

AGEC 622  
o4\_time\_series\_1 Exercises  
Due before the beginning of class 05

- Complete the exercises in the provided notebook “o4\_exercises\_LASTNAME\_FIRSTNAME.xlsx”.
- **Rename your file, replacing “LASTNAME\_FIRSTNAME” with your actual names.**
- If there is more than one question, note that each will have its own tab in the workbook.
- **Work vertically down the sheet** within your notebook. Separate the individual parts of the question(s) (a, b, c, . . .) using dividing rows like the blue example dividers in the file.
- Submit this homework by emailing your xlsx file to henry@tamu.edu, **with the subject “AGEC 622 exercises o4”**.

1) **Question 1**

For this question, you will evaluate the properties of a historical time series and determine the correct specification for an AR model. The data are daily closing prices for the S&P Oil & Gas Exploration & Production ETF (symbol XOP) for the last five years.

- a) **Apply the DF test.** Use the DF test to determine a number of differences that will render the data stationary.
- b) **Interpret.** Is the result above what you expected? Why or why not?
- c) **Determine the optimal number of lags using SACs.** Determine the optimal number of lags for the AR model using sample autocorrelation coefficients.
- d) **Determine the optimal number of lags using the SIC.** Determine the optimal number of lags for the AR model using Schwarz Bayesian information criterion.
- e) **Interpret.** Are the optimal numbers of lags from the previous two steps what you expected? Why or why not?

2) **Question 2**

In this question, you will create a random walk time series and look at the performance of the Dickey-Fuller test when applied to that synthetic data.

- a) **Create a random walk data series.** Create 100 observations, where each observation is

$$Y_t = Y_{t-1} + \epsilon_t$$

where  $\epsilon$  is stochastic, and is normally distributed with a mean of zero and a standard deviation of one. Use Simetar’s “NORM” function for  $\epsilon$ . Note that the starting value  $Y_0$  is provided for you. Also note that this synthetic time series is known with certainty to be non-stationary.

- b) **Apply the DF test.** Apply the DF test to the data with zero differences (and no trend and zero lags in the DF test model). Press F9 a few times, and you should see your DF test statistic dynamically updating.
- c) **Simulate numerous data series.** Use the simulate function of Simetar to simulate 500 values for the DF test statistic. The DF test statistic is the only value (“Output Variable”) you need to simulate. You do **not** need to include any of the  $Y$  values as simulation output variables.
- d) **Interpret.** How many times was the DF test statistic less than  $-2.9$ ? Is this more or less than you expected? Why?