Abstract for general public

The cryptocurrencies market is small in comparison with traditional currencies, stocks, or bonds markets. That is why a large order may significantly impact prices, making the market less attractive to big institutional investors. Moreover, the market is dominated by small investors, making it inefficient and highly speculative. Volatility of cryptocurrencies has different properties in comparison to volatility of other financial assets. This is due to different reasons. The value of new digital assets is not based on any tangible asset, a firm or a country economy, but instead it is based on an algorithm which is able to trace all transactions. Cryptocurrencies contain periods of very huge volatility. These periods are often connected with cybercrime and regulatory disorientation. Moreover, cryptocurrencies experience explosive behaviours in multiple periods.

Extremely large observations cannot be explained by standard volatility models like GARCH models even when heavy tailed conditional distributions of an error term are assumed. Such outliers may cause biases on the usual maximum likelihood estimator of the parameters of GARCH models and on the estimated volatilities. If such observations are not treated adequately, they can lead to a considerable deterioration of the forecasting accuracy.

It is commonly known, that the use of daily low and high prices in volatility models leads to more accurate estimates and forecasts of variances based on such models. Unfortunately, extremely large outliers present in cryptocurrencies data cause a considerable deterioration of the quality of range-based models because they are constructed on minimum and maximum prices. That is why the main idea of the project is to create a new modelling approach for cryptocurrencies volatility through the use of robust methods for range-based models.

The two major research objectives of the project are the following:

(1) The evaluation of forecasts' accuracy of the variance and covariance of returns constructed based on volatility models with the use of robust methods and low and high prices for different kinds of cryptocurrencies;
(2) The analysis of risk measures estimated with robust methods and low and high prices for the cryptocurrency market.

The project can be divided into three major research areas:

(1) Robust methods with low and high prices.
    New approach to modelling volatility of returns will be suggested. It will be based on the connection of robust methods with the application of range-based models.
(2) Modelling and forecasting variances and covariances of returns of cryptocurrencies.
    Various univariate and multivariate volatility models will be applied to describe the returns and relations on the cryptocurrency market.
(3) The analysis of risk measures
    Different risk measures like value-at-risk and beta coefficient will be calculated for a wide range of altcoins and tokens.

The results of the studies should expand the knowledge about the methods of modelling and forecasting the variances and covariances of returns and risk measures. Due to specific properties of cryptocurrencies, like periods of very huge volatility, the outcomes of the research may be useful for analysing financial crises or the COVID-19 crisis.