

- 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 ?
- 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.)

i) when $expendA$ increase by 1 %, $voteA$ will increase by β_1 units.

ii) $H_0: \beta_1 = -\beta_2$

$H_a: \beta_1 \neq -\beta_2$

$H_0: \beta_2 + \beta_1 = 0$

$H_a: \beta_2 + \beta_1 \neq 0$

iii) $voteA = 45.0789 + 6.0833 \log(expendA) - 6.6154 \log(expendB) + 0.1520(prtystrA)$

both A's expenditure and B's expenditure effect the out come but in different effect because β_1 and β_2 has different value and sign, so we can use them to test Hypothesis in part ii)

iv)

$$H_0 : \beta_2 + \beta_1 = 0$$

$$H_a : \beta_2 + \beta_1 \neq 0$$

$$\text{let } \hat{\theta} = \hat{\beta}_2 + \hat{\beta}_1$$

$$\begin{array}{l} H_0 : \theta_1 = 0 \\ H_a : \theta_1 \neq 0 \end{array} \rightarrow t = \frac{\hat{\theta}_1 - 0}{\text{s.e. } \hat{\theta}_1}$$

$$\text{so, } \beta_1 = \theta_1 - \beta_2$$

$$\begin{aligned} \text{vote A} &= 45.0789 + (\theta_1 - \beta_2) \log(\text{expendA}) - \beta_2 \log(\text{expendB}) + \beta_3 (\text{prtystrA}) + u \\ \text{vote A} &= \beta_0 + \theta_1 \log(\text{expendA}) + \beta_2 (\log(\text{expendB}) - \log(\text{expendA})) + \beta_3 (\text{prtystrA}) + u \end{aligned}$$

from the dataset

$$t = \frac{\hat{\theta}_1 - 0}{\text{s.e.}(\hat{\theta})} = \frac{-0.5321 - 0}{0.5331} = -0.998 \approx -1$$

if we are testing with 1% significant level...

$$p \text{ value} = 0.1587 > 0.005$$

,so we cant reject H_0 since p value is greater than 0.005
means that 1% increase in A's expenditure is offset by
a 1% increase in B's expenditure.

C6. Use the data in WAGE2 for this exercise.

i. Consider the standard wage equation

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

Final Review

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?

i) $H_0: \beta_2 - \beta_3 = 0$

$$H_a: \beta_2 - \beta_3 \neq 0$$

ii) $H_0: \beta_2 - \beta_3 = 0$

$$H_a: \beta_2 - \beta_3 \neq 0$$

$$\text{let } \hat{\theta}_1 = \hat{\beta}_2 - \hat{\beta}_3 \rightarrow t = \frac{\hat{\theta}_1 - 0}{\text{s.e.} \hat{\theta}_1}$$

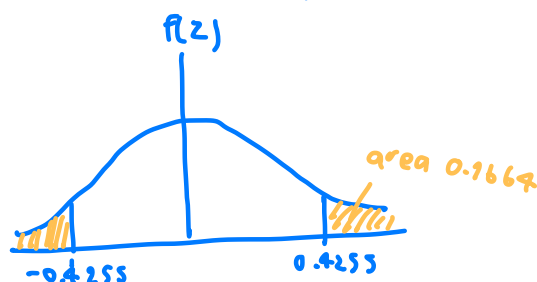
$$\hat{\theta}_1 = \hat{\beta}_2 - \hat{\beta}_3, \text{ we have } \hat{\beta}_2 = \hat{\theta}_1 + \hat{\beta}_3$$

$$\log(\text{wage}) = \beta_0 + \beta_1 \text{educ} + (\theta_1 + \beta_3) \text{exper} + \beta_3 \text{tenure} + u$$

$$\log(\text{wage}) = \beta_0 + \beta_1 \text{educ} + \theta_1 \text{exper} + \beta_3 (\text{exper} + \text{tenure}) + u$$

from the data set

$$t = \frac{0.002 - 0}{0.0047} = 0.4255$$



$$P \text{ value} = 0.1664 > 0.0025$$

, so we can't reject H_0 since P value is greater than 0.0025

means that, percentage change in year of general workforce experience has the same affect on percentage change in year of tenure with the current employer.

C8. The data set 401KSUBS contains information on net financial wealth (*netffa*), 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

$$netffa = \beta_0 + \beta_1 inc + \beta_2 age + u,$$

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?

i) from the dataset.

there are 2017 household.

$$(ii) \quad netffa = -43.0398 + 0.7993 inc + 0.8427 age$$

the slope of annual family income of 0.7993 means that when annual family income increase by \$1, the net financial wealth is expected to increase by \$ 0.7993.

the slope of age survey respondent of 0.847 means that when age survey respondent increase by \$1, the net financial wealth is expected to increase by \$ 0.847.

age survey respondent expected to have greater impact on financial wealth compare to annual family income.

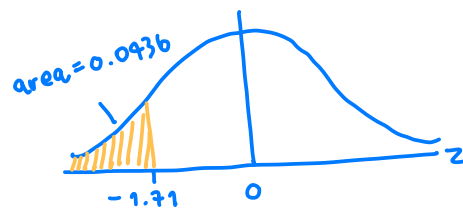
- iii. Does the intercept from the regression in part (ii) have an interesting meaning? Explain.
- iv. Find the p -value for the test $H_0: \beta_2 = 1$ against $H_1: \beta_2 < 1$. Do you reject H_0 at the 1% significance level?
- v. If you do a simple regression of *nettfa* on *inc*, is the estimated coefficient on *inc* much different from the estimate in part (ii)? Why or why not?

iii) if the age of survey respondents and annual family income is 0, financial wealth expected to have loss of \$43039.8

iv) $H_0: \beta_2 = 1$

$H_a: \beta_2 < 1$

$$z = \frac{0.843 - 1}{0.092} = -1.71$$



$P\text{ value} = 0.0436 > 0.01$

We cannot reject H_0 at 1% significant level

v) from the data set.

. regress inc nettfa if fsize == 1						
Source	SS	df	MS	Number of obs	=	2,017
Model	46335.1731	1	46335.1731	F(1, 2015)	=	181.60
Residual	514127.962	2,015	255.150354	Prob > F	=	0.0000
Total	560463.135	2,016	278.007508	R-squared	=	0.0827
				Adj R-squared	=	0.0822
				Root MSE	=	15.973

inc	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
nettfa	.100737	.0074754	13.48	0.000	.0860768	.1153973
_cons	28.07666	.3699027	75.90	0.000	27.35123	28.80209

the slope is changed a lot as it reduces from \$799.32 to 100.7

So there is a greater impact of annual income on net financial wealth than net financial wealth on an annual family income.

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.

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

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

$$(.32) \quad (.035) \quad (.0041) \quad (.00054)$$

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

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

- 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.

i) $H_0: \beta_3 = 0$
 $H_a: \beta_3 \neq 0$

ii) if ros increases by 1 point, salary will predicted to increase by 0.00024 percent

when ros increases by 50 point

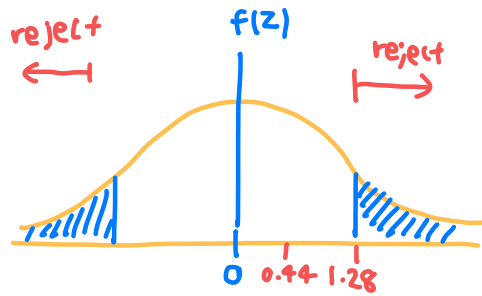
Salary will predilte to increase by $0.00024 \times 50 = 0.012 \%$

No, ros has a tiny impact on salary $\therefore$.

iii) 10% significant level

$$H_0: \beta_3 = 0$$

$$H_a: \beta_3 \neq 0$$



$$z = \frac{\hat{\beta}_3 - \beta_3}{se. \hat{\beta}_3}$$

$$z = \frac{0.00024}{0.00054}$$

$$z = 0.444$$

We cannot reject H_0 at 10% significant level
so ros alone has no impact on salary.

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iv. Would you include ros in a final model explaining CEO compensation in terms of firm performance? Explain.

NO, as the return on firm's stock has no impacts on CEO compensation.
base on the Hypothesis testing.