In [1]:

```
from IPython.display import HTML
HTML('''<script>
code_show_err=false;
function code_toggle_err() {
 if (code_show_err){
 $('div.output_stderr').hide();
 } else {
 $('div.output_stderr').show();
 }
 code_show_err = !code_show_err
}
$( document ).ready(code_toggle_err);
</script>
To toggle on/off output_stderr, click <a href="javascript:code_toggle_err()">here</a>.''')
```

Out[1]:

To toggle on/off output_stderr, click here.

In [2]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from scipy.stats.stats import pearsonr
from scipy.stats import linregress
%matplotlib inline

df_tweets = pd.read_excel(r'C:\Users\timod\Desktop\SPX_tweets_all.xlsx')
df_price = pd.read_csv(r'C:\Users\timod\Desktop\SPX_historical data_all.csv')
```

In [9]:

```
df_tweets.head()
```

Out[9]:

	date	text	follower_count	polarity	subjectivity
0	2020-03-27	b'Can\xe2\x80\x99t stop watching above chart.\...	12284	0.225	0.4
1	2020-03-27	b"Shamelessly asking\n\n$TSLAQ $TSLA $SPX $SPY...	777	0.000	0.0
2	2020-03-27	b'S&amp;P 500 | $SPX | $SPX500 $USD\n\ntest\n\...	1860	0.000	0.3
3	2020-03-27	b'Mark Snow - Trail Of Stolen Pebbles (The X-F...	206	0.000	0.0
4	2020-03-27	b'Variations In REIT Sectors - Time To Go Defe...	3516	0.000	0.0

In [10]:

```
df_price
```

Out[10]:

	Date	Price	Open	High	Low	Vol.	Change %
0	Mar 27, 2020	2,541.47	2,555.87	2,615.91	2,520.02	-	-3.37%
1	Mar 26, 2020	2,630.07	2,501.29	2,637.01	2,500.72	-	6.24%
2	Mar 25, 2020	2,475.56	2,457.77	2,571.42	2,407.53	-	1.15%
3	Mar 24, 2020	2,447.33	2,344.44	2,449.71	2,344.44	-	9.38%
4	Mar 23, 2020	2,237.40	2,290.71	2,300.73	2,191.86	-	-2.93%
5	Mar 20, 2020	2,304.92	2,431.94	2,453.01	2,295.56	-	-4.34%
6	Mar 19, 2020	2,409.39	2,393.48	2,466.97	2,319.78	-	0.47%

	Date	Price	Open	High	Low	Vol.	Change %
7	Mar 18, 2020	2,398.10	2,436.50	2,453.57	2,280.52	-	-5.18%
8	Mar 17, 2020	2,529.19	2,425.66	2,553.93	2,367.04	-	6.00%
9	Mar 16, 2020	2,386.13	2,508.59	2,562.98	2,380.94	-	-11.98%
10	Mar 13, 2020	2,711.02	2,569.99	2,711.33	2,492.37	-	9.29%
11	Mar 12, 2020	2,480.64	2,630.86	2,660.95	2,478.86	-	-9.51%
12	Mar 11, 2020	2,741.38	2,825.60	2,825.60	2,707.22	-	-4.89%
13	Mar 10, 2020	2,882.23	2,813.48	2,882.59	2,734.00	-	4.94%
14	Mar 09, 2020	2,746.56	2,863.89	2,863.89	2,734.43	-	-7.60%
15	Mar 06, 2020	2,972.37	2,954.20	2,985.93	2,901.54	-	-1.71%
16	Mar 05, 2020	3,023.94	3,075.70	3,083.04	2,999.83	-	-3.39%
17	Mar 04, 2020	3,130.12	3,045.75	3,130.97	3,034.38	-	4.22%
18	Mar 03, 2020	3,003.37	3,096.46	3,136.72	2,976.63	-	-2.81%
19	Mar 02, 2020	3,090.23	2,974.28	3,090.96	2,945.19	-	4.60%
20	Feb 28, 2020	2,954.22	2,916.90	2,959.72	2,855.84	-	-0.82%
21	Feb 27, 2020	2,978.76	3,062.54	3,097.07	2,977.39	-	-4.42%
22	Feb 26, 2020	3,116.39	3,139.90	3,182.51	3,108.99	-	-0.38%
23	Feb 25, 2020	3,128.21	3,238.94	3,246.99	3,118.77	-	-3.03%
24	Feb 24, 2020	3,225.89	3,257.61	3,259.81	3,214.65	-	-3.35%
25	Feb 21, 2020	3,337.75	3,360.50	3,360.76	3,328.45	-	-1.05%
26	Feb 20, 2020	3,373.23	3,380.45	3,389.15	3,341.02	-	-0.38%
27	Feb 19, 2020	3,386.15	3,380.39	3,393.52	3,378.83	-	0.47%
28	Feb 18, 2020	3,370.29	3,369.04	3,375.01	3,355.61	-	-0.29%
29	Feb 14, 2020	3,380.16	3,378.08	3,380.69	3,366.15	-	0.18%
30	Feb 13, 2020	3,373.94	3,365.90	3,385.09	3,360.52	-	-0.16%
31	Feb 12, 2020	3,379.45	3,370.50	3,381.47	3,369.72	-	0.65%
32	Feb 11, 2020	3,357.75	3,365.87	3,375.63	3,352.72	-	0.17%
33	Feb 10, 2020	3,352.09	3,318.28	3,352.26	3,317.77	-	0.73%
34	Feb 07, 2020	3,327.71	3,335.54	3,341.42	3,322.12	-	-0.54%
35	Feb 06, 2020	3,345.78	3,344.92	3,347.96	3,334.39	-	0.33%
36	Feb 05, 2020	3,334.69	3,324.91	3,337.58	3,313.75	-	1.13%
37	Feb 04, 2020	3,297.59	3,280.61	3,306.92	3,280.61	-	1.50%
38	Feb 03, 2020	3,248.92	3,235.66	3,268.44	3,235.66	-	0.73%

In [3]:

```
#Gathering the following for each of the first seven days of february:
#number of positive tweets, number of negative tweets, number of neutral tweets, total volume, sentiment polarity

'''
pos0331 = df_tweets.loc[df_tweets.date=='2020-03-31'][df_tweets.polarity > 0].shape[0]
neg0331 = df_tweets.loc[df_tweets.date=='2020-03-31'][df_tweets.polarity < 0].shape[0]
neutral0331 = df_tweets.loc[df_tweets.date=='2020-03-31'][df_tweets.polarity == 0].shape[0]
nonZero0331 = pos0331 + neg0331
px0331 = round(((pos0331-neg0331)/nonZero0331),3)
volume0331 = nonZero0331 + neutral0331

pos0330 = df_tweets.loc[df_tweets.date=='2020-03-30'][df_tweets.polarity > 0].shape[0]
neg0330 = df_tweets.loc[df_tweets.date=='2020-03-30'][df_tweets.polarity < 0].shape[0]
neutral0330 = df_tweets.loc[df_tweets.date=='2020-03-30'][df_tweets.polarity == 0].shape[0]
nonZero0330 = pos0330 + neg0330
px0330 = round(((pos0330-neg0330)/nonZero0330),3)
volume0330 = nonZero0330 + neutral0330

pos0329 = df_tweets.loc[df_tweets.date=='2020-03-29'][df_tweets.polarity > 0].shape[0]
neg0329 = df_tweets.loc[df_tweets.date=='2020-03-29'][df_tweets.polarity < 0].shape[0]
neutral0329 = df_tweets.loc[df_tweets.date=='2020-03-29'][df_tweets.polarity == 0].shape[0]
nonZero0329 = pos0329 + neg0329
px0329 = round(((pos0329-neg0329)/nonZero0329),3)
volume0329 = nonZero0329 + neutral0329
```

```
volume0329 = nonZero0329 + neutral0329

pos0328 = df_tweets.loc[df_tweets.date=='2020-03-28'][df_tweets.polarity > 0].shape[0]
neg0328 = df_tweets.loc[df_tweets.date=='2020-03-28'][df_tweets.polarity < 0].shape[0]
neutral0328 = df_tweets.loc[df_tweets.date=='2020-03-28'][df_tweets.polarity == 0].shape[0]
nonZero0328 = pos0328 + neg0328
px0328 = round(((pos0328-neg0328)/nonZero0328),3)
volume0328 = nonZero0328 + neutral0328
'''

pos0327 = df_tweets.loc[df_tweets.date=='2020-03-27'][df_tweets.polarity > 0].shape[0]
neg0327 = df_tweets.loc[df_tweets.date=='2020-03-27'][df_tweets.polarity < 0].shape[0]
neutral0327 = df_tweets.loc[df_tweets.date=='2020-03-27'][df_tweets.polarity == 0].shape[0]
nonZero0327 = pos0327 + neg0327
px0327 = round(((pos0327-neg0327)/nonZero0327),3)
volume0327 = nonZero0327 + neutral0327


pos0326 = df_tweets.loc[df_tweets.date=='2020-03-26'][df_tweets.polarity > 0].shape[0]
neg0326 = df_tweets.loc[df_tweets.date=='2020-03-26'][df_tweets.polarity < 0].shape[0]
neutral0326 = df_tweets.loc[df_tweets.date=='2020-03-26'][df_tweets.polarity == 0].shape[0]
nonZero0326 = pos0326 + neg0326
px0326 = round(((pos0326-neg0326)/nonZero0326),3)
volume0326 = nonZero0326 + neutral0326

pos0325 = df_tweets.loc[df_tweets.date=='2020-03-25'][df_tweets.polarity > 0].shape[0]
neg0325 = df_tweets.loc[df_tweets.date=='2020-03-25'][df_tweets.polarity < 0].shape[0]
neutral0325 = df_tweets.loc[df_tweets.date=='2020-03-25'][df_tweets.polarity == 0].shape[0]
nonZero0325 = pos0325 + neg0325
px0325 = round(((pos0325-neg0325)/nonZero0325),3)
volume0325 = nonZero0325 + neutral0325

pos0324 = df_tweets.loc[df_tweets.date=='2020-03-24'][df_tweets.polarity > 0].shape[0]
neg0324 = df_tweets.loc[df_tweets.date=='2020-03-24'][df_tweets.polarity < 0].shape[0]
neutral0324 = df_tweets.loc[df_tweets.date=='2020-03-24'][df_tweets.polarity == 0].shape[0]
nonZero0324 = pos0324 + neg0324
px0324 = round(((pos0324-neg0324)/nonZero0324),3)
volume0324 = nonZero0324 + neutral0324

pos0323 = df_tweets.loc[df_tweets.date=='2020-03-23'][df_tweets.polarity > 0].shape[0]
neg0323 = df_tweets.loc[df_tweets.date=='2020-03-23'][df_tweets.polarity < 0].shape[0]
neutral0323 = df_tweets.loc[df_tweets.date=='2020-03-23'][df_tweets.polarity == 0].shape[0]
nonZero0323 = pos0323 + neg0323
px0323 = round(((pos0323-neg0323)/nonZero0323),3)
volume0323 = nonZero0323 + neutral0323

'''
pos0322 = df_tweets.loc[df_tweets.date=='2020-03-22'][df_tweets.polarity > 0].shape[0]
neg0322 = df_tweets.loc[df_tweets.date=='2020-03-22'][df_tweets.polarity < 0].shape[0]
neutral0322 = df_tweets.loc[df_tweets.date=='2020-03-22'][df_tweets.polarity == 0].shape[0]
nonZero0322 = pos0322 + neg0322
px0322 = round(((pos0322-neg0322)/nonZero0322),3)
volume0322 = nonZero0322 + neutral0322

pos0321 = df_tweets.loc[df_tweets.date=='2020-03-21'][df_tweets.polarity > 0].shape[0]
neg0321 = df_tweets.loc[df_tweets.date=='2020-03-21'][df_tweets.polarity < 0].shape[0]
neutral0321 = df_tweets.loc[df_tweets.date=='2020-03-21'][df_tweets.polarity == 0].shape[0]
nonZero0321 = pos0321 + neg0321
px0321 = round(((pos0321-neg0321)/nonZero0321),3)
volume0321 = nonZero0321 + neutral0321
'''

pos0320 = df_tweets.loc[df_tweets.date=='2020-03-20'][df_tweets.polarity > 0].shape[0]
neg0320 = df_tweets.loc[df_tweets.date=='2020-03-20'][df_tweets.polarity < 0].shape[0]
neutral0320 = df_tweets.loc[df_tweets.date=='2020-03-20'][df_tweets.polarity == 0].shape[0]
nonZero0320 = pos0320 + neg0320
px0320 = round(((pos0320-neg0320)/nonZero0320),3)
volume0320 = nonZero0320 + neutral0320

pos0319 = df_tweets.loc[df_tweets.date=='2020-03-19'][df_tweets.polarity > 0].shape[0]
neg0319 = df_tweets.loc[df_tweets.date=='2020-03-19'][df_tweets.polarity < 0].shape[0]
neutral0319 = df_tweets.loc[df_tweets.date=='2020-03-19'][df_tweets.polarity == 0].shape[0]
nonZero0319 = pos0319 + neg0319
px0319 = round(((pos0319-neg0319)/nonZero0319),3)
volume0319 = nonZero0319 + neutral0319

pos0318 = df_tweets.loc[df_tweets.date=='2020-03-18'][df_tweets.polarity > 0].shape[0]
neg0318 = df_tweets.loc[df_tweets.date=='2020-03-18'][df_tweets.polarity < 0].shape[0]
```

```
neg0318 = df_tweets.loc[df_tweets.date=='2020-03-18'][df_tweets.polarity < 0].shape[0]
neutral0318 = df_tweets.loc[df_tweets.date=='2020-03-18'][df_tweets.polarity == 0].shape[0]
nonZero0318 = pos0318 + neg0318
px0318 = round(((pos0318-neg0318)/nonZero0318),3)
volume0318 = nonZero0318 + neutral0318

pos0317 = df_tweets.loc[df_tweets.date=='2020-03-17'][df_tweets.polarity > 0].shape[0]
neg0317 = df_tweets.loc[df_tweets.date=='2020-03-17'][df_tweets.polarity < 0].shape[0]
neutral0317 = df_tweets.loc[df_tweets.date=='2020-03-17'][df_tweets.polarity == 0].shape[0]
nonZero0317 = pos0317 + neg0317
px0317 = round(((pos0317-neg0317)/nonZero0317),3)
volume0317 = nonZero0317 + neutral0317

pos0316 = df_tweets.loc[df_tweets.date=='2020-03-16'][df_tweets.polarity > 0].shape[0]
neg0316 = df_tweets.loc[df_tweets.date=='2020-03-16'][df_tweets.polarity < 0].shape[0]
neutral0316 = df_tweets.loc[df_tweets.date=='2020-03-16'][df_tweets.polarity == 0].shape[0]
nonZero0316 = pos0316 + neg0316
px0316 = round(((pos0316-neg0316)/nonZero0316),3)
volume0316 = nonZero0316 + neutral0316

'''
pos0315 = df_tweets.loc[df_tweets.date=='2020-03-15'][df_tweets.polarity > 0].shape[0]
neg0315 = df_tweets.loc[df_tweets.date=='2020-03-15'][df_tweets.polarity < 0].shape[0]
neutral0315 = df_tweets.loc[df_tweets.date=='2020-03-15'][df_tweets.polarity == 0].shape[0]
nonZero0315 = pos0315 + neg0315
px0315 = round(((pos0315-neg0315)/nonZero0315),3)
volume0315 = nonZero0315 + neutral0315

pos0314 = df_tweets.loc[df_tweets.date=='2020-03-14'][df_tweets.polarity > 0].shape[0]
neg0314 = df_tweets.loc[df_tweets.date=='2020-03-14'][df_tweets.polarity < 0].shape[0]
neutral0314 = df_tweets.loc[df_tweets.date=='2020-03-14'][df_tweets.polarity == 0].shape[0]
nonZero0314 = pos0314 + neg0314
px0314 = round(((pos0314-neg0314)/nonZero0314),3)
volume0314 = nonZero0314 + neutral0314
'''

pos0313 = df_tweets.loc[df_tweets.date=='2020-03-13'][df_tweets.polarity > 0].shape[0]
neg0313 = df_tweets.loc[df_tweets.date=='2020-03-13'][df_tweets.polarity < 0].shape[0]
neutral0313 = df_tweets.loc[df_tweets.date=='2020-03-13'][df_tweets.polarity == 0].shape[0]
nonZero0313 = pos0313 + neg0313
px0313 = round(((pos0313-neg0313)/nonZero0313),3)
volume0313 = nonZero0313 + neutral0313

pos0312 = df_tweets.loc[df_tweets.date=='2020-03-12'][df_tweets.polarity > 0].shape[0]
neg0312 = df_tweets.loc[df_tweets.date=='2020-03-12'][df_tweets.polarity < 0].shape[0]
neutral0312 = df_tweets.loc[df_tweets.date=='2020-03-12'][df_tweets.polarity == 0].shape[0]
nonZero0312 = pos0312 + neg0312
px0312 = round(((pos0312-neg0312)/nonZero0312),3)
volume0312 = nonZero0312 + neutral0312

pos0311 = df_tweets.loc[df_tweets.date=='2020-03-11'][df_tweets.polarity > 0].shape[0]
neg0311 = df_tweets.loc[df_tweets.date=='2020-03-11'][df_tweets.polarity < 0].shape[0]
neutral0311 = df_tweets.loc[df_tweets.date=='2020-03-11'][df_tweets.polarity == 0].shape[0]
nonZero0311 = pos0311 + neg0311
px0311 = round(((pos0311-neg0311)/nonZero0311),3)
volume0311 = nonZero0311 + neutral0311

pos0310 = df_tweets.loc[df_tweets.date=='2020-03-10'][df_tweets.polarity > 0].shape[0]
neg0310 = df_tweets.loc[df_tweets.date=='2020-03-10'][df_tweets.polarity < 0].shape[0]
neutral0310 = df_tweets.loc[df_tweets.date=='2020-03-10'][df_tweets.polarity == 0].shape[0]
nonZero0310 = pos0310 + neg0310
px0310 = round(((pos0310-neg0310)/nonZero0310),3)
volume0310 = nonZero0310 + neutral0310

pos0309 = df_tweets.loc[df_tweets.date=='2020-03-09'][df_tweets.polarity > 0].shape[0]
neg0309 = df_tweets.loc[df_tweets.date=='2020-03-09'][df_tweets.polarity < 0].shape[0]
neutral0309 = df_tweets.loc[df_tweets.date=='2020-03-09'][df_tweets.polarity == 0].shape[0]
nonZero0309 = pos0309 + neg0309
px0309 = round(((pos0309-neg0309)/nonZero0309),3)
volume0309 = nonZero0309 + neutral0309

'''
pos0308 = df_tweets.loc[df_tweets.date=='2020-03-08'][df_tweets.polarity > 0].shape[0]
neg0308 = df_tweets.loc[df_tweets.date=='2020-03-08'][df_tweets.polarity < 0].shape[0]
neutral0308 = df_tweets.loc[df_tweets.date=='2020-03-08'][df_tweets.polarity == 0].shape[0]
nonZero0308 = pos0308 + neg0308
px0308 = round(((pos0308-neg0308)/nonZero0308),3)
volume0308 = nonZero0308 + neutral0308
```

```
volume0308 = nonZero0308 + neutral0308

pos0307 = df_tweets.loc[df_tweets.date=='2020-03-07'][df_tweets.polarity > 0].shape[0]
neg0307 = df_tweets.loc[df_tweets.date=='2020-03-07'][df_tweets.polarity < 0].shape[0]
neutral0307 = df_tweets.loc[df_tweets.date=='2020-03-07'][df_tweets.polarity == 0].shape[0]
nonZero0307 = pos0307 + neg0307
px0307 = round(((pos0307-neg0307)/nonZero0307),3)
volume0307 = nonZero0307 + neutral0307
'''

pos0306 = df_tweets.loc[df_tweets.date=='2020-03-06'][df_tweets.polarity > 0].shape[0]
neg0306 = df_tweets.loc[df_tweets.date=='2020-03-06'][df_tweets.polarity < 0].shape[0]
neutral0306 = df_tweets.loc[df_tweets.date=='2020-03-06'][df_tweets.polarity == 0].shape[0]
nonZero0306 = pos0306 + neg0306
px0306 = round(((pos0306-neg0306)/nonZero0306),3)
volume0306 = nonZero0306 + neutral0306

pos0305 = df_tweets.loc[df_tweets.date=='2020-03-05'][df_tweets.polarity > 0].shape[0]
neg0305 = df_tweets.loc[df_tweets.date=='2020-03-05'][df_tweets.polarity < 0].shape[0]
neutral0305 = df_tweets.loc[df_tweets.date=='2020-03-05'][df_tweets.polarity == 0].shape[0]
nonZero0305 = pos0305 + neg0305
px0305 = round(((pos0305-neg0305)/nonZero0305),3)
volume0305 = nonZero0305 + neutral0305

pos0304 = df_tweets.loc[df_tweets.date=='2020-03-04'][df_tweets.polarity > 0].shape[0]
neg0304 = df_tweets.loc[df_tweets.date=='2020-03-04'][df_tweets.polarity < 0].shape[0]
neutral0304 = df_tweets.loc[df_tweets.date=='2020-03-04'][df_tweets.polarity == 0].shape[0]
nonZero0304 = pos0304 + neg0304
px0304 = round(((pos0304-neg0304)/nonZero0304),3)
volume0304 = nonZero0304 + neutral0304

pos0303 = df_tweets.loc[df_tweets.date=='2020-03-03'][df_tweets.polarity > 0].shape[0]
neg0303 = df_tweets.loc[df_tweets.date=='2020-03-03'][df_tweets.polarity < 0].shape[0]
neutral0303 = df_tweets.loc[df_tweets.date=='2020-03-03'][df_tweets.polarity == 0].shape[0]
nonZero0303 = pos0303 + neg0303
px0303 = round(((pos0303-neg0303)/nonZero0303),3)
volume0303 = nonZero0303 + neutral0303

pos0302 = df_tweets.loc[df_tweets.date=='2020-03-02'][df_tweets.polarity > 0].shape[0]
neg0302 = df_tweets.loc[df_tweets.date=='2020-03-02'][df_tweets.polarity < 0].shape[0]
neutral0302 = df_tweets.loc[df_tweets.date=='2020-03-02'][df_tweets.polarity == 0].shape[0]
nonZero0302 = pos0302 + neg0302
px0302 = round(((pos0302-neg0302)/nonZero0302),3)
volume0302 = nonZero0302 + neutral0302

'''
pos0301 = df_tweets.loc[df_tweets.date=='2020-03-01'][df_tweets.polarity > 0].shape[0]
neg0301 = df_tweets.loc[df_tweets.date=='2020-03-01'][df_tweets.polarity < 0].shape[0]
neutral0301 = df_tweets.loc[df_tweets.date=='2020-03-01'][df_tweets.polarity == 0].shape[0]
nonZero0301 = pos0301 + neg0301
px0301 = round(((pos0301-neg0301)/nonZero0301),3)
volume0301 = nonZero0301 + neutral0301

pos0229 = df_tweets.loc[df_tweets.date=='2020-02-29'][df_tweets.polarity > 0].shape[0]
neg0229 = df_tweets.loc[df_tweets.date=='2020-02-29'][df_tweets.polarity < 0].shape[0]
neutral0229 = df_tweets.loc[df_tweets.date=='2020-02-29'][df_tweets.polarity == 0].shape[0]
nonZero0229 = pos0229 + neg0229
px0229 = round(((pos0229-neg0229)/nonZero0229),3)
volume0229 = nonZero0229 + neutral0229
'''

pos0228 = df_tweets.loc[df_tweets.date=='2020-02-28'][df_tweets.polarity > 0].shape[0]
neg0228 = df_tweets.loc[df_tweets.date=='2020-02-28'][df_tweets.polarity < 0].shape[0]
neutral0228 = df_tweets.loc[df_tweets.date=='2020-02-28'][df_tweets.polarity == 0].shape[0]
nonZero0228 = pos0228 + neg0228
px0228 = round(((pos0228-neg0228)/nonZero0228),3)
volume0228 = nonZero0228 + neutral0228

pos0227 = df_tweets.loc[df_tweets.date=='2020-02-27'][df_tweets.polarity > 0].shape[0]
neg0227 = df_tweets.loc[df_tweets.date=='2020-02-27'][df_tweets.polarity < 0].shape[0]
neutral0227 = df_tweets.loc[df_tweets.date=='2020-02-27'][df_tweets.polarity == 0].shape[0]
nonZero0227 = pos0227 + neg0227
px0227 = round(((pos0227-neg0227)/nonZero0227),3)
volume0227 = nonZero0227 + neutral0227

pos0226 = df_tweets.loc[df_tweets.date=='2020-02-26'][df_tweets.polarity > 0].shape[0]
neg0226 = df_tweets.loc[df_tweets.date=='2020-02-26'][df_tweets.polarity < 0].shape[0]
neutral0226 = df_tweets.loc[df_tweets.date=='2020-02-26'][df_tweets.polarity == 0].shape[0]
```

```
neutral0226 = df_tweets.loc[df_tweets.date=='2020-02-26'][df_tweets.polarity == 0].shape[0]
nonZero0226 = pos0226 + neg0226
px0226 = round(((pos0226-neg0226)/nonZero0226),3)
volume0226 = nonZero0226 + neutral0226

pos0225 = df_tweets.loc[df_tweets.date=='2020-02-25'][df_tweets.polarity > 0].shape[0]
neg0225 = df_tweets.loc[df_tweets.date=='2020-02-25'][df_tweets.polarity < 0].shape[0]
neutral0225 = df_tweets.loc[df_tweets.date=='2020-02-25'][df_tweets.polarity == 0].shape[0]
nonZero0225 = pos0225 + neg0225
px0225 = round(((pos0225-neg0225)/nonZero0225),3)
volume0225 = nonZero0225 + neutral0225

pos0224 = df_tweets.loc[df_tweets.date=='2020-02-24'][df_tweets.polarity > 0].shape[0]
neg0224 = df_tweets.loc[df_tweets.date=='2020-02-24'][df_tweets.polarity < 0].shape[0]
neutral0224 = df_tweets.loc[df_tweets.date=='2020-02-24'][df_tweets.polarity == 0].shape[0]
nonZero0224 = pos0224 + neg0224
px0224 = round(((pos0224-neg0224)/nonZero0224),3)
volume0224 = nonZero0224 + neutral0224

'''
pos0223 = df_tweets.loc[df_tweets.date=='2020-02-23'][df_tweets.polarity > 0].shape[0]
neg0223 = df_tweets.loc[df_tweets.date=='2020-02-23'][df_tweets.polarity < 0].shape[0]
neutral0223 = df_tweets.loc[df_tweets.date=='2020-02-23'][df_tweets.polarity == 0].shape[0]
nonZero0223 = pos0223 + neg0223
px0223 = round(((pos0223-neg0223)/nonZero0223),3)
volume0223 = nonZero0223 + neutral0223

pos0222 = df_tweets.loc[df_tweets.date=='2020-02-22'][df_tweets.polarity > 0].shape[0]
neg0222 = df_tweets.loc[df_tweets.date=='2020-02-22'][df_tweets.polarity < 0].shape[0]
neutral0222 = df_tweets.loc[df_tweets.date=='2020-02-22'][df_tweets.polarity == 0].shape[0]
nonZero0222 = pos0222 + neg0222
px0222 = round(((pos0222-neg0222)/nonZero0222),3)
volume0222 = nonZero0222 + neutral0222
'''

pos0221 = df_tweets.loc[df_tweets.date=='2020-02-21'][df_tweets.polarity > 0].shape[0]
neg0221 = df_tweets.loc[df_tweets.date=='2020-02-21'][df_tweets.polarity < 0].shape[0]
neutral0221 = df_tweets.loc[df_tweets.date=='2020-02-21'][df_tweets.polarity == 0].shape[0]
nonZero0221 = pos0221 + neg0221
px0221 = round(((pos0221-neg0221)/nonZero0221),3)
volume0221 = nonZero0221 + neutral0221

pos0220 = df_tweets.loc[df_tweets.date=='2020-02-20'][df_tweets.polarity > 0].shape[0]
neg0220 = df_tweets.loc[df_tweets.date=='2020-02-20'][df_tweets.polarity < 0].shape[0]
neutral0220 = df_tweets.loc[df_tweets.date=='2020-02-20'][df_tweets.polarity == 0].shape[0]
nonZero0220 = pos0220 + neg0220
px0220 = round(((pos0220-neg0220)/nonZero0220),3)
volume0220 = nonZero0220 + neutral0220

pos0219 = df_tweets.loc[df_tweets.date=='2020-02-19'][df_tweets.polarity > 0].shape[0]
neg0219 = df_tweets.loc[df_tweets.date=='2020-02-19'][df_tweets.polarity < 0].shape[0]
neutral0219 = df_tweets.loc[df_tweets.date=='2020-02-19'][df_tweets.polarity == 0].shape[0]
nonZero0219 = pos0219 + neg0219
px0219 = round(((pos0219-neg0219)/nonZero0219),3)
volume0219 = nonZero0219 + neutral0219

pos0218 = df_tweets.loc[df_tweets.date=='2020-02-18'][df_tweets.polarity > 0].shape[0]
neg0218 = df_tweets.loc[df_tweets.date=='2020-02-18'][df_tweets.polarity < 0].shape[0]
neutral0218 = df_tweets.loc[df_tweets.date=='2020-02-18'][df_tweets.polarity == 0].shape[0]
nonZero0218 = pos0218 + neg0218
px0218 = round(((pos0218-neg0218)/nonZero0218),3)
volume0218 = nonZero0218 + neutral0218

'''
pos0217 = df_tweets.loc[df_tweets.date=='2020-02-17'][df_tweets.polarity > 0].shape[0]
neg0217 = df_tweets.loc[df_tweets.date=='2020-02-17'][df_tweets.polarity < 0].shape[0]
neutral0217 = df_tweets.loc[df_tweets.date=='2020-02-17'][df_tweets.polarity == 0].shape[0]
nonZero0217 = pos0217 + neg0217
px0217 = round(((pos0217-neg0217)/nonZero0217),3)
volume0217 = nonZero0217 + neutral0217

pos0216 = df_tweets.loc[df_tweets.date=='2020-02-16'][df_tweets.polarity > 0].shape[0]
neg0216 = df_tweets.loc[df_tweets.date=='2020-02-16'][df_tweets.polarity < 0].shape[0]
neutral0216 = df_tweets.loc[df_tweets.date=='2020-02-16'][df_tweets.polarity == 0].shape[0]
nonZero0216 = pos0216 + neg0216
px0216 = round(((pos0216-neg0216)/nonZero0216),3)
volume0216 = nonZero0216 + neutral0216
```

```
pos0215 = df_tweets.loc[df_tweets.date=='2020-02-15'][df_tweets.polarity > 0].shape[0]
neg0215 = df_tweets.loc[df_tweets.date=='2020-02-15'][df_tweets.polarity < 0].shape[0]
neutral0215 = df_tweets.loc[df_tweets.date=='2020-02-15'][df_tweets.polarity == 0].shape[0]
nonZero0215 = pos0215 + neg0215
px0215 = round(((pos0215-neg0215)/nonZero0215),3)
volume0215 = nonZero0215 + neutral0215
'''

pos0214 = df_tweets.loc[df_tweets.date=='2020-02-14'][df_tweets.polarity > 0].shape[0]
neg0214 = df_tweets.loc[df_tweets.date=='2020-02-14'][df_tweets.polarity < 0].shape[0]
neutral0214 = df_tweets.loc[df_tweets.date=='2020-02-14'][df_tweets.polarity == 0].shape[0]
nonZero0214 = pos0214 + neg0214
px0214 = round(((pos0214-neg0214)/nonZero0214),3)
volume0214 = nonZero0214 + neutral0214

pos0213 = df_tweets.loc[df_tweets.date=='2020-02-13'][df_tweets.polarity > 0].shape[0]
neg0213 = df_tweets.loc[df_tweets.date=='2020-02-13'][df_tweets.polarity < 0].shape[0]
neutral0213 = df_tweets.loc[df_tweets.date=='2020-02-13'][df_tweets.polarity == 0].shape[0]
nonZero0213 = pos0213 + neg0213
px0213 = round(((pos0213-neg0213)/nonZero0213),3)
volume0213 = nonZero0213 + neutral0213

pos0212 = df_tweets.loc[df_tweets.date=='2020-02-12'][df_tweets.polarity > 0].shape[0]
neg0212 = df_tweets.loc[df_tweets.date=='2020-02-12'][df_tweets.polarity < 0].shape[0]
neutral0212 = df_tweets.loc[df_tweets.date=='2020-02-12'][df_tweets.polarity == 0].shape[0]
nonZero0212 = pos0212 + neg0212
px0212 = round(((pos0212-neg0212)/nonZero0212),3)
volume0212 = nonZero0212 + neutral0212

pos0211 = df_tweets.loc[df_tweets.date=='2020-02-11'][df_tweets.polarity > 0].shape[0]
neg0211 = df_tweets.loc[df_tweets.date=='2020-02-11'][df_tweets.polarity < 0].shape[0]
neutral0211 = df_tweets.loc[df_tweets.date=='2020-02-11'][df_tweets.polarity == 0].shape[0]
nonZero0211 = pos0211 + neg0211
px0211 = round(((pos0211-neg0211)/nonZero0211),3)
volume0211 = nonZero0211 + neutral0211

pos0210 = df_tweets.loc[df_tweets.date=='2020-02-10'][df_tweets.polarity > 0].shape[0]
neg0210 = df_tweets.loc[df_tweets.date=='2020-02-10'][df_tweets.polarity < 0].shape[0]
neutral0210 = df_tweets.loc[df_tweets.date=='2020-02-10'][df_tweets.polarity == 0].shape[0]
nonZero0210 = pos0210 + neg0210
px0210 = round(((pos0210-neg0210)/nonZero0210),3)
volume0210 = nonZero0210 + neutral0210

'''
pos0209 = df_tweets.loc[df_tweets.date=='2020-02-09'][df_tweets.polarity > 0].shape[0]
neg0209 = df_tweets.loc[df_tweets.date=='2020-02-09'][df_tweets.polarity < 0].shape[0]
neutral0209 = df_tweets.loc[df_tweets.date=='2020-02-09'][df_tweets.polarity == 0].shape[0]
nonZero0209 = pos0209 + neg0209
px0209 = round(((pos0209-neg0209)/nonZero0209),3)
volume0209 = nonZero0209 + neutral0209

pos0208 = df_tweets.loc[df_tweets.date=='2020-02-08'][df_tweets.polarity > 0].shape[0]
neg0208 = df_tweets.loc[df_tweets.date=='2020-02-08'][df_tweets.polarity < 0].shape[0]
neutral0208 = df_tweets.loc[df_tweets.date=='2020-02-08'][df_tweets.polarity == 0].shape[0]
nonZero0208 = pos0208 + neg0208
px0208 = round(((pos0208-neg0208)/nonZero0208),3)
volume0208 = nonZero0208 + neutral0208
'''

pos0207 = df_tweets.loc[df_tweets.date=='2020-02-07'][df_tweets.polarity > 0].shape[0]
neg0207 = df_tweets.loc[df_tweets.date=='2020-02-07'][df_tweets.polarity < 0].shape[0]
neutral0207 = df_tweets.loc[df_tweets.date=='2020-02-07'][df_tweets.polarity == 0].shape[0]
nonZero0207 = pos0207 + neg0207
px0207 = round(((pos0207-neg0207)/nonZero0207),3)
volume0207 = nonZero0207 + neutral0207

pos0206 = df_tweets.loc[df_tweets.date=='2020-02-06'][df_tweets.polarity > 0].shape[0]
neg0206 = df_tweets.loc[df_tweets.date=='2020-02-06'][df_tweets.polarity < 0].shape[0]
neutral0206 = df_tweets.loc[df_tweets.date=='2020-02-06'][df_tweets.polarity == 0].shape[0]
nonZero0206 = pos0206 + neg0206
px0206 = round(((pos0206-neg0206)/nonZero0206),3)
volume0206 = nonZero0206 + neutral0206

pos0205 = df_tweets.loc[df_tweets.date=='2020-02-05'][df_tweets.polarity > 0].shape[0]
neg0205 = df_tweets.loc[df_tweets.date=='2020-02-05'][df_tweets.polarity < 0].shape[0]
neutral0205 = df_tweets.loc[df_tweets.date=='2020-02-05'][df_tweets.polarity == 0].shape[0]
nonZero0205 = pos0205 + neg0205
```

```
nonZero0205 = pos0205 + neg0205
px0205 = round(((pos0205-neg0205)/nonZero0205),3)
volume0205 = nonZero0205 + neutral0205

pos0204 = df_tweets.loc[df_tweets.date=='2020-02-04'][df_tweets.polarity > 0].shape[0]
neg0204 = df_tweets.loc[df_tweets.date=='2020-02-04'][df_tweets.polarity < 0].shape[0]
neutral0204 = df_tweets.loc[df_tweets.date=='2020-02-04'][df_tweets.polarity == 0].shape[0]
nonZero0204 = pos0204 + neg0204
px0204 = round(((pos0204-neg0204)/nonZero0204),3)
volume0204 = nonZero0204 + neutral0204

pos0203 = df_tweets.loc[df_tweets.date=='2020-02-03'][df_tweets.polarity > 0].shape[0]
neg0203 = df_tweets.loc[df_tweets.date=='2020-02-03'][df_tweets.polarity < 0].shape[0]
neutral0203 = df_tweets.loc[df_tweets.date=='2020-02-03'][df_tweets.polarity == 0].shape[0]
nonZero0203 = pos0203 + neg0203
px0203 = round(((pos0203-neg0203)/nonZero0203),3)
volume0203 = nonZero0203 + neutral0203

'''
pos0202 = df_tweets.loc[df_tweets.date=='2020-02-02'][df_tweets.polarity > 0].shape[0]
neg0202 = df_tweets.loc[df_tweets.date=='2020-02-02'][df_tweets.polarity < 0].shape[0]
neutral0202 = df_tweets.loc[df_tweets.date=='2020-02-02'][df_tweets.polarity == 0].shape[0]
nonZero0202 = pos0202 + neg0202
px0202 = round(((pos0202-neg0202)/nonZero0202),3)
volume0202 = nonZero0202 + neutral0202

pos0201 = df_tweets.loc[df_tweets.date=='2020-02-01'][df_tweets.polarity > 0].shape[0]
neg0201 = df_tweets.loc[df_tweets.date=='2020-02-01'][df_tweets.polarity < 0].shape[0]
neutral0201 = df_tweets.loc[df_tweets.date=='2020-02-01'][df_tweets.polarity == 0].shape[0]
nonZero0201 = pos0201 + neg0201
px0201 = round(((pos0201-neg0201)/nonZero0201),3)
volume0201 = nonZero0201 + neutral0201
'''
```

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key will be reindexed to match DataFrame index.
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key will be reindexed to match DataFrame index.
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key will be reindexed to match DataFrame index.
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key will be reindexed to match DataFrame index.
C:\Users\timod\anaconda3\lib\site-packages\ipykernel_launcher.py:364: UserWarning: Boolean Series
```

```
C:\Users\timod\anaconda3\lib\site-packages\ipykernel_launcher.py:364: UserWarning: Boolean Series
key will be reindexed to match DataFrame index.
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key will be reindexed to match DataFrame index.
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key will be reindexed to match DataFrame index.
C:\Users\timod\anaconda3\lib\site-packages\ipykernel_launcher.py:414: UserWarning: Boolean Series
key will be reindexed to match DataFrame index.
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key will be reindexed to match DataFrame index.
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key will be reindexed to match DataFrame index.
C:\Users\timod\anaconda3\lib\site-packages\ipykernel_launcher.py:421: UserWarning: Boolean Series
key will be reindexed to match DataFrame index.
C:\Users\timod\anaconda3\lib\site-packages\ipykernel_launcher.py:422: UserWarning: Boolean Series
key will be reindexed to match DataFrame index.
```

Out[3]:

```
"\npos0202 = df_tweets.loc[df_tweets.date=='2020-02-02'][df_tweets.polarity > 0].shape[0]\nneg0202
= df_tweets.loc[df_tweets.date=='2020-02-02'][df_tweets.polarity < 0].shape[0]\nneutral0202 =
df_tweets.loc[df_tweets.date=='2020-02-02'][df_tweets.polarity == 0].shape[0]\nnonZero0202 =
pos0202 + neg0202\npx0202 = round(((pos0202-neg0202)/nonZero0202),3)\nvolume0202 = nonZero0202 + n
eutral0202\n\npos0201 = df_tweets.loc[df_tweets.date=='2020-02-01'][df_tweets.polarity >
0].shape[0]\nneg0201 = df_tweets.loc[df_tweets.date=='2020-02-01'][df_tweets.polarity <
0].shape[0]\nneutral0201 = df_tweets.loc[df_tweets.date=='2020-02-01'][df_tweets.polarity ==
0].shape[0]\nnonZero0201 = pos0201 + neg0201\npx0201 = round(((pos0201-
neg0201)/nonZero0201),3)\nvolume0201 = nonZero0201 + neutral0201\n"
```

In [ ]:

```

```

In [4]:

```
#combining daily returns and daily sentiment polarity into one dataframe


returnSeries = df_price['Change %'].apply(lambda x: float(x.strip('%')))

'''sentimentSeriesFEB = [px0201, px0202, px0203, px0204, px0205, px0206, px0207,
                     px0208, px0209, px0210, px0211, px0212, px0213, px0214,
                     px0215, px0216, px0217, px0218, px0219, px0220, px0221,
                     px0222, px0223, px0224, px0225, px0226, px0227, px0228,
                     px0229, px0301, '''



sentimentSeries = [px0327, px0326, px0325, px0324, px0323,
                        px0320, px0319, px0318, px0317, px0316,
                        px0313, px0312, px0311, px0310, px0309,
                        px0306, px0305, px0304, px0303, px0302,
                        px0228, px0227, px0226, px0225, px0224,
                         px0221, px0220, px0219, px0218,
                         px0214, px0213, px0212, px0211, px0210,
                         px0207, px0206, px0205, px0204, px0203]

ts = pd.DataFrame()
ts['Date'], ts['Daily Return in %'], ts['Sentiment Polarity'] = df_price['Date'], returnSeries, sen
timentSeries
ts = ts.iloc[::-1].reset_index(drop=True)
ts
```

Out[4]:

	Date	Daily Return in %	Sentiment Polarity
0	Feb 03, 2020	0.73	0.476
1	Feb 04, 2020	1.50	0.496
2	Feb 05, 2020	1.13	0.531
3	Feb 06, 2020	0.33	0.470
4	Feb 07, 2020	-0.54	0.489
5	Feb 10, 2020	0.73	0.457
6	Feb 11, 2020	0.17	0.489
7	Feb 12, 2020	0.65	0.524
8	Feb 13, 2020	-0.16	0.414
9	Feb 14, 2020	0.18	0.501
10	Feb 18, 2020	-0.29	0.393
11	Feb 19, 2020	0.47	0.534
12	Feb 20, 2020	-0.38	0.418
13	Feb 21, 2020	-1.05	0.468
14	Feb 24, 2020	-3.35	0.311
15	Feb 25, 2020	-3.03	0.318
16	Feb 26, 2020	-0.38	0.337
17	Feb 27, 2020	-4.42	0.295
18	Feb 28, 2020	-0.82	0.280
19	Mar 02, 2020	4.60	0.469
20	Mar 03, 2020	-2.81	0.371
21	Mar 04, 2020	4.22	0.416
22	Mar 05, 2020	-3.39	0.318
23	Mar 06, 2020	-1.71	0.320
24	Mar 09, 2020	-7.60	0.318
25	Mar 10, 2020	4.94	0.397
26	Mar 11, 2020	-4.89	0.254
27	Mar 12, 2020	-9.51	0.277
28	Mar 13, 2020	9.29	0.283
29	Mar 16, 2020	-11.98	0.284
30	Mar 17, 2020	6.00	0.381
31	Mar 18, 2020	-5.18	0.316
32	Mar 19, 2020	0.47	0.355
33	Mar 20, 2020	-4.34	0.282
34	Mar 23, 2020	-2.93	0.292
35	Mar 24, 2020	9.38	0.406
36	Mar 25, 2020	1.15	0.399
37	Mar 26, 2020	6.24	0.423
38	Mar 27, 2020	-3.37	0.357

In [13]:

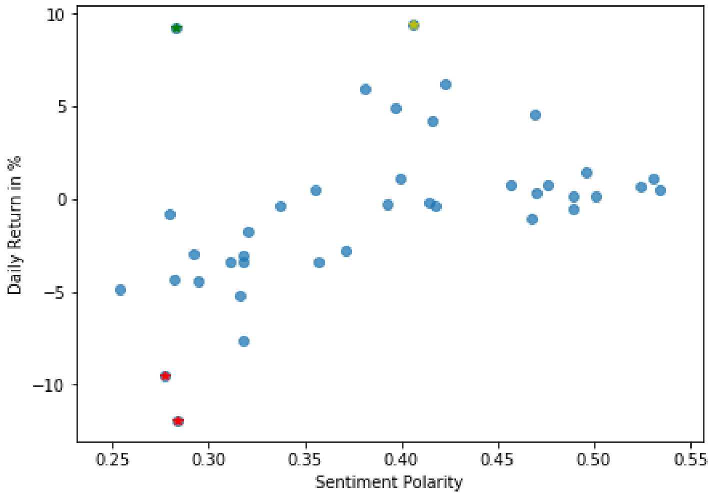
```
ts.dtypes
```

Out[13]:

```
Date                    object
Daily Return in %      float64
Sentiment Polarity     float64
dtype: object
```

In [5]:

```
plt.figure(figsize=(7,5))
plt.scatter(ts['Sentiment Polarity'],ts['Daily Return in %'], alpha=0.75)
plt.plot(ts['Sentiment Polarity'][28],ts['Daily Return in %'][28], 'g*')
plt.plot(ts['Sentiment Polarity'][35],ts['Daily Return in %'][35], 'y*')
plt.plot(ts['Sentiment Polarity'][29],ts['Daily Return in %'][29], 'r*')
plt.plot(ts['Sentiment Polarity'][27],ts['Daily Return in %'][27], 'r*')
plt.xlabel("Sentiment Polarity")
plt.ylabel("Daily Return in %")
plt.show()
```



In [6]:

```
q1 = ts['Daily Return in %'].quantile(0.25)
q3 = ts['Daily Return in %'].quantile(0.75)
iqr = q3 - q1

print(q1-1.5*iqr)
print(q3+1.5*iqr)
```

```
-9.37
7.109999999999999
```

In [7]:

```
fig, axs = plt.subplots(2, sharex=True, sharey=False, figsize=(10,7))
#fig.suptitle('Relevance and Stock Price Over Time')


x = ts['Date']
plt.xticks(rotation=90, fontsize=8)

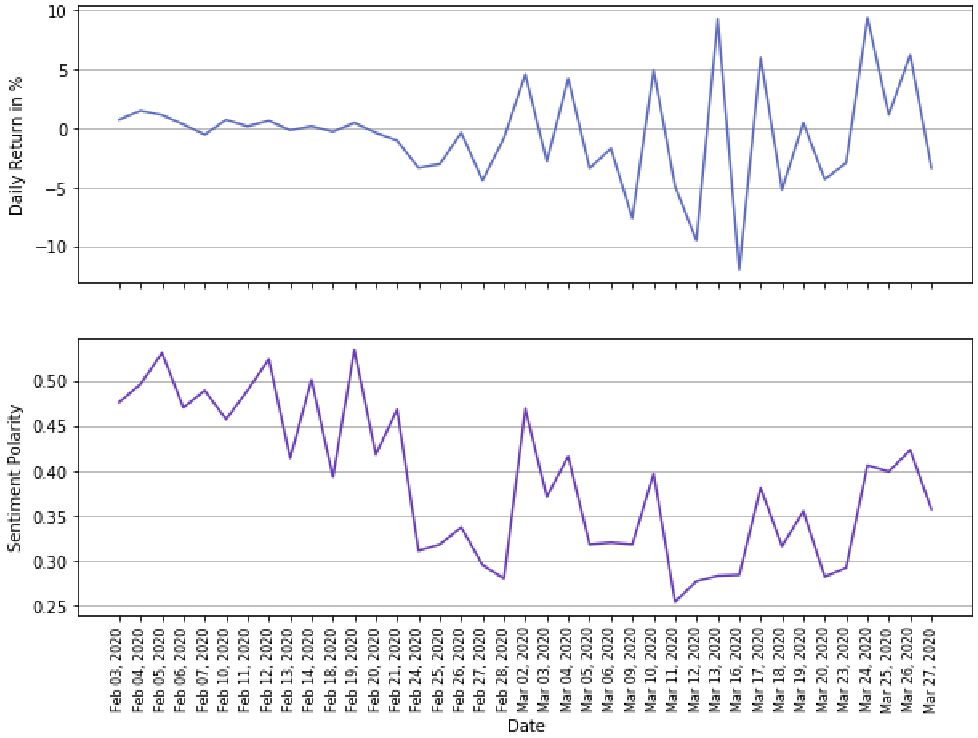
axs[0].yaxis.grid()
axs[1].yaxis.grid()

axs[0].plot(x, ts['Daily Return in %'],color='#5C6BC0')
axs[1].plot(x, ts['Sentiment Polarity'],color='#673AB7')

axs[0].set_ylabel("Daily Return in %",fontsize=10)
axs[1].set_ylabel("Sentiment Polarity",fontsize=10)

axs[1].set_xlabel("Date",fontsize=10)
```

```
plt.show()
```

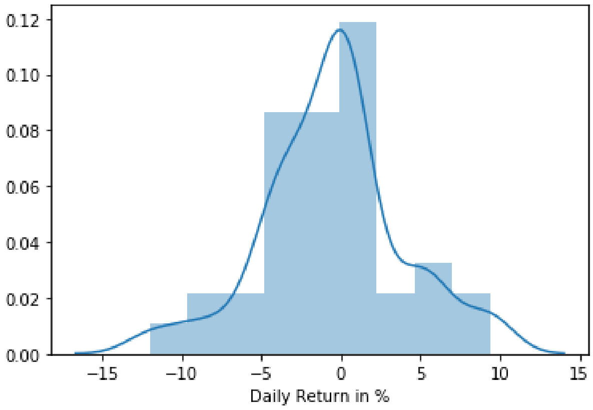


In [8]:

```
sns.distplot(ts['Daily Return in %'])
```

Out[8]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x2632fb59ac8>
```

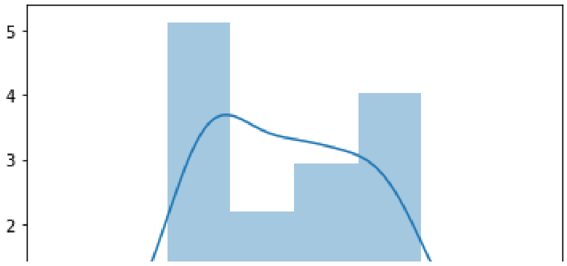


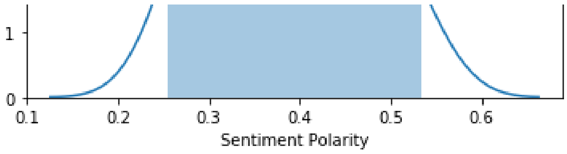
In [9]:

```
sns.distplot(ts['Sentiment Polarity'])
```

Out[9]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x263322c1248>
```





In [ ]:

```

```

In [ ]:

```

```

In [10]:

```
tsNO3 = pd.DataFrame(data=ts)
tsNO3 = tsNO3.drop(tsNO3.index[[28]])
tsNO3
```

Out[10]:

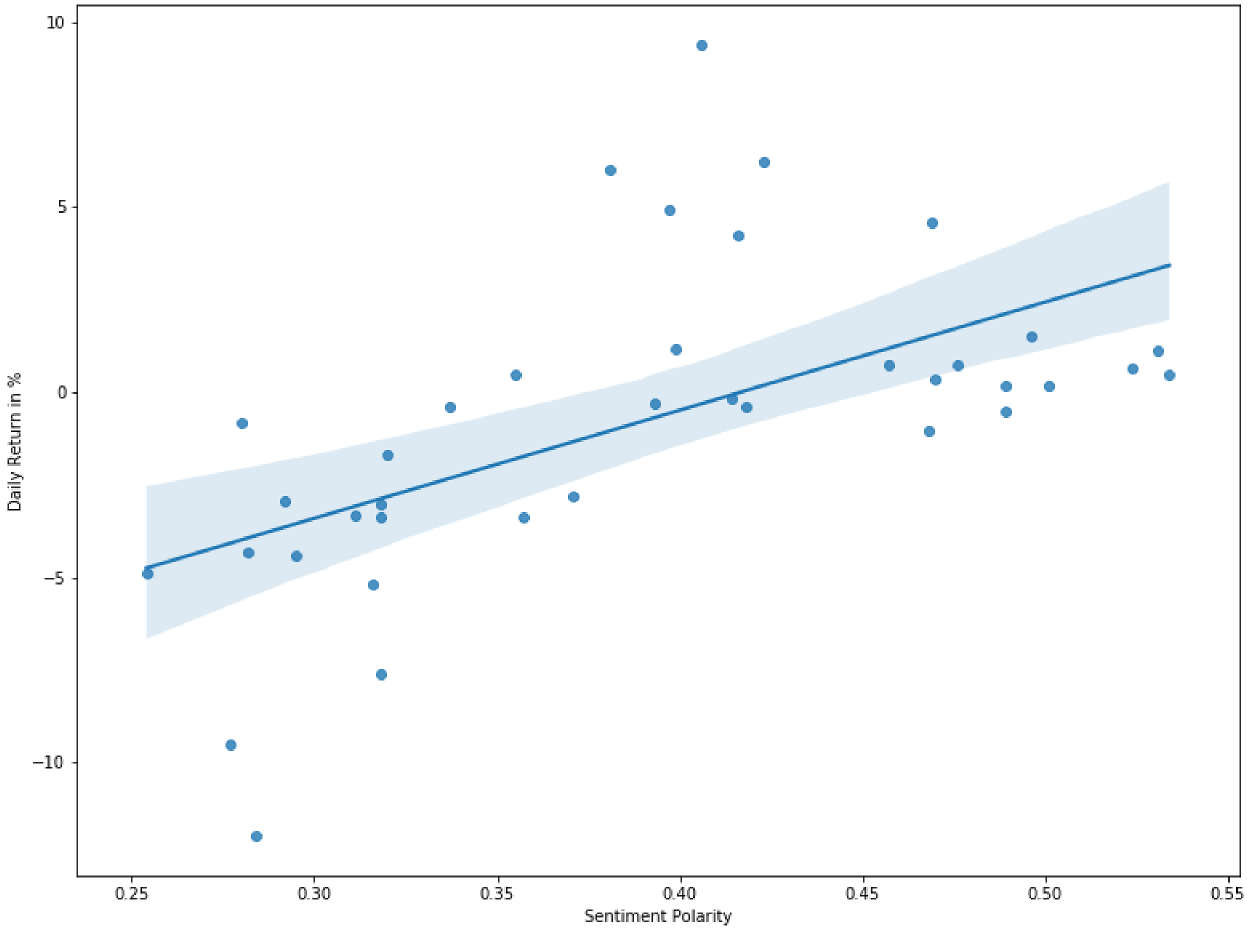
	Date	Daily Return in %	Sentiment Polarity
0	Feb 03, 2020	0.73	0.476
1	Feb 04, 2020	1.50	0.496
2	Feb 05, 2020	1.13	0.531
3	Feb 06, 2020	0.33	0.470
4	Feb 07, 2020	-0.54	0.489
5	Feb 10, 2020	0.73	0.457
6	Feb 11, 2020	0.17	0.489
7	Feb 12, 2020	0.65	0.524
8	Feb 13, 2020	-0.16	0.414
9	Feb 14, 2020	0.18	0.501
10	Feb 18, 2020	-0.29	0.393
11	Feb 19, 2020	0.47	0.534
12	Feb 20, 2020	-0.38	0.418
13	Feb 21, 2020	-1.05	0.468
14	Feb 24, 2020	-3.35	0.311
15	Feb 25, 2020	-3.03	0.318
16	Feb 26, 2020	-0.38	0.337
17	Feb 27, 2020	-4.42	0.295
18	Feb 28, 2020	-0.82	0.280
19	Mar 02, 2020	4.60	0.469
20	Mar 03, 2020	-2.81	0.371
21	Mar 04, 2020	4.22	0.416
22	Mar 05, 2020	-3.39	0.318
23	Mar 06, 2020	-1.71	0.320
24	Mar 09, 2020	-7.60	0.318
25	Mar 10, 2020	4.94	0.397
26	Mar 11, 2020	-4.89	0.254
27	Mar 12, 2020	-9.51	0.277
29	Mar 16, 2020	-11.98	0.284
30	Mar 17, 2020	6.00	0.381
31	Mar 18, 2020	-5.18	0.316
32	Mar 19, 2020	0.47	0.355

	Date	Daily Return in %	Sentiment Polarity
33	Mar 20, 2020	-4.34	0.282
34	Mar 23, 2020	-2.93	0.292
35	Mar 24, 2020	9.38	0.406
36	Mar 25, 2020	1.15	0.399
37	Mar 26, 2020	6.24	0.423
38	Mar 27, 2020	-3.37	0.357

In [11]:

```
plt.figure(figsize=(13,10))
sns.regplot(data=tsNO3, x='Sentiment Polarity', y='Daily Return in %')
print(linregress(tsNO3['Sentiment Polarity'],tsNO3['Daily Return in %']))
```

```
LinregressResult(slope=29.211065686427443, intercept=-12.174088697995725,
rvalue=0.5795339116840152, pvalue=0.00013741975438801213, stderr=6.846163416372961)
```



In [12]:

```
tsNO2 = pd.DataFrame(data=ts)
tsNO2 = tsNO2.drop(tsNO2.index[[28,35]])
tsNO2
```

Out[12]:

	Date	Daily Return in %	Sentiment Polarity
0	Feb 03, 2020	0.73	0.476
1	Feb 04, 2020	1.50	0.496
2	Feb 05, 2020	1.13	0.531
3	Feb 06, 2020	0.33	0.470
4	Feb 07, 2020	-0.54	0.489
5	Feb 10, 2020	0.73	0.457

	Date	Daily Return in %	Sentiment Polarity
5	Feb 10, 2020	0.73	0.457
6	Feb 11, 2020	0.17	0.489
7	Feb 12, 2020	0.65	0.524
8	Feb 13, 2020	-0.16	0.414
9	Feb 14, 2020	0.18	0.501
10	Feb 18, 2020	-0.29	0.393
11	Feb 19, 2020	0.47	0.534
12	Feb 20, 2020	-0.38	0.418
13	Feb 21, 2020	-1.05	0.468
14	Feb 24, 2020	-3.35	0.311
15	Feb 25, 2020	-3.03	0.318
16	Feb 26, 2020	-0.38	0.337
17	Feb 27, 2020	-4.42	0.295
18	Feb 28, 2020	-0.82	0.280
19	Mar 02, 2020	4.60	0.469
20	Mar 03, 2020	-2.81	0.371
21	Mar 04, 2020	4.22	0.416
22	Mar 05, 2020	-3.39	0.318
23	Mar 06, 2020	-1.71	0.320
24	Mar 09, 2020	-7.60	0.318
25	Mar 10, 2020	4.94	0.397
26	Mar 11, 2020	-4.89	0.254
27	Mar 12, 2020	-9.51	0.277
29	Mar 16, 2020	-11.98	0.284
30	Mar 17, 2020	6.00	0.381
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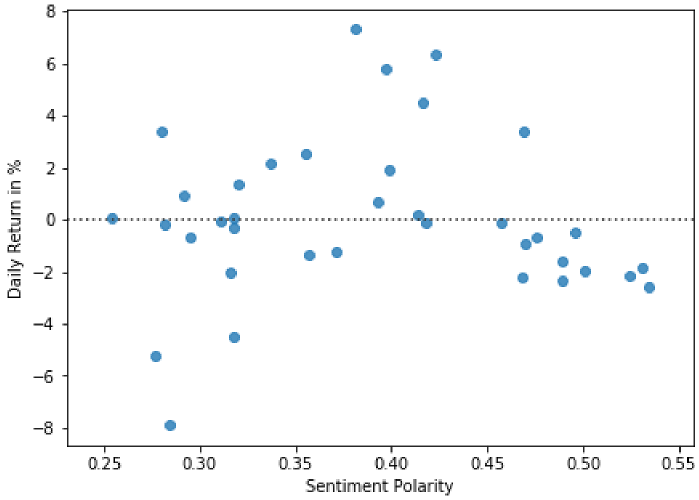
32	Mar 19, 2020	0.47	0.355
33	Mar 20, 2020	-4.34	0.282
34	Mar 23, 2020	-2.93	0.292
36	Mar 25, 2020	1.15	0.399
37	Mar 26, 2020	6.24	0.423
38	Mar 27, 2020	-3.37	0.357

In [13]:

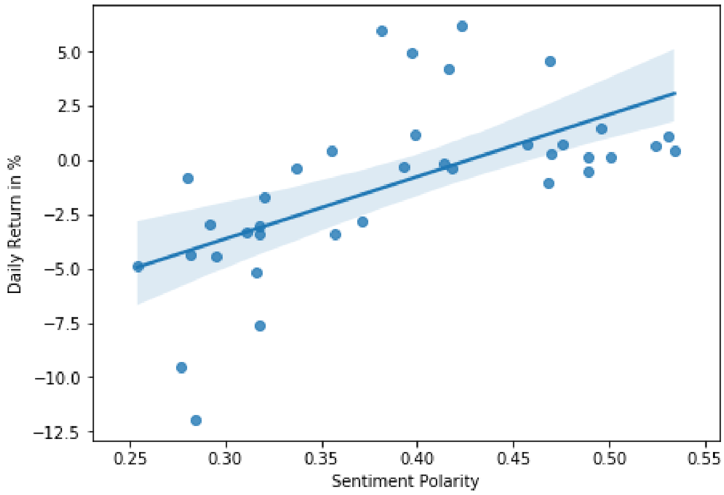
```
plt.figure(figsize=(7,5))
sns.residplot(data=tsNO2, x='Sentiment Polarity', y='Daily Return in %')
plt.show()
```



In [14]:

```
plt.figure(figsize=(7,5))
sns.regplot(data=tsNO2, x='Sentiment Polarity', y='Daily Return in %')
print(linregress(tsNO2['Sentiment Polarity'],tsNO2['Daily Return in %']))
```

```
LinregressResult(slope=28.610407614798984, intercept=-12.201842753555386,
rvalue=0.6194286207885229, pvalue=4.355624325068606e-05, stderr=6.1291143258925365)
```



In [15]:

```
tsNO = pd.DataFrame(data=ts)
tsNO = tsNO.drop(tsNO.index[[27,28,29,35]])
tsNO
```

Out[15]:

	Date	Daily Return in %	Sentiment Polarity
0	Feb 03, 2020	0.73	0.476
1	Feb 04, 2020	1.50	0.496
2	Feb 05, 2020	1.13	0.531
3	Feb 06, 2020	0.33	0.470
4	Feb 07, 2020	-0.54	0.489
5	Feb 10, 2020	0.73	0.457
6	Feb 11, 2020	0.17	0.489
7	Feb 12, 2020	0.65	0.524
8	Feb 13, 2020	-0.16	0.414
9	Feb 14, 2020	0.18	0.501
10	Feb 18, 2020	-0.29	0.393
11	Feb 19, 2020	0.47	0.534
12	Feb 20, 2020	-0.38	0.418
13	Feb 21, 2020	-1.05	0.468
14	Feb 24, 2020	-3.35	0.311
15	Feb 25, 2020	-3.03	0.318
16	Feb 26, 2020	-0.38	0.337
17	Feb 27, 2020	-4.42	0.295
18	Feb 28, 2020	-0.82	0.280
19	Mar 02, 2020	4.60	0.469
20	Mar 03, 2020	-2.81	0.371
21	Mar 04, 2020	4.22	0.416
22	Mar 05, 2020	-3.39	0.318

	Date	Daily Return in %	Sentiment Polarity
23	Mar 06, 2020	-1.71	0.320
24	Mar 09, 2020	-7.60	0.318
25	Mar 10, 2020	4.94	0.397
26	Mar 11, 2020	-4.89	0.254
30	Mar 17, 2020	6.00	0.381
31	Mar 18, 2020	-5.18	0.316
32	Mar 19, 2020	0.47	0.355
33	Mar 20, 2020	-4.34	0.282
34	Mar 23, 2020	-2.93	0.292
36	Mar 25, 2020	1.15	0.399
37	Mar 26, 2020	6.24	0.423
38	Mar 27, 2020	-3.37	0.357

In [16]:

```
print(linregress(tsNO['Sentiment Polarity'],tsNO['Daily Return in %']))
print(linregress(ts['Sentiment Polarity'],ts['Daily Return in %']))
```

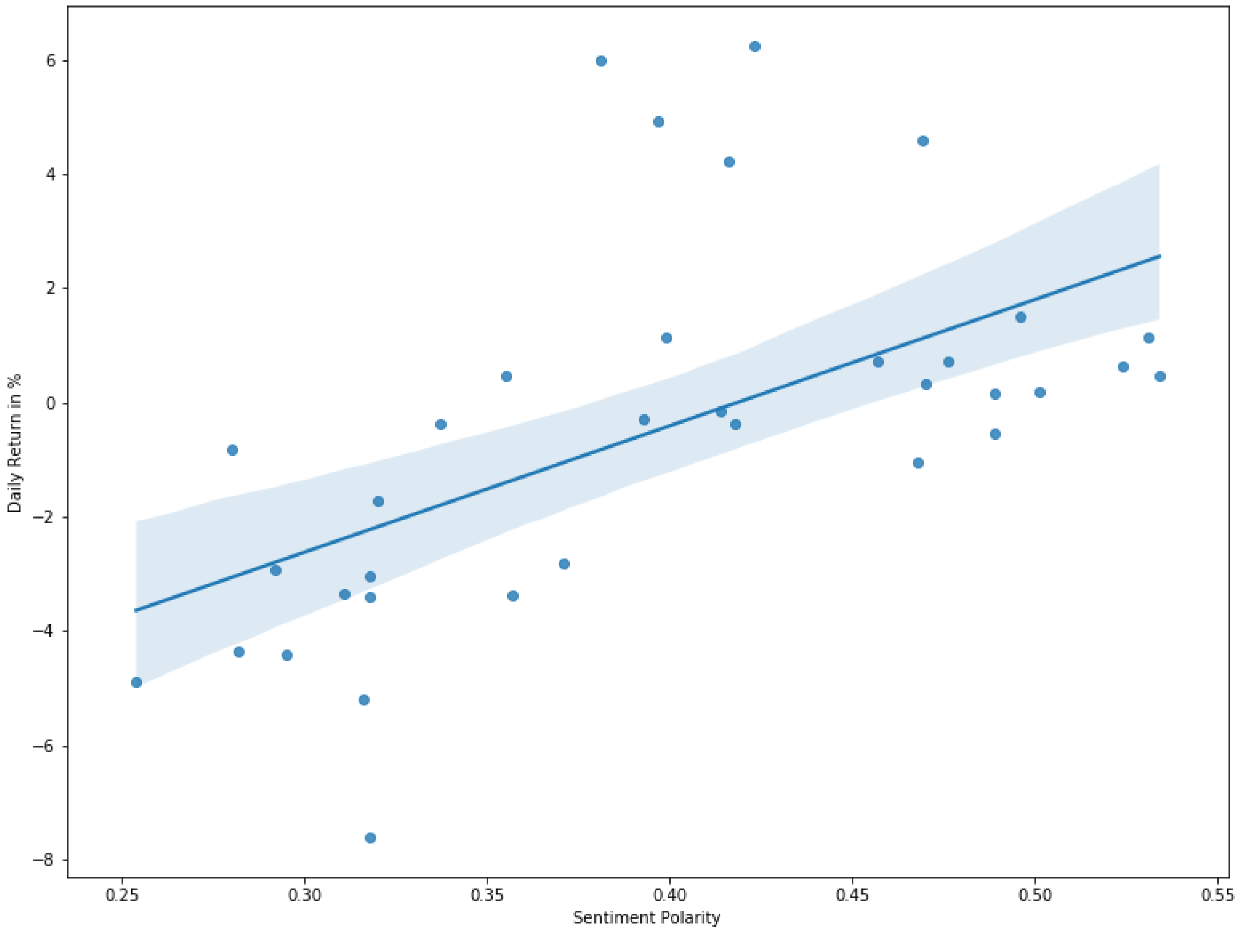
```
LinregressResult(slope=22.12008902026907, intercept=-9.254671846346051, rvalue=0.5714767249537198,
pvalue=0.0003359788324972495, stderr=5.529330348535928)
LinregressResult(slope=24.08986875602463, intercept=-9.850377582624011, rvalue=0.4552354020856667,
pvalue=0.003591561029147541, stderr=7.745841531263473)
```

In [17]:

```
plt.figure(figsize=(13,10))
sns.regplot(data=tsNO, x='Sentiment Polarity', y='Daily Return in %')
```

Out[17]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x2633140ea88>
```

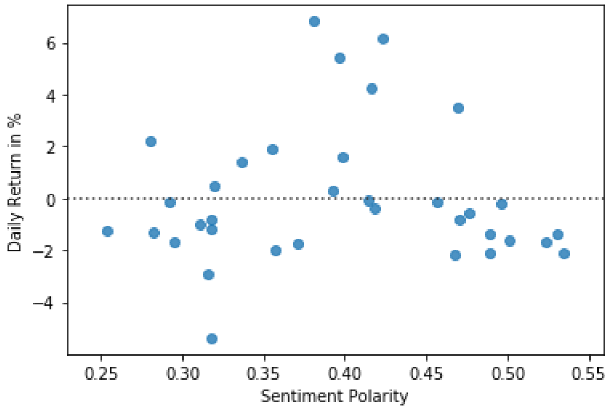


In [18]:

```
sns.residplot(x='Sentiment Polarity',y='Daily Return in %',data=tsNO)
```

Out[18]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x26331b10588>
```

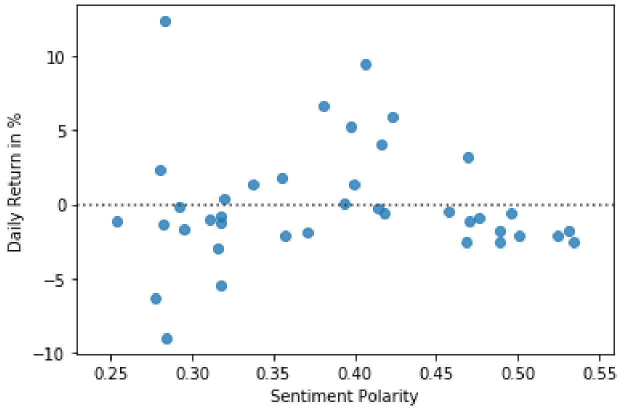


In [19]:

```
sns.residplot(x='Sentiment Polarity',y='Daily Return in %',data=ts)
```

Out[19]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x26331d961c8>
```

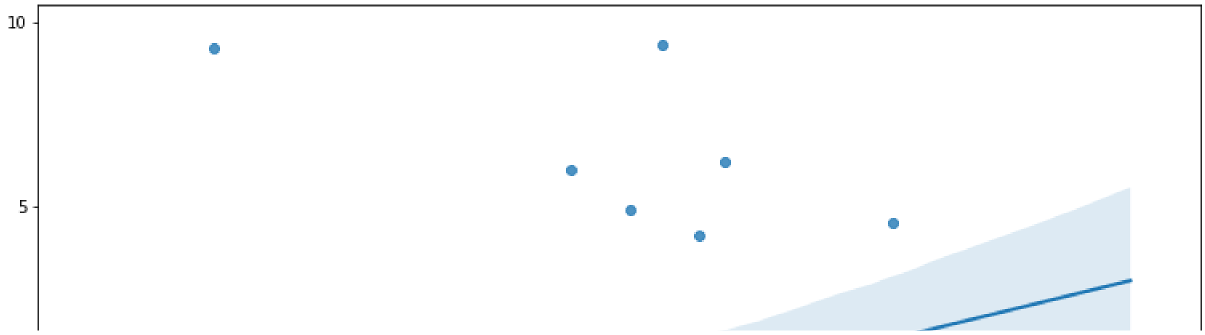


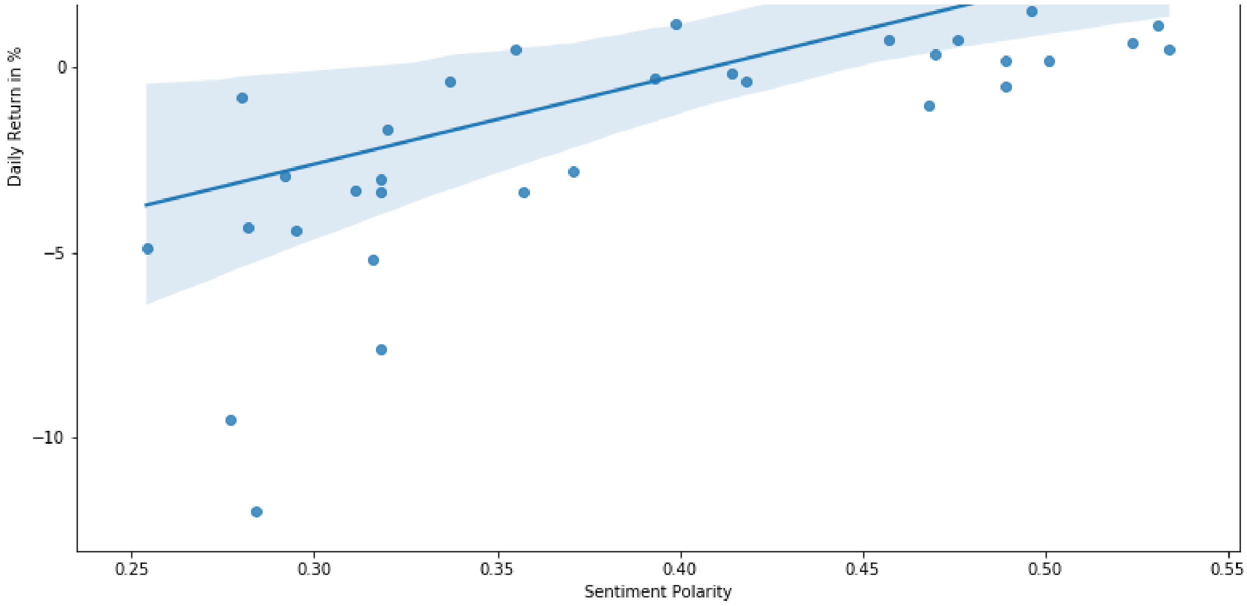
In [20]:

```
#linear relationship between sentiment polarity and daily returns (%)
plt.figure(figsize=(13,10))
sns.regplot(data=ts, x='Sentiment Polarity', y='Daily Return in %')
```

Out[20]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x26331294f48>
```





In [ ]:

In [ ]:

In [ ]:

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In [ ]:

In [22]:

```
gDelta = pd.read_excel(r'C:\Users\timod\Desktop\SPX_gDelta_all.xlsx')
gDelta['Daily Return in %'] = ts['Daily Return in %']

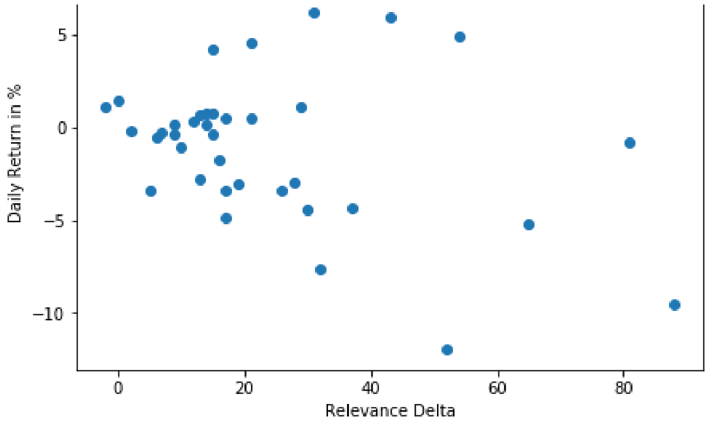
gDelta
```

Out[22]:

	Date	buy S&P 500	sell S&P 500	Delta	Daily Return in %
0	2020-02-03	14	0	14	0.73
1	2020-02-04	12	12	0	1.50
2	2020-02-05	10	12	-2	1.13
3	2020-02-06	12	0	12	0.33
4	2020-02-07	18	12	6	-0.54
5	2020-02-10	21	6	15	0.73
6	2020-02-11	15	6	9	0.17
7	2020-02-12	13	0	13	0.65
8	2020-02-13	11	9	2	-0.16
9	2020-02-14	20	6	14	0.18
10	2020-02-18	13	6	7	-0.29
11	2020-02-19	17	0	17	0.47
12	2020-02-20	17	8	9	-0.38
13	2020-02-21	16	6	10	-1.05
14	2020-02-24	23	6	17	-3.35
15	2020-02-25	25	6	19	-3.03
16	2020-02-26	26	11	15	-0.38
17	2020-02-27	52	22	30	-4.42
18	2020-02-28	100	19	81	-0.82
19	2020-03-02	29	8	21	4.60
20	2020-03-03	21	8	13	-2.81
21	2020-03-04	19	4	15	4.22
22	2020-03-05	13	8	5	-3.39
23	2020-03-06	20	4	16	-1.71
24	2020-03-09	42	10	32	-7.60
25	2020-03-10	60	6	54	4.94
26	2020-03-11	25	8	17	-4.89
27	2020-03-12	100	12	88	-9.51
28	2020-03-13	73	9	64	9.29
29	2020-03-16	68	16	52	-11.98
30	2020-03-17	53	10	43	6.00
31	2020-03-18	71	6	65	-5.18
32	2020-03-19	29	8	21	0.47
33	2020-03-20	43	6	37	-4.34
34	2020-03-23	32	4	28	-2.93
35	2020-03-24	44	8	36	9.38
36	2020-03-25	33	4	29	1.15
37	2020-03-26	37	6	31	6.24
38	2020-03-27	32	6	26	-3.37

In [23]:

```
plt.figure(figsize=(7,5))
plt.scatter(x='Delta',y='Daily Return in %',data=gDelta)
plt.xlabel("Relevance Delta")
plt.ylabel("Daily Return in %")
plt.show()
```



In [37]:

```
GT_Delta = pd.read_excel(r'C:\Users\timod\Desktop\test_gDelta_spx.xlsx')
GT_Delta['Daily Return in %'] = ts['Daily Return in %']
GT_Delta
```

```
---------------------------------------------------------------------------
FileNotFoundError                         Traceback (most recent call last)
<ipython-input-37-568518e9ef99> in <module>
----> 1 GT_Delta = pd.read_excel(r'C:\Users\timod\Desktop\test_gDelta_spx.xlsx')
      2 GT_Delta['Daily Return in %'] = ts['Daily Return in %']
      3 GT_Delta

~\anaconda3\lib\site-packages\pandas\io\excel\_base.py in read_excel(io, sheet_name, header,
names, index_col, usecols, squeeze, dtype, engine, converters, true_values, false_values,
skiprows, nrows, na_values, keep_default_na, verbose, parse_dates, date_parser, thousands,
comment, skipfooter, convert_float, mangle_dupe_cols, **kwds)
    302 
    303     if not isinstance(io, ExcelFile):
--> 304         io = ExcelFile(io, engine=engine)
    305     elif engine and engine != io.engine:
    306         raise ValueError(

~\anaconda3\lib\site-packages\pandas\io\excel\_base.py in __init__(self, io, engine)
    819         self._io = stringify_path(io)
    820 
--> 821         self._reader = self._engines[engine](self._io)
    822 
    823     def __fspath__(self):

~\anaconda3\lib\site-packages\pandas\io\excel\_xlrd.py in __init__(self, filepath_or_buffer)
     19         err_msg = "Install xlrd >= 1.0.0 for Excel support"
     20         import_optional_dependency("xlrd", extra=err_msg)
---> 21         super().__init__(filepath_or_buffer)
     22 
     23     @property

~\anaconda3\lib\site-packages\pandas\io\excel\_base.py in __init__(self, filepath_or_buffer)
    351             self.book = self.load_workbook(filepath_or_buffer)
    352         elif isinstance(filepath_or_buffer, str):
--> 353             self.book = self.load_workbook(filepath_or_buffer)
    354         elif isinstance(filepath_or_buffer, bytes):
    355             self.book = self.load_workbook(BytesIO(filepath_or_buffer))

~\anaconda3\lib\site-packages\pandas\io\excel\_xlrd.py in load_workbook(self, filepath_or_buffer)
     34             return open_workbook(file_contents=data)
     35         else:
---> 36             return open_workbook(filepath_or_buffer)
     37 
     38     @property

~\anaconda3\lib\site-packages\xlrd\__init__.py in open_workbook(filename, logfile, verbosity,
use_mmap, file_contents, encoding_override, formatting_info, on_demand, ragged_rows)
    109     else:
    110         filename = os.path.expanduser(filename)
--> 111         with open(filename, "rb") as f:
    112             peek = f.read(peeksz)
    113     if peek == b"PK\x03\x04": # a ZIP file
```

```
FileNotFoundError: [Errno 2] No such file or directory:
'C:\\Users\\timod\\Desktop\\test_gDelta_spx.xlsx'
```

In [38]:

```
plt.figure(figsize=(13,10))
plt.scatter(x='GT_Delta',y='Daily Return in %',data=GT_Delta)
plt.show()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-38-a31bb99e9f41> in <module>
      1 plt.figure(figsize=(13,10))
----> 2 plt.scatter(x='GT_Delta',y='Daily Return in %',data=GT_Delta)
      3 plt.show()

NameError: name 'GT_Delta' is not defined
```

```
<Figure size 936x720 with 0 Axes>
```

In [24]:

```
gt = pd.read_excel(r'C:\Users\timod\Desktop\S&P500_GoogleTrends.xlsx')
gt['Daily Return in %'] = ts['Daily Return in %'].abs()
gt = gt.drop(gt.index[[28,35]])
gt['S&P 500'] = gt['S&P 500']/100
gt
```

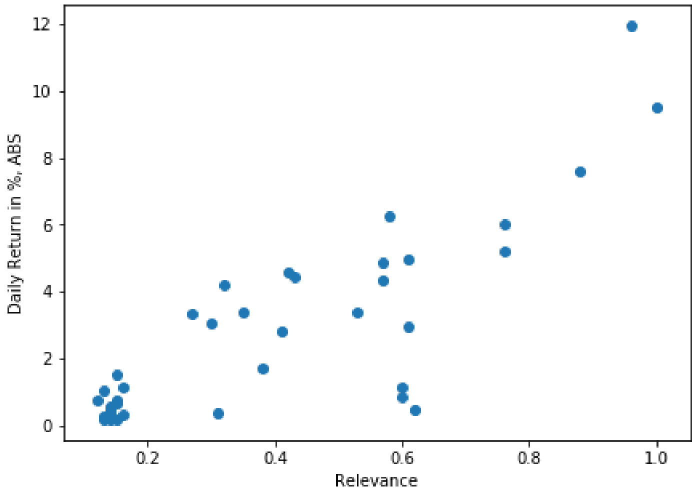
Out[24]:

	Date	S&P 500	Daily Return in %
0	2020-02-03	0.15	0.73
1	2020-02-04	0.15	1.50
2	2020-02-05	0.16	1.13
3	2020-02-06	0.16	0.33
4	2020-02-07	0.14	0.54
5	2020-02-10	0.12	0.73
6	2020-02-11	0.14	0.17
7	2020-02-12	0.15	0.65
8	2020-02-13	0.15	0.16
9	2020-02-14	0.13	0.18
10	2020-02-18	0.13	0.29
11	2020-02-19	0.14	0.47
12	2020-02-20	0.14	0.38
13	2020-02-21	0.13	1.05
14	2020-02-24	0.27	3.35
15	2020-02-25	0.30	3.03
16	2020-02-26	0.31	0.38
17	2020-02-27	0.43	4.42
18	2020-02-28	0.60	0.82
19	2020-03-02	0.42	4.60
20	2020-03-03	0.41	2.81
21	2020-03-04	0.32	4.22
22	2020-03-05	0.35	3.39
23	2020-03-06	0.38	1.71
24	2020-03-09	0.88	7.60
25	2020-03-10	0.61	4.94
26	2020-03-11	0.57	4.89

	Date	S&P 500	Daily Return in %
27	2020-03-12	1.00	9.51
29	2020-03-16	0.96	11.98
30	2020-03-17	0.76	6.00
31	2020-03-18	0.76	5.18
32	2020-03-19	0.62	0.47
33	2020-03-20	0.57	4.34
34	2020-03-23	0.61	2.93
36	2020-03-25	0.60	1.15
37	2020-03-26	0.58	6.24
38	2020-03-27	0.53	3.37

In [25]:

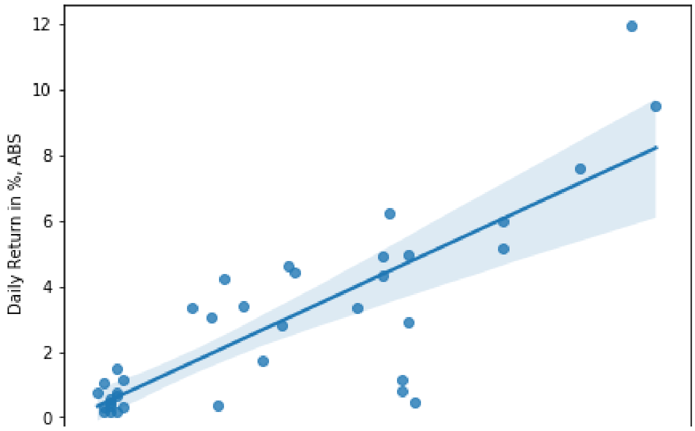
```
plt.figure(figsize=(7,5))
plt.scatter(x='S&P 500',y='Daily Return in %',data=gt)
plt.xlabel('Relevance')
plt.ylabel('Daily Return in %, ABS')
plt.show()
print(linregress(gt['S&P 500'],gt['Daily Return in %']))
```

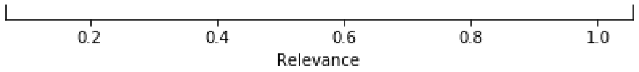


```
LinregressResult(slope=8.960598672151132, intercept=-0.7363696840000338,
rvalue=0.8267396188468501, pvalue=2.888884892830342e-10, stderr=1.0306761126824016)
```

In [26]:

```
plt.figure(figsize=(7,5))
sns.regplot(x='S&P 500',y='Daily Return in %',data=gt)
plt.xlabel('Relevance')
plt.ylabel('Daily Return in %, ABS')
plt.show()
print(linregress(gt['S&P 500'],gt['Daily Return in %']))
```





```
LinregressResult(slope=8.960598672151132, intercept=-0.7363696840000338,
rvalue=0.8267396188468501, pvalue=2.888884892830342e-10, stderr=1.0306761126824016)
```

In [ ]:

```

```

In [ ]:

```

```

In [27]:

```
GTT = pd.DataFrame()
GTT['Date'], GTT['Sentiment Polarity'], GTT['Relevance'], GTT['Daily Return in %'] = gt['Date'], ts
['Sentiment Polarity'], gt['S&P 500'], ts['Daily Return in %']
GTT
```

Out[27]:

	Date	Sentiment Polarity	Relevance	Daily Return in %
0	2020-02-03	0.476	0.15	0.73
1	2020-02-04	0.496	0.15	1.50
2	2020-02-05	0.531	0.16	1.13
3	2020-02-06	0.470	0.16	0.33
4	2020-02-07	0.489	0.14	-0.54
5	2020-02-10	0.457	0.12	0.73
6	2020-02-11	0.489	0.14	0.17
7	2020-02-12	0.524	0.15	0.65
8	2020-02-13	0.414	0.15	-0.16
9	2020-02-14	0.501	0.13	0.18
10	2020-02-18	0.393	0.13	-0.29
11	2020-02-19	0.534	0.14	0.47
12	2020-02-20	0.418	0.14	-0.38
13	2020-02-21	0.468	0.13	-1.05
14	2020-02-24	0.311	0.27	-3.35
15	2020-02-25	0.318	0.30	-3.03
16	2020-02-26	0.337	0.31	-0.38
17	2020-02-27	0.295	0.43	-4.42
18	2020-02-28	0.280	0.60	-0.82
19	2020-03-02	0.469	0.42	4.60
20	2020-03-03	0.371	0.41	-2.81
21	2020-03-04	0.416	0.32	4.22
22	2020-03-05	0.318	0.35	-3.39
23	2020-03-06	0.320	0.38	-1.71
24	2020-03-09	0.318	0.88	-7.60
25	2020-03-10	0.397	0.61	4.94
26	2020-03-11	0.254	0.57	-4.89
27	2020-03-12	0.277	1.00	-9.51
29	2020-03-16	0.284	0.96	-11.98
30	2020-03-17	0.381	0.76	6.00
31	2020-03-18	0.316	0.76	-5.18

	Date	Sentiment Polarity	Relevance	Daily Return in %
32	2020-03-19	0.355	0.62	0.47
33	2020-03-20	0.282	0.57	-4.34
34	2020-03-23	0.292	0.61	-2.93
36	2020-03-25	0.399	0.60	1.15
37	2020-03-26	0.423	0.58	6.24
38	2020-03-27	0.357	0.53	-3.37

In [29]:

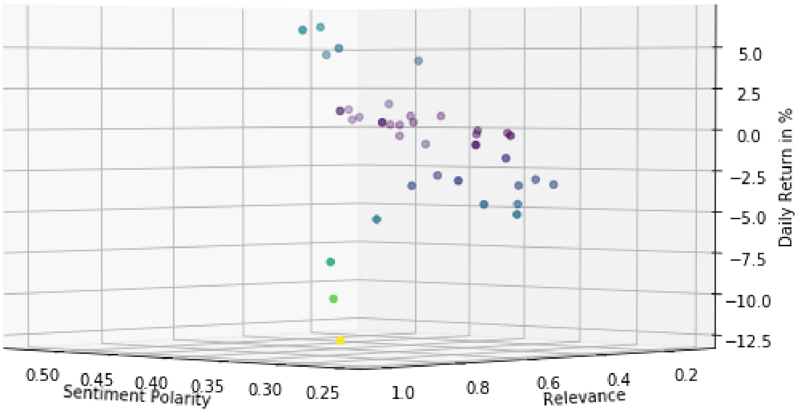
```
from mpl_toolkits.mplot3d import Axes3D
%matplotlib notebook

fig = plt.figure(figsize=(10,7))
ax = fig.add_subplot(111, projection='3d')

X = GTT['Sentiment Polarity']
Y = GTT['Relevance']
Z = GTT['Daily Return in %']

ax.scatter(X,Y,Z, c=np.linalg.norm([X,Y,Z],axis=0))
ax.set_xlabel('Sentiment Polarity')
ax.set_ylabel('Relevance')
ax.set_zlabel('Daily Return in %')

plt.show()
```



In [33]:

```
GTT['test Relevance'] = GTT['Relevance']*100
GTT
```

Out[33]:

	Date	Sentiment Polarity	Relevance	Daily Return in %	test Relevance
0	2020-02-03	0.476	0.15	0.73	15.0
1	2020-02-04	0.496	0.15	1.50	15.0

	Date	Sentiment Polarity	Relevance	Daily Return in %	test Relevance
2	2020-02-05	0.531	0.16	1.13	16.0
3	2020-02-06	0.470	0.16	0.33	16.0
4	2020-02-07	0.489	0.14	-0.54	14.0
5	2020-02-10	0.457	0.12	0.73	12.0
6	2020-02-11	0.489	0.14	0.17	14.0
7	2020-02-12	0.524	0.15	0.65	15.0
8	2020-02-13	0.414	0.15	-0.16	15.0
9	2020-02-14	0.501	0.13	0.18	13.0
10	2020-02-18	0.393	0.13	-0.29	13.0
11	2020-02-19	0.534	0.14	0.47	14.0
12	2020-02-20	0.418	0.14	-0.38	14.0
13	2020-02-21	0.468	0.13	-1.05	13.0
14	2020-02-24	0.311	0.27	-3.35	27.0
15	2020-02-25	0.318	0.30	-3.03	30.0
16	2020-02-26	0.337	0.31	-0.38	31.0
17	2020-02-27	0.295	0.43	-4.42	43.0
18	2020-02-28	0.280	0.60	-0.82	60.0
19	2020-03-02	0.469	0.42	4.60	42.0
20	2020-03-03	0.371	0.41	-2.81	41.0
21	2020-03-04	0.416	0.32	4.22	32.0
22	2020-03-05	0.318	0.35	-3.39	35.0
23	2020-03-06	0.320	0.38	-1.71	38.0
24	2020-03-09	0.318	0.88	-7.60	88.0
25	2020-03-10	0.397	0.61	4.94	61.0
26	2020-03-11	0.254	0.57	-4.89	57.0
27	2020-03-12	0.277	1.00	-9.51	100.0
29	2020-03-16	0.284	0.96	-11.98	96.0
30	2020-03-17	0.381	0.76	6.00	76.0
31	2020-03-18	0.316	0.76	-5.18	76.0
32	2020-03-19	0.355	0.62	0.47	62.0
33	2020-03-20	0.282	0.57	-4.34	57.0
34	2020-03-23	0.292	0.61	-2.93	61.0
36	2020-03-25	0.399	0.60	1.15	60.0
37	2020-03-26	0.423	0.58	6.24	58.0
38	2020-03-27	0.357	0.53	-3.37	53.0

In [35]:

```
import statsmodels.api as sm
from sklearn import linear_model

X = sm.add_constant(GTT[['Sentiment Polarity','Relevance']])
y = GTT['Daily Return in %']

regr = linear_model.LinearRegression()
regr.fit(X,y)

model = sm.OLS(y, X).fit()


print_model = model.summary()
print(print_model)
```

```
Intercept:
 -11.974262534385831
Coefficients:
 [ 0.          28.214025   -0.18210836]
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:      Daily Return in %   R-squared:                       0.384
Model:                            OLS   Adj. R-squared:                  0.348
Method:                 Least Squares   F-statistic:                     10.59
Date:                Sat, 02 May 2020   Prob (F-statistic):           0.000266
Time:                        12:10:48   Log-Likelihood:                -93.506
No. Observations:                  37   AIC:                             193.0
Df Residuals:                      34   BIC:                             197.8
Df Model:                           2
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
const                -11.9743      4.325     -2.768      0.009     -20.764      -3.184
Sentiment Polarity    28.2140      8.761      3.220      0.003      10.409      46.019
Relevance             -0.1821      2.836     -0.064      0.949      -5.945       5.580
==============================================================================
Omnibus:                        2.320   Durbin-Watson:                   2.350
Prob(Omnibus):                  0.313   Jarque-Bera (JB):                1.228
Skew:                           0.265   Prob(JB):                        0.541
Kurtosis:                       3.717   Cond. No.                         22.0
==============================================================================

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

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In [58]:

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In [63]:

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