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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.

i β_1 means 1% increase in expend(A) will increase β_1% increase in vote A

ii $H_0 : \beta_2 = -\beta_1$

$H_a : \beta_2 \neq -\beta_1$

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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regress voteA lexpendA lexpendB prtystrA
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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

$\text{vote A} = 45.08 + 6.083 \log(\text{expend A}) - 6.615 \log(\text{expend B}) + 0.752\ \text{PrtyS A}$

expend A has positive impact on vote A and expend B has a negative impact on vote A.

To test the hypothesis in part (ii), we need the s.e. of $\beta_1 + \beta_2$. So, we cannot use the result to test

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.)

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. regress voteA lexpendA diff_lexB_lexA prtystrA
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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
diff_lexB_lexA	-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

$\theta_1 = \beta_1 + \beta_2$

$\beta_1 = \theta_1 - \beta_2$

$voteA = \beta_0 + (\theta_1 - \beta_2)\log(expendA) + \beta_2 \log(expendB) + \beta_3 + prtystrA + u$

$voteA = \beta_0 + \theta_1 \log(expendA) + \beta_2 [\log(expend(B) - \log(expendA)] + \beta_3 prtystrA + u$

$\hat{\theta}_1 = -0.532$

p-value of $\hat{\theta}_1 = 0.32$ and it is more than 0.05 (5% of sig. level), we do not reject H_0 at 5% sig. level

So, one percent increase in expend A is not offset by 1% increase in expend B