Development economics

Lecture 9: Health, nutrition and development (human capital)

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Where are we on our path?

- Lectures
  1. Introduction
  2. Traditional growth models
  3. Modern (endogenous) growth models
  4. Taking stock on growth models and poverty traps
  5. Games in economic development
  6. Measuring poverty and inequality
  7. Group differences and discrimination
  8. Culture, institutions, and the role of history
  9. **Health and nutrition**
  10. Education
  11. The role of foreign aid
  12. Credit markets and microcredit
  13. Risk and insurance
  14. Behavioral development economics

Health statistics

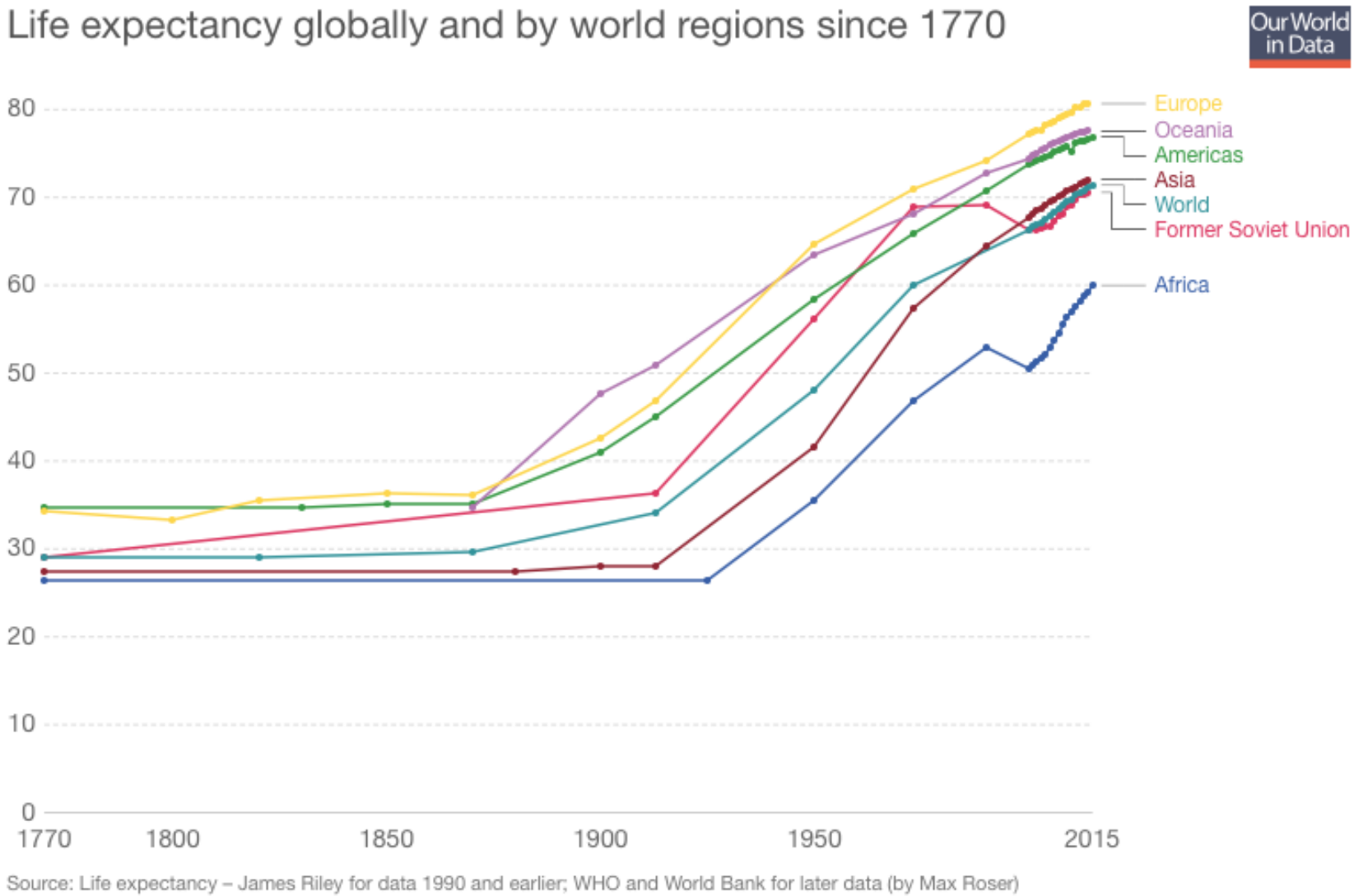
Health and economic development

Demand for health (and formalizing RCTs)

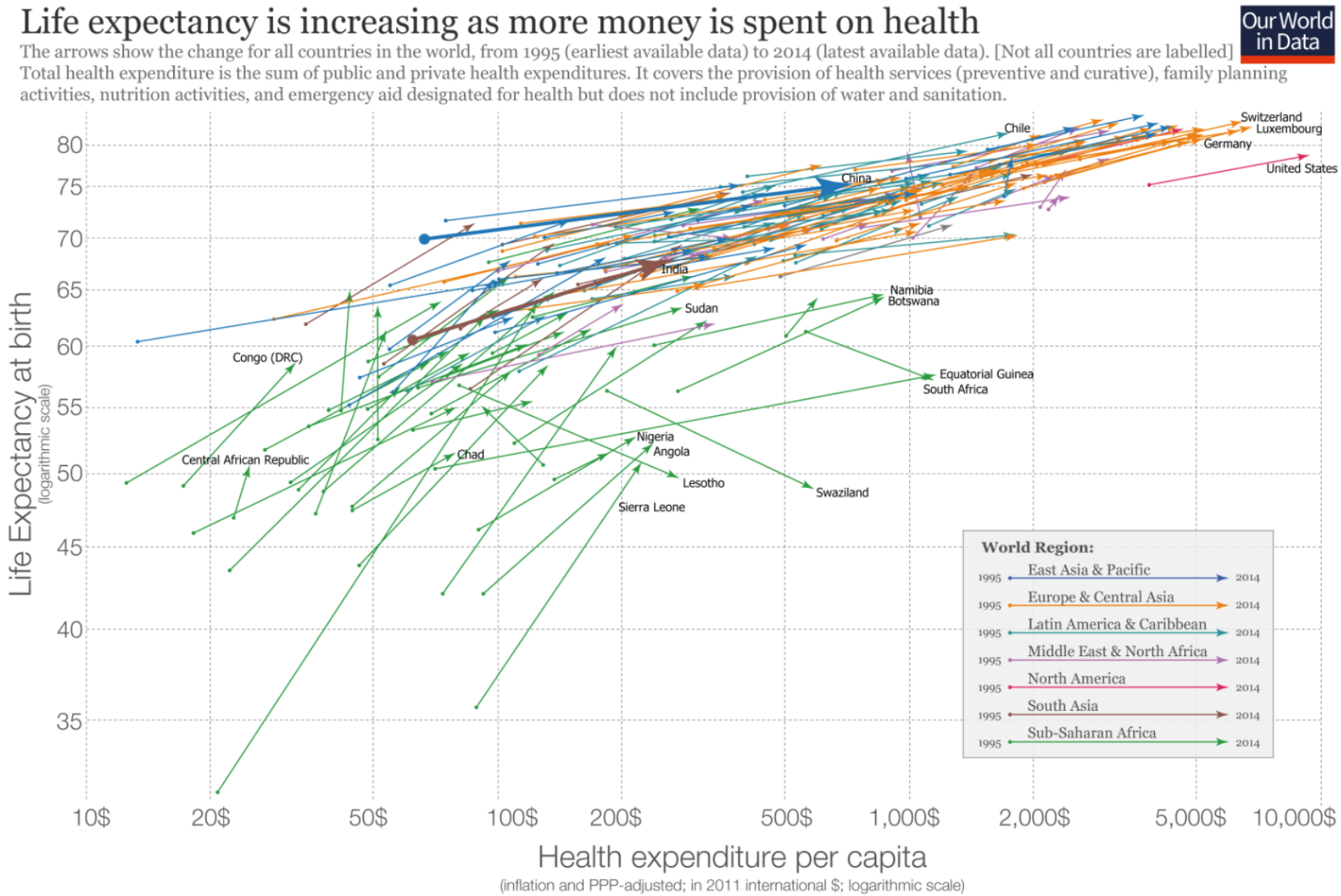
Nutrition and development

Hidden hunger

Health Statistics (World Bank)



Health Statistics (World Bank)



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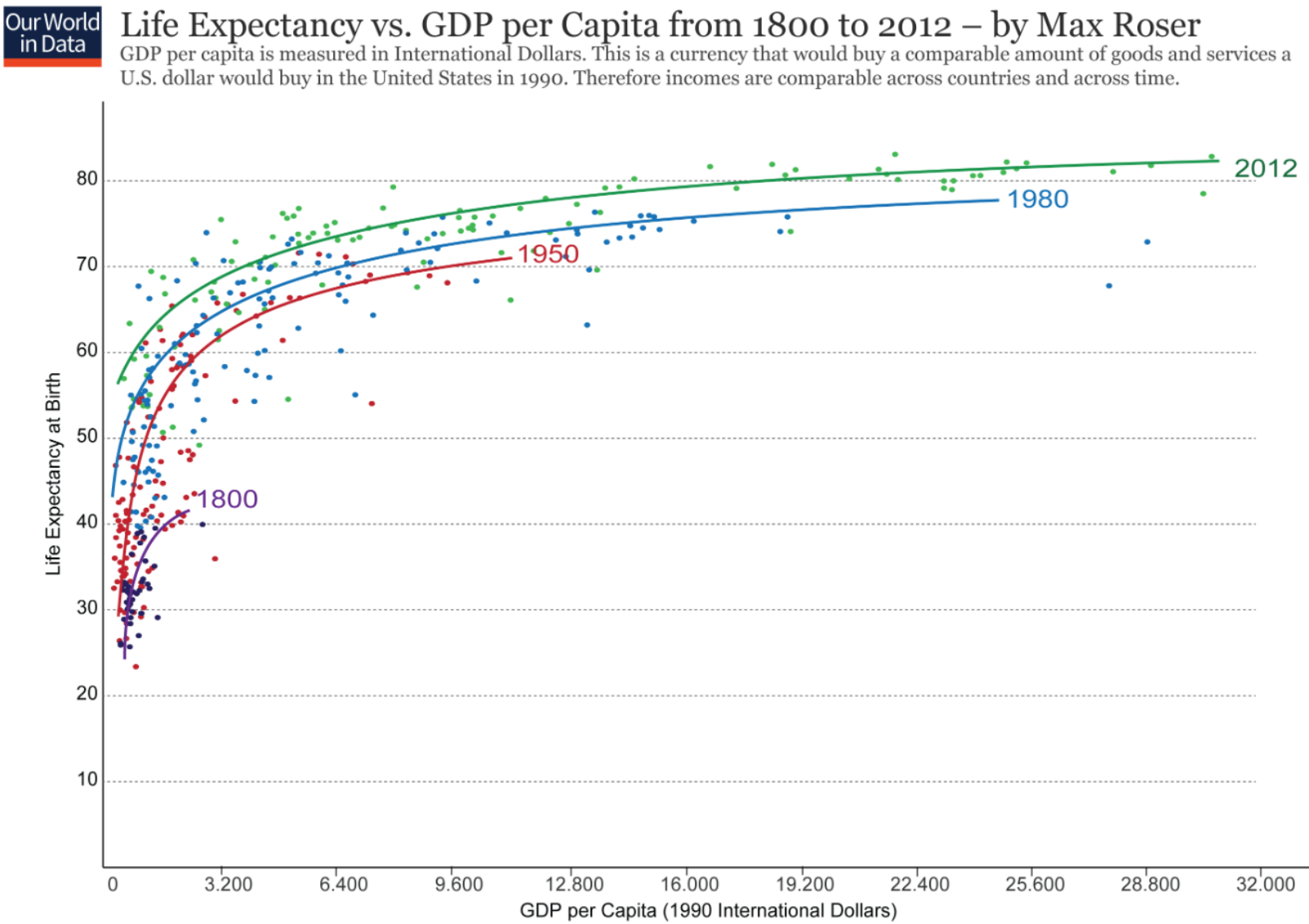
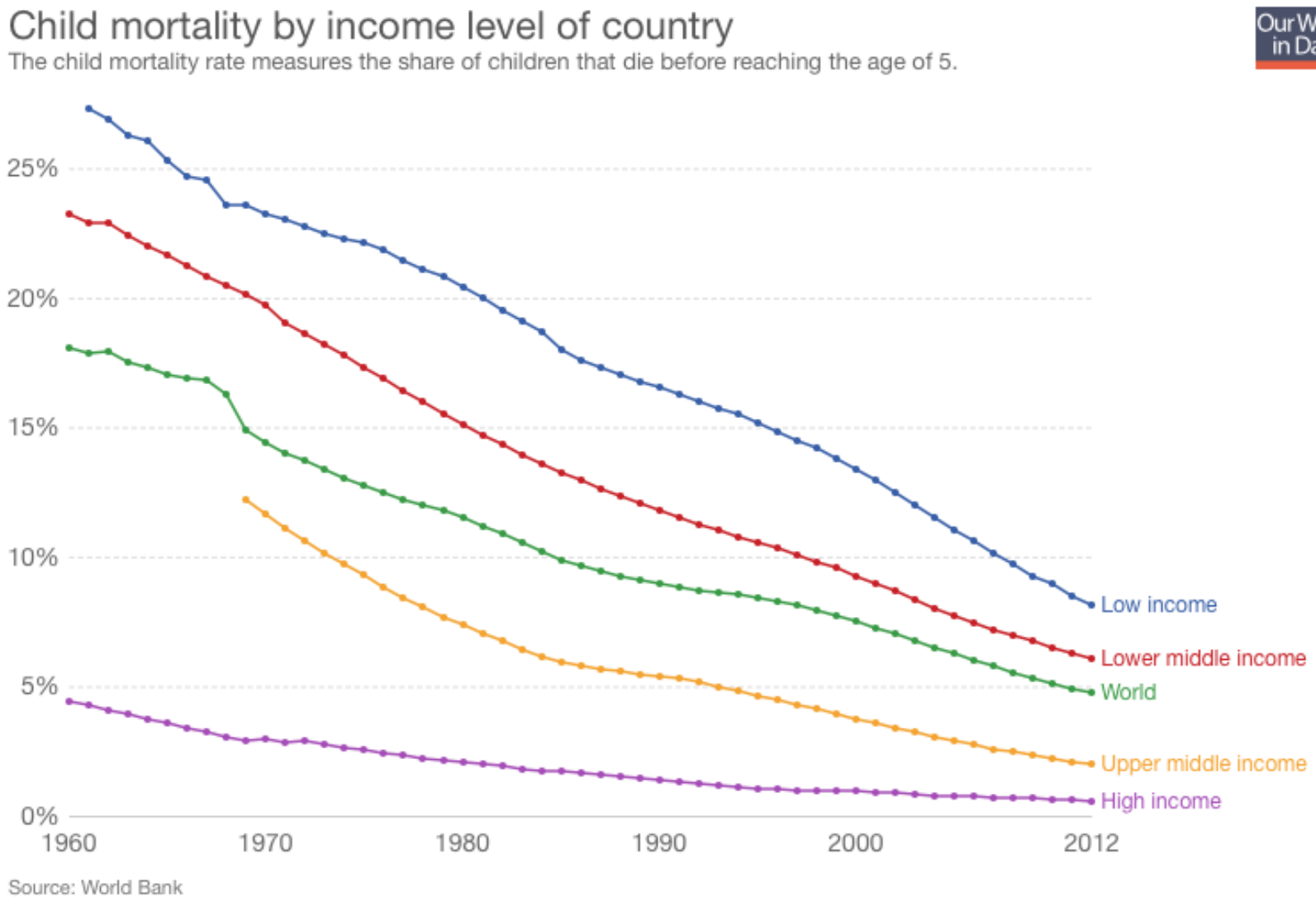


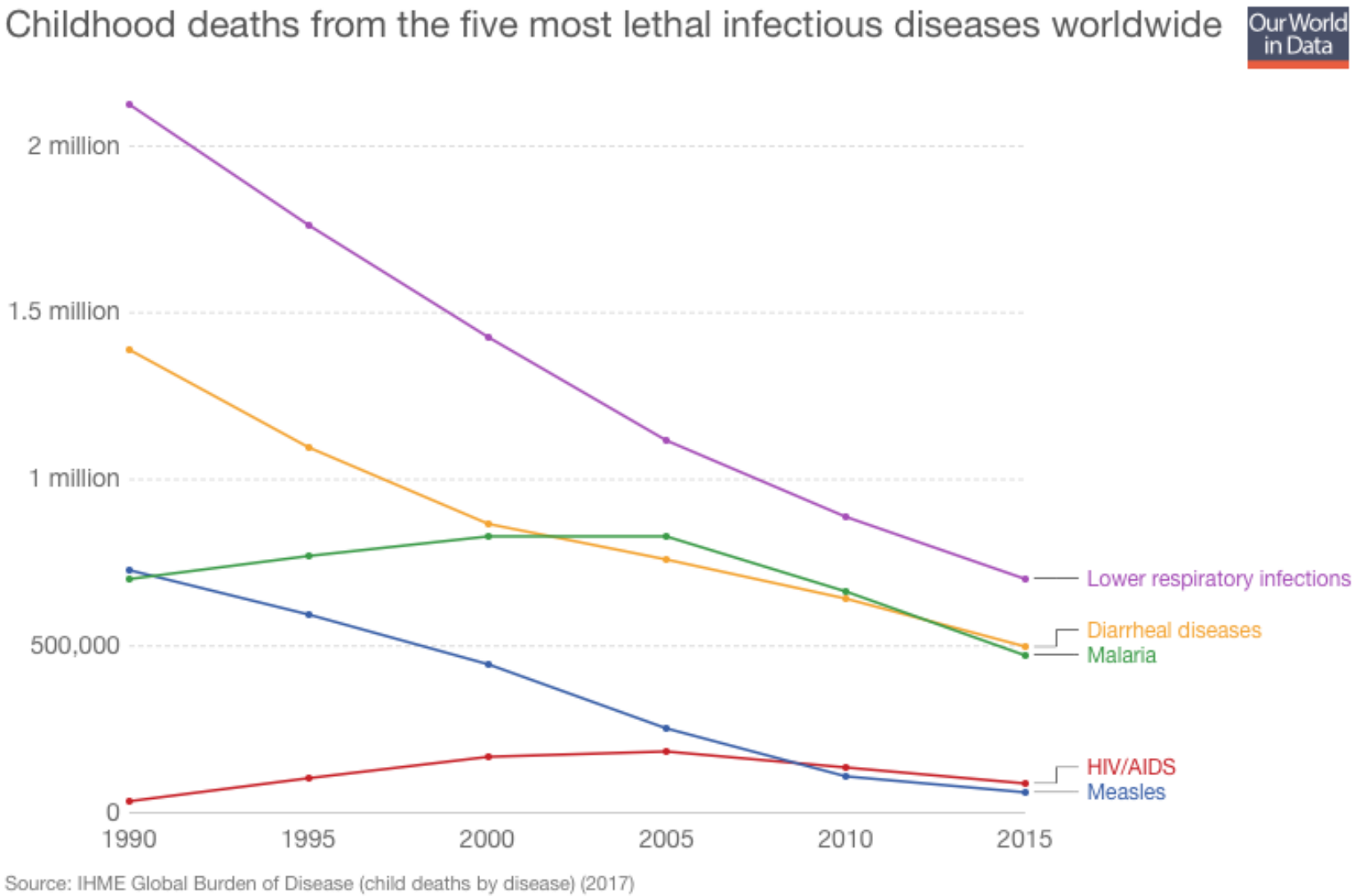
Stylized fact: health and GDP

- Stylized fact: higher income correlated with better health (causal?)
  - WHO (2001, p. 24): *"extending the coverage of crucial health services [...] to the world's poor could save millions of lives each year, reduce poverty, spur economic development and promote global security."*
  - Gallup and Sachs (2001, p. 91): *"A country with its whole territory affected by 100% P. falciparum malaria is predicted to permanently raise its annual growth by 2.6% if it completely eliminates malaria."*

Health Statistics (World Bank)



Health Statistics (World Bank)



Health Statistics (World Bank)

Reduction of number of cases for vaccine-preventable diseases in the United States before and after the introduction of the vaccine – Roush and Murphy (2007)[18]

Disease	Number of Annual Prevaccine Cases	Number of Annual Postvaccine Cases	Reduction of Cases after Vaccine Introduction (in %)
Diphteria	21,053	0	100%
Measles	530,162	55	99.90%
Mumps	162,344	6,584	95.90%
Pertussis	200,752	15,632	92.20%
Poliomyeltis, acute	19,794	0	100%
Poliomyeltis, paralytic	16,316	0	100%
Rubella	47,745	11	99.90%
Congenital rubella syndrome	152	1	99.30%
Smallpox	29,005	0	100%
Tetanus	580	41	92.90%
Hepatitis A	117,333	15,298	87%
Acute hepatitis B	66,232	13,169	80.10%
Invasive (Haemophilus influenza type b)	20,000	<50	>99.8%
Invasive (pneumococcal disease)	63,067	41,550	34.10%
Varicella	4,085,120	612,768	85

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Simple health-income model (and why education matters)

- Big question: What is the effect of improved health on economic development?
- Model:
  - Determinants of productivity: $Y = Y(T, H_3, \alpha)$
    - Y . . . income
    - T . . . test scores
    - H_3 . . . health
    - α . . . innate ability
  - How health matters in education: $T = T(H_2, I, S, \alpha, YS)$
    - I . . . inputs (parental and state)
    - S . . . school characteristics
    - YS . . . years of schooling

Simple health-income model (and why education matters)

- Model (from previous slide):
  - $Y = Y(T, H_3, \alpha)$
  - $T = T(H_2, I, S, \alpha, Y)$
- But health also determined within the system (and we can make it dynamic):
  - $H_1 = H_1(N, M, HE, F)$
    - N . . . nutrition
    - M . . . medicines
    - HE . . . health environment
    - F . . . individual fitness, innate immunity
  - $H_2 = H_1(N, M, HE, F, H_1)$ (analogous for H_3)
    - Note: health in period 1 determines health in period 2 (early childhood development)

Simple health-income model (and why education matters)

- Model (from previous slide):
  - $Y = Y(T, H_3, \alpha)$
  - $T = T(H_2, I, S, \alpha, Y)$
  - $H_1 = H_1(N, M, HE, F)$
  - $H_2 = H_2(N, M, HE, F, H_1)$ (analogous for H_3)
- If we have all the variables, we can embed all of the variables into a single model and run OLS to evaluate the effect of health on income.
- Problems?
  - Measurement issues: many variables hard to measure (innate ability? health?) - use proxies, measurement error
  - Endogeneity:
    - $cov(I, H) \neq 0$: more school investment into healthier kids
    - $cov(H, \alpha) \neq 0$: more health to better skilled kids, etc...
- Households are solving a highly complex optimization problem! Potential for biases in decision-making along the way.

Acemoglu and Johnson (2007): Disease and Development: The Effect of Life Expectancy on Economic Growth

- Big question again: What is the effect of improved health on economic development?
  - Recall correlation between health and GDP. Causality? We need exogenous source of variation in health.
- Micro-level evidence: health $\rightarrow$ productivity $\rightarrow$ income (Strauss and Thomas 1998; Schultz 2002; Bleakley 2003, 2007)
- Potential problems?
  - General equilibrium effects
  - Recall growth models: $\frac{\partial g_{pc}}{\partial n} < 0$
- This paper uses *international epidemiological transition* as a source of exogenous variation in health

International epidemiological transition

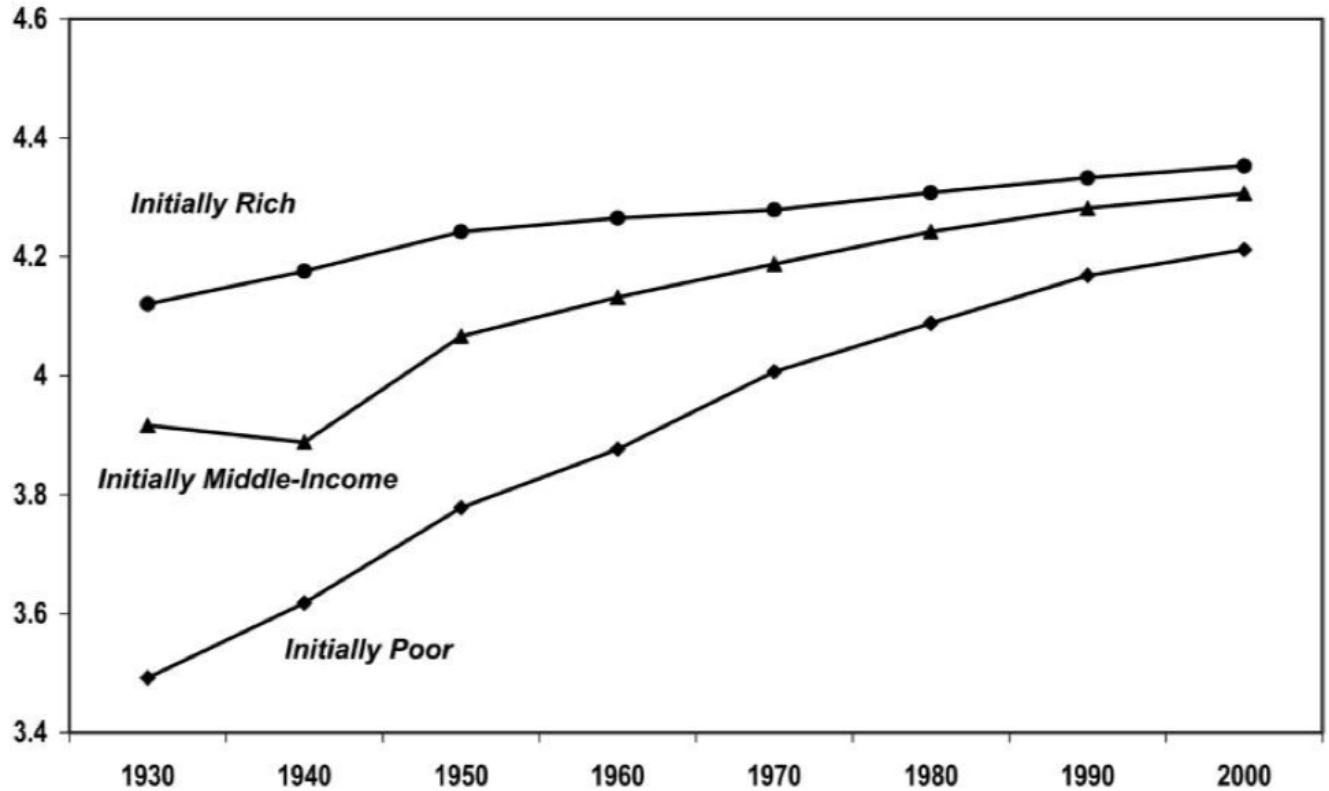


FIG. 1.—Log life expectancy at birth for initially rich, middle-income, and poor countries in the base sample.

Acemoglu and Johnson (2007)

- International epidemiological transition
  - Large improvements in life expectancy in the 1940s.
    1. Drug and chemical innovations (penicillin, other antibiotics, vaccines, DDT)
    2. Establishment of the World Health Organization: facilitates spread of medical and public health technology to poorer countries.
    3. Preston (1975): *"[After the 1930s] universal values assured that health breakthroughs in any country would spread rapidly to all others where the means for implementation existed.*
  - Exogenous improvements in life expectancy: base-rates across countries very different
  - Instrumental variable "predicted mortality": interaction of baseline cross-country disease prevalence with global intervention dates for specific diseases.

Acemoglu and Johnson (2007): Manipulation check

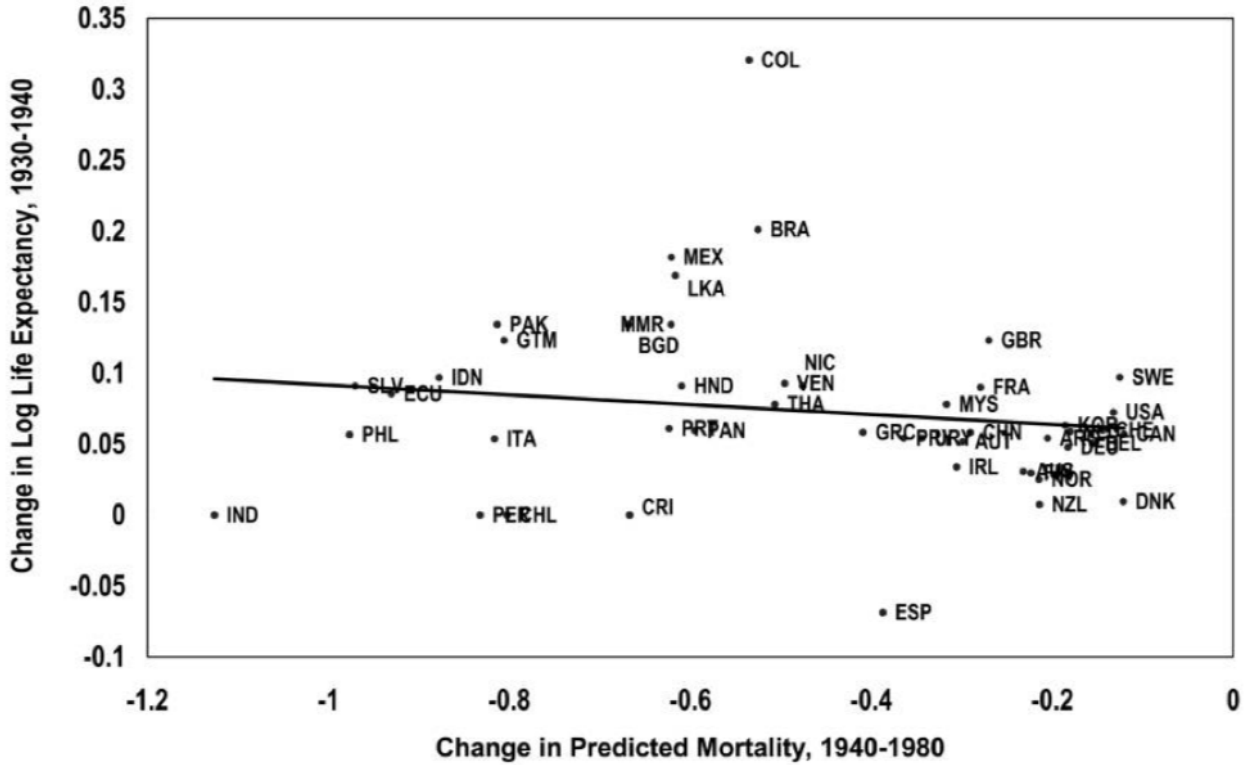
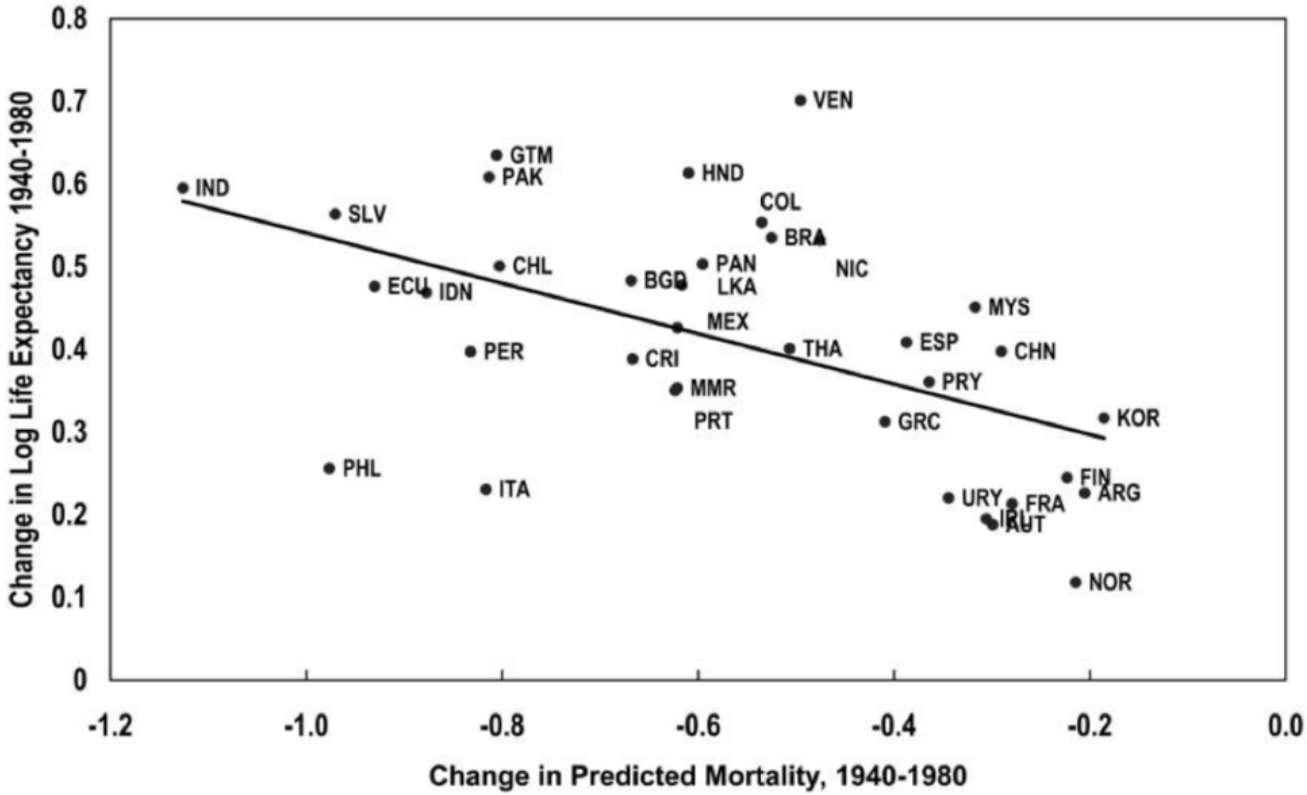
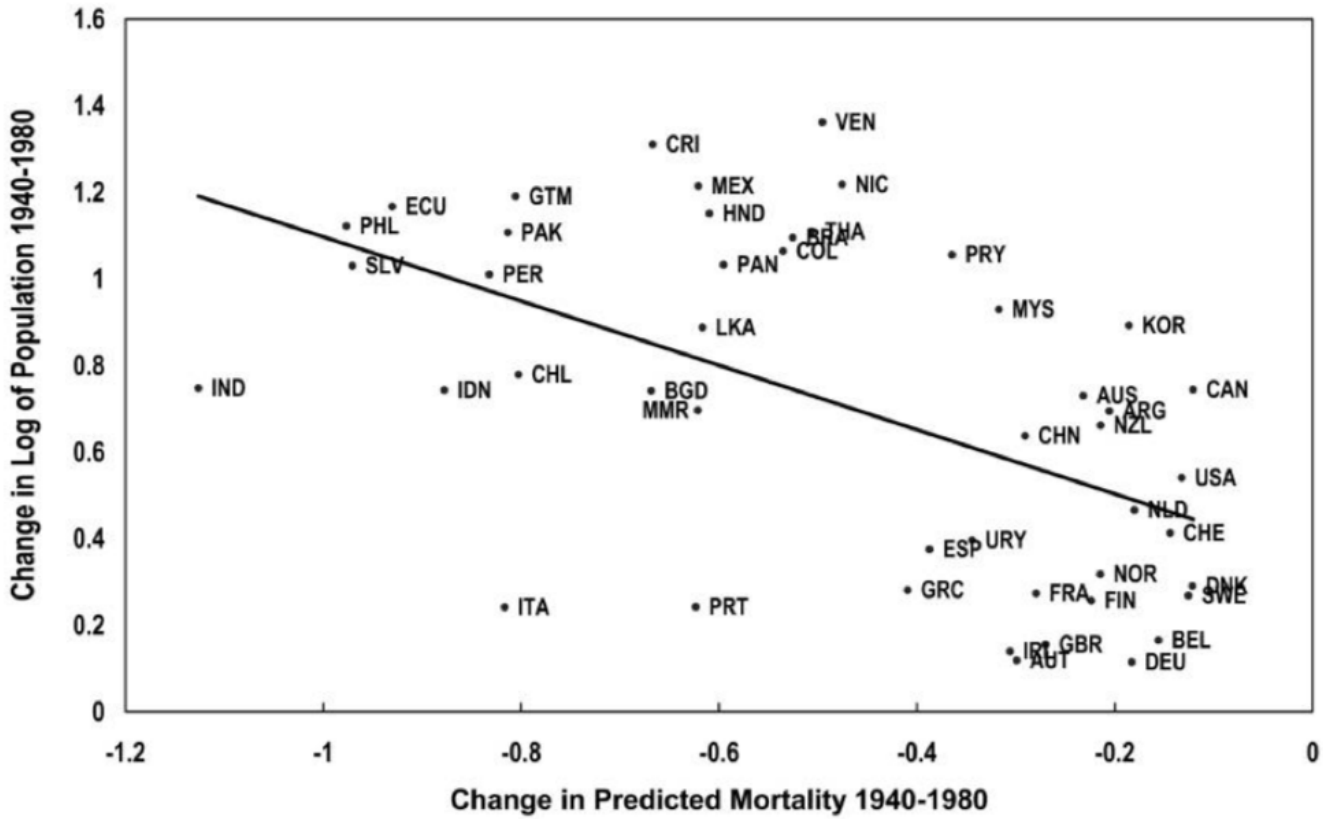


FIG. 6.—Change in log life expectancy, 1930–40, and change in predicted mortality, 1940–80, base sample.

Acemoglu and Johnson (2007): Instrument works



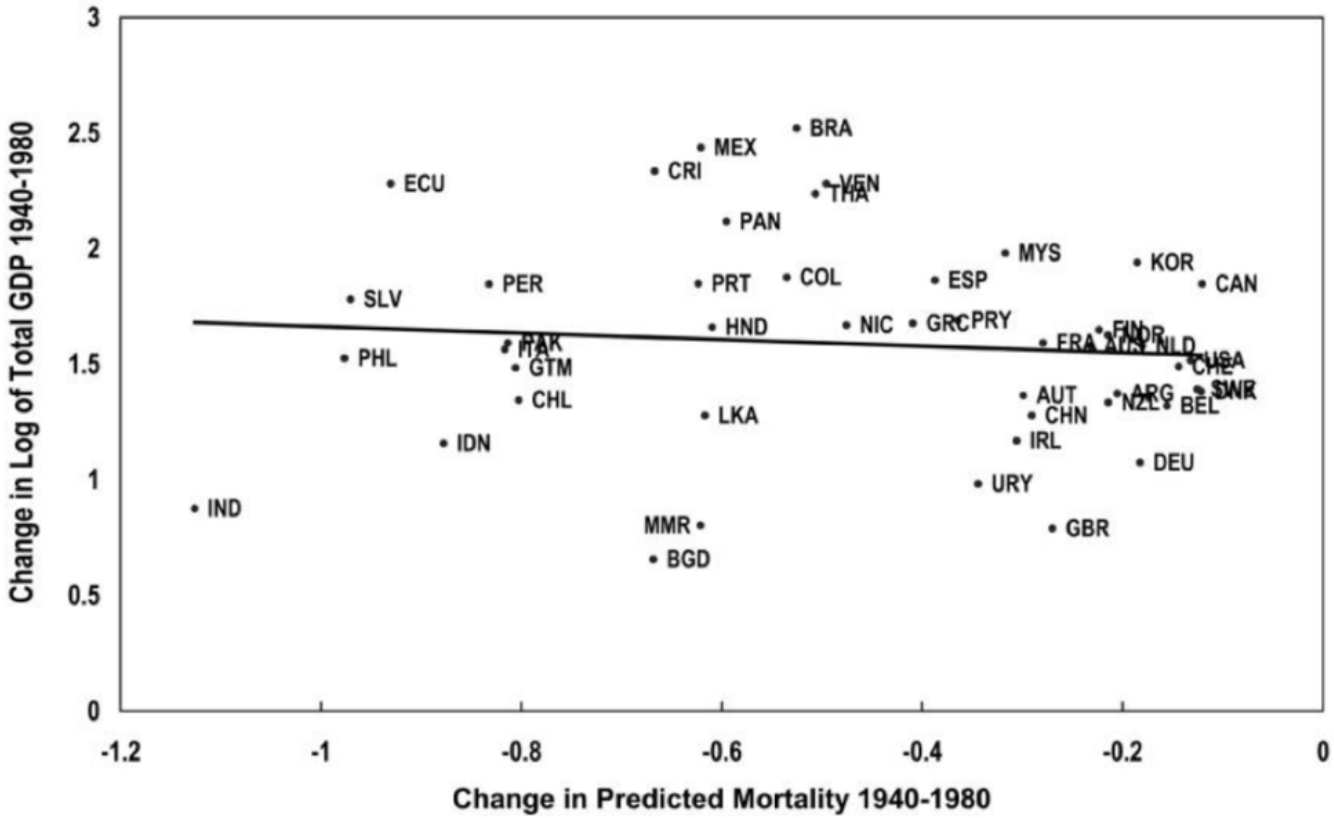
Acemoglu and Johnson (2007): Population increases with increased life expectancy



Acemoglu and Johnson (2007): Results

- For every 1% increase in life expectancy, 1.7% increase in population

Acemoglu and Johnson (2007): Per capita income stays flat



Acemoglu and Johnson (2007): No convergence

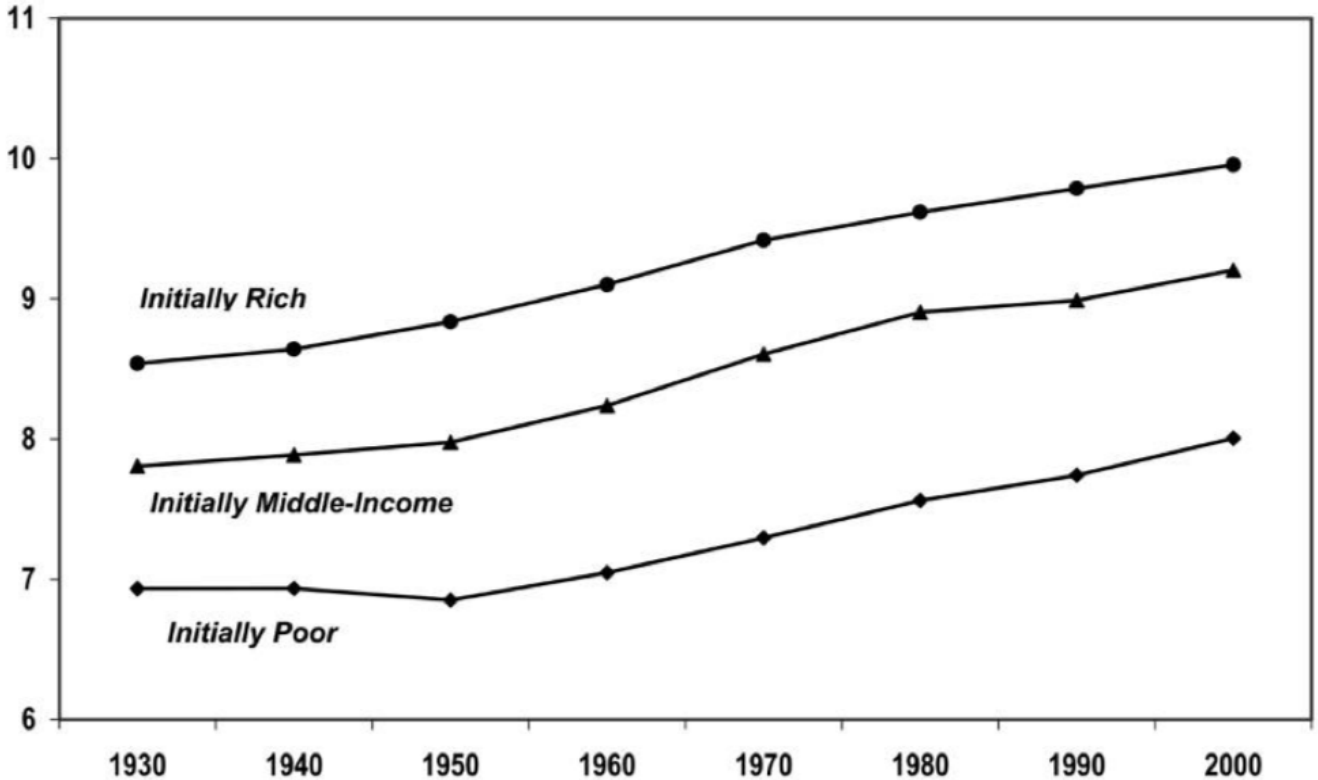


FIG. 2.—Log GDP per capita for initially rich, middle-income, and poor countries in the base sample.

Acemoglu and Johnson (2007): Results 2

- Per capita income not increasing with increasing life expectancy. Why?
  - If production factors (capital / land) fixed, increasing population reduces income per capita
  - Increases in productivity perfectly offset by population growth

Acemoglu and Johnson (2007): Issues

- Note: Even if no effect on income per capita, the intervention still saved lots of lives! (Note: income based poverty rate vs. multidimensional poverty index)
- Issues:
  - Maybe assumption of fixed production factors less binding with population shifting to urban areas (global capital flows, urbanization, advancement in agricultural technology, access to birth control)
  - Moreover: many health interventions reducing morbidity rather than mortality (so only productivity differences, no negative effect of population)
  - Cervellati and Sunde (2011): Life expectancy and economic growth: the role of the demographic transition
    - AJ07 results differ by whether country past demographic transition or not; in post-transition effect per capita effects of increased life expectancy positive!

Cervelatti and Sunde (2011): The role of the demographic transition

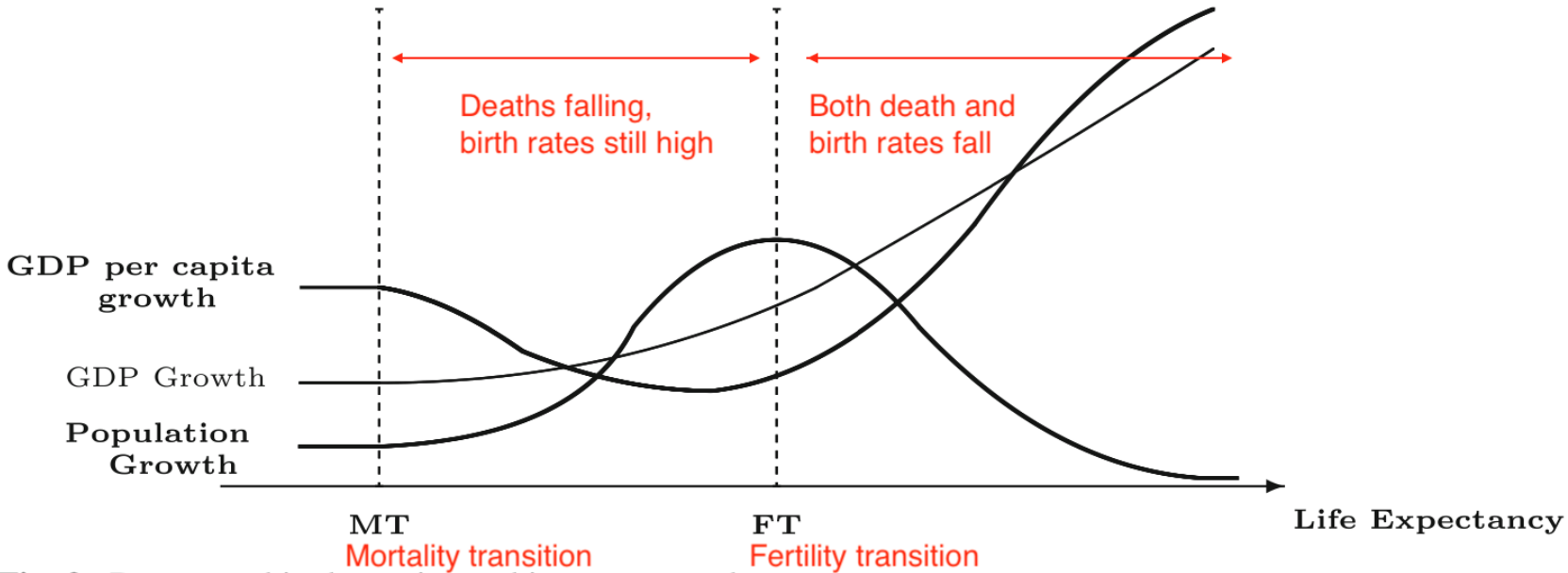
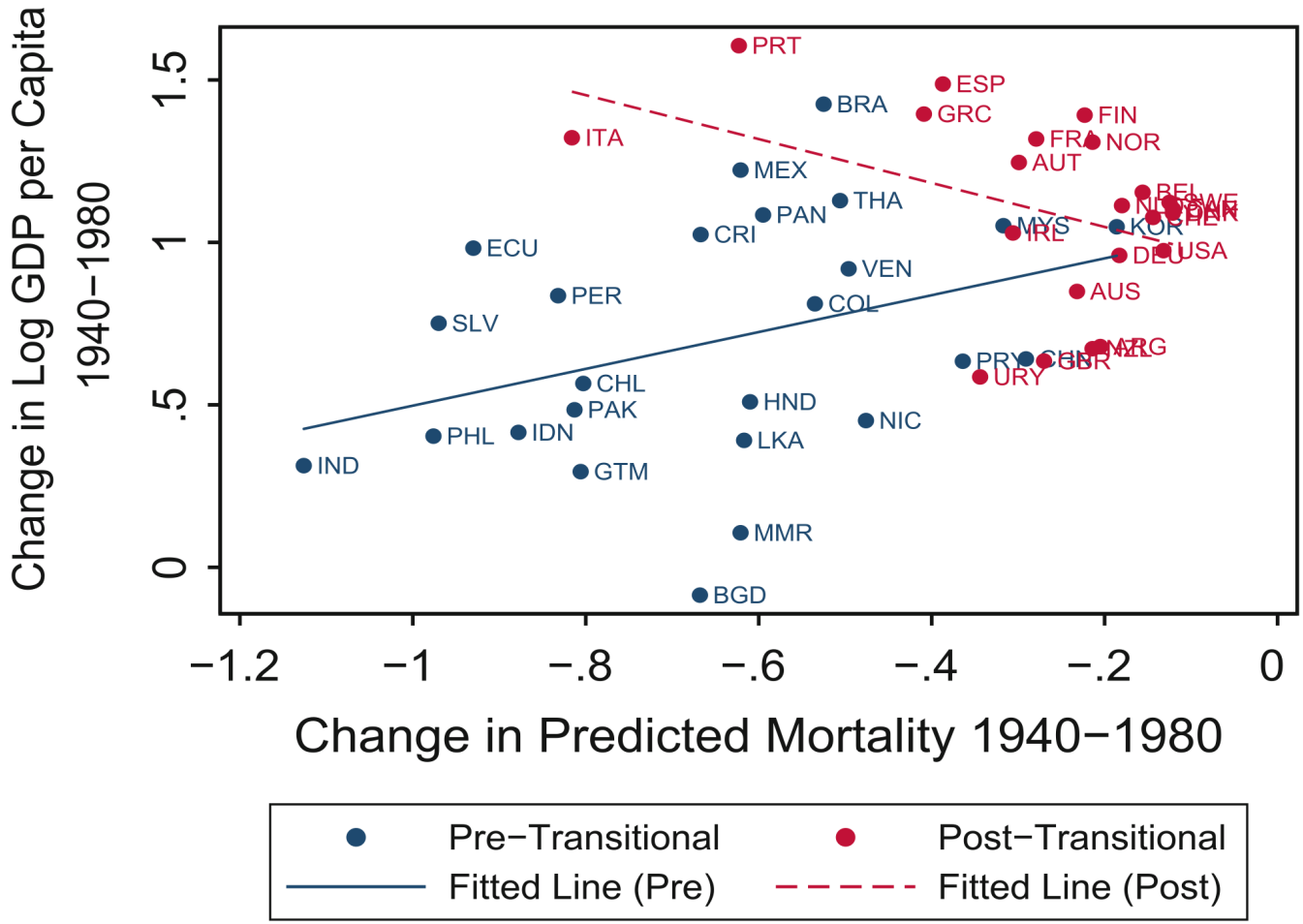


Fig. 2 Demographic dynamics and income growth

Cervelatti and Sunde (2011): The role of the demographic transition



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"Last mile problem": Demand for health

- Despite dramatic improvements in health, still many missed opportunities.
  - Stylized fact: Take-up of many potentially profitable technologies low: deworming, iron fortification, insecticide-treated bednets, continued spread of HIV in Africa, slow adoption of better purification water technologies in South Asia, low-pollution cook stoves. Why?
- Standard model (no market failures): H=H(benefits, costs (both monetary and nonmonetary), horizon over which both benefits and costs are realized). But:
  - Liquidity constrains — Now!
  - Lack of information, lack of education to process information (e.g. on returns) — Later, "hidden hunger".
  - Trust in (formal) medical services, government — Not here.
- Note: Individual learning from past exposure to disease hard: recovery hard to attribute to a particular treatment ("N=1 studies") — *Credence goods*

Demand for health: Usage fees?

- Advocates:
  - The poor can (and do) pay at least some fees. These may screen out consumers who do not need the service/product
  - Fees motivate providers
- Critics:
  - Impact on access as needy may be liquidity constrained

Demand for health: Usage fees?

- Malaria one of leading causes of deaths for children and the cause of numerous lost work hours for adults (!)
- Treatment? Over-treatment of malaria-negative patients prevalent and costly:
  1. delay proper treatment for the true cause of illness
  2. waste scarce resources for malaria control
  3. contribute to parasite resistance
- Prevention! Long-lasting antimalarial insecticide-treated bed nets (ITNs) (in Kenya, full price of $\approx$ \$6)
- How to price them?
  - Positive externalities from usage: public subsidy justifiable
  - Vaccines, deworming: subsidies of over 100% justifiable if social returns exceed private returns (private cost effects high, e.g. side effects)
  - Good that requires active use (ITNs)?

Cohen and Dupas (2010): Free Distribution or Cost-Sharing?

- Randomized control trial in rural Kenya
- Sample: 20 prenatal clinics (pregnant women)
- Design:
  - Four clinics served as a control group and four price levels were used among the other 16 clinics: \$0, \$0.15, \$0.30, \$0.60.
    - Setting: Nets available for a subsidized price of \$0.7 $\approx$ 50 KSH (although often sold out).
    - Note: Special role of "zero" price (Ariely and Shampan'er 2007)
    - Issue: small number of independent observation (4 clinics per treatment)
  - Conditional on accepting at a price, random discount offered - Why?
    - Psychological sunk cost effects (*sunk cost fallacy*)

Intermezzo: Selection issues and randomized control trials

- We are interested in the relationship between **"treatment"** and some outcome that may be affected by it
- Define: $Y_i \ldots$ value of outcome of interest for individual i
- Two potential outcomes for individual i:
  - $Y_{0i} \ldots$ i's outcome **without** treatment
  - $Y_{1i} \ldots$ i's outcome **with** treatment
- Treatment as a binary random variable: $D_i = \{0, 1\}$
- Outcome of interest:

$$Y_i = \begin{cases} Y_{0i} & \text{if } D_i = 0 \\ Y_{1i} & \text{if } D_i = 1 \end{cases}$$

Intermezzo: Selection issues and randomized control trials

- Causal effect of treatment on the outcome is: $Y_{1i} - Y_{0i}$
- Problem: No within individual Y_{1i} and Y_{0i} simultaneously.
  - Missing **counterfactual** or "parallel universe"
- We thus have to compare average outcome of those treated and of those not treated (large N assumed):

$$\underbrace{E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 0]}_{\text{Observed difference in outcome}} = \underbrace{\overbrace{E[Y_{1i}|D_i = 1]}^{\text{Observed}} - \overbrace{E[Y_{0i}|D_i = 1]}^{\text{Unobserved}}}_{\text{Average treatment effect on the treated}}$$

$$+ \underbrace{\overbrace{E[Y_{0i}|D_i = 1]}^{\text{Unobserved}} - \overbrace{E[Y_{0i}|D_i = 0]}^{\text{Observed}}}_{\text{Selection bias}}$$

Intermezzo: Selection issues and randomized control trials

$$\underbrace{E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 0]}_{\text{Observed difference in outcome}} = \underbrace{E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 1]}_{\text{Average treatment effect on the treated}}$$
$$+ \underbrace{E[Y_{0i}|D_i = 1] - E[Y_{0i}|D_i = 0]}_{\text{Selection bias}}$$

- Treatment D_i randomly assigned to a subset of the population independent of outcome Y_i
- Thus: $E[Y_{0i}|D_i = 1] = E[Y_{0i}|D_i = 0]$
  - Had neither received the treatment, Y would have been in expectation the same.
  - Selection term is cancelled and we end up with average treatment effect on treated, a causal effect of the treatment.

Intermezzo: Selection issues and randomized control trials

$$\underbrace{E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 0]}_{\text{Observed difference in outcome}} = \underbrace{E[Y_{1i}|D_i = 1] - E[Y_{0i}|D_i = 1]}_{\text{Average treatment effect on the treated}}$$
$$+ \underbrace{E[Y_{0i}|D_i = 1] - E[Y_{0i}|D_i = 0]}_{\text{Selection bias}}$$

- **Selection bias makes treatment effect look:**
  - **Larger**: say, effect of textbooks in schools on educational outcomes and parents in schools with textbooks take education more seriously, i.e. $E[Y_{1i}|D_i = 0] > E[Y_{0i}|D_i = 0]$
  - **Smaller:** say, textbooks have been provided to schools that were most lagging behind and were compared to schools without textbooks, but where parents care more about education.

Intermezzo: Selection issues and randomized control trials

- Limitations?
  1. Focus on "small" questions (compare to macro approach)
  2. External validity
  3. Lack of theory, too much focus on empirics
  4. General equilibrium effects

- For an interesting academic exchange, see for example the debate between Deaton and Banerjee, and Duflo: https://www.nature.com/news/can-randomized-trials-eliminate-global-poverty-1.18176

Cohen and Dupas (2010)

- Experiment measures:
  1. The elasticity of demand with respect to price
  2. The elasticity of usage with respect to price (conditional on take-up)
  3. The impact of price variation on the vulnerability/neediness of the marginal consumer (selection)

- Sample:
  - 545 pregnant women baseline survey (including hemoglobine levels)
  - 246 women (randomly) selected for house inspection 10 weeks after purchase to check for bednet use (unannounced); 226 found and agreed with interview

Cohen and Dupas (2010): price elasticity

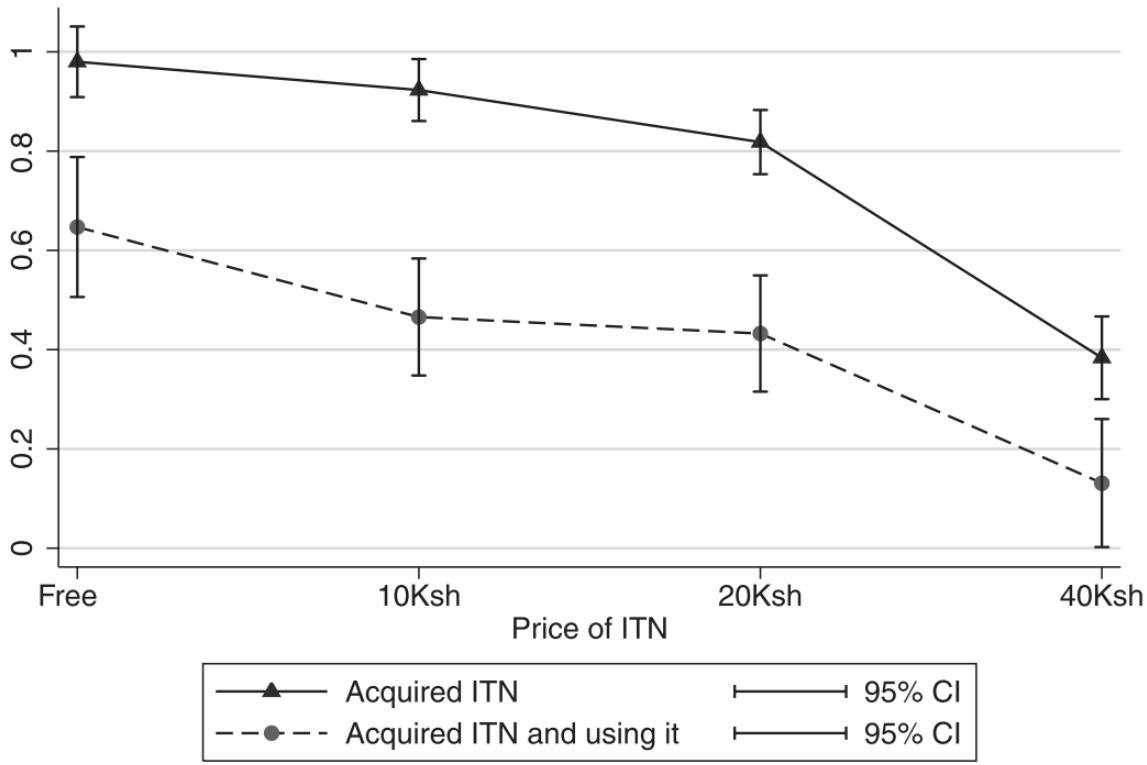


FIGURE I
Ownership vs. Effective Coverage

Sample includes women sampled for baseline survey during clinic visit, and who either did not acquire an ITN or acquired one and were later randomly sampled for the home follow-up. Usage of program ITN is zero for those who did not acquire a program ITN. Error bars represent ±2.14 standard errors (5% confidence interval with fourteen degrees of freedom). At the time this study was conducted, ITNs in Kenya were social-marketed through prenatal clinics at a price of 50 Ksh.

Cohen and Dupas (2010): usage elasticity (cond. on buying)

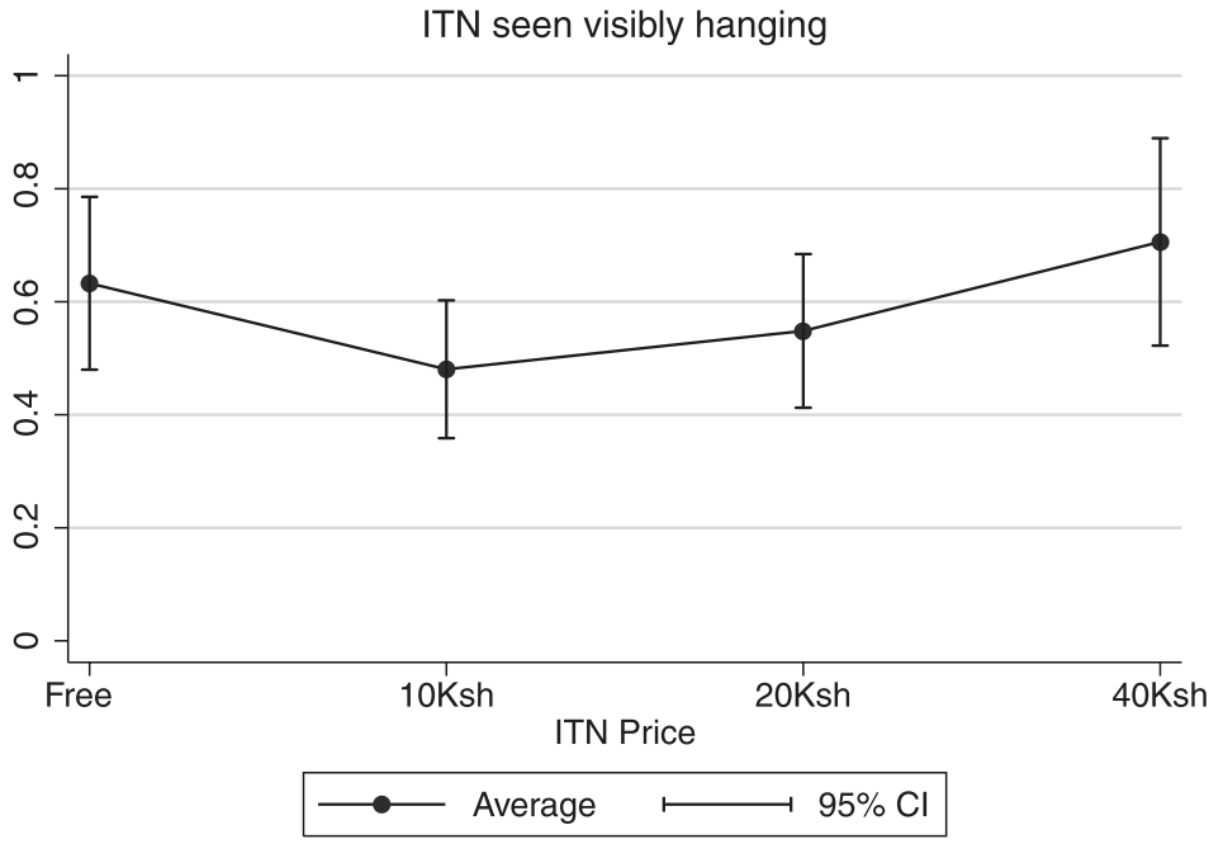


FIGURE II
Program ITN Usage Rates (Conditional on Uptake) by ITN Price
Error bars represent ±2.14 standard errors (95% confidence interval with fourteen degrees of freedom). Number of observations: 226.

Cohen and Dupas (2010): selection

TABLE VIII
CHARACTERISTICS OF PRENATAL CLIENTS BUYING/RECEIVING ITN RELATIVE TO CLIENTS OF CONTROL CLINICS

	Mean in control clinics	Differences with control clinics			
		0 Ksh (free)	10 Ksh ($0.15)	20 Ksh ($0.30)	40 Ksh ($0.60)
	(1)	(2)	(3)	(4)	(5)
	Panel A. Characteristics of visit to prenatal clinic				
First prenatal visit	0.48	−0.12	−0.02	0.03	0.02
for current pregnancy	*0.50*	(0.06)**	(0.04)	(0.06)	(0.04)
Walked to the clinic	0.73	−0.12	0.04	0.07	−0.16
	0.45	(0.13)	(0.07)	(0.06)	(0.08)*
If took transport to clinic:	4.58	3.52	0.79	−1.17	4.27
price paid (Ksh)	*10.83*	(3.29)	(1.78)	(1.37)	(1.94)**
Can read Swahili	0.81	0.10	0.05	0.00	0.09
	0.40	(0.03)***	(0.05)	(0.04)	(0.02)***
Wearing shoes	0.61	0.06	0.07	−0.11	0.11
	0.49	(0.12)	(0.12)	(0.12)	(0.12)
Respondent owns	0.19	0.00	0.01	0.12	0.07
animal assets	*0.39*	(0.06)	(0.05)	(0.05)**	(0.09)
	Panel B. Health status				
Hemoglobin level (Hb),	10.44	0.94	0.49	0.22	0.48
in g/dL	*1.77*	(0.34)**	(0.49)	(0.47)	(0.78)
Moderate anemia	0.69	−0.18	−0.09	−0.08	−0.05
(Hb < 11.5 g/dL)	*0.46*	(0.07)**	(0.12)	(0.10)	(0.19)
Severe anemia	0.16	−0.10	−0.01	0.07	−0.06
(Hb ≤ 9 g/dL)	*0.37*	(0.06)	(0.07)	(0.09)	(0.11)
Observations	110	98	120	99	28

Notes: For each variable, column (1) shows the mean observed among prenatal clients enrolling in control clinics; the standard deviations are presented in italics. Columns (2), (3), (4), and (5) show the differences between "buyers" in the clinics providing ITNs at 0, 10, 20, and 40 Ksh and prenatal clients enrolling in control clinics. Standard errors in parentheses are clustered at the clinic level; given the small number of clusters (sixteen), the critical values for T-tests were drawn from a t-distribution with 14 (16 − 2) degrees of freedom.
***, **, * Significance at 1%, 5%, and 10% levels, respectively.

Cohen and Dupas (2010): summary

- Uptake drops by sixty percentage points when the price of ITNs increases from zero to $0.60 (i.e., from 100% to 90% subsidy)
- Paying a price does not increase "ownership": usage rates constant (unlike in Ashraf, Berry, and Shapiro 2010: water treatment)
- No sorting of the needy (more sick) at higher prices
- No effect of surprise price reductions: no sunk cost fallacy
  - Price "0" effect: caused by earlier second visits (iron supplements given at first visit!)
  - Effective coverage of anemic population 60% lower under cost-sharing
- No zero price effect (no discontinuity)
  - Note: bednets widely known in the setting; if not, zero price maybe a signal of low quality

Cohen and Dupas (2010): Cautionary tale

- Corruption in distribution systems - incentives for providers not tested here!
- Story may be different for treatment: charging to prevent overuse (negative externalities from overuse of antibiotics; Cohen et al. 2015 AER on malaria treatment)
  - Demand for treatment less elastic than for prevention; conditioning subsidies on (ideally cheap and widely available over-the-counter rapid) diagnosis necessary (but problematic when healthcare system not working properly)

Dupas and Miguel (2017): Impacts and Determinants of Health Levels in Low-Income Countries

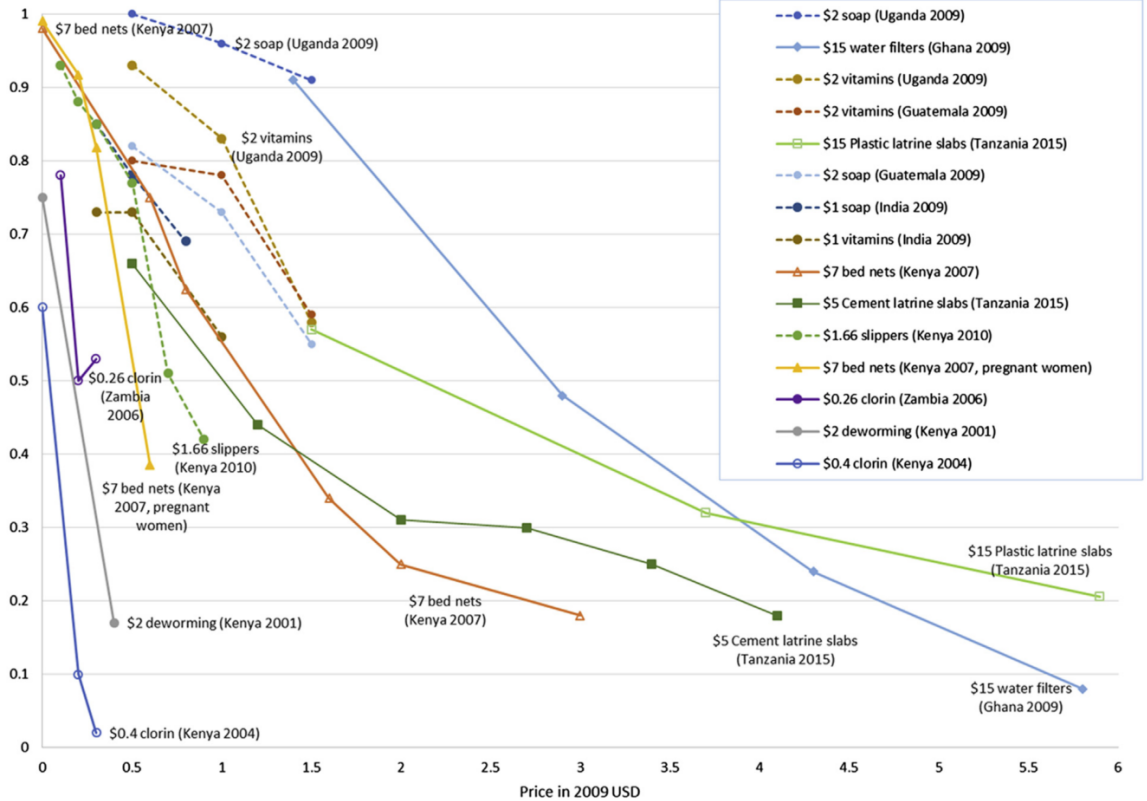


Figure 2 Purchase rate of preventive health products, by TIOLI price. *(Courtesy of Cohen, J., Dupas, P., 2010. Free Distribution or cost-sharing? Evidence from a randomized malaria experiment. Q. J. Econ. 125, 1—45; Dupas, P., September 12, 2014b. Getting essential health products to their end users: subsidize, but how much? Science 345 (6202), 1279—1281 for bed nets; Kremer, M., Miguel, E., 2007. The illusion of sustainability. Q. J. Econ. 122 (3), 1007—1065 for deworming; Ashraf, N., Berry, J., Shapiro, J., 2010. Can higher prices stimulate product use? Evidence from a field experiment in Zambia. Am. Econ. Rev. 100 (5); Kremer, M., Miguel, E., Mullainathan, S., Null, C., Zwane, A., 2011b. Social Engineering: Evidence From a Suite of Take-up Experiments in Kenya, Mimeo, Emory University for chlorine; Meredith et al., 2013. Keeping the doctor away: experimental evidence on investment in preventive health products. J. Dev. Econ. 105, 196—210 for soap, vitamins and slippers; Berry, J., Fischer, G., Guiteras, R.P., 2015. Eliciting and utilizing willingness-to-pay: evidence from field trials in Northern Ghana (CEPR discussion paper no. DP10703) for water filters; Peletz, R., Cock-Esteb, A., Ysenburg, D., Haji, S., Khush, R., Dupas, P., 2016. The Supply and Demand of Improved Sanitation: Results From Randomized Willingness-to-Pay Experiments in Rural Tanzania (In preparation) for latrine slabs.)*

Role of externalities

- Herd immunity: case for free vaccinations (positive externalities / spillovers on a wide population)
- Economics: also social learning (not just epidemiological spillovers as in medical sciences)
  - Double-blinding: common feature of experiments typical in medical sciences-may underestimate the actual role of social spillovers (behavioral responses to treatment)
  - We talk more about estimating treatment externalities in the tutorial (Miguel and Kremer 2004)
- Externalities studied on many domains:
  - water treatment (Ziegelhofer, 2012), learning about HIV results (Godlonton and Thornton, 2012), community monitoring of health clinic performance (Bjorkman and Svensson, 2009), risky sexual behavior (Dupas, 2011), child nutrition (Zivin et al., 2009; Fitzsimons et al., 2012), malaria prevention (Tarozzi et al., 2014; Dupas, 2014), deworming treatment in social networks (Kremer and Miguel, 2007)

Health statistics

Health and economic development

Demand for health (and formalizing RCTs)

Nutrition and development

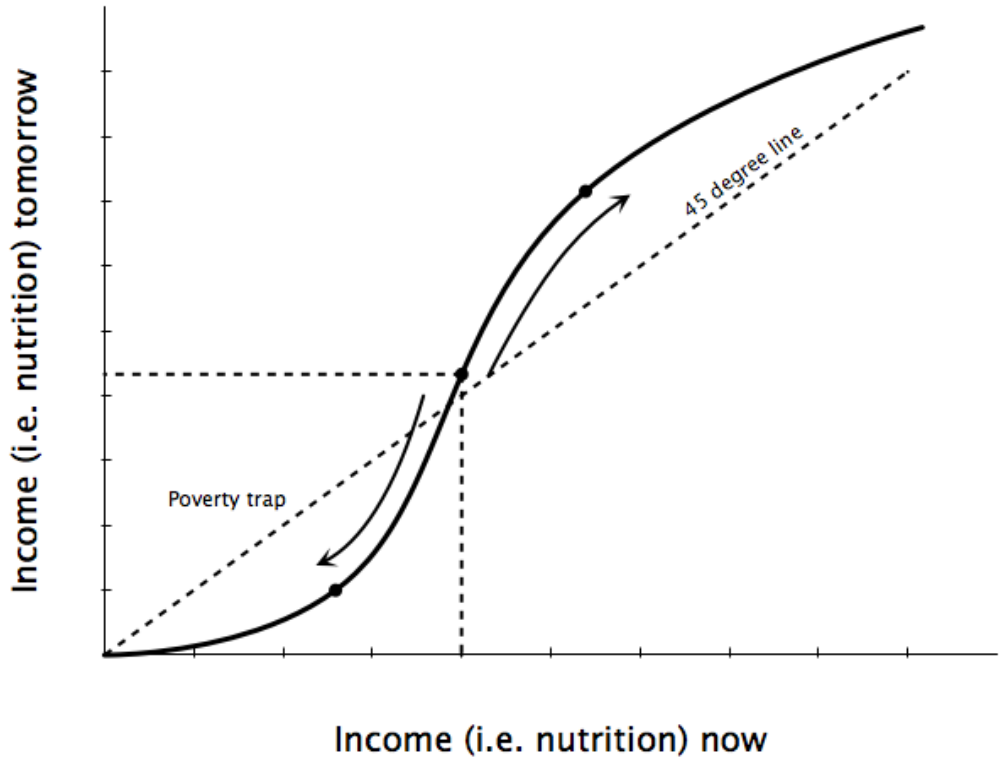
Hidden hunger

Nutrition Statistics (mostly IFPRI 2014)

- 842 million people in the world do not have enough to eat.
- Majority of hungry people (827 million) live in developing countries, where 14.3 percent of the population is undernourished;
- Poor nutrition linked to nearly half (45%) of deaths in children under five (50% due to poor immunity)
- One in six children in developing countries is underweight
- One in four of the world's children are stunted
- 66 million primary school-age children attend classes hungry across the developing world
- Large increase in food prices in 2006-2008, and again in 2010. (What impact on the poor?)

Can hunger be the cause of persistent poverty in the world?

- Poverty trap?



- Model: Productivity 1 $\rightarrow$ Income 1 $\rightarrow$ Food 1 $\rightarrow$ Productivity 2 $\rightarrow$ Income 2 ...
- Q: Policy recommendation for very poor?

Can hunger be the cause of persistent poverty in the world?

- Or no poverty trap?

Poverty trap model

- We assume the following model:
  - Productivity 1 $\rightarrow$ Income 1 $\rightarrow$ Food 1 $\rightarrow$ Productivity 2 $\rightarrow$ Income 2 ...
- We have to establish following links:
  - $\uparrow$ Productivity $\Rightarrow$ $\uparrow$ Income (basic micro)
  - $\uparrow$ Income $\Rightarrow$ $\uparrow$ Food (?)
  - $\uparrow$ Food $\Rightarrow$ $\uparrow$ Productivity (?)

↑ Income ⇒ ↑ Food (?)

- How should a budget of a very poor person look like in case the nutrition based poverty trap exists?
- Given the nutrition based poverty trap is true:
  - Is food for the poorest a normal, an inferior, or a luxury good?
  - Is food for the poorest an ordinary or a Giffen good?
- How to answer questions above empirically?
  - Jensen and Miller (2008): subsidized rice and wheat in Hunan and Gansu, China, respectively (regional staple foods!).
    - Document upward sloping demand, i.e. Giffen behavior

↑ Income ⇒ ↑ Food (?)

- Recall Banerjee and Duflo (2006): Economic lives of the poor
  - over 30% of resources spent on items other than food among the very poorest
  - 5% annually on alcohol & tobacco, 10% on festivals
  - 5% sugar and salt, 5% cooking oil
  - Poor can increase the levels of calories by switching from rice to millets without increasing expenditures (Subramanian and Deaton, 1996)
  - Downward trend in calorie expenditures over time
    - Maharashtra, India: 70% in 1983 to 62% 2000. Why?

↑ Income ⇒ ↑ Food (?) (Income Engel curves)

- Subramanian and Deaton (1996): The demand for food and calories (Maharashtra, India)
  - Increasing spending ⇒ purchasing more expensive calories
  - Food expenditures spending elasticity: 0.7
  - Calorie intake spending elasticity: 0.35
    - Colen et al. (2018): average expenditure elasticity of 0.61 and calorie elasticity of 0.42 (review of 66 studies containing 1,444 elasticity estimates)
  - ⇒ 50% of additional unit of income to food, 50% to better tasting food
  - Additional 600 calories to reach calorie levels required for work in tropics can be purchased for 4% of daily income (coarse grains)
    - *"If nutrition is a trap, it is one from which there is a ready escape."*
  - Higher income for very poor people ⇒ positive, but not huge impact on calories consumed

↑ Income ⇒ ↑ Food (?) (Income Engel curves)

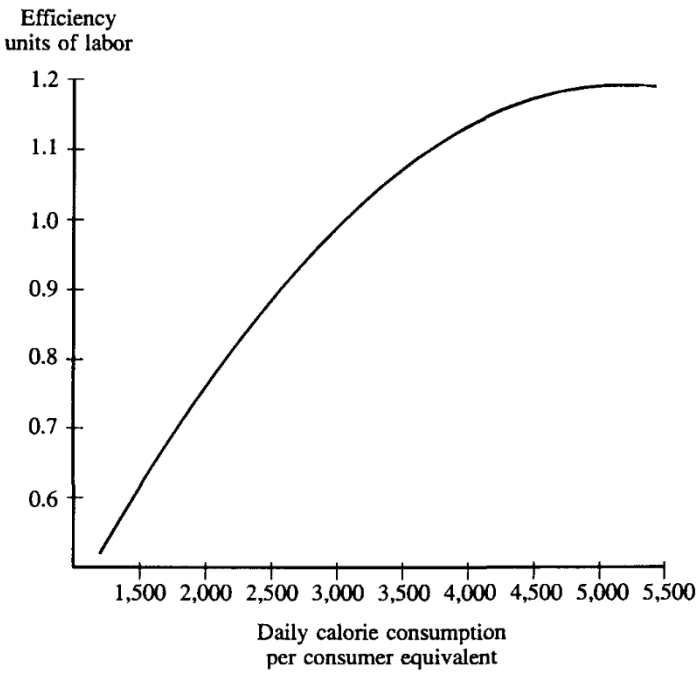
- Problems with observational data?
  - Households with different incomes may have different tastes, opportunities, and face different prices.
  - Reverse causality: calorie intake may affect productivity
  - Solution? Experiments...
- Almås, Haushofer, and Shapiro (2019): The Income Elasticity for Nutrition: Evidence from Unconditional Cash Transfers in Kenya
  - Experiment randomly disbursing unconditional cash transfers to subsistence farmers in rural Kenya.
  - Manipulating type of disbursement:
    - Transfer timing: Monthly installments over nine months vs. one-time lump sum transfer
    - Transfer magnitude: $404 vs. $1520 (at least twice monthly average household consumption)
  - Measuring food expenditures (HH level) + price/weight survey to estimate calorie consumption (village level)

Almås, Haushofer, and Shapiro (2019)

- Results:
  - Food expenditures spending elasticity: 0.78
    - Elasticity 1.30 for protein. Maybe trap there?
    - Advantage of experiments: non-experimental expenditures elasticity: 0.91
  - Calorie elasticity: 0.60
  - Transfer magnitude randomized: allows to test linearity of Engel curves $\rightarrow$ they are (little concavity, but insignificant)
  - Conclusion: poverty trap unlikely!
  - Issues: general equilibrium effects: prices affected by large cash transfers flowing in.
    - Solution: estimate elasticities while accounting for changes in prices. No effect.

↑ Food ⇒ ↑ Productivity (?)

FIGURE 10.1 Estimated efficiency labor function for Sierra Leone farm households



Source: Strauss (1984)

- Strauss (1984)
  - Consumption 1%↑, work productivity 0.35%↑ among low-income workers, but up to 1%↑ for very poor
  - Kenya similar (1%↑ ⇒ 0.5%↑)
- Schoefield (2014)
  - Experimentally providing rickshaw drivers in Delhi 700 additional calories (2200 calories baseline for Muslim population)
  - Labor supply and income 10 % ↑ after five weeks.
  - Elasticity of income with respect to calories of 0.31

Nutrition based poverty trap?

- ... poor people do not behave as if there was one.
- They do not eat as much as they could and they do not consume as much calories as they could
  - For example, if the income of the poor increased by 10%, calorie consumption would increase by 3.5% only and the productivity even less so
  - Isn't it too little for the poverty trap?
- What to take of it?
  - There may be other reasons
  - Things may also be very different for children

Health statistics

Health and economic development

Demand for health (and formalizing RCTs)

Nutrition and development

Hidden hunger

"Hidden hunger"

- Not enough nutrients (malnourished)
  - *"Malnourished person finds that their body has difficulty doing normal things such as growing and resisting disease. Physical work becomes problematic and even learning abilities can be diminished. For women, pregnancy becomes risky and they cannot be sure of producing nourishing breast milk."* (WFP)
- Not enough to eat (undernourished)
  - *"Under-nutrition affects school performance and studies have shown it often leads to a lower income as an adult. It also causes women to give birth to low birth-weight babies."* (WFP)

"Hidden hunger"

- Thomas et al. (2006): A randomized experiment in Indonesia (Work and Iron Status Evaluation):
  - Provision of iron supplement to 50% and placebo to 50%
    - Benefits? Issues?
  - Reduction in anemia ...
  - ... and increase in yearly earnings for self-employed workers who got the supplement and were anemic at baseline: $40
  - Cost of fortified Fish sauce for one year: $6
  - Cost-benefit analysis. (Why?)

Children and nutrients

- Nutrients most important before birth and during childhood
  - Pre-natal: children in-utero during (Ramadan/famine) tend to perform worse in life (Schultz-Nielsen et al., 2016; Meng and Qian, 2009)
- Better nutrition for children: long term investment
  - Improved learning ($\Rightarrow$ higher incomes)
  - Improved health ($\Rightarrow$ further improved learning)
- Fighting for nutritients with intestinal parasites (more on that in the tutorial: Miguel and Kremer 2004)

Taking stock

1. Impressive improvements in health globally; dramatic reductions in child mortality
2. Increased life expectancy on average no effect on per capita income; but positive effect on post-demographic transition countries (fertility endogenous!)
3. But take-up of many potentially profitable technologies low
   - 3.1 Price not always as a screening device but substantial elasticity; free distribution especially beneficial in presence of externalities
   - 3.2 Demand for treatment less elastic than for prevention
4. Nutrition-based poverty trap is unlikely
5. Possibly nutrient-based poverty traps?

- Where next? Education