**Assignment 4: Time Series Simulation and Cob-Web Model**

BUAD 5032 – Fall 2021

1. **Objective:**

The purpose of this assignment is to understand time dependency in an AR(1) model.

1. **What You Will Need**

Access to a computer with R and RStudio.

Rmarkdown

1. **What You Will Hand In**

Submit a Rmarkdown file and the knitted version (knitted to word or pdf) that includes your code and narrative of your solution (Assignment4Group#.Rmd/doc/pdf) via Blackboard - Assignment 4. This document should be no longer that 15 pages (including code).

1. **Due Date**

12/08/2021 at 11:59PM EST.

1. **Note on Collaboration**

This is a *Category B* assignment. Specifically, your group may not receive help from anyone outside your group. All questions concerning this assignment should be addressed to your professor. It is an honor code offense to give help to other groups and individuals or receive assistance from other groups and individuals

**Assignment 4**

1. Start by simulating some prices in R. To do this consider the following equation:
2. Let the long run equilibrium price . You can call this variable in R *PStar.*
3. Set the value of the persistence factor . You can call this variable in R *Phi.*
4. Generate prices () by creating random shocks () from a normal distribution with zero mean and standard deviation of 0.08. To create the list of prices**, you can Initialize the series at the equilibrium price (1.5).** Generate 10,000 prices. You can call the list of prices generated in R *Prices*.
5. Plot only the first 50 prices generated and include a horizontal line that illustrates the average price. Does this series look stationary? Discuss with your group how this process would change if or . How effective can we be at predicting prices in these two special cases?
6. Load the library “*forecast*” and generate both the ACF and PACF plots at a 99% confidence level. Describe any patterns you observe in the ACF and PACF (How many correlations are statistically significant? Is there decaying behavior? Do the correlations alternate in sign?). Use the option lag.max=10 when creating your plots. (ANY TRANSFORMATIONS?)
7. Run a linear regression of the prices and the first lag. Start by loading the “*dynlm*” package in R. Then create a time series object with the *Prices* variable you created in 1). You can create a lag variable within your model by using the L() operator. What is the intercept? What is the slope?
8. Load the avocado.csv data set and create a *ts()* object of "*Avocado\_Prices*". Set the starting date to January, 2018 and the frequency of the *ts()* object to 52.
9. Plot the price of avocados and include the mean in your graph. What is the time mean of the series?
10. Generate the ACF and PACF of the price of avocados (*ci=0.99*) by using the “*forecast*” package. **Describe the differences/similarities between these plots and the ones generated by your simulation in 3).**
11. Run a regression of the price of avocados against its lag. This time let’s use the “*forecast*” package and the function *Arima()*. Set the order to *c(1,0,0)* for an AR(1) process. What is the suggested value of *Phi*? What is the implied long run equilibrium price?
12. Re-run your simulation in 1) with the parameters that you have found in 8). In particular, create a *ts()* object of simulated prices with the same dates as the avocado data. Plot the new prices generated by your simulation. Continue by plotting the ACF and PACF of the new simulation. Are the plots like those found in 7)?
13. Retrieve the residuals from the regression you ran in 8) and generate the ACF and PACF plots for these residuals. Are the patterns found in 7) still there? Are there any significant lags? How would ACF and PACF plots compare to those of a white noise process?
14. What is your prediction for the next five periods? *Hint: Use the forecast() function in r.*
15. Create a plot with the original avocado data and the forecast.