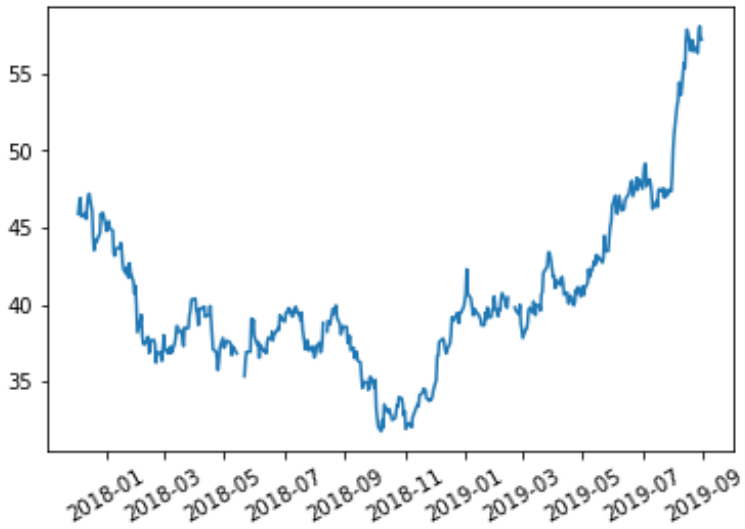
Analysis

1.Data

The spread trading involves two treasury future contract, 'CBT TU TU' and 'CBT US US' for 2 Dec 2017 though 31 Aug 2019 from the Quandl OWF database. X: CBT TU TU, Y: CBT US US, and Spread: Y-X.

2. Analysis of Spread

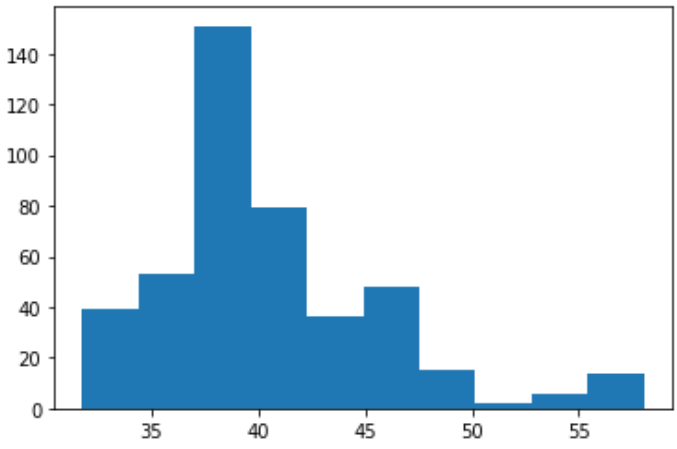
(a) Time Series Data Plot of Spread



The ts plot of spread is showed above. Overall, the price of Y is larger than X because of longer maturity of underlying bonds. The trend of spread is related to the moving of interest rate of treasury notes. According to the treasury.gov data, in 2018 the overall moving trend of interest rate is rising, so notes price decreased but it impacted long-term notes' price more, which resulted in the future spread decreasing. On the contrary, in 2019, the overall interest rate moved down, so notes price rose but it had larger impact on the long-term notes' price, which lead to the future spread rising.

(b) Statistics and Spread Histogram

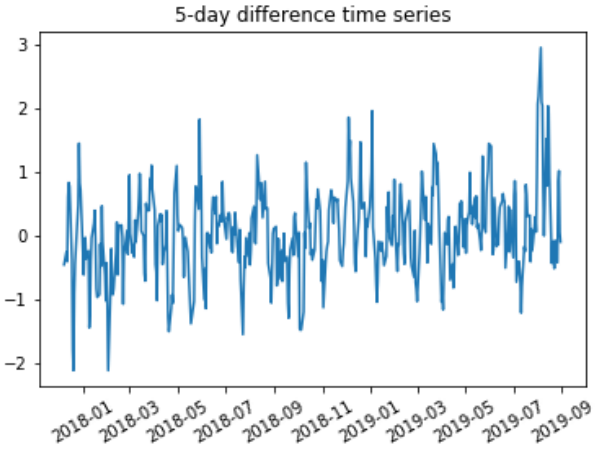
spread	
count	443
mean	40.490685
std	5.243783
min	31.765625
25%	37.273438
50%	39.367188
75%	42.835156
max	58.046875
skewness	1.186784
kurtosis	1.705929

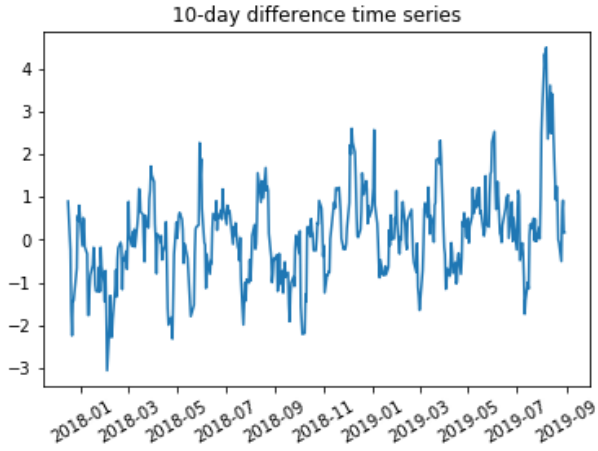


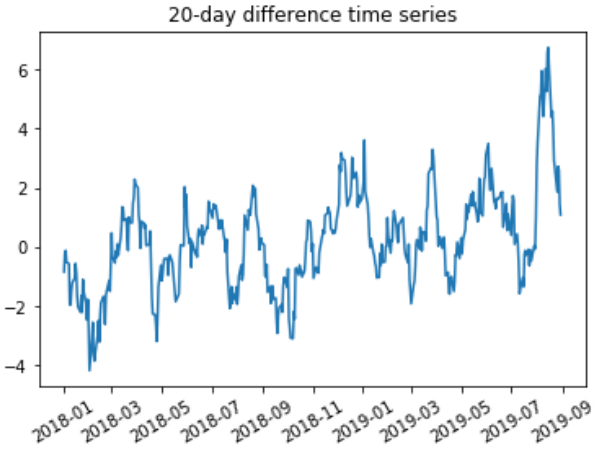
Based on the statistics of spread, the median, std, 25% and 75% quantile are shown in the table above. The spread is positively skewed and very asymmetric, and also has a fat tail.

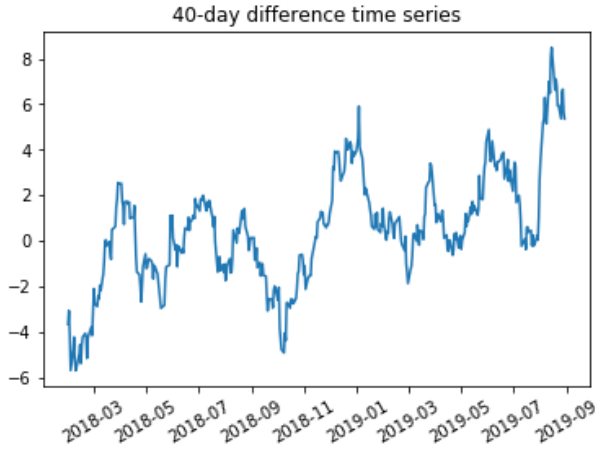
3. Analysis of N-day Difference

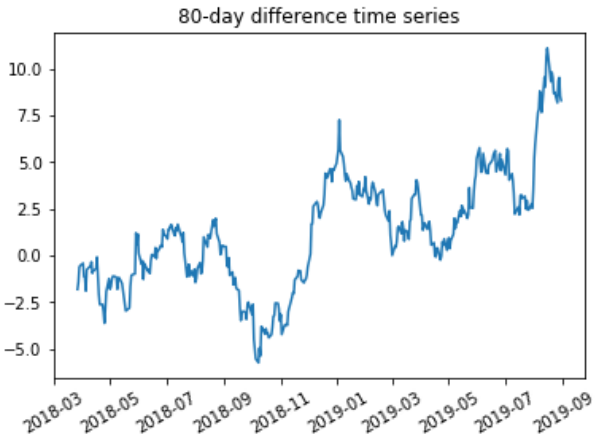
It's the difference between spread and an N-day rolling average of spread for some values of N. I chose 5, 10, 20, 40 and 80 as my window.











(a) Time Series Data Plots of N-day Difference.

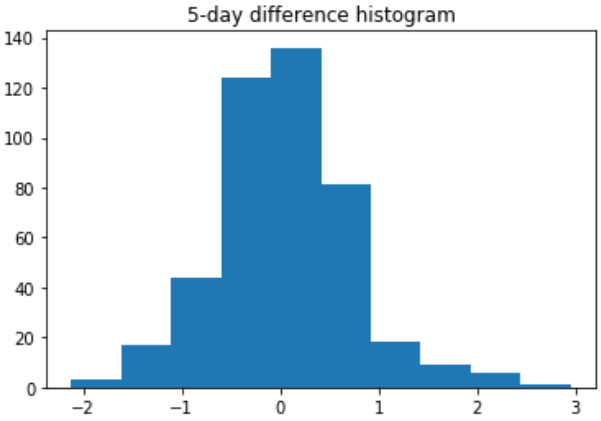
As we can see from the plots above, when the window increases, the time of going through line: y=0 for each difference is less for a fixed period.

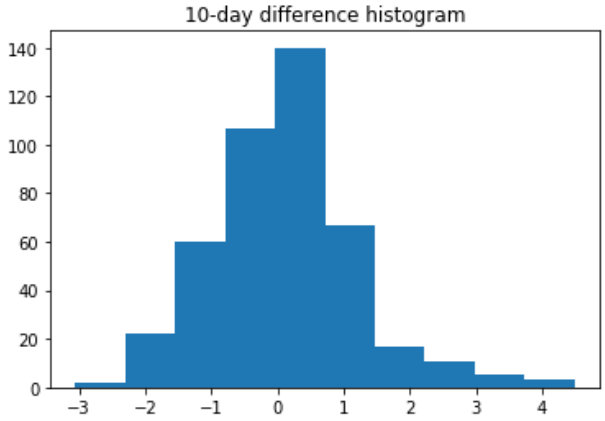
(b) Statistics and Histograms

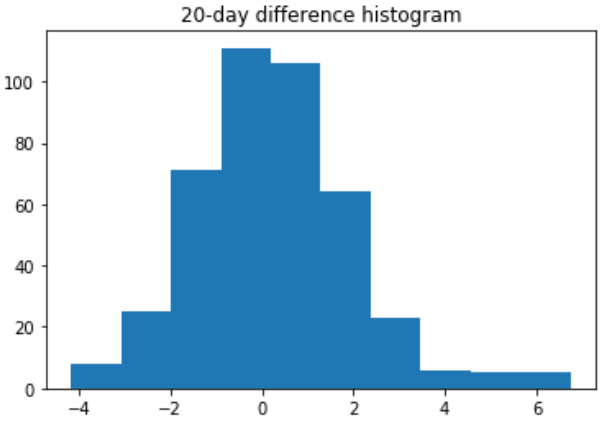
	5-day	10-day	20-day	40-day	80-day
count	439	434	424	404	364
mean	0.050839	0.113860	0.257288	0.511794	1.306377
std	0.689262	1.080961	1.708921	2.535921	3.204547
min	-2.118750	-3.056250	-4.164062	-5.698633	-5.728125
25%	-0.343281	-0.526992	-0.853164	-1.058301	-0.985425
50%	0.049375	0.087969	0.167070	0.465723	1.147314
75%	0.446406	0.689844	1.257246	1.723047	3.271484
max	2.951250	4.487344	6.741953	8.485898	11.085703
skewness	0.281227	0.542078	0.591812	0.216177	0.466882
kurtosis	1.269775	1.552816	1.338862	0.455263	0.249854

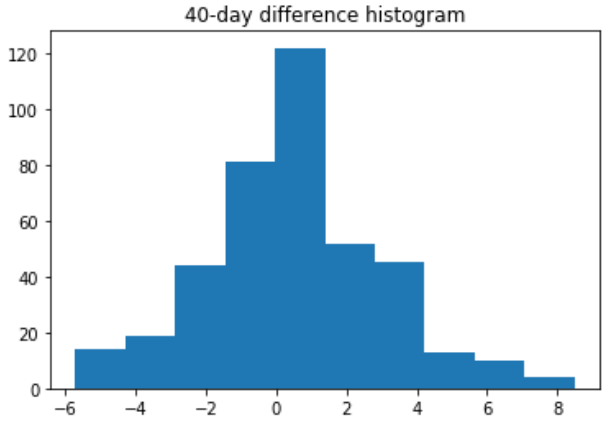
The median, std, 25% and 75% quantile are shown in the table above. It's no surprise that the median and standard deviation of difference goes up as window increases. Also, the absolute value of 25% and 75% quantile are larger as window expands. Moreover, all the differences data are slightly positively skewed. But the kurtosis goes smaller as window expands, which means the difference between actual spread and a long-term mean is less likely to show the feature of fat tail and more stable. But the information in long-term difference can be outdated and not very useful for current trading decision.

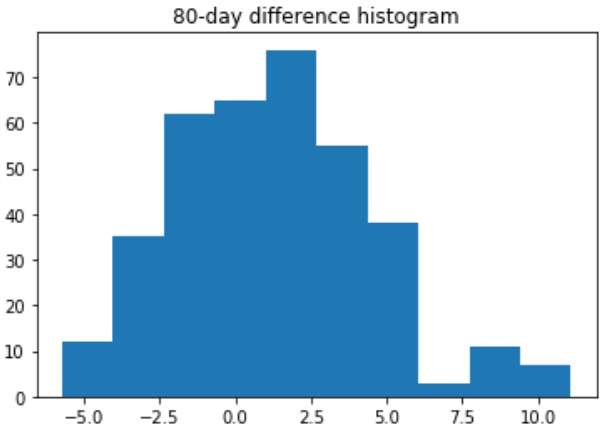
The next page shows the histograms plots of N-day difference.


5-day difference histogram
140
120
100
80
60
40
20
0
−2
−1
0
1
2
3


10-day difference histogram
140
120
100
80
60
40
20
0
−3
−2
−1
0
1
2
3
4


20-day difference histogram
100
80
60
40
20
0
−4
−2
0
2
4
6


40-day difference histogram
120
100
80
60
40
20
0
−6
−4
−2
0
2
4
6
8


80-day difference histogram
70
60
50
40
30
20
10
0
−5.0
−2.5
0.0
2.5
5.0
7.5
10.0