ECO 5375-701 Prof. Tom Fomby
Eco and Bus Forecasting Fall 2016

EXERCISE 8

Purpose: To learn how to use the **Hasza-Fuller (1982)** and **Dickey-Hasza-Fuller (1984) Seasonal Unit Root tests** to determine the appropriate differencing of the Plano Sales Tax Revenue data set. For more on these tests see the pdf file **Seasonal Differencing.pdf** on the class website. **You are to turn in this homework on Tuesday, November 9.**

Go to the course website and download the SAS program **Plano_unit_2.sas**. You are to use it to complete the following tasks:

(i) Examine the ACFs of the first difference of the Plano Sales Tax Revenue. Does the ACF of the differenced data indicate the presence of seasonality in the data? Explain your answer. (Note we differenced the data because the data has trend in it. If it had not had trend in it, we would have simply looked at the ACF of the original data.) Hand in the ACF of the differenced data with this exercise.

(ii) Use the SAS program **Plano_unit_2.sas** to conduct the Hasza-Fuller (1982) test of the appropriateness of using the first and seasonal span difference to achieve stationarity in the Plano Sales Tax Revenue data. What is the null hypothesis of this test? What is the alternative hypothesis of this test? What is the value of your test statistic? What are the 1%, 5%, and 10% critical values for this test? What conclusion do you draw from this test?

(iii) Separately, using the **Plano_unit_2.sas**, conduct the Dickey-Hasza-Fuller (1984) test of the appropriateness of using the seasonal span difference alone to achieve stationarity in the Plano Sales Tax Revenue data. What is the null hypothesis of this test? What is the alternative hypothesis of this test? What are the 1%, 5%, and 10% critical values for this test? What conclusion do you draw from this test?

(iv) Finally, given the results you derived from the above tests, which choice of seasonal filter is appropriate for the Plano Sales Tax Revenue data? $\Delta_1\Delta_{12}$ or Δ_{12}? Explain your answer.

(v) Given the results produced by the **Plano_unit._2.sas** program, write out the "best" Multiplicative Seasonal Box-Jenkins $ARIMA(P,D,Q)_s x(p,d,q)$, with coefficient estimates and standard errors, etc. when using the $\Delta_1\Delta_{12}$ transformation? Using the backshift polynomial form to write out your estimated model would probably be the best way to go. Fill in the following

blanks: P = ___, D = ___, Q = ___, p = ___, d = ___, q = ___ .

(vi) Given the results produced by the **Plano_unit._2.sas** program, write out the "best" Multiplicative Seasonal Box-Jenkins $ARIMA(P,D,Q)_s x(p,d,q)$, with coefficient estimates and standard errors, etc. when using the Δ_{12} transformation? Using the backshift polynomial form to write out your estimated model would probably be the best way to go. Fill in the following blanks: P = ___, D = ___, Q = ___, p = ___, d = ___, q = ___ .

(vii) As the Hasza-Fuller and Dickey-Hasza-Fuller tests provided contradictory results, one has to rely on other means to determine which model to forecast the 2006 Sales Tax Revenue for the City of Plano. The **Plano_unit._2.sas** program provides such a method. Describe to me this method and what conclusion you draw from the method that is used. That is, which model should you use and why?

(viii) Given the forecasts from your preferred model of the Plano Sales Tax Revenue data, I want you to fill in the following blanks:

Total Tax Revenue for Plano in 2005 (including the December 2005 forecast) = _____.

Total Forecasted Tax Revenue for Plano in 2006 = _____.

The percentage increase in Tax Revenue that is forecasted for 2006 as compared to 2005 = _____%.