3. Methodology

The focus of this thesis is to predict historical prices of bitcoin using the models listed in Chapter XX. The predictive accuracy of these obtained predictions are compared using loss functions (Annualized Sharpe, Diebold Mariano Test, MAE, MSE, RMSE, Mincer-Zarnowitz Regressions). Then, based on the best models with the most accurate predictions, trading strategies are worked out to compare with a buy-and-hold strategy. Finally, we would like to venture into the topic of explainability and attempt to explain why the chosen models lead to these outcomes. The procedure of this quantitative study is described in this chapter.

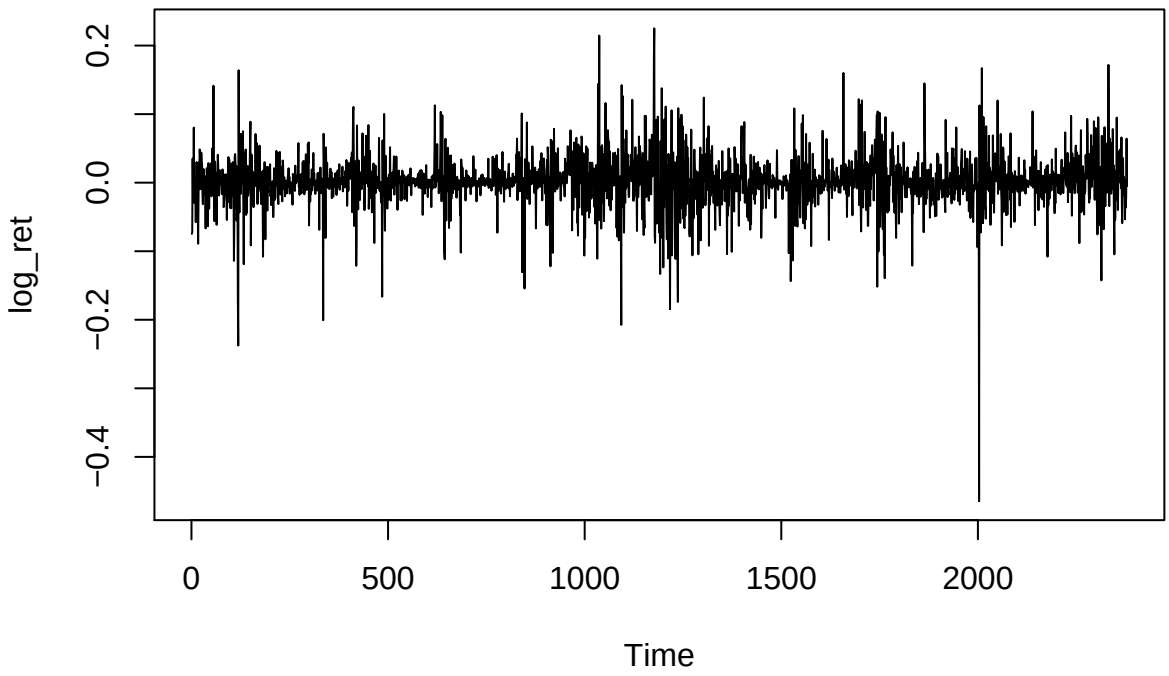
- Data and Analysis of Bitcoin (BTC/USD)
- Defining the train and test samples (including description about calm and volatile phases).
- Calculate predictions with the defined models (AR, NN, RNN, LSTM, Emponential Smoothing + NN (Slavek Smyl)).
- Compare Predictions / performance with Realized Data (Annualized Sharpe, Diebold Mariano Test, MAE, MSE, RMSE, Mincer-Zarnowitz Regressions)
- Explain trading strategies
- Explainability for the best models
- (Backup: Which models work well in which market phases?)

3.1. Data and analysis of Bitcoin

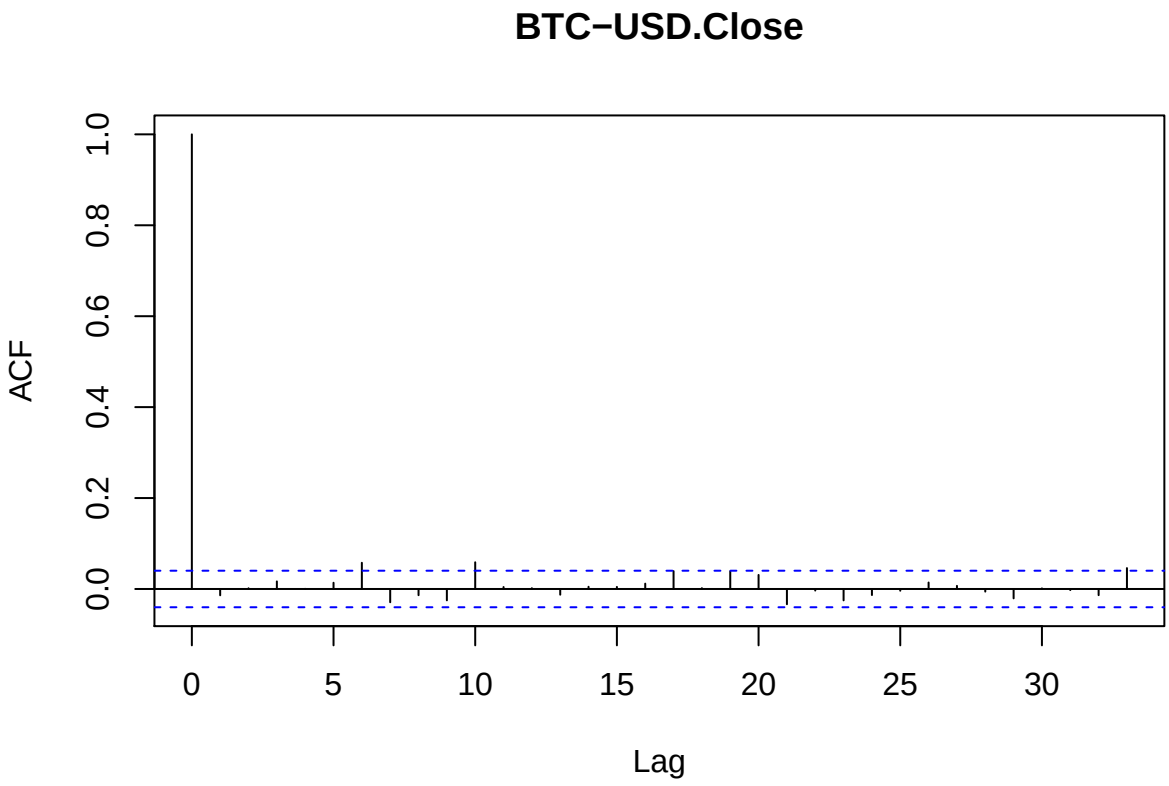
The data in this paper is accessed via yahoofinance provided by coinmarket https://coinmarketcap.com/. We use the daily "closing price" of bitcoin in US Dollars with the ticker BTC-USD. Cryptoassets are tradeble 24 hours a day 256 days a year, there is no real "closing price" for the bitcoin, therefore the "closing-Price" is just the last price of the day evaluated at last timestamp with timeformat UTC.

In chapter 2.3. the bitcoin price is visualized. For processing and analyzing the data in order to fullfill the weak stationarity assumptions we transform the data into logreturns

$$\text{LogReturn} = \log(x_t) - \log(x_{t-1})$$



By computing the autocorrelation oft the log_returns, there is still dependence visible in lag 6 and 10. This indicates dependency in volatility-cluster, to cancel out the effect an ARMA-GARCH model is fitted to the data and the residuals are standardized by the model standard-deviation.



3.2. Defining train and test samples

- Describe different phases
- Explain why we set train and test sample like this
- Describe stable and volatile phases and why we should keep that in mind for predictions

3.2.xy. Benchmark To compare the models we choose two simple benchmarks the well known buy and hold and an Ar(1) process as you can see in Figure xy and Figure xxy.

3.4. Trading strategies

- Define trading strategies
- Sign-trading (daily)
- Vola-gewichtet trading
- Define realistic fee structure for trading (Coinbase Pro, Binance, Kraken etc.)

3.4.1. Other cryptocurrency

- Test our best model with another time series

3.5. Explainability

- Performing the predictions with the two (?) best models
- Include variations to find possible starting points for explainability (number of nodes, layers)

3.6. (Relationship between accuracy and market phase)

- Test