

**EXERCISE 7**  
**KEY**

**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:

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

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

**ANSWER:**

$H_0$  : **Data is nonstationary and needs to be differenced to make it stationary**

$H_1$  : **Data is stationary as is. Doesn't need to be differenced to make it stationary.**

- (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\*\* = **0** (i.e. no augmenting terms used) \_\_\_\_\_

Dickey-Fuller t-statistic (tau) = **-4.483380** \_\_\_\_\_

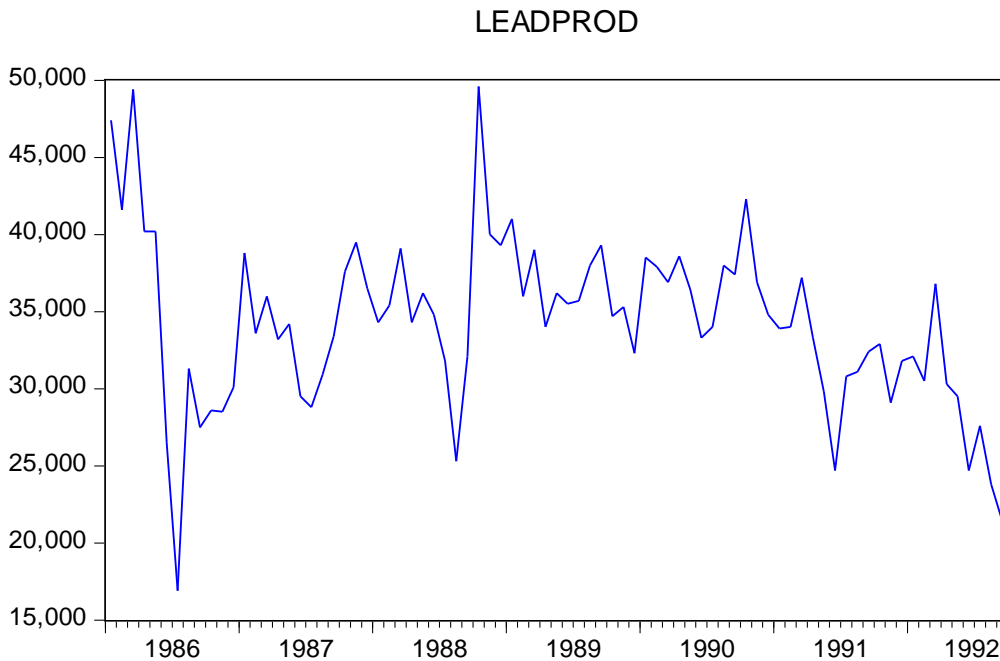
Probability Value of DF t-statistic = **0.0005** \_\_\_\_\_

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.

This is obviously the “single mean” case as the data are flat and having a non-zero level:



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

- (iii) 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\*\* = 1 (i.e. one augmenting term is used) \_\_\_\_\_

Dickey-Fuller t-statistic (tau) = -2.850085 \_\_\_\_\_

Probability Value of DF t-statistic = 0.1827 \_\_\_\_\_

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

\* The SAS %logtest macro indicates that it is preferable to model **the log of the Dow Jones index** as compared to just the index itself. So we would build a Box-Jenkins model of the monthly percentage change in the Dow-Jones index should we find the need to difference the data to make it stationary.

\*\*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.

This is obviously the “trend” case as the data are trending upward. It is a matter of how quickly the data is turning around a superimposed trend line through the data.

LDJI

