Population Health and Economic Growth

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Figure 1
Life Expectancy vs. Income, 2004


Note: The circled outliers, from lower to higher income, are Botswana and South Africa
Health and income: the traditional view

- Health
  - Biomedical technology, population policy, contraceptive technology, climate, geography, environmental policy

- Income
  - Technological change, terms of trade, geographic barriers to trade, climate

- Capital
  - Government savings, world interest rates, rates of time preference
Health and income: a new paradigm

Health

Biomedical technology, population policy, contraceptive technology, climate, geography, environmental policy

Income

Technological change, terms of trade, geographic barriers to trade, climate

Capital

Government savings, world interest rates, rates of time preference
Health to Wealth: Mechanisms

- Productivity of healthier workers
- Increased returns to education
- Longevity and savings
- Demographic effects

- Long run effects of early childhood health
  - Physical and cognitive development
Determinants of Health

- Nutrition
- Public Health - water and sanitation
- Medical Treatment

- Income -> Health
- “Technological Progress”
- Possibility of high levels of health in poor countries. China, Cuba, Kerala.
Health and Welfare

• Health and Longevity contribute directly to human welfare.
• Large increase in life expectancy in the last 50 years.
• Welfare gain from longer life spans have been about as large as from income gains (using value of life estimates).
Evidence Base for Health to Wealth Effects

Recurring Difficulties

• Measurement of Health
• Direction of Causality
• Timing and Lagged Effects
• Partial Versus General Equilibrium Effects
Micro Evidence: Expanded Idea of Human Capital

• Mincer – Human Capital is years of education plus work experience
  • large literature
• Addition of Health as a form of Human Capital
• Productivity and wages depend on health as well as education
Measurement of Health Capital

- Functional Limitations
- Self Reported Health
- Medical Records
- Bio markers
- Anthropometrics
- Cognitive Ability
Health Inputs and Health Capital

• Health Capital is the result of several factors
• Genetic, environmental, work, nutrition.
• We are interested in the effect of policy.
• Health inputs -> health capital-> worker productivity.

• We should measure only the effects of produced health not innate health
Health, Height and Wages

• Height gains due to improved childhood health and nutrition increase the wages of adults.
• Gains of 4%-8% in wages for each centimeter gained due to inputs.
• Height increases by about 10 centimeters over the course of development.
Experiments

• Natural Experiments
  – Hookworm eradication
  – Malaria eradication

• Real Experiments
  – Iron Supplementation
  – Deworming
Health, Cognitive Ability, and Education

• Evidence that health affects children’s cognitive ability and school attendance.
• Family sickness can keep girls at home.
• Higher survival rates increase time to earn a reward from education.
• Potentially large effects
  – long time lag
  – include induced education in health effect?
Health and Saving

• Longer life spans change life cycle behavior – saving for retirement
• Effect depends on social security system – retirement incentives, fully funded, payg
• Age structure effects affect national savings rates
• Investment effects – agriculture, FDI
Health and Demography

- Infant mortality declines first
- Population growth – baby boom
- Fertility response
  - Demographic Transition
- Population stabilizes
- Age structure effects
  - Demographic dividend
Sub-Saharan Africa’s population
East Asia's Population

Population (millions)

Age group

Year

1950

1975

2000

2025

2050

0 - 4
10 - 14
20 - 24
30 - 34
40 - 44
50 - 54
60 - 64
70 - 74
80 - 84
90 - 94
100 +
Health and Macroeconomics

- Mortality Measures are predictive of economic growth.
- Two approaches:
  - calibrate based on micro estimates
  - Direct estimation of the macroeconomic relationship
- Estimated macro effects tend to be larger than calibration results.
Linking Micro and Macro

- Health measures are different
- Morbidity (micro) versus mortality (macro)
- Mortality data is weak in developing countries
- Can we assume morbidity (heights) and mortality rates move together?
Table 1
Regional Time Trends in Adult Height, Infant Mortality, and Nutrition, 1961-1985

<table>
<thead>
<tr>
<th>Region</th>
<th>Adult Height</th>
<th>Infant Mortality Rate</th>
<th>Calories per capita per day</th>
<th>Protein grams per capita per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>-0.021***</td>
<td>-2.120***</td>
<td>0.394 (0.820)</td>
<td>-0.019 (0.025)</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.052)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Developing Countries</td>
<td>0.066***</td>
<td>-2.359***</td>
<td>16.488*** (0.795)</td>
<td>0.333*** (0.022)</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.037)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Macro Estimation

- Health is significant in growth regressions
  - without really trying
- Estimated effects are large
  - Each year of life expectancy increases steady state output by about 2.5%
  - Effect is slow to mature: convergence model
  - Average of many studies
Table 2
Annual Growth Rate of Per Capita Income, 1960–2000
(by income per capita and infant mortality rate, 1960)

<table>
<thead>
<tr>
<th>Initial Infant Mortality Rate, 1960</th>
<th>IMR ≤ 50</th>
<th>50 &lt; IMR ≤ 100</th>
<th>100 &lt; IMR ≤ 150</th>
<th>IMR &gt; 150</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP ≤ $1000</td>
<td>–</td>
<td>3.9 (1)</td>
<td>2.0 (11)</td>
<td>0.8 (9)</td>
</tr>
<tr>
<td>$1,000 &lt; GDP ≤ $2,000</td>
<td>–</td>
<td>4.8 (3)</td>
<td>1.5 (7)</td>
<td>0.5 (7)</td>
</tr>
<tr>
<td>$2,000 &lt; GDP &lt; $3,500</td>
<td>–</td>
<td>1.6 (6)</td>
<td>1.7 (6)</td>
<td>1.0 (4)</td>
</tr>
<tr>
<td>$3,500 &lt; GDP ≤ $7,000</td>
<td>3.5 (6)</td>
<td>2.1 (9)</td>
<td>0.7 (2)</td>
<td>1.0 (1)</td>
</tr>
<tr>
<td>GDP &gt; $7,000</td>
<td>2.5 (17)</td>
<td>0.9 (1)</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Is Effect Causal?

• Heath could be a proxy for some hidden variable.
  – Colonial Development

• Test Robustness of the result to inclusion of other variables.

• Do health improvements lead to increases in income?
Estimate all possible growth regressions

• Estimate all growth regressions for a fixed size and Bayesian update our beliefs.
• Sala-i-Martin et. al. use 67 possible variables
• Malaria and Life expectancy rank 7\textsuperscript{th} and 8\textsuperscript{th} in terms of robustly predicting growth.
• Top 5: East Asia dummy, primary education, investment price, initial income, and fraction tropical.
Health and Tropical Disease

• Malaria appears to have an effect on growth over and above its mortality effect
  – Long term consequences of childhood exposure
• Tropical diseases can have large effects on cognitive development, and energy levels without affecting mortality or disability.
• Not a priority for the health sector – neglected diseases.
• Some tropical diseases are very cheap to eliminate through mass chemotherapy
<table>
<thead>
<tr>
<th>Region</th>
<th>Trichuriasis</th>
<th>Ascariasis</th>
<th>Hookworm</th>
<th>Schistosomiasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America and Caribbean</td>
<td>19%</td>
<td>16%</td>
<td>10%</td>
<td>4%</td>
</tr>
<tr>
<td>Sub Sharan Africa</td>
<td>24%</td>
<td>25%</td>
<td>29%</td>
<td>29%</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>2%</td>
<td>7%</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td>South Asia</td>
<td>20%</td>
<td>27%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>7%</td>
<td>14%</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>East Asia and the Pacific</td>
<td>28%</td>
<td>36%</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>17%</td>
<td>39%</td>
<td>16%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
Health and HIV

• HIV is reversing the life expectancy gains in Sub-Saharan Africa and the Caribbean.
• Effects on income per capita so far small.
• Large welfare effect.
• Large potential long term effects.
• Prevention is much more cost effective than treatment at reducing the HIV/AIDS burden.