Math 466 Project Proposal

Bitcoin Volatility Prediction by HAR RV – Type Model

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Measuring and modelling the risk in the financial markets has always been a very important and popular topic, and there are many different types of volatility models using different techniques to model the risk. These include univariate models such as the ARCH by Engle (1982), the generalized autoregressive conditional heteroscedastic (GARCH) model by Bollerslev (1986), and other GARCH type models.

Despite of the popularity of GARCH family model, some studies have documented that the GARCH type of model is not sufficient with capturing the long memory, an important feature of the volatility (Huang, 2016).

As a remedy, the multivariate heterogeneous autoregressive-realized volatility (HAR-RV) model by Corsi (2009) claims that long memory process can be captured using a short-memory specification with a cascade structure of lags. In the following years, HAR model becomes popular because it presented the simplicity and the good out-of-sample accuracy in predicting the volatility. Inspired by the success of HAR model, many literatures extended the HAR model to improve the prediction power.

In this project, we want to utilize the HAR type model in cryptocurrency market to see whether these types of models have a good performance.

Our project has two – fold:

- The first fold is to fit the cryptocurrency data into HAR type models and evaluate those models by the certain metrics. (Midterm Project).

- The second fold is to use the Model Averaging Method to calibrate the model. The goal is to improve the overall performance of the volatility forecast model. (Final Project)

Framework of the project:

- ● First Fold:

- Collect the high frequency data of Bitcoin Price in the given period. (1 min data from 2018 - present)

- Transform the high frequency intra day price data to daily realized variance data

- Fit the data to several HAR type models and use the certain metrics to evaluate the model.

- Second Fold

- Implement different model averaging method to improve the model's predicting power

  ✓ Use the LASSO in the different individual HAR type model to calibrate the parameters.

  ✓ Use the different model averaging methods to combine the different models to improve the prediction power, including equal weighted, MSE based weighted , and MARS (Qiu et al., 2019) (if possible).

- Second Fold

Reference

Huang, Zhuo, Hao Liu, and Tianyi Wang. "Modeling long memory volatility using realized measures of volatility: A realized HAR GARCH model." *Economic Modelling* 52 (2016): 812-821.

Yue Qiu, Xinyu Zhang, Tian Xie, Shangwei Zhao, Versatile HAR model for realized volatility: A least square model averaging perspective, Journal of Management Science and Engineering, Volume 4, Issue 1, 2019, Pages 55-73, ISSN 2096-2320,