

# Project 2

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10/21/2022

Select a time series dataset which contains at least two predictor variables and one response variable ( $y_t$ ). We need to analyze and clean the data to ascertain a model which best fits the data.

## 1. Exploratory Data Analysis

- (a) First check for completeness and consistency of the data (if there are NAs or missing observations, replace with the value of the previous observation; make a note of this)
- (b) Provide descriptive analyses of your variables. This should include the five-number summary, histograms with fitted distribution, correlation plots (or heatmap). All figures must include comments.

## 2. Data pre-processing

- (a) With `tsdisplay` or `ggtsdisplay`, for each variable, use its time series plot, ACF and PACF to comment on its stationarity (you can also decompose the time series). To supplement this, use the appropriate Dickey-Fuller (unit root) test, to determine whether or not it is stationary.
- (b) If it is not stationary, determine the level of differencing to make our series stationary. We can use the `ndiffs` function which performs a unit-root test to determine this. After this, difference your data to ascertain a stationary time series. Re-do part c) for your differenced time series and comment on the time series plot, ACF and PACF. Recall that the time series models we've observed rely on stationarity.

## 3. Feature Generation, Model Testing and Forecasting.

- (a) Fit an AR(p) model to the data (using part (a), AIC or some built in R function)
  - (b) Plot and comment on the ACF of the residuals of the model chosen in 3(b). If the model is properly fit, then we should see no autocorrelations in the residuals.
  - (c) Using the appropriate predictors, fit an ARDL(p,q) model to the data and repeat step (b) in part 3.
- 4. Provide a brief summary of your findings and state which model performs better.
  - 5. Suggest any improvements which could've been made to the model based on your findings, and what was learnt in class.