Assignment ③

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

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

② $\log(salary) = \beta_0 + \beta_1 \log(sales) + \beta_2 roe + \beta_3 ros + u$

roe : return on equity
ros : return on the firm's stock

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

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

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

$$\widehat{\log(salary)} = \underset{(0.32)}{4.32} + \underset{(0.035)}{0.28} \log(sales) + \underset{(0.0041)}{0.0174}\, roe + \underset{(0.00054)}{0.00024}\, ros$$

$n = 209,\ R^2 = 0.283$

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

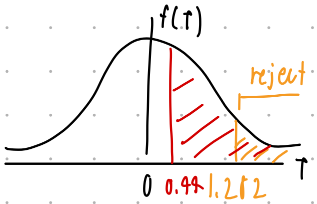
Ans $\widehat{salary} = 0.00024(50) = 0.012$ or 1.2%
A 50 point ceteris paribus increase in ros is predicted to increase salary by only 1.2%.
ROS have a partically very small effect on salary.

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

Ans $t = \dfrac{\hat{\beta}_3 - 0}{s.e(\hat{\beta}_3)} = \dfrac{0.00024}{0.00054}$

$= 0.44$

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



∴ we fail to reject Ho 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

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C6 i) $\log(wage) = \beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 tenure + u$

$H_0: \beta_2 = \beta_3$

ii)

```
. gen expten = exper + tenure

.
end of do-file

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

. reg lwage educ exper expten
```

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

α 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(wage) as another year.

C8 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
```

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

nettfa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inc	$\hat\beta_1$ .7993167	.0597307	13.38	0.000	.6821762	.9164572
age	$\hat\beta_2$ .8426563	.0920169	9.16	0.000	.6621982	1.023115
_cons	$\hat\beta_0$ -43.03981	4.080393	-10.55	0.000	-51.04204	-35.03758

we interpret $\hat\beta_1$ as a 1000 thousand dollar increase in income corresponds to a $799 increase in net financial wealth.
we interpret $\hat\beta_2$ as a 1year increase in age corresponds to a $842 increase in net financial wealth.

iii) $\hat\beta_0 = -43.04$

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) $H_0: \beta_2 = 1$

$H_a: \beta_2 < 1$ at $\alpha = 0.1$

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

p-value is $P(T < -1.71) \approx 0.44$

we fails 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
-------------+----------------------------------   F(1, 2015)      =    181.60
       Model |  377482.064         1  377482.064   Prob > F        =    0.0000
    Residual |  4188482.98     2,015   2078.6516   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.

(C1)

```
. 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
------------------------------------------------------------------------------
```

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) $voteA = 45.07893 + 6.083316 \log(expendA) - 6.615417 \log(expendB) + 0.1519574\, prtystrA + u$

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

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

$$t = \frac{(\hat{\beta}_2 + \hat{\beta}_1) - 0}{s.e.(\hat{\beta}_2 + \hat{\beta}_1)}$$

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

$H_a : \theta_1 \neq 0$

$$t = \frac{\hat{\theta}_1 - 0}{s.e.(\hat{\theta}_1)}$$

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

$$\begin{aligned}
voteA &= \beta_0 + \beta_1 \log(expendA) + \beta_2 \log(expendB) + \beta_3\, prtystrA + u \\
&= \beta_0 + \theta_1 - \beta_2 \log(expendA) + \beta_2 \log(expendB) + \beta_3\, prtystrA + u \\
&= \beta_0 + \theta_1 \log(expendA) - \beta_2 \log(expendA) + \beta_2 \log(expendB) + \beta_3\, prtystrA + u \\
&= \beta_0 + \theta_1 \log(expendA) - \beta_2 [\underbrace{\log(expendB) - \log(expendA)}_{new\ B}] + \beta_3\, prtystrA + u
\end{aligned}$$

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```
. generate newB = lexpendB - lexpendA

. reg voteA lexpendA newB prtystrA

      Source |       SS           df       MS      Number of obs   =       173
-------------+----------------------------------   F(3, 169)       =    215.23
       Model |  38405.1097         3  12801.7032   Prob > F        =    0.0000
    Residual |  10052.1388       169  59.4801115   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
    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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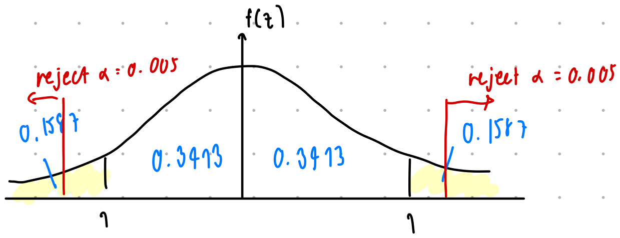

$$t = \frac{\hat{\theta}_1 - 0}{s.e.\ \hat{\theta}_1} = \frac{-0.532101 - 0}{0.5330858}$$

$$= -0.99857$$

$$\approx -1$$

p-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' expenditure is offset by 1% increase in B's expenditure

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