

Semester Review, Questions, Exam Practice

Econ 140, Section 11

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Roadmap

1. Recap: Regression Discontinuity
2. Broad topics for the exam
3. Exam practice



Recap: Regression Discontinuity

The world is full of arbitrary rules

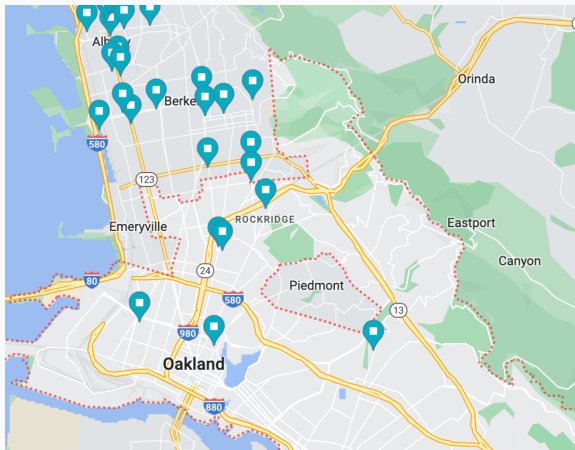
- Students receive a scholarship if their GPA is above 3.0
- Children are allowed to start school if they are five years old before January 31 of that year
- Individuals are eligible for a microfinance loan if they own less than 0.5 acres of land
- Legislators are elected if they receive over 50% of the vote

This creates wonderful discontinuities in the data that we can exploit for econometric analysis!

The most important rules of regression discontinuity

- The essence of RD is to compare people (units) just above the cut-off to others just below
- Crucial assumptions: There are no jumps but our jump at the jump // The effect of X (our running variable) and any other variable C on Y (our outcome) is smooth around the discontinuity
- Identifying assumption: In the absence of the "treatment" (which was allocated by a discontinuous rule), the outcomes of the treated would have been essentially the same as the outcomes of the untreated
- Limitations:
 - 1 We only estimate a **local** effect!
 - 2 There may be strategic behavior at the cutoff (example: school district Oakland/Piedmont)

Oakland and Piedmont



Implementing regression discontinuity designs

With a running variable X , an outcome Y , and a treatment D allocated at the discontinuity, we estimate:

$$Y_i = \alpha + f(X_i) + \beta D_i + \varepsilon_i$$

- $f(X_i)$ is a smooth function of the running variable - e.g. just linear, or quadratic
- We could also estimate whether the **slope** changes at the discontinuity
- We are eventually interested in β : Does the outcome change at the discontinuity?

Broad topics for the exam

Introduction

- Potential outcomes framework
- Interpreting regression tables
- p-values: How surprised we should be to observe the world as it is if your hypothesis about how it works were true?
- Omitted variable bias
- Measurement error
- Reverse causality
- Interpretation of control variables and their role
- Interaction terms (dummy or continuous) –
dummyXdummy: get means for every group

- Random assignment to treatment solves OVB, reverse causality, measurement error, etc.
- But: Challenges remain
- Spillover effects
- Hawthorne effects
- Imperfect compliance (IV!)
- Non-random attrition

Instrumental variables

- Calculation
- Three assumptions: Relevance, Independence (Exogeneity), Exclusion restriction
- Think of three regressions: First stage, reduced form, "target regression" (Second stage)
- Connection to RCTs (imperfect compliance)
- Local Average Treatment Effect (ITT/TOT/...)
- Connect with potential outcomes framework

Differences in Differences

- Connect with potential outcomes
- Parallel trends assumption
- Calculate with tables
- Calculate using regression tables

- Fixed effects: Calculation
- First-differences
- Useful way to think about it: We add a lot of controls, but key problem remains (time-varying confounders, ...)
- Connection of two-way fixed effects with DiD

Regression Discontinuities

- "No jump but our jump at the jump"
- Fuzzy DiD is just IV

General and overarching concepts

- Potential outcomes: Please review carefully – maybe not on the long questions but who knows?
- Comparison of OLS and other estimates: What changed and why? (Hint: Always go back to OVB, less likely measurement error or reverse causality)
- Be **creative but also clear**: Most thinking questions can be solved with reasonable economic intuition, your knowledge of the world, and what you learned on the course.
- Keep in mind the **big picture**: We are just trying to find a valid counterfactual, to estimate causal effects!

Exam practice

Question 2

The local government wants to estimate the impact on future earnings of a job training program that it operated in 2016 and 2017. Access to the program is governed by an eligibility rule: only individuals whose income in the prior tax year was less than £12,000 can participate.

- A. **(20 marks)** Explain how you could use this eligibility rule to estimate the causal effect of the program. Describe any data you would need, write down the regression equation(s) you would estimate, define all variables precisely, and explain how you would interpret the regression results. If you make any additional assumptions, state them clearly.
- B. **(10 marks)** A colleague worries that because the eligibility rule was public, your estimates of the program's causal effect may be biased. Why might this pose a problem for identification? How could you use the data to assess the validity of this concern?

Question 3

(10 marks) On 28 August 2017, a new state law forced the city of St. Louis, Missouri, United States to reduce its minimum wage from \$10 per hour to \$7.70 per hour. You have monthly employment data for at the municipal level for the entire state in the months of May 2017 and November 2017. How would you construct the difference-in-differences estimate for the effect of reducing the minimum wage? What assumption would have to hold for this to be a valid causal estimate of the effect? Precisely describe one concern that you may have with the validity of this assumption. Describe two things you could do to assess the validity of this assumption.