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STATS 170

Forecasting Average Duration of Unemployment in US by using Civilian Unemployment Rate, Number of Civilians Unemployed for 27 weeks and over and Civilian Labor Force Participation Rate.

Introduction:

In this paper, I forecast the average duration of unemployment in US. I hypothesize that there is a positive relationship between civilian unemployment rate and average duration of unemployment in US. Also, there may be a positive relationship between number of civilians unemployed for 27 weeks and over, and average duration of unemployment. Moreover, I expect that the lower the civilian labor force participation rate, the shorter the average duration of unemployment. A seasonal effect is expected since when school year ends, more students are going to find jobs which increasing the labor force, hence increase the unemployment rate.

In order to model running and its relation with the other variables, I collected data from https://fred.stlouisfed.org/. In this https://fred.stlouisfed.org/, we can see that it says that the data are not seasonally adjusted. The following section describes the variables selected to answer the research question.

(So I have four variables: average duration of unemployment, civilian unemployment rate, number of civilians unemployed for 27 weeks and over, civilian labor force participation rate)

The Data:

Here, I describe the variables used for the analysis. I give a short name to each of the variables used.

The variable **AD** measures average duration of unemployment in US. It was obtained from U.S. Bureau of Labor Statistics.

The variable **N27** measures number of civilians unemployed for 27 weeks and over in US. It was obtained from U.S. Bureau of Labor Statistics.

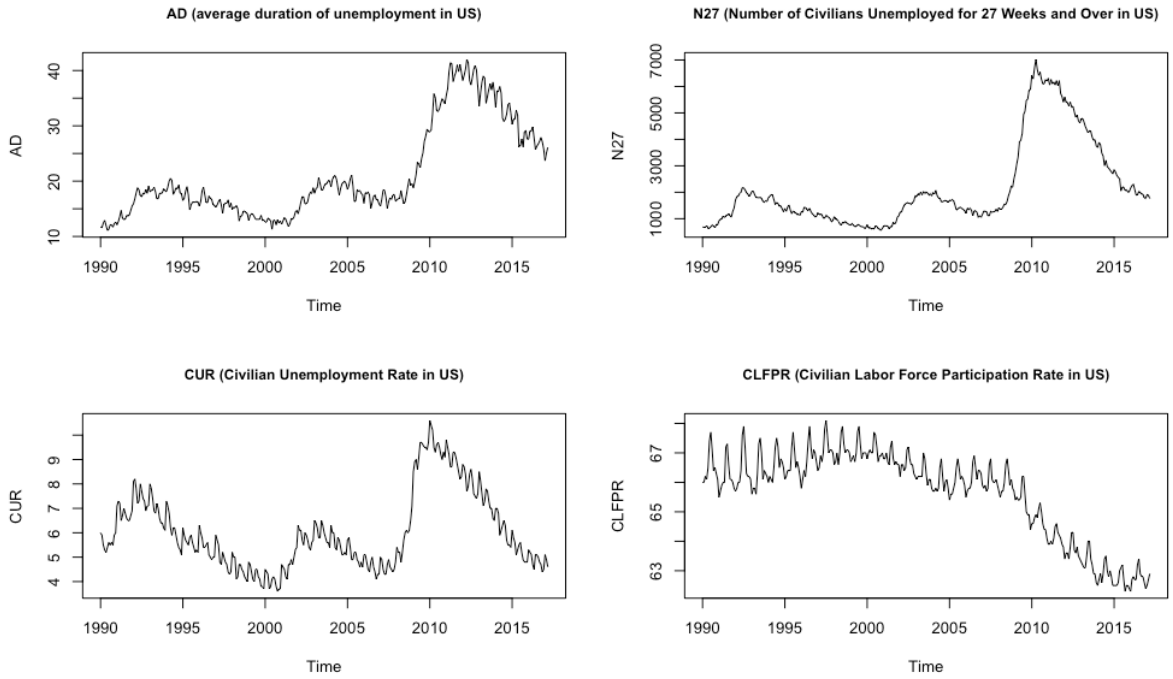
The variable **CUR** measures civilian unemployment rate in US. It was obtained from U.S. Bureau of Labor Statistics.

The variable **CLFPR** measures civilian labor force participation rate in US. It was obtained from U.S. Bureau of Labor Statistics.

Short Name	Description	Units	Length
AD	average duration of unemployment in US	Weeks	327
N27	Number of Civilians Unemployed for 27 Weeks and Over in US	Thousands of persons	327
CUR	Civilian Unemployment Rate in US	Percentage	327
CLFPR	Civilian Labor Force Participation Rate in US	Percentage	327

Description of the Data:

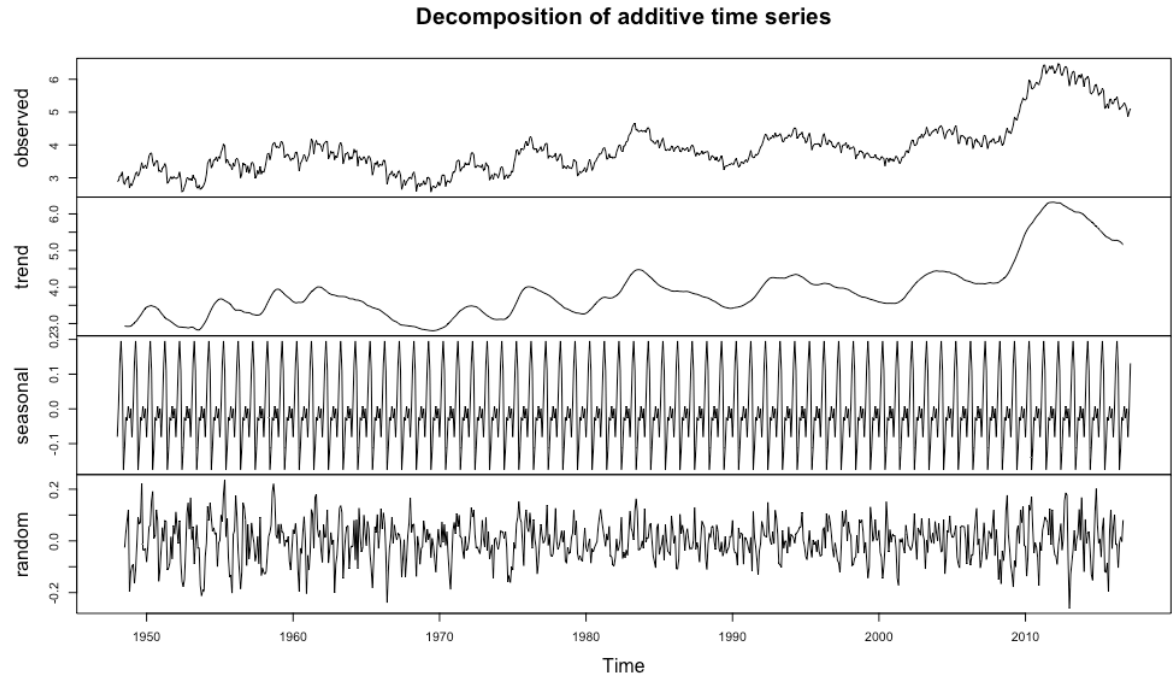
Plot 1:



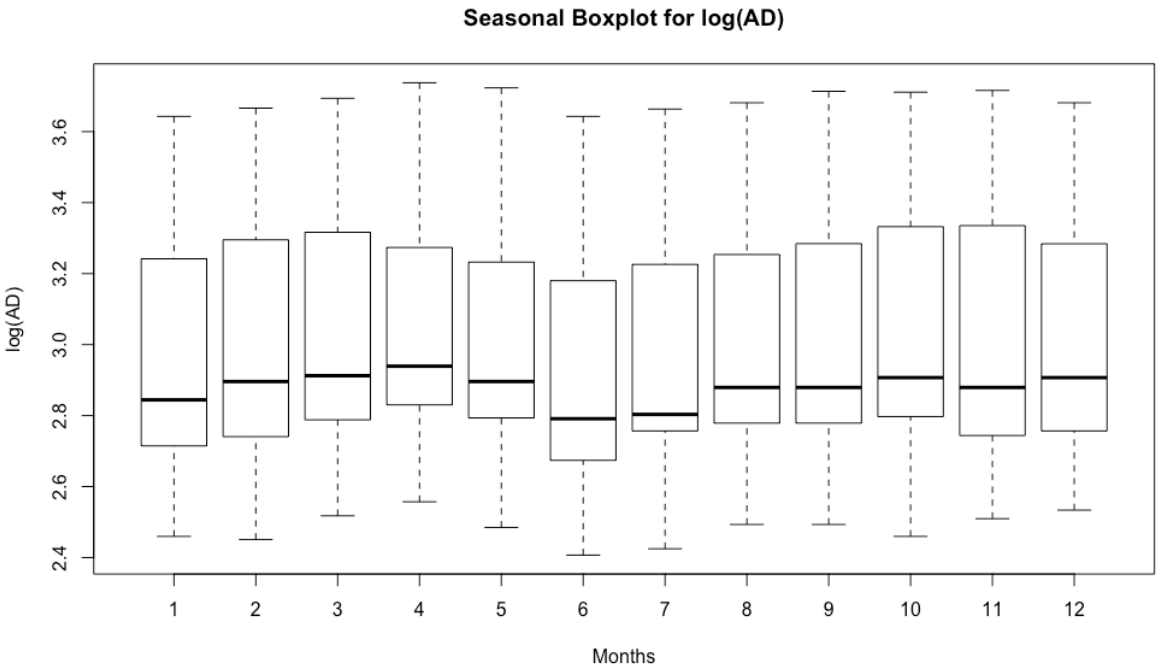
From the plots above, the graphs of AD, N27 and CUR show that there is slight decrease in first ten years. Then there is fluctuation. Around 2008, a steep increase takes place. After two years, a decreasing trend takes place. However, for graph of CLFPR, at the beginning, it is fluctuating. But after 2000, it shows a decreasing trend.

Furthermore, I observe that the variance seems to be proportional to the mean. Hence, the log transformation is needed. I also observe that there is seasonality in the plots.

Plot 2: Decomposition of Additive Time Series of log(AD)



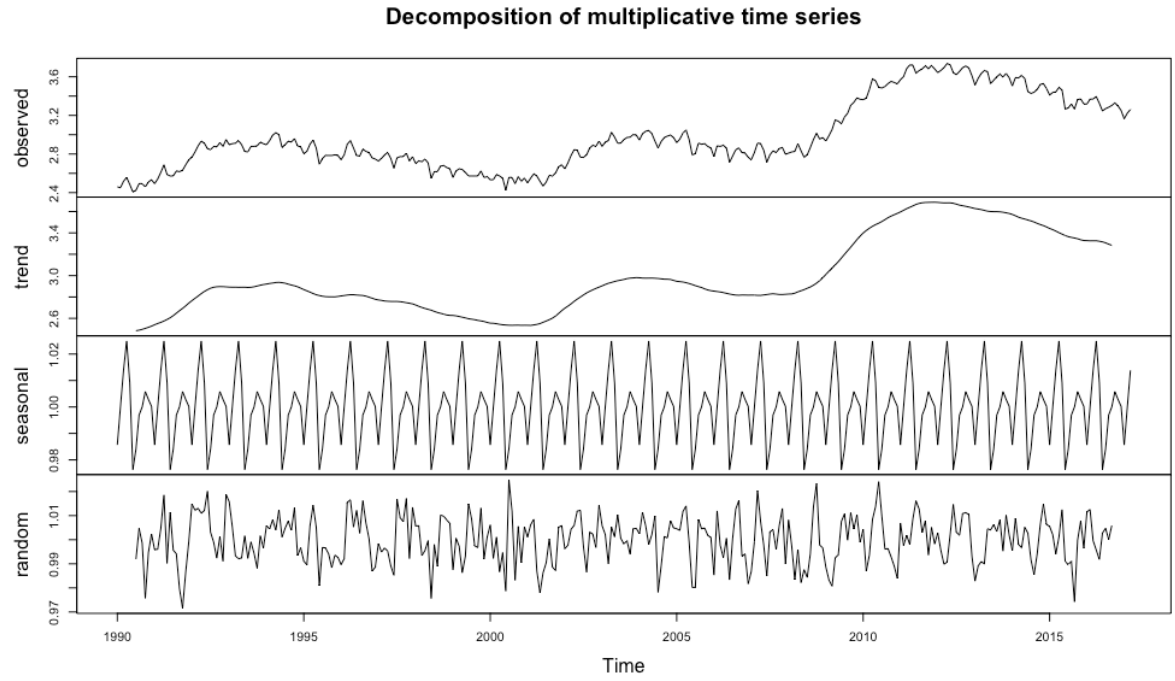
Plot 3:



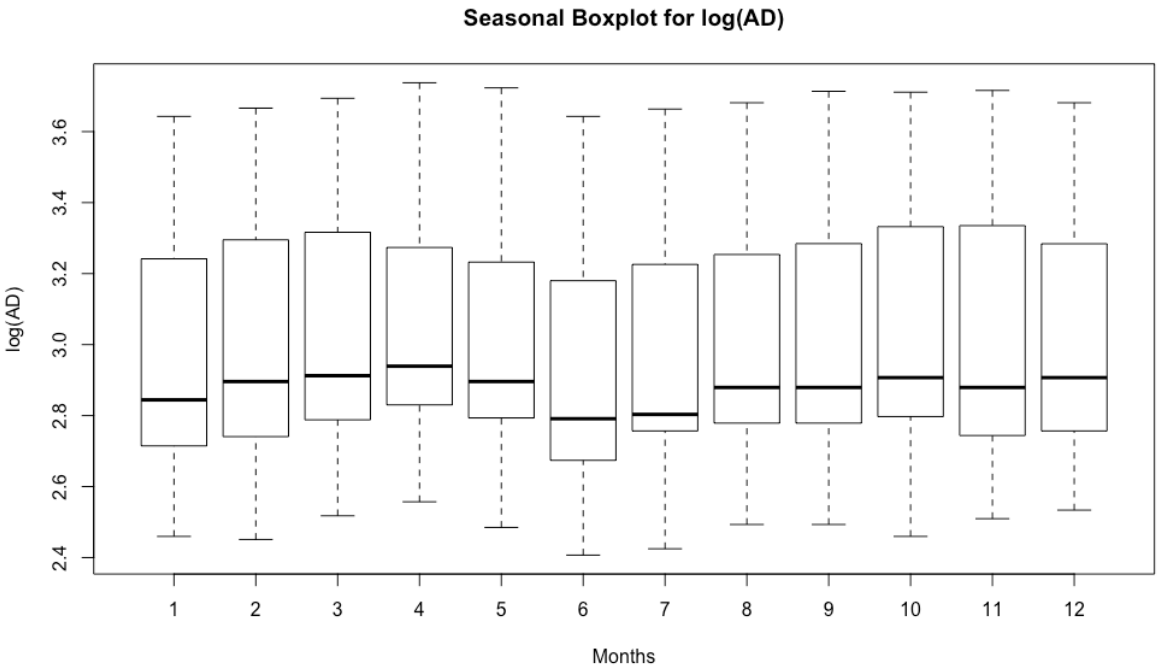
From plot 2, we can see that the trend has slight fluctuation at the beginning. But around 2008, there is a steep increase in the trend then following a downward trend after 2010.There is superimposed seasonal effect exists. But for the random components, we can see that the variance of it is decreasing then increasing. Hence, additive decomposition is not suitable here.

From plot 3, we can see that in the winter and summer, the log of average duration of unemployment has a smaller value than that in spring and autumn. This may because more companies are willing to recruit in January, June, and July.

Plot 4: Decomposition of Multiplicative Time Series of log(AD)



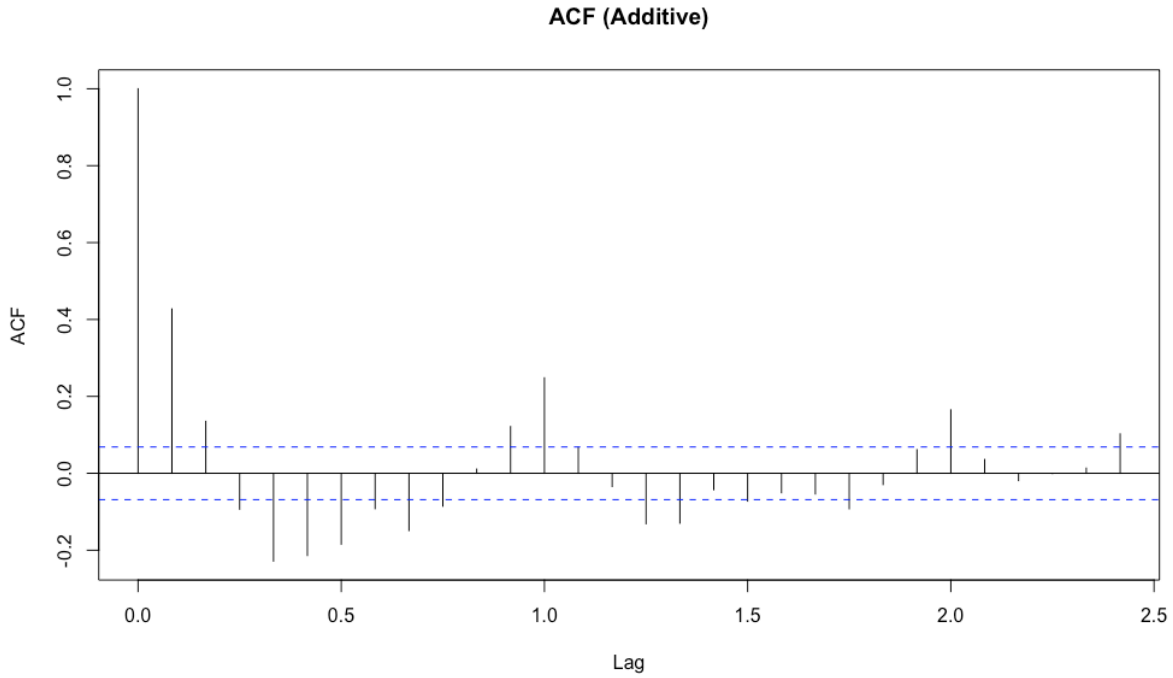
Plot 5:



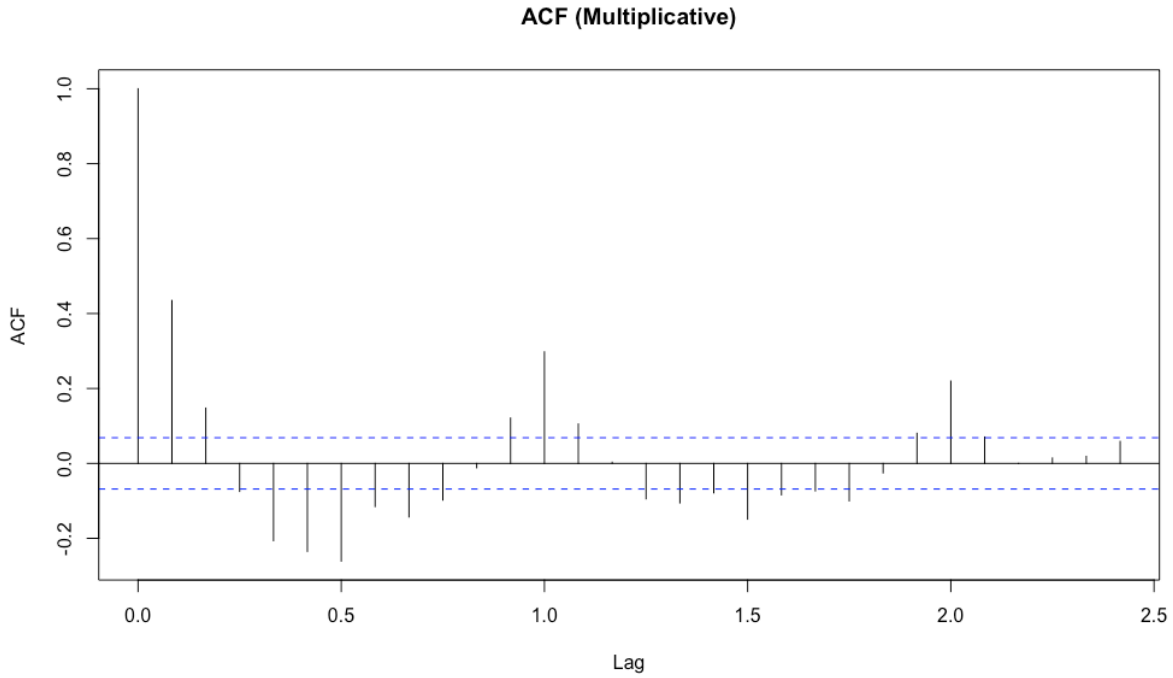
From plot 4, we can see that the trend increases at the beginning then gradually decreases. Around 2001, same pattern takes place. But around 2008, there is a steep increase in the trend then following a downward trend after 2010. There is superimposed seasonal effect exists. For random component, it is approximately stationary in mean. Hence, multiplicative decomposition is more suitable than additive decomposition.

From plot 5, we can see that in the winter and summer, the log of average duration of unemployment has a smaller value than that in spring and autumn. This may because more companies are willing to recruit in January, June, and July.

Plot 6: ACF of Additive Decomposition



Plot 7: ACF of Multiplicative Decomposition



Both ACF are what we would expect of a nonstationary series and smooth plot. This situation also suggests a strong seasonality. Most of r_k values are significant. But ACF of Multiplicative Decomposition has a better performance than additive decomposition since after lag = 2, r_k seems to be not significant for all. In the future, we need to use differencing method or other advanced methods to improve. Perhaps, lag = 12 and differences =1 will be a good way to solve this problem.

References:

[1] https://fred.stlouisfed.org/

[2] Cowpertwait, P.S.P. , Metcalfe, A.V. (2009). Introductory Time Series with R. Springer-Verlag