Can Artificial Neural Network - Generalized Auto-Regressive Conditional Heteroskedasticity (ANN-GARCH) model prove statistically effective in forecasting the price volatility of Ethereum?

Sagar Anil Tade (X18109641) MSc. FinTech 2018-19

Introduction

With growing popularity in cryptocurrencies, it is estimated that $557 billion USD worth of transactions have taken place in the year 2018 and it will tend to increase exponentially in this year. Not only this, but there is increase in number of cryptocurrencies as well. Behaviour of each of these cryptocurrencies varies a lot in terms of volatility, market share, underlying technology, consensus mechanism and a lot more. Cryptocurrencies is relatively new asset class, but its popularity has grown enormously in the past few years. There is very limited number of researches on the same. Hedge Funds and Risk managers are considering crypto markets as one of the investment options. But due to high volatility in such markets are causing a barrier for investors to invest in cryptocurrencies.

This is what motivates me to conduct a study in forecasting the price volatility, thus minimizing the risk for the investors. Along with this, how ANN which is proven to be one of the potent methods to forecast timeseries and GARCH which is better model at capturing the high volatility would work together is one of the interesting factors for me analyse.

Objectives

1) Build model for forecasting volatility of Ethereum with ANN and GARCH.
2) Comparing it statistically with traditional models such as GARCH and ARIMA.
3) Understanding the behavioural differences between Bitcoin and Ethereum prices with respect to fiat currency.

Thus, answering these questions will lead to better understanding of two major cryptocurrencies and which model yields better statistical results and can it be used for other cryptocurrencies.

Literature Review

In their paper authors (Kristjanpoller et al., 2018) have proposed a hybrid Artificial Neural Network and Generalized Auto-Regressive Conditional Heteroskedasticity Model with Principle Component Analysis along with seven different technical indices such as Moving Average, Relative strength Index (RSI), Stocastic RSI, etc. to device a state-of-the-art framework to forecast the volatility for Bitcoin. Their research was based on comparison of Mean Squared Error and Multi-

Layer Perceptron. They also verified their results with EURO USD and found that it is difficult to forecast volatility of Bitcoin rather than Fiat currency.

In another research (M Bildirici et al., 2009) authors studied the statistical comparison between GARCH family and ANN-APGARCH showing the later ones forecasting better results than the previous ones. They tested it on the Istanbul Stock Exchange. Performance of ANN-GARCH was better in terms of strong volatility clustering and asymmetric non-linearity.

On the other hand, AH Dyhrberg (2016) performed the volatility analysis and with AGARCH on Bitcoin, gold and USD. His results stated that Bitcoin may be used by risk averse investors when there is fear of negative trends in the market. His study suggested Bitcoin can counter the risk factors involved in Gold and Fiat currency.

In another study by E Hernández (2017), he used ANN-GARCH to forecast the prices of three important metals. He found similar results suggesting ANN-GARCH has better predictions than traditional models.

Conclusion

I would like to develop and test whether hybridization of GARCH and Artificial Neural Network along with some technical analysis yield better forecasting results for Ethereum cryptocurrency which behaves slightly different from Bitcoin. I want to compare the result statistically with GARCH Model and ARIMA Model.

Though most of the research that I came across revolves around either ANN or GARCH or Bitcoin, I would like to take this research further and combine it to find and measure its implications on Ethereum.

References

Bildirici, M. and Ersin, Ö.Ö., 2009. Improving forecasts of GARCH family models with the artificial neural networks: An application to the daily returns in Istanbul Stock Exchange. *Expert Systems with Applications*, *36*(4), pp.7355-7362.

Kristjanpoller, W. and Minutolo, M.C., 2018. A hybrid volatility forecasting framework integrating GARCH, artificial neural network, technical analysis and principal components analysis. *Expert Systems with Applications*, *109*, pp.1-11.

Dyhrberg, A.H., 2016. Bitcoin, gold and the dollar–A GARCH volatility analysis. *Finance Research Letters*, *16*, pp.85-92.

Hernández, E., 2017. Volatility of main metals forecasted by a hybrid ANN-GARCH model with regressors. *Expert Systems with Applications*, *84*, pp.290-300.