Regression Discontinuity Design (RDD) & the Michigan R&D Loan Program

Bo Zhao & Rosemarie Ziedonis

AOM 2014

The Challenge

- Firm A receives support from Source X
  - Does the support boost Firm A's performance above and beyond what its performance would have been in the <u>absence</u> of the support? ("treatment")
  - Or… is Source X simply good at picking winners? ("selection")
- Examples:
  - Alliances
  - Venture Capital
  - Government Programs

Most Common Approach

- Compile a Matched Sample, but…
  - Were firms in the counterfactual group even interested in being 'treated'?
  - How good are your observables?
  - And a curmudgeonly reviewer might still insist that there are unobservable differences between the groups. (But darn. You can't observe them.)

Is RDD an Option?

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REGRESSION-DISCONTINUITY ANALYSIS:

AN ALTERNATIVE TO THE EX POST FACTO EXPERIMENT[1]

DONALD L. THISTLETHWAITE   AND   DONALD T. CAMPBELL

National Merit Scholarship Corporation   Northwestern University

Michigan Innovation Program

- Competitive R&D Loan Program, 2002-2008
    - Fund allotment = pre-determined
    - Sector and Location Requirements
    - Multi-stage selection process
    - Merit-based scores by external reviewers

- Typical applicant: 4-year old life science company

- Typical "treatment":
   - Financing: $1 million loan that lasts 2-3 years
   - Added services

Our Study
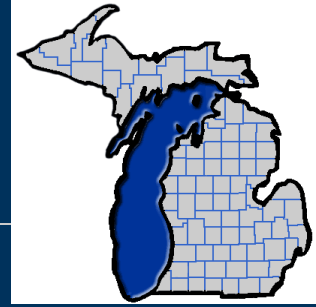
- Benefits from…
    - Access to the entire applicant pool (n=301), including external reviewer scores
    - A useful institutional process

- Uses regression discontinuity approach to test "treatment" effect of public R&D financing on recipient startups
    - Commercial viability (survival)
    - Follow-on financing (VCs & SBIR)
    - Broader business activity (proxy: news articles)
    - Production of patents

- Finds a sizeable "treatment" effect – not simply explained by the picking of winners.

Intuition
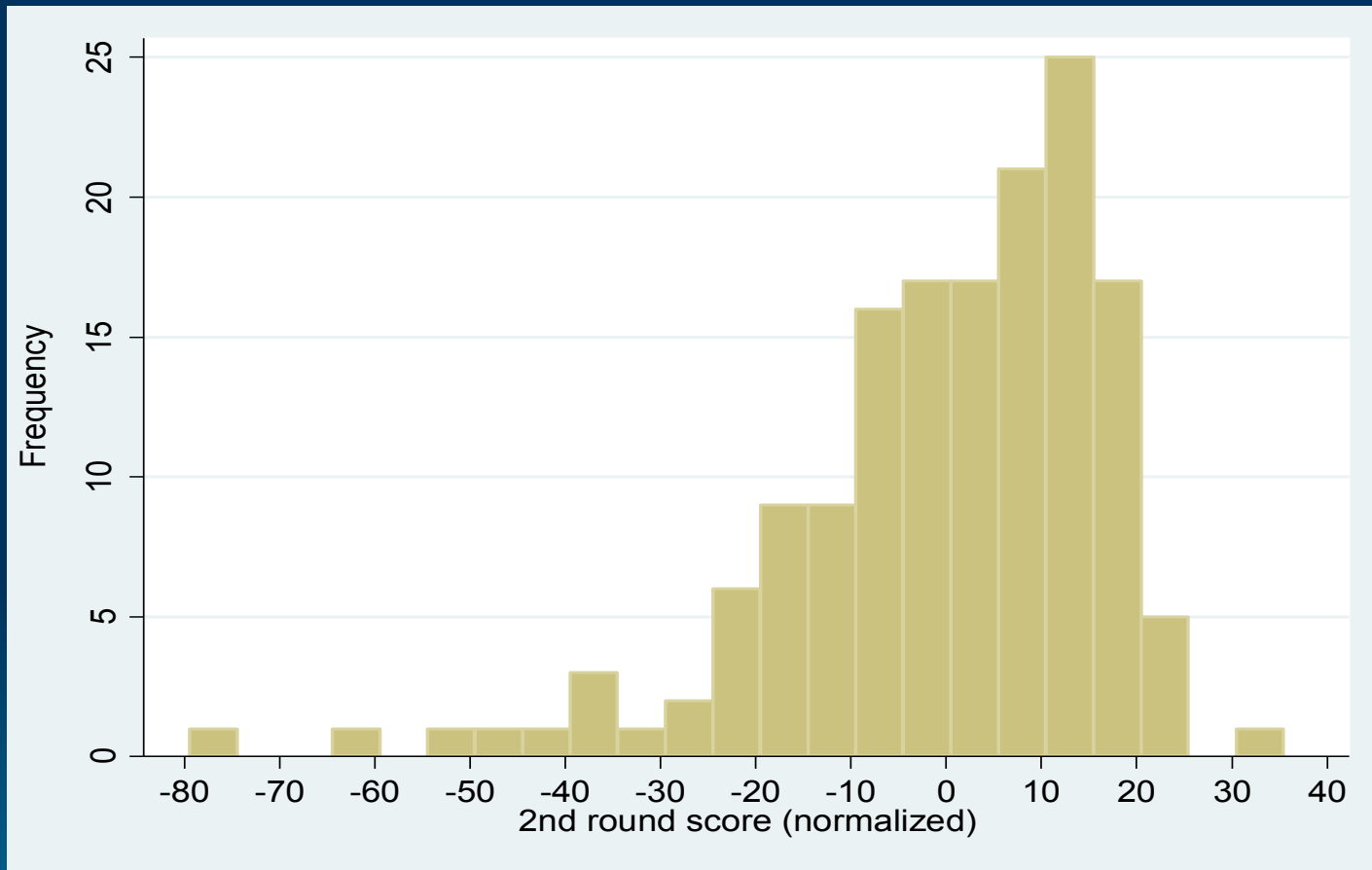
Distribution of scores centered on funding cutoff, round-2 firms only
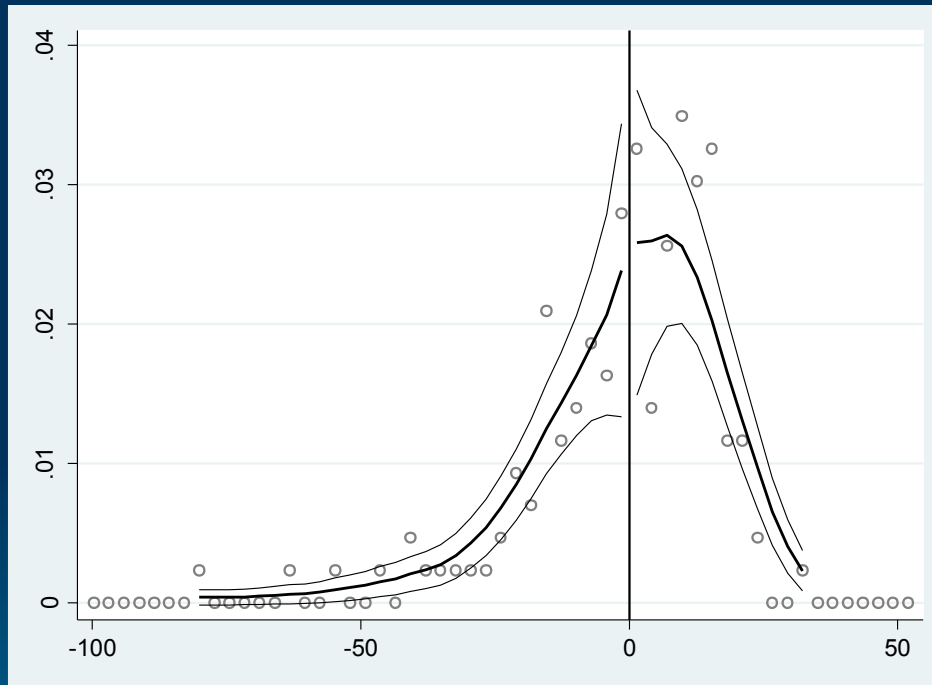
Intuition
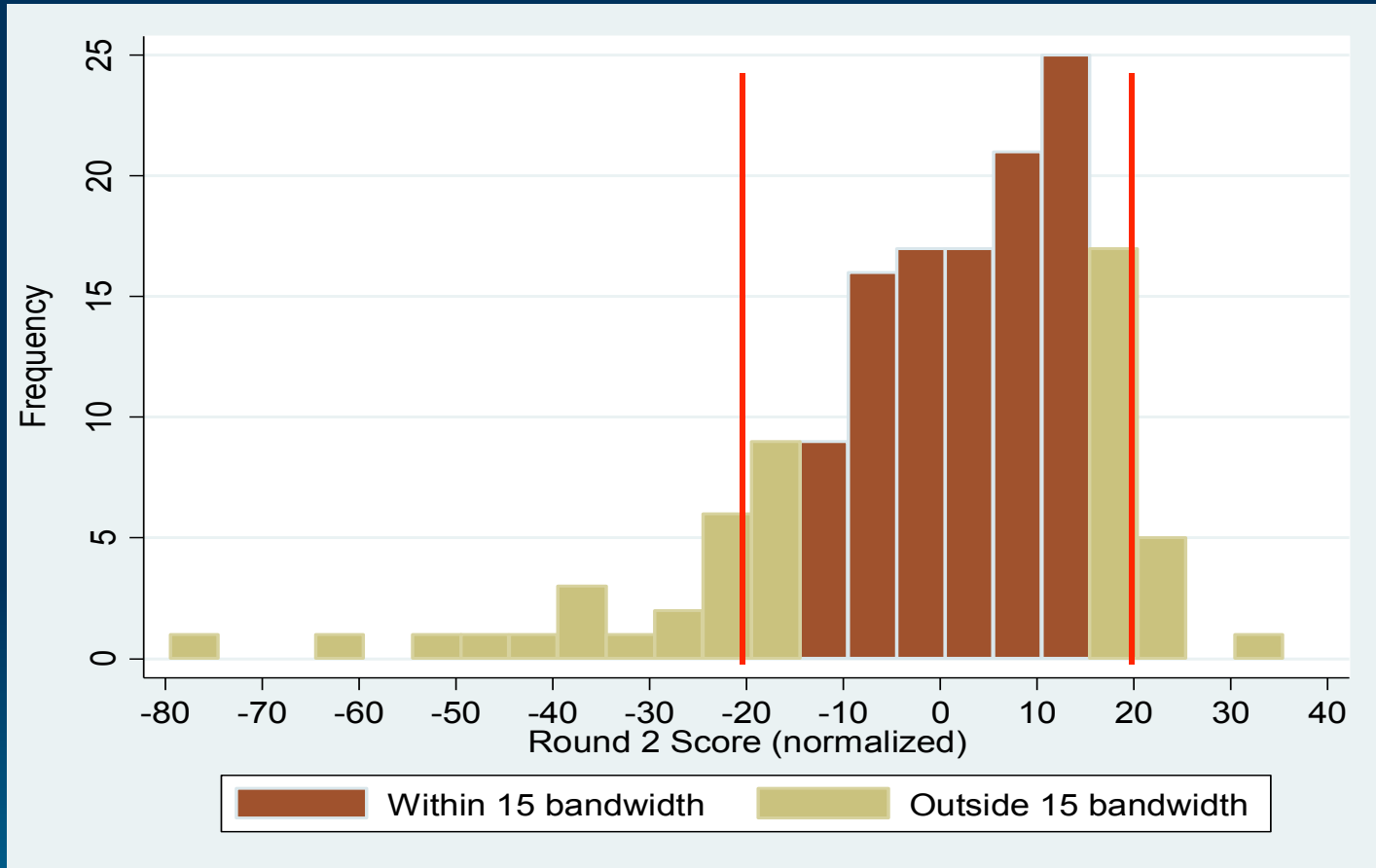
Distribution of scores centered on funding cutoff, round-2 firms only

Identifying Assumptions

1. Applicants are unable to manipulate the cutoff score

McCrary (2008) test for 'missing mass'

Identifying Assumptions

1. Applicants are unable to manipulate the cutoff score

2. The cutoff score doesn't move endogenously with quality

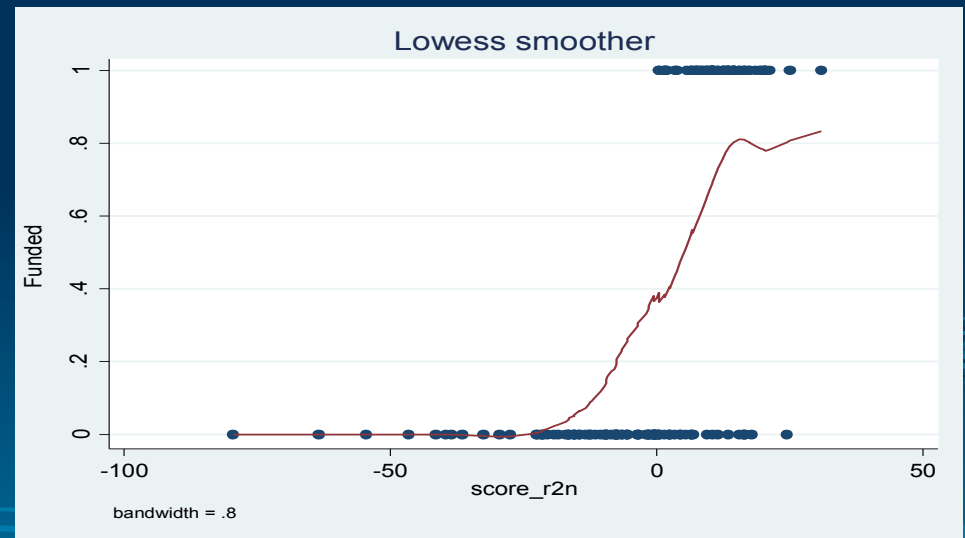# Identifying Assumptions

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3. A breakpoint between the score and the probability of funding exists

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4. Applicants characteristics (observed <u>and</u> unobserved) are comparable within the cutoff region
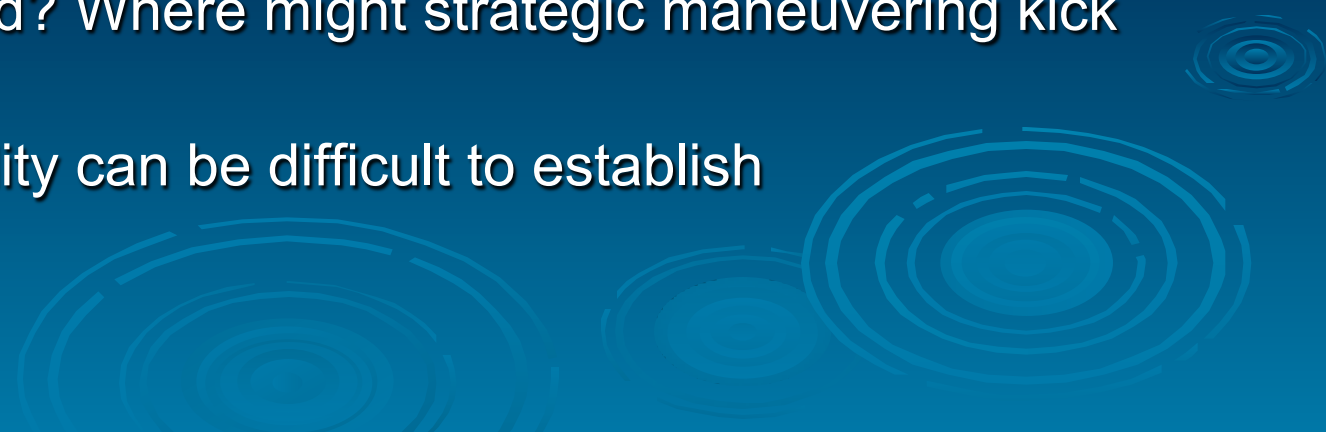
RDD Pros/Cons

➤ Pros:

- "As good as random" if identifying restrictions are met (i.e, high internal validity)
- Is in a Renaissance Period in economics (Cook, 2008)
- Excellent "how to" guides now exist (see references at end)

➤ Cons:

- Must observe information about parties that didn't win
- Must dig deeply into institutional context (is the cut-off predetermined? Where might strategic maneuvering kick in?)
- External validity can be difficult to establish

Learn More!

Regression Discontinuity Designs in Economics

DAVID S. LEE AND THOMAS LEMIEUX[*]

This paper provides an introduction and "user guide" to Regression Discontinuity (RD) designs for empirical researchers. It presents the basic theory behind the research design, details when RD is likely to be valid or invalid given economic incentives, explains why it is considered a "quasi-experimental" design, and summarizes different ways (with their advantages and disadvantages) of estimating RD designs and the limitations of interpreting these estimates. Concepts are discussed using examples drawn from the growing body of empirical research using RD. (JEL C21, C31)
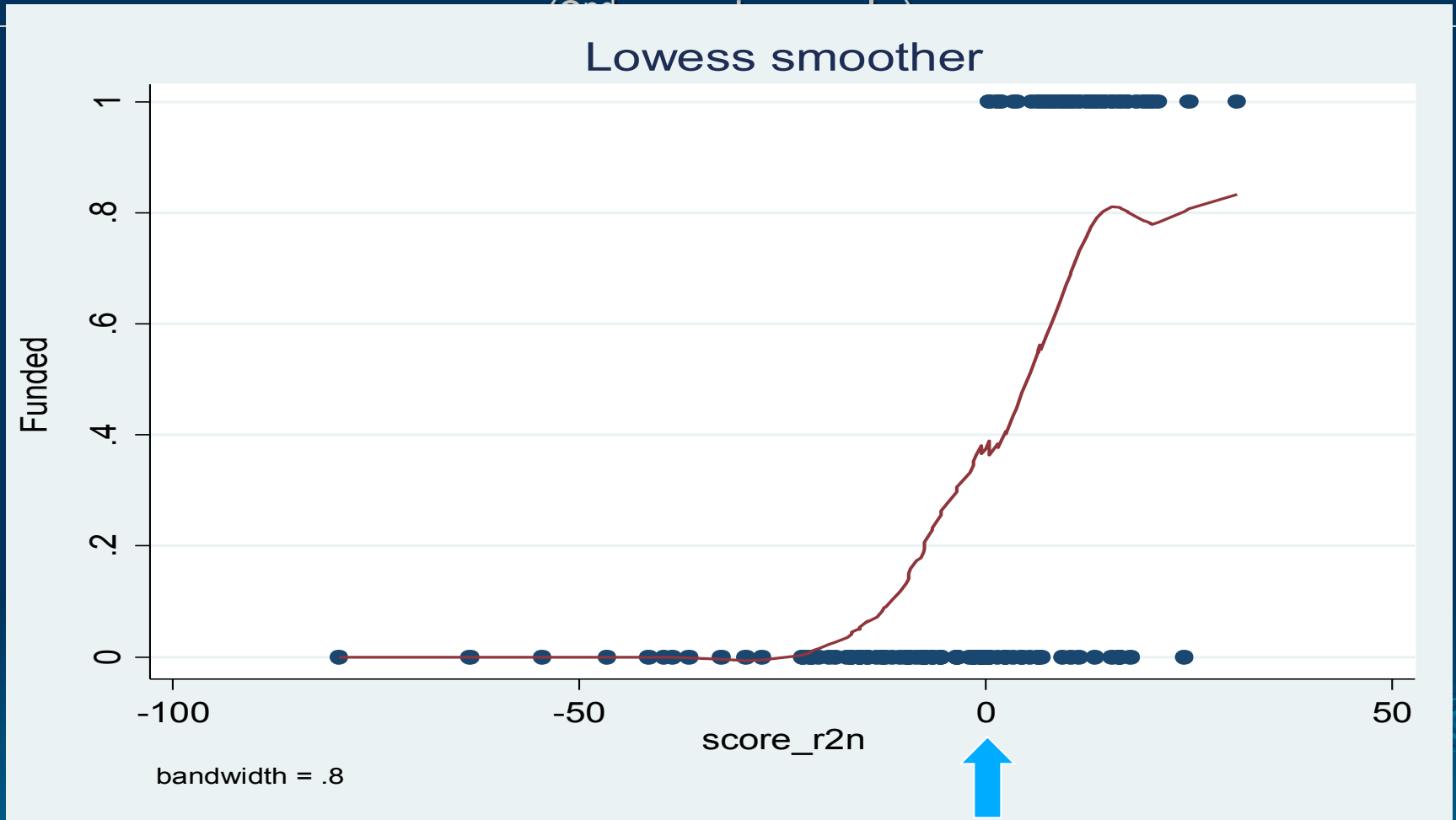
Thanks!

New Venture Survival (t+3) & Funding Cutoff
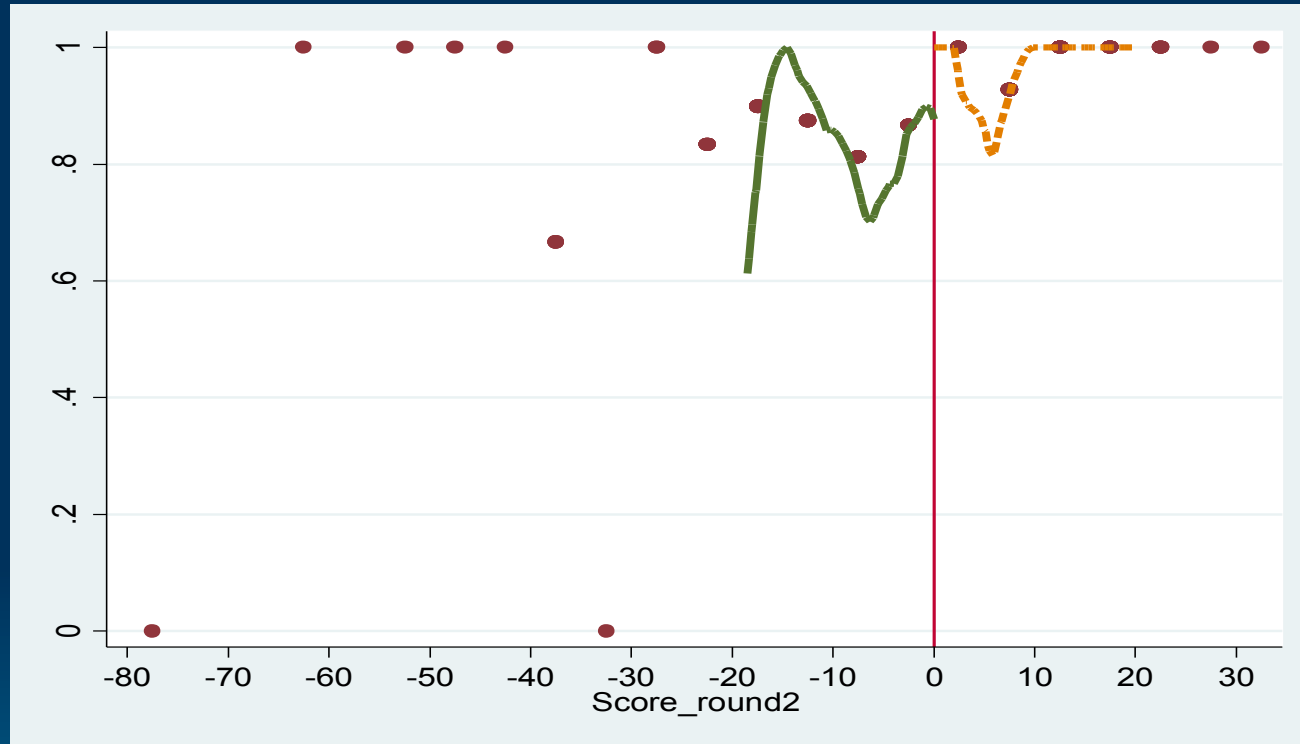
Plot = bins of 5-unit intervals
Line = local linear means within 20-bandwidth sample

Relationship between Normalized Score and Probability of Funded

Note: probability is calculated using Lowess smoother with bandwidth of 0.8