Prima D.
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1. Which of the following can cause the usual OLS t statistics to be invalid (that is, not to have t distributions under $\mathbf{H}_0$)?

   i. Heteroskedasticity.

   ii. A sample correlation coefficient of .95 between two independent variables that are in the model.

   iii. Omitting an important explanatory variable.

Ans (i) and (ii) cause the t statistics not to have a t distribution under H_0
Homoskedasticity is one of the Classical Linear model assumption, OLS method does not work with Heteroskedasticity. (ii) An important omitted variable violates assumption MLR 3.

2. Consider an equation to explain salaries of CEOs in terms of annual firm sales, return on equity (*roe*, in percentage form), and return on the firm's stock (*ros*, in percentage form):

$$\log(salary) = \beta_0 + \beta_1 \log(sales) + \beta_2 roe + \beta_3 ros + u.$$

   i. In terms of the model parameters, state the null hypothesis that, after controlling for *sales* and *roe*, *ros* has no effect on CEO salary. State the alternative that better stock market performance increases a CEO's salary.

$H_0 : \beta_3 = 0$

$H_a : \beta_3 > 0$

   ii. Using the data in CEOSAL1, the following equation was obtained by OLS:

$$\widehat{\log(salary)} = \underset{(.32)}{4.32} + \underset{(.035)}{.280} \log(sales) + \underset{(.0041)}{.0174}\, roe + \underset{(.00054)}{.00024}\, ros$$

$$n = 209, R^2 = .283.$$

By what percentage is *salary* predicted to increase if *ros* increases by 50 points? Does *ros* have a practically large effect on *salary*?

the proportionate effect on $\widehat{salary}$ = 0.00024(50) = .012 = 1.2 %
Therefore, a 50 point ceteris paribus increase in ros is predicted to increase salary by 1.2 %.

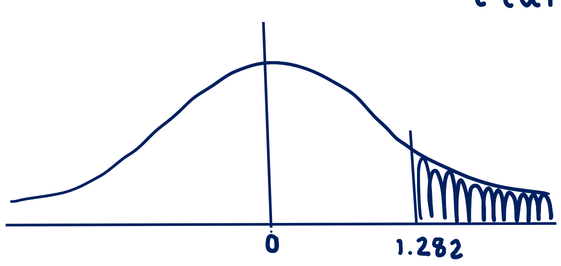
   iii. Test the null hypothesis that *ros* has no effect on *salary* against the alternative that *ros* has a positive effect. Carry out the test at the 10% significance level.

significant level 10% = 0.1

$H_0 : \beta_3 = 0$ d.f = 209-3-1 = 205 > 30 use Z-score

$H_a : \beta_3 > 0$ $t_{cri} = 1.282$

$t\ cal = \dfrac{\hat{\beta}_3 - 0}{SE(\hat{\beta}_3)} = \dfrac{.0024}{.00054} = .44$



0.44 < 1.282

we cannot reject H_0 at 10 % significant level

C1. The following model can be used to study whether campaign expenditures affect election outcomes:

$$voteA = \beta_0 + \beta_1 \log(expendA) + \beta_2 \log(expendB) + \beta_3 prtystrA + u,$$

where *voteA* is the percentage of the vote received by Candidate A, *expendA* and *expendB* are campaign expenditures by Candidates A and B, and *prtystrA* is a measure of party strength for Candidate A (the percentage of the most recent presidential vote that went to A's party).

i. What is the interpretation of β_1 ?

$\Delta voteA = \beta_1 \Delta \log(ExpendA)$

$= (\beta_1/100)[100 \times \Delta \log(ExpendA)]$

$\approx (\beta_1/100)[\% \Delta \log(ExpendA)]$

$\therefore$ $\beta_1/100$ is the ceteris paribus percentage point change of vote recieved when campaign expenditure by candidate A increases by one percent

ii. In terms of the parameters, state the null hypothesis that a 1% increase in A's expenditures is offset by a 1% increase in B's expenditures.

$H_0 : \beta_2 = -\beta_1$

$H_1 : \beta_2 \neq -\beta_1$

iii. Estimate the given model using the data in VOTE1 and report the results in usual form. Do A's expenditures affect the outcome? What about B's expenditures? Can you use these results to test the hypothesis in part (ii)?

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. reg voteA lexpendA lexpendB prtystrA

      Source |       SS           df       MS      Number of obs   =       173
-------------+----------------------------------   F(3, 169)       =    215.23
       Model |  38405.1096         3  12801.7032   Prob > F        =    0.0000
    Residual |  10052.1389       169   59.480112   R-squared       =    0.7926
-------------+----------------------------------   Adj R-squared   =    0.7889
       Total |  48457.2486       172  281.728189   Root MSE        =    7.7123

------------------------------------------------------------------------------
       voteA |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lexpendA |   6.083316     .38215    15.92   0.000     5.328914    6.837719
    lexpendB |  -6.615417   .3788203   -17.46   0.000    -7.363246   -5.867588
    prtystrA |   .1519574   .0620181     2.45   0.015     .0295274    .2743873
       _cons |   45.07893   3.926305    11.48   0.000     37.32801    52.82985
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regression model in usual form:

$$\text{vote } A = \underset{(11.48)}{(45.1)} + \underset{(15.92)}{6.08} \log(\text{Expend } A) - \underset{(-17.46)}{6.62} \log(\text{Expend } B) + \underset{(2.45)}{0.152} (\text{prtystrA})$$

iv. Estimate a model that directly gives the *t* statistic for testing the hypothesis in part (ii). What do you conclude? (Use a two-sided alternative.)

rewrite hypothesis $\theta_1 = \beta_1 + \beta_2 \Rightarrow H_0 : \theta_1 = 0 \quad H_a : \theta_1 \neq 0$

rearrange equation $\widehat{\text{vote}}\ A = \beta_0 + \theta \log(\text{Expend } A) + \beta_2[\log(\text{Expend } B - \log(\text{Expend } A)] + \beta_3 \text{prtystrA}$

when estimatimate equation we obtain $\hat{\theta}_1 \approx -.532$

$se(\hat{\theta}_1) \approx .533$

then $t_{cal} = \dfrac{-.532 - 0}{.533} \approx -1$ $\therefore$ cannot reject $H_0 : \beta_2 = -\beta_1$