ECON 326: The Economics of Developing Countries

Midterm Exam

80 minutes

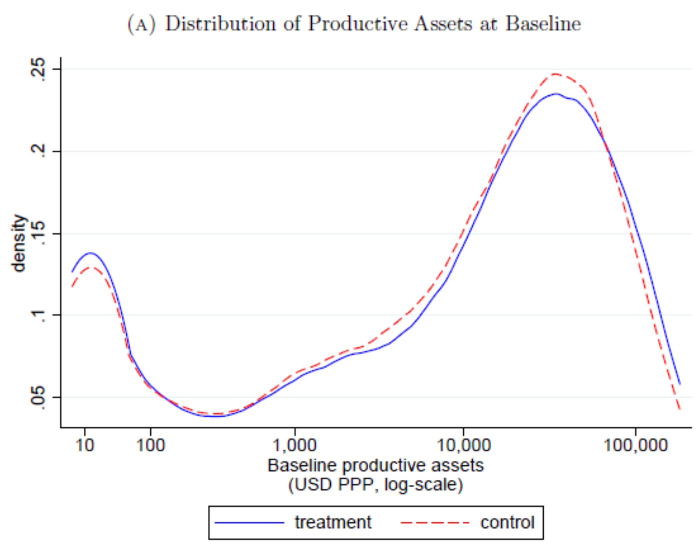
Please do not open the exam until you are instructed to do so. The entire exam is worth 75 points (+ 1 potential bonus point), with point values assigned as a roughly suggested amount of time spent on each question. **None of the free response questions are intended to require more than a few sentences, with many requiring no more than a sentence or two. You do not need to write in complete sentences (or even words!) as long as the idea is clear (e.g. bullet points are sufficient, and you can use $\uparrow$ or $\downarrow$ as shorthand for an increase or decrease, respectively).** You do not need to do any numerical calculations; you can simply write out the steps instead. For example, you can write "3×2.5" instead of "7.5." If asked to recall evidence from the literature, you do not need to directly cite the author or paper name, but only the result.

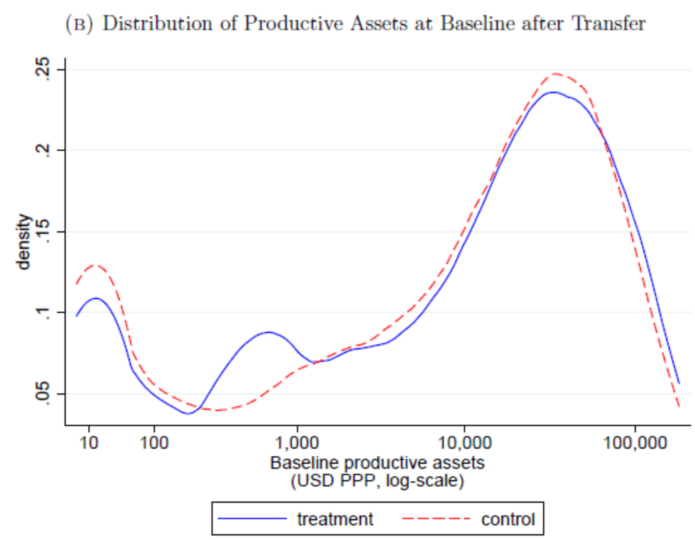
Name: ____

1 Literature Review (39 points)

1.1 Poverty Traps (5 points)

Balboni et al. (2021) evaluate a randomized asset transfer program to test the existence of household-level poverty traps. The figures below show the probability density functions of log(productive assets) before (left) and immediately after (right) the transfer.





(a) (2 pts) What observation from these graphs suggests the existence of poverty traps before the experiment?

The bimodality of the treatment and control distributions suggest that there are fixed points at each mode with more density. This suggests there are households are "stuck" at each level, or a poverty trap.

(b) (3 pts) What is important about the size of the transfer that the treatment group received in determining whether poverty traps exist?

We send households to the point where there's no mass, suggesting that there is an inflection point here where households will either become richer or poorer. We can use this to then figure out the exact asset cutoff where the poverty trap occurs.

1.2 Fundamental Causes of Development (5 points)

Acemoglu, Johnson, and Robinson (2001) on "Colonial Origins" aims to measure the effect of institutions on economic growth using an instrumental variable (IV). Glaeser (2004) responds to their claim with an alternative explanation for the correlation between institutions and growth.

(a) (2 pts) What is the IV they use, and what does the exclusion restriction mean in this context?

The authors use settler mortality to instrument for institutions. The exclusion restriction means that settler mortality only affects current GDP (growth) through institutions, or that there is no other correlation between settler mortality and current GDP.

(b) (3 pts) How do the tables below provide evidence for Glaeser's critique of the exclusion restriction?

Panel A: Dependent variable is the 5-year change in years of schooling $(t+5, t)$	
Years of schooling (t)	-0.0721^{a}
	(0.0237)
Log GDP per capita (t)	0.2839^{a}
	(0.0790)
Executive constraints (t)	-0.0099
	(0.0118)

Panel B: Dependent variables are the 5-year changes in political institutions $(t+5, t)$	
Years of schooling (t)	0.4975^{a}
	(0.1191)
Log GDP per capita (t)	0.0382
	(0.4035)
Executive constraints (t)	-0.5724^{a}
	(0.0716)

Glaeser argues that human capital is more fundamental to growth than institutions. In the tables, Panel A shows that executive constraints (institutions) don't affect changes in schooling, but schooling affects changes in executive constraints. This suggests that the direction of causality is schooling $\rightarrow$ institutions, so human capital is more fundamental to growth than institutions.

1.3 Nutrition (3 points)

(3 pts) Hidrobo et al. (2014) evaluates the effect of providing different modalities of food assistance (cash and two types of in-kind transfers) on calories consumed and dietary diversity. Why might we choose to provide an in-kind transfer rather than cash? What is one downside of the Food in-kind transfer in this experiment?

An in-kind transfer essentially requires recipients to use the aid received for an intended purpose, or could work toward changing behavior toward something that the experimenters believe is more desirable. In this experiment, providing food was very expensive due to the cost of storage, delivery, etc. and thus would be difficult to scale up. It was also the least preferred modality of aid relative to cash and vouchers.

1.4 Health and Health Care (6 points)

(a) (3 pts) In Ashraf et al. (2010), the authors vary the price of Clorin, a water purification solution. In no more than 3 sentences, discuss the merits (one positive effect and one adverse effect) of raising the price of Clorin.

    Raising the (offer) price of Clorin reduced the proportion of buyers, i.e. had a negative effect on demand which could price out certain buyers (especially low-income). However, it also increased usage for those who did buy it, suggesting a positive screening effect.

(b) (3 pts) Cohen and Dupas (2010) run a similar experiment to Ashraf et al., except with insecticide-treated bednets. What do Cohen and Dupas find in their experiment regarding the effects from the previous question? What does this suggest about the optimal policy regarding subsidies for bednets?

    Cohen and Dupas also find an effect of demand (pricing out buyers) but no positive screening effects. Their findings suggest that we should aim to subsidize bednets heavily (or at least more heavily than Clorin) as all we are doing by increasing the price is pricing out buyers without increasing usage.

1.5 Education (11 points + 1 bonus)

Duflo et al. (2011) evaluates the effect of tracking (grouping students of similar ability within the same classroom).

(a) (3 pts) What are their findings about the effect of tracking on test scores for above- and below-median students? How does this provide evidence that teachers change their teaching level in response to classroom composition in ability?

Tracking improves test scores for both above- and below-median students. This suggests that teachers do change their teaching levels. If they didn't, then indirect peer effects would be constant. As a result, below-median students would be worse off from being in a tracking school because they would only receive relatively worse direct peer effects from being grouped with worse peers in a tracking school.

(b) (3 pts + 1 bonus) How does the figure below rule out teacher payoffs being linear in student achievement? For one bonus, while not discussed in class, how does the figure also rule out concave teacher payoffs?

With linear payoffs, teachers teach to the median of the classroom (the 75th percentile in the better classroom and the 25th percentile in the worse classroom in tracking schools). Since the school's median student is equally far from the teaching level in each case, the indirect effect is equal for either classroom, but they receive more positive direct peer effects from being placed in the better classroom. This suggests that there should be a discrete jump in test score for the median student in a tracking school, which is not the case.

(Bonus) In the case of concave payoffs, teachers teach below the median level in the classroom. This means that the school's median student has both relatively worse direct and indirect peer effects from being placed in the worse classroom in a tracking school vs. the better classroom, and there should also be a discrete jump in test score for being placed into the better classroom.

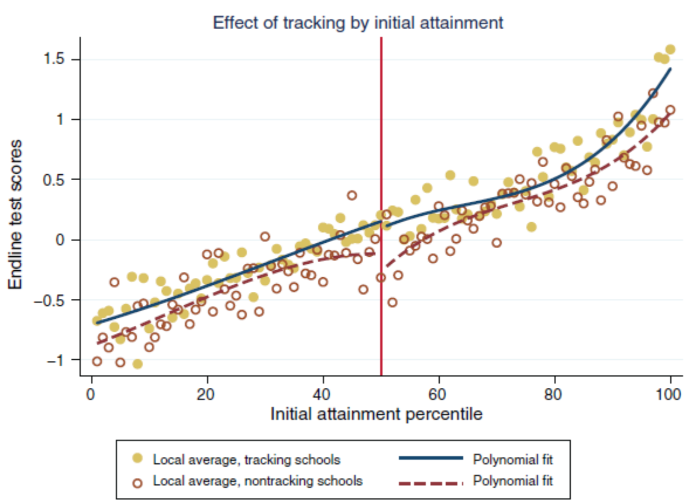


FIGURE 3. LOCAL POLYNOMIAL FITS OF ENDLINE SCORE BY INITIAL ATTAINMENT

In Jensen et al. (2010), the authors randomize schools to receive information about the returns to schooling in the Dominican Republic. Panel A shows the results of regressing the dependent variables in each column heading (different measures of education) on implied perceived returns and (omitted) controls in the control group.

	Panel A. Round 1 implied perceived returns (control group only)					
	(1) Returned next year	(2) Returned next year	(3) Finished school	(4) Finished school	(5) Years of schooling	(6) Years of schooling
Implied perceived returns	0.11***	0.083**	0.14***	0.092**	0.53***	0.37**
	(0.030)	(0.034)	(0.036)	(0.038)	(0.13)	(0.14)

(c) (2 pts) What does Panel A broadly say, and how does it motivate the experiment?

Panel A says that students in the control group who internalize higher returns to schooling also receive more schooling. This suggests that if we can increase the returns to schooling in students' minds, we can induce them to stay in school longer.

The table below shows the effect of receiving information about the returns to schooling for poor (below-median income) households and the least poor (at- or above-median income) households.

	Poor households				Least poor households			
	(5) Returned next year	(6) Finished school	(7) Years of schooling	(8) Perceived returns	(9) Returned next year	(10) Finished school	(11) Years of schooling	(12) Perceived returns
Treatment	0.006	−0.01	0.037	344***	0.072*	0.054*	0.33***	386***
	(0.034)	(0.026)	(0.11)	(41)	(0.038)	(0.031)	(0.12)	(41)

(d) (3 pts) Using Y_i to represent the outcome, T_i as a dummy for treatment, X_i as a vector of all relevant controls, and $Poor_i$ as a dummy for having income below the median, write a regression which yields a coefficient that allows you to test whether the effect of treatment is statistically different on below- vs. above-median households. What would the value of this coefficient be for the years of schooling?

Regression:

$$Y_i = \alpha_0 + \alpha_1 T_i + \alpha_2 X_i + \alpha_3 T_i * Poor_i + \varepsilon_i$$

The coefficient α_3 tests for the difference in coefficients between above- and below-median households. For the years of schooling, we know that the effect for below-median schools is .037, and the effect for above-median schools is .33. This means that the effect of treatment for poor households is .037 - .33 (= -.293) different from rich households. Thus, the coefficient is -.293 (leaving it as .037 - .33 is sufficient).

1.6 Health and Education Relationship (9 points)

Miguel and Kremer (2004) evaluate the effects of a deworming program in Kenya. There were three rounds of treatment: 1998 (Group 1 treated), 1999 (Groups 1 and 2 treated), and 2001 (Group 3 treated). Use the table below to answer the following questions:

	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:						
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:						
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)

(a) (3 pts) Describe (broadly) in 1-2 sentences what the final two columns of Panel A show and explain why it is necessary to the authors' strategy; do not go into detail about any specific variable.

The final two columns show that for the covariates in Panel A, the treated students in Groups 1 and 2 are similar, and the untreated students in Groups 1 and 2 are also similar. This suggests that we can compare their outcomes to at least yield a (non-experimental) treatment effect.

(b) (3 pts) Describe the decomposition that the final two columns of Panel B show, including which effect each column identifies.

These columns decompose the effect on a treated school into the direct effect and the spillover effect. The first column shows the direct effect: the effect of actually receiving treatment. The second column shows the within-school spillover effect: the effect of sharing a school with treated students, but not being treated directly.

(c) (3 pts) Can these effects be generalized to the broader population? Explain why or why not.

These effects cannot be generalized to the full population on the individual-level because there is selection into treatment for both Groups 1 and 2. For example, students in Group 1 who were treated had to be present on the day of schooling and be willing to take the treatment, so we are only able to measure the direct effects on this subset of students.

Full credit was given for saying that the effects can be generalized on the school level since “population” wasn’t specified, but the intention of the question was to ask about the broader population of individuals.

2 Model of Educational Choice with Outside Option and Parent Income (18 points)

Your explanations and interpretations in this question should be understandable to a non-economist, i.e. someone who wouldn't understand the math of the model.

Consider an augmented version of the model of educational choice from class. Parent utility is given by:

$$U(Y,S) = m\ln(Y) - \frac{c(S)}{\ln(Y_p)} \tag{1}$$

where:

$$\ln(Y) = a + \delta S \tag{2}$$

$$c(S) = \frac{\phi}{2}S^2 + AS \tag{3}$$

and:

- $\ln(Y)$ is logged child's future income
- S is child's years of education
- $\ln(Y_p)$ is logged parent's income
- $c(S)$ is the cost of S years of schooling
- A represents the value of a year of child labor

Parents choose children's education S to maximize utility.

(a) (3 pts) Explain why it makes sense to include AS within $c(S)$ and divide $c(S)$ by $\ln(Y_p)$ in the utility function.

The opportunity cost of a year of schooling includes the alternative of the child not being able to work, so AS is included within cost.

Dividing the cost function by $\ln(Y_p)$ suggests that costs are less salient for richer households (or that costs are *relatively* cheaper), which lines up with evidence seen in class.

Some points were taken off for saying the cost decreases; the cost function $c(S)$ itself doesn't change, but the *relative* cost does.

(b) (4 pts) Solve for the optimal level of schooling S^*.

Plugging into the utility function:

$$m(a + \delta S) - \frac{\frac{\phi}{2}S^2 + AS}{\ln(Y_p)}$$

Take the derivative with respect to S and set equal to 0:

$$m\delta - \frac{\phi S + A}{\ln(Y_p)} = 0$$

Solve for S^*:

$$\begin{aligned} m\delta &= \frac{\phi S^* + A}{\ln(Y_p)} \\ m\delta \ln(Y_p) &= \phi S^* + A \\ S^* &= \frac{m\delta \ln(Y_p) - A}{\phi} \end{aligned}$$

(c) (2 pts) Explain whether S^* increases or decreases in response to an increase in each of the following variables, including a one-sentence explanation of the intuition:

(i) A

Increasing A decreases schooling: if child labor is more valuable, opportunity cost of school increases so schooling decreases.

(ii) $\ln(Y_p)$

Increasing $\ln(Y_p)$ increases schooling: richer families worry less about schooling costs in sending kids to school, or face lower relative costs.

(d) (6 pts) Describe how you could modify the model (equations (1), (2), and/or (3)) to introduce the effects of each cash transfer below, writing 2-3 sentences justifying your modification (assume the cash transfer goes to the parents). You do not need to solve for the new S^*, but it should be clear that you understand how your change justifies why S^* would increase or decrease.

(i) Unconditional cash transfer (of size T)

An unconditional cash transfer provides parents with transfer T regardless of schooling, which we can model by changing (1):

$$U(Y,S) = m\ln(Y) - \frac{c(S)}{\ln(Y_p + T)}$$

This will increase schooling because costs are now less salient for the household as parent income in the denominator increases.

(ii) Conditional cash transfer

An unconditional cash transfer provides parents with income for increasing the child's schooling, which we can model by changing (1) (the equation below provides T for every year of education).

$$U(Y,S) = m\ln(Y) - \frac{c(S)}{\ln(Y_p + ST)}$$

For both (i) and (ii), most of the credit was given for including T within the cost of schooling. For (i) and (ii) respectively:

$$c(S) = \frac{\phi}{2}S^2 + AS - T \tag{i}$$

$$c(S) = \frac{\phi}{2}S^2 + (A - T)S \tag{ii}$$

However, this is not 100% correct since we assume the conditional cash transfer specifically goes to the parents, so it should be affecting Y_p.

(e) (3 pts) Based on the evidence in class or TA section, discuss the merits of providing an unconditional cash transfer over a conditional cash transfer. *You do not need to provide the names of any authors or papers.*

In the literature, we found that education interventions were most effective for households that were not suffering through poverty, suggesting that poverty alleviation needs to occur before households can send their kids to school. Unconditional cash transfers would be better in this case.

My intention with this question was to discuss the merits of a UCT over a CCT *specifically in the context of education*, but credit was given for other merits of UCTs over CCTs as well (e.g. less costly to monitor).

One common confusion: CCTs do not need to be spent on education; they are received *for attaining education*, but they do not need to be spent on attaining more education.

3 Improving Healthcare in India (18 points)

This question is loosely based on Patrick Agte's job market paper, but you do not need to know anything from the talk to answer the questions.

You are evaluating the effect of a large-scale reform to India's public healthcare system that adds a trained Community Health Officer (CHO) who provides outpatient care and screening for diseases to public primary health centers (PHCs), which are staffed by formally trained doctors and nurses. The 50 CHOs were randomly assigned across 100 villages, with each village having one PHC located centrally. 3 months after treatment, you collect data on the number of days sick in the past month for each household head across all villages and some household-level characteristics.

You regress the village-level (indexed by i) average for the household head's sick days $Sick_i$ on a dummy for being a treatment village (T_i) and a vector of village-level controls (X_i):

$$Sick_i = \alpha_0 + \alpha_1 T_i + \alpha_2 X_i + \varepsilon_i$$

The estimate of $\hat{\alpha}_1$ yields -2.5. **Treat the following situations independently: they do not build on each other**.

(a) (3 pts) Suppose you learn that control villages are statistically denser on average than treatment villages, and this is not included within X_i. Is -2.5 an overestimate or underestimate (in absolute value) of the true effect on a typical village? Explain in 1-2 sentences.

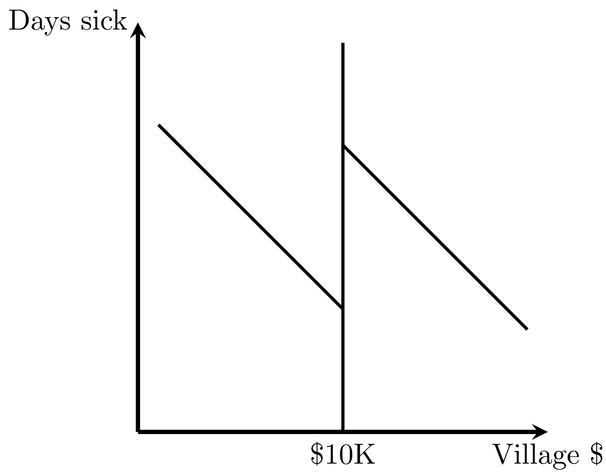
If control villages are denser, we would expect days sick to be higher due to greater spread of disease. This would mean that -2.5 would be an overestimate of the actual effect; since the control group would already have more days sick naturally, the difference between treatment and control should be smaller.

(b) (3 pts) Suppose patients in control villages, hearing about the CHOs, go to treatment villages for treatment instead. Their outcomes are measured as part of the control group. Is -2.5 an overestimate or underestimate (in absolute value) of the true effect on a typical village? Explain in 1-2 sentences.

-2.5 is an underestimate of the true effect; the effect is spilling over to the control group, who now benefit from the CHO. The control group would have more sick days if they stayed in their own village, so the difference between treatment and control would be greater.

(c) (4 pts) Suppose the reform was actually targeted toward low-income villages: villages with average household income less than $1,000 USD received the additional CHO (assume there were exactly 50). Draw a graph depicting the likely relationship between number of sick days (y-axis) and village average income (x-axis). Describe a strategy you could use to estimate a LATE, and identify the group for which the LATE applies.

We could use a regression discontinuity design to estimate a LATE that applies to villages that are close to the threshold: the jump in days sick for villages close to the threshold represents the LATE for these villages. Richer villages likely have fewer days sick, so the lines should be downward-sloping. Anything that resembled the graph below was fine (the magnitude of the slopes didn't matter, just that they're downward-sloping).



Now, you would like to estimate results on the household level. Even though the CHO improves quality of care at the PHCs, not every household chooses to go to PHCs for care.

(d) (2 pts) On the household level, is -2.5 an ATE, ITT, or ATT? Explain in 1 sentence.

-2.5 is an ITT: by treating the village, we intend to the treat the household, but the household still chooses themselves whether to actually go to the PHC.

(e) (6 pts) What additional data would you need to estimate the household-level LATE? Now indexing households by i, show how you could use a regression strategy to estimate the LATE using this data, and identify the group for which the LATE applies. Be sure to define any additional notation necessary.

We would need data on household-level usage of the PHC. Defining $D_i = 1$ if the household uses the PHC, we could run the following two-stage IV regression where we instrument for D_i using T_i in the first stage:

$$D_i = \alpha_0 + \alpha_1 T_i + \alpha_2 X_i + \varepsilon_i \qquad \text{(First stage)}$$
$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + \nu_i \qquad \text{(Second stage)}$$

Alternatively, we can run the reduced form (ITT) regression:

$$Y_i = \gamma_0 + \gamma_1 T_i + \gamma_2 X_i + \omega_i$$

and divide the coefficient γ_1 by the first-stage coefficient α_1: $LATE = \frac{\gamma_1}{\alpha_1}$.

The LATE would then apply to households which are *compliers*: households that use the PHC if and only if they are assigned to the treatment group.