

Statistics 256: Causality

In-class Activity 9: Regression Discontinuity

Name(s): _____

Question 1: Sharp RD — continuity and the two limits.

In Hidalgo (2012), Brazilian municipalities with $> 40,500$ registered voters got electronic voting in 1998; those at or below got paper. Let X_i = registered voters, $c = 40,500$, $D_i = \mathbb{1}\{X_i > c\}$, Y_i = valid-vote share.

- (a) Define $\alpha_{SRD} = \mathbb{E}[Y(1) - Y(0) \mid X = c]$, the average effect at the cutoff. Show how we are able to identify this in RD. Label where the “continuity of conditional expectations” assumption comes in. Hint: use something like $\lim_{\epsilon \downarrow 0} \mathbb{E}[Y_i \mid X_i = c + \epsilon, D_i = 1]$.

- (b) The continuity assumption does *not* require $\mathbb{E}[Y(0) \mid X]$ to be flat or unrelated to X . What *does* it forbid? In the Hidalgo setting, name one thing that could in principle violate it.

Question 2: The RD killer — bundled treatments.

A researcher wants the causal effect of *Medicare eligibility* (D) on out-of-pocket medical spending (Y), using age X with cutoff $c = 65$.

- (a) Name one *other* thing that plausibly changes at age 65 and could move medical spending:

- (b) If you ran the RD anyway, what can you say about what $\hat{\alpha}_{SRD}$ actually estimates?

Question 3: Fuzzy RD — plug in the numbers.

A merit scholarship is offered to applicants scoring above c on an entrance exam, but not everyone above c takes it up, and a few below c get it through appeals. Let X_i = exam score (centered at c), $Z_i = \mathbb{1}\{X_i > c\}$, D_i = received scholarship, Y_i = first-year GPA. At the cutoff:

	$\lim_{x \uparrow c}$	$\lim_{x \downarrow c}$
$\mathbb{E}[D_i \mid X_i = x]$	0.20	0.70
$\mathbb{E}[Y_i \mid X_i = x]$ (GPA points)	2.60	2.80

- (a) What is the reduced form effect (effect of crossing threshold on Y)?
- (b) What is the first stage effect?
- (c) What do we then get for the fuzzy RD estimated effect of the scholarship on GPA?
- (d) Interpret this LATE correctly (explain how it is “doubly local”)