Health and Economic Growth

Health Economics
Bill Evans
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Preston Curve

- Suggestive of a causal link – greater economic success increases life expectancy
- Could also suggest health is key to development – economies grow with a healthy population
- Belief by many that poor health is holding back the development of many countries – especially in Africa

Many interesting questions

- Role of rising incomes?
- What do those rising incomes purchase that allows mortality to fall?
- Can you “jump start” the change in mortality?
- Q we are going to consider is a little different – does health detract from growth and can a healthier population improve economic returns?
  - Some suggestive evidence from previous section
Case study: Malaria

- **Burden**
  - 300-500 million cases per year
  - 1-3 million fatalities, mostly children
  - 90% of malaria mortality in Africa
- **Centered on tropics**
  - Transmission less likely when temp <18°C (64.4)
  - Parasite dies at 16°C (60.8)
- **Has been successfully eradicated in the US**

Jeff Sachs

- “...malaria not only takes an enormous human toll in Africa, but also contributes to an enormous economic loss and is a barrier to economic growth. Investments in malaria control thus offer an enormous return in lives saved and in economic benefits for Africa.”
What we do in this lecture

• Isolate pathways through which health can impact growth. Provide:
  – Theoretical link
  – Empirical evidence for each of these links
  – Emphasis on historical data
• Some examples – rapid changes in mortality – does it impact health?

Bloom and Canning

4 pathways linking health to growth
1. Productivity
2. Education
3. Investments in Physical Capital
4. Demographic dividend

Health and productivity

• Many good papers demonstrate a link between health shocks and
  – Contemporaneous productivity
  – Productivity later in life
• Much from developing country
• One quick example from the US -- 1918 Flu epidemic

1918 Flu Epidemic

• Spanish flu
• World wide epidemic
  – Killed 30-50 million, 675K in the US
• Those particularly vulnerable
  – Children
  – Compromised immune system
  – Pregnant women
Fig. 1: All cause mortality

- Mortality rates shown are adjusted to standard population of U.S. in 1940.

Fig. 2: Cardiovascular disease (1982-1996) and mean height (1841-1942) by birth year. (a) National Health Interview Surveys (NHIS) of 1982-1996 (U.S.A.), shown as unadjusted, or adjusted for cohort trend and year for sample aged 60 to 82 years. (b) Male height at ages 19 to 37 years, by birth year, at enrollment in 1941 and 1942. From the National Archives and Records Administration (numbers of respondents in parentheses).
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Evidence: Rise of Crack Cocaine

- Crack enters in 1982 on coasts – spreads to the center of the country
- Devastating to young black males
  - 2x ↑ murder rate
  - 4x ↑ in incarceration rates
- Human capital models – should see ↓ investment
  - ↓ life expectancy
  - ↓ job prospects (due to prison records)
  - ↑ “outside” option

When Crack Arrives

- 1982: NY, LA, Miami
- 1983: Atlanta, Riverside, SF
- 1984: Seattle, Tampa, San Jose, Ft. Lauderdale
- 1985: Detroit, Houston, KC, Orange Co., Philly, DC
- 1986: Boston, Chicago, Cleveland, Indy, Memphis, MSP, New Orleans, Newark, Sacramento
- 1987: Dallas, Portland, Milwaukee, Hartford, Newark, Providence, Greensboro/WS

Murder rates black males 57 cities

- Ages 25-39 yrs (LH axis)
- Ages 15-24 yrs (LH axis)
- Ages 40+ yrs (RH axis)
Are there other situations where there are rapid changes in mortality that one can use in the same manor?

Bloom and Canning

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Figure 1: Saving as a share of household income, 1950-2009. Source: Modigliani and Cao (2004) and the China Statistical Yearbook (various issues).
Alternate hypothesis: Black Plague

- Plague strikes Europe 1348-1350
- Carried by fleas living on black rats
- Shipping routes spread the disease quickly
- Kills 75 – 200 million
- Reduces pre-plague population in England by 50%
Consequences

- Europe in 1300s was mired in stagnant wages and high population
- Massive decline in population increased value of labor
- Jump-started income growth in Europe
- Young: “Gift of Dying.” Argues the same for Africa and AIDS

Acemoglu and Johnson (JPE)

- International epidemiological transition
  -Began in 1940
  -Large improvements world wide in life expectancy
- Three factors
  -Drugs (mass production of penicillin, antibiotics), vaccines (polio, measles, etc.), DDT
  -WHO
  -Change in universal values – encouraged spread of changes to poor countries
- IDT was “technology” based
- Therefore – it impacted poor countries the most (impacted those most in need)
- Exogenous change in mortality
- Since it impacted poor countries the most, we should see a greater change in GDP for this group if health has an impact on the economy
Explaining results

• Drop in mortality increases population
• Should increase output
• BUT -- because capital is fixed
  – Capital used more intensely
  – Productivity declines, reduces wages
• Growth in output from more people is not enough to compensate for loss in productivity per worker
• Black plague argument
Bleakley – Hookworm Removal in South

- Intestinal parasite, absorbs nutrients
- Symptoms: lethargy and anemia
- Death is rare
- Hookworm eventually dies, but re-infection high
- Two ways to reduce harm
  - Treatment (cheap de-worming medicine)
  - Prevention (reduced exposure to fecal matter)

Rockefeller Sanitation Commission

- Formed in 1910
- Goal – eradicate hookworm in the US
- Dr. Charles Stiles convinced Rockefeller of the problem
- Surveyed 600 counties in south
- Found 40% hookworm infection rate among kids

Campaign

- Primary period was 1910-15
- Treated over 400K with de-worming medicine
- Educated doctors to recognize disease
- Public education about prevention
- Program eventually taken over by state/local governments

TABLE 5

| Life Expectancy, GDP, GDP per capita, and GDP per working age population: OLS Estimates |
|---------------------------------|-----------------|---------------|-----------------|-----------------|
| Whole World: Just 1900 and 2000 | Base Sample: Just 1900 | Base Sample: Just 1940 | Base Sample: Just 1980 | Base Sample: Just 1900 and 2000 |
| Log life expectancy | .17 | .15 | .78 | .05 | .85 | .43 |
| Number of countries | 120 | 59 | 47 | 36 | 47 | 36 |

A. Dependent Variable: Log GDP

| Log life expectancy | -.42 | -.19 | -.81 | -1.12 | -1.14 | -1.79 |
| Number of countries | 120 | 59 | 47 | 36 | 47 | 36 |

B. Dependent Variable: Log GDP per Capita
Questions

• Did campaign reduce hookworm incidence?
• Did campaign improve educational outcomes?

Research Strategy

• Hookworm infection rates differ across areas
• Areas with high infection rates should benefit more from the campaign
• Basic difference-in-difference model
  – Low infection rate areas – treated
  – High infection rates are control
• Sound familiar?

Econometric model

\[ Y_{ip} = (H_j^{p} \times Post_j)\beta + \delta_i + \gamma_j + \text{X}_{ip} \Gamma + \epsilon_{ip} \]

- person i, area j, time t
- \(Y_{ip}\) outcome (like enrolled in school)
- \(Post_j = 1\) after 1915
- \(H_j^{p}\) = hookworm incidence rate before 1910
- \(\delta_i\) and \(\gamma_j\) are time and area effects
- \(X_{ip}\) are control variables
A high pre-intervention infection rate is 50%. 0.5 * 0.0883 = 0.04 – an increase in school enrollment rates of 4 percentage points.

**Falsification test**

- Hookworms are thought to alter outcomes for children
- Suppose we look at adults over the same time period
- Should they be impacted by the intervention?

First row, first column: 50% infection rate, 10 years of exposure
0.50(0.029) = 0.145 or a 14.5% increase in earnings
Why the disparity in results?

- Bleakley shows convincing evidence of growth in outcomes later in life given medical advances in early life
- Similar results from 1918 Flu
- What is different about Acemoglu and Johnson?

Cutler et al., Malaria Eradication in India

- Will reductions in Malaria necessarily lead to higher education?
- What are definitive predictions about outcomes?
  - Income/consumption
  - Education?

Malaria Eradication in India

- National Malaria Control Program launched April of 1953
- Heavy use of DDT
  - Effective, nontoxic for humans, cheap
  - Eradicated malaria in Taiwan, Caribbean, Balkans, parts of North Africa, north Australia, large parts of South Pacific
- Prior to program, 75 million annual cases in India and 800K annual deaths (~350 million people)
• Two annual rounds of spraying
  – 1/3 of country initially part of program
  – Program reformulated in 1958
  – Whole country part of program in 1960-61
• Strategy – Difference-in-Difference
  – Compare outcomes of groups – some born before and after eradication program
  – Variation in timing of program across regions
  – Some areas had higher pre-treatment malaria rates so allow treatment to vary

Model

\[ y_{icd} = x_{icd} \gamma + POST_i \times Malaria_d \beta + \delta_t + \alpha_c + \epsilon_{icd} \]

\( i = \text{person}, \ c = \text{cohort}, \ d = \text{district} \)

\( y = \text{outcome} \)

\( x = \text{covariates} \)

\( POST_i = 1 \text{ if cohort was born after eradication program} \)

\( Malaria_d = \text{malaria incidence rate prior to program} \)

\( \alpha_c = \text{district effects} \)

\( \delta_t = \text{cohort effects} \)

Figure 2: Malaria Eradication Map
## Table 2—Childhood Malaria Exposure and Human Capital Attainment

<table>
<thead>
<tr>
<th></th>
<th>Litteracy (ages 15–74)</th>
<th>Primary school (ages 15–75)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>A. Districts classified by average malaria category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post × malaria index</td>
<td>0.007</td>
<td>0.004</td>
</tr>
<tr>
<td>Observations</td>
<td>111,139</td>
<td>111,139</td>
</tr>
<tr>
<td>State × post fixed effects</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Region × post fixed effects</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>District-specific linear trends</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

B. Districts classified by average malaria category

| Post × malaria index    | 0.003                   | 0.002                       | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| Observations            | 107,472                 | 107,472                     | 107,472 | 107,472 | 107,472 | 107,472 | 107,472 | 107,472 |
| State × post fixed effects | X                      | X                           | X     | X     | X     | X     | X     |
| Region × post fixed effects | X                      | X                           | X     | X     | X     | X     |
| District-specific linear trends | X                      | X                           | X     | X     | X     | X     |

A includes results for males, B for females.

## Table 3—Childhood Malaria Exposure and Adult Economic Status

<table>
<thead>
<tr>
<th></th>
<th>Log per capita household expenditure (ages 20–60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>A. Districts classified by average malaria category</td>
<td></td>
</tr>
<tr>
<td>Post × malaria index</td>
<td>0.008</td>
</tr>
<tr>
<td>Observations</td>
<td>75,230</td>
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<tr>
<td>State × post fixed effects</td>
<td>X</td>
</tr>
<tr>
<td>Region × post fixed effects</td>
<td>X</td>
</tr>
<tr>
<td>District-specific linear trends</td>
<td>X</td>
</tr>
</tbody>
</table>

B. Districts classified by average malaria category

| Post × malaria index    | 0.005 | 0.005 | 0.005 | 0.005 |
| Observations            | 75,212 | 75,212 | 75,212 | 75,212 |
| State × post fixed effects | X         | X       | X     | X     |
| Region × post fixed effects | X         | X       | X     | X     |
| District-specific linear trends | X         | X       | X     | X     |

A includes results for males, B for females.