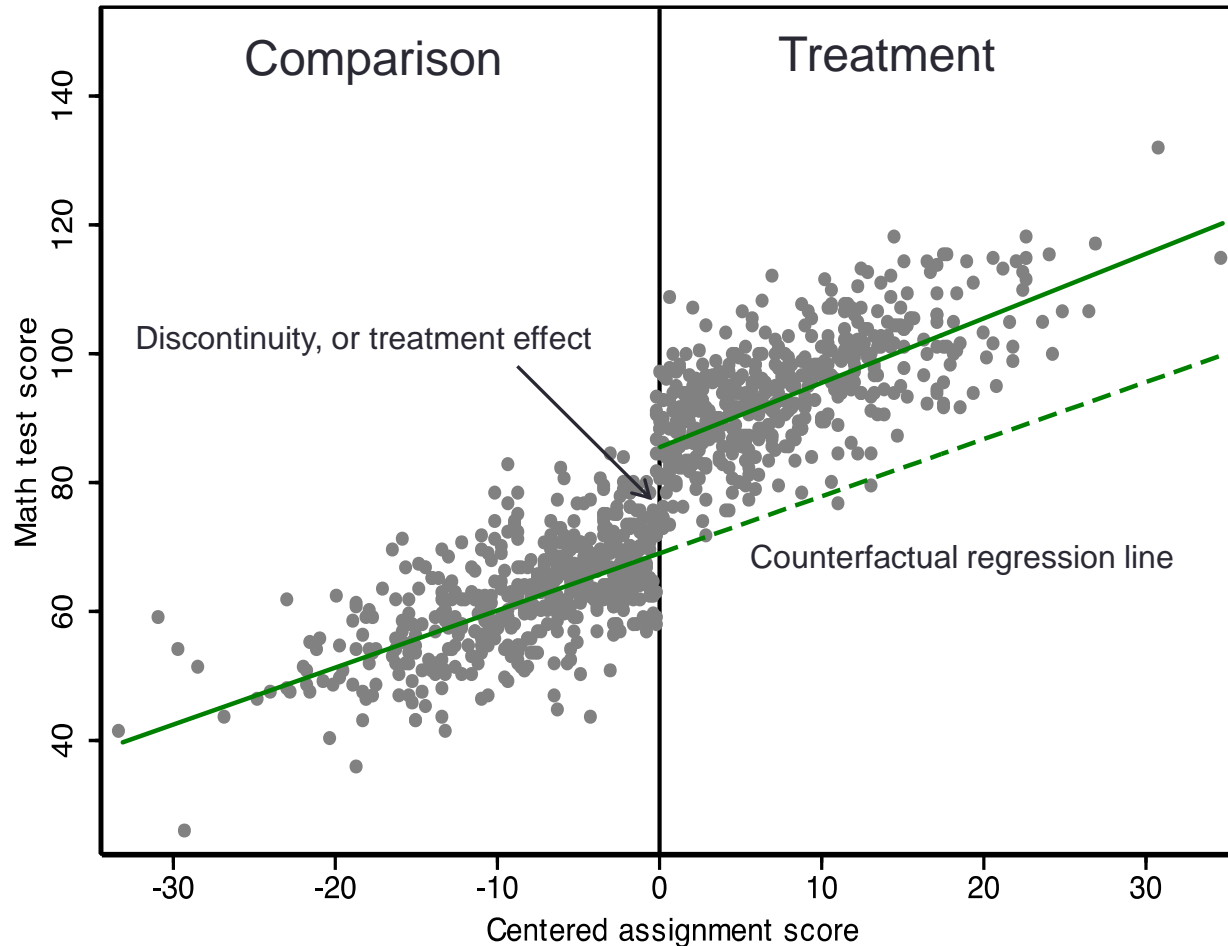


# USING DESIGN ELEMENTS TO STRENGTHEN THE RD DESIGN

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# The Regression Discontinuity Design



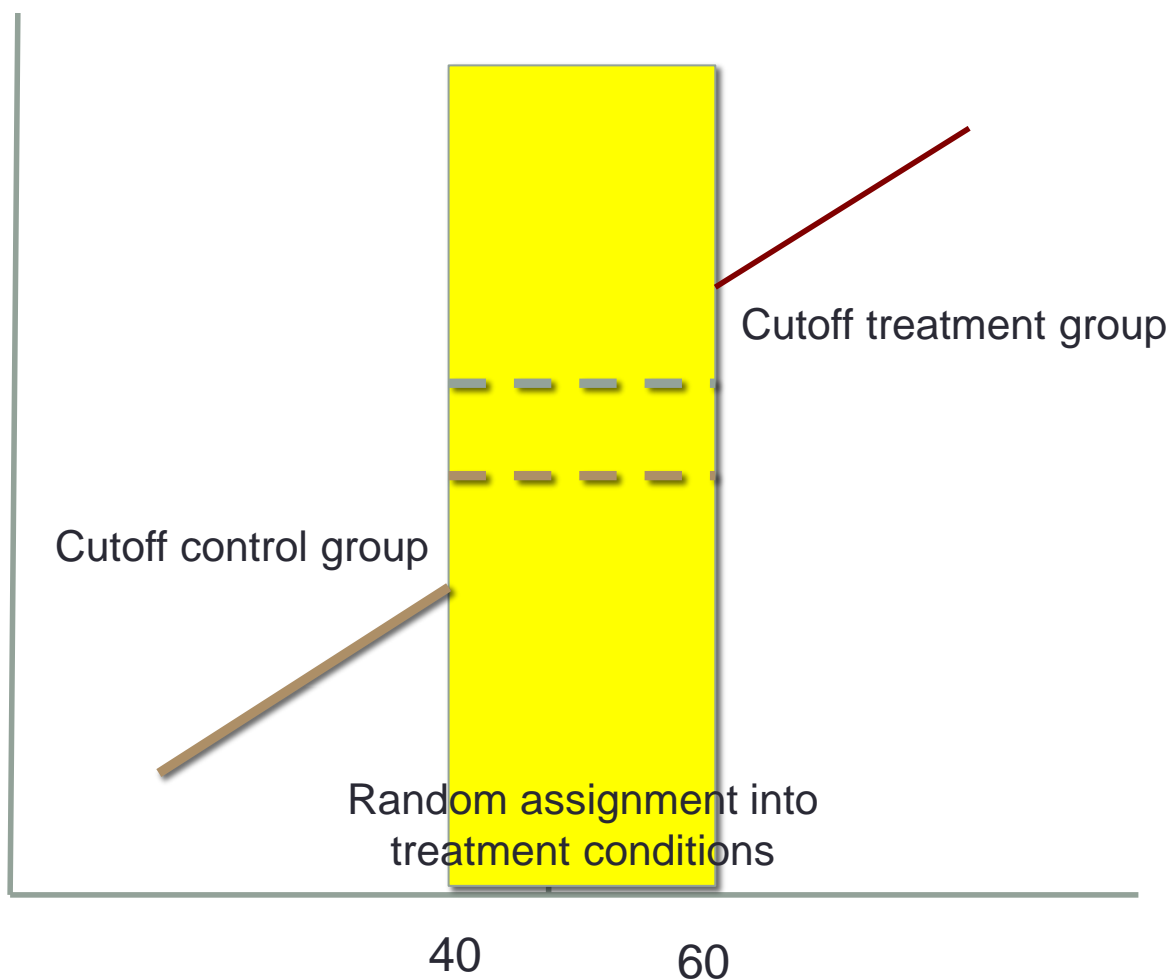
# RD Issues to Consider

1. Correct specification of the functional form
2. Treatment non-compliance
3. Reduced statistical power (as compared to the RCT)
4. Generalization of treatment effects

# Design Elements for Improving the RDD

1. Tie-breaker experiment at the cutoff
2. Adding a pretest
3. Multiple assignment variables and cutoffs

# Design feature 1: Tie-breaking Experiment



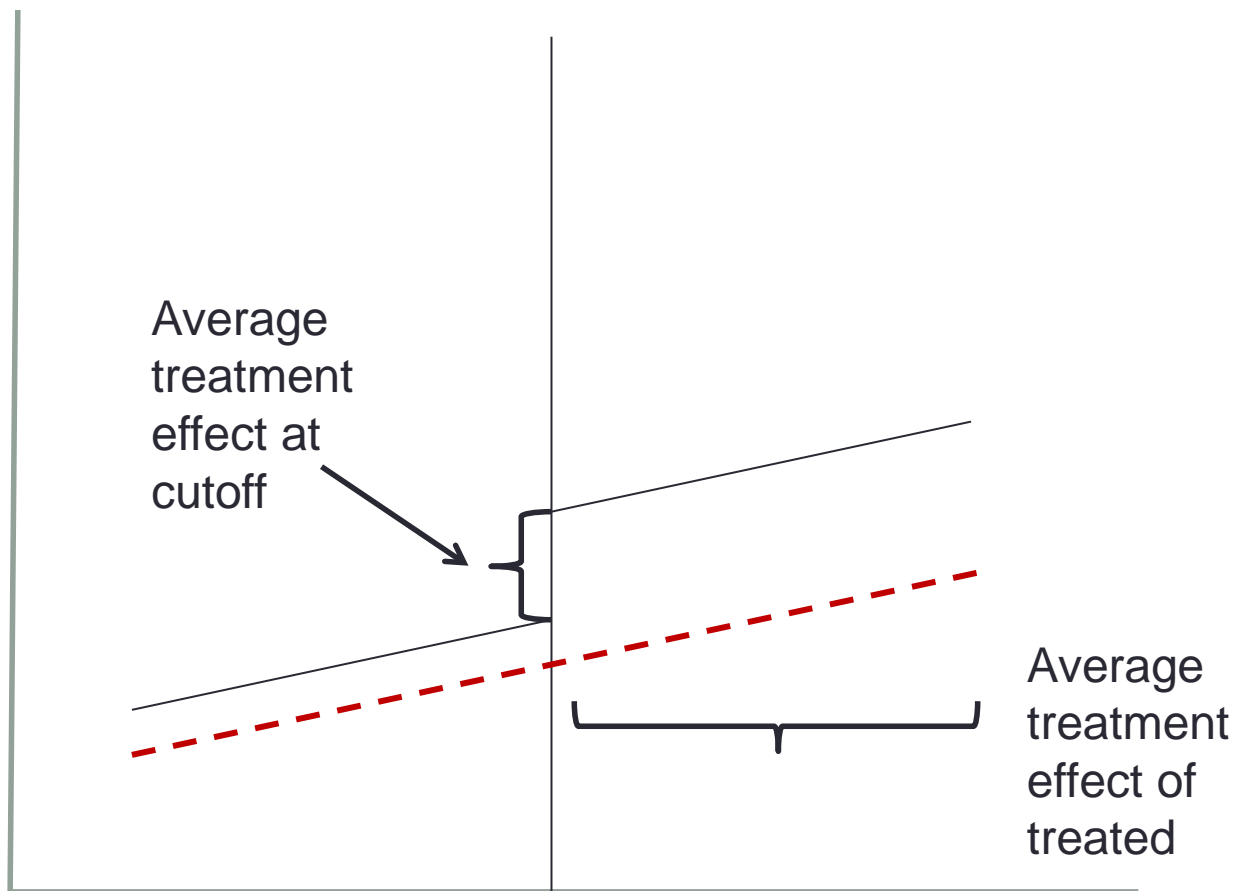
# Tie Breaking Experiments

- Individuals with assignment scores between two cutoffs are randomly assigned into treatment conditions
  - Those above one threshold are assigned into treatment condition and those below the second threshold are assigned into control condition
- Design is useful when RCT is not ethical or feasible
- Advantages:
  - Strengthens causal inference
  - Improves statistical power around the cutoff
  - May help with treatment compliance

# Example: Black, Galdo, & Smith

- Intervention: Job training program in Kentucky
- Outcomes: Weeks receiving UI benefits, amount of UI benefits received, annual earnings
- RD: Assignment variable was index for likelihood for long-term unemployment.
  - Each week within site, those scoring above cutoff required to participate in training, those below cutoff were not required.
  - For sites where capacity was reached, claimants with identical scores were randomly assigned to treatment and control conditions

# Design feature 2: Adding a Pretest





# Adding a Pretest

- Use information about the response function from pretest time period
- Allow for simple time period fixed effect, but assume that the functional form did not change between two time periods
- Using pretest data, you can extend the untreated outcome line beyond cutoff to calculate average treatment effect for the treated
- Key assumption is that the pretest function is time invariant except for an intercept shift

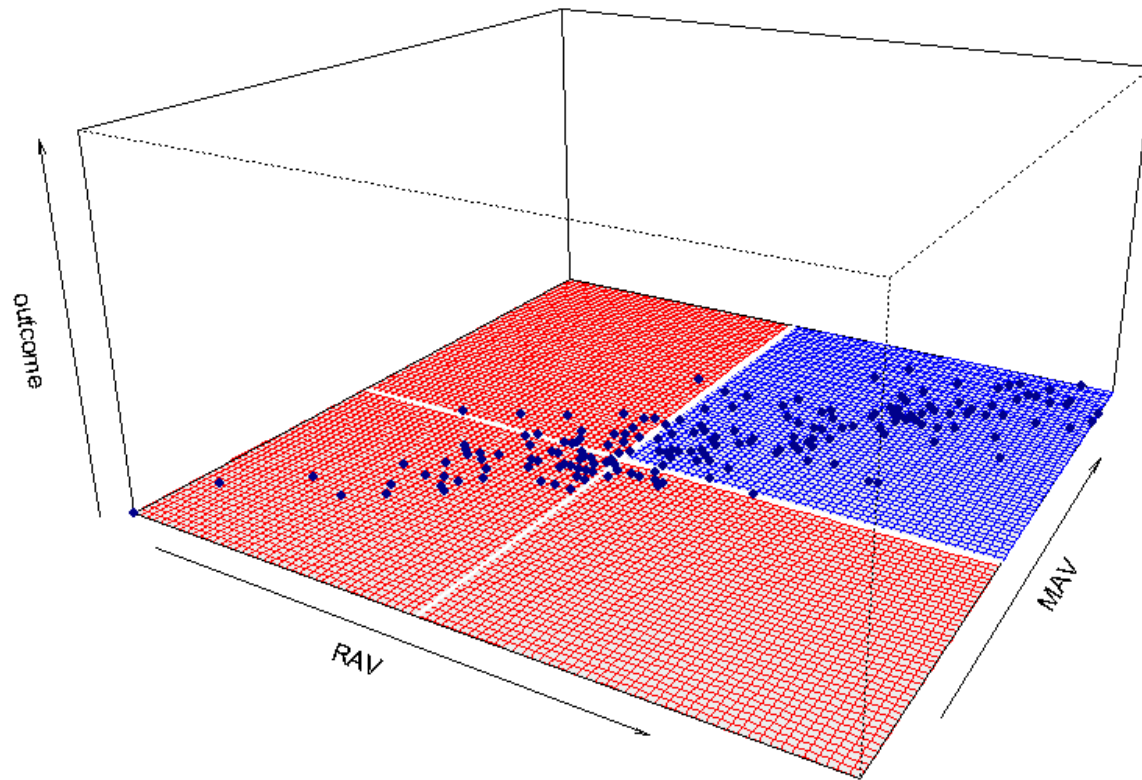
## Example: Wing & Cook (under review)

- Intervention: Cash allowance program for disabled Medicaid recipients to purchase their own services in Arkansas, Florida, and New Jersey
- Outcome: Individual Medicaid expenditures 12 months after study began
- RD: Assignment variable was age, three cutoff thresholds (35, 50, & 70)
- Pretest was Medicaid cash expenditures for the individual in the prior year
- Wing & Cook found that using pretest data was able to replicate the experimental benchmark average treatment on treated effect

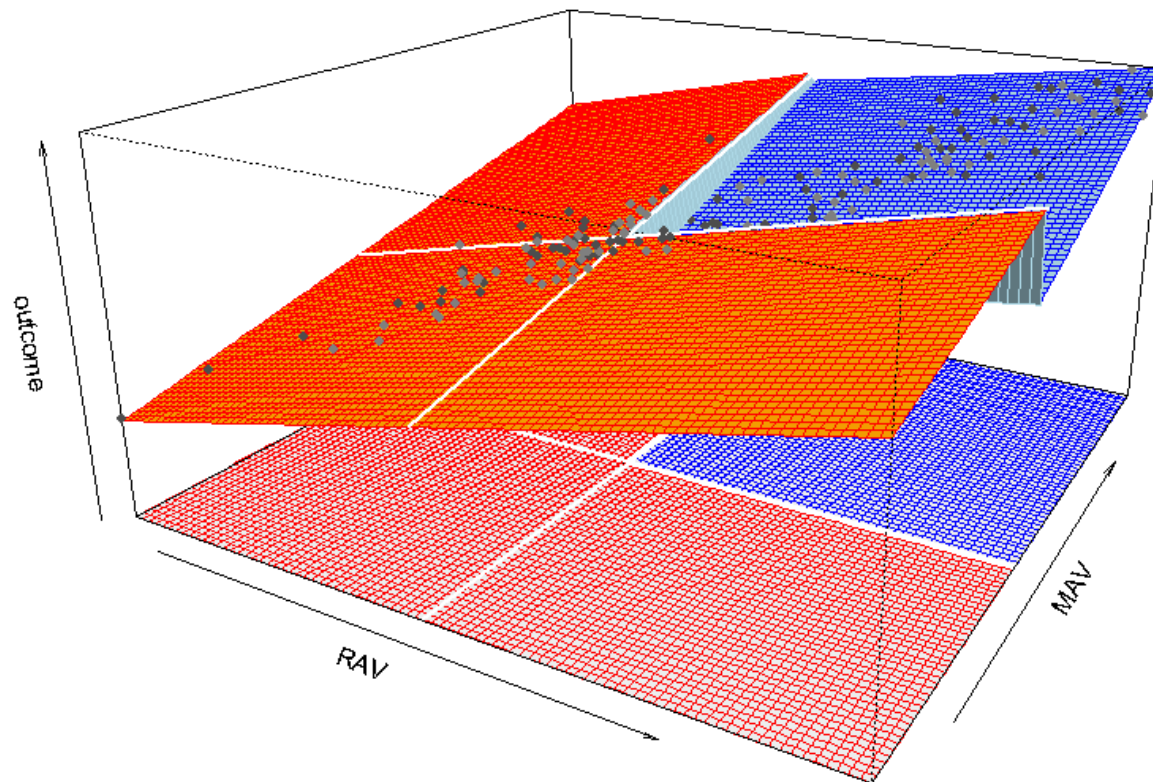
# Design feature 3: Multiple assignment variables and cutoffs

- Sometimes, units are assigned into treatment conditions based on assignment scores from multiple assignment variables and cutoffs
  - College financial aid offer (van der Klaauw, 2002; Kane, 2003)
  - High school exit exams (Martorell, 2005; Papay et al. 2010)
  - No Child Left Behind (Gill et al., 2007)
- Causal estimands of interest:
  - Average treatment effect along the cutoff frontier
  - Frontier-specific effects

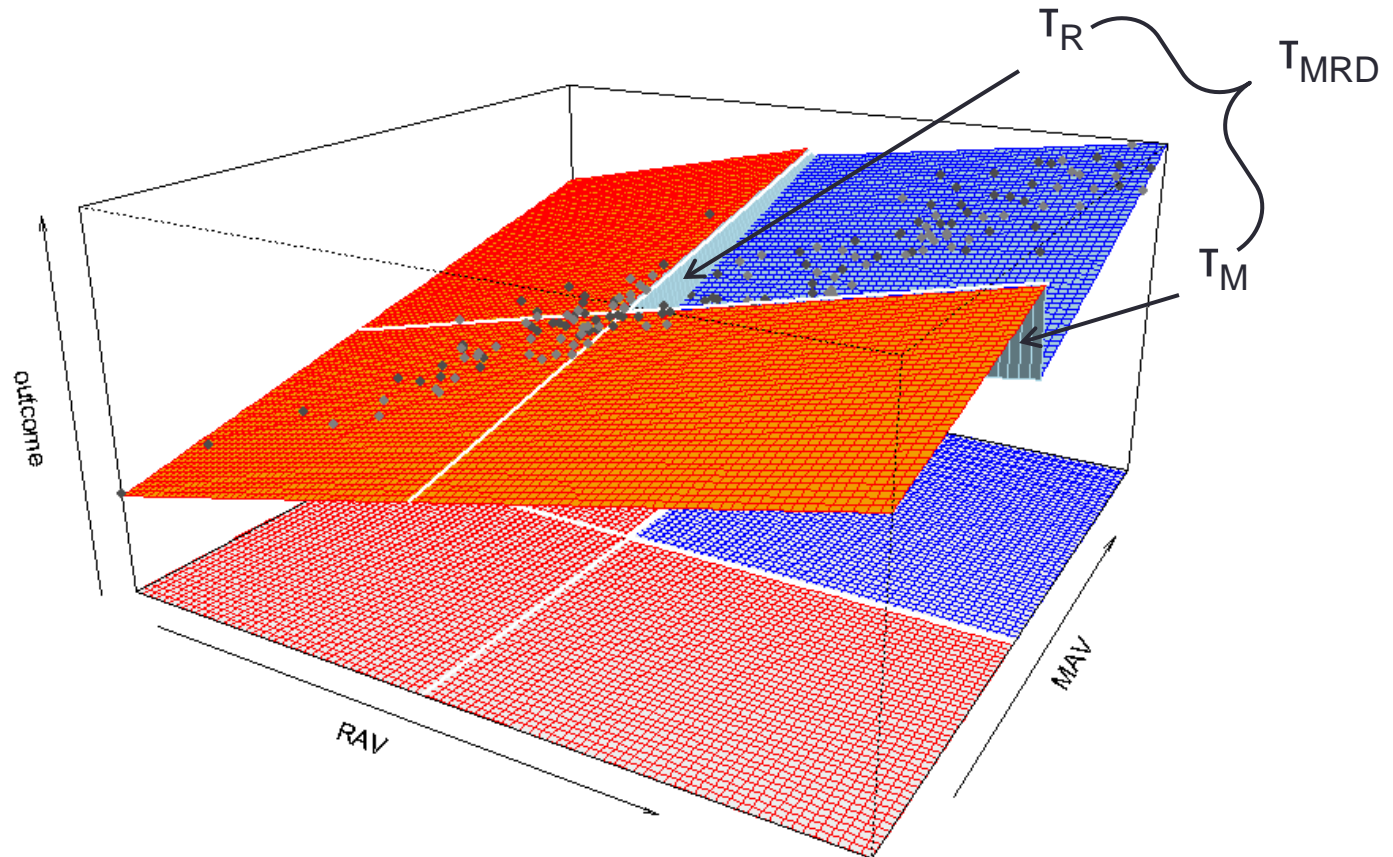
# Distribution of Units in an RD with Two Assignment Variables: A visual depiction



# Multivariate RDD with Two Assignment Variables: A visual depiction



# Multivariate RDD with Two Assignment Variables: A visual depiction



# MRD Design

- Wong et al. identifies four approaches for analyzing MRD designs (frontier, centering, univariate, & and instrumental variable)
  - Each approach has their advantages and limitations
- Main point for today is that when you have multiple assignment variables, you can estimate treatment effects along the entire frontier or for each cutoff frontier
  - Be clear about your research question
  - Estimate the causal estimand that addresses your research question best
  - Design is useful if you are interested in detecting heterogeneous treatment effects along different cutoff frontiers

# Summary: Design Elements for Strengthening RDD

	Correct specification of response function	Treatment non-compliance	Reduced statistical power	Generalization of treatment effects or treatment heterogeneity
<b>Tie-breaker experiment</b>	X	X	X	
<b>Adding a pretest</b>	X		X	X
<b>Multiple assignment variables and cutoffs</b>				X