Introduction:

I had recently built a web facing app (link here) that uses a respository I made in GitHub (link here). The repo exclusively contains python code and works with the Streamlit API. There overall goal of the app is to run time series related analysis on financial time series.

After a post that I made on Reddit a couple of people had asked me about looking at QQQ and SPY to see how the results look. For writeup will skip directly to the results, for more background and methodology please read the original writeup (LinkedIn: here, GitHub: here)

General Methodology:

1. Using yfinance data for all prices

2. Using Adjusted Close Prices

3. Using weekly prices

4. Using percent change (in this case weekly)
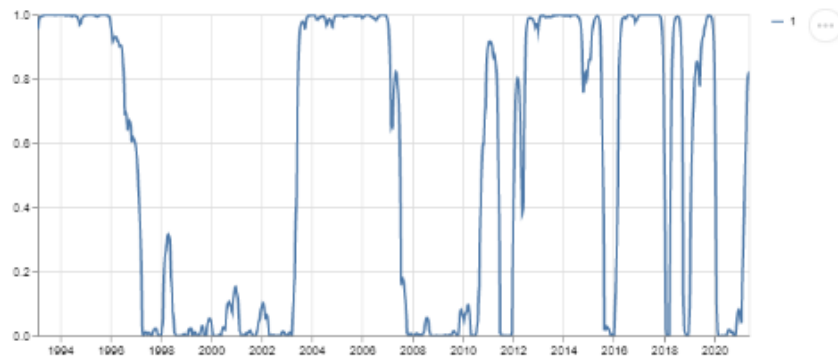
5. Using all historical data

SPY Results:

This is the original set of graphs that plot the smoothed probability of each regime (low, medium, high)
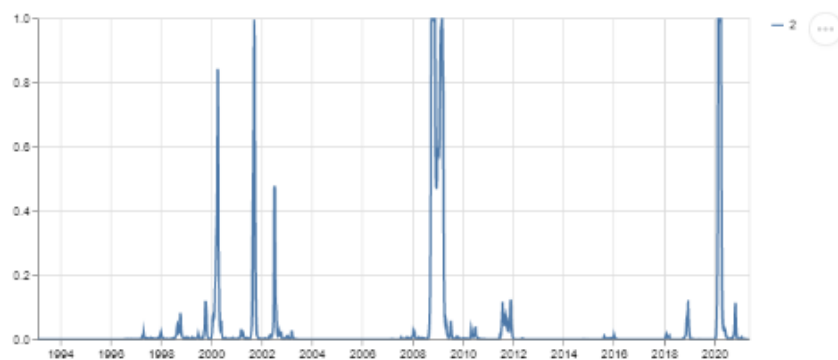
Smoothed probability of a low-variance regime for SPDR S&P 500 weekly returns

Smoothed probability of a medium-variance regime for SPDR S&P 500 weekly returns

Smoothed probability of a high-variance regime for SPDR S&P 500 weekly returns


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Created by Diego Alvarez

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First thing I notice is that periods of high variance returns are not sustained and they look possibly isolated, although there minor spikes before each big one. That could be for a couple of things, one being that the market participants *self-correct* by profiting off gains by selling the position, or the product's ability to provide lower volatility (assuming that exists) works.

Smoothed probability of a high-variance regime for SPDR S&P 500 weekly returns
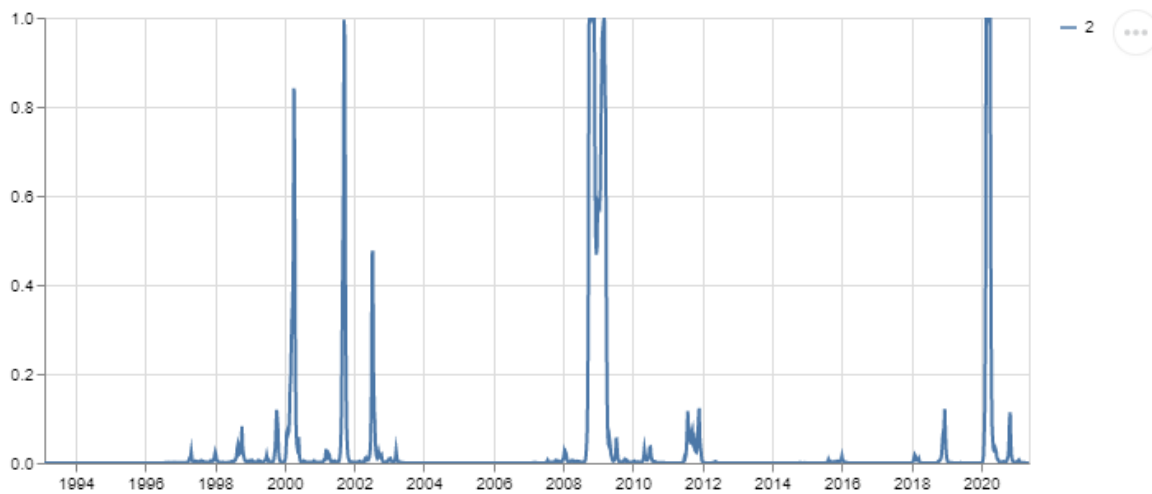
On the other hand it looks like medium variance and low variance are in a constant switch off. We can

see the almost perfect inversion between low variance probabilities and medium.

Smoothed probability of a low-variance regime for SPDR S&P 500 weekly returns
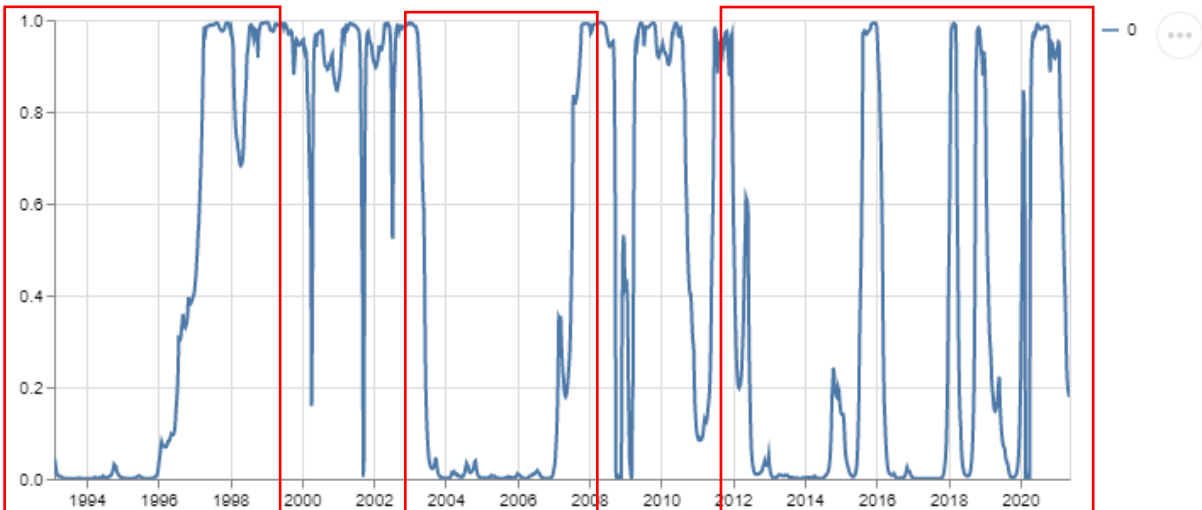
Smoothed probability of a medium-variance regime for SPDR S&P 500 weekly returns

Once I build this out into a python-only model and extract these time series there are probably easy

applications to getting rolling averages on these time series and detect trends and show their inverse

relationship. It also looks like there are areas where inverse breaks and we see a jump in high variance

returns. Most of those high variance returns come from changes from low to high variance.

Smoothed probability of a low-variance regime for SPDR S&P 500 weekly returns

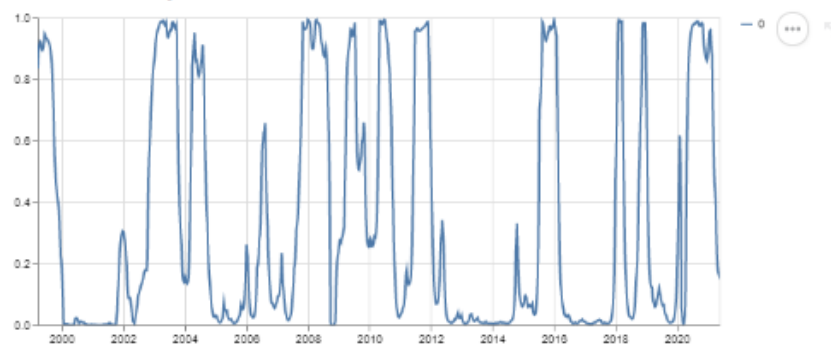### Smoothed probability of a high-variance regime for SPDR S&P 500 weekly returns
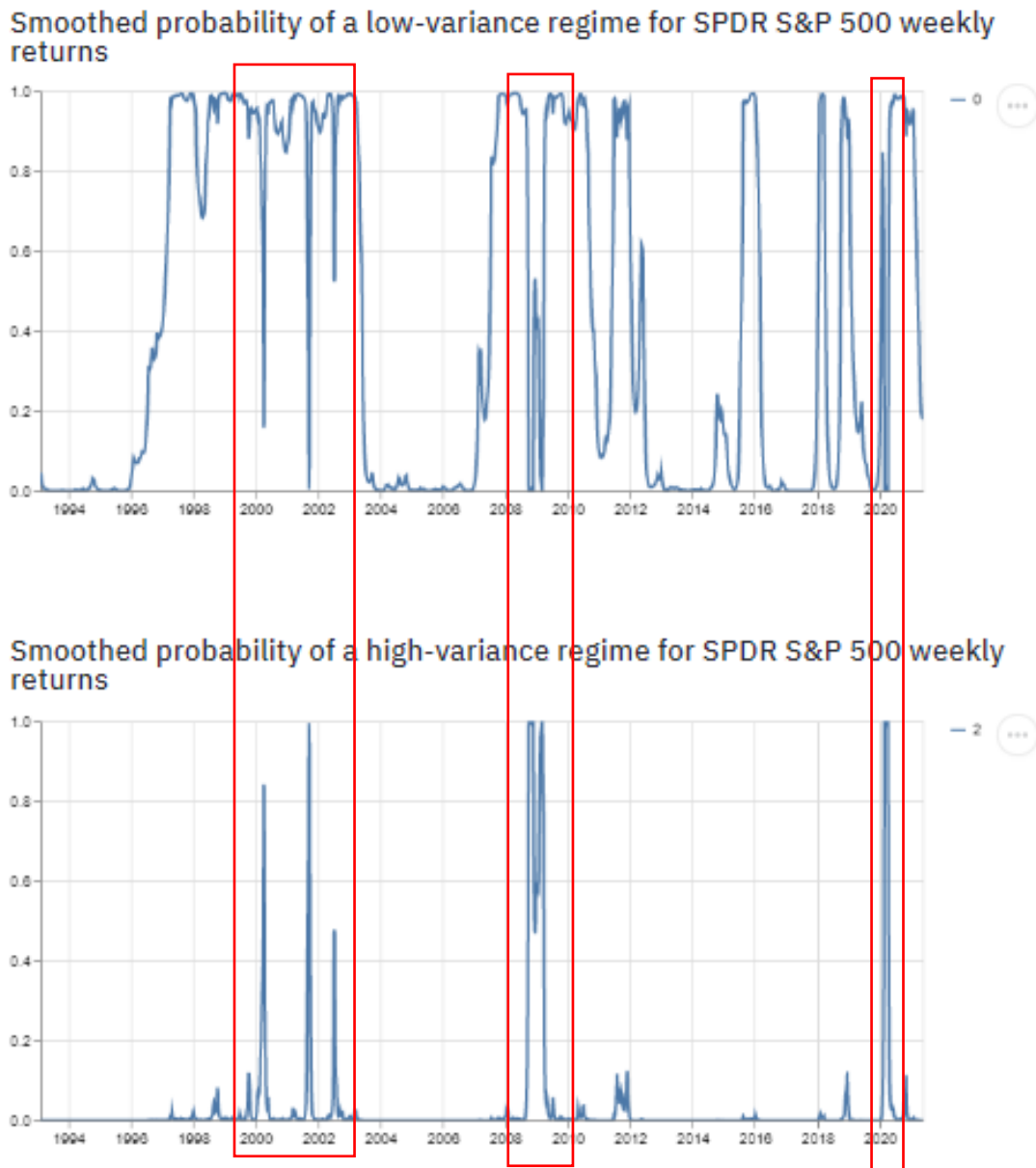
This shows that high variance returns are more like *surprises* in the market because they come from low

variance returns, its not a gradual buildup. Also because there is probably an inverse relationship cyclical

relationship between low variance and medium variance returns finding when a *break* occurs could be
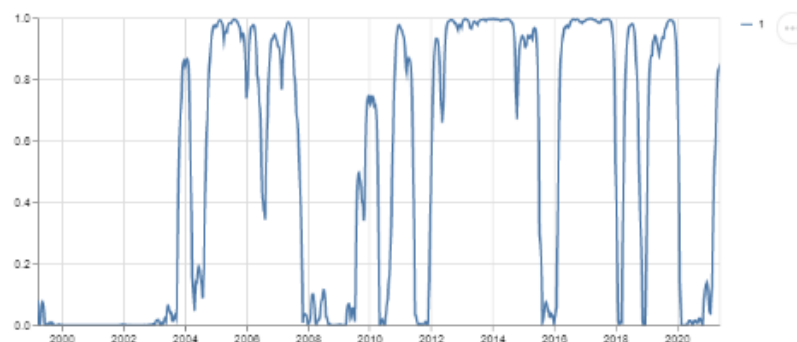
an indicator of high variance returns.

QQQ results

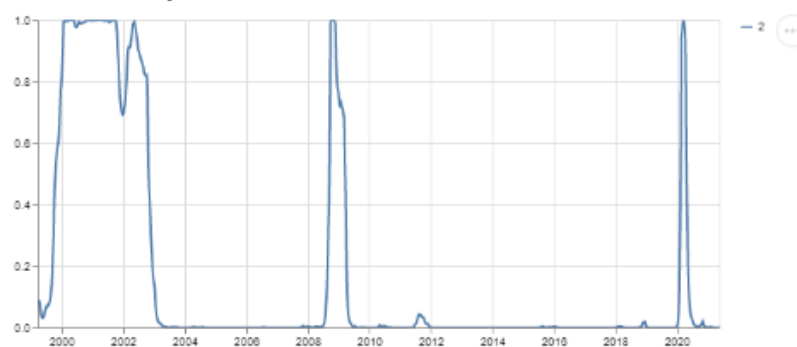QQQ's results are very similar to SPY's results.

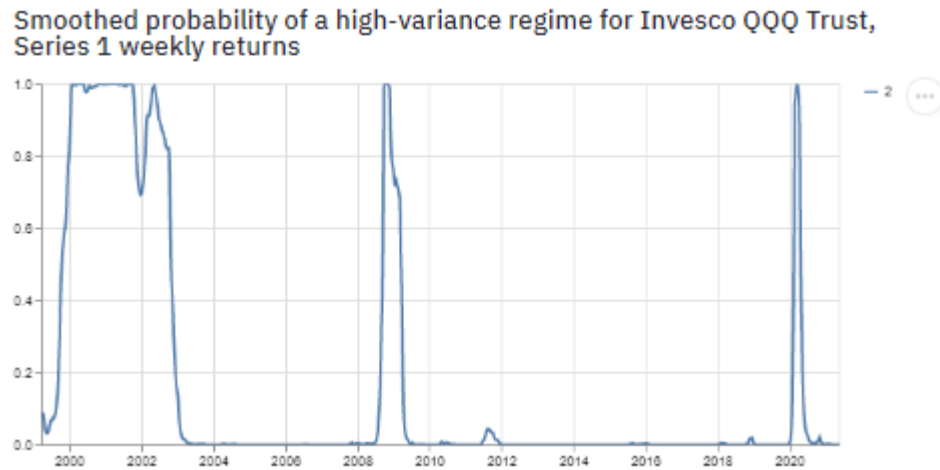Smoothed probability of a low-variance regime for Invesco QQQ Trust, Series 1 weekly returns

Smoothed probability of a medium-variance regime for Invesco QQQ Trust, Series 1 weekly returns

Smoothed probability of a high-variance regime for Invesco QQQ Trust, Series 1 weekly returns

It seems like there are not *precursor* spikes in high variance returns, and the occur in isolation.

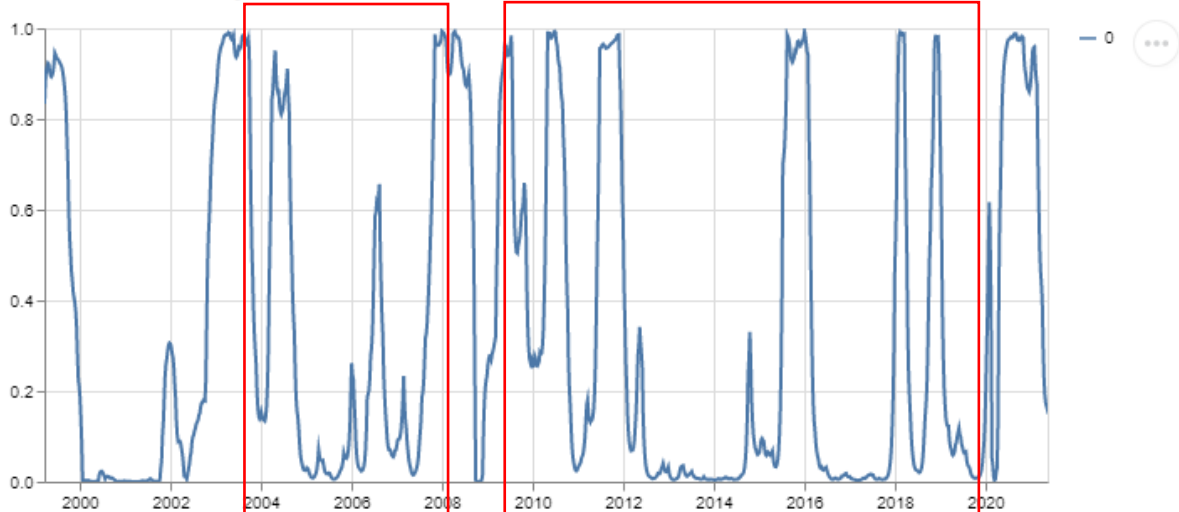Smoothed probability of a high-variance regime for Invesco QQQ Trust, Series 1 weekly returns

In this case it does seem like there is a sustained period of high variance returns in the early 2000s. I would assume that there are longer sustained periods of high returns in QQQ than SPY because QQQ is a growth fund so while economy growth and or lower interest rates prevail those equities tend to perform.

The same cyclical inverse pattern occurs within the low and medium level regimes.

Smoothed probability of a low-variance regime for Invesco QQQ Trust, Series 1 weekly returns

Smoothed probability of a medium-variance regime for Invesco QQQ Trust, Series 1 weekly returns
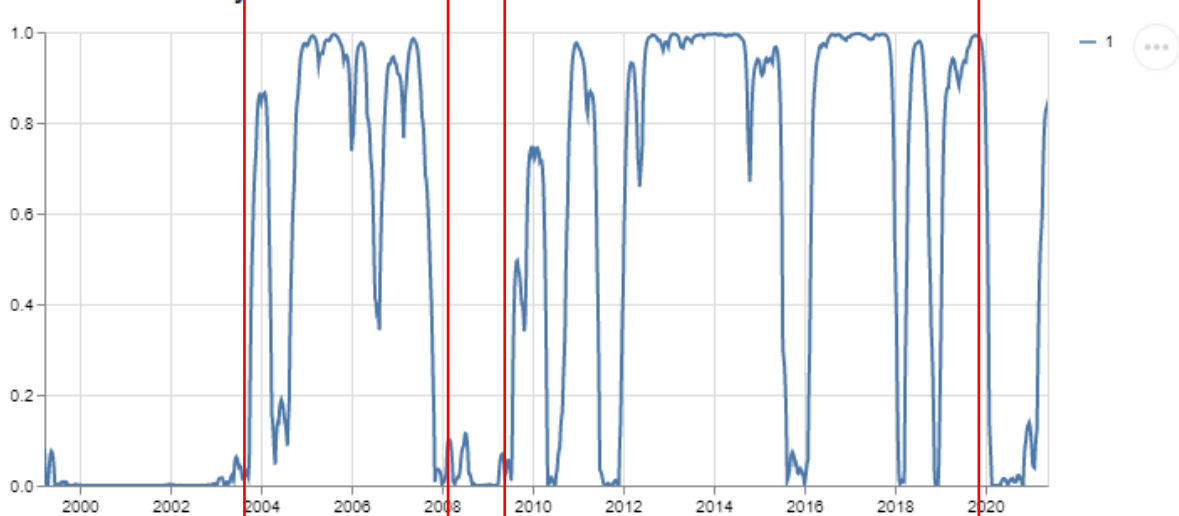
And consistent with SPY it seems like high variance regime spikes come from low variance to high variance.

Smoothed probability of a low-variance regime for Invesco QQQ Trust, Series 1 weekly returns

Smoothed probability of a high-variance regime for Invesco QQQ Trust, Series 1 weekly returns

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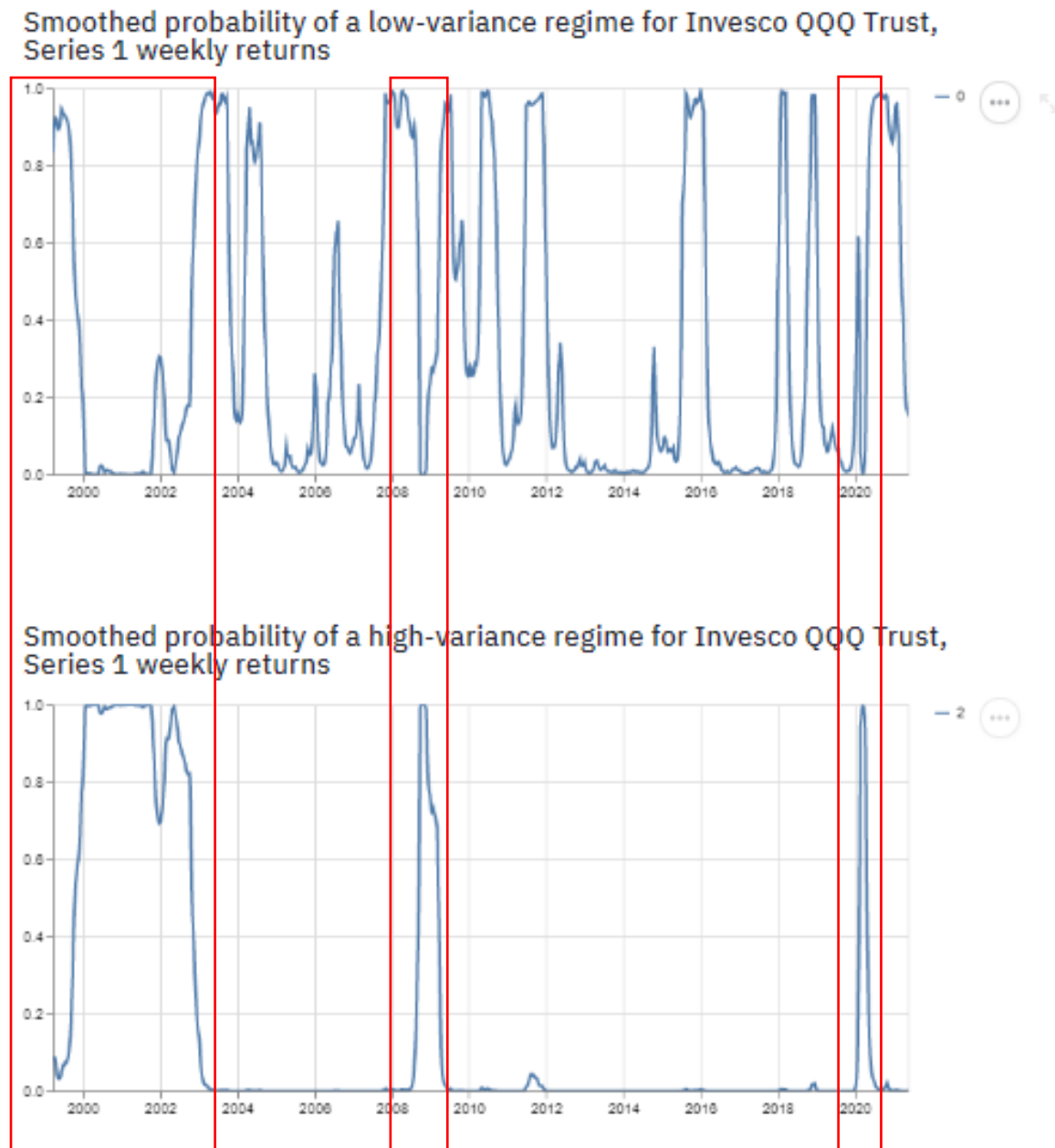
Conclusions / Future areas to investigate

- In CBOE VIX data is was common for large spikes in high variance to come from medium variance regimes, that does not seem to be the case for SPY or QQQ most of the high variance spikes come from changes from low variance to high variance

- Both QQQ and SPY exhibited what look like to be an inverse relationship between low and medium variance regimes. Confirming results and possibly making indicators could be comparing covariances and trends between the time series and then if a there is a *shift* that is probably a *break* in the relationship which probably leads to a time of high variance

- QQQ did exhibit high variance regime for a longer sustained time and that may be because of its growth-orientation.

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LinkedIn | GitHub | Medium