

# Financial Econometrics

## Fall 2014

### Homework 1

HOMEWORK 1 DUE MONDAY SEPTEMBER 22, 2014

#### INSTRUCTIONS:

Download homework from NYU Classes. Fill it in as a word document and then upload it to NYU Classes in the Assignments section.

**Print out your own copy of the homework and bring it to class for discussion.**

1. Using the attached EViews workfile, estimate a GARCH model for BNP Paribas. Correct any obvious data errors.
  - a. Calculate and plot the annualized volatility. What is its peak and what is it today?
  - b. Test for residual autocorrelation, and residual heteroskedasticity
  - c. Test the hypothesis that this is correctly specified vs having either one more lag in the ARCH or GARCH.
  - d. Test the hypothesis that the error distribution is normal against a fat tailed alternative.
  - e. Test the model against an asymmetric alternative
  - f. Test the hypothesis of parameter non-constancy before and after Aug 1, 2007.
  - g. Plot the one step ahead forecasts in-sample and the forecast up to 1 year ahead out of sample
  - h. Of all the readily available models in EViews, which has the best Schwarz criterion?
  - i. Confirm that the models are relatively unaffected by using fractional rather than log returns, and by setting the intercept to zero rather than estimating it or using excess returns.
2. Go to V-LAB and find the GJR-GARCH model for the assets presented in the first class.
  - a. Find the one day and one year ahead forecast – notice how they compare with the numbers from class
  - b. Which assets had asymmetric volatility of the opposite direction?
  - c. Which are most asymmetric?
3. “Delta Method.” Assume that there is a scalar sequence with the following properties:  $\beta_n \xrightarrow{p} \beta_0$ ,  $\sqrt{n}(\beta_n - \beta_0) \xrightarrow{d} z$ ,  $z \sim N(0, \sigma^2)$

- a. If  $f$  is a continuous function, find expressions for the probability limit and limiting distribution of  $f(\beta_n)$  using only the limit results from class.
- b. Formulate the same problem and write the result for a vector process.
- c. Apply this result to find the standard error of a GARCH estimate of the unconditional variance and of the 1 and 2 step ahead forecast of the conditional variance

4. Consider the following *new* ARCH model:

$$r_t = \sqrt{h_t} z_t, \quad z_t \sim IN(0,1)$$

$$h_t = \omega + \delta h_{t-1} + \alpha(r_{t-1}^2 - h_{t-1})h_{t-1}^{-1/2}$$

Answer the following questions:

- a. Find  $E_t(r_{t+2}^2)$ . Is this symmetric in  $r_t$ ? \_\_\_\_\_
- b. Find conditions for  $r_t$  to be covariance stationary. \_\_\_\_\_
- c. Find the unconditional variance of  $r$ . \_\_\_\_\_
- d. Find the unconditional skewness and kurtosis of  $r$ . \_\_\_\_\_, \_\_\_\_\_
- e. Find the likelihood function. \_\_\_\_\_
- f. Find the First Order Conditions. Is this a QMLE?  
\_\_\_\_\_
- g. Without doing the work, discuss how you would compute standard errors for the QMLE estimates.