Economics 144: Project 2
Spring 2024, UCLA
Instructor: Dr. Rojas

Due Date: May 16, 2024

For this project you will fit a forecasting model with trend, seasonal dummies, and cycles. You may choose any data of your choice (except any data used in class and/or previous homework assignments) provided your time-series data suggest the presence of all three components. To make sure you capture any dynamics related to cycles, you will need a large time horizon, therefore, you might want to make sure that your observations span at least $\sim$ 10 years. In addition, since you will also try to fit a VAR model to your data, you will need to have at least two time-series variables, e.g., S&P500 returns from 1985-present and Apple returns from 1985-present with the same frequency.

The assignment that you will submit, consists of a written report which includes answers to the respective questions (including plots), and source code (must be your own) you wrote to execute the computations.

Make sure all the plots conform to the standards delineated in Chapter 4^b, e.g., correct time units, axis labels, legends, etc.

Your report needs to be typed (no limit on the number of pages) and will consist of 5 parts:

I. (5%) Introduction (describe the data, provide some background on the topic, etc.).

II. (80%) Results (answers and plots).

III. (5%) Conclusions and Future Work.

IV. (5%) References (include the source of your data and any other resources).

V. (5%) R Source code. Although the code is only worth 5%, if you do not submit your code, you will not receive credit for the assignment.

1. Modeling and Forecasting Trend, Seasonality, and Cycles

For each of your time-series variables, compute the following:

(a) Produce a time-series plot of your data including the respective ACF and PACF plots.

(b) Plot the `stl` decomposition plot of your data, and discuss the results.

(c) Fit a model that includes, trend, seasonality and cyclical components. Make sure to discuss your model in detail.

(e) Plot the respective residuals vs. fitted values and discuss your observations.

(f) Plot the ACF and PACF of the respective residuals and interpret the plots.

(g) Plot the respective CUSUM and interpret the plot.

(h) For your model, discuss the associated diagnostic statistics.

(i) Use your model to forecast 12-steps ahead. Your forecast should include the respective error bands.

(j) Compare your forecast from (i) to the 12-steps ahead forecasts from `auto.arima` model. Which model performs best in terms of MAPE?

(k) Combine the two forecasts and comment on the MAPE from this forecasts vs., the individual ones.

(l) Fit an appropriate VAR model using your two variables. Make sure to show the relevant plots and discuss your results from the fit.

(m) Compute, plot, and interpret the respective impulse response functions.

(n) Perform a Granger-Causality test on your variables and discuss your results from the test.

(o) Use your VAR model to forecast 12-steps ahead. Your forecast should include the respective error bands. Comment on the differences between the VAR forecast and the other ones obtained using the different methods.