University of Zurich[UZH]

Bachelor Thesis

Interdependencies of Cryptocurrencies
A VAR model analysis

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Date of Submission

July 19, 2018

Abstract

In this thesis I consider the implementation of a VAR-DCCGARCH based strategy on a cryptocurrency portfolio consisting of Bitcoin and six widely used Altcoins, to take advantage of possible spillover effects between the currencies in the portfolio. Furthermore, the use of a moving average crossover rule, based on the network value to transaction volume ratio, to improve the strategy is examined. As a benchmark a simple Buy and Hold portfolio strategy is used. To compare the the strategies the Sharpe ratio is used and a studentized bootstrap interference is implemented to test the hypotheses that there is no difference in the Sharpe ratios of the strategies. Strong evidence that the VAR-DCCGARCH strategy renders superior risk adjusted returns compared to the Buy and Hold benchmark is presented. Additionally evidence, that VAR-DCCGARCH is improved upon by combining it with the moving average crossover rule, is presented.

Executive Summary

In recent years, especially in 2017, cryptocurrencies have seen a steep increase in total market value and popularity. With the high general interest in cryptocurrencies the amount of papers on the topic is increasing as well. Many of these papers focus on Bitcoin, which is still dominating the crptocurrency market. Corbet, Meegan, Larkin, Lucey, and Yarovaya (2018) and Ciaian, Rajcaniova, and Kancs (2018) are among the few considering Altcoins as well as Bitcoin and show, that mean return as well as volatility spill overs between the currencies exist. Based on the findings of these to papers this thesis considers the implementation of a cryptocurrency portfolio strategy based on the interdependencies of the currencies in the portfolio, to answer the question whether it is applicable to use the interdependencies as an advantage in a portfolio strategy. The strategy is implemented on a portfolio consisting of seven currencies, namely Bitcoin, Ethereum, Ripple, Litecoin, Dash, NEM and Stellar.

To capture the mean spillover effects a VAR(1) model is employed, while a DCCGARCH(1,1) model is used to capture the volatility spillovers between the cryptocurrencies in the portfolio. The DCCGARCH approach is used, as it is easily scalable to larger portfolios. As the univariate GARCH model in the DCCGARCH approach the exponential GARCH is used, because it allows for different effects of positive and negative shocks on the volatility. The VAR(1)-DCCGARCH(1,1) model is applied to a 500 day rolling window, each time rendering a one day ahead forecast vector, containing the forecasted return of each currency in the portfolio. Based on the return forecasts the investment decision is made.

In a second step I try to improve the initial strategy using a moving average crossover rule. The rule uses the Network to Transaction Volume (NVT) ratio, smoothed over two different time frames. Depending on which NVT ratio is higher, the signal is either to invest in the currency or not. This signal is then combined with the signal of the VAR(1)-DCCGARCH(1,1) signal, an investment in a currency on a certain day is only conducted if both signals on that day are

positive.

To assess the benefit of the strategies they are compared to a Buy and Hold strategy, using the Sharpe ratio, to capture the risk adjusted returns. Compared to the Buy and Hold baseline, both strategies have a higher Sharpe ratio, having slightly lower mean returns but significantly reduce the variance, hence having lower risk. Furthermore, the Sharpe ratio of the strategy combining the VAR(1)-DCCGARCH(1,1) signal with the NVT crossover signal has a higher Sharpe ratio, than the strategy solely based on the VAR(1)-DCCGARCH(1,1) model.

To test if the difference in the Sharpe ratio is significant, a studentized bootstrap interference is implemented. The suggested interference compares the Sharpe ratios of two return time series under the null hypothesis, that the Sharpe ratios of both time series are equal. Evidence is found, that the differences in Sharpe ratios are significant. Hence, the findings suggest that a strategy, capitalizing on the interdependencies of cryptocurrencies, based on a VAR(1)-DCCGARCH(1,1) model is feasible. Furthermore, there is strong evidence, that such a strategy can be improved using the NVT ratio.

References

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