

Financial Econometrics II HW#2 Part I

GARCH Models and Its Applications

Part I

Due date: The homework is due Monday: 2/5/2019 in class. Note that this homework may take longer than the first homework and you may not want to wait until the last minute.

For this part of the homework, you are asked to build a model for the conditional volatility of a financial time series (see below for a list of choices). This consists of finding a parsimonious model for conditional volatility using Matlab, producing a 1-step forecast of future conditional volatilities. For this part, you can use the built in functions in Matlab.

Keep the following issues in mind for your project:

- Download a time series data X_t that you are interested in (see below).
- Think about if you want to build your model on the original X_t directly or on some of its transformations. For example, do you need convert the price time series into continuously compounded return time series $R_t = \log(X_{t+1}/X_t)$? *For those who really want to know the advantages of the "log", please try to build your model on both the original data and its log and compare the results [this part is for the motivated students and not required].*
- Go through the Pre-estimation step, Estimation step, and Post-estimation step as in the GARCH toolbox Manual to Estimate GARCH(1,1). Are the parameters statistically significant from zero? Note that before you move on to modeling conditional volatility, for some time series, you may need to find a good model (AR, MA, ARMA, etc) for the "mean" of the time series.
- Conduct the post-estimation diagnostics to check if your model adequately describes the data. You can estimate GARCH(1,2), and GARCH(2,1) to see if you really need a more complex model. Decide on your final model (type it out in mathematics form).
- Use your model to forecast one-period ahead future conditional volatility.

- Do some robustness check by breaking your sample into two sub-samples and re-estimate the final GARCH model you obtained for each subsample. Are the parameter estimations the same as the ones estimated using the whole sample?

Data Source. You can choose one of the following time series. [You can use daily data, or weekly data]

- S&P 500 Index prices
- S&P 500 subindexes: the Growth Index, or S&P 500 Value Index, etc.
- Interest rates: such as Federal Fund Rate, or 3-month T-bill rate [Available from Federal Reserve website] [Be careful about how the rates are quoted: the rates are continuously compounded rate or just simple rate?]
- Euro to USD exchange rate
- Japanese Yen to USD exchange rate
- GBP to USD exchange rate
- Any financial time-series that interests you more.