Parametric Versus Semi-Parametric RD Estimation

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1 Non-Parametric RD Estimation

- Estimate differential one-sided non-parametric estimates just above and below the discontinuity:

$$\frac{\sum_{j=1}^{N} K\left(x_j - x_i^{+}\right) Y_j}{\sum_{j=1}^{N} K\left(x_j - x_i^{+}\right)} - \frac{\sum_{j=1}^{N} K\left(x_j - x_i^{-}\right) Y_j}{\sum_{j=1}^{N} K\left(x_j - x_i^{-}\right)}$$

- Computing standard errors: either analytically or bootstrapping.

- Benefit of this approach:

  – More robust to functional form choices and non-local outliers in comparison with global polynomial approach

- Problem with this approach

  – Much lower reliance on data and thus much lower power.

2 Semi-Parametric RD Estimation

- Estimate parametric jump parameter parametrically while simultaneously estimating non-parametrically. In other words, estimate the residual non-parametrically after netting out the jump parameter where the jump parameter is chosen to minimize the sum of squared residual variance in prediction:

$$\min_{\beta} \sum_{j=1}^{N} \left[Y_j - \beta A_j - \frac{\sum_{j=1}^{N} K\left(x_j - x_i\right)\left(Y_j - \beta A_j\right)}{\sum_{j=1}^{N} K\left(x_j - x_i\right)} \right]$$

where

$$\begin{aligned} A_j &= 1 \text{ if } x_j \geq c \\ &= 0 \text{ if } x_j < c \end{aligned}$$

- Computing standard errors: either analytically or bootstrapping

- Benefit of this approach:

- Allows for two-sided non-parametric estimation at the discontinuity (because what is now being non-parametrically estimated is the density net of the jump - which should be similar on both sides of the discontinuity. This will not work if the jump is not the only change at or near the discontinuity. This helps with statistical power.

- Can compute OLS-type standard errors for β.

- Problem with this approach:

  - Purely dominates the non-parametric version because it has more power with the same assumptions. However, it still has less power than the parametric global polynomial approach.