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Problem Set #3

1. We are going to learn how to do Monte Carlo simulations for a simple AR model. You can use any software of your preference. Just post the output (I do not to see your code but you are welcome to post that as well if you want).

   (a) Generate a sample of T = 100 observations from an AR(1) with $\rho = 0.5$. Using 5,000 monte carlo simulations, compute the distribution of the OLS estimate for ρ.

   (b) Do the same as in a. but this time compute the empirical distribution for the $t-$ startistics for the test $\rho = 0.5$

   (c) Do the same for $\rho = 1$ and the t -statistics for the test $\rho = 1$

   (d) Repeat a, b and c for T = 1000. How do things change?

   (e) Repeat a and b and c for T = 100 and T = 1000 and $\rho = 0.90$ and $\rho = 0.99$. Compare your results and discuss.

2. Go to the FRED database (the data base of the Federal Reserve). It contains all sorts of macro data for the US. We want to look at a measure of GDP for the US. Choose one and download the data.

   (a) Using your program of choice, estimate the autocorrelation and partial autocorrelation function for USGDP. What can you say just looking at the correlogram?

   (b) Estimate the model that is suggested by the correlogram and compute the one and two-step-ahead forecasts. (If you have more than one model in mind, compute the forecasts with both models).

   (c) Estimate a AR(1) model for USGDP. What is the value of the root?

(d) Test for the presence of a unit root in USGDP using any test we talked about in class. Do you reject or not? Make sure you think about which is the relevant model we should test (deterministic, no deterministic etc.).

(e) Discuss your results.

3. You have two possible models for your data. Model "a" is a trend stationary model of the form $y_t = \alpha + \beta t + \varepsilon_t + \vartheta\varepsilon_{t-1}$. Model "b" is the unit root model $(1 - L)y_t = \delta + \varepsilon_t + \vartheta\varepsilon_{t-1}$

(a) Compute the s-period ahead forecast error and MSE for both models. What is the difference between the forecast errors and the MSE for the two models, as forecast horizon gets large?

(b) Compute the dynamic multiplier $\frac{\partial y_{t+s}}{\partial \varepsilon_t}$ for both models. Comment on the difference.