Financial Econometrics - Homework 5

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1   Guidelines

- Deadline: Before June 14, 2019 by email to rombouts@essec.edu, oscarjoel.leonsandoval@essec.edu.

- If you use R, integrate your solutions into R-Markdown allowing you to embed the answers and code in one pdf file. if you use Python, make a Jypyter notebook file.

- Work in groups of 2.

- Explain the code making comments in each step of it.

- Professional presentation and visualisations are part of the evaluation.

2   Cryptocurrency GARCH volatility and dynamic conditional correlations

Bitcoin is definitely the best known among cryptocurrencies, though its share in the total cryptocurrency market capitalisation is to date close to 50% compared to more than 90% two years ago. In fact, hundreds of cryptocurrencies exist and this homework aims to model the volatility of these assets and understand how they are dynamically correlated. A legitimate question for an investor with interest in this new asset class is if Bitcoin is

sufficient to invest in and how the other currencies relate to each other.

QUESTIONS:

1. Extract daily price time series of the 10 largest Cryptocurrencies according to the most recent Market Cap from Coinmarketcap plus Bitcoin. For each series (11 series), go as far as possible in the past but discard initial periods where the prices are extremely small.

2. Make a table reporting for each series, starting date, end date, number of observations, current Market Cap, current volume in USD.

3. Make one plot with all price series and another plot standardized prices (e.g. price of 100 for 01-01-2014). Comment.

4. Transform the series in percentage log returns, make separate plots, and make one descriptive statistics table reporting mean, standard deviation, skewness, kurtosis, autocorrelation coefficient of order 1. Comment and compare with your experience from stock returns in the previous home-works.

5. Compute daily pairwise correlations based on a window size of 60 days, when data is available, among the 10 Cryptocurrencies. Make a daily time series plot of the average of these correlations, and 95% confidence bands (based on asymptotic normality). Comment.

6. Compute the 10 daily pairwise correlations with Bitcoin based on a window size of 60 days, when data is available. Make a daily time series plot of the average of these correlations, and 95% confidence (bands based on asymptotic normality). Comment.

7. For each of the Cryptocurrencies, estimate a GARCH (p,q) type model. Report in a table all the parameter estimates. Make individual plots of the estimated daily volatilities. Explain why you choose these p and q.

8. Estimate a dynamic conditional correlation (DCC) model for the 10 series, shortening the data to shortest sample available. Comment the parameter estimates.

9. Make a daily time series plot of the average of the DCC correlations, and 95% confidence bands (based on asymptotic normality). Comment. Compare with your previous rolling window correlation plot.

10. Based on the descriptive statistics and the correlation analysis, what is your answer to the investor wishing to invest in Cryptocurrencies? Bitcoin is enough?

3 EXTRA FOR THE FAST (for fame only)

Compute daily optimal portfolios for a mean variance investor.