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## 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
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## 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
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## 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 6<sup>th</sup> 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 6<sup>th</sup> 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

- 8<sup>th</sup> 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
- 4<sup>th</sup> 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 20<sup>th</sup> 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 6<sup>th</sup> 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 3<sup>rd</sup> and 4<sup>th</sup> 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

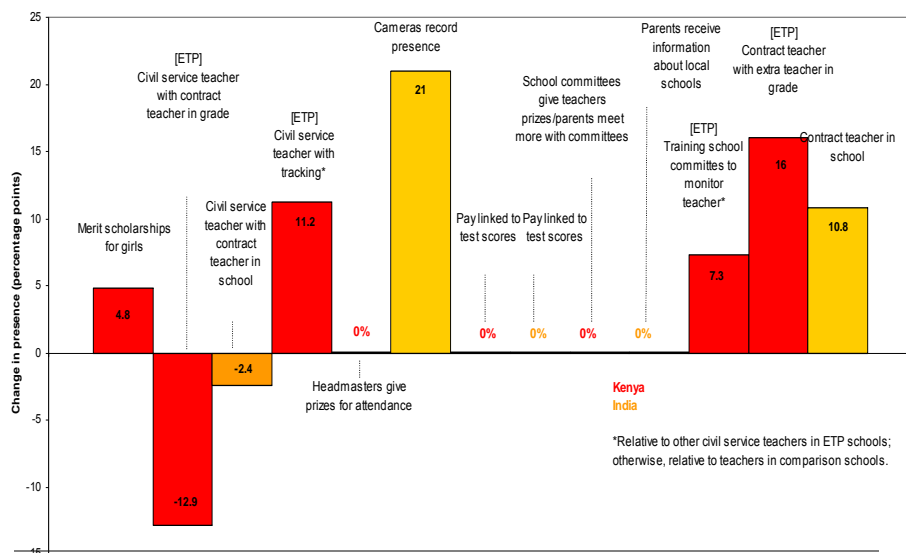
## Local hiring of contract teachers

- 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 8<sup>th</sup> 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