1. In this question we will explore if there is any evidence in favor of stochastic trends for commonly used macroeconomic series. We will consider log output, the inflation rate (% changes in prices from year ago, converted to quarterly frequency), and the unemployment rate (converted to quarterly frequency). We will conduct unit root tests for all 3 series. You do not need to make major changes to the code for this part, but you do need to read through it.
   1. Plot all three (log GDP, unemployment rate, inflation) in a single graph and discuss if they drift up or down over time, if they have a zero mean, and if they exhibit any evidence of persistence over time. The code will generate the graph but you need to include it in your answer and comment on its features.
      1. A graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of a graph of

         Description automatically generatedlog(GDP) steadily increases over time (I’d say around 2% if I were a betting man) but inflation and unemployment are cyclical.
   2. Report the results of the ADF test for all three series. You can report them in three separate tables or in a single table. Which variables have stochastic trends? Which variables are stationary? Are the results inconclusive for any of the series? Are any p-values kind of close to 10% or 5%, perhaps slightly above or below? The code will generate the output but you will need to report it in your answer and interpret it.
      1. Log(GDP): -1.658

Inflation: -3.449  
Unemployment: -3.466

* 1. If a series that has borderline p-values, it’s a good idea conduct a stationarity test (KPSS test). A stationarity test flips the null hypothesis of a unit root test. It differences the data and checks if the first difference of the data has a moving average coefficient equal to 1. If it does, then over-differenced something that did not have a stochastic trend and your data is stationary (=it does not have a unit root). If you can reject the null for a stationarity test, then the data is not stationary=it has a unit root. Are any p-values kind of close to 10% or 5%, perhaps slightly above or below?
     1. Log(GDP): 5.13  
        Inflation: 0.486  
        Unemployment: 0.472
  2. Regress inflation (pi) on the unemployment rate (ur), including a constant. The code will run this regression but you need to report and discuss the results. Report the results (estimates and standard errors).
     1. Π = .087(ur) +3.043
  3. Unemployment data is released at the beginning of the month, and inflation data is released in the middle of the month. This means that at the beginning of the month we have unemployment data, but we don’t have the inflation data. We can use our regression from part d) to predict inflation. Based on our estimates from part d), what would happen to inflation if the unemployment rate goes up by 1%? Is there anything surprising about the sign or the magnitude of the coefficient? If you're stuck here, go back to principles of econ/ the Wall Street Journal/ the Economist/ Google and look up the Phillips curve. What is the expected sign of the coefficient? What is the sign that you got?
     1. Based on the code, if inflation increases by 1%, then the model expects unemployment to increase .0867%. This is backwards in so many ways, but mostly because (in theory) the Phillips curve is a negative relationship between inflation and unemployment.
  4. Next, we will remove the stochastic trends by taking first differences. What happens if you take first differences of the unemployment rate and inflation and re-run the regression? Report the results. If the unemployment rate goes up by 1%, what would happen to inflation?
     1. The new model gets the sign correct with the new coefficient being -0.308.
  5. The Phillips Curve coefficient that is typically used in intermediate macroeconomics textbooks is typically -0.6 to -0.15? Is the number you got in part g) within this range? You don’t have to do a formal test, just informally assess if it’s within or close to the standard range.
     1. The coefficient is within the bounds of what we are used to using.
  6. If you wanted to predict inflation using the unemployment rate, would you use the regression from part d or from part g?
     1. I would personally use the number found in part G) not only for the correct sign, but also because the intercept is much smaller (-0.018)

1. Find two very persistent or trending series that you know, a priori, should have no causal relationship. The classic example is the Boston Snow stock market indicator: if you run a regression that uses snowfall in Boston and US stock market returns you will get very significant results. However, you cannot use this in your answer. You can use any two other trending series you want. Feel free to be creative. I appreciate ridiculous examples because they illustrate the point.
   1. Make a 1 to 2 sentence informal argument why the two series that you picked really have no causal relationship.
      1. Caitlyn Clark is a college basketball player who is a huge star in the women’s college basketball world. JANX is a therapeutics company that has no relation to Caitlyn Clark or basketball at all.
   2. Conduct unit root tests for both series to verify that they have stochastic trends and report the results. If they do not have a unit root, find other series to consider. The point here is to demonstrate the spurious regression phenomenon with real-life series, and this is most pronounced when there are stochastic trends. It also happens with time trends, but it is particularly bad with stochastic trends.
      1. Clark: 2.466  
         JANX: -1.372
   3. Regress one series on the other as in question 1, and report the results. Is there a spurious regression problem? (The answer here will depend on what data series you selected.)
      1. Formula: clark = 1.12(JANX) -8.665
   4. Come up with a clickbait title for a hypothetical article about the “causality and the link” between these two series. You’re not writing an actual article, just a title based on your results from part c). Feel free to be creative and outrageous with your title.
      1. 😱😱😱 CAITLYN CLARK PREDICTS THIS ONE STOCK?!?!?!???!?
   5. What does the regression output look like if you take first differences? Report the regression results. Does your clickbait title hold up? (The answer here might potentially be ambiguous, it really depends on what data series you selected.)
      1. The coefficient changed to -0.243 and the intercept change to 0.817. My clickbait title unfortunately does not work anymore. The R-squared also decreased from 0.45 to .0098