ECON 140: Econometrics

Homework: Class Size and Student Performance

University of California, Berkeley

Background. The California Department of Education is considering a policy to reduce class sizes in public elementary schools. To assess whether smaller classes lead to better academic performance, you are asked to analyze the relationship between class size and student achievement using the `CASCHOOL` dataset (California School Districts).

The dataset includes, among other variables:

- `testscr`: Average student test score (reading + math)
- `str`: Student–teacher ratio (students per teacher)

Question. We are interested in the following regression model:

$$\text{testscr}_i = \beta_0 + \beta_1 \, \text{str}_i + u_i$$

1. Estimate the regression above and report the estimated intercept $\hat{\beta}_0$ and slope $\hat{\beta}_1$.
   - What is the interpretation of the intercept?
   - What is the interpretation of the slope?
2. Use your regression to predict the average test score for districts with the following class sizes (student–teacher ratios):

   $$\text{STR} = 14, \ 20, \ 25, \ 30.$$

   Comment on how predicted performance changes as class size increases.
3. Suppose the government is considering adding more students per class.
   - By how many points would the predicted test score change if we *increase class size by 10 students* (holding everything else constant)?
   - What about an increase of 5 students? 20 students?

   Use your estimated $\hat{\beta}_1$ to answer each.
4. Construct the 95% and 99% confidence intervals for β_1.
   - Based on these intervals, do you conclude that class size has a statistically significant effect on test scores?
   - Explain the economic and statistical interpretation of your results.
5. The California government will only invest money in reducing class sizes if the *marginal impact of decreasing class size by one student* is at least 2 points in average test scores. Formally test this claim at the 5% significance level.

- Write the null and alternative hypotheses in terms of the parameter(s).
- Use your regression results to test it at 95% confidence level.
- What is your recommendation?

6. Summarize your findings in a short paragraph for a policy brief to the California government:

   (a) Should they reduce class sizes? Justify your recommendation using your regression results and the confidence intervals.

   (b) Be critical about why (or why not) the government should trust these results. How would extend the anlysis for addressing potential drawbacks.