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Small Assignment 3

Are rent rates influenced by the student population in a college town? Let *rent* be the average monthly rent paid on rental units in a college town in the United States. Let *pop* denote the total city population, *avginc* the average city income, and *pctstu* the student population as a percentage of the total population. One model to test the relationship is

$$\log(rent) = \beta_0 + \beta_1 \log(pop) + \beta_2 \log(avginc) + \beta_3 pctstu + u$$

1. State the null hypothesis that size of the student body relative to the population has no ceteris paribus effect on monthly rents. State the alternative hypothesis that there is an effect.

   $H_0: \beta_3 = 0$
   $H_1: \beta_3 \neq 0$

2. What signs do you expect from β_1 and β_2?

We might expect that population is positively associated with monthly rent, since more people means more demand for housing, and landlords can charge more knowing there is more likely to be someone willing to pay when there is a larger population. Average income might also be positively associated with monthly rent, as people with more income likely prefer nicer housing which costs more per month.

3. Suppose we estimate the model using data on 64 college towns, and we deliver the estimates (with standard errors in parentheses)

$$\widehat{\beta_0} = 0.043 \ (0.844)$$
$$\widehat{\beta_1} = 0.076 \ (0.039)$$
$$\widehat{\beta_2} = 0.507 \ (0.081)$$
$$\widehat{\beta_3} = 0.0056 \ (0.0017)$$
$$R^2 = 0.458$$

   Name two things that are wrong with the statement "A 10% increase in population is associated with about a 7.6% increase in rent."

There are two issues with this statement. First, both population and monthly rent are logged in the model. This means that we interpret β_1 (exactly as it is) as the effect of a 1 percent change in population on monthly rent in percentage terms, and we do not need to multiply or divide β_1 by 100 (implicitly, we do both and they cancel out). The other problem with the statement is that it doesn't mention the other variables in the regression. So the correct interpretation of β_1 is that "A 10% increase in population is associated with about a 0.76% (0.076*10) increase in monthly rent, holding average income and the share of students in the population constant."

4. Test the hypothesis in part 1 at the 1% significance level. Be sure to state the critical value that you use.

We are doing a 2-tailed test, so the critical value with 64-3-1=60 degrees of freedom and a 1% significant level will be 2.66.

The t-statistic will be t = $\dfrac{\widehat{\beta_3}}{SE(\widehat{\beta_3})} = \dfrac{0.0056}{0.0017} = 3.294$.

|3.294| > 2.66, so we reject the null hypothesis. The size of the student body relative to the population has a statistically significant and positive relationship with monthly rents holding population and average income constant.