Application of Regression Discontinuity Design

The impact of tracking in Kenyan primary schools

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Analysis & Evaluation of Public Policies

Outline

Motivation

Introduction

Duflo, E., P. Dupas, & M. Kremer (2011) "Peer Effects, Teacher Incentives, and the Impact of Tracking: Evidence from a Randomized Evaluation in Kenya". In *American Economic Review*, 101: 1739-1774.

'Tracking': splitting up pupils according to prior achievements

- High-achieving pupils are widely regarded to gain from tracking
- Low-achieving pupils should be affected ambiguously
  - ↓ Less direct student-to-student spillovers (Epple et al., 2002).
  - ↑ Indirect effect: Teacher chooses an instruction level closer to pupil's ability (Figlio and Page, 2002; Zimmer, 2003; Lefgren, 2004).
- Mid-achieving pupils are divided by the median → **discontinuity**

Randomized experiment in Kenyan primary schools:

→ Duflo et al. (2011) find that all quartiles receive a net benefit from tracking compared to the control group.

Theoretical model

Model of educational outcome

y_{ij} : The educational outcome of a pupil i in class j, given by

$$y_{ij} = x_i + f(\bar{x}_{-ij}) + g(e_j)h(x_j^* - x_i) + u_{ij} \tag{2.1}$$

Where

x_i : Prior test score of the pupil.

$\bar{x}_{-ij}$: Average score of the other pupils in the class. $f(\bar{x}_{-ij})$: is direct peer effect.

e_j : Teacher's effort. $g(e_j)$ is concave.

x_j^* : The target level of teacher's instructions depending on class test scores. $h(\cdot)$: decreases to 0 when the difference between target and pupil's score is $x_j^* - x_i > \theta$.

u_{ij} : i.i.d. stochastic pupil- and class-specific factors (symmetric, single-peak).

Teacher's utility maximization problem

The teacher decides on effort e^* and target level x^* to **maximize utility**.

$P(x^*, e^*)$: Payoff function of the distribution of pupils' endline test scores.

$c(e^*)$: Cost function of effort (convex).

$\lambda > 1$: Contract teachers receive λ times more payoff than civil service teachers.

The empirical results are **inconsistent** with three special cases:

- No direct peer-effects.
- No teacher response to class composition.
- Teachers payoffs are linear or concave in students' test scores.

Results are **consistent** with a model where:

$\rightarrow$ Class composition has both direct and indirect effects.

$\rightarrow$ Teacher's payoffs are convex in student's test scores $\rightarrow$ target top of class.

Anticipated effects of tracking in general

The indirect effects depend on whether teachers are incentivized to target the top-, median- or low-achievers in a class (unaffected by treatment).

- High-achieving pupils should gain from tracking.
  - ↑ Direct student-to-student spillovers.
  - ↑ Indirect effect: Teacher increases effort and level.
- Low-achieving pupils could be affected ambiguously
  - ↓ Less direct student-to-student spillovers.
  - ↑ Indirect effect: Teacher chooses instruction level closer to pupil's ability.
- Mid-achieving pupils *above* the median could be affected ambiguously
  - ↑ Direct student-to-student spillovers
  - ↑↓ Indirect effect: Teacher might increase effort but also increase instruction level above pupil's ability. Depends on teacher's incentives (initial target).
- Mid-achieving pupils *below* the median could be affected ambiguously
  - ↓ Less direct student-to-student spillovers.
  - ↑↓ Indirect effect: Teacher will lower the instruction level. Direction of effect depends on teacher's incentives.

Effects of tracking in Kenya consistent with empirical results

Incentive to maximize scores at the end of 8^{th} grade $\Rightarrow$ Kenyan teachers target the top-achievers in a class as many low- and medium-achievers drop out.

- High-achieving pupils gain from tracking
  - $\uparrow$ Direct student-to-student spillovers.
  - $\uparrow$ Indirect effect: Teacher increases effort ~~and level~~.
- Low-achieving pupils receive a net gain
  - $\downarrow$ Less direct student-to-student spillovers.
  - $\uparrow$ Indirect effect: Teacher chooses instruction level closer to pupil's ability.
- Mid-achieving pupils *above* the median receive a net gain
  - $\uparrow$ Direct student-to-student spillovers.
  - $\uparrow\downarrow$ Indirect effect: Teacher might increase effort ~~but also increase instruction level above pupil's ability~~. *Teachers initially target top-achievers anyway*.
- Mid-achieving pupils *below* the median receive a net gain
  - $\downarrow$ Less direct student-to-student spillovers.
  - $\uparrow\downarrow$ Indirect effect: Teacher will lower the instruction level. *Positive effect as teacher now targets mid-achievers as they are the top of the new class.*

Background

Primary education in Kenya

Characteristics

- Centralized education system
  - National exams.
  - Curriculum benefitting only high-achieving pupils (Glewwe et al., 2009).
- Most teachers are hired centrally through the civil service
  - Face weak incentives.
- A minority of teachers are hired locally on short-term contracts.
  - Face strong incentives $\rightarrow$ good track record can lead to a civil-service job.
- Kenya recently abolished school fees $\rightarrow$ huge heterogeneity in pupils.
  - Many 1^{st} generation learners.
  - Few have attended preeschools (costly and optional).

Incentives to target teaching to the top of the class

- Scores of own pupils in exit exam: A high rate drop out or repeat grades.
- Parents of top-achievers are more likely to interact with teachers.

Experimental data

Experimental data:

- In 2005 grants secured an extra teacher in 121 primary schools in Western Kenya with a single first-grade class that was split into two smaller classes.
- Random assignment into treatment:

T=1: **Tracking:** Students were assigned to the two classes based on prior test scores, i.e. above median or below median (60 schools).

T=0: **Control group:** Students were randomly assigned to the two classes (61 schools).

Study design

Estimation strategy

Results

Main results

Additional evidence

Concluding remarks

Conclusion

Policy implications

Econometric takeaways

Selection bias is not eliminated by controlling for intial test scores (Manning and Pischke, 2006).

$\rightarrow$ Need matching or experimental data with a low level of non-compliers.

References

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