## R Exercise 3 – RegARIMA Models

.\data\retail\Automobile dealers.dat contains data from retail sales at automobile dealerships. Adjust the series with a test for log transformation, a test for trading day and Easter, automatic model selection, and tests for AO, LS, and TC outliers:

**ad <- import.ts("x:\\courses\\2019cr\\data\\retail\\automobile dealers.dat",format="datevalue")**

**m <- seas(ad,outlier.types=”all”,x11=””)**

Use the output file and the udg() function to answer the following questions.

1. What ARIMA model was chosen for this series? Is this a mixed model? SARIMA(0 1 1)(0 1 1) the so-called ‘airline’ model. This is not a mixed model.

When a seasonal object is created with automdl{}, the AIC test tables for trading day and Easter are not printed in the output file. Hard-code the ARIMA model and run the seas function again.

**m\_arima <- seas(ad,**

**outlier.types = "all",**

**x11 = "",**

**arima.model = '(0 1 1)(0 1 1)')**

1. Did X-13A-S find Easter to be significant? If yes, what was this regressor’s t value?

\*\*\*\*\* AICC (with aicdiff = 0.0000) prefers model **without Easter** \*\*\*\*\*

1. Did X-13A-S find a significant trading day regressor? If yes:
   1. Which trading day was chosen, one coefficient or six coefficient?
   2. How different are the AIC values for no TD, TD1, and TD6?
   3. What were the F test statistic and *p*-value for the trading day regressor(s)?

Six coefficient trading day was selected. AICC is 5013.8 with no td, 4936.2 with td-6, and 4957.3 with td1coef.

The p-value is given in Win X-13 in the Trading Day column – 0.00 – but the F-statistic itself is only in the output file:

|  |  |  |  |
| --- | --- | --- | --- |
| **F Tests for Trading Day Regressors** | | | |
|  | **df** | **F-statistic** | **P-Value** |
| **Trading Day** | 6, 259 | **31.58** | 0.00 |

1. Were any outliers found? If so, what were they, and what were their t values? This information can be found on the Regression Model table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Regression Model** | | | |
|  | **Parameter Estimate** | **Standard Error** | **t-value** |
| **Trading Day** | | | |
| **Mon** | 0.0033 | 0.00319 | 1.05 |
| **Tue** | 0.0032 | 0.00311 | 1.02 |
| **Wed** | 0.0037 | 0.00308 | 1.19 |
| **Thu** | 0.0088 | 0.00312 | 2.83 |
| **Fri** | 0.0051 | 0.00315 | 1.63 |
| **Sat** | 0.0020 | 0.00312 | 0.65 |
| **\*** [**Link to definition of \***](file:///X:\courses\2015\X13\data\retail\Automobile%20dealers.html#footnote0001)**Sun (derived)** | -0.0262 | 0.00313 | -8.34 |
| **Automatically Identified Outliers** | | | |
| **TC2001.Oct** | 0.2558 | 0.02696 | 9.49 |
| **AO2005.Jul** | 0.1169 | 0.02322 | 5.03 |
| **LS2008.Oct** | -0.1483 | 0.02761 | -5.37 |
| **AO2009.Aug** | 0.1412 | 0.02325 | 6.07 |

1. What was the estimate of the seasonal MA parameter? From summary(m\_arima):

Estimate Std. Error Z-value Pr(>|z|)

MA-Seasonal-12 0.610338 0.049340 12.370 < 2e-16 \*\*\*

1. Based on these results, would you consider a regARIMA model of the form (p d q)(0 0 0) + fixed seasonal regressors? Why or why not?

No. Fixed seasonal regressors should be used only if the seasonal pattern is stable. Stable seasonal patterns have a seasonal MA parameter very close to 1. (Although a seasonal MA parameter close to 1 does not mean that you have to use seasonal regressors, and if you suspect your series is poorly modelled this result should not be trusted.

**Creating New Spec Files –** *Optional*

.\data\Retail contains data files for retail series.

Select a series and create a seasonal object which

* Selected the best transformation using the AIC test,
* Tests for trading day and Easter effects,
* Searches for additive outliers, temporary changes, and level shifts,
* Selects an ARIMA model automatically,
* Creates ACF and PACF plots for all combinations of zero and one first differences and zero and one seasonal differences.

Run your new spec file.

Look at the ACF and PACF plots from the identify spec using X-13-Graph. Based on these plots, do you agree with the ARIMA model selected using automdl?