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Small Project 3

Problem 1

(i) B_1 is the measure of how much **voteA** (the percentage of the vote received by the Candidate A) will change if campaign expenditures of Candidate A increases by 1%, holding other things fixed.

(ii) The null hypothesis would be the following: $B_1+B_2 = 0$

(iii) $voteA\ (hat) = 45.08 + 6.08\log\ (expendA) - 6.62\log\ (expendB) + 0.15prtystrA$

N = 173, R-squared = 0.7926

By looking at the parameters of **log(expendA)** and **log(expendB)**, we can say that A's expenditure clearly affects the outcome, and the effect is positive. B's expenditure also affects the outcome, but in a negative way (as expected). We can use the estimated parameters to test the hypothesis stated in (ii).

(iv) We make a substitution to our population model.

Let $\alpha = B_1+B_2$. Then $B_1 = \alpha - B_2$

Our population model will look like the following:

$$voteA = B_0 + \alpha\log(\mathrm{expendA}) + B_2\log\left(\frac{expendB}{expendA}\right) + B_3 prtystrA + u$$

After running the regression, we will get the following estimated model:

$$voteA(hat) = 45.08 - 0.53\log(expendA) - 6.62\log\left(\frac{expendB}{expendA}\right) + 0.15prtystrA$$

The estimated parameter of the variable **log(expendA)** has a **t statistic** equal to -0.998 and a **p-value** of 0.3196. As a result, we **fail** to reject the null hypothesis stated in (ii) even at large significance level like 15%.

Problem 2

(I) and (ii)

$$\log(wage) = \beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 educ\cdot exper + u$$

(i) If we take a derivative of log(wage) in terms of educ, holding exper fixed, we get:

$$\frac{\partial \log(wage)}{\partial educ} = \frac{\partial}{\partial educ}\left(\beta_0 + \beta_1 educ + \beta_2 exper + \beta_3 educ\cdot exper + u\right) =$$

$$= 0 + \beta_1 + 0 + \beta_3 exper + 0 = \underline{\beta_1 + \beta_3 exper}$$

(ii) The null hypothesis: $H_0: \beta_3 = 0$

Alternative: $H_1: \beta_3 \neq 0$

(iii) $\boldsymbol{log(wage)hat = 5.95 + 0.044educ - 0.021exper + 0.003educ * exper}$

N = 935, R-squared = 0.1349

The estimated parameter of the interaction variable (educ*exper) is approximately equal to 0.003, and its **p-value** is equal to 0.0365. This means that we would fail to reject our null hypothesis in (ii) at 5% significance level, but we would reject it at 1% significance level.

(iv)

The estimate of θ_1 is equal to 0.076 and its 95% confidence interval is (0.063, 0.089)

Problem 3

(i) The estimated model:

$$\log(wage)hat =$$
$$= 5.4 + 0.065educ + 0.014exper + 0.117tenure + 0.199married - 0.188black - 0.091south + 0.184urban$$

N = 935, R-squared = 0.2526

Holding other factors fixed, black people earn approximately 19% less than nonblack people. The t-value of variable "black" parameter is equal to -5, which means that the estimated difference between blacks and nonblacks is statistically significant at all common significant levels, even at 1% significance level.

(ii)

After estimating the extended population model and testing the hypothesis that $tenure^2$ and $exper^2$ are statistically insignificant, we got an F value of 1.4898 (Pr(>F) = 0.226). That means that $tenure^2$ and $exper^2$ are statistically insignificant, even at 20% significance level.

(iii)

After estimating the newly adjusted model in R, we see that the p-value of the interaction variable (educ*black) is approximately equal to approximately 0.26. This means that the interaction variable is statistically insignificant even at large (20%) significance levels and thus we can say that return to education does not depend on race.

(iv)

After running the regression in R, we see that the estimated wage differential between married blacks and married nonblacks is approximately equal to 18% (married blacks earn 18% less wage than married nonblacks).