Economics 270c

Graduate Development Economics

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Graduate Development Economics

Lecture 13 – April 21, 2009

Macroeconomic growth empirics

Lecture 1: Global patterns of economic growth and development (1/20)

Lecture 2: Inequality and growth (1/27)

The political economy of development

Lecture 3: History and institutions (2/3)

Lecture 4: Corruption (2/10)

Lecture 5: Patronage politics (2/17)

Lecture 6: Democracy and development (2/24)

Lecture 7: War and Economic Development (3/3)

Lecture 8: Economic Theories of Conflict (3/10) – Guest lecture by Gerard Padro

Human resources

Lecture 9: Human capital and income growth (3/17)

Lecture 10: Increasing human capital (3/31)

Lecture 11: Labor markets and migration (4/7)

Lecture 12: Health and nutrition (4/14)

Lecture 13: The demand for health (4/21)

Other topics

Lecture 14: Environment and development (4/28)

Lecture 15: Resource allocation and firm productivity (5/5)

Additional topics for the development economics field exam

-- Ethnic and social divisions

-- The Economics of HIV/AIDS

- Grading:
  Four referee reports – 40%

  Two problem sets – 20%
  → Problem set 2 due this Thursday April 23

  Research proposal – 30%
  Class participation – 10%

Lecture 13 outline

(1) Miguel and Kremer (2004), Kremer and Miguel (2007) on deworming in Kenya: impacts and take-up

(2) Thornton (2007, 2008) on HIV testing in Malawi

(3) Cohen and Dupas (2009)

Health outcomes in poor countries

- Many development observers believe the take-up of useful health behaviors and technologies is surprisingly slow in less developed countries

- E.g., the continued spread of HIV in Africa, slow adoption of better purification water technologies in South Asia, low-pollution cook stoves

  -- Similar claims are often made about other sectors in development, most importantly in agriculture

- Return to the case of deworming in Kenya for a concrete example

(4) Miguel and Kremer (2004)

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

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

  which is equivalent to
  $\{E(\ Y_{ij}\ |\ T_{1i} = 1,\ N^{T} = N^{AVG}\ ) - E(\ Y_{ij}\ |\ T_{1i} = 0,\ N^{T} = N^{AVG})\}$
  $+ \{E(\ Y_{ij}\ |\ T_{1i} = 0,\ N^{T} = N^{AVG}\ ) - E(\ Y_{ij}\ |\ T_{1i} = 0,\ N^{T} = 0)\}$

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

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 (0.04)	−0.06 (0.05)
Grade progression (= Grade − (Age − 6)), 1998	−2.0	−1.8	−1.8	−1.8	−0.2** (0.1)	−0.0 (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 (0.04)	−0.01 (0.06)
Clean (observed by field worker), 1998	0.53	0.59	0.60	0.66	−0.07 (0.05)	−0.07 (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*** (0.06)	−0.21** (0.10)
Hookworm moderate-heavy infection, 1999	0.04	0.11	0.22	0.20	−0.19*** (0.03)	−0.09* (0.05)
Roundworm moderate-heavy infection, 1999	0.08	0.12	0.22	0.30	−0.14*** (0.04)	−0.18** (0.07)
Schistosomiasis moderate-heavy infection, 1999	0.09	0.08	0.20	0.13	−0.11* (0.06)	−0.05 (0.06)
Whipworm moderate-heavy infection, 1999	0.12	0.16	0.16	0.20	−0.04 (0.16)	−0.05 (0.09)

<u>Cross</u>-school infection externalities (1999)

- Large reductions in moderate-heavy infection levels within 3 km (2 miles) of treatment schools in 1999, smaller positive reductions up to 6 km

- An average reduction in moderate-heavy infections of approximately 20 percentage points in the study area can be attributed to cross-school externalities

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

(4) Miguel and Kremer (2004)

- Educational outcomes: school absenteeism (both from poor attendance and drop outs) fall by roughly 7 percentage points, or one quarter

  -- One of the most cost-effective ways to boost school participation found in less developed countries

- But test scores do not improve in either year 1 or year 2 (or in cognitive tests administered in year 3)

  -- But the average test gain from deworming is **zero**. Why? increased congestion in the classroom; the quality of classroom learning is low; time lags; other explanations

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

Cost-benefit calculations

- Cost of this program: US$1.46 per pupil per year
- Cost of a larger-scale program in neighboring Tanzania: only US$0.49 per pupil per year

- Cost of health education component (classroom lessons, teacher training) was US$0.44 per pupil per year

Cost-benefit calculations

- Deworming as a human capital investment:
  Health gains → More schooling → Higher adult wages

- Deworming led to 7% gain in school participation
- Previous study: each year of school → 7% higher wages
- Take these gains in wages (7% x 7%) over 40 years in the workforce, discounted at 5% per year

→ Deworming benefits are at least three times (3x) as large as treatment costs (using the Tanzania costs)

Contentious debate on user fees

- Historically lots of slogans, limited evidence
- Advocates:
  - The poor can (and do) pay at least some fees
  - Fees are vital to sustainability, motivating providers
  - Charging may screen out low valuation consumers
  - Sunk cost effects (“ownership”)
- Critics: impact on access; a compromise: small fees?
- In recent years, a number of randomized evaluations have provided lessons on the impact of price on take-up of health services and products

The Impact of Higher Drug Costs

- In 1998, 1999, 2000 deworming was given for free
- In 2001, parents in 25 randomly chosen Group 1 and Group 2 schools paid US$0.10-0.30 per child

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- 2001 deworming take-up (Kremer and Miguel 2007):

  Free-treatment schools: 75%

  Cost-sharing schools: 18%

The Impact of Higher Drug Costs

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- In 2001, parents in 25 randomly chosen Group 1 and Group 2 schools paid US$0.10-0.30 per child

- 2001 deworming take-up (Kremer and Miguel 2007):

  Free-treatment schools: 75%

  Cost-sharing schools: 18%

  → Average household valuation for deworming drugs appears very low if few are willing to pay even these small amounts

TABLE VII
THE IMPACT OF COST-SHARING

	Dependent variable: Child took deworming drugs in 2001		
	(1)	(2)	(3)
Explanatory variables:			
Cost-sharing school indicator	−0.580***	−0.459***	−0.572***
	(0.054)	(0.122)	(0.080)
Cost-sharing *Respondent years of education		0.002	
		(0.007)	
Cost-sharing *Community group member		0.021	
		(0.072)	
Cost-sharing *Total number of children		−0.021	
		(0.016)	
Cost-sharing *Iron roof at home		−0.047	
		(0.064)	
Effective price of deworming per child(= cost/# household children in that school)			−0.001
			(0.002)
1/(# household children in that school)			−0.348***
			(0.066)
Social links, other controls	Yes	Yes	Yes
Number of observations (parents)	1,678	1,678	1,678
Mean of dependent variable	0.61	0.61	0.61

Given the returns, why is take-up not 100%?

- Possible explanations:

  (1) Low demand for better (child) health:

  -- Socio-cultural explanations / resistance to new technologies. Evidence from anthropologist Wenzel Geissler: “worms are our life”

  -- Side effects minor but salient (12% report vomiting or stomach ache). Little empirical support for this, though

  -- Agency issues within the household

  (2) Externalities / Free-riding

  -- Private benefits are smaller than social benefits; the demand for health may still be too low

Given the returns, why is take-up not 100%?

- Externalities / Free-riding

  -- The private benefits are much smaller than the social benefits (i.e., if everyone else in your school is taking the drugs, the returns to taking them are small)

  -- Strong evidence people learned through their social network that the drugs were "not effective"

  → Households with more social contacts in "early treatment" schools were actually somewhat less likely to take deworming drugs. People learned to "free ride"

- Continued high levels of subsidies may be necessary to induce socially optimal levels of deworming

Estimating social effects

- Cross-sectional correlations of social contacts and deworming take-up are potentially biased, if (unobservably) similar types of individuals are members of the same networks

  -- Experimental variation is induced here by the staggered phase-in of schools into deworming: “early treatment” (groups 1 and 2, receiving treatment starting in 1998 and 1999) and “late treatment” (group 3, 2001)

- Large differences between experimental and non-experimental estimates here, suggesting large bias

Types of social effects

- Why might additional social contacts in early treatment schools affect deworming take-up?

  -- Learning about benefits (positive or negative effect)

  -- Learning by doing (positive)

  -- Infection externalities (negative, small empirically among social contacts)

  -- Imitation effects (positive)

  -- Others?

- We develop a stylized model to describes these effects

  -- A negative empirical effect seems likely due to learning about benefits

Let $\hat{\phi}_{it}$ denote the individual's beliefs in period t about drug effectiveness ϕ conditional on prior beliefs and any signals received, and let $T_{it} \in \{0, 1\}$ be an indicator variable for drug take-up in period t. Then the individual's expected private benefit from adoption can be expressed as

$$(1) \qquad E[U(T_{it} = 1) - U(T_{it} = 0)] = \hat{\phi}_{it} h(\gamma_{it}) \mu_i - C + \beta\omega_{it}$$

where U is individual utility from deworming, conditional on the treatment choices of other individuals, and ω_{it} is the share of social contacts who took up the drug in the previous period.

The impact of early treatment links on the expected private benefits to adoption is thus

Prior belief of benefit

True benefit

$$\frac{\partial E[U(T_{it}=1)-U(T_{it}=0)]}{\partial N^E_{it}} = \left[\frac{-\sigma_N^2\sigma_0^2}{(\sigma_N^2+\sigma_0^2)^2 N^E_{it}}\right]\cdot(\phi_0(X_i)-\phi_S) \cdot h(\gamma(\omega_{it},X_i))\cdot\mu_i - \frac{\partial C(N^E_{it})}{\partial N^E_{it}} + \hat{\phi}_{it}\,\frac{\partial h}{\partial\gamma}\cdot\frac{\partial\gamma(\omega_{it},X_i)}{\partial\omega_{it}}\cdot\frac{\partial\omega_{it}}{\partial N^E_{it}}\,\mu_i + \beta\,\frac{\partial\omega_{it}}{\partial N^E_{it}}. \tag{5}$$

The first right-hand side term is the social effect from *information on drug effectiveness* and can be positive or negative depending on the difference between priors and true private adoption benefits. The second term captures the social effect from *learning how to use the drugs* described earlier and is always positive. The third term is the *infection social effect*, which should be negative because having more early treatment links could lead to a lower individual infection level (due to epidemiological externalities), which, in turn, reduces treatment benefits. The positive *imitation effect* is captured in the fourth term.

We conclude that, to the extent that we observe negative overall social effects empirically, this is evidence that the combined effect of the information and infection externalities is larger than the learning-by-doing effect plus the pure imitation effect.

The impact of early treatment links on the expected private benefits to adoption is thus

Prior belief of benefit

True benefit

$$(5)\quad \frac{\partial E[U(T_{it}=1)-U(T_{it}=0)]}{\partial N_{it}^E} = \left[\frac{-\sigma_N^2\sigma_0^2}{(\sigma_N^2+\sigma_0^2)^2 N_{it}^E}\right]\cdot(\phi_0(X_i)-\phi_S)$$

$$\cdot\, h(\gamma(\omega_{it},X_i))\cdot\mu_i - \frac{\partial C(N_{it}^E)}{\partial N_{it}^E} + \hat{\phi}_{it}\,\frac{\partial h}{\partial\gamma}\cdot\frac{\partial\gamma(\omega_{it},X_i)}{\partial\omega_{it}}\cdot\frac{\partial\omega_{it}}{\partial N_{it}^E}\,\mu_i + \beta\,\frac{\partial\omega_{it}}{\partial N_{it}^E}.$$

The first right-hand side term is the social effect from *information on drug effectiveness* and can be positive or negative depending on the difference between priors and true private adoption benefits. The second term captures the social effect from *learning how to use the drugs* described earlier and is always positive. The third term is the *infection social effect*, which should be negative because having more early treatment links could lead to a lower individual infection level (due to epidemiological externalities), which, in turn, reduces treatment benefits. The positive *imitation effect* is captured in the fourth term.

We conclude that, to the extent that we observe negative overall social effects empirically, this is evidence that the combined effect of the information and infection externalities is larger than the learning-by-doing effect plus the pure imitation effect.

TABLE I

SUMMARY STATISTICS

	Mean	Std dev.	Obs.
Panel A: Parent social links (Round 1 and Round 2 data)			
Total direct (first-order) links	10.2	3.4	1,678
With children in own school	4.4	2.8	1,678
With children not in Group 1, 2, or 3 schools	3.0	2.4	1,678
With children in Group 1, 2, 3 schools—not own school	2.8	2.4	1,678
With children in Group 1, 2 schools—not own school ("early treatment")	1.9	2.0	1,678
With children in Group 1 schools—not own school	0.9	1.4	1,678
Proportion with children in early treatment schools	0.66	0.37	1,358

TABLE III
NONEXPERIMENTAL SOCIAL EFFECT ESTIMATES (GROUPS 2 AND 3)

	Dependent variable: Child took deworming drugs in 2001		
	(1)	(2)	(3)
Explanatory variables:			
Proportion deworming drug take-up in 2001, respondent's own school (not including respondent)	0.852*** (0.107)		
# parent links with children in respondent's own school whose children received deworming		0.016 (0.011)	
# parent links with children in early treatment schools whose children received deworming and had "good effects"			0.004 (0.025)
# parent links with children in early treatment schools whose children received deworming and had "side effects"			−0.152* (0.080)
# parent links with children in early treatment schools whose children received deworming and respondent does not know effects			0.003 (0.049)
# parent links with children in early treatment schools whose children did not receive deworming			−0.006 (0.055)
# parent links with children in early treatment schools, respondent does not know whether they received deworming			−0.010
Total social link controls, socio-economic controls	Yes	Yes	Yes
Number of observations (parents)	1,678	886	886
Mean of dependent variable	0.61	0.56	0.56

TABLE IV
EXPERIMENTAL SOCIAL EFFECT ESTIMATES

	Dependent variable: Child took deworming drugs in 2001				
	(1)	(2)	(3)	(4)	(5)
Explanatory variables:					
# parent links with children in early treatment schools (Groups 1 and 2, not own school)	−0.031**	−0.040**			−0.002
	(0.014)	(0.017)			(0.018)
# parent links with children in early treatment schools		0.017			
* Group 2 school indicator		(0.029)			
Proportion direct (first-order) parent links with children in early			−0.098**		
treatment schools			(0.045)		
# parent links with children in early treatment schools, with whom				−0.030**	
respondent speaks at least twice/week				(0.016)	
# parent links with children in early treatment schools, with whom				−0.033	
respondent speaks less than twice/week				(0.033)	
# parent links with children in Group 1, 2, or 3 schools, not own				0.008	
school, with whom respondent speaks at least twice/week				(0.012)	
# parent links with children in Group 1, 2, or 3 schools, not own				0.026	
school, with whom respondent speaks less than twice/week				(0.027)	
# parent links with children in early treatment schools					−0.0062*
* Respondent years of education					(0.0032)
# parent links with children in Group 1, 2, or 3 schools, not own school	0.013	0.012	−0.006		−0.014
	(0.011)	(0.017)	(0.009)		(0.014)
# parent links with children not in Group 1, 2, or 3 schools	−0.007	−0.008	−0.005	−0.007	−0.008
	(0.007)	(0.009)	(0.007)	(0.007)	(0.011)
# parent links, total	0.019***	0.029***	0.021***	0.018***	0.013
	(0.005)	(0.007)	(0.007)	(0.005)	(0.008)

TABLE VI

EFFECTS ON DEWORMING ATTITUDES AND KNOWLEDGE

	Estimate on # parent links with children in early treatment schools	Estimate on # parent links with children in early treatment schools whose children received deworming	Estimate on # parent links with children in early treatment schools with whom respondent spoke about deworming	Mean dep. var.
	Experimental	Nonexperimental	Nonexperimental	
Dependent variable:				
Panel A: attitudes				
Parent thinks deworming drugs "not effective"	0.017**	0.009	0.009**	0.12
	(0.007)	(0.009)	(0.004)	
Parent thinks deworming drugs "very effective"	−0.007	0.042**	0.040***	0.43
	(0.010)	(0.013)	(0.007)	
Parent thinks deworming drugs have "side effects"	0.000	0.004	0.003*	0.04
	(0.003)	(0.003)	(0.002)	
Parent thinks worms and schisto. "very bad" for child health	−0.001	0.001	−0.006*	0.92
	(0.006)	(0.008)	(0.003)	
Panel B: knowledge				
Parent "knows about ICS deworming program"	0.004	0.054***	0.055***	0.70
	(0.011)	(0.014)	(0.011)	
Parent "knows about the effects of worms and schistosomiasis"	−0.001	0.055***	0.039***	0.68
	(0.013)	(0.014)	(0.009)	
Number of infection symptoms parents able to name (0–10)	−0.029	0.078***	0.076***	1.8
	(0.025)	(0.029)	(0.015)	

Boosting take-up of a new health technology

- Learning through social networks alone will *not* lead this technology to spread widely: people learn not to adopt

  -- Cost-sharing massively dampens demand

  -- In other results, neither an “encouragement” / commitment intervention nor health education lead to higher take-up of deworming or other changes in worm prevention behavior (e.g., cleanliness, wearing sandals)

- The punchline: multiple approaches to achieve low-cost “sustainable” increases in deworming take-up failed in rural Kenya. Continued full subsidies may be necessary to boost take-up in the presence of large externalities, as implied by standard public finance theory

Why does HIV continue to spread?

- Lack of information, awareness about HIV/AIDS?
  - Probably not a good explanation anymore, based on surveys in Africa

- What else? Demand for health, social factors (stigma), psychological factors

  -- Externalities based explanations seem much less important in the HIV/AIDS than for deworming

Why does HIV spread? A simple model

- Timing: two periods, Youth (t=1), Old age (t=2)
- Key decision in Youth: Engage in unsafe sex or not

Why does HIV spread? A simple model

- Timing: two periods, Youth (t=1), Old age (t=2)
- Key decision in Youth: Engage in unsafe sex or not

- Likelihood of living to Old age:
  - $P \in (0,1)$ if HIV-
  - $P^{HIV} \in (0,P)$ if HIV+, so $P^{HIV} < P$

- Value of one period of life: $V > 0$
- Value of unsafe sex: $S > 0$

- Assume the agent is HIV- in her/his youth

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- “Rational” decision rule: engage in unsafe sex if the “expected utility” of unsafe is greater than of safe sex

$$EU\ (Safe\ sex) \qquad = V + \{PV + (1 - P)*0\} = V(1+P)$$

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- Assume unsafe sex always leads people to be HIV+

$$EU\ (Unsafe\ sex) \ = \{V + \boxed{S}\} + \{P^{HIV}V + (1 - P^{HIV})*0\}$$

Key term: benefits of unsafe sex (financial, physical, etc.)

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$$EU\ (\text{Unsafe sex}) = \{V+S\} + \{P^{HIV}V + (1 - P^{HIV})*0\}$$
$$= V(1+P^{HIV}) + S$$

- $EU\ (\text{Unsafe sex}) - EU\ (\text{Safe sex}) = \boxed{S} + \boxed{V(P^{HIV} - P)} > 0$

Benefits (+) Costs (-)

- Information, time discounting, disease environment

Why does HIV spread? An extension

- Imagine people do not know their infection status. S/he thinks she has likelihood $R \in [0,1]$ of already being HIV+

EU (Safe sex) $= V + [RP^{HIV} + (1 - R)P]V$

EU (Unsafe sex) $= V(1+P^{HIV}) + S$ (UNCHANGED)

Why does HIV spread? An extension

- Imagine people do not know their infection status. S/he thinks she has likelihood $R \in [0,1]$ of already being HIV+

EU *(Safe sex)* $= V + [RP^{HIV} + (1 - R)P]V$

EU *(Unsafe sex)* $= V(1+P^{HIV}) + S$ (UNCHANGED)

- EU *(Unsafe sex)* – EU *(Safe sex)*

$$= \boxed{S} + \boxed{V(P^{HIV} - P)(1 - R)} > 0$$

- "Nothing to lose" effect: cost of unsafe sex smaller than before. How plausible empirically?

Why does HIV spread? An extension

- What are implications of this model for public health messages that stress how widespread the HIV virus already is?

  -- This increases the *R* term in the model, and thus could actually increase risky behavior if the “nothing to lose” effect is important

What is this model missing?

(1) People are altruistic

- Allow the benefits of unsafe sex to be a function of R: $S = S(R)$. This may offset the “nothing to lose” effect

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- Allow the benefits of unsafe sex to be a function of R: $S = S(R)$. This may offset the "nothing to lose" effect

- For example, let $S = S(1 - R)$

EU (Unsafe sex) – EU (Safe sex)

$$= S(1 - R) + V(P^{HIV} - P)(1 - R)$$

$$= (1 - R)(S + V(P^{HIV} - P)) > 0$$

→ In this case the "nothing to lose" effect and the "altruism effect" exactly cancel out. But more generally, altruism could dominate (e.g., $S = S(1-R)^{\alpha}$, $\alpha > 1$)

What is this model missing?

(1) People are altruistic

- Allow the benefits of unsafe sex to be a function of R: $S = S(R)$. This may offset the “nothing to lose” effect

(2) Not all sexual choices are voluntary (e.g., rape)

(3) Social / cultural norms regarding “acceptable” sexual behavior, especially regarding safe sex

(4) Pockets of poor information about HIV/AIDS, in key populations (e.g., sex workers)

(5) Others?

What can public policy do about HIV/AIDS?

(1) Testing people, inform them of their HIV status

-- Is voluntary counseling and testing (VCT) the "missing weapon in the battle against AIDS" (Hoolbrooke and Fuhrman in a 2004 *NYT* Op-Ed)

-- In the model, testing would change R to zero (if the person is HIV-) or to one (if HIV+). So it could theoretically either increase or decrease unsafe sex, depending on what people's expectations are about their infection status

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-- Thornton (2007, 2008) tests these implications with original data from Malawi

Information, HIV's spread and savings

- How can we understand the impact of better information about one's HIV status on risky sexual choices (as in the model)?

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- Thornton carried out a randomized evaluation in which some rural Malawians were given a cash incentive to retrieve the results of their HIV test

  -- With this “exogenous” variation in knowledge in hand, she estimates effects on behavior

  -- Selection into testing is plausibly very important

Information, HIV’s spread and savings

- 120 villages in all three regions of Malawi
- Nurses also tested for other STIs (e.g., gonorrhea)
- 91% of people offered an HIV test accepted, quite representative and higher than most recent DHS surveys (in the 2003 Kenyan DHS it was about 75%).
- 7% HIV infection for females, 5% for males in the sample

  -- 2004 Malawi DHS: 12% nationally (lower in rural areas)

- Couples were informed of their status separately. Regardless of the test result, everyone received safe sex counseling and education.

  -- Free treatment was provided for the STIs, but not HIV since it’s much more expensive and logistically difficult

Malawi project research design

- Two stages to the project:

  -- t=1: individuals were given free door-to-door tests (from mobile local clinics)

  -- t=2: since not all individuals actually retrieve the results of their test, additional cash incentives (on the order of US$1-3) were offered to a random subset of individuals to encourage them to get their results

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- A nice research design: we researchers know the true infection status of the entire sample, but only a subset of the individuals know their own status. Variation in this knowledge is driven by the incentive experiment

Table 2: Summary Statistics

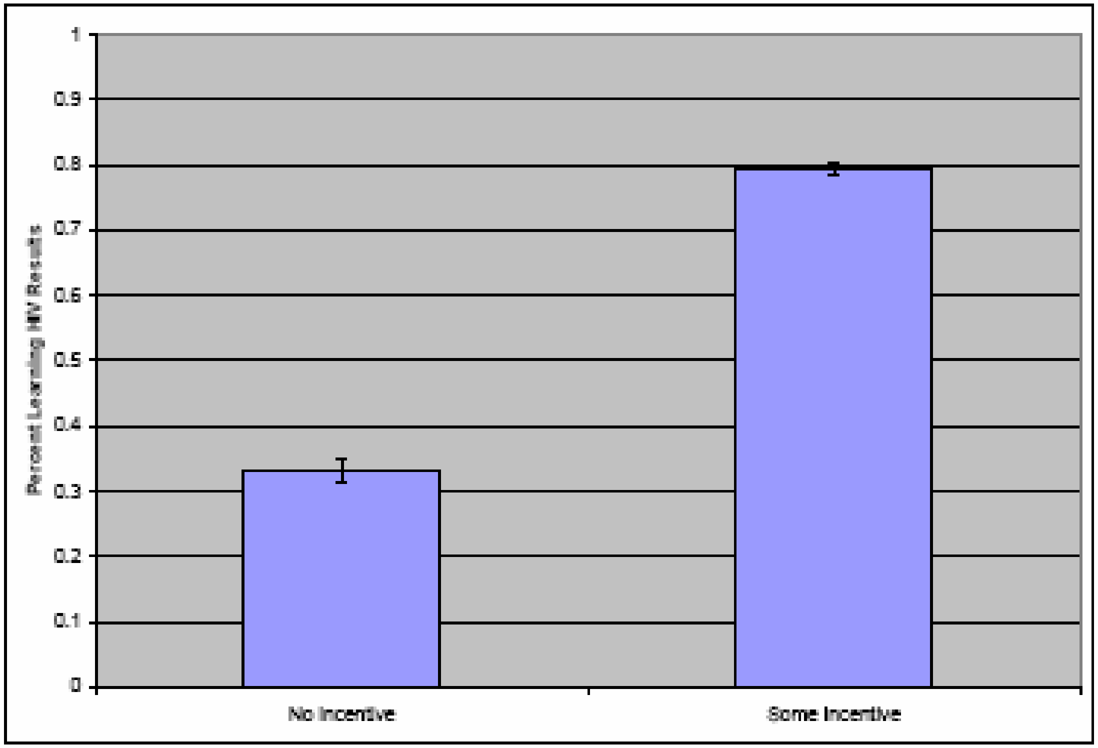
Panel A: Respondent Characteristics	Full Sample		Follow-up Sample	
Observations	2812		1524	
	Mean	SD	Mean	SD
Male	0.46	(0.50)	0.46	(0.50)
Age	33.4	(13.66)	34.6	(14.30)
Married	0.71	(0.45)	0.72	(0.45)
Years of education	3.6	(3.70)	3.8	(3.80)
Owns land	0.73	(0.44)	0.74	(0.44)
Panel B: Health				
HIV positive	0.063	(0.24)	0.048	(0.21)
Gonorrhea positive	0.032	(0.18)	0.034	(0.18)
Chlamydia positive	0.003	(0.06)	0.004	(0.06)
Trichomoniasis positive	0.024	(0.15)	0.014	(0.12)
Ever had an HIV test (before 2004)	0.181	(0.385)	0.217	(0.412)
Thinks treatment will be available in five years	0.341	(0.474)	0.372	(0.484)
Reported having sex during 2004	0.761	(0.43)	0.759	(0.43)
Reported using condoms during 2004	0.210	(0.41)	0.210	(0.41)
Sexual acts in one month (if >0)	5.104	(4.89)	5.104	(4.82)
Panel C: Incentives, Distance and Attendance at Results Centers				
Monetary incentive (Dollars)	1.01	(0.90)	1.05	(0.91)
Distance to VCT center (km)	2.02	(1.27)	2.20	(1.34)
Attended VCT center	0.69	(0.46)	0.72	(0.45)
Attended VCT center (if incentive=0)	0.34	(0.47)	0.37	(0.48)
Panel D: Follow-up Condom Sales				
Purchased condoms at the follow-up	--	--	0.24	(0.43)
Number of condoms purchased (if >0)	--	--	3.66	(2.18)
Reported purchasing condoms	--	--	0.08	(0.27)
Reported having sex after VCT	--	--	0.62	(0.49)
Reported having sex with more than one partner after VCT	--	--	0.033	(0.18)

Malawi project results

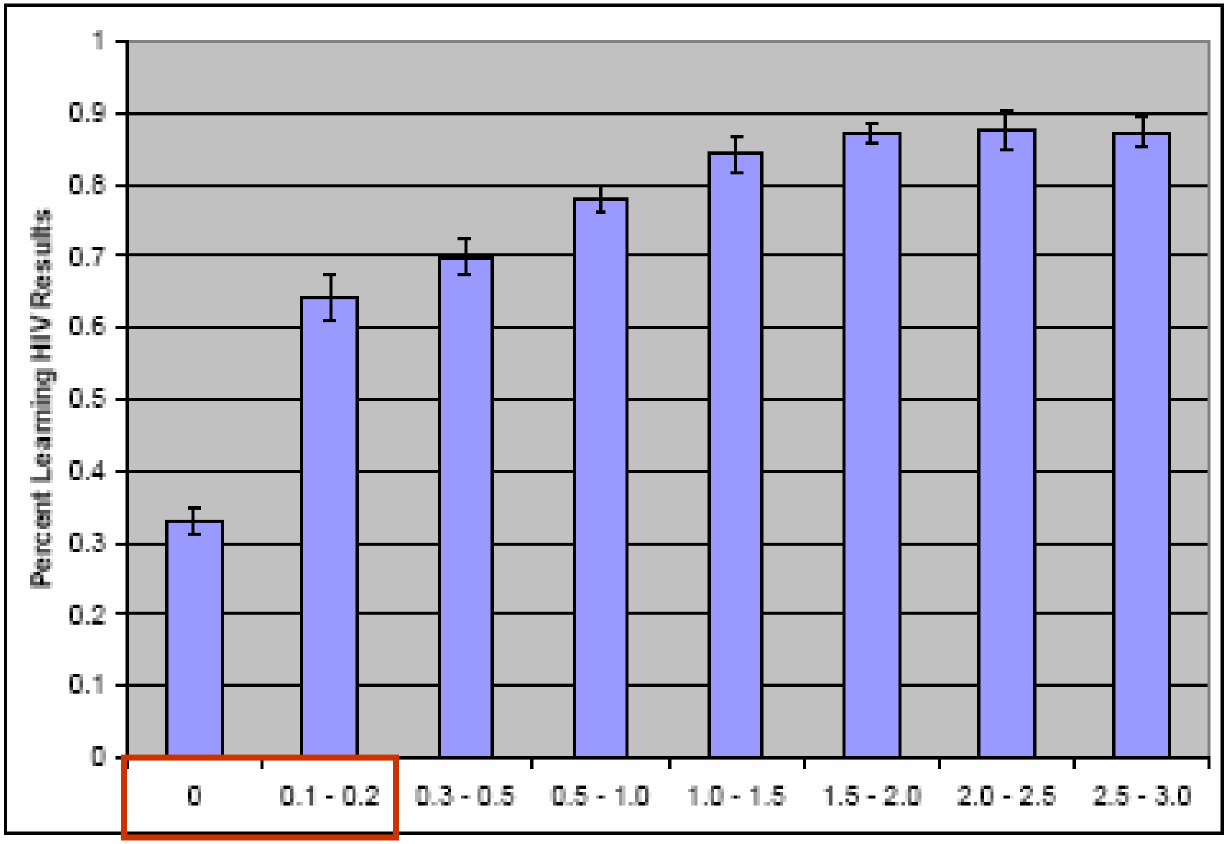
- Result #1: the small cash incentive was very effective at boosting people's acquisition of information. Without an incentive 34% of people retrieved their test results, but even the smallest incentive doubles this figure

  -- This implies that *very small costs* impede people from getting life or death test results. "Stigma" costs appear moderate for most people in Malawi.

Figure 3: Percent Returning for HIV Results

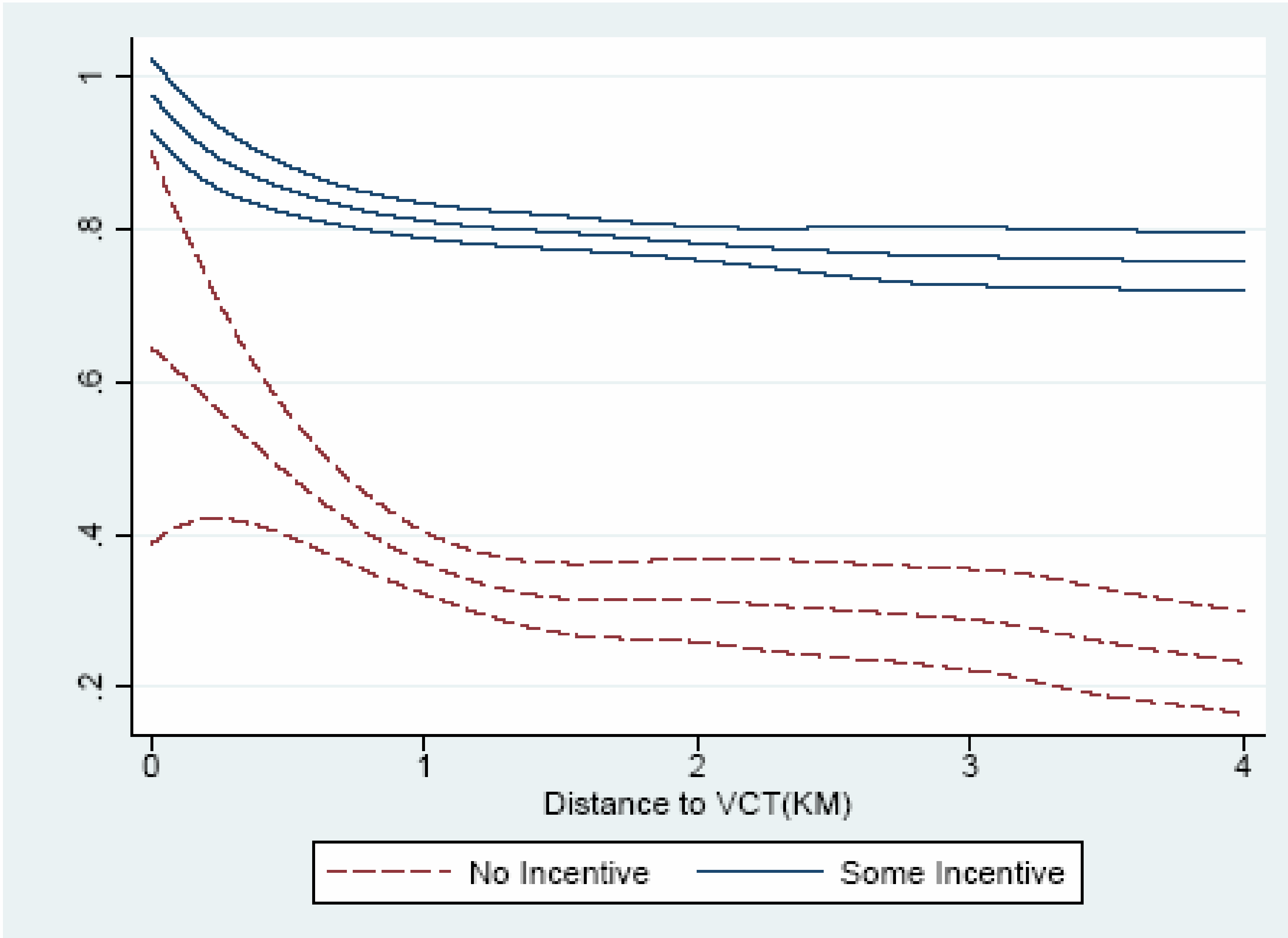


(a) Effects of Receiving Some Incentive



(b) Effects of the Total Amount of the Incentive

Notes: Sample includes 2,812 individuals who tested for HIV. 0.05 percent error bars are presented. Figures present the percent of individuals attending HIV results centers.



(b) Sample Receiving and Not Receiving an Incentive

To measure the demand for learning HIV results in a regression framework I estimate:

$$GotResults_{ij} = \alpha + \beta_1 Any_{ij} + \beta_2 Amt_{ij} + \beta_3 Dist_{ij} + X'_{ij}\mu + \epsilon_{ij} \tag{1}$$

Attendance at the VCT center is indicated by "*GotResults*" = 1 for person i in village j. "*Any*" indicates if the respondent received any non-zero voucher and "*Amt*" is the dollar amount of the incentive. Including both terms allows for non-linear effects of the incentive. "*Dist*" is the number of kilometers from the randomly placed VCT center assigned to person i. A vector of controls, "X", includes covariates of gender, age, age-squared, HIV status, and district dummies, as well as a control for a simulated average distance in each VCT zone.

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  -- This implies that *very small costs* impede people from getting life or death test results. "Stigma" costs appear moderate for most people in Malawi.

- HIV+ people were 5.5 percentage points <u>less</u> likely to obtain results. This may shed light on the likely bias in existing DHS studies, though illness could play a role

  -- Neither previous HIV testing, nor belief about own infection likelihood, are correlated with test retrieval

Malawi project results

- Result #2: Individuals who found out they were HIV+ were had significantly higher willingness to pay for condoms than those without this information.

  -- In particular, HIV+ people who learned their results were three times <u>more</u> likely to purchase condoms two months later (although the total number of condoms purchased was small), evidence of altruism

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  -- However, no change in self-reported sexual behavior

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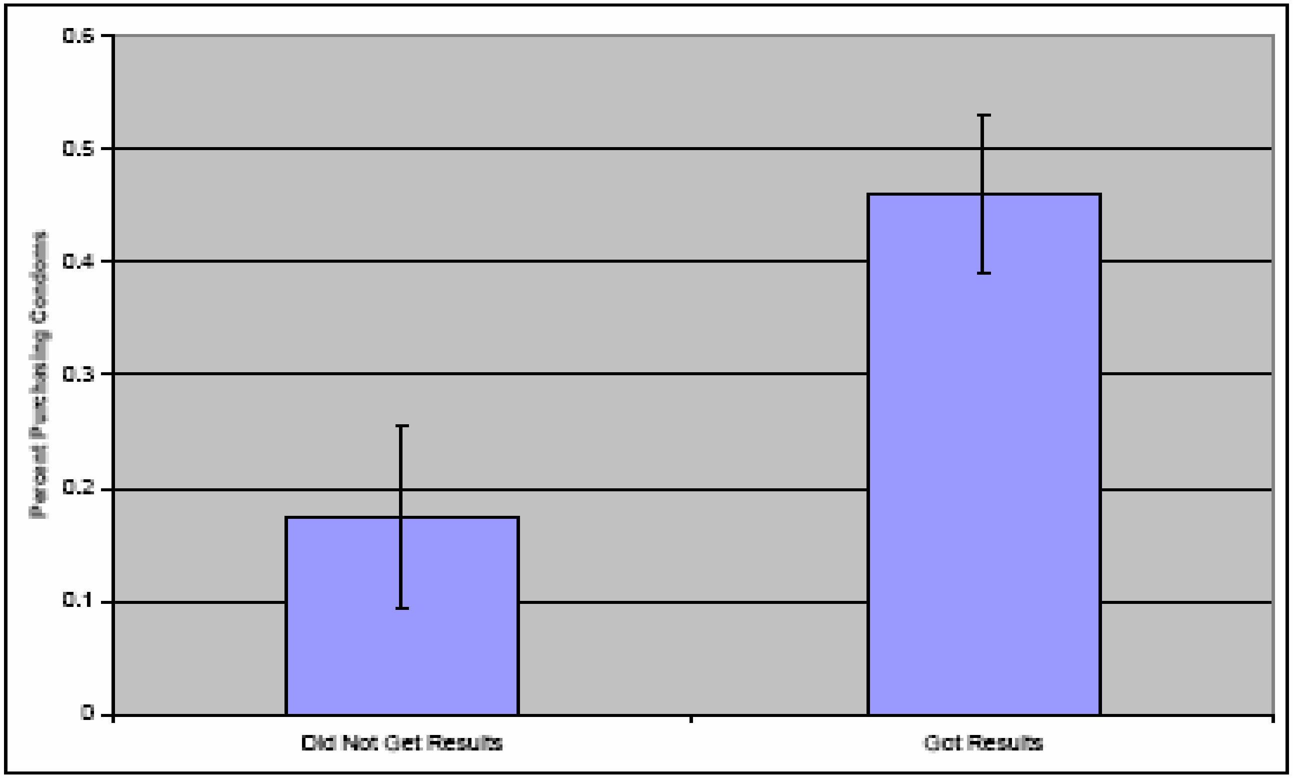
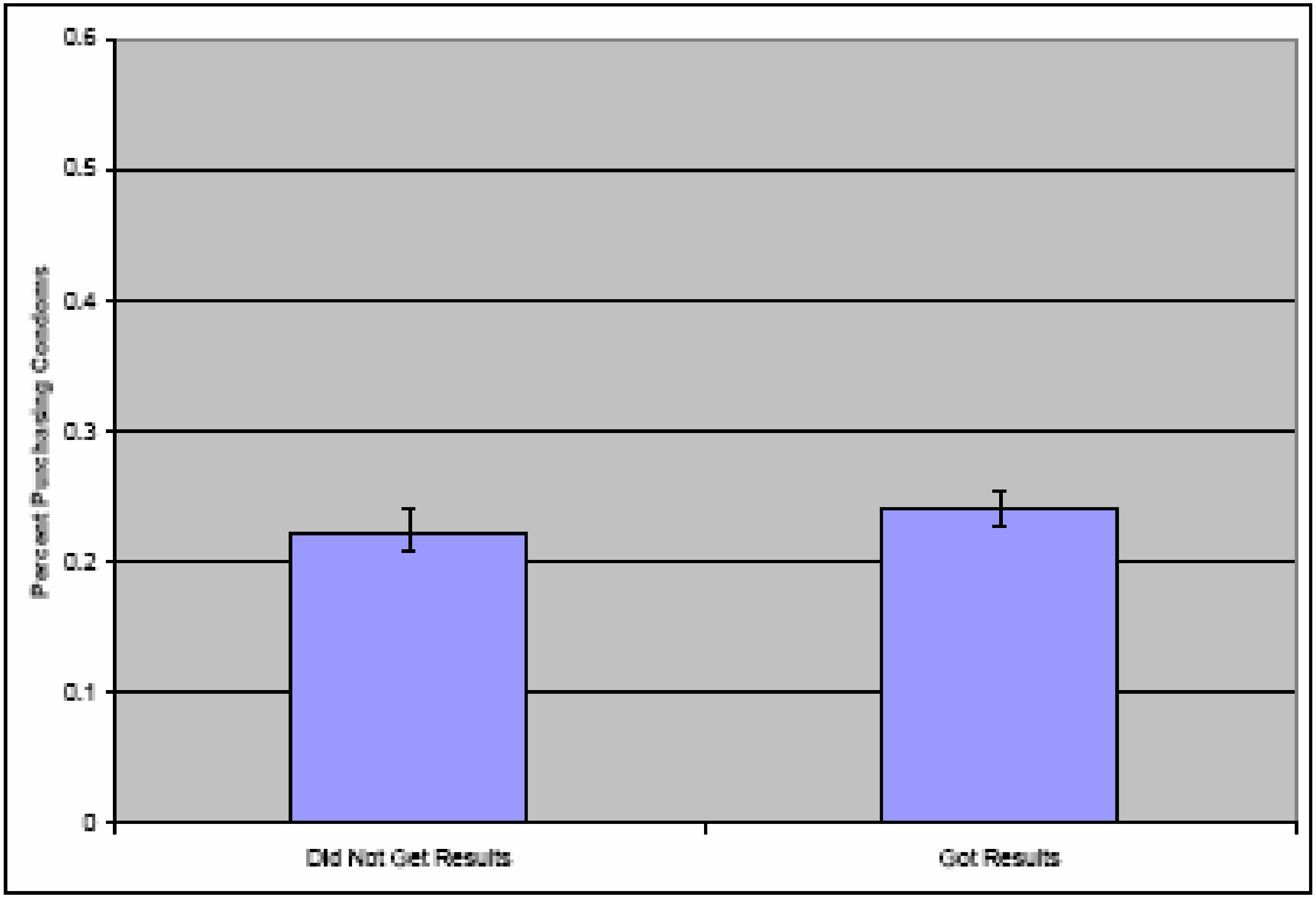
  -- However, <u>no change</u> in self-reported sexual behavior

- VCT may not be the most cost-effective HIV prevention strategy: US$55 per individual in the project

Figure 5: Percent Purchasing Condoms



(a) HIV Positives



(b) HIV Negatives

Panel A of Figure 5 presents the percent purchasing condoms among those who knew and did not know their HIV status. For HIV-positive respondents, those who obtained their test results were more than twice as likely to purchase condoms than those who did not; while among HIV-negatives, condom purchase did not vary significantly by knowledge of HIV status (Figure 5, Panel B).

I measure the effects of learning HIV results with the following regression:

$$Y_{ij} = \alpha + \beta_1 GotResults_{ij} + \beta_2 (HIV_{ij} * GotResults_{ij}) + \beta_3 HIV_{ij} + X'_{ij}\mu + \epsilon_{ij} \qquad (2)$$

Y indicates condom purchase at the time of the follow-up survey (as measured by whether the respondent purchased condoms or the total number of condoms purchased) or if the respondent reported having sex; and "*GotResults*" indicates knowledge of HIV status. The fact that individuals choose to learn their HIV status means that OLS estimates are likely to be biased, but estimating the effects of knowing HIV status with exogenous instruments provides unbiased estimates. In particular, I instrument "*GotResults*" with being offered any incentive, the amount of the incentive, and living over 1.5 kilometers from the assigned center.

Malawi project results

- Result #3: Individuals who found out they were HIV+ were 27 percentage points less likely to save than those without this information, two years after finding out their status

  -- HIV- people who retrieved their status were significantly more likely to save

  -- No effects on income earned, or total expenditures. But some suggestive evidence that HIV positives who learned their status spend less on medical care – less investment in “health capital”?

Table 6: Impact of Learning HIV Results on Savings in 2006

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
	Any Savings (0/1)		Log Savings		Savings (dollars)	
Got Results	-0.002	**0.024**	-0.036	**0.21**	-6.166	**23.265***
	[0.021]	[0.050]	[0.081]	[0.184]	[8.667]	[13.541]
HIV Positive * Got Results	-0.136	**-0.269***	-0.737*	**-0.928**	-37.019	**-63.827**
	[0.085]	[0.140]	[0.385]	[0.626]	[30.056]	[50.997]
HIV Positive	0.112*	0.203**	0.656**	0.805*	24.106	44.556
	[0.065]	[0.102]	[0.317]	[0.427]	[27.889]	[41.584]
Years of Education	0.003	0.003	0.018	0.018	1.702	1.815
	[0.004]	[0.003]	[0.014]	[0.014]	[1.292]	[1.306]
Male	0.091***	0.092***	0.428***	0.434***	18.477**	19.177**
	[0.022]	[0.021]	[0.087]	[0.086]	[7.733]	[7.892]
Number of Assets	0.029***	0.029***	0.154***	0.155***	10.342***	10.527***
	[0.005]	[0.005]	[0.025]	[0.025]	[3.252]	[3.253]
Expenditures	0.000***	0.000***	0.002***	0.002***	0.210***	0.218***
	[0.000]	[0.000]	[0.001]	[0.001]	[0.071]	[0.072]
Constant	-0.093	-0.136	-0.738	-0.972	-100.000***	-128.565***
	[0.160]	[0.169]	[0.686]	[0.722]	[37.198]	[43.495]
Observations	1962	1962	1963	1963	1963	1963
R-squared	0.06	0.06	0.11	0.10	0.06	0.06

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Mosquito nets

- Randomized offer price at clinics
- Having accepted the offer price, individuals receive a random discount → randomized final transaction price

- Increasing price for insecticide treated nets at prenatal clinics from 0 to $0.75 reduces take-up by 75% (Cohen and Dupas, 2009)

  -- Net purchasers not sicker than comparison group

- Paying a price does not increase "ownership": charging does *not* increase likelihood that net is hung up in house

  -- Argues against one of the rationales for cost-sharing

Summary of health price results

- A small increase (from zero to 10-30 cents) in the cost of deworming drugs decreased take-up by 80%

  -- Externalities play a role but this still seems like very low demand for better health in rural Kenya

- Few Malawians take advantage of free HIV testing, but even $1 doubles testing rates, suggesting that the disutility of testing (stigma, etc.) is very low

  -- Special role of “zero” price

- Small increases in the price of mosquito bed nets greatly reduce take-up (Cohen and Dupas 2009)
- Low willingness to pay for clean water and reduced child diarrhea in Kenya (Kremer et al 2009)

Summary of health price results

- Boosting access to care may be insufficient to lead African households to improve their health

  -- Pure information alone does not seem to be the key constraint (e.g., with HIV/AIDS knowledge)

  -- Take-up very sensitive to price. Large impact of small, immediate rewards and costs

- How to achieve behavioral change in health?
- Is this paternalistic approach even desirable?
- Is more application of psychology, sociology insights necessary?
- Effect of prices on provider incentives?

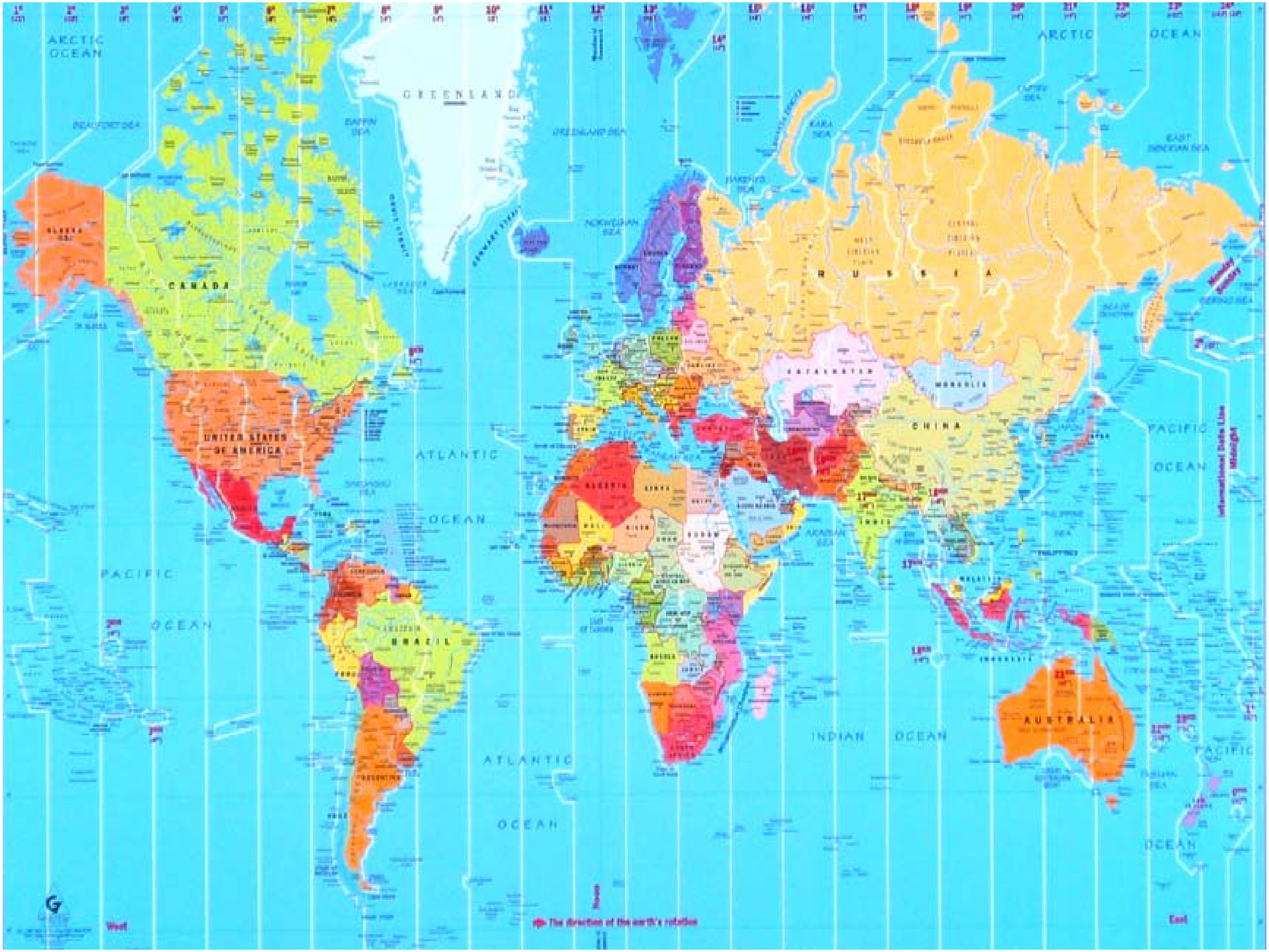
Whiteboard #1

Whiteboard #2

Whiteboard #3

Whiteboard #4

Whiteboard #5



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The direction of the earth's rotation
East