
Improving Education in the Developing World:

What Have We Learned from Randomized Evaluations?

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Introduction

- Lessons on ways to increase school participation and improve learning
 - Lessons for understanding human capital investment decisions
 - Learning for randomized evaluations themselves
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Outline

- Increasing access
 - Background
 - Cost reductions and subsidies
 - Merit scholarships
 - Providing information on returns
 - School health programs
 - Response to quality improvements
- Improving learning
 - Background
 - Increasing existing inputs
 - Inputs to correct systems distortions
 - Teacher incentives
 - Decentralization and local control
 - School choice
- Implications for policy and research

Tremendous progress in access

- Average years of education and secondary school attendance in low-income countries (Barro and Lee, 2001)
 - 1960: 1.6 years, 14%
 - 2000: 5.2 years, 54%
- 85% of world's primary-school age children in school
 - 100 million remain, mostly in Sub-Saharan Africa and South Asia
 - Most have school nearby

Cost reductions and subsidies

- Free uniforms in Kenya
 - Kremer, Moulin, and Namunyu (2003)
 - Enrollment 0.5 years longer
 - Grade advancement 0.3 grades further
 - Evans, Kremer, and Ngatia (2008)
 - Absence 6 percentage points or 1/3 lower
 - 13 percentage points for students if no uniform pre-program
 - Duflo, Dupas, Kremer, and Sinei (2006)
 - Dropout 2.5 percentage points lower for 6th grade girls from base of 18.5% ; 1.5 percentage points lower for boys from base of 12%
 - Pregnancy rate down by 1.5 percentage points from base of 15%

Conditional cash transfers

- PROGRESA in Mexico
 - Cash transfers (1/4 of hh income) conditional on school attendance
 - Premia for older children and girls
- Impact
 - 11.1 percentage point increase in transition rate to junior secondary school from base of 58% (Schultz, 2004)
 - Girls: 14.8 percentage points
 - Boys: 6.5 percentage points
 - Increase in school re-entry after dropout and decrease in repetition (Behrman, Sengupta, and Todd, 2005)
 - Consistent with increase in student effort

School meals

- CCT programs require monitoring of school attendance
 - Might not always be done accurately
 - Example: India's grain distribution program in schools (Shastry and Linden, 2008)
- School meals automatically condition on attendance
- School meals in community-run Kenyan preschools
 - School participation 8.5 percentage points higher from base of 27% (Kremer and Vermeersch, 2004)

Peer effects

- Attendance spillovers to ineligibles in PROGRESA
 - 2.1 percentage point increase for primary school from base of 76% (Lalive and Cattaneo, 2006)
 - 5 percentage point increase for secondary school from base of 68% (Bobonis and Finan, 2008)
 - Negative spillovers to untreated within the home in a Colombian CCT program, positive to treated friends (Barrera-Osorio et al, 2008)
- Implications for theory
 - Standard model: households trade off value of education against value of children's time in agricultural and household work
 - → If some children go to school, then close substitutes should work more.
 - Evidence of positive spillovers consistent with an alternative model in which children choose between schooling and social activity with peers.

Savings constraints

- Basic CCT program in Bogota
 - Similar impact as PROGRESA on contemporaneous attendance (Barrera-Osorio et al, 2008)
- In variant, part of monthly payment withheld and saved until time to pay school fees following year
 - If families credit constrained → forced savings should reduce value of the subsidy and hence decrease contemporaneous attendance.
 - If saving difficult due to time inconsistent preferences → forced savings could raise enrollment in subsequent year w/o deterring contemporaneous attendance
 - Increased current attendance by 2.8 percentage points from base of 79.4% like basic CCT
 - *And* increased secondary and tertiary school enrollment by 3.6 percentage points (base: 69.8) and 8.8 percentage points (base: 22.7%) following year

Merit scholarships (1)

- Scholarships for 6th grade girls in top 15% on govt exams in western Kenya
 - Girls eligible to compete score 0.19 SD higher (Kremer, Miguel, and Thornton, 2007)
 - Teacher absence lower by 4.8 percentage points (base: 16%)
 - Treatment effect heterogeneity across districts
 - In successful district
 - Student absence lower by 3.2 percentage points (base: 13%)
 - Spillovers to ineligible: boys (0.15 SD) and gains for girls statistically indistinguishable across quartiles

Merit scholarships (2)

- Graduation/matriculation treatment in Colombia CCT program
 - Forced savings treatment + transfer \approx 73% of first year in voc school
 - 5 percentage points higher contemporaneous secondary school attendance (base: 79.3%) (Barrera-Osorio et al, 2008)
 - 49.7 percentage points higher enrollment in tertiary institution in subsequent year (base: 19.3%)

Information on returns to schooling

- 8th grade boys in Dominican Republic
 - Underestimated earnings difference associated with secondary school completion by 25%
 - Providing information about earnings difference
 - Increased enrollment in secondary school next year by 17% (base: 30%) (Jensen, 2007)
 - Increased educational attainment 4 years later by 0.20 years (base: 9.66 yrs)
 - Stronger effects for wealthier students
- 4th graders in Madagascar
 - 3.5 percentage point increase in attendance (base: 85.6%)
 - 0.20 SD increase in test scores
 - Positive test score effect of role model from poor background

School-based health programs

- More than 2 billion people have worms, children especially
 - Cause anemia, lethargy,
 - Drugs are cheap, safe; diagnosis expensive
 - WHO endorsed school-based mass treatment
- School-based mass treatment in Kenyan primary schools (Miguel and Kremer, 2004)
 - Reduced infection rates by 25 percentage points (base: 52%)
 - Reduced absence by 7 percentage points (base: 30%)
 - Health and education externalities to non-treated students, nearby schools

 - Cost per additional year of schooling = \$3.50; benefit/cost ratio > 120
- Non-experimental evidence from U.S. South in early 20th century wages (Bleakley, 2007)
 - 2.1 additional years of school
 - 21 to 40% wage gain
- School-based iron supplementation in India (Bobonis, Miguel, and Sharma, 2004)

Response to school quality

- Generally no attendance/enrollment response to improvements in school quality
 - Counter to standard models of human capital investment
- Exception, adding female teacher in India
 - Extra teacher in non-formal schools in rural India
 - Old staff mostly male; new hires mostly female;
 - Increased girls' attendance by 50% (from base of 4 students)
 - Banerjee, Jacob, Kremer, Lanjouw, and Lanjouw, 2005

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Quality of education often low

- Very low scores on international tests
 - Average science score in Peru equivalent to lowest scoring 5% in US on PISA (Prichett, Hasan, and Filmer, 2006)
- Bangladesh: 58% of rural children 11 and older failed to identify 7 of 8 presented letters
- India: 36% of 6th graders unable to answer: “The dog is black with a white spot on his back and one white leg. The color of the dog is mostly: (a) black, (b) brown, or (c) grey”

Centralized systems

- GDP *per capita* spending on education
 - Much lower in developing countries vs developed
 - 7% vs 18.8% on primary school in 2000 (WDI, 2006)
- Budgets overwhelmingly on teachers
 - Salaries an average of 3.7x GDP/capita (UNESCO, 2005)
 - Account for ¾ of education budgets (Bruns et al, 2003) → high pupil-teacher ratios.
- Weak teacher incentives (Chaudhury et al, 2006)
 - 19% absent from school in 6 country survey on provider absence
 - In India, 25% absent from school; only half teaching
- Inappropriate curricula: many pupils left behind

Reducing pupil-teacher ratios

- Extra Teacher Program in Kenya
 - Gave school committees funds to hire local contract teacher for grades 1 & 2
 - Brought class size down to 46 from 84
 - No test score impact for students assigned to civil service teachers in treatment schools (Duflo, Dupas, and Kremer, 2007)
- Balsakhi Program in urban India
 - Trained woman from community tutors 15-20 lowest performing students outside classroom for 2 hours/day
 - Remaining students have lower PTR but no test score gains relative to comparison classrooms (Banerjee, Cole, Duflo, and Linden, 2007)
- Extra teacher program in non-formal schools in rural India
 - No impact on test scores (Banerjee et al, 2005)
- Influx of students after free uniform provision in Kenya
 - Treatment schools receive 9 additional students (base class size: 27)
 - No impact on test scores (Kremer, Moulin, and Namunyu, 2003)

Increasing non-teacher inputs

- Provision of official government textbooks in rural Kenya
 - No impact on test scores for typical student (Glewwe, Kremer, and Moulin, 2007)
 - No impact on dropout, repetition, or absence
- No impact of flipcharts presenting material from govt curriculum (Glewwe, Kremer, Moulin, and Zitzewitz, 2004)
- In both cases, non-experimental estimates suggest strong positive impact

Systemic distortions

- Extra teacher program in Kenya
 - Contract teachers reduced likelihood that civil service teachers in class and teaching by 12.9 percentage points (base: 58.2%)
- Textbooks
 - Pupils in top 2 quintiles in pre-test score 0.14 - 0.22 SD higher
 - Higher transition rate to secondary school
 - Typical student can't read English textbooks
 - 3 factors leading to mismatch between curriculum and needs of majority:
 - Centralized education system w/ single national curriculum
 - Heterogeneity among students after rapid expansion of education
 - Political dominance of elite

Technology-assisted learning

- Inputs that allow shifts in pedagogy to adapt to weak teacher incentives and to match teaching to students' level
- Nicaragua (Jamison et al, 1981)
 - 1.5 SD increase in math scores after 1 year from radio instruction
 - 1/3 SD increase for supplemental workbooks
- India
 - Computers with math games in primary schools (Banerjee et al, 2006)
 - 0.47 SD increase in math test scores after 2 years
 - Gains of 0.10 SD persist one year after program end
 - Electronic machine or flash cards to teach English (He, Linden, and McLeod, 2007)
 - 0.3 SD increase in English test scores
 - When randomly implemented by teachers rather than NGO workers, spillovers to math

Remedial education

- Balsakhi program
 - Young women from community teach basic literacy and numeracy to 3rd and 4th graders in urban India
 - 0.14 SD increase in test scores in year 1, 0.28 SD increase in year 2 (Banerjee, Cole, Duflo, and Linden, 2006)
 - Greatest gain at bottom of distribution
 - Gains of 0.10 SD persist one year after program end
- Reading intervention in rural India
 - Trained community volunteers for 4 days to teach children to read
 - Children attending camps 22.3 percentage points more likely to read at least several letters and 23.2 percentage points more likely to read at least a word/paragraph (Banerjee, Banerji, Duflo, Glennerster, and Khemani, 2008)

Tracking

- Splitting classes an alternative to adjusting curriculum downward
- Tracking component in Kenyan ETP program
 - Classrooms split in two by pre-test scores in ½ of program schools
 - 0.14 SD test score gains for both high and low ability students (Duflo, Dupas, and Kremer, 2007)
 - RDD: scores of students near median of pre-test independent of assigned track
 - Untracked schools, students benefit from having stronger peers
 - Suggests tracking helps teachers focus material to appropriate level
 - Civil service teachers in tracked schools 11.2 percentage points more likely to be in class teaching than in untracked schools
 - Effect concentrated in above-median track

Teacher compensation based on attendance

- Informal schools in India
 - Cameras for teachers to take pictures with students w/ time-date stamps
 - Pay based on presence documented in photos
 - Impact (Duflo, Hanna, and Ryan, 2007)
 - 21 percentage point decrease in teacher absence rate (base: 44%)
 - No effect on activity while in school
 - 0.17 SD increase in test scores after 1 year
 - 10 percentage point increase in graduation rate to mainstream primary schools (base: 16%)
- Preschools in Kenya
 - Bonuses paid for presence
 - Headmasters gave bonuses regardless of presence (Chen and Kremer, 2001)
 - No impact on teacher attendance

Compensation based on student test scores: Kenya

- Bonus of 21-43% of monthly salary
- Top scoring or most improved schools on annual district exams
- Students absent for exam assigned low score
- Impact
 - Increase in test-taking but no impact on dropout, repetition, or graduation
 - 0.14 SD gain on incentivized tests during program; gains don't persist
 - No improvement on non-incentivized test w/ different format
 - No effect on teacher absence
 - Increase in test-preparation sessions outside of school hours
 - Evidence of improved test-taking techniques
- Teacher seems focused on short-term signaling rather than long-run learning

Compensation based on student test scores: India

- Paid for every percentage point increase in test scores (10 percentage points \approx 30% of monthly salary)
- 0.22 SD test score increase over 2 years (Muralidharan and Sundararaman, 2007)
- No change in teacher absence or activity in classroom
- 38 percentage point increase in test preps (base: 25%)
- Evidence of long-term learning?
 - Spillovers to non-incentivized subjects
 - Equal gains on questions w/ unfamiliar format
 - Program ongoing
- Individual-based and group-based incentives for teachers similar in year 1 but individual incentives worked significantly better in year 2

Local control

- Interventions in rural communities in India (Banerjee et al, 2008)
 - Meetings on school conditions
 - Meetings plus community participation in student testing
 - High household participation but no impact on
 - performance of village education committees
 - school involvement/knowledge of parents
 - teacher (25%) or student absence (50%)
- School committees award teachers in Kenya (de Laat, Kremer, and Vermeersch, 2008)
 - No change in teacher absence
 - Little systematic and significant evidence of changes in pedagogy, student attendance, test scores
 - More educated and older people become committee members over program duration
 - Teacher absence never discussed in meetings w/ parents

Local control

- Extra Teacher Program in Kenya (Dupas, Duflo, and Kremer, 2007)
 - Randomly selected school committees receive training to monitor contract teacher
 - No impact on absence of contract teacher
 - Civil service teachers 7.3 percentage points more like to be in class teaching relative to unmonitored program schools
 - Students w/ monitored civil service teachers relative to program counterparts w/o monitoring
 - Attendance 2.8 percentage points higher (base: 86.1)
 - Score 0.18 SD higher in math
- Summary
 - Mixed evidence on training communities to monitor teachers but no dramatic improvements
 - Effects likely to differ by context

Decentralization

- Pitfalls of mismatches between authority and responsibility under partial decentralization
- Kenyan Harambee system
 - Local school committees pay for construction, central government pays teacher salaries
 - Incentives for local school committees to build many small schools and set fees and requirements higher than what median parent could afford
- Influx of students following provision of free uniforms
 - Median parents prefers combination of lower-costs, more non-teacher inputs, and much higher PTRs
- Multiparty democracy
 - Move towards preferences of median parent
 - Abolition of school fees and surges in enrollment

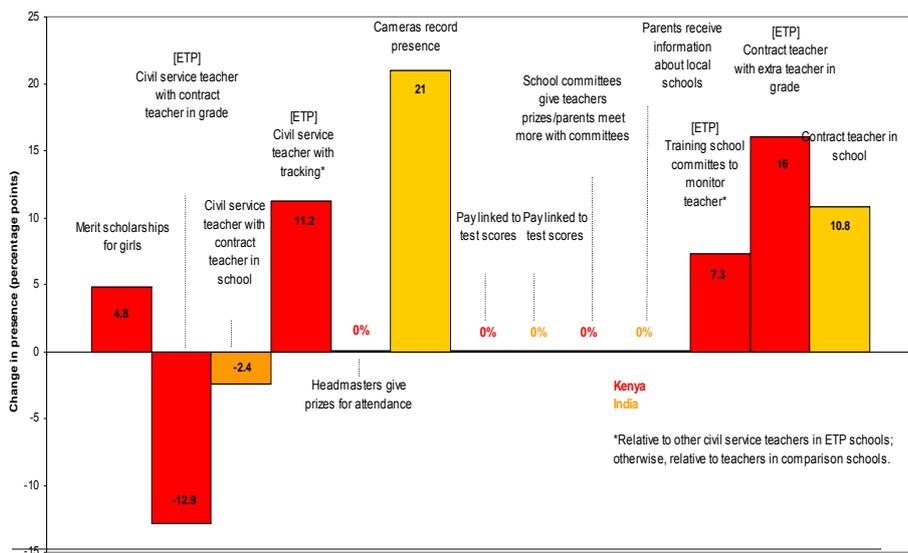
Local hiring of contract teachers

- Extra Teacher Program in Kenya (Duflo, Dupas, and Kremer, 2007)
 - Same qualifications as regular teachers
 - Paid $\frac{1}{4}$ as much
 - 16 percentage points more likely to be in class teaching than civil service teachers in comparison schools (base: 58.2%)
 - 29.1 percentage points more likely than civil service teachers in program schools
 - Students relative to those assigned to civil service teachers in program schools
 - Scored 0.23 SD higher
 - Attended 1.7 percentages points more often (base: 86.1%)

Local hiring of contract teachers

- Program in Andhra Pradesh, India (Muralidharan and Sundararaman, 2008)
 - Much less qualified than civil service teachers
 - Not assigned to particular classroom
 - 10.8 percentage points less likely to be absent (base: 26.8%)
 - 8.4 percentage points more likely to be engaged in teaching activity (base: 39%)
 - 0.12 SD increase in student test scores
 - Civil service teachers in schools w/ contract teachers increase absence by 2.4 percentage points and decreased teaching activity by 3.2 percentage points

Summary of increasing teacher presence



School choice

- School vouchers in Colombia (PACES)
 - Demand for vouchers exceeded supply → lottery
 - Allowed to attend private schools
 - Renewable conditional on satisfactory performance

- Impact
 - Short-run
 - Lottery winners complete 0.12 -0.16 more years of schooling from base of 7.5 yrs, scored 0.2 SD higher on standardized tests, worked 1.2 fewer labor hours/week from base of 4.9 (Angrist et al, 2002)

 - Long-run
 - Winners were 5-7% more likely to graduate high school, on a base of 25-30%; higher test scores (Angrist et al, 2006)

School choice

- General equilibrium effects of school choice?
 - Hsieh and Urquiola, 2006 [+]
 - Gallego, 2006 [-]

- Sorting might not be detrimental to initially weak students
 - Vocational variant of PACES
 - Winners face lower peer quality than losers
 - Improvements in finishing 8th grade, repetition, and test scores (Bettinger, Kremer, and Saavedra 2007)
 - Tracking in Extra Teacher Program in Kenya
 - No significant difference in endline scores between lowest scoring student in high achievement section and highest scoring student in low achievement section (Duflo, Dupas, and Kremer, 2008)

Implications for policy and research

- Quantity
 - Prices and subsidies have large impact on school access
 - Merit scholarships can provide incentives for households to increase investment
 - School health programs and providing information about earnings differences by education levels very low cost ways of improving participation
- Quality
 - Limited impact of increases in existing inputs b/c of systems distortions (teacher incentives, curricula)
 - Changes in pedagogy to work around these distortions (technology-assisted learning, remedial education, tracking) dramatically improve learning at low cost
 - Students learn more when teachers given incentives to attend
 - Under merit pay tied to test scores – gains on incentivized tests, no impact on teacher attendance, increase in exam preps; mixed evidence on long-term learning
 - Limited impact on providing information to communities
 - But locally hired contract teachers cheaper, absent less, and students learn more
 - School choice w/ merit component improves both quantity and quality of schooling, possibly operating on both sides of market

Implications for policy and research

- Different impacts in different years
 - Importance of knowledge depreciation across time (Andrabi, Das, Khwaja, and Zajonc, 2008)
 - Need longer-term follow-ups
- REs typically measure full effect
 - Direct effect on outcome (test scores) + indirect effect on changes in behavior (student, teacher)
 - Important to separate to know welfare effects
 - Recent evaluations moving in this direct
- REs feasible in many settings
 - Collaboration w/ an NGO to examine impact of a variety of policies → dynamic learning process → earlier results influence design of subsequent interventions
 - Series of related interventions
 - Cost-savings in data collection
 - Cost-effectiveness comparisons across program variants

Implications for policy and research

- REs → insight into broader functioning of education systems
 - Textbooks → mismatches in curriculum and needs → developing and testing of tracking

- Omitted variables a serious concern
 - Results from REs can be different from retrospective estimates
 - Bias most likely upward, compensatory programs not prevalent
 - Econometric techniques to deal with OVB can lead to misleading inferences (Urquiola and Verhoogen, 2008; Andrabi et al, 2008; Rothstein, 2008)

- Results also relevant for theory
 - High price elasticity, savings constraints, peer effects, lack of attendance response to improvements in quality
 - Important to supplement standard models of human capital investment w/ insights from behavioral economics
 - Student effort response to merit scholarships, peer effects
 - Children have agency in education decisions