Econ 9011 **Assignment 2** **Due: Friday., Oct 25**

1. What is the standard frequentist estimator and distribution of that estimator for an AR(1) model? What happens to the frequentist estimator for a unit root process (and values of the AR(1) parameter that lead to a characteristic root inside the unit circle)? Why is it so different in this case?

2. Do a simulation study to show what happens to the distribution of a variable generated by an AR(1) stochastic process over the possible range of the parameter space for the AR(1) coefficient, with special attention to "roots local to unity", i.e. characteristic roots at and near (either side) of unity.

3. Do a simulation study to show what happens to the distribution of a variable generated by an AR(2) stochastic process over the possible range of the parameter space for the AR(2) coefficients, with special attention to "roots local to unity", i.e. characteristic roots at and near (either side) of unity.

4. Is the log(CPI) difference stationary or trend stationary (data are in the CPI.csv file)? Provide and discuss (very briefly!) all the evidence.

5. Using Turing.jl, estimate an ARIMA(2,1,1) for log(CPI) (data are in the CPI.csv file). Report the results (summary statistics for posteriors similar to regression output). Plot the posterior for the AR(1) coefficient (and save the MCMC draws for the next question).

6. Estimate an ARIMA(1,1,2). Report the results (as above) and plot the posterior for the AR(1) coefficient along with the estimated coefficient from qu. 4, plotted on the same figure for comparison. Obtain posterior draws for the difference in the two estimates of the AR(1) coefficient and plot that posterior (of the difference).

7. Is the difference computed in qu.5 significantly different from zero? Compute the probability that the difference is > 0, and ≤ 0. Plot a 95% credible interval on the posterior figure. Compute the posterior odds against the null hypothesis of exactly zero. Compute a "frequentist" p-value. What is a frequentist method for testing if the coefficient is statistically different between the two models?

8. What is the spurious regression problem (briefly, one paragraph max.)? Generate pseudo-data (200 observations on two variables) to demonstrate the spurious regression problem. Provide some plots, etc. and briefly explain.

9. Using two nonstationary variables generated in qu. 8 (or similar) that are NOT actually related (i.e., the are independent), provide evidence on whether or not they are cointegrated.

10. Repeat qu. 9 using two variables that ARE actually cointegrated, i.e. generate pseudo-data for two cointegrated (by construction) variables, then, treating them as data you collected, examine if they are cointegrated.