

Regression Analysis

Okun's Law is an empirical relationship between the change in the unemployment rate and the percentage growth in real output. Define the following variables:

- Y_t = four-quarter *change in*¹ the unemployment rate (in percentage points)
- X_t = four-quarter percentage growth rate² in real output

Arthur Okun estimated the following relationship between these two variables:

$$Y_t = -0.4(X_t - 2.5)$$

The expression above can be rewritten as a more traditional linear regression:

$$Y_t = \beta_0 + \beta_1 X_t$$

$$Y_t = 1 - 0.4 X_t$$

The basic question you have to answer is whether or not this relationship holds using U.S. economic data. Please complete/answer the following:

1. Download all available quarterly data on real GDP, real GNP, and the civilian unemployment rate.³ Put this data into an Excel spreadsheet.
2. Construct the variables X and Y, taking care to define them as written above.⁴ Create a scatter plot of X and Y, add a trendline to your graph, and print out the resulting chart.
3. Use regression to estimate the parameters in the equation above (β_0, β_1). Print out the regression output from Excel.
4. Clearly set up two hypothesis tests to answer the following questions:
 - a. Based on your output in (3), are the parameters that you estimate statistically different from zero?
 - b. Do you get parameter estimates which are significantly (in a statistical sense) different from the ones predicted by Arthur Okun?
5. Does it make a difference whether or not you use real GNP or real GDP in the regression?
6. Does Okun's Law hold for some time periods but not others?
7. Does Okun's Law do a reasonable job of explaining changes in the unemployment rate?

¹ Four-quarter changes simply look at the difference relative to the same quarter one year ago (i.e. 1997Q3 compared to 1996Q3).

² Four-quarter percentage changes simply look at the growth relative to the same quarter one year ago.

³ You can get these data from various sources. Real GDP and GNP are generated by the Bureau of Economic Analysis (www.bea.gov) and the unemployment rate by the Bureau of Labor Statistics (www.bls.gov). You can go straight to these primary sources or you can find the data from a secondary source like the St. Louis Fed, for example (<https://research.stlouisfed.org/fred2/>). Note that the unemployment rate is a monthly data series, but it is available quarterly or you can just average the three monthly values in each quarter.

⁴ You will get more out of this assignment if you download the data in *levels* and then transform them as indicated rather than attempting to download the data in right percentage change form directly from the website.