Final Project: Milestone 3

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Crypto-Currency and Stock Data - Ethereum and NVIDIA

As a group we are looking at a set of 7 stocks and crypto-currencies, with the focus of finding any relationships between them. My individual contribution will be to look at a stock and crypto-currency set, Ethereum and NVIDIA. NVIDIA is a technology company that manufacture high-end GPU's. A majority of their revenues are spearheaded through GPU card sales which are subsequently used for crypto-mining. This suggests there may be a relationship between the two series.

The following data is retrieved using a Yahoo API in R named tidyquant. Retrieving the daily adjusted stock prices for NVIDIA and Ethereum between 10-01-2016 to 09-30-2021. The biggest difference between the two series is the number of instances. Since NvIDIA is a stock, it is subject to the market closing on weekends, holidays, and business hours, whereas a crypto-currency is actively traded 24/7. This means that there will be more instances for Ethereum than NVIDIA within the same time-frame.

The NVIDA series contains 1,257 observations and 4 features, date, symbol, volume and adjusted price. Ethereum contains 1,826 observations with the same four features (date, symbol, volume, adj. price).

Distributions

The distributions of the adjusted prices for two series shown in Figure 1 are highly skewed right, more often the prices are lower than extremely high. Aside from the skewness, NVIDA has 4 different peaks in its distribution suggesting multiple means during different time periods compared to Ethereum which only has a single peak.

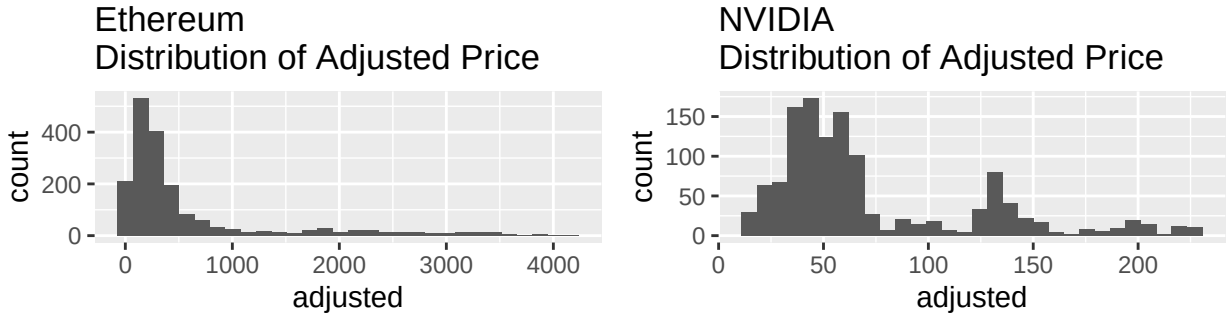

Figure 1

Graphing the Time Series

Figure 2 shows the time series for Ethereum and NVIDIA over the past 5 years. It appears to be a multiplicative, non-stationary time series with an exponential positive trend that has exploded most recently in 2021. What is also apparent is that both series seem to follow a similar trend. There is a are two similar peaks that happen in the same time frame.

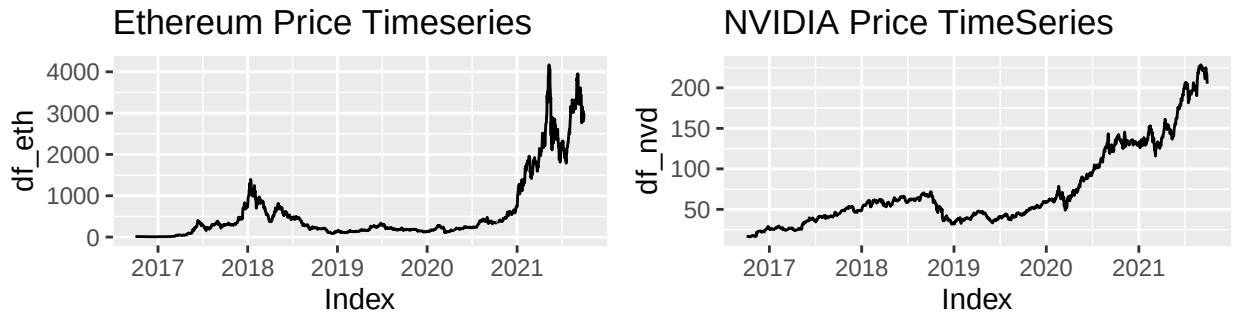

Figure 2

Figure 3, we can see the time series with a log transformation. It has transformed the exponential behavior into something more linear. There still remains a general increasing trend, and appears to be more additive. Again, we can note that both series are very similar trends.

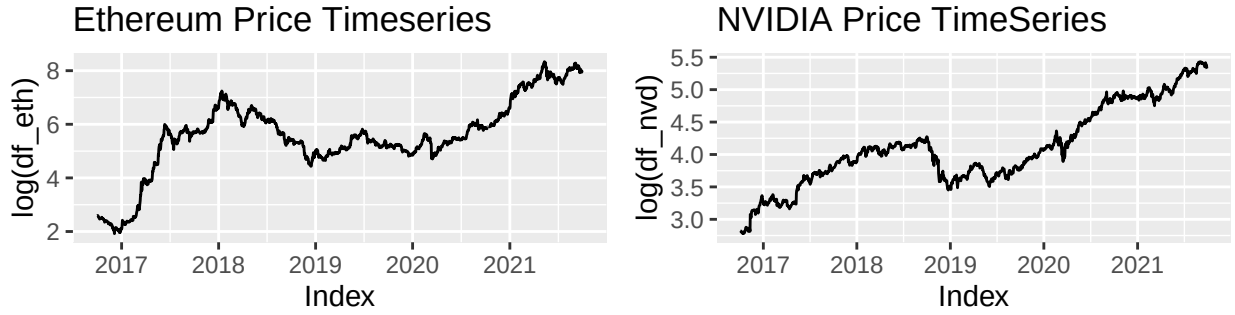

Figure 3

Figure 4, we can see the log returns. The plot shows general white noise with a few outliers in 2017 and 2020.They both seem to have a mean that floats around zero, and have a similar range between .2 and -.2 (with the exception of an outlier in 2020 at -.4)

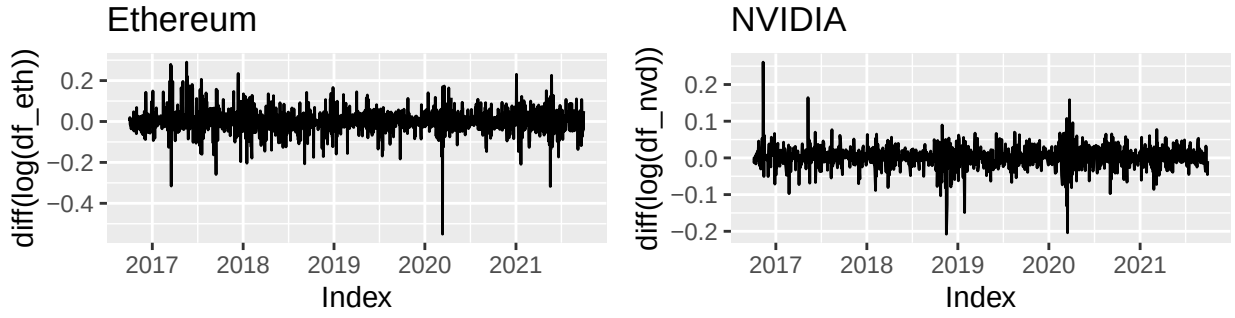

Figure 4

Auto-correlation

ACF of the time series

Figure 4 is the ACF plot for both Ethereum and NVIDIA. Auto-correlation has a strong presence in this time series. The ACF gradually decreases indicating a non-stationary series.

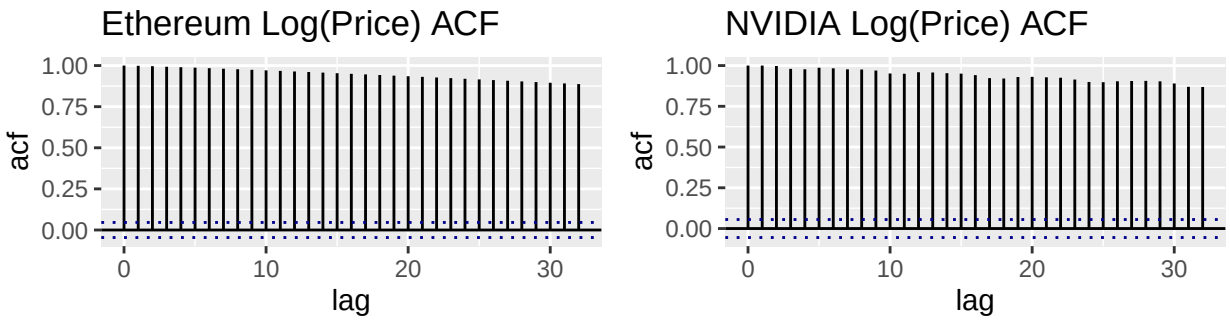

Figure 5

PACF of the time series

Figure 5 shows the PACF for both Ethereum and NVIDIA. Ethereum shows auto-correlation with an extreme value at lag 19, while NVIDIA shows no evidence of partial auto-correlation.

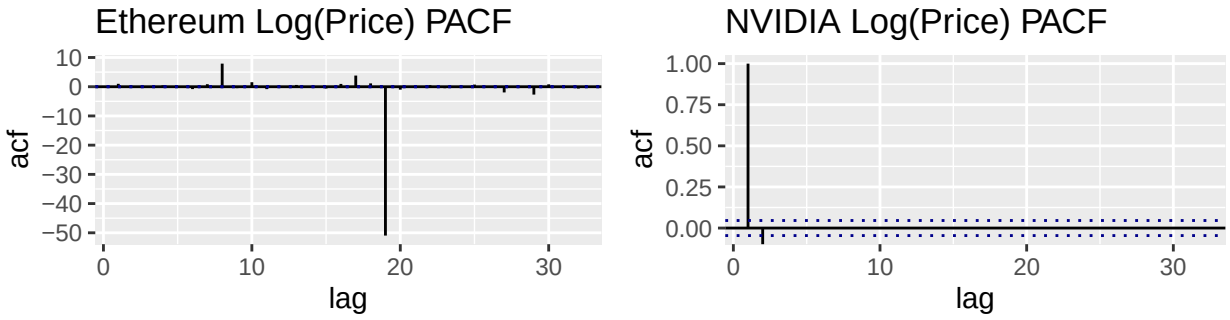

Figure 6

ACF of the Log Returns

Figure 5 shows the ACF for the log returns of both Ethereum and NVIDIA. Ethereum shows some minor auto-correlation, while NVIDIA shows evidence of seasonality and auto-correlation.

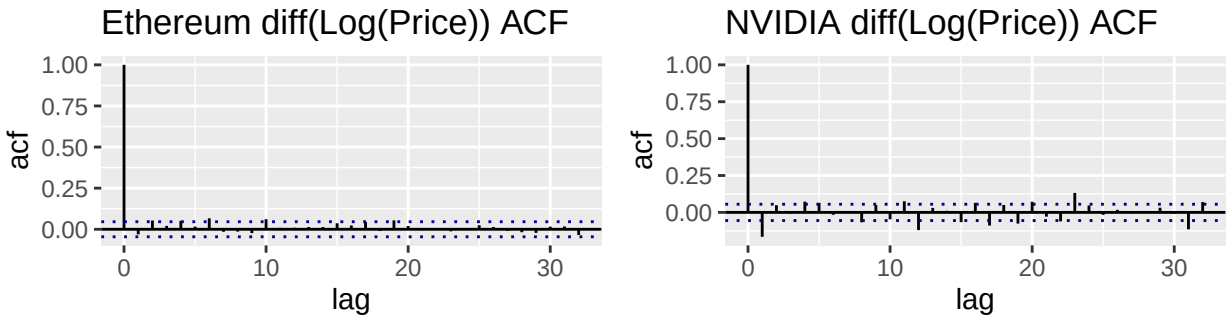

Figure 7

Ljung Box Test

This can be further confirmed by performing the Ljung Box test. At lag 1, the Ljung-Box p-value is close to zero. This indicates that at the 99% confidence, the null hypothesis is rejected and one can conclude that the series is not independently distributed and exhibit serial correlation.

```
##
##  Box-Ljung test
##
## data:  log(df_nvd)
## X-squared = 1260, df = 1, p-value < 2.2e-16

##
##  Box-Ljung test
##
## data:  log(df_eth)
## X-squared = 1819.9, df = 1, p-value < 2.2e-16
```