Lab Eight: Macroeconomic Effects of Long-Term Interest Rates

STA 111: Probability & Statistical Inference

Lab Objective

To gain more experience with histograms, box plots, correlations, and line fitting.

Lab Procedures

Long-term interest rates drive much of the economic activity in the U.S. When interest rates are low, people and establishments are more likely to borrow money for purchasing homes or growing their businesses. When interest rates are high, people and establishments are less likely to do so. In this lab, we'll work with economic data from the U.S. from 1990 to 2010 to explore relationships involving interest rates. Load in the *"USeconstat2.txt"* data. The data are from the Organization for Economic Cooperation and Development.

Data Analysis Caveat: One can look at many relationships with economic (or any) data. It is tempting to assign causal explanations to those relationships. This is risky. Just because there is (or is not) a relationship between two variables, does not mean there is (or is not) a causal relationship between those variables. There could be many other factors that affect both variables, and these could explain what is seen in the graphs.

Questions:

1. Describe the distribution of long-term interest rates. That is, say where most values are, note any outliers, and say whether the distribution is tightly packed around its mean or is spread out. Also, report the mean and standard deviation.

2. How did long-term interest rates change annually between 1990 - 2010? Were they (i) generally going up; (ii) generally steady; (iii) generally going down; or (iv) all over the place? Just write a short phrase as your answer.

3. Using the data, describe the relationship between long-term interest rates and household net savings rates. Include in your descriptions a one-number summary of the strength of the association between the two variables.

4. Using the data, describe the relationship between long-term interest rates and unemployment rates. Include in your descriptions a one-number summary of the strength of the association between the two variables.

5. Using the data, describe the relationship between long-term interest rates and gross domestic product (gdp). Include in your descriptions a one-number summary of the strength of the association between the two variables.

6. Of the following two variables, which one has the weaker linear association with long-term interest rates: (i) wage rate; or (ii) government net lending rate? Explain your choice in one sentence.

7. Fit a multiple regression to the data using interest rates and time period as covariates, and gdp as the response variable.

   For multiple linear regression in R using p covariates, type:

   `Model = lm(y ~ x_1 + x_2 + ... + x_p, data = Data); summary(Model)`

   where **y** is the response variable, $x_1, x_2, \ldots, x_p$ are the p independent variables and **Data** is the data frame containing your data.

8. Interest rates are notoriously hard to predict. However, there are many statisticians and economists trying to do so. Suppose you predict that interest rates in 2011 will be 5.0%. Predict gross domestic product for 2011 using your regression from the previous question. This can be done easily in R but I want you to do it by hand.

9. Test the null hypothesis that the coefficients (or slopes) of interest rate and time are zero. What is your conclusion for each coefficient?

   All the pieces you need will be in your R output of the regression; feel free to ask me if you are not sure where to find them. This can also be done easily in R but I want you to do it by hand.

10. Create a scatterplot of gdp and each covariate. Does it suggest any clearly non-linear relationships in the data? Justify your answer in at most two sentences.

    For a scatter plot between two variables x and y, type: `plot(x,y)` .

11. If interest rates were 1%, could you use the regression equation to predict the corresponding gross domestic product? If you think so, write down the predicted value of GDP. If you think not, explain why not in at most one sentence.

This ends the lab. Remember to turn in your lab reports on Sakai.