

# Economics 471: Econometrics

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## Problem Set #3

1. Using the data in GPA2.RAW on 4,137 college students, the following equation was estimated by OLS

$$\widehat{colgpa} = 1.392 - 0.135 * hsperc + 0.00148 * sat$$

where  $colgpa$  is measured on a four-point scale,  $hsperc$  is the percentile in the high school graduating class (defined so that, for example,  $hsperc = 5$  means the top five percent of the class), and  $sat$  is the combined math and verbal scores on the student achievement test.

- (a) Replicate the results of the above equation using the dataset GPA2.RAW.
  - (b) Why does it make sense for the coefficient on  $hsperc$  to be negative?
  - (c) What is the predicted college GPA when  $hsperc = 20$  and  $sat = 1050$ ?
  - (d) Suppose that two high school graduates  $A$  and  $B$ , graduated in the same percentile from high school, but student  $A$ 's SAT scores was 140 points higher. What is the predicted difference in college GPA for these two students? Is this difference large?
  - (e) Holding  $hsperc$  fixed, what difference in SAT scores leads to a predicted  $colgpa$  difference of .50, or one-half of a grade point?
2. The median starting salary for new law school graduates is determined by

$$\ln(\text{salary}) = \alpha + \beta_1 LSAT + \beta_2 GPA + \beta_3 \ln(\text{libvol}) + \beta_4 \ln(\text{cost}) + \beta_5 \text{rank} + u$$

where  $LSAT$  is the median  $LSAT$  score of the graduating class,  $GPA$  is the median college GPA of the graduating class,  $libvol$  is the number of volumes in the law school library,  $cost$  is the annual cost of the school, and  $rank$  is the law school ranking (with 1 being the best).

- (a) Explain why we expected  $\beta_5 \leq 0$ .
- (b) What signs do you expect on the other slope parameters?
- (c) Using the data LAWSCH85.RAW, the estimated equation is

$$\ln(\widehat{\text{salary}}) = 8.34 + 0.0047LSAT + 0.248GPA + 0.095 \ln(\text{libvol}) + 0.038 \ln(\text{cost}) - 0.0033rank$$

Replicate the results. What is the predicted ceteris paribus difference in salary for schools with a median GPA different by one point?

- (d) Interpret the coefficient on the variable  $\ln(\text{libvol})$ .
- (e) Would you say it is better to attend a higher ranked law school? How much is a difference in ranking of 20 worth in terms of predicted starting salary?

3. What are the consequences on the unbiasedness property of OLS estimators under the following scenarios
- (a) Heteroskedasticity
  - (b) Omitted an important variable
  - (c) Including an irrelevant variable
  - (d) A sample correlation coefficient of 0.95 between two independent variables both included in the model