Final Project: Milestone 2

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Final Project: Milestone 2

Crypto-Currency and Stock Data

```
## [1] "SPY"      "RIOT"     "COIN"     "HOOD"     "BTC-USD"  "ETH-USD"  "ADA-USD"
## [8] "DOGE-USD"
```

```
##       Index            RIOT.Adjusted
##  Min.   :2016-10-03   Min.   : 0.650
##  1st Qu.:2018-01-03   1st Qu.: 2.300
##  Median :2019-04-05   Median : 3.487
##  Mean   :2019-04-05   Mean   : 9.347
##  3rd Qu.:2020-07-07   3rd Qu.: 7.850
##  Max.   :2021-10-05   Max.   :77.900
```

Graphing the Time Series

Figure 1 shows the time series for Ethereum 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.

```
autoplot(data)
```

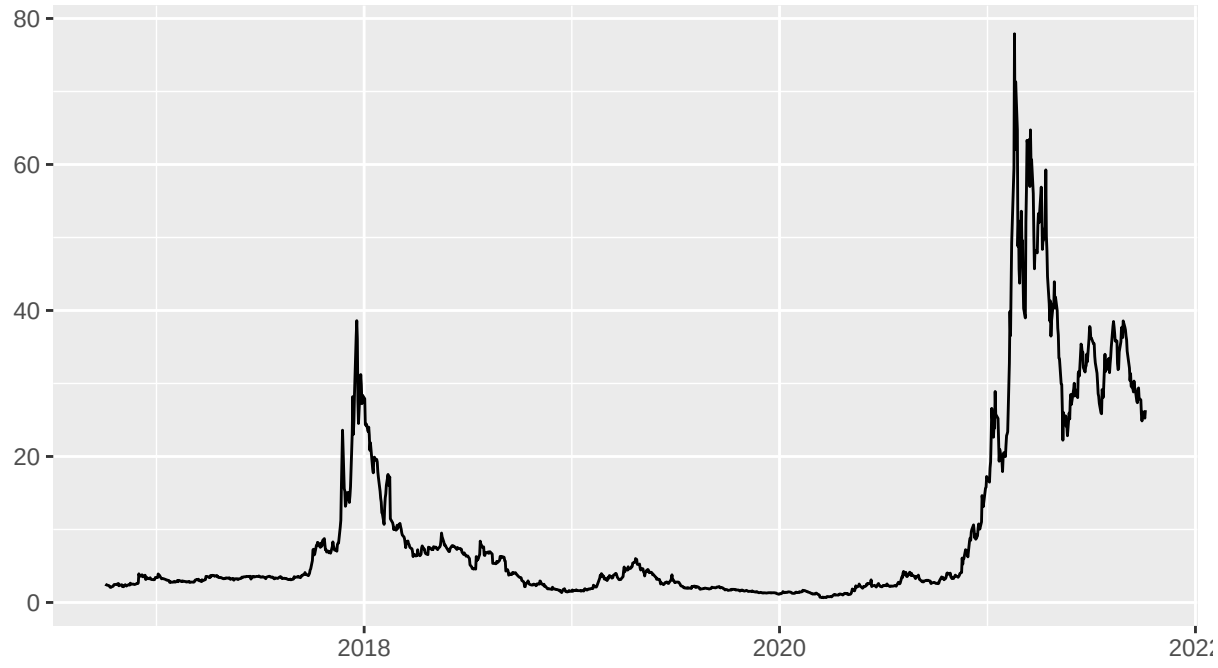

Figure 1

Figure 2, 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.

```
autoplot(log(data))
```

Figure 2

Figure 3, we can see the log returns. The plot shows general white noise with a few outliers in 2017 and 2020.

```
autoplot(diff(log(data)))
```

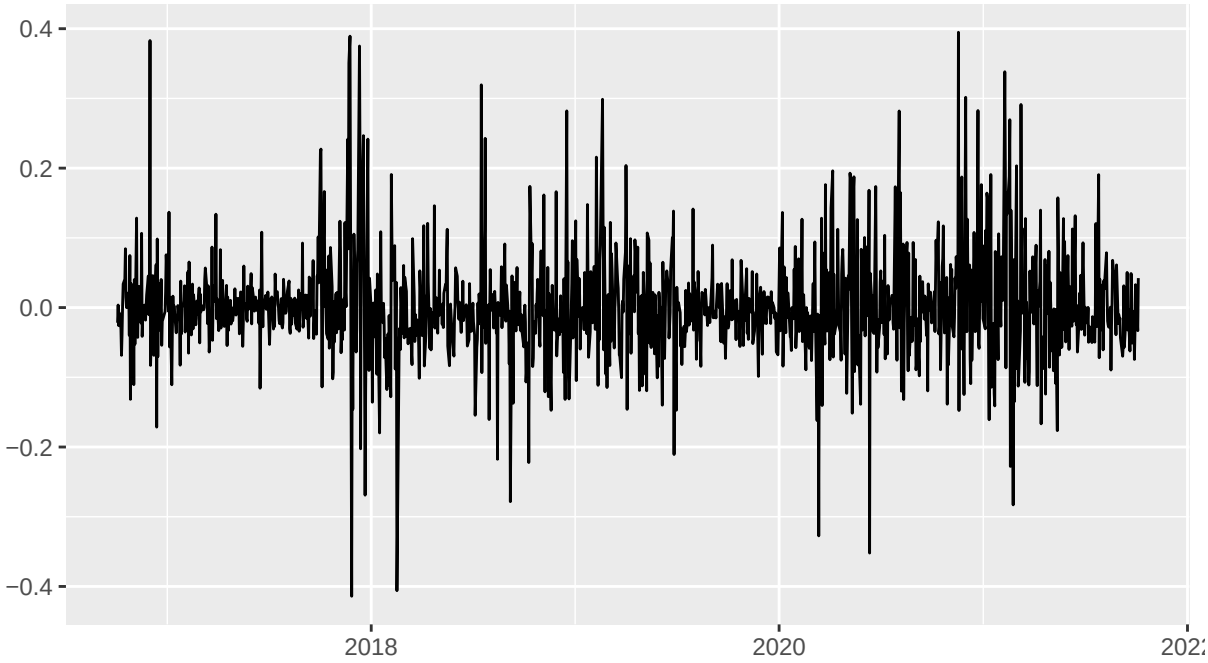

Figure 3

Auto-correlation

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

```
acf(log(data), na.action = na.pass)
```

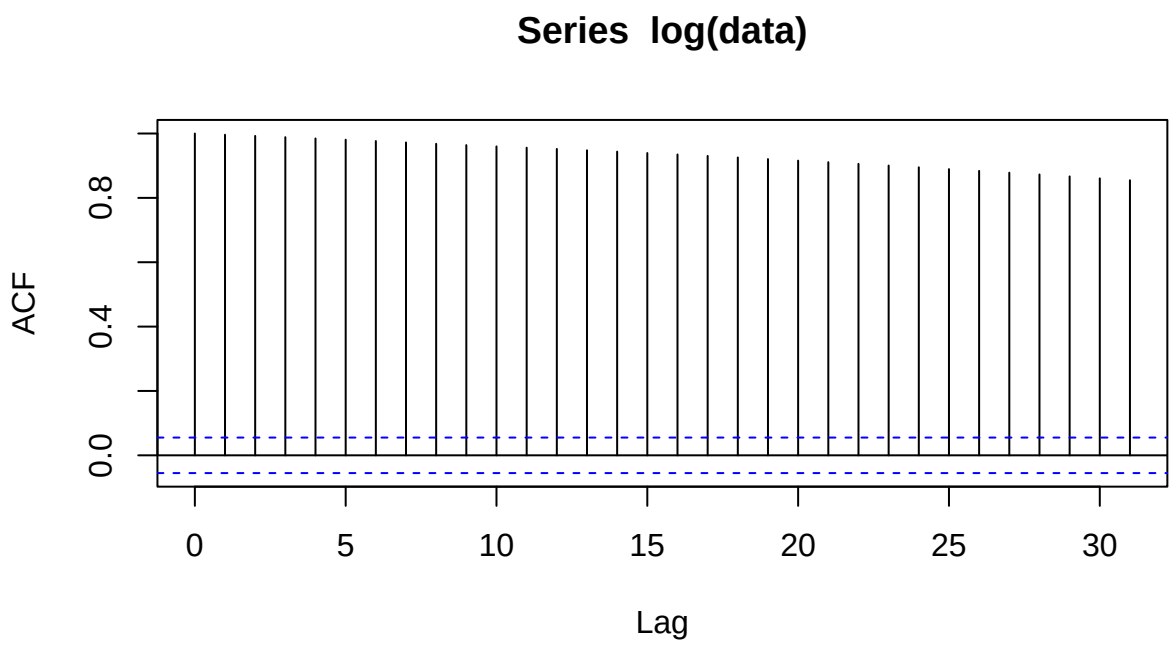

Figure 4

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.test(log(data), lag = 1, type = "Ljung-Box")
```

```
##
##  Box-Ljung test
##
## data:  log(data)
## X-squared = 1254.4, df = 1, p-value < 2.2e-16
```

Coinbase and Cardano

Coinbase Summary Statistics

```
##      Index            COIN.Adjusted
##  Min.   :2021-04-14   Min.   :220.6
##  1st Qu.:2021-05-26   1st Qu.:231.5
##  Median :2021-07-10   Median :244.3
##  Mean   :2021-07-09   Mean   :251.9
##  3rd Qu.:2021-08-22   3rd Qu.:259.2
##  Max.   :2021-10-05   Max.   :342.0
```

Cardano Summary Statistics

```
##      Index            ADA-USD.Adjusted
##  Min.   :2017-10-01   Min.   :0.01854
##  1st Qu.:2018-10-02   1st Qu.:0.04753
##  Median :2019-10-04   Median :0.09333
##  Mean   :2019-10-04   Mean   :0.36573
##  3rd Qu.:2020-10-04   3rd Qu.:0.29569
##  Max.   :2021-10-06   Max.   :2.96824
##                       NA's   :4
```

Graphing the Time Series

The figures below show the time series for Coinbase and Cardano (ADA-USD) since their inception in 2021 and 2017, respectively. While Cardano appears to be a multiplicative, non-stationary time series, Coinbase seem to be an additive time series.

In the figures below we can see both time series with a log transformation. The log transformation did not affect Coinbase much, confirming the additive nature. On the other hand, it has transformed Cardano's into a more stable form.

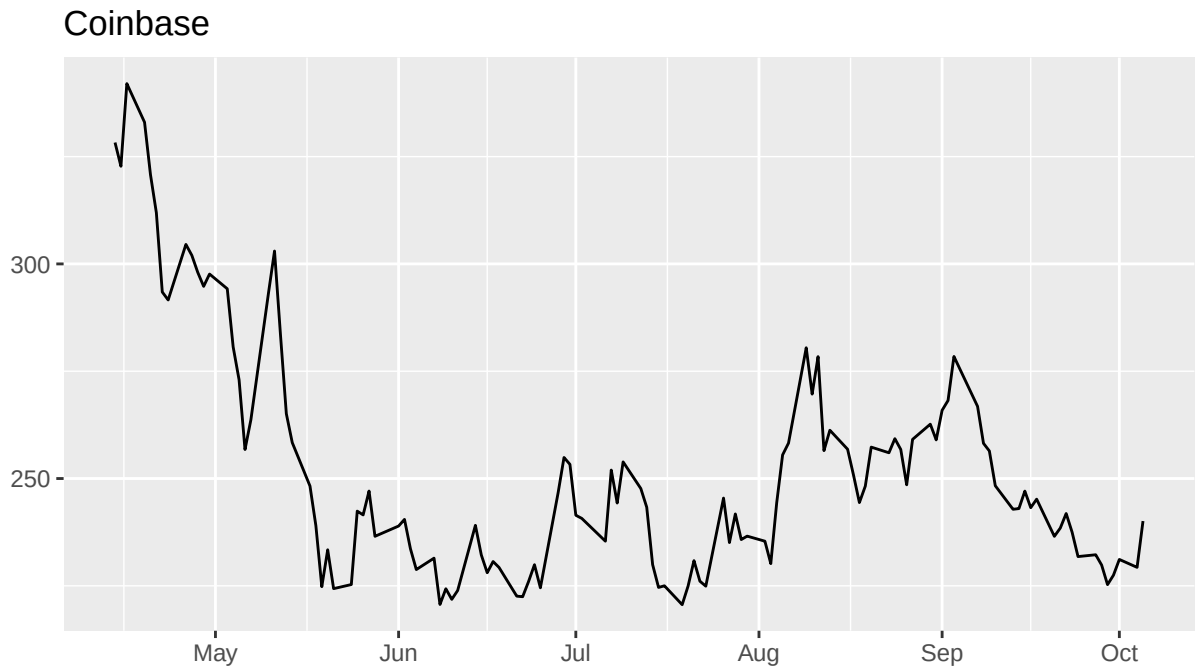

Figure 5

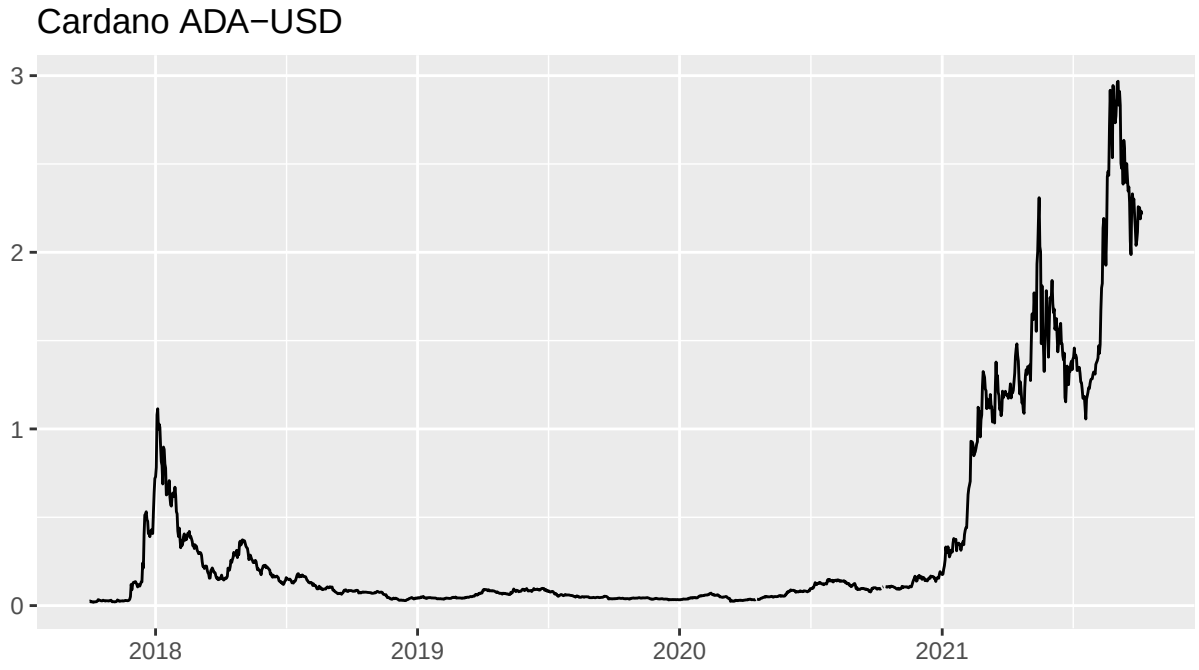

Figure 6

```
autoplot(log(stock.COIN)) +
  ggtitle('Coinbase "Log"')
```

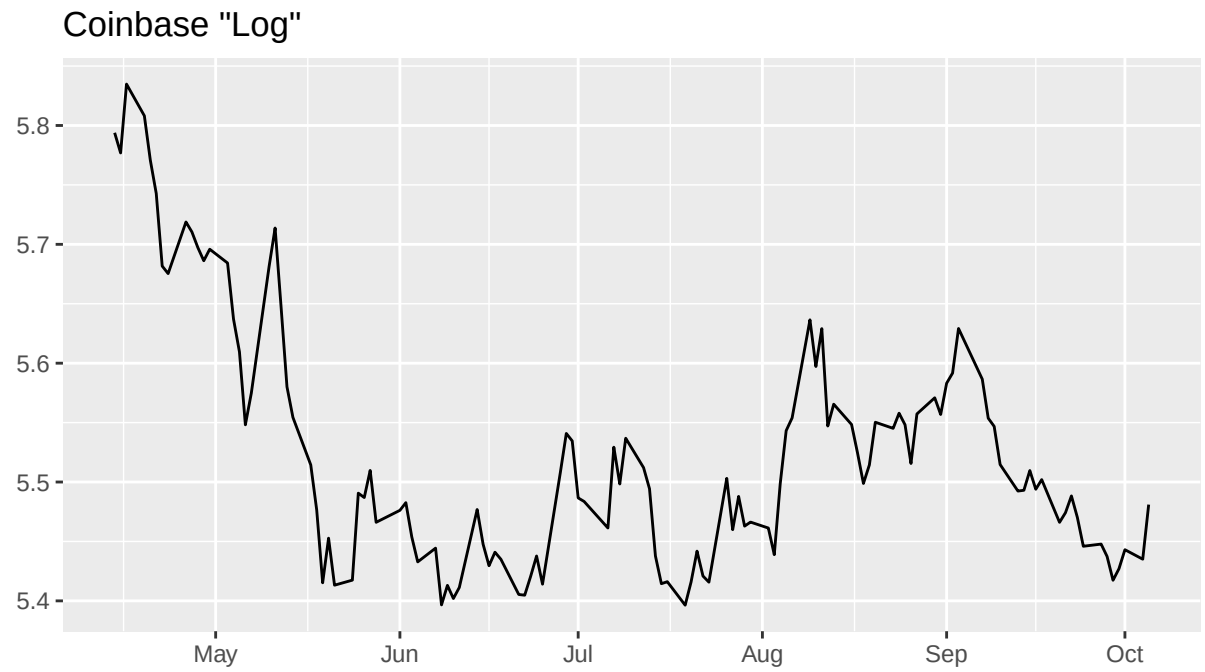

Figure 7

```
autoplot(log(stock.ADA)) +
  ggtitle('Cardano ADA-USD "Log"')
```

The figures below, we can see the log returns. The plot shows general white noise in both tickers with a few outliers fro Cardano in late 2017 and early 2020.

```
autoplot(diff(log(stock.COIN))) +
  ggtitle('Coinbase "Log Returns"')
```

```
autoplot(diff(log(stock.ADA))) +
  ggtitle('Cardano ADA-USD "Log Returns"')
```

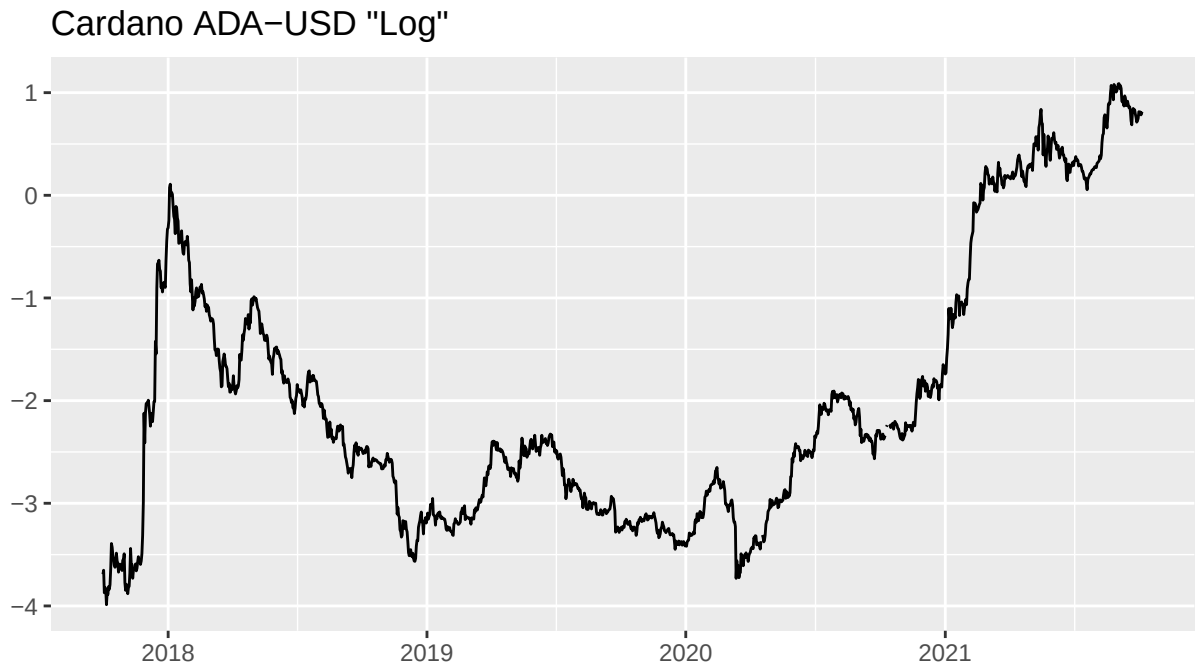

Figure 8

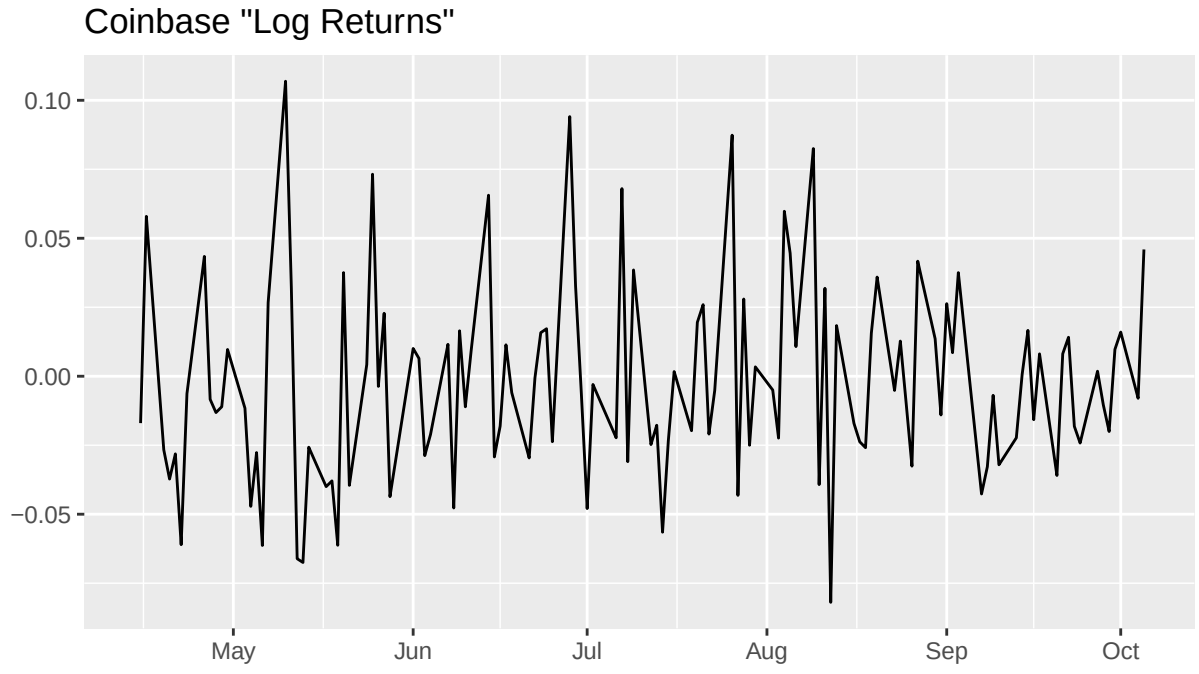

Figure 9

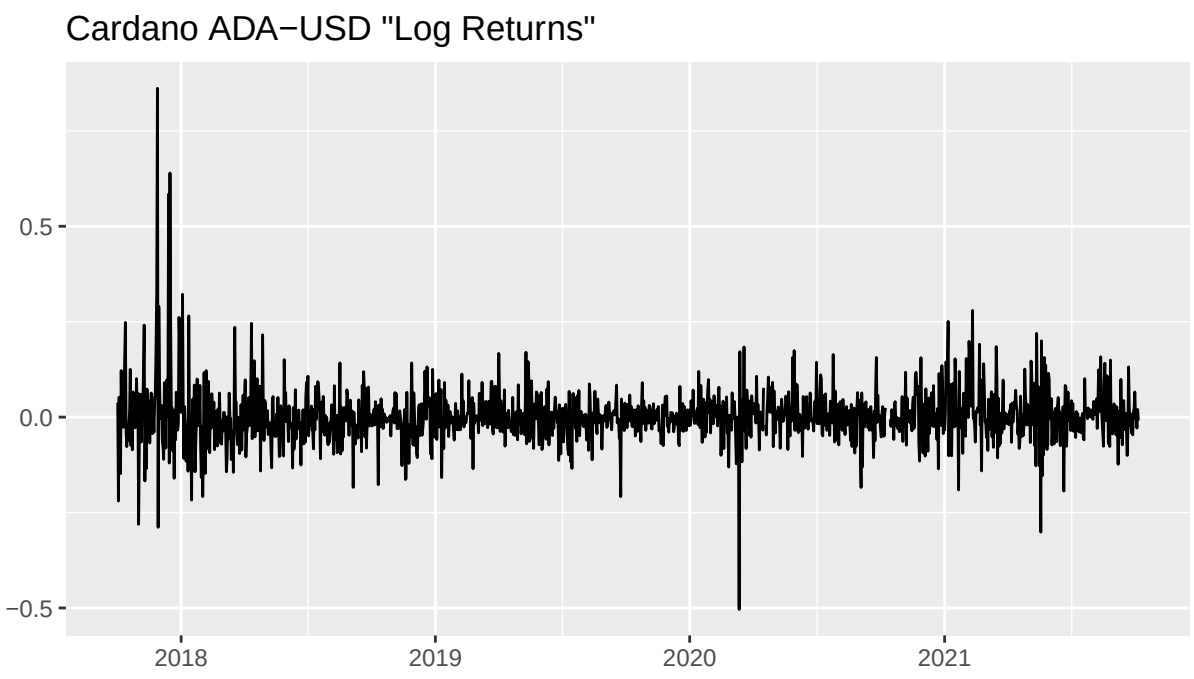

Figure 10

Auto-correlation

The ACF plots shows that Cardano's Auto-correlation has a strong presence in this time series. The ACF gradually decreases indicating a non-stationary series. Coinbase's ACF quickly decays indicating also indicating non-stationary series.

```
acf(log(stock.COIN), na.action = na.pass)
```

```
acf(log(stock.ADA), na.action = na.pass)
```

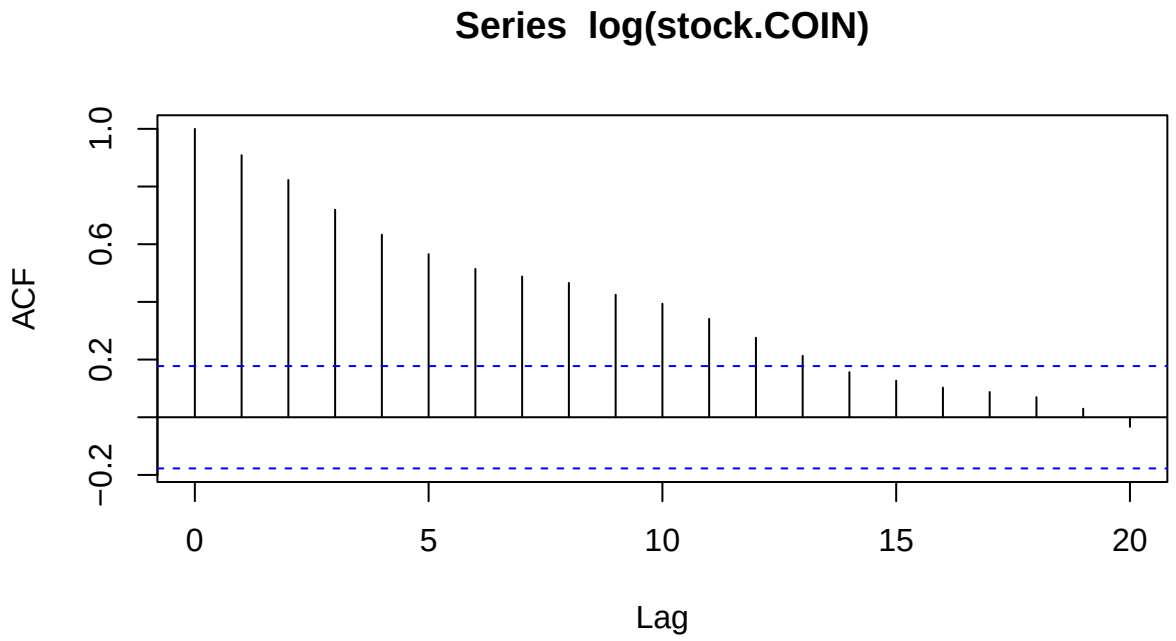

Figure 11

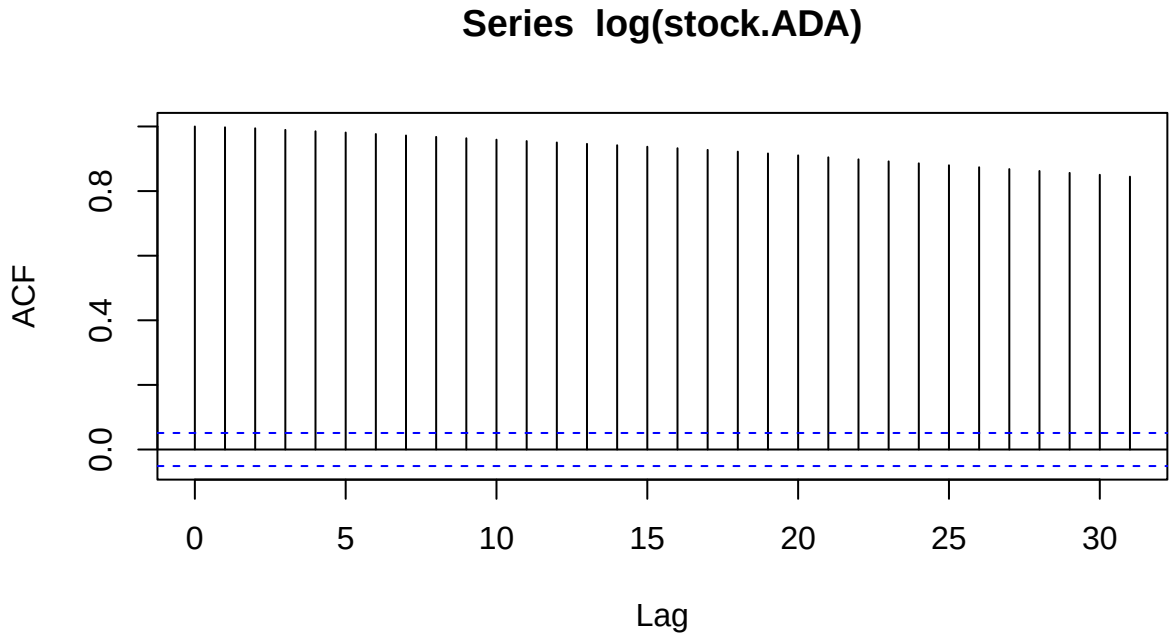

Figure 12

Ljung Box Test

This can be further confirmed by performing the Ljung Box test. At lag 100, 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.test(log(stock.COIN), lag = 100, type = "Ljung-Box")
```

```
##
##  Box-Ljung test
##
## data:  log(stock.COIN)
## X-squared = 941.17, df = 100, p-value < 2.2e-16
```

```
Box.test(log(stock.ADA), lag = 100, type = "Ljung-Box")
```

```
##
##  Box-Ljung test
##
## data:  log(stock.ADA)
## X-squared = 87142, df = 100, p-value < 2.2e-16
```