

# Economics 471: Econometrics

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## Problem Set #2

1. Please describe the relationship between the following
  - (a)  $\beta$  and  $\hat{\beta}$
  - (b)  $u$  and  $\hat{u}$
  - (c) The population model and the sample model
2. Describe the two assumptions used in class (least-squares and normal equations) to derive the OLS estimates of the intercept and slope. Are these assumptions explicit or implicit assumptions?
3. In the formula  $\hat{\beta} = \beta + \left[ \sum_{i=1}^n (x_i - \bar{x}) u_i \right] / \left[ \sum_{i=1}^n (x_i - \bar{x})^2 \right]$ , explain the importance of each term.
4. Consider two variables: cigarette consumption and income.
  - (a) Which variable should be the dependent variable and which variable is the independent variable?
  - (b) Write down a model that is linear in parameters that captures the causality you just described.
  - (c) Using the dataset smoke.xls<sup>1</sup>, what is the average yearly income for a person in the sample and what is the average number of cigarettes smoked per day?
  - (d) How many nonsmokers are there in the dataset? Do you think this percentage is indicative of everyday people?
  - (e) Use OLS to determine the intercept and slope coefficient in the sample. Interpret your slope coefficient.
  - (f) Does yearly income explain most of the variation in cigarettes smoked per day?
  - (g) What is the income elasticity of cigarettes calculated at the average of the variables?
5. Consider two variables: sleeping and work.
  - (a) Use the dataset sleep75.xls to determine the average number of hours slept per week and the average number of hours worked per week.
  - (b) Estimate a linear relationship that characterizes the causal relationship you described above. Give the output and highlight your intercept and slope coefficient along with the  $R^2$ .
  - (c) Provide an interpretation of your estimated coefficients.

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<sup>1</sup>All datasets for the homeworks can either be found using the password from the textbook or by using a search engine such as google.com.