

## Statistics 256: Causality

### In-class Activity 7: Sensitivity — Use, Interpretation, and Abuses

Name(s): \_\_\_\_\_

**Setup.** A study estimates the effect of a binary treatment on an outcome, adjusting for covariates  $\mathbf{X}$ . The augmented regression table:

| Treatment        | Est. | SE   | $t$  | $R^2_{Y \sim D   \mathbf{X}}$ | RV    | $RV_{\alpha=0.05}$ |
|------------------|------|------|------|-------------------------------|-------|--------------------|
| <i>Treatment</i> | 0.30 | 0.10 | 3.00 | 1.5%                          | 11.4% | 4.0%               |

df = 600. The strongest observed covariate is  $X_1$ , with  $R^2_{Y \sim X_1 | \mathbf{X}_{-1}, D} = 8\%$  and  $R^2_{D \sim X_1 | \mathbf{X}_{-1}} = 4\%$ .

**Question 1: Plain English** (answer in one sentence each)

(a) What does  $RV = 11.4\%$  tell us?

(b) What does  $RV_{\alpha=0.05} = 4.0\%$  tell us? Why is it smaller than the RV?

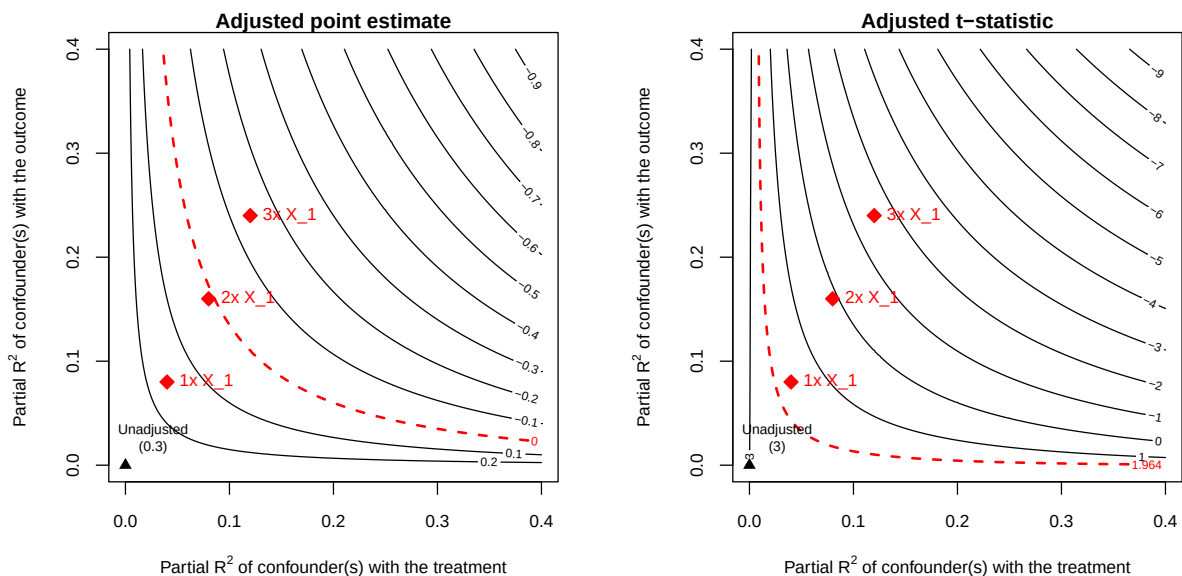
(c) What does  $R^2_{Y \sim D | \mathbf{X}} = 1.5\%$  tell us?

**Question 2: FWL check.** Consider the linear regression of  $Y$  on  $D$  and  $\mathbf{X}$ . Using Frisch–Waugh–Lovell, restate the coefficients you get on  $D$  as the result of a bivariate regression.

**Question 3: Spot the abuse.** What is problematic with this statement: “*The RV is 50%, that’s really high — we don’t need to worry about unobserved confounding.*”

#### Question 4: Read the contour

For hypothetical  $(R_{D \sim Z|X}^2, R_{Y \sim Z|X,D}^2)$ , the plots show the adjusted point estimate (left) and adjusted  $t$ -statistic (right). Diamond markers indicate confounder strengths  $1\times$ ,  $2\times$ ,  $3\times$  that of  $X_1$ .



- Would the *point estimate* be driven to zero by a confounder  $1\times$  as strong as  $X_1$ ?
- Is *significance at  $\alpha = 0.05$*  lost when the confounder is  $1\times$  as strong as  $X_1$ ?
- Roughly how strong (in multiples of  $X_1$ ) would a confounder have to be to drive the *point estimate* to zero?