

Assignment ③

① which of the following can cause the usual OLS t statistics to be invalid

Ans Heteroskedasticity - GLM assumptions
Omitting an important explanatory variable - MLR assumptions

② $\log(\text{salary}) = \beta_0 + \beta_1 \log(\text{sales}) + \beta_2 \text{roe} + \beta_3 \text{ros} + u$
 roe : return on equity.
 ros : return on the firm's stock

i) state null hypothesis, ros has no effect on CEO salary

Ans $H_0: \beta_3 = 0$
 $H_a: \beta_3 \neq 0$

ii) using the data in CEOSAL1, the following equation was obtained by OLS

$$\widehat{\log(\text{salary})} = 9.32 + 0.28 \log(\text{sales}) + 0.0174 \text{roe} + 0.00024 \text{ros}$$

$(0.32) \quad (0.035) \quad (0.004) \quad (0.00054)$
 $n = 209, R^2 = 0.283$

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

Ans $\widehat{\text{salary}} = 0.00024(50) = 0.012$ or 1.2%

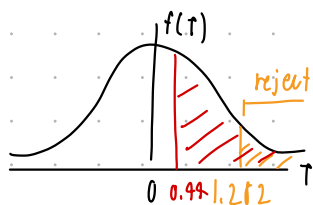
A 50 point ceteris paribus increase in ros is predicted to increase salary by only 1.2%.

ROS have a practically very small effect on salary.

iii) Hypothesis, ros has no effect on salary against the alternative that ros has $\neq$ effect. $\alpha = 0.1$

Ans $t = \frac{\hat{\beta}_3 - 0}{\text{S.E.}(\hat{\beta}_3)} = \frac{0.00024}{0.00054} = 0.44$

using $df = \infty$ and $\alpha = 0.1 \rightarrow 1.282$ from the table



$\therefore$ we fail to reject H_0 at the 10% significance level

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

Ans From the problem above, the estimated ros coefficient has all the earmarks of being not the same as zero due to sampling variation. However, including ros may not be causing any damage; it relies upon how correlated it is with the other independent variables

C6 i) $\log(\text{wage}) = \beta_0 + \beta_1 \text{educ} + \beta_2 \text{exper} + \beta_3 \text{tenure} + u$
 $H_0: \beta_2 = \beta_3$

ii)

```
. gen expten = exper + tenure
.
. end of do-file
```

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. do "C:\Users\610464~1\AppData\Local\Temp\STD1164_000000.tmp"
```

```
. reg lwage educ exper expten
```

Source	SS	df	MS	Number of obs	=	935
Model	25.6953242	3	8.56510806	F(3, 931)	=	56.97
Residual	139.960959	931	.150334005	Prob > F	=	0.0000
				R-squared	=	0.1551
				Adj R-squared	=	0.1524
Total	165.656283	934	.177362188	Root MSE	=	.38773

lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
educ	.0748638	.0065124	11.50	0.000	.062083 .0876446
exper	.0019537	.0047434	0.41	0.681	-.0073554 .0112627
expten	.0133748	.0025872	5.17	0.000	.0082974 .0184522
_cons	5.496696	.1105282	49.73	0.000	5.279782 5.713609

is insignificant at 95% of confidence interval, we fail to reject the null hypothesis.

Therefore, one additional year of general workforce experience has the same effect on $\log(\text{wage})$ as another year.

C7 i)

```
. sum nettfa if fsize == 1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
nettfa	2,017	13.59498	47.59058	-143.5	1134.098

There are 2017 observations left.

ii)

```
. reg nettfa 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
				R-squared	=	0.1193
				Adj R-squared	=	0.1185
Total	4565965.05	2,016	2264.86361	Root MSE	=	44.683

nettfa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
inc	8799.3167	.0597307	13.38	0.000	.6821762 .9164572
age	8426563	.0920169	9.16	0.000	.6621982 1.023115
_cons	-43.03981	4.080393	-10.55	0.000	-51.04204 -35.03758

We interpret β_1 as a 1000 thousand dollar increase in income corresponds to a 8799 increase in net financial wealth.

We interpret β_2 as a 1 year increase in age corresponds to a 842 increase in net financial wealth.

iii)

$$\beta_0 = -93.04$$

This is an individual's net financial wealth when their income is 0 and their age is 0.

It is the net financial wealth of newborn babies which we are not interested in.

iv)

$$H_0: \beta_2 = 1$$

$$H_a: \beta_2 < 1 \quad \text{at } \alpha = 0.1$$

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

$$P\text{-value is } P(T < -1.71) \approx 0.44$$

We fail to reject the null hypothesis.

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v)

. reg nettfa inc if fsize == 1

Source	SS	df	MS	Number of obs	=	2,017
Model	377482.064	1	377482.064	F(1, 2015)	=	181.60
Residual	4188482.98	2,015	2078.6516	Prob > F	=	0.0000
				R-squared	=	0.0827
				Adj R-squared	=	0.0822
Total	4565965.05	2,016	2264.86361	Root MSE	=	45.592

nettfa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
inc	.8206815	.0609	13.48	0.000	.7012479 .940115
_cons	-10.57095	2.060678	-5.13	0.000	-14.61223 -6.529671

$\hat{\beta}_1 = 0.821$ that is not different from 0.799 from the previous regression.
So, the coefficient does not change much.

(c)

. reg voteA lexpendA lexpendB prtysrA

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
				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
prtysrA	.1519574	.0620181	2.45	0.015	.0295274 .2743873
_cons	45.07893	3.926305	11.48	0.000	37.32801 52.82985

i) $\hat{\beta}_1 = 6.083$

if campaign expenditure by Candidate A increase 1 unit, the percentage of vote received by candidate A will increase approximately 6.083

ii) $H_0: \beta_2 = -\beta_1$, $H_0: \beta_2 + \beta_1 = 0$

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

iii) $\text{vote A} = 45.07893 + 6.083316 \log(\text{lexpend A}) - 6.615417 \log(\text{lexpend B}) + 0.1519574 \text{prtysr A} + u$

A's expenditure has a positive effect on vote A but B's expenditure has a negative effect on vote A.

So, we can't use these results to test the hypothesis in previous part.

iv) $H_0: \beta_2 = -\beta_1$, $H_0: \beta_2 + \beta_1 = 0$

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

$$t = \frac{(\hat{\beta}_2 + \hat{\beta}_1) - 0}{\text{S.E.}(\hat{\beta}_2 + \hat{\beta}_1)}$$

let $\hat{\theta}_1 = \hat{\beta}_2 + \hat{\beta}_1 \rightarrow H_0: \theta_1 = 0$

$H_a: \theta_1 \neq 0$

$$t = \frac{\hat{\theta}_1 - 0}{\text{S.E.}(\hat{\theta}_1)}$$

rearrange $\hat{\theta}_1 = \hat{\beta}_2 + \hat{\beta}_1$ to $\hat{\beta}_1 = \hat{\theta}_1 - \hat{\beta}_2$ or $\beta_1 = \theta_1 - \beta_2$

$$\begin{aligned}
 \text{vote A} &= \beta_0 + \beta_1 \log(\text{lexpend A}) + \beta_2 \log(\text{lexpend B}) + \beta_3 \text{prtysr A} + u \\
 &= \beta_0 + \theta_1 - \beta_2 \log(\text{lexpend A}) + \beta_2 \log(\text{lexpend B}) + \beta_3 \text{prtysr A} + u \\
 &= \beta_0 + \theta_1 \log(\text{lexpend A}) - \beta_2 \log(\text{lexpend A}) + \beta_2 \log(\text{lexpend B}) + \beta_3 \text{prtysr A} + u \\
 &= \beta_0 + \theta_1 \log(\text{lexpend A}) - \beta_2 [\log(\text{lexpend B}) - \log(\text{lexpend A})] + \beta_3 \text{prtysr A} + u
 \end{aligned}$$

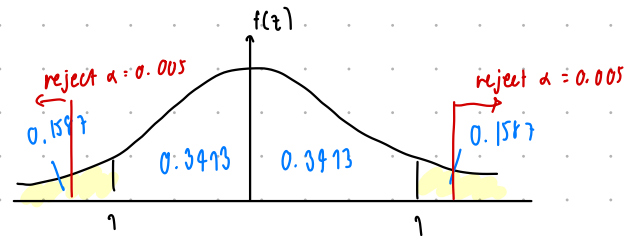
new B

. generate newB = lexpendB - lexpendA

. reg voteA lexpendA newB prtysrA

Source	SS	df	MS	Number of obs	=	173
Model	38405.1097	3	12801.7032	F(3, 169)	=	215.23
Residual	10052.1388	169	59.4801115	Prob > F	=	0.0000
				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	-.532101	.5330858	-1.00	0.320	-1.584466 .5202638
newB	-6.615417	.3788203	-17.46	0.000	-7.363246 -5.867588
prtysrA	.1519574	.0620181	2.45	0.015	.0295274 .2743873
_cons	45.07893	3.926305	11.48	0.000	37.32801 52.82985



$$t = \frac{\hat{\theta}_1 - 0}{\text{S.E. } \hat{\theta}_1} = \frac{-0.532101 - 0}{0.5330858}$$

$$= -0.99857$$

$$\approx -1$$

$$P\text{-value} : 0.1587 > 0.005$$

v) we fail to reject the null hypothesis because p-value (0.1587) is greater than the significant level (0.005)

So, 1% increase in A's expenditure is offset by 9% increase in D's expenditure