

Disentangling School and Peer Effects: A Non-linear Approach with School Lotteries

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Why Separate School and Peer Effects?

- Designing effective education policy requires understanding how inputs translate into learning
- Separating **peer** and **school** effects is key to evaluating reforms that alter school assignments
 - changes to admission criteria, charter school expansions, school closures/mergers
- **Goals:**
 - Quantify the contributions of peers and schools to learning beyond linear-in-means models
 - Evaluate how school admission reforms affect student outcomes through peers and schools
- **Challenges:**
 1. School assignments and peer composition may correlate with unobserved student ability
 2. Need to flexibly and efficiently summarize the distribution of peer achievement
- **Proposed Solutions:**
 1. Exploit random variation in school assignments and peer composition from DA assignments
 2. Data-driven method to summarize peer achievement distributions → functional PCA

A Flexible Model of Peer Effects that Nests Linear-in-Means

$$y_i = \alpha + \underbrace{\mu_{j_i}}_{\text{school effect}} + \underbrace{\int \beta(r) f_i(r) dr}_{\text{peer effect}} + \varepsilon_i$$

- $f_i(r)$ denotes the distribution of lagged peer achievement, excluding student i
- $\beta(r)$ captures the effect of exposure to peers with achievement r
- r measures the difference between peer and student achievement

Challenge: Peer composition is high-dimensional

- FPCA: Summarize each peer distribution using a small number of estimated factors that maximize explained variation in peer composition
- Three factors explain 92% of variation in peer composition

Identification from School Lotteries

- NYC school assignments are determined by:
 - student rankings, coarse priorities, and random tie-breakers

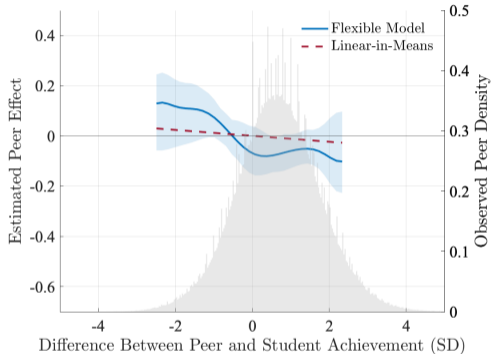
- Conditional on rankings and priorities, assignment differences are driven solely by lottery numbers

- Random tie-breakers generate two sources of quasi-experimental variation:
 1. Random variation in a student's assigned school (Abdulkadiroğlu et al. 2017)
 - A student's tie-breaker may determine admission to schools
 2. Random variation in peer composition within schools
 - Other students' tie-breakers affect who else is admitted to each school

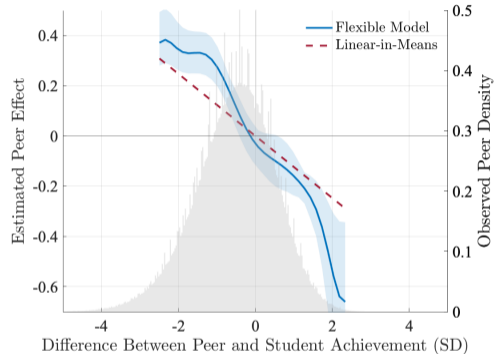
- Summarize confounders using:
 - Assignment propensity scores Abdulkadiroğlu et al., 2017; Rosenbaum and Rubin, 1983
 - Expected peer distributions Borusyak and Hull, 2023

Peer Effects Are Negative, Heterogeneous, and Moderately Non-linear

Low-Achieving Students



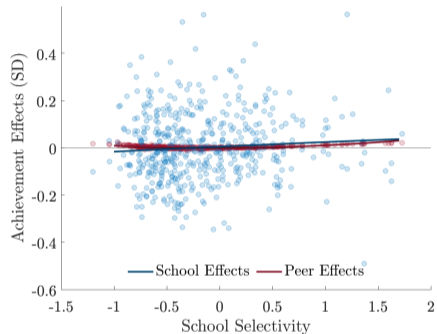
High-Achieving Students



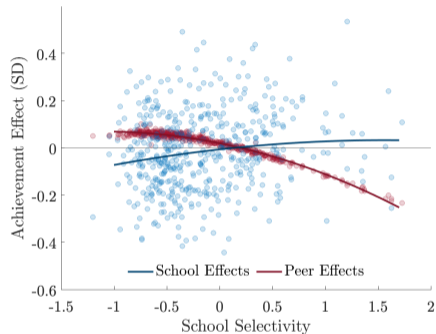
- Higher-achieving peers reduce achievement relative to lower-achieving peers
- Effects exhibit moderate nonlinearities
- Negative peer effects are driven primarily by high-achieving students

School Effects Matter More than Peer Effects

Low-Achieving Students



High-Achieving Students



- Peer effects are limited for low-achieving students
 - Peer effects generate only 6% as much variation in achievement as school effects
- For high-achieving students, school and peer effects work in opposite directions
 - Peer effects generate 37% as much variation in achievement as school effects

Conclusion

- Estimate flexible peer effects and peer-adjusted school effects using quasi-random variation from school lotteries
- 1. Peer effects are negative, moderately nonlinear, and heterogeneous across students
- 2. Given observed peer assignments, school effects remain the dominant source of achievement variation
- 3. Ongoing work: How do school assignment reforms affect learning through peer and school effects?