

Ti sakorum use

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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 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.

- i: Yes, violating the assumption of homoskedasticity
- ii: No, It requires the coefficient not to be 1
- iii: Yes, violating the 4th assumption $E(u|x) = 0$
if the omitted variable is correlated with the independent variables in the model

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):

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

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.

i $H_0: \beta_3 = 0$

$H_a: \beta_3 \neq 0$

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

$$\widehat{\log(\text{salary})} = 4.32 + .280 \log(\text{sales}) + .0174 roe + .00024 ros$$

(.32) (.035) (.0041) (.00054)

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

ii the proportionate effect on $\widehat{\text{salary}}$
 $= 0.00024(50) = 0.012 = 1.2\%$

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

Thus, a 50 point return ~~previous~~
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.

iii $H_0: \beta_3 = 0$

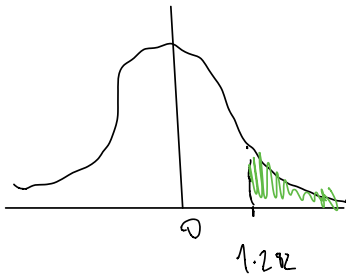
$H_a: \beta_3 > 0$

Significant level $10\% = 0.1$; $d.f. = 209 - 3 - 1 = 205$

$d.f. > 30 \rightarrow z \text{ score}$

$t_{crit} = 1.282$

$t_{cal} = \frac{\hat{\beta}_3 - 0}{s.e.(\hat{\beta}_3)} = \frac{0.00024}{0.00054} = 0.44$



$$0.44 < 1.282$$

so, we do not reject H_0 at $\alpha = 0.1$

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

$$\text{voteA} = \beta_0 + \beta_1 \log(\text{expendA}) + \beta_2 \log(\text{expendB}) + \beta_3 \text{prtystrA} + u_i$$

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 ?

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.

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)?

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.)

Source	SS	df	MS	Number of obs	=	173
Model	38405.1096	3	12801.7032	F(3, 169)	=	215.23
Residual	10052.1389	169	59.480112	Prob > F	=	0.0000
Total	48457.2486	172	281.728189	R-squared	=	0.7826
				Adj R-squared	=	0.7889
				Root MSE	=	7.7123

voteA	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
leapendA	6.083316	.38215	15.92	0.000	5.328914 6.837719
leapendB	-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

$$\begin{aligned} \textcircled{i} \quad \Delta \text{vote A} &= \beta_1 \Delta \log(\text{ExpendA}) \\ &= (\beta_1 / 100) [100 \times \Delta \log(\text{ExpendA})] \\ &\approx (\beta_1 / 100) [\% \Delta \log(\text{ExpendA})] \end{aligned}$$

so, $\beta_1 / 100$ is ceteris paribus percentage point change of vote received when campaign expenditure by candidate A increases by 1%.

$$\begin{aligned} \textcircled{ii} \quad H_0 : \beta_2 &= -\beta_1 \\ H_1 : \beta_2 &\neq -\beta_1 \end{aligned}$$

(iii) regression model in usual form

$$\begin{aligned} \text{Vote A} = & \underbrace{(45.1)}_{(11.41)} + \underbrace{6.26}_{(15.42)} \log(\text{Expend A}) - \underbrace{6.62}_{(-17.46)} \log(\text{Expend B}) \\ & + \underbrace{0.152}_{(2.45)} (\text{Prtystr A}) \end{aligned}$$

(iv) we write hypothesis $\theta_1 = \beta_1 + \beta_2 \Rightarrow H_0: \theta_1 \leq 0$ $H_1: \theta_1 > 0$
rearrange equation $\widehat{\text{Vote A}} = \beta_0 + \theta \log(\text{Expend A}) + \beta_2 [\text{Expend B} - \log(\text{Expend A})]$

when estimate equation we have $\hat{\beta}_1 \approx -0.532$

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

$$\text{then } t_{\text{cal}} = \frac{-0.532 - 0}{.533} \approx -1$$

so, we do not reject H_0

C6. Use the data in WAGE2 for this exercise.

i. Consider the standard wage equation

$$\log(\text{wage}) = \beta_0 + \beta_1 \text{educ} + \beta_2 \text{exper} + \beta_3 \text{tenure} + u.$$

State the null hypothesis that another year of general workforce experience has the same effect on $\log(\text{wage})$ as another year of tenure with the current employer.

ii. Test the null hypothesis in part (i) against a two-sided alternative, at the 5% significance level, by constructing a 95% confidence interval. What do you conclude?

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. reg voteA lexpendA lexpendB prtystrA
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Model	38405.1096	3	12801.7032	F(3, 169)	=	215.23
Residual	10052.1389	169	59.480112	Prob > F	=	0.0000
Total	48457.2486	172	281.728189	R-squared	=	0.7926
				Adj R-squared	=	0.7889
				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	.0420181	2.45	0.015	.0295274 .2743873
_cons	45.07893	3.926305	11.48	0.000	37.32801 52.82965

(i) $H_0 : \beta_2 = \beta_3$

(ii) α is insignificant at 95% of confidence interval,

Thus, we do not reject H_0 . We conclude that the one additional year of general workforce experience has the same effect on $\log(\text{wage})$ as another year.

C8. The data set 401KSUBS contains information on net financial wealth (*netfwa*), age of the survey respondent (*age*), annual family income (*inc*), family size (*fsize*), and participation in certain pension plans for people in the United States. The wealth and income variables are both recorded in thousands of dollars. For this question, use only the data for single-person households (so *fsize* = 1).

i. How many single-person households are there in the data set?

ii. Use OLS to estimate the model

$$\text{netfwa} = \beta_0 + \beta_1 \text{inc} + \beta_2 \text{age} + u_i$$

and report the results using the usual format. Be sure to use only the single-person households in the sample. Interpret the slope coefficients. Are there any surprises in the slope estimates?

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. reg netfwa inc age if fsize ==1

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Source	SS	df	MS	Number of obs	=	2,017
Model	544916.989	2	272458.495	F(2, 2014)	=	136.46
Residual	4021048.06	2,014	1996.54819	Prob > F	=	0.0000
Total	4565965.05	2,016	2264.86361	R-squared	=	0.1193
				Adj R-squared	=	0.1185
				Root MSE	=	44.683

netfwa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
inc	.7993167	.0597307	13.38	0.000	.6821762 .9164572
age	.8626563	.0920169	9.16	0.000	.6621982 1.023115
_cons	-43.03981	4.080393	-10.55	0.000	-51.04204 -35.03758

iii. Does the intercept from the regression in part (ii) have an interesting meaning? Explain.

iv. Find the *p*-value for the test $H_0: \beta_2 = 1$ against $H_1: \beta_2 < 1$. Do you reject H_0 at the 1% significance level?

v. If you do a simple regression of *netfwa* on *inc*, is the estimated coefficient on *inc* much different from the estimate in part (ii)? Why or why not?

① 2017 observations

② β_1 can be interpreted as a \$1,000 increase in income corresponds to a \$799 increase in net financial wealth.

③ $\beta_0 = -43.04$

this is an individual's net financial wealth when their income is \$0 and their age is 0.

④ t -statistic = $\frac{0.843 - 1}{0.092} \approx -1.71$ p -value = $P(T < -1.71) \approx 0.044$

Against the one-sided alternative $H_1: \beta_2 < 1$

So, we reject H_0 at $\alpha = 0.05$ but not at $\alpha = 0.01$