## Exercise 2 – ARIMA Models

Many questions in this exercise can be answered using the udg function: udg(seas\_object\_name,”udg name”). You can find the udg name you need in **diag list R.html**. For example, udg(m,”arimamdl”) will give the ARIMA model for the seas object m. You can also find the answers by looking through the output file – use out(m) to open it.

In this example we will look at the models selected by the automdl{} procedure when we use different options. We use the quarterly Mexican unemployment rate, found in *.\data\mx\National unemployment rate.dat*.

First, start R and load the seasonal library: **library(seasonal)**

Read in the datafile and save it as a time series object called nur: **nur <- import.ts(“***[full directory]***\\National unemployment rate.dat”,format=”datevalue”)**

Then create a seas object to adjust nur. By default, the seas object includes a test for transformation, default automdl, default outlier identification, a test for Easter and trading day, and a seats adjustment. Create a seas object that has a test for transformation, default automdl, default outlier identification, no Easter or trading day tests (this is a quarterly stock series, and there is no built in regressor for quarterly stock trading day), and a 3x3 seasonal filter:

**amd <- seas(nur, regression.aictest=NULL,x11.seasonalma=”s3x3”)**

You can view a basic adjustment summary with **summary(amd)** or the full HTML output (preferred method) with **out(amd)**.

1. What is the transformation choice? Log transform
2. What ARIMA model was selected? SARIMA(1 0 2)(1 1 0)

The selected model is a mixed model. Run automdl without allowing for mixed models:

**amd\_nomix <-** **seas(nur, regression.aictest=NULL,x11.seasonalma=”s3x3”, automdl.mixed = “no”)**

1. What ARIMA model was selected? SARIMA(1 0 0)(1 1 0)

So far both automdl{} choices have had no first difference. Let’s see the model selected when we restrict the nonseasonal and seasonal differencing orders to 1:

**amd\_diff11 <-** **seas(nur, regression.aictest=NULL,x11.seasonalma=”s3x3”, automdl.diff = “(1 1)”)**

1. What ARIMA model was selected? SARIMA(0 1 0)(0 1 1)

Look at the graphs of the original series and the logs of the original series:

**plot(nur)**

**plot(log(nur))**

From these graphs, it does not look obvious that the log transformation is the better choice. Open the output file of amd: **out(amd)**. In the output file, look for the tables from the AIC test for the transformation.

1. What is the AICC of the series with the log transformation? With no transformation? Which is lower? **With log transformation, AICC = 21.058. With no transformation, AICC = 20.3525. The AICC is lower with no transformation, but because aicdiff = -2 for the transform spec the log transformation is chosen unless the AICC for no transformation is smaller than the AICC for log transformation by over two.**

We can look at the model with no transformation to compare it to our models with the log transformation.

**amd\_notransf <-** **seas(nur, regression.aictest=NULL, x11.seasonalma=”s3x3”, transform.function = “none”)**

1. What ARIMA model was selected? SARIMA(0 1 0)(0 1 1)
2. Compare the ARIMA parameters of this model with those of the model from *National unemployment rate diff11.* Are they similar? With the log transformation, Theta = 0.496. Without it, Theta = 0.612. They are slightly different.

Compare the seasonal adjustments of amd, amd\_diff11, and amd\_notransf.

**plot(final(amd))**

**lines(final(amd\_diff11),col=”blue”)**

**lines(final(amd\_notransf),col=”red”)**

1. Which adjustments are most similar? Most different? amd and amd\_diff11 are very similar. Amd\_notransf is the most different.