Homework #2

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Instruction: Do all the following empirical exercises using R. Turn in your R markdown file with answers and supporting tables and graphs, if any. Refer to the R output whenever appropriate when discussing your results. It does not matter which method you use to plot a time series variable.

Question 1: [The factors that determine forecasting performances]

As discussed in class, there are several factors that could affect forecasting performances of our statisical methods. For example, when studying the effects of vacine against a contagious disease, discuss how general equilibrium effects may affect the estimates that we observe.

Question 2. [Learn How to Conduct Preliminary Analysis of Time Series Data]

Recently the White House published a report on the trend of male labor force participation. See report here.

> The share of men between the ages of 25 and 54 either working or actively seeking work has been falling for more than 60 years. The decline in participation has been roughly constant over much of this time horizon. As Figure 1 shows, participation among prime-age men peaked in 1954, declined only slightly until the mid-1960s, but then began to decline in earnest in the decade between 1965 and 1975, when the share in the labor force fell from 96.7 percent to 94.2 percent. Since then, participation has fallen persistently, with sharper declines in recessionary periods, such as the early 1990s, that were not fully reversed in the subsequent expansion periods. Since 1965, the prime-age male labor force participation rate has fallen by an average of 0.16 percentage point each year, totaling an 8.3 percentage-point decline as of May 2016

1. Obtain seasonally adjusted male labor force participation from St. Louis Fed's website.
2. Plot the time series.
3. Can you replicate some of the figures in this paragraph? Please fill in your numbers in four decimals, if possible.

> The share of men between the ages of 25 and 54 either working or actively seeking work has been falling for more than 60 years. The decline in participation has been roughly constant over much of this time horizon. As Figure 1 shows, participation among prime-age men peaked in 1954, declined only slightly until the mid-1960s, but then began to decline in earnest in the decade between 1965 and 1975, when the share in the labor force fell from _____ percent to _____ percent. Since then, participation has fallen persistently, with sharper declines in recessionary periods, such as the early 1990s, that were not fully reversed in the subsequent expansion periods. Since 1965, the prime-age male labor force participation rate has fallen by an average of _____ percentage point each year, totaling an _____ percentage-point decline as of May 2016.

4. Examining the time series plot, which component(s) of the variable are more distinct?
5. Use the classical decomposition method to separate these distinct components.
6. Using your answer to (4), what do you think next period's male labor force participation rate would be, roughly speaking?
7. Now, obtain the labor force participation rates for women. Pretend that you are a government official who is going to write a separate report on women. Use the data, plot it, and summarize its patterns. Finally describe its evolution over time using similar language as the one for men above.

Question 3. [Learn How to Use simple forecasting methods]
Use data on male labor force participation rates from the pre-Trump period and obtain forecasts for the Trump period using the following methods and compare them to the true values.

1. Average Method
2. Naive Method
3. Seasonal Naive Method
4. Drift Method
5. Naive Drift Method (suggested by Yandong and Heather in class)

Also, use only the data from the George W. Bush era. How would your results change?

Question 4. [**Learn How to Use a Multiplicative Model to Decompose Time Series**] In class we illustrate how to use the classical decomposition method to isolate different components in time series. The default is an **additive** model.

1. Obtain unemployment rates **without** sesonality adjustments.
2. Use a mulitiplicative model to decompose this variable, and plot the results.
3. Use the decomposition results, generate and plot a new variable that is free of the random component.
   Hint: Note that in case of multiplicative models, the answer is slightly different from the one that we discussed in class.
4. Also use the STL method to decompose the time series.