Economics 270c

Development Economics

Lecture 9 – March 14, 2007

Lecture 1: Global patterns of economic growth and development (1/16)

<u>The political economy of development</u>

Lecture 2: Inequality and growth (1/23)
Lecture 3: Corruption (1/30) – Guest lecture by Ben Olken
Lecture 4: History and institutions (2/6)
Lecture 5: Democracy and development (2/13)
Lecture 6: Ethnic and social divisions (2/20)
Lecture 7: Economic Theories of Conflict (2/27)
Lecture 8: War and Economic Development (3/6)

<u>Human resources</u>

Lecture 9: Human capital and income growth (4/3)
Lecture 10: Increasing human capital (4/10)
☆Lecture 11: Health and nutrition (3/13)
Lecture 12: The Economics of HIV/AIDS (3/20)
Lecture 13: Labor markets and migration (4/17)

Lecture 14: Environment and development (4/24)
Lecture 15: Social Learning and Technology Adoption (5/1)

- Referee report #3 is due today
- I will pass out problem set #1 next week

Lecture 9 outline

(1) Health, education and economic development

(2) Using randomized evaluations to estimate causal relationships

(3) Miguel and Kremer (2004) on deworming in children

(4) Thomas et al. (2003) on iron supplementation in adults

(1) Some leading questions

- An observation: health and wealth are correlated both across countries and across people within societies. Why?

- Question #1: What is the impact of income on health and nutrition? Richer people consume more “health”

- Question #2: What is the impact of health/nutrition on labor productivity?

- Question #3: Which policies / institutions improve the delivery of public health services in poor countries? Banerjee et al (2004) on Rajasthan - 50% absetneeism

(1) A simple model of health and education

- A production function for academic skills, as measured by test scores when the child is in primary school (time 2). Time period 1 is pre-primary school:

  (1) $$T_2 = T(H_1, H_2, EI_1, EI_2, \alpha, SC, YS)$$

- H_t is child health at *t*, EI_t is parents' provision of educational inputs (supplies, time spent teaching the child), α is the child's innate intelligence (ability), SC is school characteristics, YS years of schooling by time 2

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- H_t is child health at *t*, EI_t is parents' provision of educational inputs (supplies, time spent teaching the child), α is the child's innate intelligence (ability), SC is school characteristics, YS years of schooling by time 2
- The production function shows how child health status in both time periods could affect learning. This is a *structural relationship* because all of the variables in the production function *directly* affect academic skills, and all the variables with direct effects are included

(1) A simple model of health and education

- If one had accurate data on all the variables in equation (1) one could estimate it using relatively simple methods, such as OLS, to obtain unbiased estimates of the direct impacts of all variables on child academic skills

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- However, some of the variables are unobserved and the observable variables themselves are *chosen* in a household optimization problem. Correlations between unobserved child ability and healthiness complicate interpretation. For example, innately clever kids could naturally be healthier. Parents may also direct more educational investments towards healthier kids.

(1) A simple model of health and education

- Child health is also chosen (in part) by households:

  $H_1 = H(C_1, M_1, HE_1, \eta)$

  $H_2 = H(C_2, M_2, HE_2, \eta; H_1)$

- C_t is the child's consumption of the aggregate good (e.g., food) in period t, M_t is health inputs ("medicine") broadly defined, HE_t is the local health environment (prevalence of infectious diseases, air / water quality, etc.) and η is the innate healthiness of the child

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- Households then maximize the utility function

  $U = U(C_1, C_2, H_1, H_2, T_2)$ subject to a budget constraint

(2) Randomized evaluation methods

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- Randomized provision of a health/nutrition intervention breaks the link between household characteristics, (unobserved) child innate ability and health, and prior investments in child health/education

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- Randomized provision of a health/nutrition intervention breaks the link between household characteristics, (unobserved) child innate ability and health, and prior investments in child health/education

- There may be endogenous household behavioral response to an intervention. Thus the difference between the treatment / comparison groups should be thought of as the combined impact of the intervention *per se* together with any resulting behavioral changes

(2) Randomized evaluation methods

- Imagine a public intervention that improves the health outcomes of young children, increasing H_1

- In the production function for academic skills:

  (1) $$T_2 = T(H_1, H_2, EI_1, EI_2, \alpha, SC, YS)$$

- This exogenous change in young child health not only directly affects academic performance (potentially) but also affects later health outcomes H_2 as well as parent education investment levels EI_2 and "medicine" M_2

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- This exogenous change in young child health not only directly affects academic performance (potentially) but also affects later health outcomes H_2 as well as parent education investment levels EI_2 and “medicine” M_2

- The overall program impact – directly and indirectly through behavior – is often of public policy interest

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  (1) Randomization helps address an array of well-known biases, e.g., it can resolve the selection problem that often plagues treatment effect estimates

  (2) As a result, randomized research designs can allow the researchers to identify behavioral parameters that are of theoretical interest, and that are difficult or impossible to estimate using other methods (e.g., estimating social effects)

  (3) The results of randomized evaluations are typically transparent and highly credible to policymakers

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  This is arguably a strength rather than a weakness

  (4) These methods are inherently atheoretical

  Not true: several recent papers have used these methods to tackle fundamental theoretical issues (e.g., Karlan and Zinman 2006 on moral hazard and adverse selection in credit markets, Todd and Wolpin 2005)

(2) Broader critiques

- The trend towards empirical work in development economics has been criticized by some senior leaders in the field (i.e., the Economic and Political Weekly "debate" in 2005 pitting Bardhan, Basu and Mookherjee versus Banerjee)

- This is part of a broader trend throughout economics (e.g., labor economics) as micro-data has improved, computing power has become cheaper, and better applied econometric tools have been developed

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  (1) Within-household agency problems or imperfect parental altruism towards children

  (2) Positive treatment externalities

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- To frame the discussion: why might there be scope for public intervention in the health sector? In other words, why don't households provide the necessary health investments themselves privately?

  (1) Within-household agency problems or imperfect parental altruism towards children

  (2) Positive treatment externalities

  (3) Poor (or incorrect) knowledge of new health technologies among individuals

  (4) Credit constraints prevent good health investments

(3) Miguel and Kremer (2004)

- Worms infections (e.g., hookworm, whipworm, roundworm, schistosomiasis) are among the world’s most common infections

- We study school-based deworming treatment. In our sample of rural Kenyan school children, over 90% were infected at baseline. Between one third and one half had “serious” infections

- Worms do not reproduce within the body. They pass worm larvae out through human fecal matter and this can infect others. Treatment generates a positive externality by reducing this transmission to others

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- 75 primary schools, over 30,000 children (aged 6-18)
- Deworming treatment (drugs, health education) phased in randomly across three treatment groups. These groups are similar along observables

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- Deworming treatment (drugs, health education) phased in randomly across three treatment groups. These groups are similar along observables
  - Listed school alphabetically (by zone), and counted off 1-2-3, 1-2-3, etc. Thus the placement of schools into groups was not done by a random number generator, but is completely arbitrary and orthogonal to omitted variables

- Group 1: treatment 1998 and 1999
- Group 2: no treatment 1998, treatment 1999
- Group 3: no treatment in 1998 or 1999

TABLE I

1998 AVERAGE PUPIL AND SCHOOL CHARACTERISTICS, PRE-TREATMENT[a]

	Group 1 (25 schools)	Group 2 (25 schools)	Group 3 (25 schools)	Group 1 – Group 3	Group 2 – Group 3
Panel A: Pre-school to Grade 8					
Male	0.53	0.51	0.52	0.01	−0.01
				(0.02)	(0.02)
Proportion girls <13 years, and all boys	0.89	0.89	0.88	0.00	0.01
				(0.01)	(0.01)
Grade progression (= Grade − (Age − 6))	−2.1	−1.9	−2.1	−0.0	0.1
				(0.1)	(0.1)
Year of birth	1986.2	1986.5	1985.8	0.4**	0.8***
				(0.2)	(0.2)
Panel B: Grades 3 to 8					
Attendance recorded in school registers (during the four weeks prior to the pupil survey)	0.973	0.963	0.969	0.003	−0.006
				(0.004)	(0.004)
Access to latrine at home	0.82	0.81	0.82	0.00	−0.01
				(0.03)	(0.03)
Have livestock (cows, goats, pigs, sheep) at home	0.66	0.67	0.66	−0.00	0.01
				(0.03)	(0.03)
Weight-for-age Z-score (low scores denote undernutrition)	−1.39	−1.40	−1.44	0.05	0.04
				(0.05)	(0.05)

TABLE II

JANUARY 1998 HELMINTH INFECTIONS, PRE-TREATMENT, GROUP 1 SCHOOLS[a]

	Prevalence of infection	Prevalence of moderate-heavy infection	Average infection intensity, in eggs per gram (s.e.)
Hookworm	0.77	0.15	426 (1055)
Roundworm	0.42	0.16	2337 (5156)
Schistosomiasis, all schools	0.22	0.07	91 (413)
Schistosomiasis, schools <5 km from Lake Victoria	0.80	0.39	487 (879)
Whipworm	0.55	0.10	161 (470)
At least one infection	0.92	0.37	–
Born since 1985	0.92	0.40	–
Born before 1985	0.91	0.34	–
Female	0.91	0.34	–
Male	0.93	0.38	–
At least two infections	0.31	0.10	–
At least three infections	0.28	0.01	–

TABLE III

PROPORTION OF PUPILS RECEIVING DEWORMING TREATMENT IN PSDP[a]

	Group 1		Group 2		Group 3	
	Girls <13 years, and all boys	Girls ≥ 13 years	Girls <13 years, and all boys	Girls ≥ 13 years	Girls <13 years, and all boys	Girls ≥ 13 years
	Treatment		*Comparison*		*Comparison*	
Any medical treatment in 1998	0.78	0.19	0	0	0	0
(For grades 1–8 in early 1998)						
Round 1 (March–April 1998), Albendazole	0.69	0.11	0	0	0	0
Round 1 (March–April 1998), Praziquantel[b]	0.64	0.34	0	0	0	0
Round 2 (Oct.–Nov. 1998), Albendazole	0.56	0.07	0	0	0	0

(3) Miguel and Kremer (2004)

- One of the goals of the paper is to compare the naïve treatment effect estimator, “Treatment minus comparison”, $E(Y_{ij} \mid T_{1i} =1) - E(Y_{ij} \mid T_{1i} =0)$, to estimators that take into account “contamination” of the experiment from externalities. This contamination may produce gains in the comparison group

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- Externalities would lead us to doubly under-estimate treatment effects: (i) miss impacts in the comparison group, (ii) understate impacts in the treatment group
  – A real concern in existing studies that randomize within schools and often found no significant impact

(3) Miguel and Kremer (2004)

- The naïve program impact estimator (in existing studies, which often find small or insignificant effects):
  $E(Y_{ij} \mid T_{1i} =1) – E(Y_{ij} \mid T_{1i} =0)$, which can be re-written
  $E(Y_{ij} \mid T_{1i} =1, N^T = N^{AVG}) – E(Y_{ij} \mid T_{1i} =0, N^T = N^{AVG})$

TABLE V

JANUARY TO MARCH 1999, HEALTH AND HEALTH BEHAVIOR DIFFERENCES BETWEEN GROUP 1 (1998 TREATMENT) AND GROUP 2 (1998 COMPARISON) SCHOOLS[a]

	Group 1	Group 2	Group 1 – Group 2
Panel A: Helminth Infection Rates			
Any moderate-heavy infection, January–March 1998	0.38	–	–
Any moderate-heavy infection, 1999	0.27	0.52	−0.25***
			(0.06)
Hookworm moderate-heavy infection, 1999	0.06	0.22	−0.16***
			(0.03)
Roundworm moderate-heavy infection, 1999	0.09	0.24	−0.15***
			(0.04)
Schistosomiasis moderate-heavy infection, 1999	0.08	0.18	−0.10*
			(0.06)
Whipworm moderate-heavy infection, 1999	0.13	0.17	−0.04
			(0.05)
Panel B: Other Nutritional and Health Outcomes			
Sick in past week (self-reported), 1999	0.41	0.45	−0.04**
			(0.02)
Sick often (self-reported), 1999	0.12	0.15	−0.03**
			(0.01)
Height-for-age Z-score, 1999	−1.13	−1.22	0.09*
(low scores denote undernutrition)			(0.05)
Weight-for-age Z-score, 1999	−1.25	−1.25	−0.00
(low scores denote undernutrition)			(0.04)
Hemoglobin concentration (g/L), 1999	124.8	123.2	1.6
			(1.4)
Proportion anemic (Hb < 100g/L), 1999	0.02	0.04	−0.02**
			(0.01)
Panel C: Worm Prevention Behaviors			
Clean (observed by field worker), 1999	0.59	0.60	−0.01
			(0.02)
Wears shoes (observed by field worker), 1999	0.24	0.26	−0.02
			(0.03)
Days contact with fresh water in past week	2.4	2.2	0.2
(self-reported), 1999			(0.3)

(3) Miguel and Kremer (2004)

- The naïve program impact estimator (in existing studies, which often find small or insignificant effects): $E(Y_{ij} \mid T_{1i} =1) - E(Y_{ij} \mid T_{1i} =0)$, which can be re-written $E(Y_{ij} \mid T_{1i} =1, N^T = N^{AVG}) - E(Y_{ij} \mid T_{1i} =0, N^T = N^{AVG})$

- The ideal program impact estimator, taking into account treatment externalities:
- $E(Y_{ij} \mid T_{1i} =1, N^T = N^{AVG}) - E(Y_{ij} \mid T_{1i} =0, N^T = 0)$,

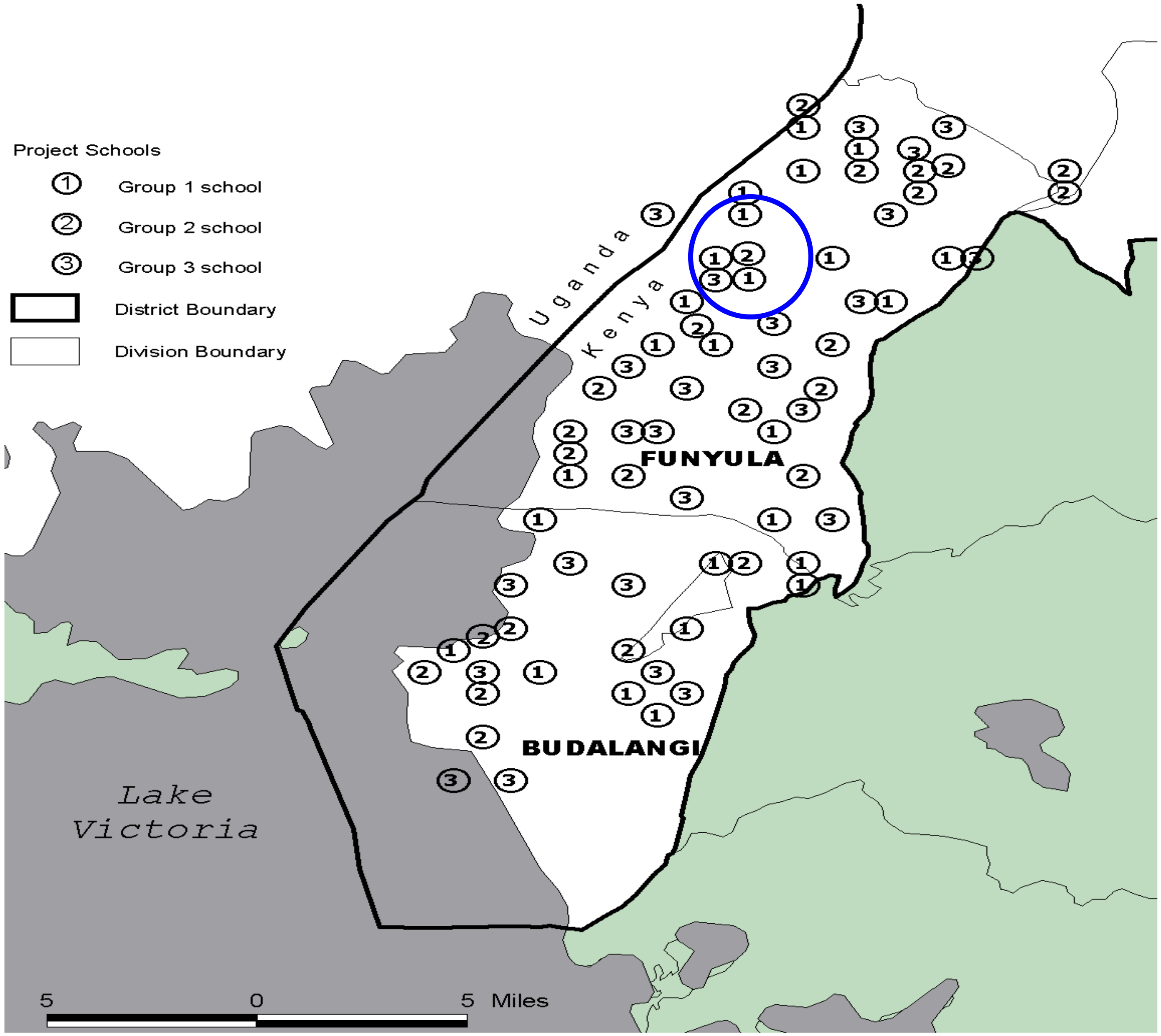
which is equivalent to

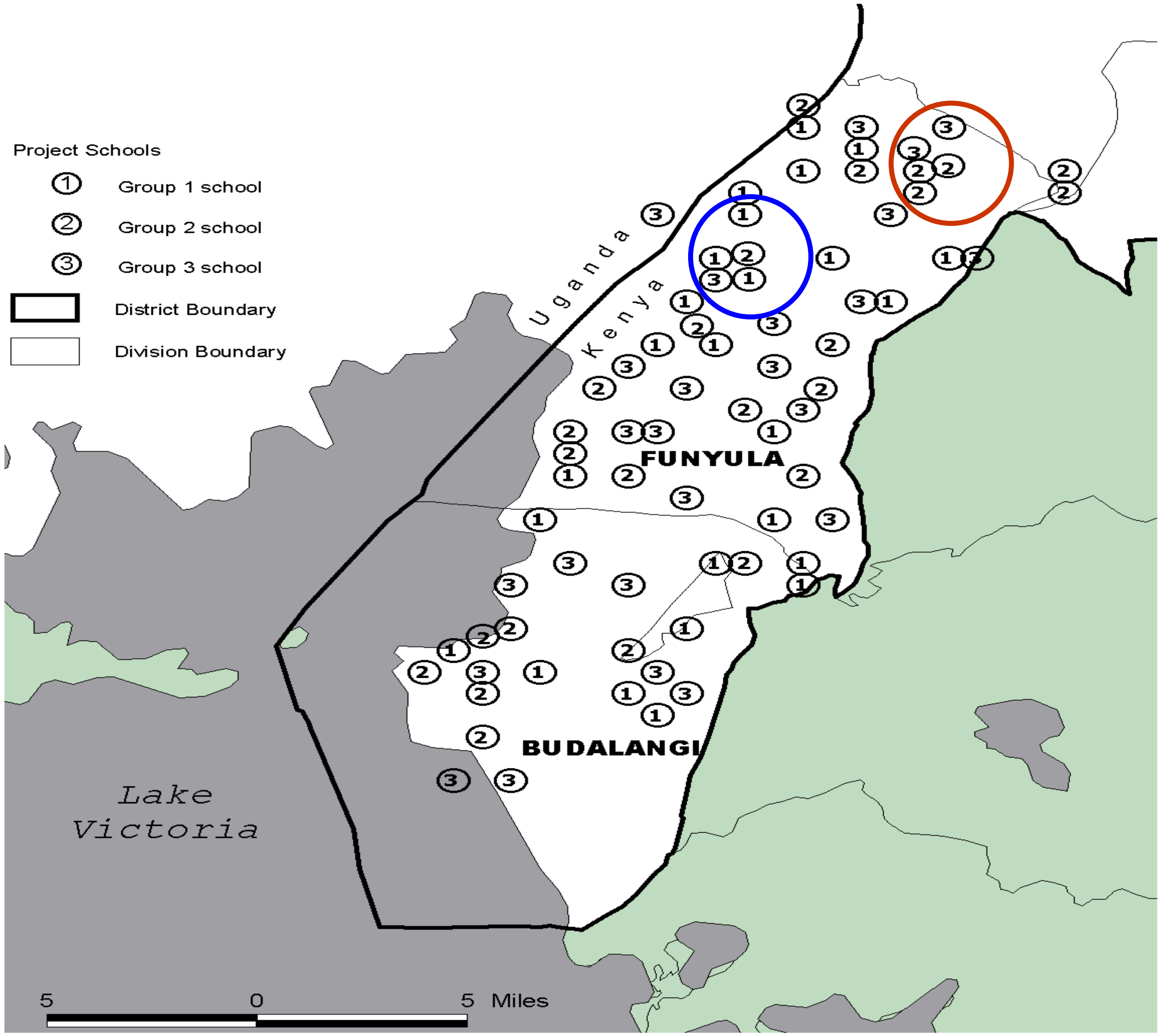
$$\{E(Y_{ij} \mid T_{1i} =1, N^T = N^{AVG}) - E(Y_{ij} \mid T_{1i} =0, N^T = N^{AVG})\}$$
$$+ \{E(Y_{ij} \mid T_{1i} =0, N^T = N^{AVG}) - E(Y_{ij} \mid T_{1i} =0, N^T = 0)\}$$

We first estimate program impacts in treatment schools, as well as cross-school treatment externalities:[24]

$$(1) \qquad Y_{ijt} = a + \beta_1 \cdot T_{1it} + \beta_2 \cdot T_{2it} + X'_{ijt}\delta + \sum_d (\gamma_d \cdot N^T_{dit}) + \sum_d (\phi_d \cdot N_{dit}) + u_i + e_{ijt}.$$

Y_{ijt} is the individual health or education outcome, where i refers to the school, j to the student, and $t \in \{1, 2\}$ to the year of the program; T_{1it} and T_{2it} are indicator variables for school assignment to the first and second year of deworming treatment, respectively; and X_{ijt} are school and pupil characteristics. N_{dit} is the total number of pupils in primary schools at distance d from school i in year t, and N^T_{dit} is the number of these pupils in schools randomly assigned to deworming treatment. For example, in Sections 5 and 6, $d = 03$ denotes schools that are located within three kilometers of school i, and $d = 36$ denotes schools that are located between three to six kilometers away.[25] Individual disturbance terms are assumed to be independent across schools, but are allowed to be correlated for observations within the same school, where the school effect is captured in the u_i term.


Project Schools
Group 1 school
Group 2 school
Group 3 school
District Boundary
Division Boundary
Uganda
Kenya
FUNYULA
BUDALANGI
Lake Victoria
5
0
5 Miles


Project Schools
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5
0
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TABLE VII

DEWORMING HEALTH EXTERNALITIES WITHIN AND ACROSS SCHOOLS, JANUARY TO MARCH 1999[a]

	Any moderate-heavy helminth infection, 1999			Moderate-heavy schistosomiasis infection, 1999			Moderate-heavy geohelminth infection, 1999		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Indicator for Group 1 (1998 Treatment) School	−0.25***	−0.12*	−0.09	−0.03	−0.02	−0.07	−0.20***	−0.11**	−0.03
	(0.05)	(0.07)	(0.11)	(0.03)	(0.04)	(0.06)	(0.04)	(0.05)	(0.09)
Group 1 pupils within 3 km (per 1000 pupils)	−0.26***	−0.26***	−0.11	−0.12***	−0.12***	−0.11**	−0.12*	−0.12*	−0.01
	(0.09)	(0.09)	(0.13)	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)	(0.07)
Group 1 pupils within 3–6 km (per 1000 pupils)	−0.14**	−0.13**	−0.07	−0.18***	−0.18***	−0.27***	0.04	0.04	0.16
	(0.06)	(0.06)	(0.14)	(0.03)	(0.03)	(0.06)	(0.06)	(0.06)	(0.10)
Total pupils within 3 km (per 1000 pupils)	0.11***	0.11***	0.10**	0.11***	0.11***	0.13***	0.03	0.04	0.02
	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Total pupils within 3–6 km (per 1000 pupils)	0.13**	0.13**	0.12*	0.12***	0.12***	0.16***	0.04	0.04	0.01
	(0.06)	(0.06)	(0.07)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Received first year of deworming treatment, when offered (1998 for Group 1, 1999 for Group 2)		−0.06*			0.03**			−0.04**	
		(0.03)			(0.02)			(0.02)	
(Group 1 Indicator) * Received treatment, when offered		−0.14*			−0.02			−0.10***	
		(0.07)			(0.04)			(0.04)	
(Group 1 Indicator) * Group 1 pupils within 3 km (per 1000 pupils)			−0.25*			−0.04			−0.18**
			(0.14)			(0.07)			(0.08)
(Group 1 Indicator) * Group 1 pupils within 3–6 km (per 1000 pupils)			−0.09			0.11			−0.15
			(0.13)			(0.07)			(0.10)
Grade indicators, school assistance controls, district exam score control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	2328	2328	2328	2328	2328	2328	2328	2328	2328
Mean of dependent variable	0.41	0.41	0.41	0.16	0.16	0.16	0.32	0.32	0.32

$$Y_{ijt} = a + \beta_1 \cdot T_{1it} + b_1 \cdot D_{1ij} + b_2 \cdot (T_{1it} * D_{1ij}) + X'_{ijt}\delta + \sum_d (\gamma_d \cdot N^T_{dit}) + \sum_d (\phi_d \cdot N_{dit}) + u_i + e_{ijt}. \tag{3}$$

TABLE VI

DEWORMING HEALTH EXTERNALITIES WITHIN SCHOOLS, JANUARY TO MARCH 1999[a]

	Group 1, Treated in 1998	Group 1, Untreated in 1998	Group 2, Treated in 1999	Group 2, Untreated in 1999	(Group 1, Treated 1998) – (Group 2, Treated 1999)	(Group 1, Untreated 1998) – (Group 2, Untreated 1999)
Panel A: Selection into Treatment						
Any moderate-heavy infection, 1998	0.39	0.44	–	–	–	–
Proportion of 1998 parasitological sample tracked to 1999 sample[b]	0.36	0.36	–	–	–	–
Access to latrine at home, 1998	0.84	0.80	0.81	0.86	0.03	–0.06
					(0.04)	(0.05)
Grade progression (= Grade – (Age – 6)), 1998	–2.0	–1.8	–1.8	–1.8	–0.2**	–0.0
					(0.1)	(0.2)
Weight-for-age (Z-score), 1998 (low scores denote undernutrition)	–1.58	–1.52	–1.57	–1.46	–0.01	–0.06
					(0.06)	(0.11)
Malaria/fever in past week (self-reported), 1998	0.37	0.41	0.40	0.39	–0.03	–0.01
					(0.04)	(0.06)
Clean (observed by field worker), 1998	0.53	0.59	0.60	0.66	–0.07	–0.07
					(0.05)	(0.10)
Panel B: Health Outcomes						
Girls <13 years, and all boys						
Any moderate-heavy infection, 1999	0.24	0.34	0.51	0.55	–0.27***	–0.21**
					(0.06)	(0.10)
Hookworm moderate-heavy infection, 1999	0.04	0.11	0.22	0.20	–0.19***	–0.09*
					(0.03)	(0.05)
Roundworm moderate-heavy infection, 1999	0.08	0.12	0.22	0.30	–0.14***	–0.18**
					(0.04)	(0.07)
Schistosomiasis moderate-heavy infection, 1999	0.09	0.08	0.20	0.13	–0.11*	–0.05
					(0.06)	(0.06)
Whipworm moderate-heavy infection, 1999	0.12	0.16	0.16	0.20	–0.04	–0.05
					(0.16)	(0.09)

TABLE IX

SCHOOL PARTICIPATION, DIRECT EFFECTS AND EXTERNALITIES[a]
DEPENDENT VARIABLE: AVERAGE INDIVIDUAL SCHOOL PARTICIPATION, BY YEAR

	OLS (1)	OLS (2)	OLS (3)	OLS (4) May 98– March 99	OLS (5) May 98– March 99	OLS (6) May 98– March 99	IV-2SLS (7) May 98– March 99
Moderate-heavy infection, early 1999						−0.028*** (0.010)	−0.203* (0.094)
Treatment school (T)	0.051*** (0.022)						
First year as treatment school (T1)		0.062*** (0.015)	0.060*** (0.015)	0.062* (0.022)	0.056*** (0.020)		
Second year as treatment school (T2)		0.040* (0.021)	0.034* (0.021)				
Treatment school pupils within 3 km (per 1000 pupils)			0.044** (0.022)		0.023 (0.036)		
Treatment school pupils within 3–6 km (per 1000 pupils)			−0.014 (0.015)		−0.041 (0.027)		
Total pupils within 3 km (per 1000 pupils)			−0.033** (0.013)		−0.035* (0.019)	0.018 (0.021)	0.021 (0.019)
Total pupils within 3–6 km (per 1000 pupils)			−0.010 (0.012)		0.022 (0.027)	−0.010 (0.012)	−0.021 (0.015)
Indicator received first year of deworming treatment, when offered (1998 for Group 1, 1999 for Group 2)					0.100*** (0.014)		
(First year as treatment school Indicator) * (Received treatment, when offered)					−0.012 (0.020)		
1996 district exam score, school average	0.063*** (0.021)	0.071*** (0.020)	0.063*** (0.020)	0.058 (0.032)	0.091** (0.038)	0.021 (0.026)	0.003 (0.023)

TABLE X

ACADEMIC EXAMINATIONS, INDIVIDUAL-LEVEL DATA[a]

	Dependent variable: ICS Exam Score (normalized by standard)		
	(1)	(2)	(3) Among those who filled in the 1998 pupil survey
Average school participation (during the year of the exam)	0.63***		
	(0.07)		
First year as treatment school (T1)		−0.032	−0.030
		(0.046)	(0.049)
Second year as treatment school (T2)		0.001	0.009
		(0.073)	(0.081)
1996 District exam score, school average	0.74***	0.71***	0.75***
	(0.07)	(0.07)	(0.07)
Grade indicators, school assistance controls, and local pupil density controls	Yes	Yes	Yes
R^2	0.14	0.13	0.15
Root MSE	0.919	0.923	0.916
Number of observations	24958	24958	19072
Mean of dependent variable	0.020	0.020	0.039

(4) Thomas et al (2003)

- Iron deficiency anemia (IDA) is one of the world’s most common health problems
  - IDA leads to weakness, lower aerobic capacity

- Randomized evaluation of iron supplementation (and deworming, too) among over 17,000 adults in Indonesia, 30-70 years old

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- Iron deficiency anemia (IDA) is one of the world's most common health problems
  - IDA leads to weakness, lower aerobic capacity

- Randomized evaluation of iron supplementation (and deworming, too) among over 17,000 adults in Indonesia, 30-70 years old
  - Double-blind experiment: the comparison group received identical appearance placebo pills. This may help to limit differences in behavioral responses to the treatment (but not entirely)

- Intention-to-treat (ITT) analysis for first 6 months

Figure 2: Hemoglobin level of males age 30-70

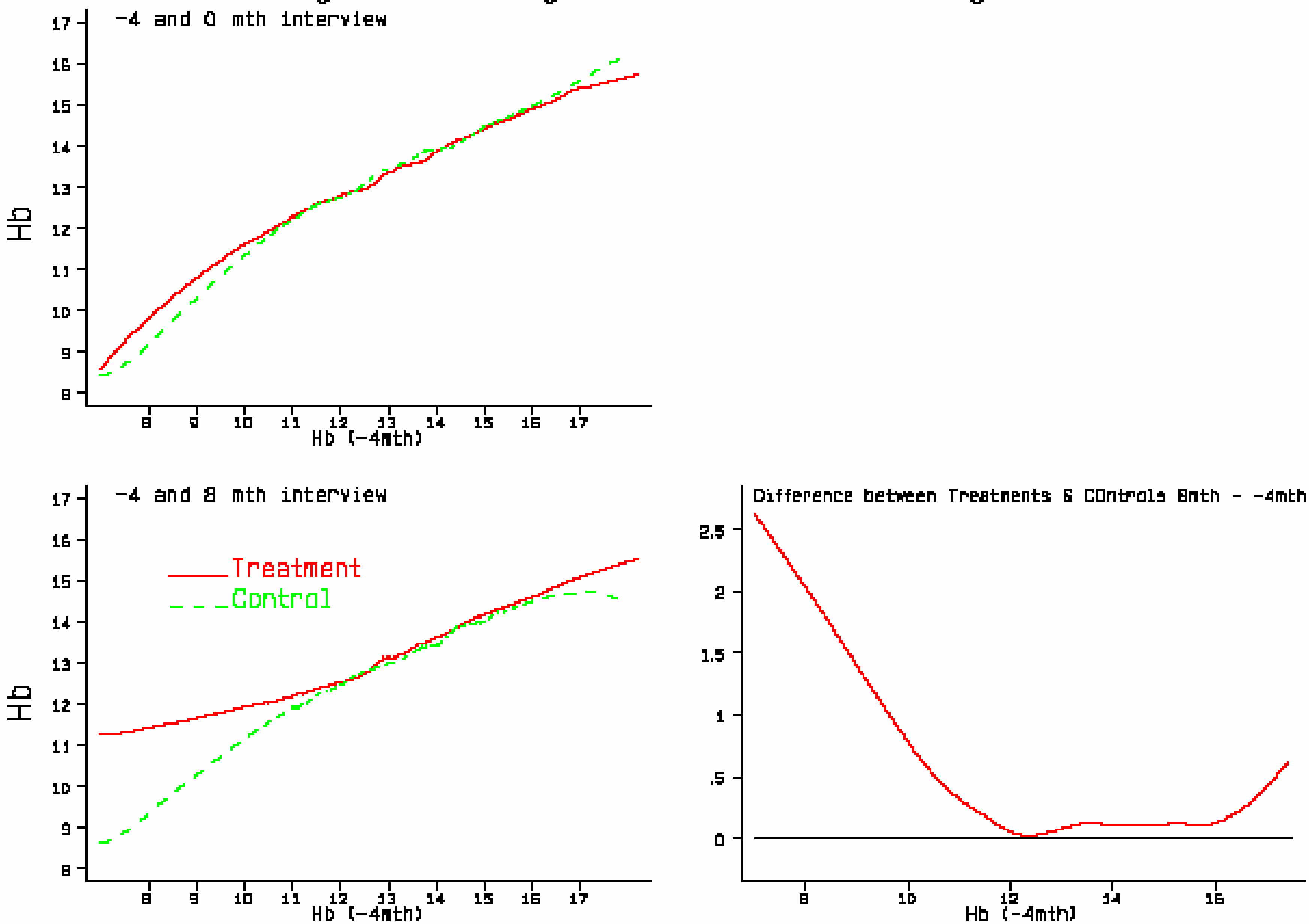


Figure 3: Hemoglobin level of females age 30-70

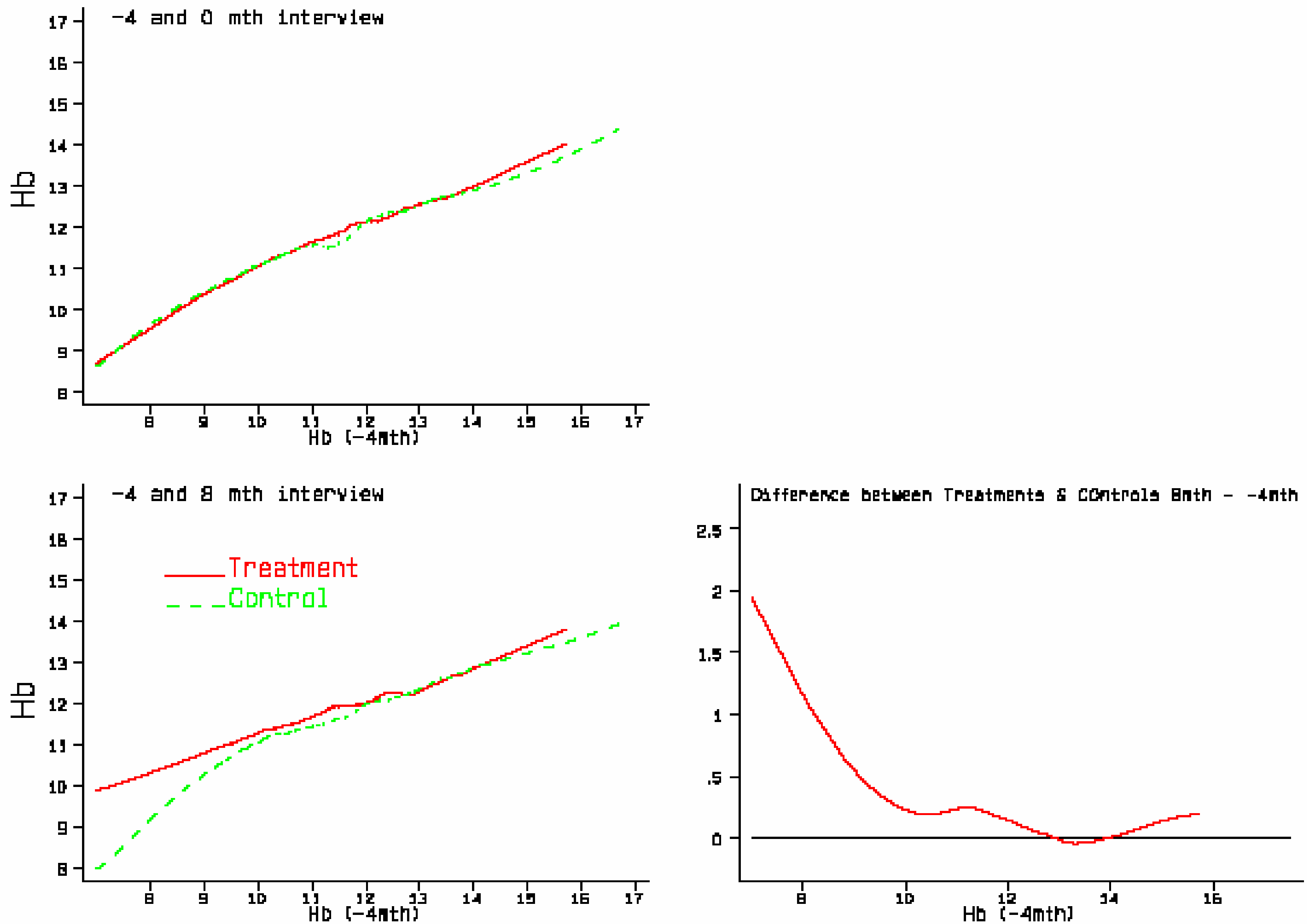


Table 4: Intent to treat effects on subjects stratified by Hb status at baseline
Work, earnings and hours of work

		Change in Treatments - Change in Controls		
Indicator	Sample	If low Hb @baseline DinD (1)	If high Hb @baseline DinD (2)	Low-High Hb @baseline DinDinD (3)
1. Pr(not working in month of survey interview)	Male	-0.036	-0.003	-0.033
		[0.012]	[0.007]	[0.014]
	Female	-0.020	0.029	-0.049
		[0.014]	[0.020]	[0.024]
2. $\sqrt[4]{}$Earnings (Rp 000) (last 4 months)	Male	0.576	-0.012	0.582
		[0.299]	[0.173]	[0.346]
	Female	0.163	0.033	0.130
		[0.091]	[0.127]	[0.156]
3. Hours spent working (last 4 months)	Male	-12.968	-44.185	31.217
		[36.368]	[21.027]	[42.013]
	Female	9.644	30.137	-20.493
		[15.264]	[21.425]	[26.309]
4. $\sqrt[4]{}$Hrly earnings (Rp 000) (last 4 months)	Male	0.126	0.007	0.119
		[0.066]	[0.038]	[0.076]
	Female	0.034	-0.009	0.043
		[0.025]	[0.035]	[0.043]
5. $\sqrt[4]{}$Hrly earnings (Rp 000) conditional on being non zero (last 4 months)	Male	0.113	-0.006	0.119
		[0.069]	[0.040]	[0.080]
	Female	0.056	-0.021	0.077
		[0.026]	[0.037]	[0.046]
6. $\sqrt[4]{}$Earnings (Rp 000) if self-employed (last 4 months)	Male	1.091	-0.386	1.477
		[0.445]	[0.285]	[0.528]
	Female	0.177	0.101	0.076
		[0.214]	[0.305]	[0.373]
7. $\sqrt[4]{}$Hrly earnings (Rp 000) if self-employed (last 4 months)	Male	0.230	-0.078	0.308
		[0.093]	[0.059]	[0.110]
	Female	0.031	-0.036	0.067
		[0.052]	[0.074]	[0.090]

Table 7: Intent to treat effects on subjects stratified by Hb status at baseline
Psychological health: Intent to treat effects

Indicator	Sample	Change in Treatments - Change in Controls: If low Hb @baseline DinD (1)	If high Hb @baseline DinD (2)	Low-High Hb @baseline DinDinD (3)
1. Pr(finds normal tasks an effort)	Male	-0.073	-0.009	-0.064
		[0.029]	[0.017]	[0.034]
	Female	0.026	0.011	0.015
		[0.019]	[0.027]	[0.033]
2. Pr(has difficulty sleeping)	Male	-0.102	0.007	-0.109
		[0.036]	[0.021]	[0.042]
	Female	0.032	0.018	0.014
		[0.022]	[0.031]	[0.038]
3. Pr(feels anxious)	Male	-0.018	0.003	-0.021
		[0.023]	[0.013]	[0.027]
	Female	-0.020	0.042	-0.062
		[0.017]	[0.024]	[0.029]
4. Pr(does not think about future)	Male	0.074	-0.004	0.078
		[0.023]	[0.013]	[0.027]
	Female	-0.006	0.034	-0.040
		[0.014]	[0.020]	[0.025]

(4) Thomas et al (2003)

- Given these impacts, why aren’t Indonesians taking iron pills already (they are given out free in clinics)?
  - Lack of information; lack of self-control with respect to food; within-household bargaining problems

(4) Thomas et al (2003)

- Given these impacts, why aren’t Indonesians taking iron pills already (they are given out free in clinics)?
  - Lack of information; lack of self-control with respect to food; within-household bargaining problems

- How much of the impact is a deworming effect? 30% of adults were infected with hookworm, whipworm, or roundworm at baseline

- What is the ideal public policy response – supplementation for everyone, for those likely to be anemic, or food fortification?

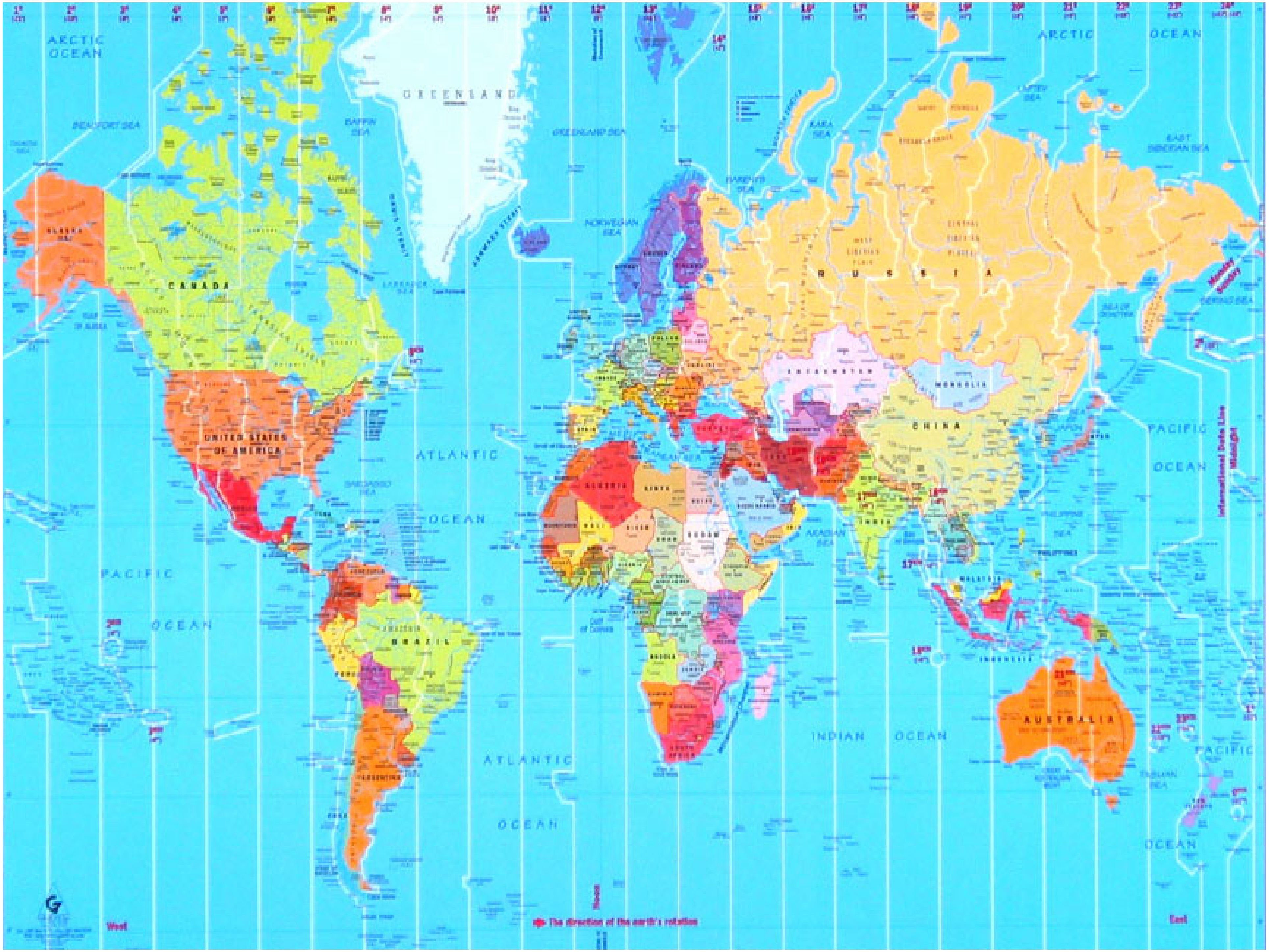
Whiteboard #1

Whiteboard #2

Whiteboard #3

Whiteboard #4

Whiteboard #5



ARCTIC OCEAN
GREENLAND
BEAUFORT SEA
BAFFIN SEA
GREENLAND SEA
NORWEGIAN SEA
BARENTS SEA
KARA SEA
EAST SIBERIAN SEA
CANADA
ALASKA
UNITED STATES OF AMERICA
RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
INDIA
ALGERIA
LIBYA
SUDAN
BRAZIL
ARGENTINA
AUSTRALIA
INDONESIA
ATLANTIC OCEAN
PACIFIC OCEAN
INDIAN OCEAN
ARABIAN SEA
International Date Line
Midnight
West
East
The direction of the earth's rotation