Economics 172
Issues in African Economic Development

Lecture 6 – February 1, 2007
Health and wealth: cause or effect?

• How can we determine whether poor health is the cause of poverty (as Bloom and Sachs assert) or vice versa?
• This is a difficult problem

• More generally how to interpret $\text{Corr} (A, B) > 0$?
  1. “A causes B”: $A \rightarrow B$
  2. “B causes A”: $B \rightarrow A$
  3. $A \rightarrow B$ and $B \rightarrow A$ simultaneously
  4. Some other factor C causes both: $C \rightarrow A$ and $C \rightarrow B$
  5. The association is purely coincidental (but regression confidence intervals help address this)
Another approach: analysis with “micro-data”

- Both Bloom and Sachs (1998) and AJR (2001) focus on broad country-level historical trends
- But establishing causality and theoretical channels is exceedingly difficult in that setting

- Another approach uses data at the level of individuals, communities, or firms to test theories about the link between health and wealth
- Problem Set #1 features some analysis of this kind

• Education is a possible channel linking health, income

Poor health  Lower income

- Education is a possible channel linking health, income

- Education

- Poor health

- Lower income

- Worms are among the world’s most prevalent diseases:

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<tr>
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Figure 1. The global distribution of (a) *Ascaris lumbricoides*, (b) *Trichuris trichiura* and (c) hookworm. White areas represent countries not included in the present analysis. Data obtained from [http://www.fic.nih.gov/dcpp/dcp2.html](http://www.fic.nih.gov/dcpp/dcp2.html)

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- Health and nutritional consequences – anemia, weakness, listlessness, stunting, wasting, stomach pain – especially for heavy infections

- Transmission of worm infections through poor hygiene, sanitation. Eliminating one person’s infection may reduce transmission to others: “externalities” / spillovers

• Transmission of worm infections through poor hygiene, sanitation. Eliminating one person’s infection may reduce transmission to others: “externalities” / spillovers

• Treatment is cheap (<US$1 per year)
  – Drugs: albendazole, praziquantel
Health and education: cause or effect?

What is the impact of worm infections on education?
Health and education: cause or effect?

- What is the impact of worm infections on education?

- In data, children with worse worm infections tend to have worse educational performance than other children

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  1. “A causes B”: $\text{Health} \rightarrow \text{Education}$
  2. “B causes A”: $\text{Education} \rightarrow \text{Health}$
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Omitted variable bias in OLS
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(1) \[ Y_i = a + bW_i + cX_i + e_i \]
Omitted variable bias in OLS

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- \(Y\): educational outcome (e.g., school attendance)
- \(W\): indicator variable (=0 or 1) for having worms
- \(X\): child characteristic (e.g., home socioeconomic status)
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e: white noise “error/disturbance” term, \( E(e) = 0 \)
i: denotes person “i” in the population, i from 1, …, N
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(1) \[ Y_i = a + bW_i + cX_i + e_i \]

Expectations ("average") of the outcome for different cases:
1. \[ E(Y_i | W_i=1, X_i=1) = ? \]
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(1) \[ Y_i = a + bW_i + cX_i + e_i \]

(2) \[ E(Y_i \mid W_i=1) - E(Y_i \mid W_i=0) \]
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\[ = [a + b + cE(X_i | W_i=1) + E(e_i | W_i=1)] \]
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*True effect*  
“Omitted variable/selection bias” term
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  1) Collect information on $X$
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     \textit{“Experimental” variation in variables of interest}
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    \[ c = 0 \]

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    \textit{“Experimental” variation in variables of interest}

• If treatment with deworming drugs is assigned “randomly”, and reduces worm infection, then the reduction in worms should be uncorrelated with $X$

- Primary School Deworming Project (PSDP) in Kenya

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• Randomized evaluation design: Three steps
  (i) Schools divided by geographic zone, (ii) alphabetized,
  (iii) divided into three groups (1-2-3, 1-2-3, etc.)

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<tr>
<th>Group</th>
<th>1998</th>
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</tr>
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<tbody>
<tr>
<td>Group 1 (25 schools)</td>
<td>Treatment</td>
<td>Treatment</td>
</tr>
<tr>
<td>Group 2 (25 schools)</td>
<td>Comparison</td>
<td>Treatment</td>
</tr>
<tr>
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## PSDP Baseline differences (1998)

<table>
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<tr>
<th>Group</th>
<th>Average</th>
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</tr>
<tr>
<td>Latrine at home</td>
<td>0.82</td>
<td>0.81</td>
<td>0.82</td>
</tr>
<tr>
<td>Livestock at home</td>
<td>0.66</td>
<td>0.67</td>
<td>0.66</td>
</tr>
<tr>
<td>Child sick often</td>
<td>0.10</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>(self-reported)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996 exam score</td>
<td>-0.10</td>
<td>0.09</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(normalized mean 0, s.d. 1)</td>
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Program impacts

• Three types of analysis:
  (1) Direct treatment effects: simple difference between treatment and comparison schools
  (2) Within-school externality impacts
  (3) Cross-school externality impacts
# Health, nutrition impacts (1999)

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<th>Group 2</th>
<th>G1–G2</th>
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<tr>
<td>Rate of moderate-heavy infection</td>
<td>0.27</td>
<td>0.52</td>
<td>-0.25*</td>
</tr>
<tr>
<td>Sick in past week</td>
<td>0.41</td>
<td>0.45</td>
<td>-0.04*</td>
</tr>
<tr>
<td>Height for age (Z-score)</td>
<td>-1.13</td>
<td>-1.22</td>
<td>0.09*</td>
</tr>
<tr>
<td>Hemoglobin (Hb)</td>
<td>124.8</td>
<td>123.2</td>
<td>1.6</td>
</tr>
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Within-school infection externalities (1999)

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<th>Group 2</th>
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<td>Rate of moderate-heavy Infection, 1999</td>
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Cross-school infection externalities (1999)

• Large reductions in moderate-heavy infection levels within 6 km of treatment schools in 1999
Cross-school infection externalities (1999)

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• An average reduction in moderate-heavy infections of 23 percentage points in the study area can be attributed to cross-school externalities
Educational impacts – school participation

- “School participation” data collected by enumerators during unannounced primary school visits
Educational impacts – school participation

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<th>Group 3 (C)</th>
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<td>Younger girls, and all boys</td>
<td>0.84</td>
<td>0.73</td>
</tr>
<tr>
<td>Older girls ($\geq$ 13 years)</td>
<td>0.86</td>
<td>0.80</td>
</tr>
<tr>
<td>Pre-school, Grades 1-2</td>
<td>0.80</td>
<td>0.69</td>
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<tr>
<td>Grades 6-8</td>
<td>0.93</td>
<td>0.86</td>
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Educational impacts – academic tests

• Standardized academic exams administered in grades 3-8 in 1998 and 1999

• Why might deworming affect test scores?
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  2) Greater efficiency of learning (+)
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  – Congestion effects in the classroom
  – Time lags
Cost-benefit calculations
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- Cost of this program: US$1.46 per pupil per year
- Cost of a larger-scale program in neighboring Tanzania: only US$0.49 per pupil per year
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- Deworming as a human capital investment:
  Health gains $\rightarrow$ More schooling $\rightarrow$ Higher adult wages
Cost-benefit calculations

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- Deworming led to 7% gain in school participation
- Previous study: each year of school → 7% higher wages
- Take these gains in wages (7% x 7%) over 40 years in the workforce, discounted 5% per year
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→ Deworming benefits are at least three times (3x) as large as treatment costs (using the Tanzania costs)
Given the returns, why is take-up not 100%?
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• Possible explanations:
  (1) Free-riding / externalities
    -- Strong evidence people learned through their social network that the drugs were “not effective”
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  1. Free-riding / externalities
     -- Strong evidence people learned through their social network that the drugs were “not effective”
  2. Socio-cultural explanations / resistance to new technologies (evidence from anthropology)
The Impact of Higher Drug Costs

- In 1998, 1999, 2000 deworming was given for free
- In 2001, parents in 25 randomly chosen Group 1 and Group 2 schools paid US$0.10-0.30 per child
The Impact of Higher Drug Costs

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- 2001 deworming take-up:
  Free-treatment schools: 75%
  Cost-sharing schools: 18%
• For next time: Read Miguel (2005)