Economics 471: Econometrics

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Problem Set #4 – Answers

1. (a) $H_0 : \beta_3 = 0$ vs. $H_1 : \beta_3 \neq 0$

   (b) All else equal, a larger population increases the demand for rental housing, which should increase rents. The demand for overall housing is higher when average income is higher.

   (c) $\widehat{\ln(rent)} = 0.043 + 0.066 \ln(pop) + 0.507 \ln(avginc) + 0.0056 * pctstu$ The coefficient on $\ln(pop)$ is an elasticity. A correct statement is that "a 10% increase in population increases *rent* by $0.066(10) = 0.66\%$."

   (d) With degrees of freedom equal to $64 - 4 = 60$, the 1% critical value for a two-tailed test is 2.660. This is smaller than the test-statistic 3.29 and so we say that β_3 is statistically different from zero and the 1% level.

2. (a) $V\left(\widehat{\beta}_1 - 3\widehat{\beta}_2\right) = V\left(\widehat{\beta}_1\right) + 9V\left(\widehat{\beta}_2\right) - 6COV\left(\widehat{\beta}_1, \widehat{\beta}_2\right)$

   (b) $t = \left(\widehat{\beta}_1 - 3\widehat{\beta}_2 - 1\right) / se\left(\widehat{\beta}_1 - 3\widehat{\beta}_2\right)$

   (c) Because $\theta = \beta_1 - 3\beta_2$, we can write $\beta_1 = \theta + 3\beta_2$. Plugging this into the population model gives

$$\begin{aligned} y &= \alpha + (\theta + 3\beta_2) x_1 + \beta_2 x_2 + \beta_3 x_3 + u \\ &= \alpha + \theta x_1 + \beta_2 (x_2 + 3x_1) + \beta_3 x_3 + u \end{aligned}$$

   The coefficient and standard error on x_1 is what we need.

3. (a) A one percent increase in expenditures for Candidate A leads to a β_1 percentage increase in votes for Candidate A.

   (b) The null hypothesis is $H_0 : \beta_2 = -\beta_1$, which mean a z% increase in expenditure by A and a z% increase in expenditure by B leaves *voteA* unchanged.

   (c) The OLS estimation equation is

$$\widehat{voteA} = 45.08 + 6.083 \ln(expendA) - 6.615 \ln(expendB) + 0.152 prtystrA$$

   The coefficient on $\ln(expendA)$ is significant as is the coefficient on $\ln(expendB)$.

   (d) Write $\theta = \beta_1 + \beta_2$ or $\beta_1 = \theta - \beta_2$, then

$$\begin{aligned} voteA &= \alpha + (\theta - \beta_2) \ln(expendA) + \beta_2 \ln(expendB) + \beta_3 prtystrA + u \\ &= \alpha + \theta \ln(expendA) + \beta_2 [\ln(expendB) - \ln(expendA)] + \beta_3 prtystrA + u \end{aligned}$$

   OLS estimation leads to a coefficient on $\ln(expendA)$ equal to -0.532 with a standard error of 0.533. The test statistic will be less than negative one and therefore we fail to reject the null.