

EXERCISE 7

Purpose: To learn how to use the **Augmented Dickey-Fuller Unit Root test** to determine if a time series needs to be differenced in order to make it stationary or if it can be modeled as is. We will be looking at two time series: First, the lead production time series and, second, the Dow Jones index. Besides the lectures that I have given on this topic you can consult the files **ADF Lecture Notes.pdf** and **ADF Notes.pdf** that you can find in the “notes” subdirectory for this course. **This homework is due Thursday, October 20.**

Go to the course website and download the EVIEWS program **leadprod.wf1**. In the below discussion we are using the notation presented in **ADF Notes.pdf**. On Apps.smu you will find the EVIEWS (Econometric Views) program. Use it as required by this exercise.

- (i) Consider the correct Augmented Dickey-Fuller test of the following hypotheses (θ is the same as τ in my class notes):

$$H_0 : \theta = 0 \text{ versus } H_1 : \theta < 0$$

In lay terms, what is the meaning of H_0 ? H_1 ?

- (ii) Using EVIEWS and the correct Dickey-Fuller case for the Lead Production data report the following information:

Case = Zero Mean / Single Mean / Trend (circle a choice)

Lag Length* = _____

Dickey-Fuller t-statistic (tau) = _____

Probability Value of DF t-statistic = _____

This test result indicates that lead production (is/is not) stationary and (does/does not) need to be differenced.

* Let EVIEWS use automatic lag length selection by means of the Schwartz information criterion to choose the appropriate lag length for the augmenting terms in the Dickey-Fuller test.

- (iii) Go to the class website and download the SAS program called **Leadunit.sas**. Run it and report the ADF results that are produced by the first Proc ARIMA statement. It uses the “stationary” option in the IDENTIFY statement to produce the ADF results. Circle the part of the ADF table that most closely matches the result produced by EVIEWS.

Go to the class website and download the EViews program **Dow Jones.wf1**. Then use this EViews program to complete part (iv) of this exercise.

- (iv) Using EViews and the correct Dickey-Fuller case for the **log of Dow Jones Index** (*), report the following information:

Case = Zero Mean / Single Mean / Trend (circle a choice)

Lag Length** = _____

Dickey-Fuller t-statistic (tau) = _____

Probability Value of DF t-statistic = _____

This test result indicates that the log of the Dow Jones Index (is/is not) trend stationary and (does/does not) need to be differenced before it is modeled by Box-Jenkins methods.

* For the Dow Jones data, as discussed in class, it is preferable to transform the series to the log of the Dow Jones Index. If, by the means of the ADF test there is a need to difference $\log(\text{Dow Index})$ to make $\log(\text{Dow Index})$ stationary, we would be building a Box-Jenkins model of the **monthly percentage change** in the Dow-Jones index.

**Let EViews use automatic lag length selection by means of the Schwartz information criterion to choose the appropriate lag length for the augmenting terms in the Dickey-Fuller test.