Cognitive Skills and Growth

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Plan for Discussion

• School quality and economic growth
  - Cognitive skills
  - Early versus late investment

• Special policy considerations
  - Basic skills v. advanced skills
  - Tertiary education

• Causation

• Teacher Quality
Human Capital in Empirical Growth

• Simple cross-country growth regressions
  - Enrollment rates

• Wide variety of measurement alternatives
  - Literacy
  - School enrollment and attainment
Years of Schooling and Long Run Economic Growth

coef = 0.581, se = 0.095, t = 6.10
Human Capital in Empirical Growth

• Simple cross-country growth regressions
  - Enrollment rates

• Wide variety of measurement alternatives
  - Literacy
  - School enrollment and attainment

• Cognitive skills
  - Measuring knowledge, not sitting in the classroom
  - International tests of students’ performance in cognitive
    - 12 testing occasions, 36 separate test observations (age levels, subjects)
Cognitive Skills and Economic Growth

coef = 1.980, se = 0.217, t = 9.12
Years of Schooling and Economic Growth

Without quality control:

- Conditional growth vs. Conditional years of education
- Coefficient: 0.5814499, se = 0.0953807, t = 6.1

With quality control:

- Conditional growth vs. Conditional years of education
- Coefficient: 0.0264058, se = 0.07839797, t = 0.34
Rocket Scientists or Basic Education for All?

• Should policy concentrate on lowest or highest achievers?
Rocket Scientists or Basic Education for All?

• Should policy concentrate on lowest or highest achievers?
  - BOTH seem important
  - Rocket scientists more important in developing countries

• Does more tertiary education make sense?
  - Frontier vs. off-frontier
  - No evidence for developing or developed after considering cognitive skills
Estimating the Value of School Reform

- Reform that increases achievement
  - 20 years to reach new levels

- Assume future growth like 1960-2000 growth
  - Holds for former communist members

- Discount future at 3 percent

- Growth without education reform at 1.5 percent

- Calculate present value over lifetime of person born today
  - 80 year expected life
  - 40 year working life
## Present Value of Achievement Gains
### United Kingdom

<table>
<thead>
<tr>
<th>Achievement change</th>
<th>Present value ($billion)</th>
<th>% GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plus $\frac{1}{4}$ standard deviation (Australia, Germany)</td>
<td>$6,862$</td>
<td>268%</td>
</tr>
<tr>
<td>Achievement = Finland (51 PISA points)</td>
<td>$14,982$</td>
<td>630%</td>
</tr>
<tr>
<td>Eliminate “below level 1” (14.4% &lt; 400 PISA)</td>
<td>$9,642$</td>
<td>405%</td>
</tr>
</tbody>
</table>
Do Skills Cause Growth?

• Simple reverse causation

• Omitted factors
  - Institutions (openness, property rights)
  - Regulations
  - Culture
Causation

- **Robustness** of cognitive skills and growth
  - Time period, test measures, country sample, outliers, region

- **IV models**: Variation in cognitive skills driven by school systems
  - exit exams, school choice, Catholic schools

- **DiD model I**: Skill improvement and improved growth

- **DiD model II**: Comparing the impacts of U.S. and home-country education on the U.S. labor market
Policy options

- Spending
Resources and Performance across Countries

Math performance in PISA 2003

Cumulative educational expenditure per student

$R^2 = 0.01$

$R^2 = 0.15$
Policy options

- Spending
- Teacher quality
Teacher Quality

• Strongest evidence on systematic effects

• Not related to common measures

• Observable through both student performance \textit{and} supervisor ratings
# Teacher Effectiveness ($\sigma_w$)

<table>
<thead>
<tr>
<th>Study</th>
<th>Location</th>
<th>Reading</th>
<th>Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockoff (2004)</td>
<td>New Jersey</td>
<td>0.10</td>
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<tr>
<td>Nye, Konstantopoulos, and Hedges (2004)</td>
<td>Tennessee</td>
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<td>Rivkin, Hanushek, and Kain (2005)</td>
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<td>Aaronson, Barrow, and Sander (2007)</td>
<td>Chicago</td>
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<tr>
<td>Kane, Rockoff, and Staiger (2008)</td>
<td>New York City</td>
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<td>Jacob and Lefgren (2008)</td>
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<tr>
<td>Kane and Staiger (2008)</td>
<td>Los Angeles</td>
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<tr>
<td>Koedel and Betts (2009)</td>
<td>San Diego</td>
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<td>0.23</td>
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<tr>
<td>Rothstein (2010)</td>
<td>North Carolina</td>
<td>0.11</td>
<td>0.15</td>
</tr>
<tr>
<td>Hanushek and Rivkin (2010)</td>
<td>Undisclosed city</td>
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<td>0.11</td>
</tr>
<tr>
<td><strong>AVERAGE</strong></td>
<td></td>
<td><strong>0.13</strong></td>
<td><strong>0.17</strong></td>
</tr>
</tbody>
</table>
Alternative Estimates of Least Effective Teachers on Student Achievement

- Finland
- Canada

s.d. performance gain vs. Percent deselected

- high estimate of teacher effectiveness
- low estimate of teacher effectiveness
Conclusions

• Europe 2020
  - Correct to emphasize human capital development
  - Incorrect to headline quantity
    - Reduce dropouts to less than 10 percent
    - 40 percent of 30-34 year olds with tertiary education

• Early versus late investment strategies

• Vocational v. general education

• Huge benefits to quality

• Must deal with myopic pressures of fiscal problems