L16 Health Policy and Development

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Introduction

- **Q1:** What is the evidence for effects of health on productivity and incomes?
- This pertains to the growth and anti-poverty implications for policies that seek to improve healthcare
- **Q2:** Is there evidence of effectiveness of specific health interventions?
- *References:* Q1: Strauss and Thomas JEL survey 1997 (+JEcTr results) Q2: Baird, Hicks, Kremer and Miguel (WP2012): 'Worms at Work'

Measurement Issues

- Measurement of *health* and *nutrition* is tricky: bias/errors in self-reported information
- For *health*, tend to rely on anthropometric measures:
  - height
  - weight, BMI
- Height depends on early childhood nutrition, weight depends also on recent nutrition, energy expended etc.
- For *nutrition*, measure calorie consumption, proteins, (+iron)

Hypotheses to be Tested

- Health and nutrition affects work productivity $\longrightarrow$ affects wages
- Health and nutrition affects hours worked $\longrightarrow$ affects earnings
- Expect these effects to be stronger for poorer groups, and those engaged in manual occupations

Problems in Empirical Testing

- Omitted variables: education, wealth, family/neighborhood characteristics
- Direction of causation: health to earnings, or vice versa?

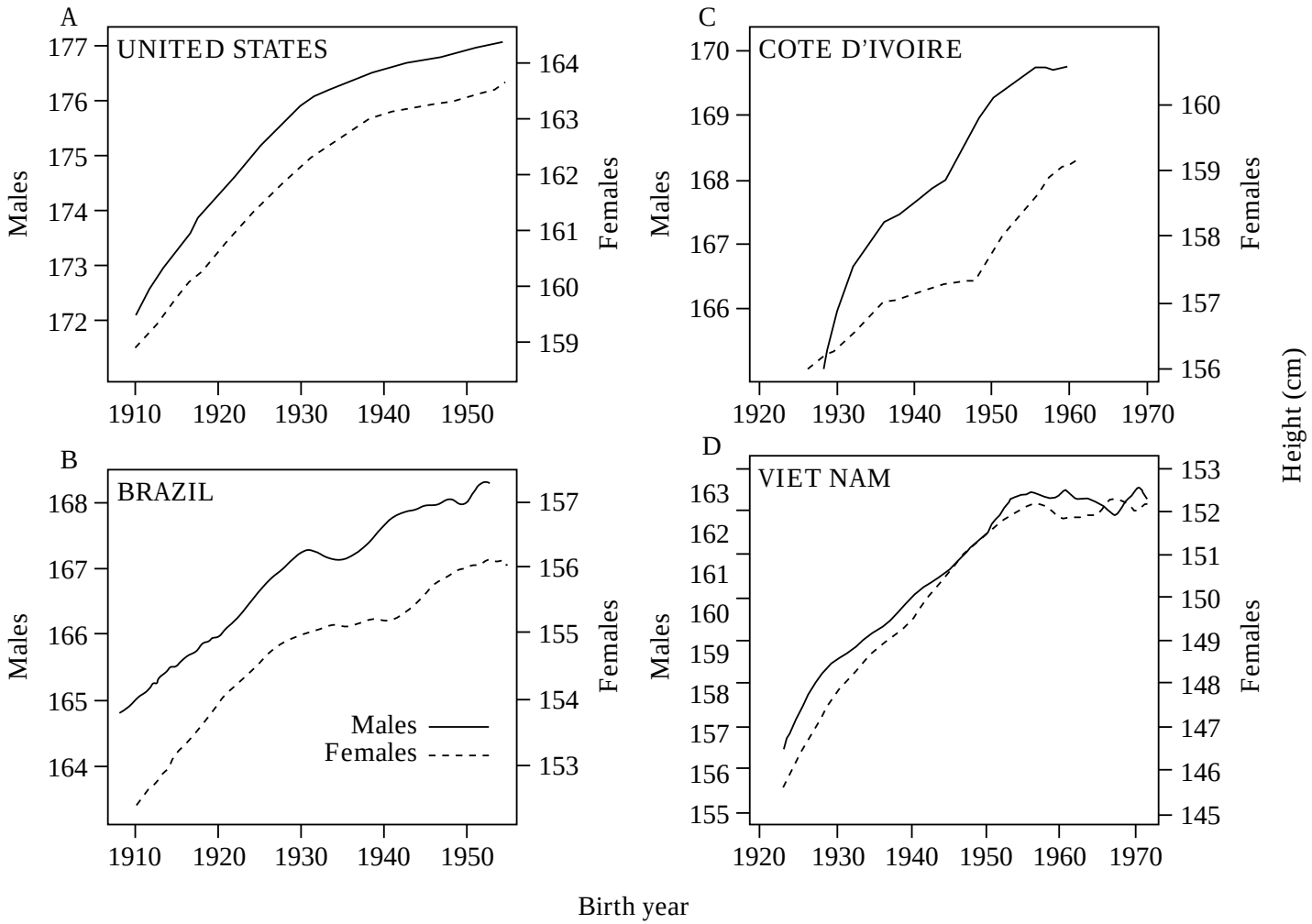
Steps in Empirical Analysis

1. Correlations/plots
2. Add controls: run regressions
3. Endogeneity concerns:
   - IV regressions (Thomas-Strauss 1997 results)
   - RCEs (Deworming Experiment in Kenya)

Is Height and Weight Entirely a Result of Genetics?

- Historical evidence (Robert Fogel) for US and Western Europe: significant increases in height over two successive centuries
- Observed in Japan over 1870-1900

Height Variations Across and Within Countries, 45-55 cohort



Variations within Vietnam

TABLE 1
ANNUAL RATES OF GROWTH OF ADULT STATURE: VIETNAMESE MALES

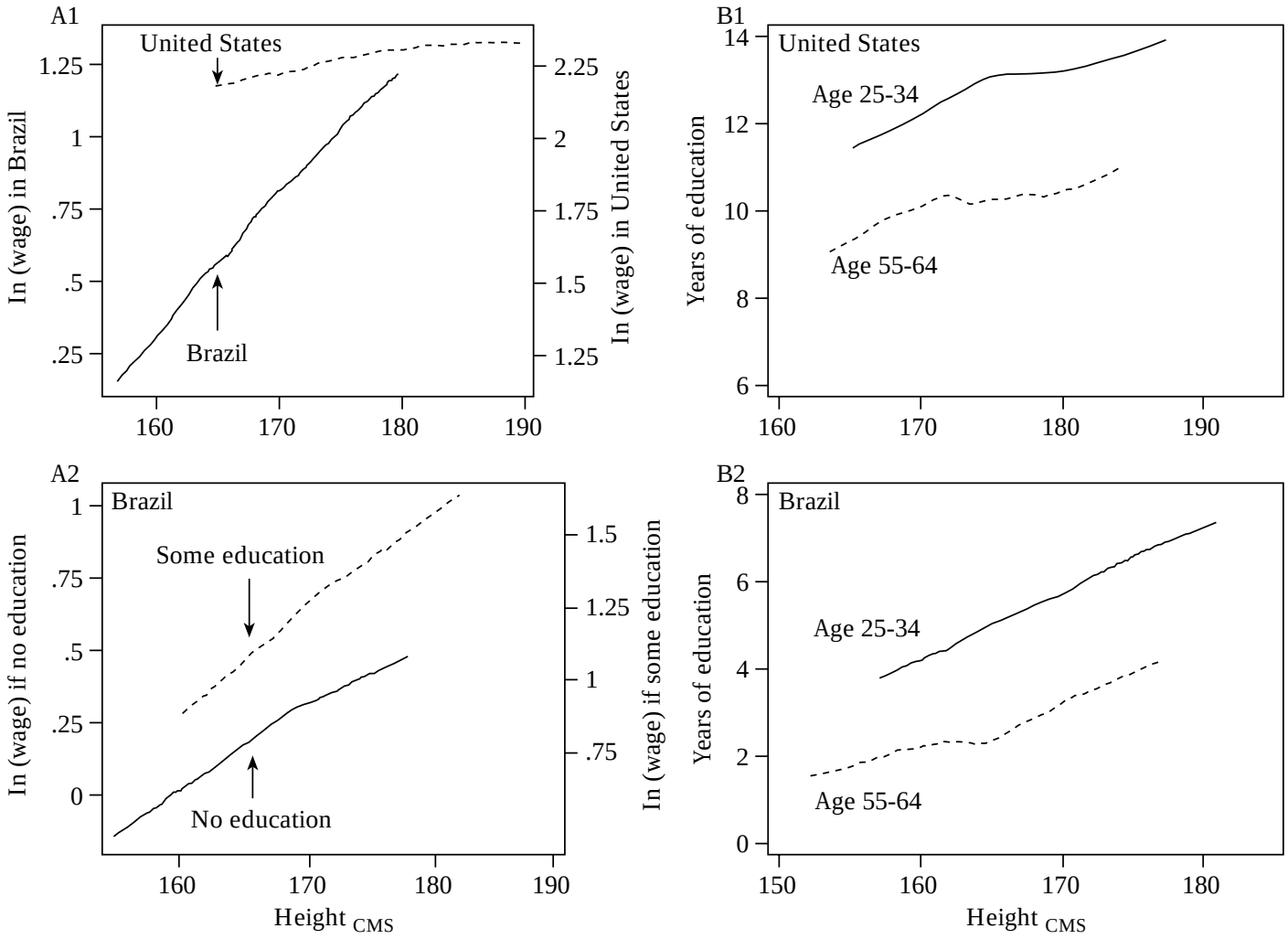
Birth Cohort:	1925–55		1956–70	
Birth Place:	North	South	North	South
10th Percentile	0.251*	0.164	–0.086	–0.041
	(0.03)	(0.03)	(0.05)	(0.05)
Mean	0.189*	0.150	–0.008	–0.060
	(0.02)	(0.02)	(0.03)	(0.04)
90th Percentile	0.134	0.129	0.039*	–0.075
	(0.03)	(0.03)	(0.05)	(0.05)

Notes: Coefficients from piecewise-linear regressions of height (in cm) on exact birth date (measured in years) for least squares (Mean) and quantile regressions (at 10th and 90th percentiles). Standard errors in parentheses. Quantile regression standard errors calculated using bootstrap. * Denotes significant difference between North and South at 5 percent level.

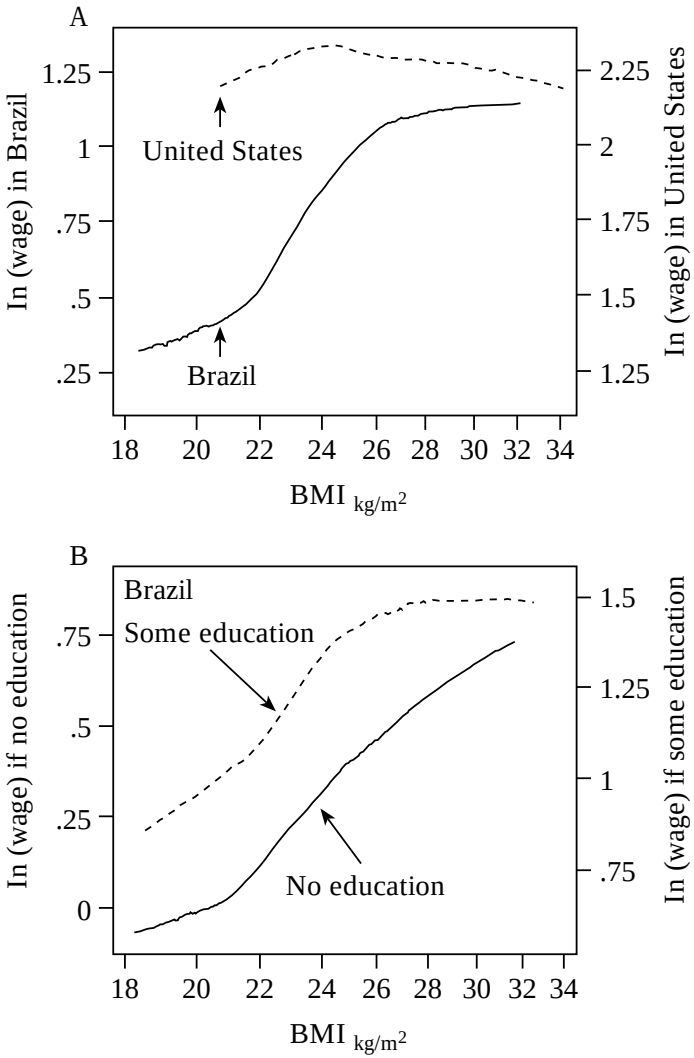
Brazil Sample in Strauss and Thomas

- 1974-75 Brazil Household Survey
- 53,000 households, nationally representative sample
- direct measurement of anthropometrics, nutrition
- survey-based data on earnings, education, hours worked

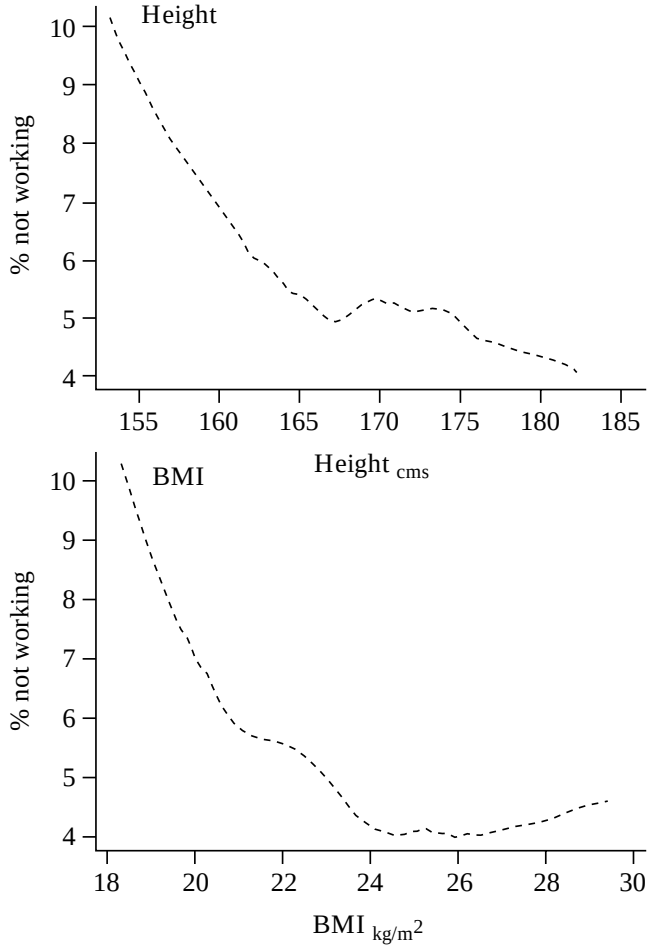
Height and Wages in US and Brazil, by Education and Age



BMI and Wages in US and Brazil



Height and BMI correlation with Labor Force Participation



Regressions: Inclusion of Controls; Endogeneity Concerns (Thomas and Strauss, J Econometrics 1997)

- Include controls for education, age, gender, neighborhood characteristics
- Cross-section data: no capacity for longitudinal analysis (irrelevant for height)
- Endogeneity concerns: direction of causality?
- Instrumental Variables: prices for 10 relevant food groups, and nonlabor income
- Exclusion Restriction: is it plausible?

Are the Instruments Strong Enough?

Table 1
First-stage F-statistics for significance of identifying instruments

	Males			Females		
	BMI	Calorie intakes	Protein intakes	BMI	Calorie intakes	Protein intakes
Prices & nonlabor income	11.7	10.7	20.6	10.3	15.1	34.6
p-value	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Prices	13.5	14.1	23.7	14.4	18.0	29.7
p-value	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Nonlabor income	6.5	1.9	12.2	0.2	8.6	43.9
p-value	(0.00)	(0.12)	(0.00)	(0.92)	(0.00)	(0.00)
R^2	0.07	0.16	0.16	0.09	0.16	0.17

IV Regression Results: male non-self-employed

Table 2
Males in market sector: Impact of health characteristics on ln(wages)

Covariates	No health (1)	Height only (2)	Add BMI (3)	Add calories (4)	Add protein (5)	All health (6)
ln(height)	.	2.431 (0.17)	2.407 (0.17)	2.832 (0.44)	1.437 (0.29)	3.921 (0.98)
ln(body mass index)	.	.	2.223 (1.08)	.	.	4.740 (2.29)
ln(per capita calories)	.	.	.	88.763 (35.94)	.	163.759 (74.75)
– squared	.	.	.	– 5.860 (2.37)	.	– 10.964 (4.96)
ln(per capita protein)	.	.	.	.	27.537 (13.67)	– 28.848 (29.73)
– squared	.	.	.	.	– 2.049 (1.06)	2.301 (2.29)
Education						
(1) literate	0.398 (0.02)	0.391 (0.02)	0.338 (0.03)	0.262 (0.07)	0.201 (0.06)	0.223 (0.08)
(1) elementary	0.830 (0.03)	0.803 (0.02)	0.709 (0.05)	0.636 (0.09)	0.484 (0.08)	0.515 (0.10)
(1) secondary +	1.867 (0.03)	1.791 (0.03)	1.642 (0.09)	1.606 (0.12)	1.372 (0.10)	1.338 (0.13)

IV Regression Results: Others

Table 4
Males and females: Self-employed and market sector workers

Covariates	Males, self-employed		Females, market sector		Females, self-employed	
	Hgt & BMI (1)	All health (2)	Hgt & BMI (1)	All health (2)	Hgt & BMI (1)	All health (2)
ln(height)	3.085	3.580	2.089	2.458	2.003	− 1.002
	(0.41)	(1.50)	(0.32)	(0.67)	(1.49)	(3.40)
ln(body mass index)	4.943	5.177	1.292	− 0.412	0.516	− 3.918
	(1.52)	(2.78)	(0.78)	(1.44)	(3.43)	(6.37)

Summary of Thomas-Strauss Regression Results

- Elasticity of wage rate with respect to height or BMI varies between 3-4 for males
- For females, elasticity with respect to height is approximately 2, BMI not significant
- Based on IV regression, so interpret these as causal effects (assuming the instruments are valid)

Concerns/Questions

- Are the instruments valid?
- What does this mean for health policy: do there exist health interventions which:
  - increase height and BMI
  - in a cost-effective manner?

Experimental Evidence (Strauss-Thomas JEL Survey, Section 5)

- 1972 Fenwick-Figerschon RCE with chemotherapy treatment for sugarcane plantation workers in Tanzania: significant impact on daily earnings (based on sugarcane cut)
- But similar experiment (Gateff et al 1971) in Cameroon found no impact
- No explanation available to explain these differences

Experimental Evidence (Strauss-Thomas JEL Survey, Section 5), contd.

- Criticisms: experiments were small in scale, short time-frame, relatively homogenous populations, so were low-powered
- Significant effects of 100% subsidy on Indonesian health clinic user fees (Gertler-Molyneaux 1996) on hours of work of men, esp. those less educated
- In general, studies find more systematic and significant effects on hours worked, than on wages/productivity

Deworming in Kenya: A Recent Policy Experiment

- Kremer and Miguel (2004) study an RCE involving deworming interventions in 75 schools in Busia, W. Kenya in 1998-2001, for 12-year-old kids in 4th grade
- Follow up study by Baird, Hicks, Kremer and Miguel (WP2012), 2007-09, **ten years later**, examining effects on education, wages, hours worked
- Large sample (7500 children), long-term effects (tracking rate 84%), spillovers to neighboring areas, benefit-cost analysis of intervention

Context: Worm Infections

- Two kinds of worm infections:
  - geohelminths (hookworm, roundworm, whipworm)
  - schistosomiasis
- Effects: anemia, stunting, lowered immune system (helminths); liver/spleen enlargements, death (sch.)
- Spread via: open defecation (helminths), across waterways (sch.)

Experiment Details

- Schools randomly divided into three groups
- Group 1: free deworming treatment, starting 1998
- Group 2: free deworming treatment, starting 1999 (control 1998)
- Group 2: free deworming treatment, starting 2001 (control 1998-2000)
- 2001 variation: half randomly chosen, required to pay small price for drugs; 2002 onwards, returned to free treatment: had large effects on takeup

Baseline

Table 1: Baseline (1998) summary statistics and PSDP randomization checks, and KLPS (2007-09) survey attrition patte

	All mean (s.d.)	Treatment mean (s.d.)	Control mean (s.d.)	Treatment – Control (s.e.)	Kolmogorov-Smirnov p-value
Panel A: Baseline summary statistics					
Age (1998)	11.9	11.9	12.0	-0.04	0.106
	(2.6)	(2.6)	(2.6)	(0.11)	
Grade (1998)	4.23	4.22	4.25	-0.03	0.162
	(1.68)	(1.70)	(1.66)	(0.05)	
Female	0.470	0.469	0.473	-0.004	--
				(0.019)	
School average test score (1996)	0.029	0.024	0.038	-0.013	0.299
	(0.427)	(0.436)	(0.406)	(0.109)	
Primary school located in Budalangi division	0.370	0.364	0.381	-0.017	--
				(0.137)	
Population of primary school	476	494	436	58	0.405
	(214)	(237)	(146)	(54)	

Impact on Health, Nutrition, School Participation, 2004 results

Table 2: Impacts on health, nutrition and education outcomes

Dependent variable	Control group variable mean (s.d.)	Coefficient estimate (s.e.) on deworming treatment indicator	Coefficient estimate (s.e.) on deworming treatment school pupils within 6 km (in '000s), demeaned
Panel A: Health and education outcomes during 1998-2001			
Moderate-heavy worm infection (1999, 2001 parasitological surveys)	0.321	-0.245***	-0.075***
	(0.467)	(0.030)	(0.026)
Hemoglobin (Hb) level (1999, 2001 parasitological survey samples)	126.1	1.03	0.91
	(14.7)	(0.81)	(0.96)
Falls sick often (self-reported), 1999	0.154	-0.037**	0.001
	(0.361)	(0.015)	(0.014)
Total primary school participation, 1998-2001	2.51	0.127***	-0.115*
	(1.12)	(0.064)	(0.060)
Academic test score (normalized across all subjects), 1999	0.026	0.059	0.158
	(1.000)	(0.090)	(0.101)
Panel B: Health and nutrition outcomes, KLPS (2007-09)			
Self-reported health "very good"	0.673	0.041**	0.028
	(0.469)	(0.018)	(0.022)
Height (cm)	167.3	-0.12	-0.39
	(8.0)	(0.26)	(0.33)
Number of pregnancies	0.98	-0.093	-0.044
	(1.29)	(0.066)	(0.065)
Miscarriage indicator (among females only)	0.039	-0.028**	-0.020*
	(0.194)	(0.013)	(0.010)

Impact on Education Outcomes, 2007-09 Survey, In-School sample

Panel C: Education outcomes, KLPS (2007-09)			
Total years enrolled in school, 1998-2007	6.69	0.279*	0.138
	(2.97)	(0.147)	(0.149)
Grades of schooling attained	8.72	0.153	0.070
	(2.21)	(0.143)	(0.146)
Indicator for repetition of at least one grade (1998-2007)	0.672	0.060***	0.010
	(0.470)	(0.017)	(0.023)
Enrolled in school in year of 2007-09 survey	0.252	0.003	-0.045*
	(0.434)	(0.022)	(0.026)
English vocabulary test score (normalized), 2007-09	0.000	0.076	0.067
	(1.000)	(0.055)	(0.053)
Passed primary school leaving exam during 1998-2007	0.505	0.048	0.032
	(0.500)	(0.031)	(0.029)

Impact on Education Outcomes, 2007-09 Survey, Out-of-School sample

English vocabulary test score (normalized), 2007-09	-0.232	0.107**	0.149***
	(0.972)	(0.052)	(0.047)
Passed primary school leaving exam during 1998-2007	0.413	0.061*	0.083***
	(0.493)	(0.032)	(0.028)

Impact on Labor Supply, 2007-09 Survey

Table 3: Deworming impacts on labor supply (out-of-school sample)

Dependent variable	Control group variable mean (s.d.)	Coefficient estimate (s.e.) on deworming Treatment indicator	Coefficient estimate (s.e.) on deworming Treatment pupils within 6 km (in '000s), demeaned	Obs.
Panel A: Hours worked in last week				
Full sample	15.2	1.76*	1.54	5,084
	(21.9)	(0.97)	(1.16)	
Out-of-school sample	18.5	3.10**	1.71	3,873
	(23.8)	(1.21)	(1.44)	
Indicator for hours worked > 0	0.704	0.023	-0.027	3,873
	(0.457)	(0.024)	(0.030)	
Hours worked within sector (conditional on hours>0) by individuals in:				
Wage employment, self-employment, agriculture	26.3	3.23**	3.51**	2,853
	(24.5)	(1.44)	(1.58)	
Traditional agriculture	9.8	1.10*	-0.77	2,187
	(9.1)	(0.66)	(0.62)	
Wage employment and/or self-employment	44.6	5.03**	7.40***	1,120
	(23.0)	(2.19)	(2.39)	
Self-employment	38.2	6.7**	7.7***	528
	(24.0)	(3.0)	(2.9)	
Wage employment	47.3	4.53*	5.06**	605
	(21.3)	(2.67)	(3.11)	
Panel B: Hours worked in all sectors, by individuals with hours>0 in past week in:				

Impact on Wages and Earnings, 2007-09 Survey

Table 5: Deworming impacts on wage and non-agricultural self-employment earnings

Dependent variable	Control group variable mean (s.d.)	Coefficient estimate (s.e.) on deworming Treatment indicator	Coefficient estimate (s.e.) on deworming Treatment pupils within 6 km (in '000s), demeaned	Obs.
Panel A: Wage earners, out-of-school subsample				
Ln(Total labor earnings, past month)	7.84	0.301***	0.228	687
	(0.84)	(0.091)	(0.163)	
Ln(Wage = Total labor earnings / hours, past month)	2.76	0.203*	0.027	605
	(0.94)	(0.111)	(0.155)	
Panel B: Wage earners since 2007 subsample				
Ln(Total labor earnings, most recent month worked)	7.88	0.211***	0.170	1,175
	(0.91)	(0.072)	(0.116)	
Indicator for worked for wages (or in-kind) since 2007	0.244	0.000	0.040	5,081
	(0.430)	(0.021)	(0.024)	
Panel C: Self-employed (non-agriculture), out-of-school subsample				
Total self-employed profits (self-reported) past month	1,771	409	-53	570
	(2,621)	(313)	(361)	
Total self-employed profits (self-reported) past month, top 5% trimmed	1,224	407**	198	539
	(1,151)	(176)	(212)	
Total employees hired (excluding self), among the self-employed	0.189	0.641*	0.623	616
	(0.625)	(0.374)	(0.530)	
Panel D: Wage earners or self-employed (non-agr.), out-of-school subsample				
Total earnings (wages, self-employed profits), past month (=0 for non-earners)	974	245*	46	3,847
	(2,392)	(136)	(186)	
Total earnings (wages, self-employed profits), past month, top 5% trimmed profits	900	231*	51	3,816
	(2,227)	(130)	(180)	
Panel E: Agriculture, out-of-school subsample				
Total value (KSh) of crop sales past year (if farm household)	578	126	-168	2,732
	(2534)	(198)	(264)	
Uses "improved" agricultural practice (fertilizer, seed, irrigation)	0.295	0.047*	0.035	2,738
	(0.456)	(0.027)	(0.028)	

Benefit-Cost Analysis: Social Rate of Return

Panel B: Deworming as a human capital investment	Total benefits (per pupil), USD	Deworming cost and DWL (per pupil), USD	Internal rate of return, per annu
Total lifetime earnings (over 40 years), only current non-agricultural sample gains	$1,001	$0.53	64.1%
Total lifetime earnings (over 40 years), entire sample gains	$2,961	$0.53	81.7%

Notes: The take-up levels and deworming subsidies and prices are taken from Kremer and Miguel (2007). Data on number of school-age children comes from the US census, on enrollment rates from UNICEF, and on tax rates from the World Bank.

Summary

- Evidence that health interventions for children can raise earnings, hours of work ten years later when they work as adults
- The interventions are cost-effective: would more than pay for themselves many times over (from social point of view)
- Why don't parents ensure their children take these drugs?
- Possible explanations:
  - poverty (significant effect of price on take-up)
  - ignorance of future benefits?