Financial Econometrics and Empirical Finance
Fall 2021
HW5

Due: *November 30th, 2021, before class.*

All assignments must be completed using a software or programming language that allows the manipulation of matrices and vectors. No canned statistical packages are allowed. You may use existing toolboxes of programming languages. This assignment has two parts. Please complete both parts.

Part 1: Forecasting REIT returns

1. Download monthly data for the REIT (Real Estate Investment Trust) return index in file reit_data_2019.xls, available on Canvas. The data can also be found on the FTSE /NAREIT website. It contains REIT total returns, price appreciation, and dividend yields.

2. Compute the simple return (R_t), unfiltered dividend yield, DY, and price appreciation.

3. Compute the smoothed DY over the previous 12 months by taking the moving average over the last 12 months, denoted by DY^s.

4. Compute the log return (r_t), log DY,and log DY^s

5. Compute annualized summary statistics for the simple return (R_t), log return (r_t), DY, DY^s, log DY, and log DY^s— mean, standard deviation, autocorrelation, skewness, kurtosis.

6. Run the following regressions for simple returns

   (a) R_t on R_{t-1}
   (b) R_t on R_{t-1} and R_{t-2}
   (c) R_t on R_{t-1} and $R_{t-2}..., R_{t-12}$
   (d) How do you test for persistence in returns in AR(1) model?
   (e) How do you test for persistence of returns in AR(p) model?

7. Run the same regressions as in 6.a-6.e but for log returns. Are the results different?

8. Are REIT returns predictable by their own lags?

9. Run the following returns-dividend yield regressions:

   (a) R_t on DY_{t-1}
   (b) R_t on DY^s_{t-1}
   (c) r_t on $\log DY_{t-1}$
   (d) r_t on $\log DY^s_{t-1}$

10. Are returns predictable by the dividend yield? Are returns predictable by the smoothed dividend yield?

11. Should you adjust your results in question 9? How? Display the adjusted results. How large is the bias?

12. From the specifications in question 9, which one would you choose to forecast future REIT returns? Why?

13. Use your best model from question 9 to form an out-of-sample forecast of REIT returns in November 2017, December 2017, and January 2018.

14. Redo the regressions in questions 6, 7, and 9 for the 1972-1993 and 1994-2014 subsamples.

Part 2: Volatility Forecasting

1. Download the daily S&P500 index, the EuroUSD exchange rate, the NYSE oil gas price index which can be found in file vol_data_homework.xls, available on Canvas.

2. Compute daily log returns for all three indices. Compute monthly log returns for all three indices. Please provide summary statistics for the three returns series at daily and monthly horizons. Whenever possible, convert to annualized percents.

3. Compute the realized monthly volatility RV_t for all three assets. Be careful with the units.

4. Using the daily returns for each of the three assets, please estimate:

   (a) ARCH(1)
   (b) ARCH(3)
   (c) ARCH(12)
   (d) Can you estimate the ARCH models with OLS? What is the preferred way to estimate an ARCH model?
   (e) Test for ARCH effects in all three asset markets.
   (f) Test whether the ARCH(12) fits the data better than an ARCH(3).

5. Using daily returns, please estimate:

   (a) GARCH(1,1)
   (b) GARCH(2,2)
   (c) Can you estimate the GARCH models with OLS?
   (d) Plot the estimates of the GARCH(1,1) and GARCH(2,2) on one figure along with the RV_t from question 3. Are there any differences between the GARCHs? Are there any differences between the GARCHs and RV_t?
   (e) Test whether the GARCH(1,1) fits the data better than an ARCH(1)?
   (f) Test whether the GARCH(2,2) fits the data better than a GARCH(1,1)

6. Based on your findings in questions 4 and 5, would you say that volatility is persistent across all markets? Why?

7. Redo questions 4-6 with monthly returns.

8. Are there any systematic characteristics of the volatility estimated across all three asset classes? Are there any differences?

9. OPTIONAL: Download data for the three indices from 10/1/2014 to now. Use the monthly GARCHs to forecast the volatility over the next 4 months. Use the RV (with an AR(p) model) to also forecast future volatility. Which model performs best in this limited out-of-sample experiment?