Pratical 1 - Group XX

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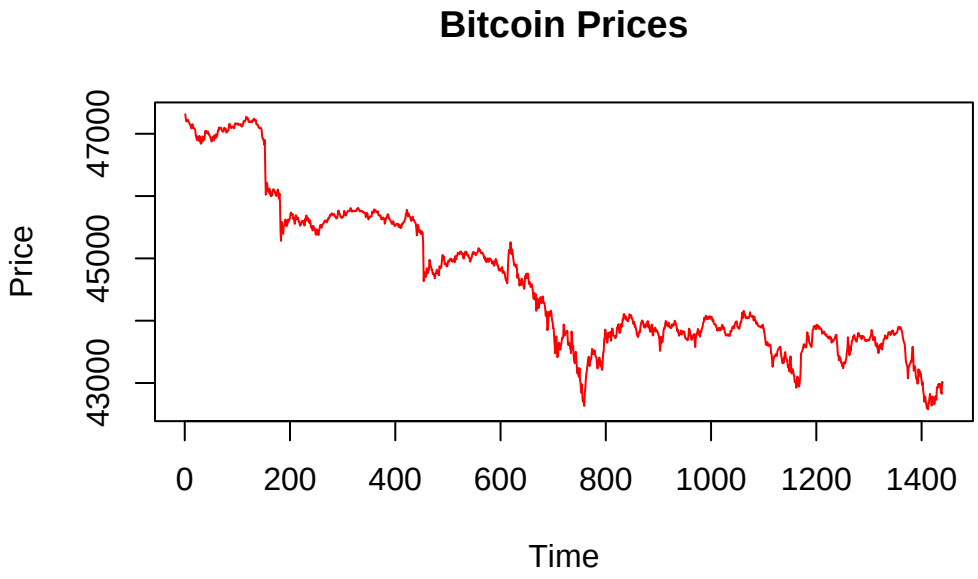
Part 1: Financial returns and normality

The working directory is set to: /Users/lodrik/Documents/GitHub/RA_Praticals

a) Load Bitcoin data and assess price stationarity

> Statement
>
> Read in the Bitcoin data from file Crypto data.csv. Then, assess the stationarity of the (raw) Bitcoin prices.

First, let's take a look at the Bitcoin Prices on a plot.



The graph of the raw Bitcoin prices suggest that the series might not be stationary.

Let's perform the Augmented Dickey-Fuller test to check if the raw Bitcoin prices are stationary.

```
# test for stationarity
adf.test(crypto_data$Bitcoin)
```

```
    Augmented Dickey-Fuller Test

data:  crypto_data$Bitcoin
Dickey-Fuller = -2.4484, Lag order = 11, p-value = 0.3885
alternative hypothesis: stationary
```

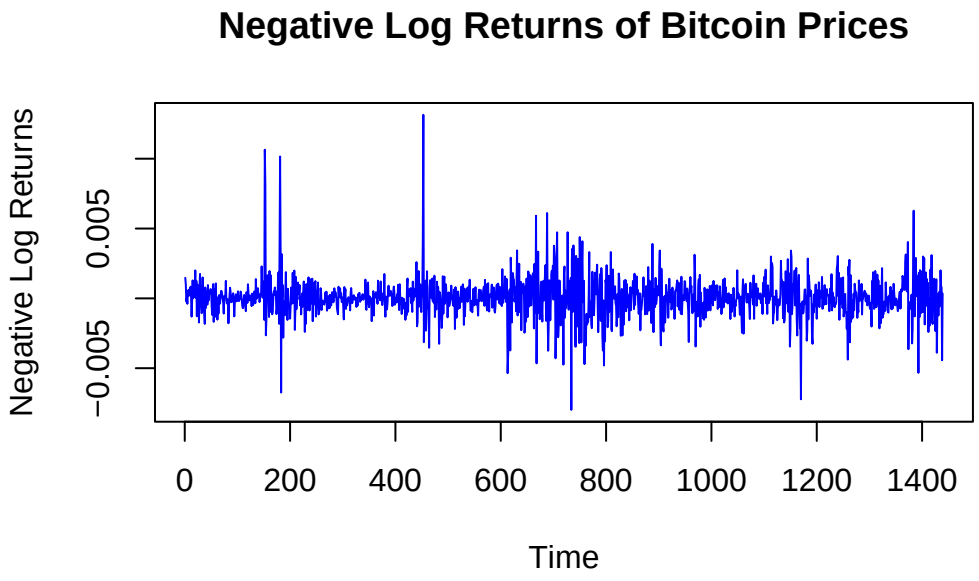
Since the p-value is significantly bigger than 0.05, we can not reject the null hypothesis and therefore, we can conclude that the raw Bitcoin prices are non-stationary.

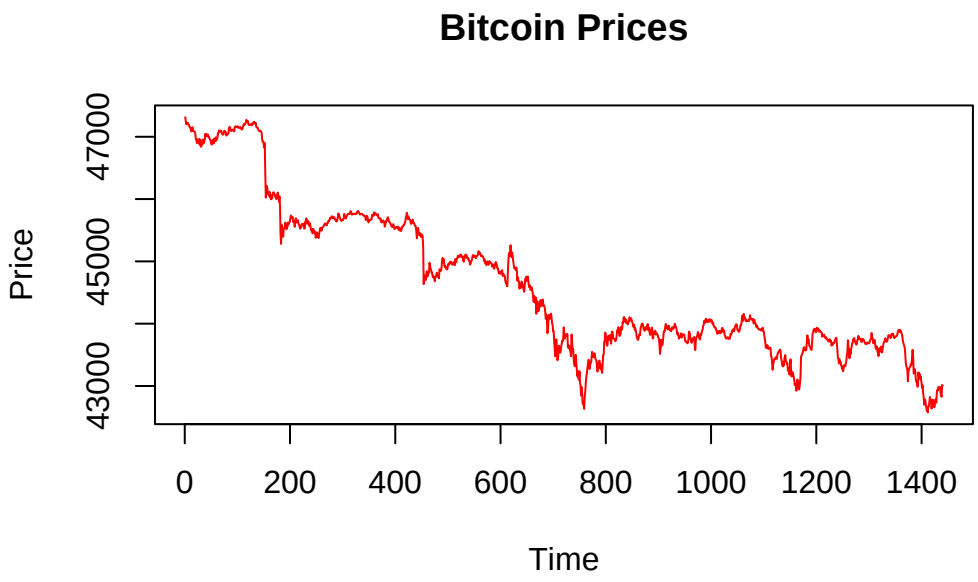
b) Create and plot Bitcoin negative log returns, assess stationarity

> Statement
>
> Create a function to transform the Bitcoin prices into their negative log returns counterparts. Plot the latter series and assess their stationarity. To compare the series, also plot the negative log returns on a common scale.

Let's create a function to compute the negative log returns of a given price series. We will then apply this function to the Bitcoin prices to compute the negative log returns.

We can now plot the negative log returns series and the raw Bitcoin prices to compare.





Let's also perform the Augmented Dickey-Fuller test to check if the negative log returns are stationary.

```
# Perform the Augmented Dickey-Fuller test on negative log returns
adf_test_neg_log <- adf.test(neg_log_returns_bitcoin)
```

```
Warning in adf.test(neg_log_returns_bitcoin): p-value smaller than printed
p-value
```

```
# Display the test results
print(adf_test_neg_log)
```

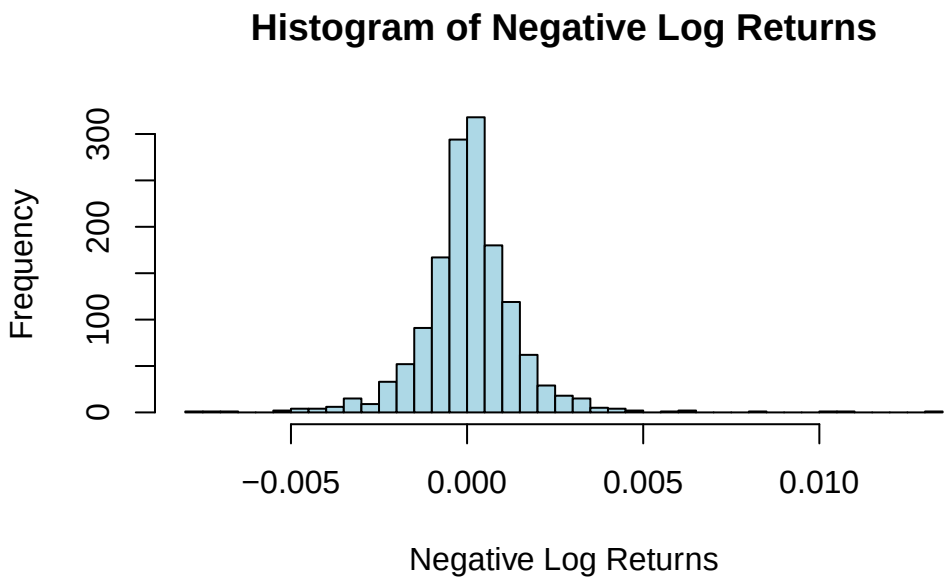
```

    Augmented Dickey-Fuller Test

data:  neg_log_returns_bitcoin
Dickey-Fuller = -11.035, Lag order = 11, p-value = 0.01
alternative hypothesis: stationary
```

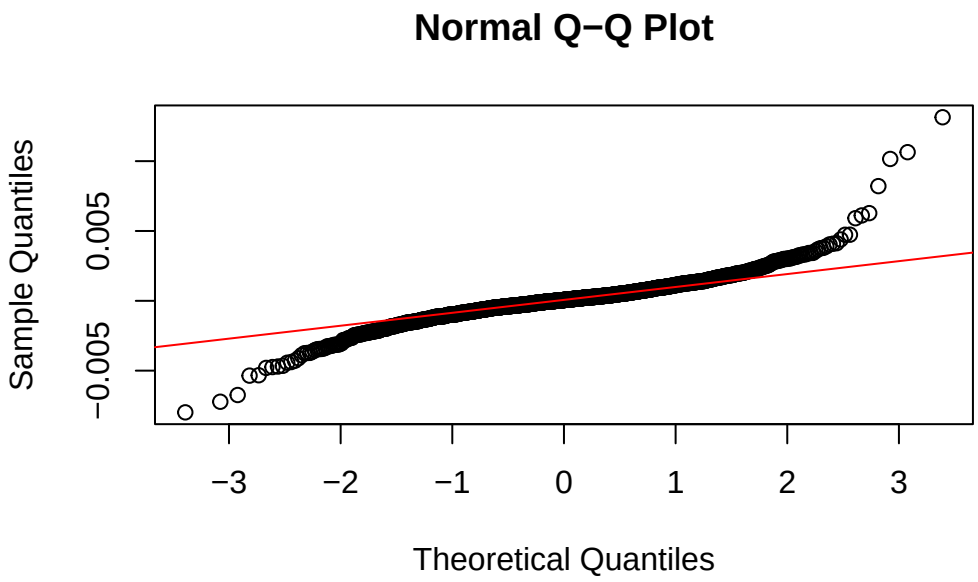
Since the p-value is significantly smaller than 0.05, we can reject the null hypothesis and conclude that the negative log returns series is stationary.

c)

Statement

Are the negative log returns normally distributed? Draw histograms, check QQ-plots and use an Anderson-Darling testing procedure to answer this question.






```
    Anderson-Darling normality test

data:  neg_log_returns_bitcoin
A = 26.277, p-value < 2.2e-16
```

Even though the Histogram suggest that the negative log returns follows a normal distribution, the p-value when performing the Andersen-Darling test is smaller than 5%. It indicates that the data does not follow a normal distribution. The Normal Q-Q plot suggest also that the data does not follow a normal distribution.

d) ((DOES NOT WORK YET))

Statement

-

```
# # Fit a t-distribution to the negative log returns
# fit_t <- fitdistr(neg_log_returns_bitcoin, "t")
#
# # Display the t-distribution fit parameters
# print(fit_t)
```

```
#
# # Generate QQ-plot for t-distribution
# df_t <- fit_t$estimate[3]  # Degrees of freedom from the fit
# qqplot(rt(length(neg_log_returns_bitcoin), df=df_t),
#        neg_log_returns_bitcoin,
#        main="QQ-plot for t-distribution",
#        xlab="Theoretical Quantiles (t-distribution)",
#        ylab="Sample Quantiles")
# qqline(neg_log_returns_bitcoin, col="red")
#
# # For comparison: QQ-plot for normal distribution
# qqnorm(neg_log_returns_bitcoin, main="QQ-plot for Normal distribution")
# qqline(neg_log_returns_bitcoin, col="blue")
```

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```
crypto_data <- read.csv(here("data", "crypto_data.csv"))
```

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