

Final Project DSC 425

Milestone 3

Scott Elmore

10/16/20

I have decided to take a look at the correlation aspect between SPX and VIX. This is a very interesting relationship, because of the strong negative correlation year over year and what it says about the financial market. The primary reason for the negative correlation is because of how risk is managed in the stock market. In bull markets, there is limited risk and unlimited (but not likely to exceed market average) upside to buying stocks. This causes a decline in volatility in options markets, thus causing a decline in the VIX, as money moves towards the more risk neutral asset (stocks). However, when the market turns bearish and returns fall, money will find its way into options markets. This is because the upside to stocks becomes limited, and a hedge on market returns can be had by purchasing put options or selling call options, thus increasing volatility in options. An example of this relationship can be seen here:

<http://www.cboe.com/products/vix-index-volatility/vix-options-and-futures/vix-index/the-relationship-of-the-spx-and-the-vix-index>.

My group mates will go over the time series of SPX and VIX more in depth but the inverse relationship can be seen by looking at their values in 2020 as seen in this chart.

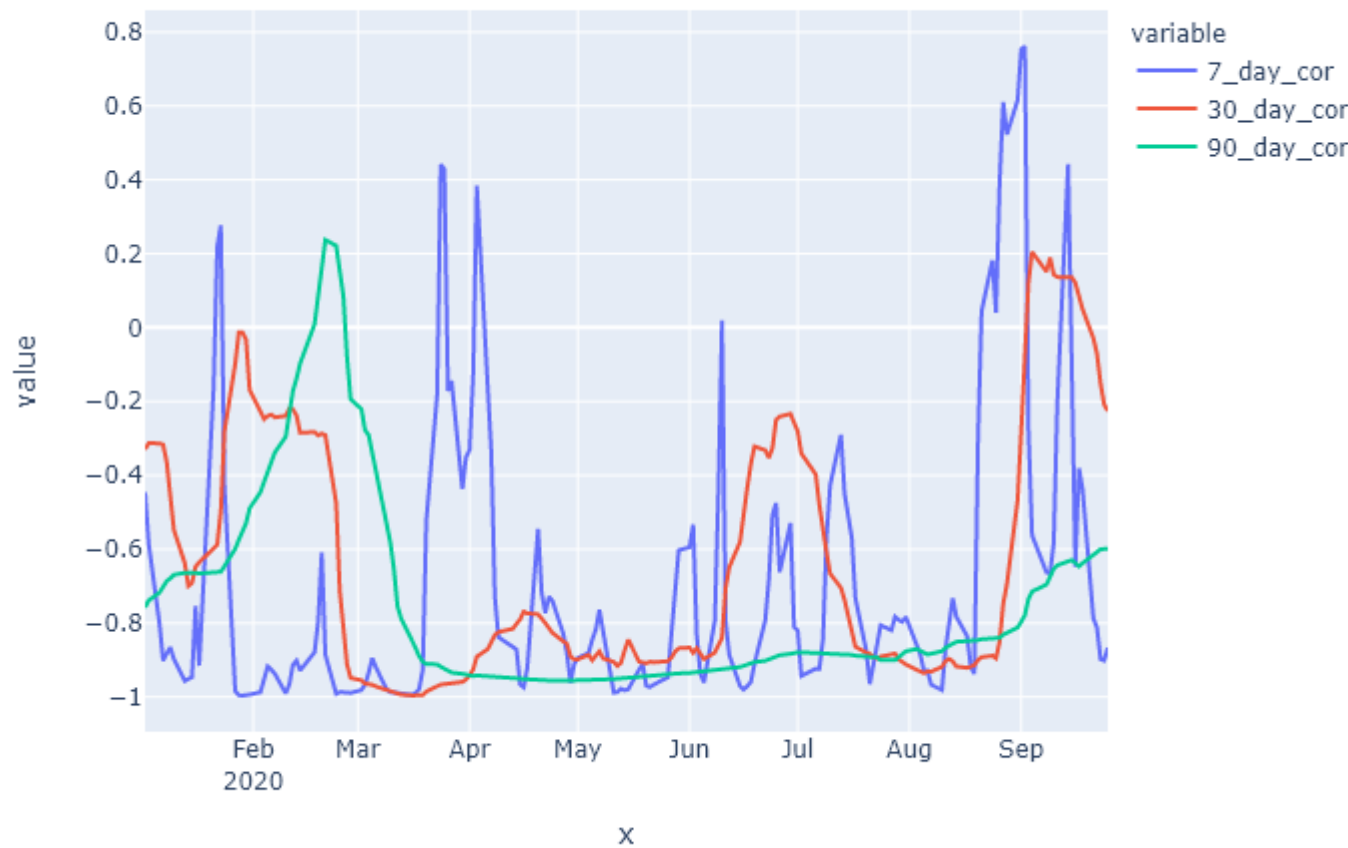
SPX, VIX in 2020



Yet, there are interesting periods when this relationship breaks down. It can be true, but not likely, that volatility increases with SPX price, and volatility decreases when the market falls. This has been true over the past year because of the turmoil due to COVID, which has increased market uncertainty. The SPX is above where it was before COVID affected the market, but the volatility has been high during this period. It is my goal in this project to investigate the correlation between the SPX and VIX and see if the relationship can be modeled accurately, including these periods of positive correlation (inverse to normal). This article is a good primer on the unlikelihood of positive correlation and what it means:

<https://seekingalpha.com/article/4334337-s-and-p-down-vix-down-what-gives>

The correlation between the two can be seen in the following chart of 7, 30, and 90 day correlations for the year 2020.

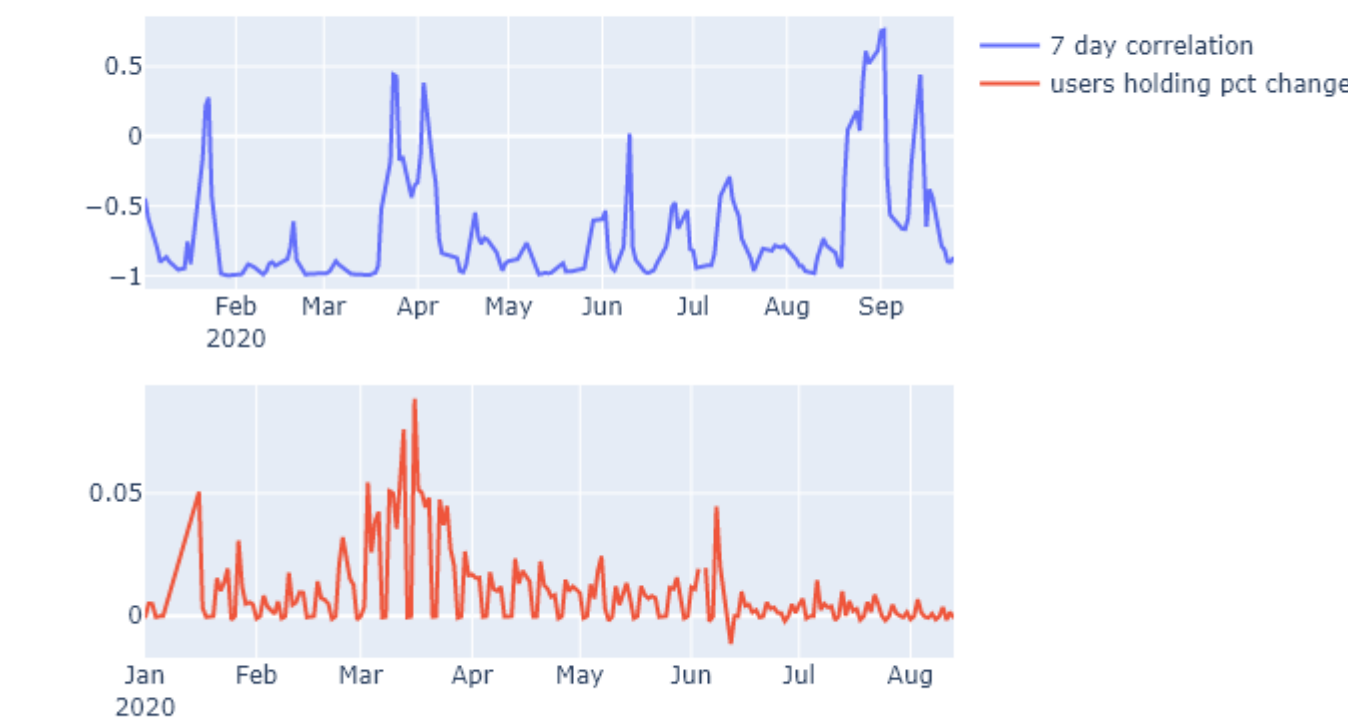


Robinhood is a popular trading platform for retail investors due to its no commission trades and ability to trade options. This past year there has been a spike in users signing up for accounts on Robinhood, and the result is an influx of *retail* money into the market. The effect of Robinhood users may be insignificant in the overall stock market, but I believe their presence has effected the volatility of options. Options have become quite popular to the average investor because of their potential for huge profit, with relatively low cost. There is no way of knowing the exact number of options purchased through Robinhood, but thanks to the site <https://robintrack.net>, I can download the number of unique users who own each individual stock. It is my hypothesis that as more Robinhood users have purchased a stock, the options are more likely to be purchased, and thus volatility increases. I hope to see some relationship between number of users holding stocks on Robinhood and volatility as measured through the VIX. This article referring to a JP Morgan study is what peaked my interest that perhaps retail money, including Robinhood, could have some effect on the VIX:

<https://markets.businessinsider.com/news/stocks/robinhood-popular-stocks-outperform-less-traded-peers-jpmorgan-study-price-2020-8-1029497817#>

Getting the popularity data from Robinhood was a little tricky. The site <https://robintrack.net> had a .tar.gz file containing a .csv of every stock on Robinhood with the number of unique users holding that stock taken at hourly intervals from when Robinhood first started sharing the popularity numbers with the public through their API, 5/2/2018. The series goes through 8/13/2020, after which Robinhood stopped publicly broadcasting these popularity numbers because the clients for which they sell their data to didnt want this valuable info being free to the public. After downloading the .csv files, I decided to only keep the top 50 stocks in terms of highest users holding. I merged the data from the top 50 stocks into a pandas dataframe where I could do things like take the aggregate sum of all users holding and the percent change of users holding day over day. With this information I can highlight how percent change of users holding seems to have some relationship with the 7 day correlation of SPX and VIX as seen in this chart.

7-day Correlation SPX and VIX with Pct. Change of Users Holding Robinhood Top Stocks



As seen in the chart, there is still work to be done to remove weekend data, where users aren't signing up.