Time Series Modeling and Forecasting   **Problem Set 2**

Submit a single file containing the answers to all questions through canvas.

<u>Part A</u>

1) Write the model $y_t = \alpha + \delta t + \rho y_{t-1} + \beta x_{t-1} + r_t$ in first differences.

2) Suppose after first differencing a model is $\Delta y_t = \delta - \phi + 2\phi t + \rho \Delta y_{t-1} + \beta \Delta x_{t-1} + \Delta r_t$. What was it before the first difference was taken? (Hint: both t and t^2 are in it.)

3) Suppose you are originally interested in the model $y_t = \alpha + \delta t + \rho y_{t-1} + \beta x_{t-1} + r_t$, where $r_t = \gamma r_{t-1} + \varepsilon_t$ and ε_t is an independent random disturbance. Write the dynamically complete model in first differences. Hint: first substitute to make the model dynamically complete, and then take the first difference.

<u>Part B</u>

1) From FRED (Federal Reserve Economic Database) download the following monthly non-seasonally adjusted variables for Florida and the U.S., and name them as indicated:

Geography	FRED Series Name	Rename
Florida	All Employees: Total Nonfarm in Florida	fl_nonfarm
Florida	Civilian Labor Force in Florida	fl_lf
Florida	New Private Housing Units Authorized by Building Permits for Florida	fl_bp
U.S.	Employment Population Ratio	us_epr

2) Prepare your data for analysis:
a) Read the documentation so you know your data
b) Load the data
c) Turn on a log file
d) Generate a monthly date variable (make its display format monthly time, %tm)
e) tsset your data
f) Generate natural logs of the four variables to be used in the analysis.

3) Evaluate Autocorrelation and Weak Dependence
a) Obtain the correlation of each variable with its one period lag.
b) Obtain the autocorrelogram and partial autocorrelagram for each variable.
c) Conduct the Dickey-Fuller unit root rest for each variable.
d) Interpret these results.

4) Given the results of the previous question, transform the data as needed and estimate a dynamically complete ARDL model for non-farm employment. Include at least one lag of the relevant dependent variable. How many additional lags of the dependent variable, and how many lags of which independent variables you include, are up to you. Looking back at what you did for Problem Set 1 might be informative, but don't be limited by it. Produce and interpret the AC and PAC for the residuals and the results of a Breusch-Godfrey test. In your write up, justify your specification and interpret the results.

5) Suppose you are interested in the relationship between the first difference in non-farm employment and the lags 0 to 4 of the differences of Florida building permits, controlling for seasonal impacts, but not controlling for any other variables or lags, including lags of employment. That is, you explicitly do not want to a dynamically complete model. (Don't worry about why, for this purpose.) Estimate the model both with and without Newey-West standard errors and discuss the difference that makes.

6) Provide a neat report writing up your answers to 3-5. Do not simply post screenshots of the Stata results window. Rather, provide neat professional looking tables of the results you obtain. Make sure any results you refer to in written answers to questions appear near the written answers so that your overall submission is easy to make sense of.

7) As Appendix A, include the clean do file to replicate your analysis.

8) As Appendix B, include the log file of a run of your clean do file to your write up.