**Time Series Lab 1**

Research Question: Modeling Macroeconomic data

Goals for Lab:

* Upload Time Series Data
* Test for stationarity (ADF/KPSS)
* Create Correlograms to determine lags
* Model time series
* Make predictions about future events

Deliverable:

Write-Up

Write a 2-3 page report of your results. The file should include:

* Plots
* Regression output
* Post-regression tests/analyses
* Explanation of results

**Steps for Lab:**

Necessary Packages: [forecast](https://cran.r-project.org/web/packages/forecast/index.html), [XLConnect](https://cran.rstudio.com/web/packages/XLConnect), [tidyverse](https://cran.r-project.org/web/packages/tidyverse/index.html), [corrgram](http://cran.us.r-project.org/web/packages/corrgram/), [tseries](http://cran.us.r-project.org/web/packages/tseries/), [urca](http://cran.us.r-project.org/web/packages/urca/),zoo

Create Information for Report, based on the questions that follow.

Prepare and submit report

1. Create a scatterplot of Unemployment, Inflation and GDP data
2. Test for stationarity in Unemployment, Inflation and GDP data
3. Create the correlograms of Unemployment, Inflation and GDP data
4. Model Unemployment, Inflation and GDP data using an ARMA(p) process
5. Make a prediction about these data in the future, using forecast

Sheet 2 - Unemployment Rate

Sheet 3 - National Consumer price index (All-items) (2010 dollars)

Sheet 7 - Gross Domestic Product at 2010 prices

MacroData.xlsx

Notes:

For the adf.test, if p-value < 0.05 => stationary

For the kpss.test, if p-value > 0.05 => stationary (note change of inequality)

In the correlograms:

|  |  |
| --- | --- |
| **SHAPE** | **INDICATED MODEL** |
| Exponential, decaying to zero | Autoregressive model. Use the partial autocorrelation plot to identify the order of the autoregressive model. |
| Alternating positive and negative, decaying to zero | Autoregressive model. Use the partial autocorrelation plot to help identify the order. |
| One or more spikes, rest are essentially zero | Moving average model, order identified by where plot becomes zero. |
| Decay, starting after a few lags | Mixed autoregressive and moving average model. |
| All zero or close to zero | Data is essentially random. |
| High values at fixed intervals | Include seasonal autoregressive term. |
| No decay to zero | Series is not stationary. |

https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc446.htm

Another interpretation:

* The model is AR if the ACF trails off after a lag and has a hard cut-off in the PACF after a lag. This lag is taken as the value for *p*.
* The model is MA if the PACF trails off after a lag and has a hard cut-off in the ACF after the lag. This lag value is taken as the value for *q*.
* The model is a mix of AR and MA if both the ACF and PACF trail off.

https://machinelearningmastery.com/gentle-introduction-box-jenkins-method-time-series-forecasting/