Assignment 7

Problem 1:
Use the datafile BOND which contains monthly observations on railroad bond yields for the period January 1968 to June 1976.

1. Plot the data. Looking at this graph would you expect this time series to be stationary? Look at the autocorrelation and partial autocorrelation of this time series. What do you think which order this process has?
2. Use a Dickey Fuller test to examine whether it is stationary or not.
3. A time series is called trend-stationary when it is stationary after removing a time trend from this time series. Regress the bond data against a linear time trend and obtain the residuals as the new detrended time series. Plot the autocorrelation and partial autocorrelation of this series. What do you observe here?
4. Now use again the original (not the detrended) time series and calculate the first difference. Plot the acf and pacf and use a Dickey Fuller Test to test for stationarity.
5. Which order of integration does this time series have?

Problem 2:
The dataset HOUSE contains data on housing prices in the USA. Use this time series to do the following exercises. We are especially interested in the relationship between *linvpc* which is the log of the per capita housing investments and *lprice* which is the log of the housing price index.

1. Obtain the coefficient of a regression of *linvpc* on *lprice* ignoring the time dimension of the data. Report the coefficient of *lprice*. Is it statistically significant?
2. Sometimes regressing two variables with upward trends can lead to a highly significant relationship between these two, simply because both are trending in the same direction over time. This is known as spurios

regression. Regress each variable on a time trend, do you find significant results for a trend?

3. Now regress *linvpc* on *lprice* and a linear time trend. Report the result on *lprice* and whether there is a statistically significant influence on the housing investments. Compare your results to the regression in 1.

4. Detrend both time series by regressing them on a constant and a trend and obtain the residuals as the new variables $linvpc_{res}$ and $lprice_{res}$ (FWL!). Then regress the residuals of *linvpc* on *lprice* and report the coefficients. Compare the coefficient of $lprice_{res}$ with the coefficient of the regression in point 3.

5. Plot the original time series (not the detrended!) *linvpc* and *lprice* and the according autocorrelation and partial autocorrelation. Do they seem nonstationary? Perform a Dickey Fuller Test and report whether the series has a unit root or not. Which specification of the Dickey Fuller Test did you use (only constant, trend or drift included)?

6. Now plot the detrended time series and perform again a DF-Test. Which time series has still a unit root?

7. Use the detrended series of *linvpc* and regress it against the first difference of *lprice*. Is there a statistically significant relationship between the housing price index and the housing investments?

8. Build the first difference of the original time series *linvpc* and *lprice* and perform the regression in first differences. Report the regression output and interpret the coefficient. Is there a statistically significant relationship?