AMZN_Sentiment_Scores = AMZN_Sentiment_Scores.reset_index(drop=True)
AMZN_Sentiment_Scores.index = AMZN_Sentiment_Scores.index + 1

print('\n\nHere are the Mean Sentiment Polarity Scores for News with r
AMZN_Sentiment_Scores
```

```
For the following data:
 0    AI Stocks To Watch In 2023Put eyes on these AI...
1    Else Nutrition Reports an 82% increase in Fisc...
0    ICT Investment In Government Global Market Rep...
1    Laird Superfood, Inc. (AMEX:LSF) Q4 2022 Earni...
2    Amazon class action lawsuit goes after company...
Name: Concat, dtype: object

Sample values of Polarity Scores:
      neg    neu    pos  compound
0  0.000  1.000  0.000    0.0000
1  0.000  0.938  0.062    0.3182
2  0.000  0.796  0.204    0.7717
3  0.000  0.849  0.151    0.6705
4  0.059  0.836  0.105    0.1280


Here are the Mean Sentiment Polarity Scores for News with respect to Amaz
on
```

Out[260]:

	Date	Mean
1	2023-03-31	0.16
2	2023-03-17	0.38
3	2023-03-14	0.53
4	2023-03-16	0.50
5	2023-03-07	0.42
6	2023-03-30	0.25
7	2023-03-18	0.26
8	2023-03-06	0.31
9	2023-03-13	0.34
10	2023-03-28	0.34
11	2023-03-10	0.33
12	2023-03-11	0.34
13	2023-03-29	0.34
14	2023-03-04	0.35
15	2023-03-24	0.32
16	2023-03-15	0.33
17	2023-03-20	0.26
18	2023-03-09	0.28
19	2023-04-03	0.26
20	2023-03-22	0.27
21	2023-03-23	0.29
22	2023-03-08	0.28
23	2023-03-21	0.29
24	2023-03-27	0.27

In [261]:

```
# importing stock price data from yahoo finance
from yahoo_fin import stock_info as si
import yfinance as yf
import pandas as pd
import os
import matplotlib.pyplot as plt
from datetime import date, timedelta, datetime

# taking the start and end dates as per the news data
start_date = min(AMZN_Sentiment_Scores['Date'])
end_date = max(AMZN_Sentiment_Scores['Date'])

# getting the stock price data for Amazon
ticker = "AMZN"
stock_data_all = si.get_data(ticker, start_date=start_date, end_date=e
```

In [262]:
```
# resetting index
stock_data_all = stock_data_all.reset_index()
stock_data_all.index = stock_data_all.index + 1
stock_data_all
```

Out[262]:

	index	open	high	low	close	adjclose	volume	ticker
1	2023-03-06	95.190002	96.550003	93.739998	93.750000	93.750000	52112400	AMZN
2	2023-03-07	94.059998	95.089996	92.779999	93.550003	93.550003	49100700	AMZN
3	2023-03-08	93.599998	94.169998	92.180000	93.919998	93.919998	44899100	AMZN
4	2023-03-09	93.680000	96.209999	92.180000	92.250000	92.250000	56218700	AMZN
5	2023-03-10	92.669998	93.570000	90.250000	90.730003	90.730003	69827500	AMZN
6	2023-03-13	89.970001	94.019997	88.120003	92.430000	92.430000	72397100	AMZN
7	2023-03-14	93.830002	95.070000	92.709999	94.879997	94.879997	60912700	AMZN
8	2023-03-15	93.220001	96.669998	93.070000	96.199997	96.199997	70731800	AMZN
9	2023-03-16	95.750000	100.989998	95.610001	100.040001	100.040001	84446900	AMZN
10	2023-03-17	99.790001	100.660004	97.459999	98.949997	98.949997	87300200	AMZN
11	2023-03-20	98.410004	98.480003	95.699997	97.709999	97.709999	62388900	AMZN
12	2023-03-21	98.139999	100.849998	98.000000	100.610001	100.610001	58597300	AMZN
13	2023-03-22	100.449997	102.099998	98.610001	98.699997	98.699997	57475400	AMZN
14	2023-03-23	100.430000	101.059998	97.620003	98.709999	98.709999	57559300	AMZN
15	2023-03-24	98.070000	98.300003	96.400002	98.129997	98.129997	56095400	AMZN
16	2023-03-27	99.070000	99.339996	97.080002	98.040001	98.040001	46721300	AMZN
17	2023-03-28	98.110001	98.440002	96.290001	97.239998	97.239998	38720100	AMZN
18	2023-03-29	98.690002	100.419998	98.559998	100.250000	100.250000	49783300	AMZN
19	2023-03-30	101.550003	103.040001	101.010002	102.000000	102.000000	53633400	AMZN
20	2023-03-31	102.160004	103.489998	101.949997	103.290001	103.290001	56750300	AMZN

In [263]:

```
# resetting column names and date format
new_column = {'index':'Date', 'open':'Open','high':'High', 'low':'Low'
stock_data_all = stock_data_all.rename(columns=new_column)
import datetime
for i in stock_data_all['Date']:
  date_obj = i
  date_str = date_obj.strftime('%Y-%m-%d')
  stock_data_all['Date'] = date_str
```

In [264]:

```
for i in AMZN_Sentiment_Scores['Date']:
  for j in stock_data_all['Date']:
    # print(i,j)
    if i == str(j):
      AMZN_Sentiment_Scores['Open'] = stock_data_all['Open']
      AMZN_Sentiment_Scores['Adjclose'] = stock_data_all['Adjclose']
      AMZN_Sentiment_Scores['High'] = stock_data_all['High']
      AMZN_Sentiment_Scores['Low'] = stock_data_all['Low']
      AMZN_Sentiment_Scores['Close'] = stock_data_all['Close']
      AMZN_Sentiment_Scores['Volume'] = stock_data_all['Volume']

print('\n\nThe Sentiment Scores Concatenated with the Stock Price Data
AMZN_Sentiment_Scores = AMZN_Sentiment_Scores.dropna()
AMZN_Sentiment_Scores
```

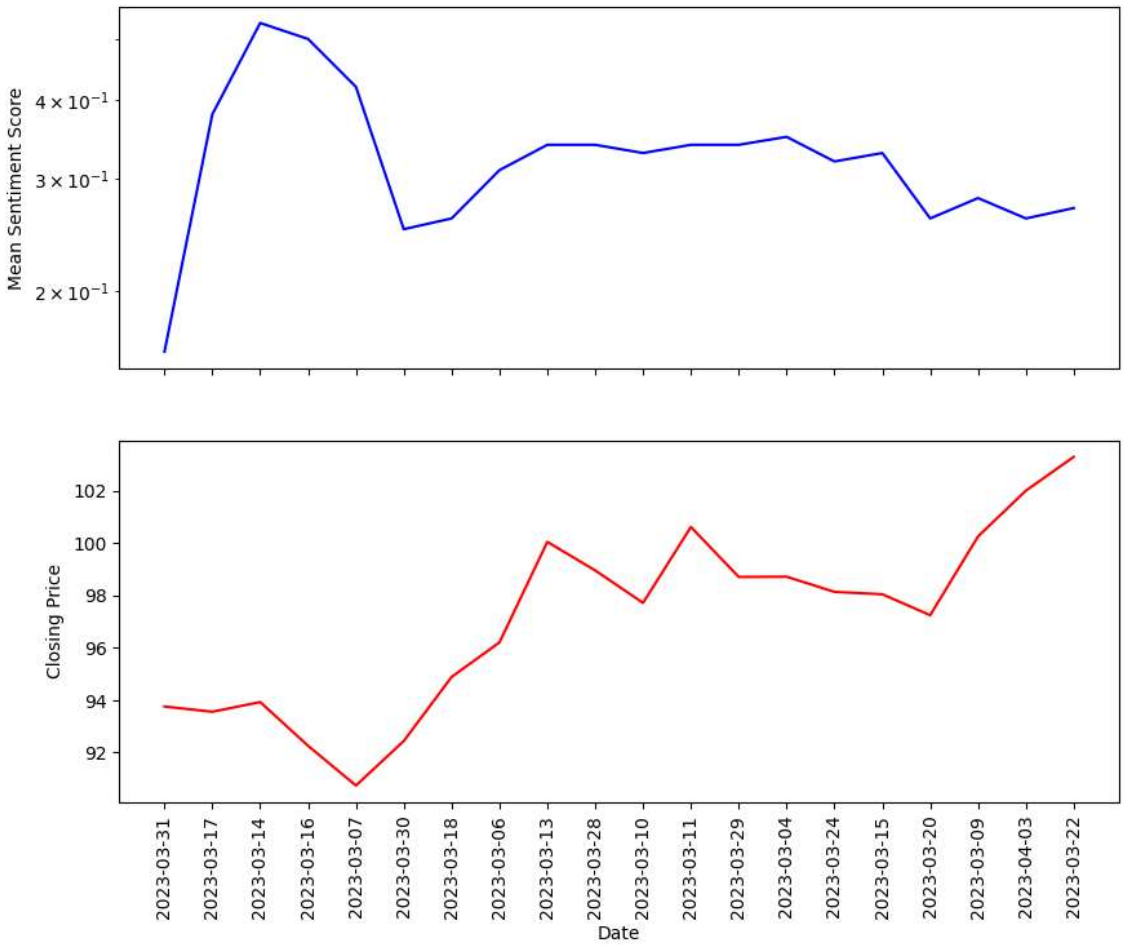
```
The Sentiment Scores Concatenated with the Stock Price Data for Amazon
```

Out[264]:

	Date	Mean	Open	Adjclose	High	Low	Close	Volume
1	2023-03-31	0.16	95.190002	93.750000	96.550003	93.739998	93.750000	52112400.0
2	2023-03-17	0.38	94.059998	93.550003	95.089996	92.779999	93.550003	49100700.0
3	2023-03-14	0.53	93.599998	93.919998	94.169998	92.180000	93.919998	44899100.0
4	2023-03-16	0.50	93.680000	92.250000	96.209999	92.180000	92.250000	56218700.0
5	2023-03-07	0.42	92.669998	90.730003	93.570000	90.250000	90.730003	69827500.0
6	2023-03-30	0.25	89.970001	92.430000	94.019997	88.120003	92.430000	72397100.0
7	2023-03-18	0.26	93.830002	94.879997	95.070000	92.709999	94.879997	60912700.0
8	2023-03-06	0.31	93.220001	96.199997	96.669998	93.070000	96.199997	70731800.0
9	2023-03-13	0.34	95.750000	100.040001	100.989998	95.610001	100.040001	84446900.0
10	2023-03-28	0.34	99.790001	98.949997	100.660004	97.459999	98.949997	87300200.0
11	2023-03-10	0.33	98.410004	97.709999	98.480003	95.699997	97.709999	62388900.0
12	2023-03-11	0.34	98.139999	100.610001	100.849998	98.000000	100.610001	58597300.0
13	2023-03-29	0.34	100.449997	98.699997	102.099998	98.610001	98.699997	57475400.0
14	2023-03-04	0.35	100.430000	98.709999	101.059998	97.620003	98.709999	57559300.0
15	2023-03-24	0.32	98.070000	98.129997	98.300003	96.400002	98.129997	56095400.0
16	2023-03-15	0.33	99.070000	98.040001	99.339996	97.080002	98.040001	46721300.0
17	2023-03-20	0.26	98.110001	97.239998	98.440002	96.290001	97.239998	38720100.0
18	2023-03-09	0.28	98.690002	100.250000	100.419998	98.559998	100.250000	49783300.0
19	2023-04-03	0.26	101.550003	102.000000	103.040001	101.010002	102.000000	53633400.0
20	2023-03-22	0.27	102.160004	103.290001	103.489998	101.949997	103.290001	56750300.0

In [265]:

```
import matplotlib.pyplot as plt

fig, (ax1, ax2) = plt.subplots(2, 1, sharex=True, figsize=(10, 8))

ax1.plot(AMZN_Sentiment_Scores['Date'], AMZN_Sentiment_Scores['Mean'],
ax1.set_yscale('log')
ax1.set_ylabel('Mean Sentiment Score')

ax2.plot(AMZN_Sentiment_Scores['Date'], AMZN_Sentiment_Scores['Adjclos
ax2.set_ylabel('Closing Price')

plt.xlabel('Date')

plt.xticks(rotation='vertical')

plt.show()
```



For Bank of America Corporation Ticker

In [266]:

```
# for Stock Price Estimation and News related to Apple, limiting the c
c_name = ['Bank of America Corporation']
print('\nThe news data available for Bank of America for 30 days, and
```

```
The news data available for Bank of America for 30 days, and consolidated
by news per company is 24 in number
```

In [267]:

```
# Sentiment Scores for every day data within the directory - 'Bank of A

BAC_Sentiment_Scores = pd.DataFrame()
for i in c_name:
  BAC_Sentiment_Scores = BAC_Sentiment_Scores.append(myread_csv(i))
BAC_Sentiment_Scores = BAC_Sentiment_Scores.reset_index(drop=True)
BAC_Sentiment_Scores.index = BAC_Sentiment_Scores.index + 1

print('\n\nHere are the Mean Sentiment Polarity Scores for News with r
BAC_Sentiment_Scores
```

```
For the following data:
 0    Again? Government socialism saves reckless cap...
0     US regulators say deposits into First Republic...
1     North Holdings 3 Oy extends the offer period o...
2     Impersonation attacks leverage Silicon Valley ...
3     Wall Street rides to the rescue as 11 banks pl...
4     CIO Leadership: HMG Strategy Celebrates Extrao...
5     Small banks vs. big banks: Where should you pu...
6     Wall Street giants move to rescue First Republ...
7     10 Best Canadian Gold Stocks To Buy NowIn this...
8     First Republic Stock Crashes But Bounces Back ...
9     TD announces new interim financed emissions ta...
Name: Concat, dtype: object

Sample values of Polarity Scores:
       neg    neu    pos  compound
0    0.206  0.772  0.022   -0.8519
1    0.000  0.881  0.119    0.4939
2    0.000  0.951  0.049    0.1280
3    0.208  0.792  0.000   -0.8689
4    0.000  0.821  0.179    0.8271
5    0.000  0.859  0.141    0.8126
6    0.157  0.843  0.000   -0.6380
7    0.073  0.787  0.139    0.3612
8    0.000  0.704  0.296    0.9313
9    0.073  0.832  0.095    0.2617
10   0.000  0.902  0.098    0.6124


Here are the Mean Sentiment Polarity Scores for News with respect to Bank
of America
```

Out[267]:

	Date	Mean
1	2023-03-21	-0.85
2	2023-03-16	0.19
3	2023-03-13	0.04
4	2023-03-28	0.01
5	2023-03-08	0.01
6	2023-03-19	0.03
7	2023-03-11	0.08
8	2023-03-22	0.12
9	2023-03-23	0.11
10	2023-03-18	0.12
11	2023-03-04	0.11
12	2023-03-29	0.13
13	2023-03-10	0.11
14	2023-03-24	0.11
15	2023-03-30	0.11
16	2023-03-14	0.09
17	2023-03-17	0.09
18	2023-03-31	0.10
19	2023-03-09	0.08
20	2023-03-12	0.09
21	2023-03-20	0.07
22	2023-03-06	0.06
23	2023-03-27	0.05
24	2023-03-15	0.06

In [268]:

```
# importing stock price data from yahoo finance
from yahoo_fin import stock_info as si
import yfinance as yf
import pandas as pd
import os
import matplotlib.pyplot as plt
from datetime import date, timedelta, datetime

# taking the start and end dates as per the news data
start_date = min(BAC_Sentiment_Scores['Date'])
end_date = max(BAC_Sentiment_Scores['Date'])

# getting the stock price data for Bank of America
ticker = "BAC"
stock_data_all = si.get_data(ticker, start_date=start_date, end_date=e
```

In [269]:

```
# resetting index
stock_data_all = stock_data_all.reset_index()
stock_data_all.index = stock_data_all.index + 1
stock_data_all
```

Out[269]:

	index	open	high	low	close	adjclose	volume	ticker
1	2023-03-06	34.240002	34.560001	33.990002	34.090000	34.090000	36646700	BAC
2	2023-03-07	33.849998	33.900002	32.799999	33.000000	33.000000	52855300	BAC
3	2023-03-08	32.660000	32.970001	32.439999	32.560001	32.560001	40045600	BAC
4	2023-03-09	32.279999	32.389999	30.309999	30.540001	30.540001	112457900	BAC
5	2023-03-10	30.320000	31.040001	28.920000	30.270000	30.270000	165330900	BAC
6	2023-03-13	28.920000	29.719999	27.870001	28.510000	28.510000	218403300	BAC
7	2023-03-14	29.990000	30.090000	28.469999	28.760000	28.760000	154255800	BAC
8	2023-03-15	27.879999	28.559999	27.680000	28.490000	28.490000	131104400	BAC
9	2023-03-16	28.379999	29.469999	28.110001	28.969999	28.969999	108348800	BAC
10	2023-03-17	28.660000	28.660000	27.620001	27.820000	27.820000	130665500	BAC
11	2023-03-20	28.240000	28.430000	27.650000	27.750000	27.750000	81441200	BAC
12	2023-03-21	28.629999	28.980000	28.510000	28.590000	28.590000	84854800	BAC
13	2023-03-22	28.709999	28.740000	27.639999	27.639999	27.639999	76925900	BAC
14	2023-03-23	28.000000	28.090000	26.790001	26.969999	26.969999	105335900	BAC
15	2023-03-24	26.600000	27.290001	26.320000	27.139999	27.139999	96872700	BAC
16	2023-03-27	27.930000	28.650000	27.910000	28.490000	28.490000	102469800	BAC
17	2023-03-28	28.379999	28.650000	27.980000	28.120001	28.120001	63416500	BAC
18	2023-03-29	28.490000	28.770000	28.240000	28.670000	28.670000	62666400	BAC
19	2023-03-30	28.920000	29.059999	28.110001	28.299999	28.299999	67427100	BAC

In [270]:

```
# resetting column names and date format
new_column = {'index':'Date', 'open':'Open','high':'High', 'low':'Low'
stock_data_all = stock_data_all.rename(columns=new_column)
import datetime
for i in stock_data_all['Date']:
  date_obj = i
  date_str = date_obj.strftime('%Y-%m-%d')
  stock_data_all['Date'] = date_str
```

In [271]:

```
for i in BAC_Sentiment_Scores['Date']:
  for j in stock_data_all['Date']:
    # print(i,j)
    if i == str(j):
      BAC_Sentiment_Scores['Open'] = stock_data_all['Open']
      BAC_Sentiment_Scores['Adjclose'] = stock_data_all['Adjclose']
      BAC_Sentiment_Scores['High'] = stock_data_all['High']
      BAC_Sentiment_Scores['Low'] = stock_data_all['Low']
      BAC_Sentiment_Scores['Close'] = stock_data_all['Close']
      BAC_Sentiment_Scores['Volume'] = stock_data_all['Volume']

print('\n\nThe Sentiment Scores Concatenated with the Stock Price Data
BAC_Sentiment_Scores = BAC_Sentiment_Scores.dropna()
BAC_Sentiment_Scores
```

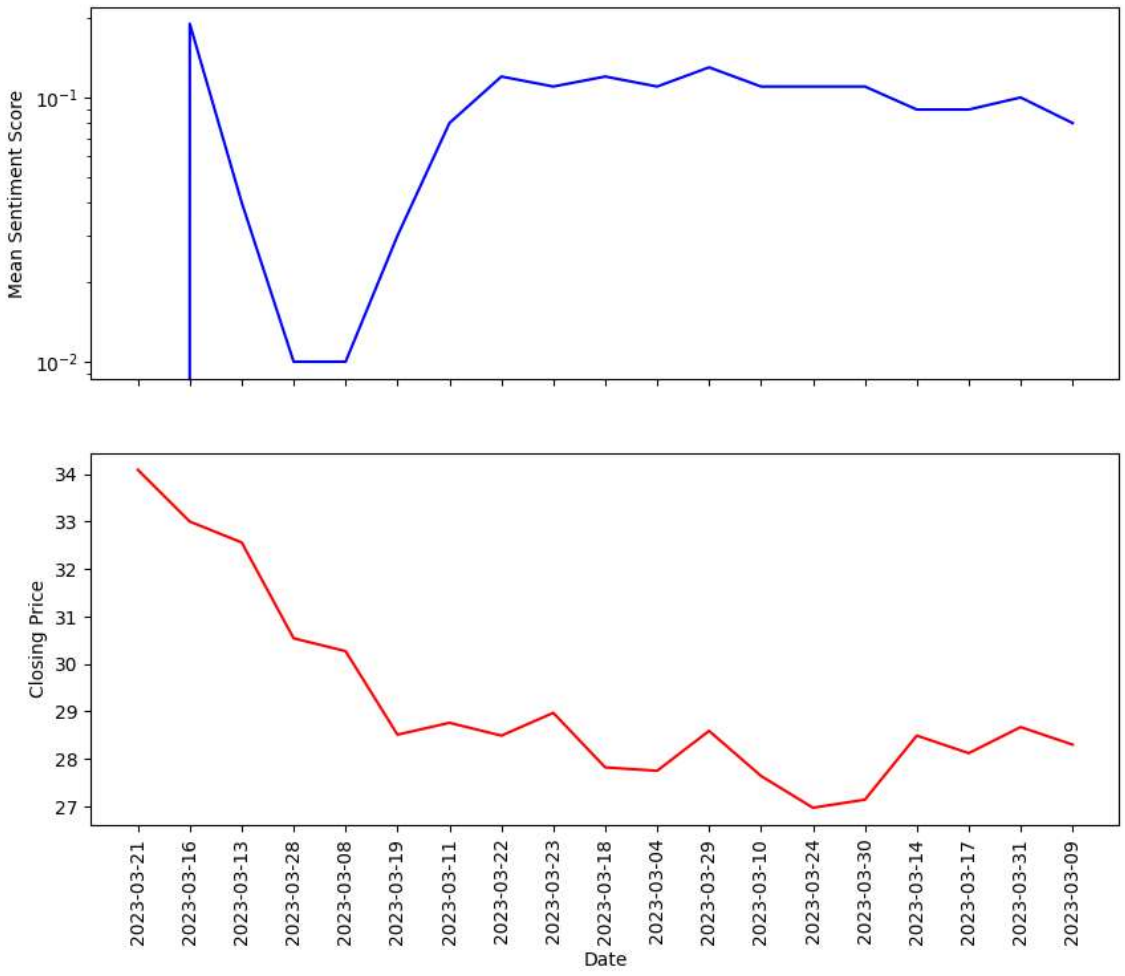
```
The Sentiment Scores Concatenated with the Stock Price Data for Bank of A
merica
```

Out[271]:

	Date	Mean	Open	Adjclose	High	Low	Close	Volume
1	2023-03-21	-0.85	34.240002	34.090000	34.560001	33.990002	34.090000	36646700.0
2	2023-03-16	0.19	33.849998	33.000000	33.900002	32.799999	33.000000	52855300.0
3	2023-03-13	0.04	32.660000	32.560001	32.970001	32.439999	32.560001	40045600.0
4	2023-03-28	0.01	32.279999	30.540001	32.389999	30.309999	30.540001	112457900.0
5	2023-03-08	0.01	30.320000	30.270000	31.040001	28.920000	30.270000	165330900.0
6	2023-03-19	0.03	28.920000	28.510000	29.719999	27.870001	28.510000	218403300.0
7	2023-03-11	0.08	29.990000	28.760000	30.090000	28.469999	28.760000	154255800.0
8	2023-03-22	0.12	27.879999	28.490000	28.559999	27.680000	28.490000	131104400.0
9	2023-03-23	0.11	28.379999	28.969999	29.469999	28.110001	28.969999	108348800.0
10	2023-03-18	0.12	28.660000	27.820000	28.660000	27.620001	27.820000	130665500.0
11	2023-03-04	0.11	28.240000	27.750000	28.430000	27.650000	27.750000	81441200.0
12	2023-03-29	0.13	28.629999	28.590000	28.980000	28.510000	28.590000	84854800.0
13	2023-03-10	0.11	28.709999	27.639999	28.740000	27.639999	27.639999	76925900.0
14	2023-03-24	0.11	28.000000	26.969999	28.090000	26.790001	26.969999	105335900.0
15	2023-03-30	0.11	26.600000	27.139999	27.290001	26.320000	27.139999	96872700.0
16	2023-03-14	0.09	27.930000	28.490000	28.650000	27.910000	28.490000	102469800.0
17	2023-03-17	0.09	28.379999	28.120001	28.650000	27.980000	28.120001	63416500.0
18	2023-03-31	0.10	28.490000	28.670000	28.770000	28.240000	28.670000	62666400.0
19	2023-03-09	0.08	28.920000	28.299999	29.059999	28.110001	28.299999	67427100.0

In [272]:

```
import matplotlib.pyplot as plt

fig, (ax1, ax2) = plt.subplots(2, 1, sharex=True, figsize=(10, 8))

ax1.plot(BAC_Sentiment_Scores['Date'], BAC_Sentiment_Scores['Mean'], c
ax1.set_yscale('log')
ax1.set_ylabel('Mean Sentiment Score')

ax2.plot(BAC_Sentiment_Scores['Date'], BAC_Sentiment_Scores['Adjclose'
ax2.set_ylabel('Closing Price')

plt.xlabel('Date')

plt.xticks(rotation='vertical')

plt.show()

```



For Best Buy Co., Inc Ticker

In [273]:

```
# for Stock Price Estimation and News related to Apple, limiting the c
c_name = ['Best Buy Co., Inc']
print('\nThe news data available for Best Buy for 30 days, and consoli
```

```
The news data available for Best Buy for 30 days, and consolidated by new
s per company is 26 in number
```

In [274]:

```
# Sentiment Scores for every day data within the directory - 'Best Buy

BBY_Sentiment_Scores = pd.DataFrame()
for i in c_name:
  BBY_Sentiment_Scores = BBY_Sentiment_Scores.append(myread_csv(i))
BBY_Sentiment_Scores = BBY_Sentiment_Scores.reset_index(drop=True)
BBY_Sentiment_Scores.index = BBY_Sentiment_Scores.index + 1

print('\n\nHere are the Mean Sentiment Polarity Scores for News with r
BBY_Sentiment_Scores
```

```
For the following data:
 0    HKTDC Twin Jewellery Shows Attract Exhibitors ...
1    SanctuaryA woman, an elephant, and their uncom...
0    Roku and Best Buy Help Create Better TV Experi...
1    More than $70 billion is wiped off crypto mark...
Name: Concat, dtype: object

Sample values of Polarity Scores:
      neg    neu    pos  compound
0  0.000  0.883  0.117    0.5994
1  0.000  0.756  0.244    0.6369
2  0.000  0.691  0.309    0.9081
3  0.163  0.837  0.000   -0.7783


Here are the Mean Sentiment Polarity Scores for News with respect to Best
Buy
```

Out[274]:

	Date	Mean
1	2023-03-05	0.62
2	2023-03-10	0.34
3	2023-03-04	0.28
4	2023-03-06	0.35
5	2023-03-11	0.42
6	2023-03-12	0.44
7	2023-03-30	0.48
8	2023-04-01	0.44
9	2023-03-14	0.42
10	2023-03-17	0.39
11	2023-03-23	0.36
12	2023-04-03	0.38
13	2023-03-24	0.36
14	2023-03-08	0.39
15	2023-03-15	0.39
16	2023-03-20	0.38
17	2023-03-29	0.40
18	2023-03-22	0.40
19	2023-03-09	0.38
20	2023-03-13	0.39
21	2023-03-07	0.39
22	2023-03-21	0.39
23	2023-03-18	0.39
24	2023-03-31	0.39
25	2023-03-16	0.39
26	2023-03-27	0.40

In [275]:
```
# importing stock price data from yahoo finance
from yahoo_fin import stock_info as si
import yfinance as yf
import pandas as pd
import os
import matplotlib.pyplot as plt
from datetime import date, timedelta, datetime

# taking the start and end dates as per the news data
start_date = min(BBY_Sentiment_Scores['Date'])
end_date = max(BBY_Sentiment_Scores['Date'])

# getting the stock price data for Apple
ticker = "BBY"
stock_data_all = si.get_data(ticker, start_date=start_date, end_date=e
```

In [276]:
```
# resetting index
stock_data_all = stock_data_all.reset_index()
stock_data_all.index = stock_data_all.index + 1
stock_data_all
```

Out[276]:

	index	open	high	low	close	adjclose	volume	ticker
1	2023-03-06	83.800003	84.309998	82.120003	82.300003	81.326416	2503700	BBY
2	2023-03-07	82.900002	83.580002	82.059998	82.260002	81.286888	1889400	BBY
3	2023-03-08	82.129997	82.260002	79.820000	81.150002	80.190018	2018500	BBY
4	2023-03-09	81.370003	81.580002	78.889999	79.000000	78.065453	2051400	BBY
5	2023-03-10	78.919998	79.639999	77.690002	78.610001	77.680069	2172200	BBY
6	2023-03-13	76.809998	77.480003	75.669998	75.769997	74.873657	3794700	BBY
7	2023-03-14	76.769997	76.879997	74.050003	74.839996	73.954659	3326700	BBY
8	2023-03-15	73.489998	75.570000	73.209999	75.550003	74.656265	3135300	BBY
9	2023-03-16	74.709999	77.349998	74.599998	77.089996	76.178040	2949800	BBY
10	2023-03-17	77.050003	77.279999	75.459999	76.730003	75.822311	7806000	BBY
11	2023-03-20	76.879997	78.730003	76.690002	78.129997	77.205742	3113100	BBY
12	2023-03-21	79.110001	79.480003	77.339996	77.769997	76.849998	3634100	BBY
13	2023-03-22	77.349998	77.989998	75.900002	75.940002	75.940002	2522200	BBY
14	2023-03-23	76.000000	76.660004	73.940002	74.589996	74.589996	2161000	BBY
15	2023-03-24	74.279999	74.930000	73.889999	74.320000	74.320000	1604000	BBY
16	2023-03-27	74.720001	75.010002	73.440002	73.849998	73.849998	2021900	BBY
17	2023-03-28	73.250000	74.720001	73.150002	73.320000	73.320000	2022300	BBY
18	2023-03-29	73.779999	74.889999	72.750000	74.860001	74.860001	2027000	BBY
19	2023-03-30	75.500000	75.769997	74.660004	75.320000	75.320000	1588300	BBY
20	2023-03-31	75.839996	78.379997	75.720001	78.269997	78.269997	2621800	BBY

In [277]:

```
# resetting column names and date format
new_column = {'index':'Date', 'open':'Open','high':'High', 'low':'Low'
stock_data_all = stock_data_all.rename(columns=new_column)
import datetime
for i in stock_data_all['Date']:
  date_obj = i
  date_str = date_obj.strftime('%Y-%m-%d')
  stock_data_all['Date'] = date_str
```

In [278]:

```
for i in BBY_Sentiment_Scores['Date']:
  for j in stock_data_all['Date']:
    # print(i,j)
    if i == str(j):
      BBY_Sentiment_Scores['Open'] = stock_data_all['Open']
      BBY_Sentiment_Scores['Adjclose'] = stock_data_all['Adjclose']
      BBY_Sentiment_Scores['High'] = stock_data_all['High']
      BBY_Sentiment_Scores['Low'] = stock_data_all['Low']
      BBY_Sentiment_Scores['Close'] = stock_data_all['Close']
      BBY_Sentiment_Scores['Volume'] = stock_data_all['Volume']

print('\n\nThe Sentiment Scores Concatenated with the Stock Price Data
BBY_Sentiment_Scores = BBY_Sentiment_Scores.dropna()
BBY_Sentiment_Scores
```

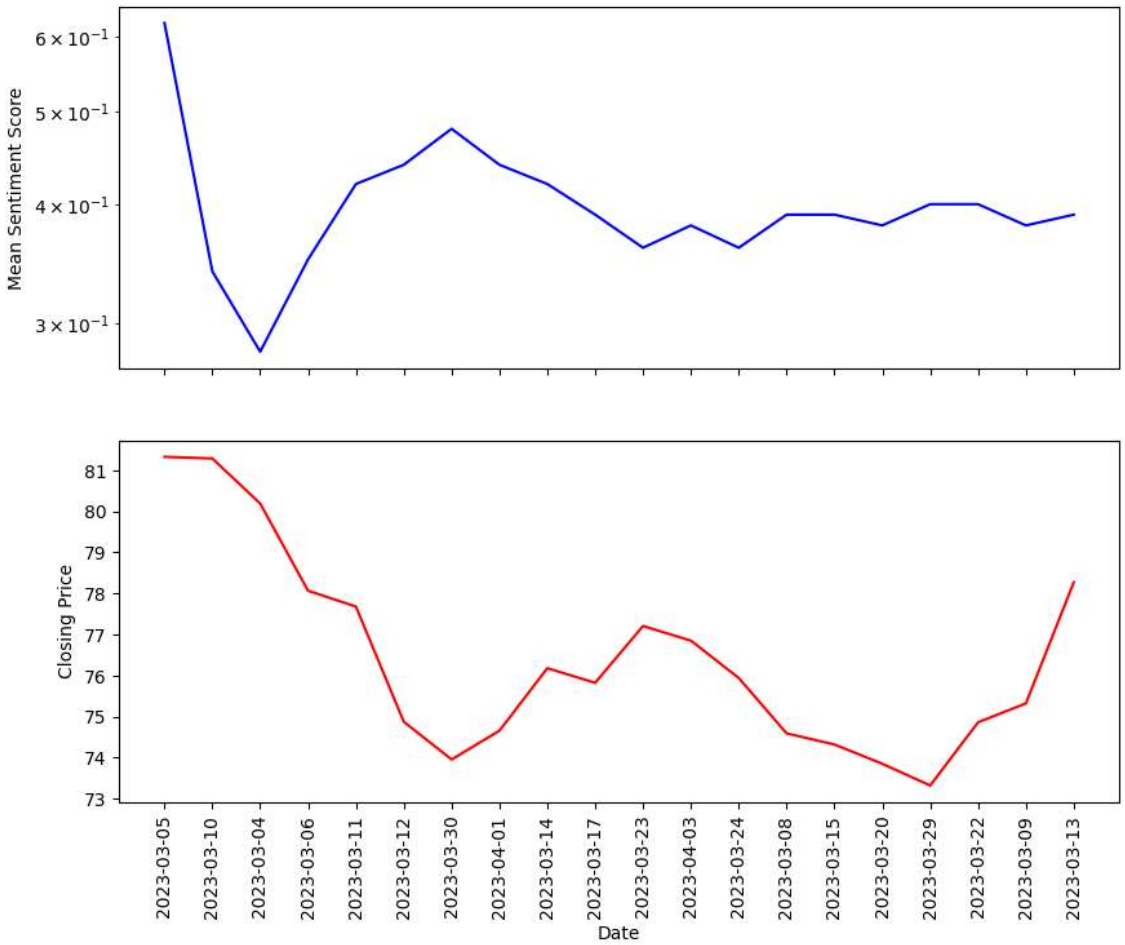
```
The Sentiment Scores Concatenated with the Stock Price Data for Best Buy
```

Out[278]:

	Date	Mean	Open	Adjclose	High	Low	Close	Volume
1	2023-03-05	0.62	83.800003	81.326416	84.309998	82.120003	82.300003	2503700.0
2	2023-03-10	0.34	82.900002	81.286888	83.580002	82.059998	82.260002	1889400.0
3	2023-03-04	0.28	82.129997	80.190018	82.260002	79.820000	81.150002	2018500.0
4	2023-03-06	0.35	81.370003	78.065453	81.580002	78.889999	79.000000	2051400.0
5	2023-03-11	0.42	78.919998	77.680069	79.639999	77.690002	78.610001	2172200.0
6	2023-03-12	0.44	76.809998	74.873657	77.480003	75.669998	75.769997	3794700.0
7	2023-03-30	0.48	76.769997	73.954659	76.879997	74.050003	74.839996	3326700.0
8	2023-04-01	0.44	73.489998	74.656265	75.570000	73.209999	75.550003	3135300.0
9	2023-03-14	0.42	74.709999	76.178040	77.349998	74.599998	77.089996	2949800.0
10	2023-03-17	0.39	77.050003	75.822311	77.279999	75.459999	76.730003	7806000.0
11	2023-03-23	0.36	76.879997	77.205742	78.730003	76.690002	78.129997	3113100.0
12	2023-04-03	0.38	79.110001	76.849998	79.480003	77.339996	77.769997	3634100.0
13	2023-03-24	0.36	77.349998	75.940002	77.989998	75.900002	75.940002	2522200.0
14	2023-03-08	0.39	76.000000	74.589996	76.660004	73.940002	74.589996	2161000.0
15	2023-03-15	0.39	74.279999	74.320000	74.930000	73.889999	74.320000	1604000.0
16	2023-03-20	0.38	74.720001	73.849998	75.010002	73.440002	73.849998	2021900.0
17	2023-03-29	0.40	73.250000	73.320000	74.720001	73.150002	73.320000	2022300.0
18	2023-03-22	0.40	73.779999	74.860001	74.889999	72.750000	74.860001	2027000.0
19	2023-03-09	0.38	75.500000	75.320000	75.769997	74.660004	75.320000	1588300.0
20	2023-03-13	0.39	75.839996	78.269997	78.379997	75.720001	78.269997	2621800.0

In [279]:

```
import matplotlib.pyplot as plt

fig, (ax1, ax2) = plt.subplots(2, 1, sharex=True, figsize=(10, 8))

ax1.plot(BBY_Sentiment_Scores['Date'], BBY_Sentiment_Scores['Mean'], c
ax1.set_yscale('log')
ax1.set_ylabel('Mean Sentiment Score')

ax2.plot(BBY_Sentiment_Scores['Date'], BBY_Sentiment_Scores['Adjclose'
ax2.set_ylabel('Closing Price')

plt.xlabel('Date')

plt.xticks(rotation='vertical')

plt.show()
```



For The Boeing Company Ticker

In [280]:

```
c_name = ['Amazon.com, Inc']
print('\nThe news data available for The Boeing Company for 30 days, a
```

```
The news data available for The Boeing Company for 30 days, and consolida
ted by news per day is 28 in number
```

In [281]:

```
# Sentiment Scores for every day data within the directory - 'The Boei

BA_Sentiment_Scores = pd.DataFrame()
for i in c_name:
  BA_Sentiment_Scores = BA_Sentiment_Scores.append(myread_csv(i))
BA_Sentiment_Scores = BA_Sentiment_Scores.reset_index(drop=True)
BA_Sentiment_Scores.index = BA_Sentiment_Scores.index + 1

print('\n\nHere are the Mean Sentiment Polarity Scores for News with r
BA_Sentiment_Scores
```

```
For the following data:
 0    AI Stocks To Watch In 2023Put eyes on these AI...
1    Else Nutrition Reports an 82% increase in Fisc...
0    ICT Investment In Government Global Market Rep...
1    Laird Superfood, Inc. (AMEX:LSF) Q4 2022 Earni...
2    Amazon class action lawsuit goes after company...
Name: Concat, dtype: object

Sample values of Polarity Scores:
      neg    neu    pos  compound
0  0.000  1.000  0.000    0.0000
1  0.000  0.938  0.062    0.3182
2  0.000  0.796  0.204    0.7717
3  0.000  0.849  0.151    0.6705
4  0.059  0.836  0.105    0.1280


Here are the Mean Sentiment Polarity Scores for News with respect to The
Boeing Company
```

Out[281]:

	Date	Mean
1	2023-03-31	0.16
2	2023-03-17	0.38
3	2023-03-14	0.53
4	2023-03-16	0.50
5	2023-03-07	0.42
6	2023-03-30	0.25
7	2023-03-18	0.26
8	2023-03-06	0.31
9	2023-03-13	0.34
10	2023-03-28	0.34
11	2023-03-10	0.33
12	2023-03-11	0.34
13	2023-03-29	0.34
14	2023-03-04	0.35
15	2023-03-24	0.32
16	2023-03-15	0.33
17	2023-03-20	0.26
18	2023-03-09	0.28
19	2023-04-03	0.26
20	2023-03-22	0.27
21	2023-03-23	0.29
22	2023-03-08	0.28
23	2023-03-21	0.29
24	2023-03-27	0.27

In [282]:

```
# importing stock price data from yahoo finance
from yahoo_fin import stock_info as si
import yfinance as yf
import pandas as pd
import os
import matplotlib.pyplot as plt
from datetime import date, timedelta, datetime

# taking the start and end dates as per the news data
start_date = min(BA_Sentiment_Scores['Date'])
end_date = max(BA_Sentiment_Scores['Date'])

# getting the stock price data for The Boeing Company
ticker = "BA"
stock_data_all = si.get_data(ticker, start_date=start_date, end_date=e
```

In [283]:
```
# resetting index
stock_data_all = stock_data_all.reset_index()
stock_data_all.index = stock_data_all.index + 1
stock_data_all
```

Out[283]:

	index	open	high	low	close	adjclose	volume	ticker
1	2023-03-06	214.119995	214.750000	209.600006	211.919998	211.919998	7004400	BA
2	2023-03-07	211.309998	213.179993	207.779999	207.919998	207.919998	4619700	BA
3	2023-03-08	208.250000	208.880005	205.940002	207.199997	207.199997	2406900	BA
4	2023-03-09	208.320007	209.020004	200.300003	201.240005	201.240005	4284000	BA
5	2023-03-10	201.429993	205.000000	197.789993	203.070007	203.070007	8547100	BA
6	2023-03-13	200.199997	207.080002	197.110001	203.369995	203.369995	6671200	BA
7	2023-03-14	207.529999	213.559998	205.000000	207.279999	207.279999	8245700	BA
8	2023-03-15	201.919998	202.210007	192.410004	198.210007	198.210007	10894200	BA
9	2023-03-16	196.210007	203.910004	194.429993	203.190002	203.190002	6747300	BA
10	2023-03-17	201.350006	202.830002	199.000000	201.050003	201.050003	9858900	BA
11	2023-03-20	201.119995	205.869995	200.869995	204.770004	204.770004	4764000	BA
12	2023-03-21	207.300003	207.860001	203.889999	204.699997	204.699997	4673300	BA
13	2023-03-22	203.679993	203.830002	196.009995	196.160004	196.160004	7311600	BA
14	2023-03-23	197.899994	201.500000	195.139999	197.899994	197.899994	6266900	BA
15	2023-03-24	195.500000	197.570007	193.919998	197.529999	197.529999	4511600	BA
16	2023-03-27	198.630005	201.550003	198.630005	200.570007	200.570007	3891700	BA
17	2023-03-28	200.820007	206.300003	200.490005	204.960007	204.960007	5460600	BA
18	2023-03-29	206.500000	208.649994	205.880005	207.970001	207.970001	3572200	BA
19	2023-03-30	208.970001	212.869995	206.520004	211.039993	211.039993	6583400	BA
20	2023-03-31	211.750000	214.800003	211.389999	212.429993	212.429993	5147500	BA

In [284]:

```
# resetting column names and date format
new_column = {'index':'Date', 'open':'Open','high':'High', 'low':'Low'
stock_data_all = stock_data_all.rename(columns=new_column)
import datetime
for i in stock_data_all['Date']:
  date_obj = i
  date_str = date_obj.strftime('%Y-%m-%d')
  stock_data_all['Date'] = date_str
```

In [285]:

```
for i in BA_Sentiment_Scores['Date']:
  for j in stock_data_all['Date']:
    # print(i,j)
    if i == str(j):
      BA_Sentiment_Scores['Open'] = stock_data_all['Open']
      BA_Sentiment_Scores['Adjclose'] = stock_data_all['Adjclose']
      BA_Sentiment_Scores['High'] = stock_data_all['High']
      BA_Sentiment_Scores['Low'] = stock_data_all['Low']
      BA_Sentiment_Scores['Close'] = stock_data_all['Close']
      BA_Sentiment_Scores['Volume'] = stock_data_all['Volume']

print('\n\nThe Sentiment Scores Concatenated with the Stock Price Data
BA_Sentiment_Scores = BA_Sentiment_Scores.dropna()
BA_Sentiment_Scores
```

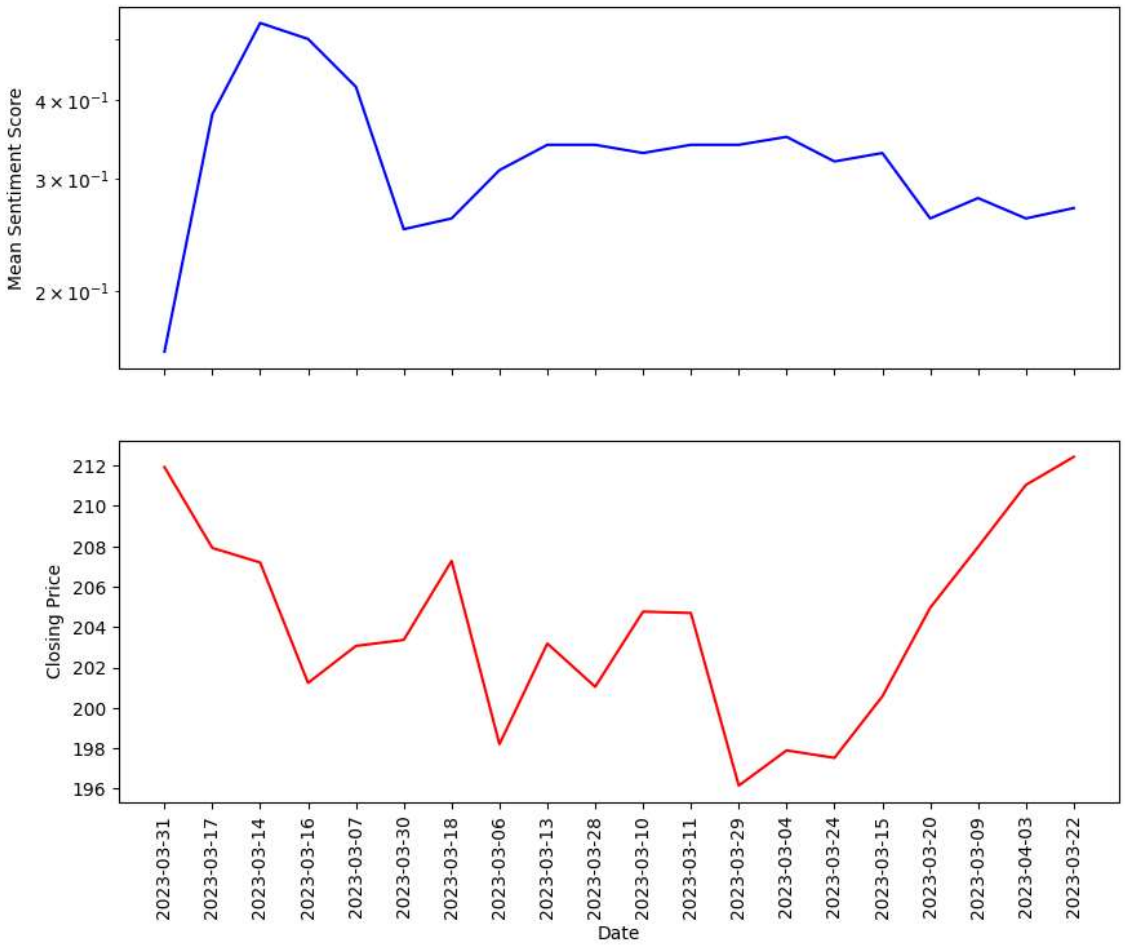
```
The Sentiment Scores Concatenated with the Stock Price Data for The Boein
g Company
```

Out[285]:

	Date	Mean	Open	Adjclose	High	Low	Close	Volume
1	2023-03-31	0.16	214.119995	211.919998	214.750000	209.600006	211.919998	7004400.0
2	2023-03-17	0.38	211.309998	207.919998	213.179993	207.779999	207.919998	4619700.0
3	2023-03-14	0.53	208.250000	207.199997	208.880005	205.940002	207.199997	2406900.0
4	2023-03-16	0.50	208.320007	201.240005	209.020004	200.300003	201.240005	4284000.0
5	2023-03-07	0.42	201.429993	203.070007	205.000000	197.789993	203.070007	8547100.0
6	2023-03-30	0.25	200.199997	203.369995	207.080002	197.110001	203.369995	6671200.0
7	2023-03-18	0.26	207.529999	207.279999	213.559998	205.000000	207.279999	8245700.0
8	2023-03-06	0.31	201.919998	198.210007	202.210007	192.410004	198.210007	10894200.0
9	2023-03-13	0.34	196.210007	203.190002	203.910004	194.429993	203.190002	6747300.0
10	2023-03-28	0.34	201.350006	201.050003	202.830002	199.000000	201.050003	9858900.0
11	2023-03-10	0.33	201.119995	204.770004	205.869995	200.869995	204.770004	4764000.0
12	2023-03-11	0.34	207.300003	204.699997	207.860001	203.889999	204.699997	4673300.0
13	2023-03-29	0.34	203.679993	196.160004	203.830002	196.009995	196.160004	7311600.0
14	2023-03-04	0.35	197.899994	197.899994	201.500000	195.139999	197.899994	6266900.0
15	2023-03-24	0.32	195.500000	197.529999	197.570007	193.919998	197.529999	4511600.0
16	2023-03-15	0.33	198.630005	200.570007	201.550003	198.630005	200.570007	3891700.0
17	2023-03-20	0.26	200.820007	204.960007	206.300003	200.490005	204.960007	5460600.0
18	2023-03-09	0.28	206.500000	207.970001	208.649994	205.880005	207.970001	3572200.0
19	2023-04-03	0.26	208.970001	211.039993	212.869995	206.520004	211.039993	6583400.0
20	2023-03-22	0.27	211.750000	212.429993	214.800003	211.389999	212.429993	5147500.0

In [286]:

```
import matplotlib.pyplot as plt

fig, (ax1, ax2) = plt.subplots(2, 1, sharex=True, figsize=(10, 8))

ax1.plot(BA_Sentiment_Scores['Date'], BA_Sentiment_Scores['Mean'], col
ax1.set_yscale('log')
ax1.set_ylabel('Mean Sentiment Score')

ax2.plot(BA_Sentiment_Scores['Date'], BA_Sentiment_Scores['Adjclose'],
ax2.set_ylabel('Closing Price')

plt.xlabel('Date')

plt.xticks(rotation='vertical')

plt.show()
```



Using these three company news and stock price data, let us now create a classification algorithm based on the obtained Sentiment Scores and their respective opening and closing prices.

The aim of the classification model is to predict that given the Sentiment Score and the Opening Value, if we can predict the stock price to close at higher (bullish) or lower (bearish) value.

In [307]:
```
# to concatenate all the three dataframes into one and preprocess it

df = pd.concat([AAPL_Sentiment_Scores, AMZN_Sentiment_Scores, BAC_Sent
```

In [308]:
```
df.shape
```

Out[308]: (99, 8)

To convert this dataframe suitable for running classification models, converting the Adjclose column to target based on the difference in the opening and closing price and dropping the close column

In [309]:
```
df['Difference'] = df['Adjclose'] - df['Open'] # Shows the difference
# df['Output'] = df['Difference'].apply(lambda x: 'Positive' if x > 0
df['Volatility'] = df['High'] - df['Low'] # Shows the voltatility of t
df['Max_Peak_of_the_day'] = df['High'] - df['Open'] # Shows the differ
df['Max_Dip_of_the_day'] = df['Open'] - df['Low'] # Shows the differen
df.head()
```

Out[309]:

	Date	Mean	Open	Adjclose	High	Low	Close	Volume	Di
1	2023-03-11	0.66	153.789993	153.830002	156.300003	153.460007	153.830002	87558000.0	(
2	2023-03-29	0.23	153.699997	151.600006	154.029999	151.130005	151.600006	56182000.0	-2
3	2023-03-27	0.18	152.809998	152.869995	153.470001	151.830002	152.869995	47204800.0	(
4	2023-03-25	0.20	153.559998	150.589996	154.539993	150.229996	150.589996	53833600.0	-2
5	2023-03-17	0.22	150.210007	148.500000	150.940002	147.610001	148.500000	68572400.0	-1

In [310]:
```
df = df.drop(['Adjclose','Close','Date'], axis = 1)
```

In [311]:
```
df.head()
```

Out[311]:

	Mean	Open	High	Low	Volume	Difference	Volatility	Max_Peak_o
1	0.66	153.789993	156.300003	153.460007	87558000.0	0.040009	2.839996	
2	0.23	153.699997	154.029999	151.130005	56182000.0	-2.099991	2.899994	
3	0.18	152.809998	153.470001	151.830002	47204800.0	0.059998	1.639999	
4	0.20	153.559998	154.539993	150.229996	53833600.0	-2.970001	4.309998	
5	0.22	150.210007	150.940002	147.610001	68572400.0	-1.710007	3.330002	

In [312]:
```
1 df.isna().sum()
```

Out[312]:
```
Mean                0
Open                0
High                0
Low                 0
Volume              0
Difference          0
Volatility          0
Max_Peak_of_the_day 0
Max_Dip_of_the_day  0
dtype: int64
```

In [313]:
```
1  from sklearn.preprocessing import MinMaxScaler
2  import pandas as pd
3
4  scaler = MinMaxScaler()
5  volume = df['Volume'].values.reshape(-1, 1)
6  normalized_volume = scaler.fit_transform(volume)
7
8  df['Normalized_Volume'] = normalized_volume
9
10 df.head()
```

Out[313]:

	Mean	Open	High	Low	Volume	Difference	Volatility	Max_Peak_o
1	0.66	153.789993	156.300003	153.460007	87558000.0	0.040009	2.839996	
2	0.23	153.699997	154.029999	151.130005	56182000.0	-2.099991	2.899994	
3	0.18	152.809998	153.470001	151.830002	47204800.0	0.059998	1.639999	
4	0.20	153.559998	154.539993	150.229996	53833600.0	-2.970001	4.309998	
5	0.22	150.210007	150.940002	147.610001	68572400.0	-1.710007	3.330002	

In [314]:
```
1 df = df.drop('Volume', axis = 1)
```

In [315]:
```
1  from sklearn.cluster import KMeans
2  import pandas as pd
3
4  kmeans = KMeans(n_clusters=5, random_state=42)
5
6  kmeans.fit(df)
7
8  labels = kmeans.labels_
9
10 data_with_clusters = df.copy()
11 data_with_clusters['Cluster'] = labels
```

In [316]:
```
1 data_with_clusters
```

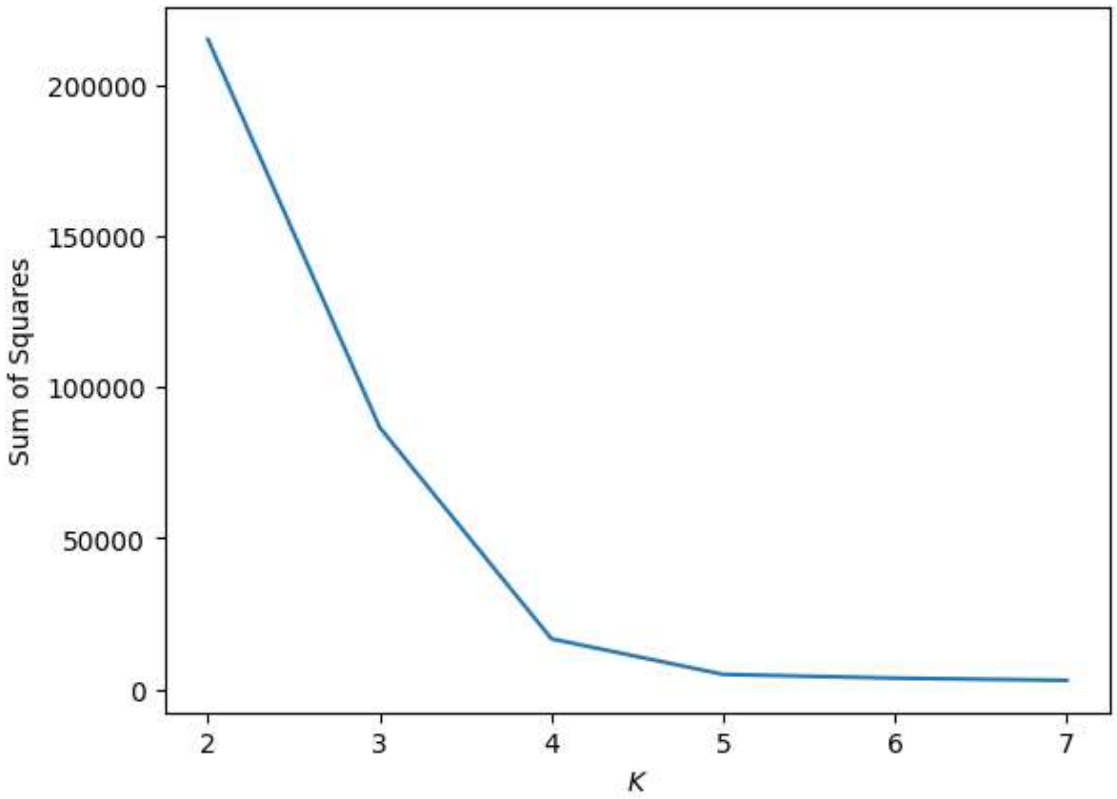
Out[316]:

	Mean	Open	High	Low	Difference	Volatility	Max_Peak_of_the_day
1	0.66	153.789993	156.300003	153.460007	0.040009	2.839996	2.510010
2	0.23	153.699997	154.029999	151.130005	-2.099991	2.899994	0.330002
3	0.18	152.809998	153.470001	151.830002	0.059998	1.639999	0.660004
4	0.20	153.559998	154.539993	150.229996	-2.970001	4.309998	0.979996
5	0.22	150.210007	150.940002	147.610001	-1.710007	3.330002	0.729996
...	...	...	...	...	...	...	...
16	0.33	198.630005	201.550003	198.630005	1.940002	2.919998	2.919998
17	0.26	200.820007	206.300003	200.490005	4.139999	5.809998	5.479996
18	0.28	206.500000	208.649994	205.880005	1.470001	2.769989	2.149994
19	0.26	208.970001	212.869995	206.520004	2.069992	6.349991	3.899994
20	0.27	211.750000	214.800003	211.389999	0.679993	3.410004	3.050003

99 rows × 10 columns

In [317]:

```
from sklearn import cluster
import numpy as np

sse = []
krange = list(range(2,8))
X = df.values
for n in krange:
    model = cluster.KMeans(n_clusters=n, random_state=3)
    model.fit_predict(X)
    cluster_assignments = model.labels_
    centers = model.cluster_centers_
    sse.append(np.sum((X - centers[cluster_assignments]) ** 2))

plt.plot(krange, sse)
plt.xlabel("$K$")
plt.ylabel("Sum of Squares")
plt.show()
```



In [318]:
```
kmeans = KMeans(n_clusters=4).fit(df)

data_with_clusters['Cluster'] = kmeans.labels_

data_with_clusters
```

Out[318]:

	Mean	Open	High	Low	Difference	Volatility	Max_Peak_of_the_day
1	0.66	153.789993	156.300003	153.460007	0.040009	2.839996	2.510010
2	0.23	153.699997	154.029999	151.130005	-2.099991	2.899994	0.330002
3	0.18	152.809998	153.470001	151.830002	0.059998	1.639999	0.660004
4	0.20	153.559998	154.539993	150.229996	-2.970001	4.309998	0.979996
5	0.22	150.210007	150.940002	147.610001	-1.710007	3.330002	0.729996
...	...	...	...	...	...	...	...
16	0.33	198.630005	201.550003	198.630005	1.940002	2.919998	2.919998
17	0.26	200.820007	206.300003	200.490005	4.139999	5.809998	5.479996
18	0.28	206.500000	208.649994	205.880005	1.470001	2.769989	2.149994
19	0.26	208.970001	212.869995	206.520004	2.069992	6.349991	3.899994
20	0.27	211.750000	214.800003	211.389999	0.679993	3.410004	3.050003

99 rows × 10 columns

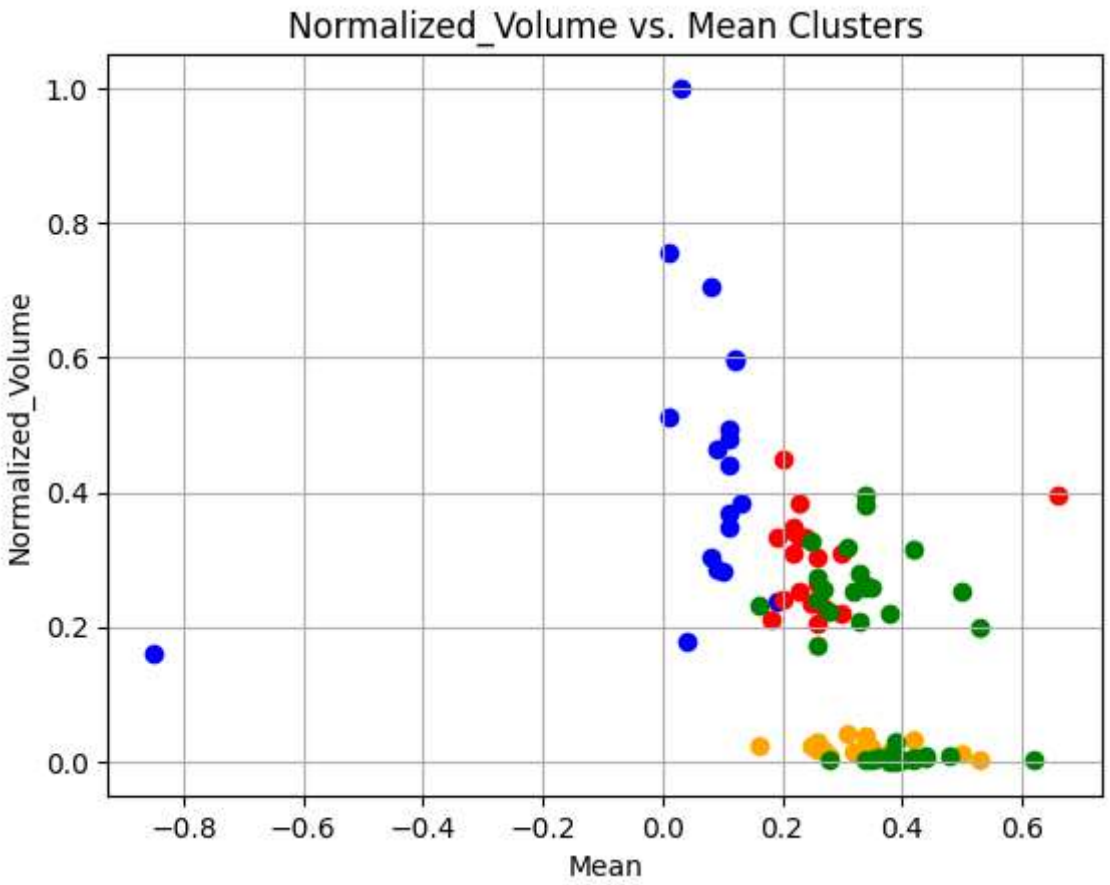
In [325]:
```
cluster1_metrics = kmeans.cluster_centers_[0]
cluster2_metrics = kmeans.cluster_centers_[1]
cluster3_metrics = kmeans.cluster_centers_[2]
cluster4_metrics = kmeans.cluster_centers_[3]

data = [cluster1_metrics, cluster2_metrics, cluster3_metrics, cluster4
cluster_center_df = pd.DataFrame(data)

cluster_center_df.columns = data_with_clusters.columns[:-1]
cluster_center_df
```

Out[325]:

	Mean	Open	High	Low	Difference	Volatility	Max_Peak_of_the_day
0	0.041579	29.530526	29.895790	28.808421	-0.336842	1.087369	0.365264
1	0.257000	155.661001	157.565001	154.415500	0.435999	3.149501	1.904000
2	0.328500	204.140500	207.061001	201.105000	-0.016499	5.956001	2.920501
3	0.364500	87.037500	88.275250	85.759250	-0.289013	2.516000	1.237750

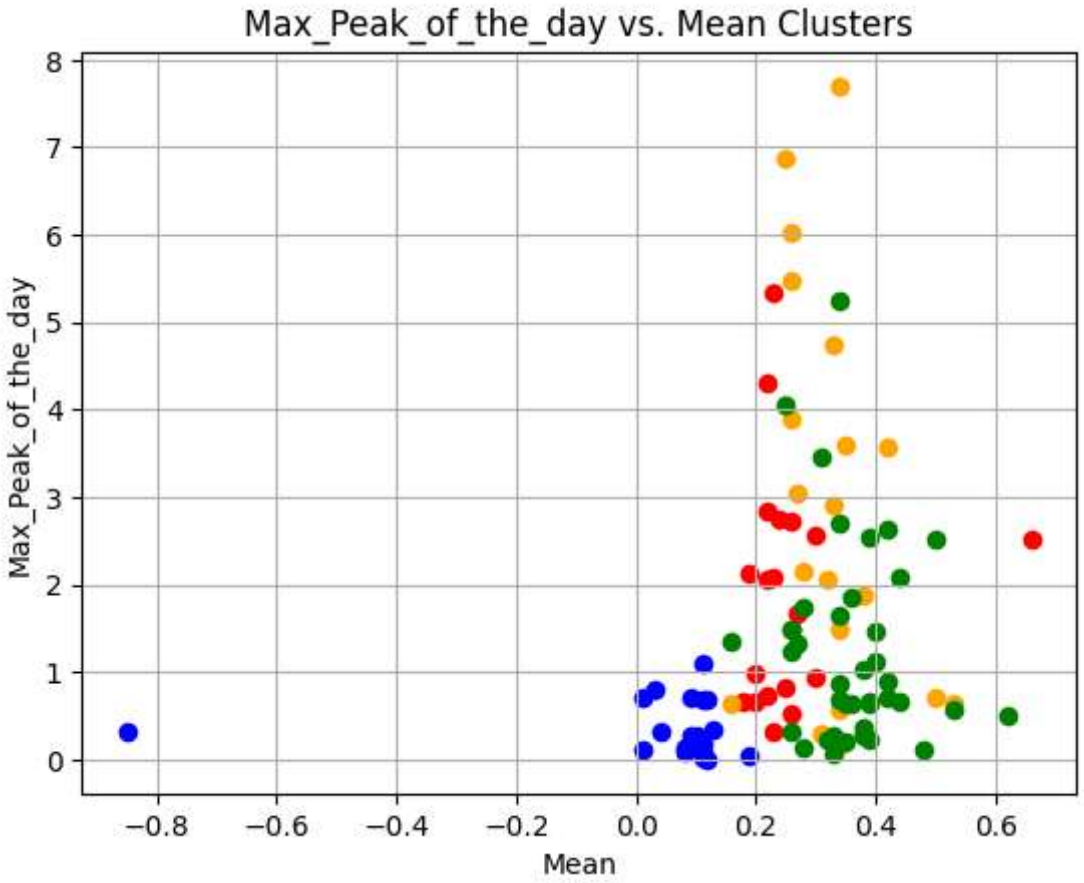
In [330]:

```
plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Normal
    c='blue')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Normal
    c='red')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Normal
    c='orange')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Normal
    c='green')


plt.title('Normalized_Volume vs. Mean Clusters')
plt.xlabel('Mean')
plt.ylabel('Normalized_Volume')

plt.grid()
plt.show()
```



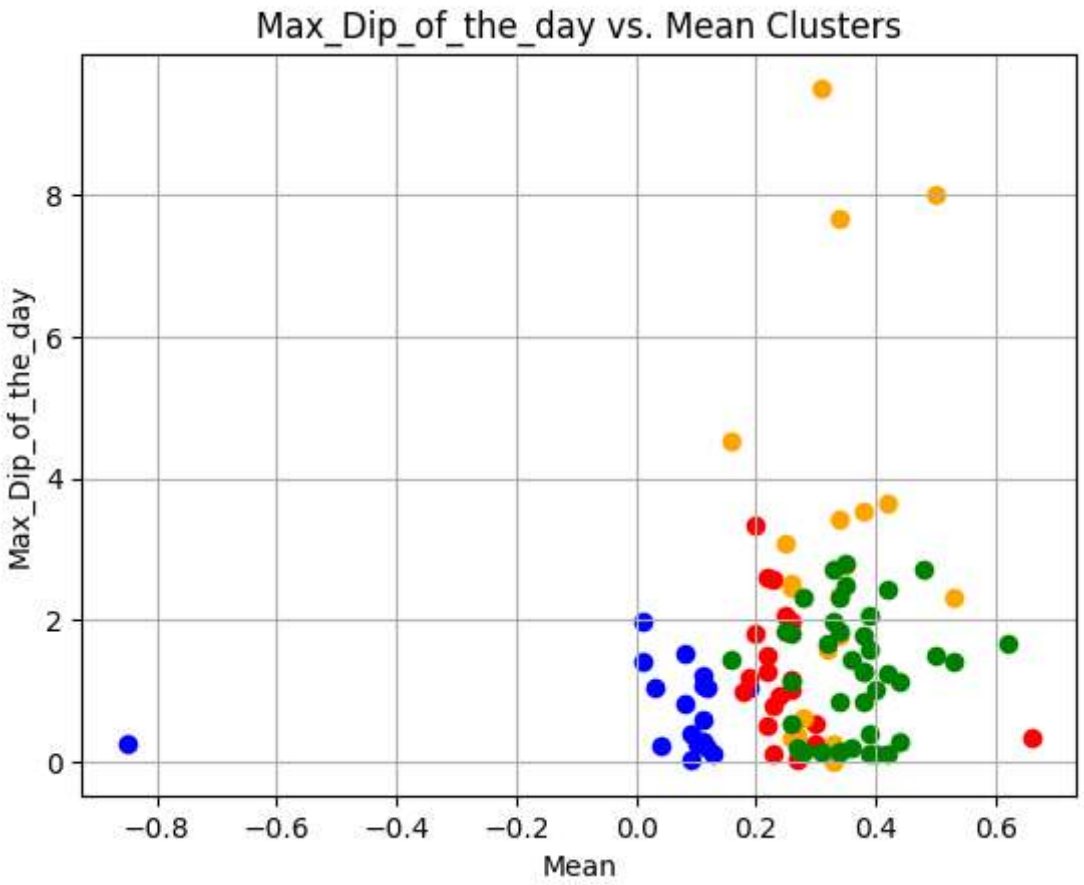
In [331]:

```
plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Max_Pe
    c='blue')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Max_Pe
    c='red')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Max_Pe
    c='orange')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Max_Pe
    c='green')


plt.title('Max_Peak_of_the_day vs. Mean Clusters')
plt.xlabel('Mean')
plt.ylabel('Max_Peak_of_the_day')

plt.grid()
plt.show()
```



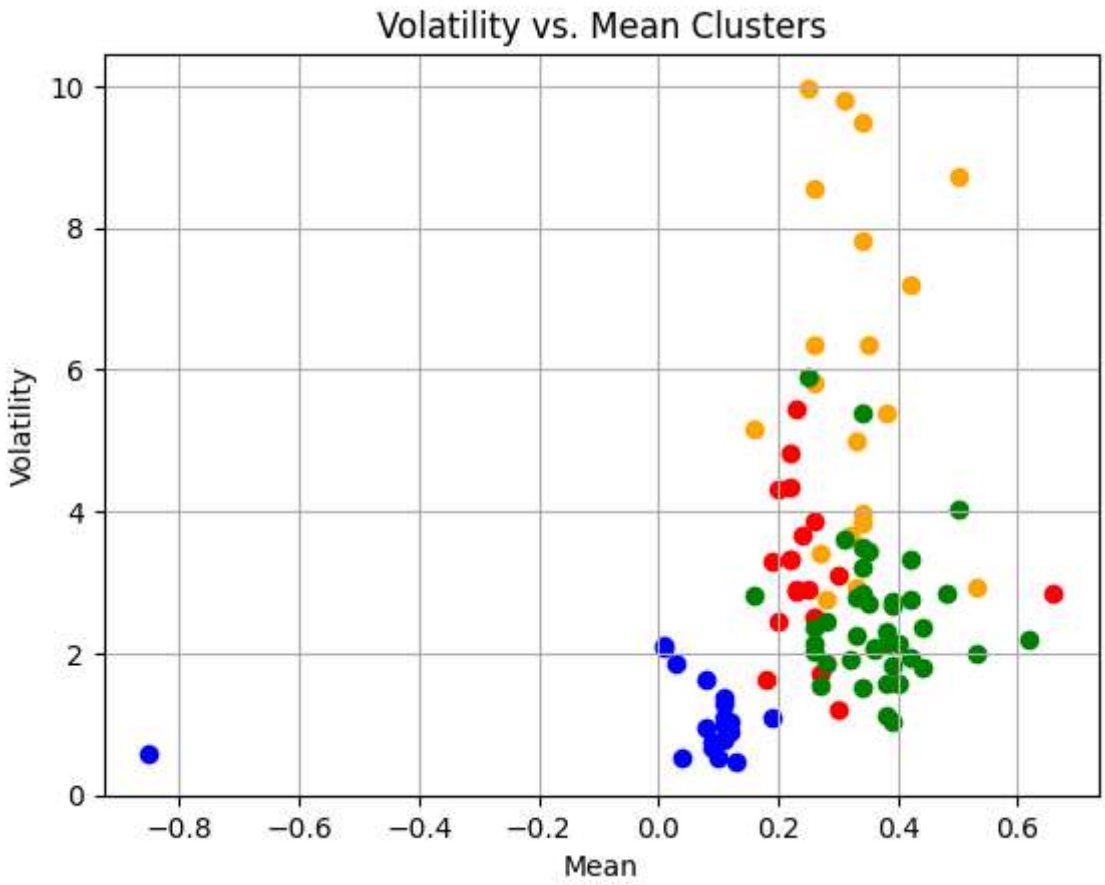
In [332]:

```
plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Max_Di
    c='blue')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Max_Di
    c='red')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Max_Di
    c='orange')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Max_Di
    c='green')


plt.title('Max_Dip_of_the_day vs. Mean Clusters')
plt.xlabel('Mean')
plt.ylabel('Max_Dip_of_the_day')

plt.grid()
plt.show()
```



In [333]:

```
plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Volati
    c='blue')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Volati
    c='red')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Volati
    c='orange')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Volati
    c='green')


plt.title('Volatility vs. Mean Clusters')
plt.xlabel('Mean')
plt.ylabel('Volatility')

plt.grid()
plt.show()
```



In [334]:

```
plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 0]['Differ
    c='blue')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 1]['Differ
    c='red')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 2]['Differ
    c='orange')

plt.scatter(
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Mean']
    data_with_clusters.loc[data_with_clusters['Cluster'] == 3]['Differ
    c='green')


plt.title('Difference vs. Mean Clusters')
plt.xlabel('Mean')
plt.ylabel('Difference')

plt.grid()
plt.show()
```